EPCOR Water Services
Water Services, Drainage Services and Wastewater Treatment PBR Applications
List of Appendices

APPENDIX A – Part 1

SUMMARY OF THE EPCOR WATER SERVICES BYLAW AND KEY CHANGES

1.0 OVERVIEW OF PROPOSED WATER BYLAW

1.1. Overview

Through the Water Bylaw, EWSI seeks approval for the following:

(a) Extension of the PBR from April 1, 2022 to March 31, 2027.

(b) Adjustment of rates to reflect the accepted methodology for determining costs of service for each customer segment (In-City customers, City of Edmonton Fire Rescue Services and Regional Customers).

(c) The addition of the public fire protection monthly charges for each customer class to Schedule 1 Part I Water Rates.

(d) The addition of two new Service Charges (Schedule 1 Part III).

(e) An annual adjustment of Service Charges (Schedule 1 Part III) for inflation.

(f) Updated Terms and Conditions of Water Service that govern the relationship between EWSI and its water customers. The majority of the proposed changes add clarity, improve consistency and readability and eliminate duplication. Details of the proposed amendments (except changes of a more minor nature) are summarized in the table below. The remaining minor changes are set out in the blacklined version of the Bylaw, included in Part II of the Rates Report. These changes add clarity, improve consistency and readability, and eliminate duplication.

(g) Special Rate Adjustments for Water Services to include special rate adjustments for: (i) rebasing of the revenue requirement based on forecast costs for the PBR term; (ii) to increase the monthly service connection fee; (iii) for the 90-day deferral program established for the deferral of water utility bill payments for customers in need; and (iv) for the collection of the public fire protection revenue requirement.

(h) The Inflation factor applied each year to prior year's water rates to be calculated based on a weighting of 60% non-labour component and 40% labour component to represent Water Services' internal cost structure (Schedule 3).

(i) Maintain the Efficiency factor from the previous PBR term at 0.25%.

(j) Updated Water Services performance standards to ensure that the standards continue to be appropriate and achievable but also sufficiently rigorous to result in a high level of customer service. All changes to the Performance Measures are described in detail in the table below and are in Schedule 3 of the Bylaw.

(k) Revisions to non-routine adjustment clauses to: (i) clarify that circumstances for the deterioration of the Waterworks Systems may include unanticipated asset failure or deterioration requiring immediate repair or remediation; and (ii) to allow for negative non-routine adjustments related to grants (Schedule 3).

2.0 CHANGES FROM CURRENT WATERWORKS BYLAW TO PROPOSED WATER BYLAW

2.1. Schedule 1 Price Schedule

2.1.1. Water Rates

Reference:	Schedule 1, Part I – Water Rates
Current:	N/A
Proposed:	For each of Residential Water Service, Multi-Residential Water Service and Commercial Water Service the Public Fire Protection Monthly Charges have been added to Schedule 1, Part I – Water Rates for each Customer class.
Rationale:	This proposed change is required to reflect the collection of the public fire protection revenue requirement through water rates, as directed by Edmonton City Council.

Reference:	Schedule 1, Part I – Water Rates for each of Residential Water Service, Multi-Residential Water Service and Commercial Water Service
Current:	**Effective Dates and Adjustments for Future Years** Consumption Charges for the period April 1, 2017 to March 31, 2022 will be determined by applying the adjustment factors in Schedule 3 of this Bylaw to the rates set out below, with new rate approval and implementation occurring on an annual basis in accordance with the adjustment methodology prescribed in Section 6 of this Bylaw.
Proposed:	**Effective Dates and Adjustments for Future Years** Consumption Charges and Public Fire Protection Monthly Charges for the period April 1, 2022 to March 31, 2023 are set out below. Consumption

	Charges and Public Fire Protection Monthly Charges for the period April 1, 20~~17~~23 to March 31, 20~~22~~27 will be determined by applying the adjustment factors in Schedule 3 of this Bylaw to the rates set out below, with new rate approval and implementation occurring on an annual basis in accordance with the adjustment methodology prescribed in Section ~~7~~6 of this Bylaw.
Rationale:	This proposed change is required to reflect that the rates for April 1, 2022 to March 31, 2023 will be the rates set out in Schedule 1, Part I – Water Rates. Previously, the rates for the first year of the new PBR term were determined by a formulaic extension of the rates of the last year of the prior PBR term. If this proposed change is approved, the rates will only be set for the first year of the PBR term and all other years of the PBR term will follow the formulaic approach.

Reference:	Schedule 1, Part I – Water Rates for Fixed Monthly Service Charges
Current:	**Effective Dates and Adjustments for Future Years** Fixed Monthly Water Service Charges for the period April 1, 2017 to March 31, 2022 will be determined by applying the adjustment factors in Schedule 3 of this Bylaw to the rates set out below, with new rate approval and implementation occurring on an annual basis in accordance with the adjustment methodology prescribed in Section 6 of this Bylaw.
Proposed:	**Effective Dates and Adjustments for Future Years** Fixed Monthly Water Service Charges for the period April 1, 2022 to March 31, 2023 are set out below. Fixed Monthly Water Services Charges for the period April 1, 20~~17~~23 to March 31, 20~~22~~27 will be determined by applying the adjustment factors in Schedule 3 of this Bylaw to the rates set out below, with new rate approval and implementation occurring on an annual basis in accordance with the adjustment methodology prescribed in Section ~~6~~7 of this Bylaw.
Rationale:	This proposed change is required to reflect that the rates for April 1, 2022 to March 31, 2023 will be the rates set out in Schedule 1, Part I – Water Rates. Previously, the rates for the first year of the new PBR term were determined by a formulaic extension of the rates of the last year of the prior PBR term. If this proposed change is approved, the rates will only be set for the first year of the PBR term and all other years of the PBR term will follow the formulaic approach.

2.1.2. Service Charges

The following contains explanations for the changes to Schedule 1 – Part III Service Charges.

Reference:	Schedule I, Part III – Service Charges
Current:	Non-Standard Meter Read Charge To all customers who decline the installation of a Radio Frequency Meter. Rate: $15.20 per month
Proposed:	Non-Standard Meter Read Charge To all customers who decline the installation of a Non-Standard Meter ~~Radio Frequency Meter~~. Rate: ~~$15.20~~ $49.03 per month
Rationale:	This proposed change is required to reflect the implementation of the advanced metering infrastructure ("AMI") deployment project, if approved. Currently, a customer is charged this fee when they decline a radio frequency capable water meter. As EWSI currently has a team of Meter readers who read all Meters each month, there is an economy of scale built into the current fee. Following the implementation of the AMI project, EWSI will no longer require a Meter reading workforce. As such, any Customers who opt out of the AMI meter will require an individual truck roll once a month to have their Non-Standard Meter read. Accordingly, the actual cost of the service to read a Non-Standard Meter has substantially increased as there is no longer an economy of scale.

Reference:	Schedule I, Part III – Service Charges
Current:	No Access Charge To all customers who do not allow access by EWSI for the purpose of water meter reading for a period of 6 consecutive months.
Proposed:	No Access Charge To all customers who do not allow access by EWSI ~~for the purpose of water meter reading~~ to install, inspect, test, maintain, repair, investigate, replace or remove Facilities, including reading a Meter, for a period of 6 consecutive months.
Rationale:	This change is requested to align with EWSI's right of entry in Section 5.2(a) of Schedule 2 Terms and Conditions of Water Services and the circumstances under which EWSI may charge a "no access fee" in Section 5.2(c) of Schedule 2 Terms and Conditions of Water Services. Section 5.2(c) provides that EWSI

	may charge a "no access fee" if EWSI's lawful entry to a Customer's premises is prevented or hindered.

Reference:	Schedule I, Part III – Service Charges
Current:	Not applicable
Proposed:	Customer Locate Fee To all customers who fail to notify EWSI that they have taken possession of a site and EWSI is required to conduct searches to identify the customer. Rate $20.00
Rationale:	This change is requested to cover the costs associated with locating customers who have taken possession of a site but have not informed EWSI. The $20.00 fee will cover the cost of obtaining the land title (approximately $10.00) and the remaining $10.00 will cover the administration costs that are involved in conducting the searches.

Reference:	Schedule I, Part III – Service Charges
Current:	Not applicable
Proposed:	Service Connection Fees The fee for a new water service installation is calculated on a cost of service basis in accordance with the Water Services Guidelines. Rate Cost of service
Rationale:	This addition is to incorporate fees paid for by the customer on a cost-of-service basis for new water service installations. Previously, this fee was charged but was not set out in the Service Charges.

Reference:	Schedule I, Part III – Service Charges
Current:	Part III Service Charges are effective April 1, 2017.
Proposed:	Part III Service Charges are effective April 1, 20~~17~~22. Service Charges for the period April 1, 2023 to March 31, 2027 will be determined by applying the adjustment factors for Service Charges set out in Schedule 3 of this Bylaw to the rates set out in this Part III – Service Charges, with new rate approval and implementation occurring on an annual basis in accordance with the adjustment methodology prescribed in Section 7 of this Bylaw.
Rationale:	EWSI has proposed to introduce an annual update of Service Charges for inflation for the 2022-2026 PBR term in order to ensure the cost of EWSI providing the service remains appropriately allocated. This change is requested to reflect the annual update for inflation.

2.1.3. Late Payment Charges

The following contains explanations for the changes to Schedule 1 – Part V Late Payment Charges.

Reference:	Schedule 1, Part V – Late Payment Charges
Current:	Late Payment Charges A late payment charge of 2.5% per month, not compounded, is applied to all charges on a Customer's Account, if the Customer's payment has not been received by EWSI before one month from the date of issuance of the bill in respect of the charges. If considered to be interest payable for credit advanced, then the late payment charge is equivalent to a maximum yearly rate of 45.6%. A dishonoured cheque charge is applied for each cheque returned for insufficient funds.
Proposed:	A late payment charge of 2.5% per month, not compounded, is applied to all charges on a Customer's Account, if the Customer's payment has not been received by EWSI ~~before one month from the date of issuance of the bill in respect of the charges~~ in full by the payment due date specified on the bill. If considered to be interest payable for credit advanced, then the late payment charge is equivalent to a maximum yearly rate of 45.6%. A dishonoured cheque charge of $25.00 is applied for each cheque returned for insufficient funds.
Rationale:	This proposed change will align with the wording in Section 3.1(a) 'Requirement for Account and Obligation to Pay' of Schedule 2 Terms and Conditions of Water Services which provides that: "A late payment charge of 2.5% per month, not compounded, is applied to all charges on a Customer's Account, if a Customer does not pay a bill in full by the payment due date specified on the bill." Please note that with removal of wastewater from the Waterworks Bylaw, this reference is now 'Schedule 1, Part IV'.

2.2. Schedule 2 Terms and Conditions of Water Services

The following contains explanations for the more substantive changes to Schedule 2 – Terms and Conditions of Water Services.

Article 1 – Definitions and Interpretation

Reference:	1.1 Definitions
Current:	"**Non-Standard Meter**" means a water meter that is not equipped with a radio frequency module.
Proposed:	"**Non-Standard Meter**" means a water meter that ~~is not equipped with a radio frequency module~~ does not have the capability of remotely

	communicating via radio frequency signals with EWSI's advanced metering network;~~.~~
Rationale:	This proposed change is required to reflect the implementation of the AMI deployment project, if approved. Following the implementation of AMI meters, under this proposed change any meter that does not fall under the proposed definition of Standard Meter (see below) will be a Non-Standard Meter. This change is requested in order to allow EWSI to recover the additional costs associated with providing an on-site meter read to Customers with non-AMI meters.

Reference:	1.1 Definitions
Current:	"**Standard Meter**" means a water meter that is equipped with a radio frequency (RF) module. A RF module is a device that is used to transmit and/or receive radio signals between two devices.
Proposed:	**"Standard Meter**" means an advanced water meter that ~~is equipped with a radio frequency (RF) module. A RF module is a device that is used to transmit and/or receive radio signals between two devices.~~ has the capability of remotely communicating via radio frequency signals with EWSI's advanced metering network;~~.~~
Rationale:	This proposed change is required to reflect the implementation of the AMI deployment project, if approved.

Article 2 – General Provisions

Reference:	2.2 Water Services Guidelines
Current:	(c) The following are deemed to be Water Services Guidelines and are effective and binding upon every Customer, and may be amended or rescinded from time to time by EWSI: (i) the EWSI document entitled "EWSI Service Standards"; (ii) the document entitled "Design and Construction Standards for the City of Edmonton; Volume 4 – Water" ("Design and Construction Standards"); (iii) the EWSI document entitled "Cross Connection Control Policy"; and (iv) the EWSI document entitled "Guidelines for Working Around Water Infrastructure".

Proposed:	(c) The following are deemed to be Water Services Guidelines and are effective and binding upon every Customer, and may be amended or rescinded from time to time by EWSI: (i) the EWSI document entitled "EWSI Service Standards"; (ii) the document entitled "Design and Construction Standards for the City of Edmonton; Volume 4 – Water" ("Design and Construction Standards"); (iii) the EWSI document entitled "Cross Connection Control Policy"; ~~and~~ (iv) the EWSI document entitled "Guidelines for Working Around Water Infrastructure"; (v) the EWSI document entitled "Hydrant Servicing Guidelines"; (vi) the EWSI document entitled "Water and Sewer Connections Guidelines"; and (vii) the EWSI document entitled "Water Utility Handbook".
Rationale:	This proposed change is required to reflect additional guidelines developed by EWSI which form part of the Water Services Guidelines under the Terms and Conditions. The Hydrant Servicing Guidelines are required in order to set out the servicing standards for fire hydrant services provided by EWSI for public fire protection. The Water and Sewer Connections Guidelines set out the standards and requirements related to new sewer service connections and have been developed to provide assistance to building owners, developers, engineering consultants, architects and other contractors. The Water Utility Handbook sets out the requirements for notifying, locating and working in close proximity to the existing Waterworks System in order to protect EWSI's Facilities.

Article 3 – Methods and Procedures for Obtaining Water Services

Reference:	3.1 Requirement for Account and Obligation to Pay
Current:	(a) Prior to receiving any Water Services from EWSI, a Customer is obligated to open an Account. Customers shall pay in full for all Water Services provided by EWSI. EWSI will send a Customer a bill for Water Services provided to the Customer during the previous month, or an

		amount of time reasonably close to a month, calculated in accordance with Schedule 1. A Customer's obligation to pay the amount set out in the bill shall continue regardless of whether the Customer receives the bill. A late payment charge of 2.5% per month, not compounded, is applied to all charges on a Customer's Account, if a Customer does not pay a bill in full by the payment due date specified on the bill. If considered to be interest payable for credit advanced, then the late payment charge is equivalent to a maximum yearly rate of 45.6%. A dishonoured cheque charge is applied for each cheque returned for insufficient funds.
Proposed:	(a)	Prior to receiving any Water Services from EWSI, a Customer is obligated to open an Account. Customers shall pay in full for all Water Services provided by EWSI. If a Customer fails to open an Account when they have possession of the premises to which Water Services are being supplied, EWSI may bill the Customer for the Water Services received, from their legal possession or occupancy date, whichever occurs first, and EWSI shall determine the retroactive billing by reasonably estimating the Customer's consumption. EWSI will send a Customer a bill for Water Services provided to the Customer during the previous month, or an amount of time reasonably close to a month, calculated in accordance with Schedule 1. A Customer's obligation to pay the amount set out in the bill shall continue regardless of whether the Customer receives the bill. A late payment charge of 2.5% per month, not compounded, is applied to all charges on a Customer's Account, if a Customer does not pay a bill in full by the payment due date specified on the bill. If considered to be interest payable for credit advanced, then the late payment charge is equivalent to a maximum yearly rate of 45.6%. A dishonoured cheque charge is applied for each cheque returned for insufficient funds.
Rationale:	The proposed change allows EWSI to retroactively bill Customers for metered Water Services where they fail to open an Account in accordance with this section and will align with EWSI's current retroactive billing practices. As historical data for these Customers' usage will not be available, EWSI's current practice is to calculate retroactive billing for Customers: (i) billed the Residential Water Service rate under Schedule 1 by using the estimated average daily usage of City of Edmonton Residential Water Service Customers; and (ii) billed the Commercial Water Service or Multi-Residential Water Service rates under Schedule 1 by using the Customer's average usage within a three-month time period as the average Residential Water Service	

	usage does not accurately capture the usage by these other classes of Customers.

Reference:	3.1 Requirement for Account and Obligation to Pay
Current:	(d) EWSI may, without approval or consent of an Owner, upon not less than 90 days written notice to the Owner, open a new Account in the name of the Owner in respect of leased premises if: (i) the tenant or lessee is more than 60 days in arrears of payment for Water Services; and (ii) it is physically impossible or impracticable to Turn Off Water Services to the tenant or lessee without adversely affecting Water Services to one or more other Customers that occupy the same premises and/or that receive Water Services through a common Service Connection. In such a case, the Owner shall be required to pay for Water Services from the date on which the new account is opened by EWSI in the Owner's name. The Owner shall not be required to pay EWSI for the tenant or lessee's arrears for Water Services at that location, unless a provision in an agreement otherwise specifies.
Proposed:	(d) EWSI may, without approval or consent of an Owner, upon not less than ~~90~~ 30 days written notice to the Owner, open a new Account in the name of the Owner in respect of leased premises if: (i) the tenant or lessee is more than 60 days in arrears of payment for Water Services; and (ii) it is physically impossible or impracticable to Turn Off Water Services to the tenant or lessee without adversely affecting Water Services to one or more other Customers that occupy the same premises and/or that receive Water Services through a common Service Connection. In such a case, the Owner shall be required to pay for Water Services from the date on which the new account is opened by EWSI in the Owner's name. The Owner shall not be required to pay EWSI for the tenant or lessee's arrears for Water Services at that location, unless a provision in an agreement otherwise specifies.
Rationale:	The proposed change is to minimize the loss of revenue in situations where a tenant or lessee has not paid their Account. The current wording does not

	allow EWSI to commence collection until the site has been in arrears for 150 days. This change would allow EWSI to commence collection from the Owner at 90 days.

Reference:	3.5 Security Deposits
Current:	(b) EWSI, in its sole discretion, may at the time of a Customer's application for Water Services or at any time thereafter require the Customer to post a security deposit or an increase to an existing security deposit in circumstances that may include, without limitation, the following: (i) late payment by the Customer for Water Services or other services provided by EWSI; (ii) the Customer has issued more than one cheque or pre-authorized debit that has been returned for non-sufficient funds in any six month period; (iii) there has been a significant increase in the Customer's rate of consumption of water; (iv) the Customer is applying for Turn On or for a new Water Services after having previously been Turned Off from Water Services for non-payment; (v) the Customer making the application for Water Service has a credit rating that is not satisfactory to EWSI; or (vi) the Customer is applying for a permit to use water from a fire hydrant. (c) EWSI, in its sole discretion, may determine that a Customer is not required to post a security deposit or is no longer required to maintain an existing security deposit, in circumstances that may include, without limitation, the following: (viii) the Customer has a good payment history with EWSI; (ix) where a result satisfactory to EWSI is obtained from an external credit check; or (iii) where the Customer provides to EWSI an indemnity bond or irrevocable letter of credit from a financial institution satisfactory to EWSI. (d) Unless extraordinary circumstances apply, the maximum security deposit EWSI will require from a Customer for Water Services not

	involving a new Service Connection is an amount equal to three times the amount EWSI estimates will be the average monthly billing to the Customer for Water Services.
Proposed:	(b) EWSI, in its sole discretion, may at the time of a Customer's application for Water Services or at any time thereafter require the Customer to post a security deposit or an increase to an existing security deposit in circumstances that may include, without limitation, the following: (i) late payment by the Customer for Water Services or other services provided by EWSI; (ii) the Customer has issued more than one cheque or pre-authorized debit that has been returned for non-sufficient funds in any six month period; (iii) there has been a significant increase in the Customer's rate of consumption of water; (iv) the Customer is applying for Turn On or for a new Water Services after having previously been Turned Off from Water Services for non-payment; (v) the Customer making the application for Water Service has a credit rating that is not satisfactory to EWSI; ~~or~~ (vi) the Customer is applying for a permit to use water from a fire hydrant;~~.~~ or (vii) the Customer has a permit to use water from a fire hydrant and is issued EWSI-owned equipment for use in connection with the hydrants. (c) EWSI, in its sole discretion, may determine that a Customer is not required to post a security deposit or is no longer required to maintain an existing security deposit, in circumstances that may include, without limitation, the following: (i) the Customer has a good payment history with EWSI; (ii) where a result satisfactory to EWSI is obtained from an external credit check; or

	(iii) where the Customer provides to EWSI an indemnity bond or irrevocable letter of credit from a financial institution satisfactory to EWSI. (d) Unless extraordinary circumstances apply, the maximum security deposit EWSI will require from a Customer for Water Services not involving a new Service Connection is an amount equal to three times the amount EWSI estimates will be the average monthly billing to the Customer for Water Services. Notwithstanding this Section 3.5(d), if a Customer is required to post a security deposit pursuant to Section 3.5(b) (vii) above, then such amount shall be in addition to any other security deposit required under Section 3.5.
Rationale:	EWSI currently provides EWSI-owned equipment on request to Customers with a permit to use water from a fire hydrant. The Customer is expected to return the equipment to EWSI. EWSI has requested the proposed change in order to ensure this equipment is returned to EWSI, and in the instance the equipment is not returned, to offset the costs incurred by EWSI related to the equipment loss.

Reference:	3.8 Temporary Water Service and Construction Water Service
Current:	(c) Where a Customer fails to apply for metered Water Services as required by this section, EWSI may bill the Customer retroactively for the unmetered water as if it were metered Water Services from the date a City occupancy permit was issued or the date upon which the development began to be used for its intended purpose, whichever is earlier. The retroactive billing shall be based on a three-month average.
Proposed:	(c) Where a Customer fails to apply for metered Water Services as required by this section, EWSI may bill the Customer retroactively for the unmetered water as if it were metered Water Services from the date a City occupancy permit was issued or the date upon which the development began to be used for its intended purpose, whichever is earlier. EWSI shall determine ~~T~~the retroactive billing ~~based on a three-month average~~ by reasonably estimating the Customer's consumption.
Rationale:	Similar to the proposed change in Section 3.1(a), this proposed change is to align with EWSI's current retroactive billing practices. As historical data for these Customers' usage will not be available, EWSI's current practice is to calculate retroactive billing for Customers: (i) billed the Residential Water Service rate under Schedule 1 by using the estimated average daily usage of City of Edmonton Residential Water Service Customers; and (ii) billed the

	Commercial Water Service or Multi-Residential Water Service rates under Schedule 1 by using the Customer's average usage within a three-month time period.

Article 4 – Water Service Requirements and Facilities

Reference:	4.1 Protection of EWSI's Facilities and Property of Other Customers
Current:	(b) Deep Ground Disturbance in Proximity to Water Facilities Any party that proposes any construction involving ground disturbance to a depth exceeding two (2) metres within five (5) metres of the boundary of lands containing EWSI Facilities is required to enter into a Facility Proximity Agreement with EWSI, prior to performing the ground disturbance. The conditions of the agreement may at EPCOR's sole discretion include, but not be limited to, the following: (i) The EWSI Facility must be isolated and drained. Active customers on the isolated main, must be provided with temporary water service. Temporary servicing, and construction activity may be limited to the months of May to October. The constructor will be responsible for all costs associated with de-commissioning, temporary servicing and re-commissioning of the EWSI Facility. (ii) The water main is to be exposed by hydrovac at a minimum of two locations to confirm the existing location and the proposed clearances prior to any ground disturbance. (iii) A requirement to contact the Inspections Coordinator a minimum of 72 hours in advance of the hydrovac exposure to arrange for an EPCOR Inspector to be on-site. (iv) All Service Connections not required for the future building(s) must be formally abandoned at the main prior to excavation. (v) All appropriate measures must be taken to ensure the existing support around the water main is not disturbed by any of the construction activities. Any sloughing, settlement or undermining of the ground within five (5) metres of a EWSI Facility must be reported to EWSI. Any damage to the existing EWSI Facility resulting from the construction, how so ever caused, will be repaired at the sole cost of the constructor.

	(vi) The constructor must notify EWSI when the ground disturbance in proximity to the EWSI Facility is completed so that the Facility can be re-commissioned. (vii) An indemnification in favour of EPCOR for any and all costs or liabilities arising from the construction, including costs or liabilities arising in respect of any (A) water service interruption, defect or failure, (B) damage to any existing EWSI Facility, (C) damage to the property of third parties, (D) damage to a construction site, (E) delay of construction, other than as caused by any deliberate or negligent action of EPCOR
Proposed:	Deletion of all of section 4.1(b) from the Terms and Conditions and insertion into the Water Service Guidelines.
Rationale:	This proposed change is to streamline the Terms and Conditions by removing a highly technical provision that is best suited for the Water Service Guidelines. Accordingly, if this proposed change is accepted, the language from section 4.1(b) will be inserted in the Water Service Guidelines.

Article 5 – Easements, Rights-of-Way, and Use of and Access to Facilities

Reference:	5.2 Right of Entry
Current:	(a) EWSI's employees, agents and other representatives shall have the right to enter a Customer's premises at all reasonable times, or at any time during an event of Force Majeure, for the purpose of installing, maintaining, replacing, testing, monitoring, reading or removing EWSI's Facilities and for any other purpose incidental to the provision of Water Services. A Customer shall not prevent or hinder EWSI's entry to the Customer's premises for any such purpose. Without limiting the generality of the foregoing, EWSI has the right to enter a Customer's premises at any reasonable hour in order to: (i) install, inspect, test, repair, replace or remove Facilities; (ii) perform necessary maintenance to Facilities; (iii) investigate or respond to a Customer complaint or inquiry; (iv) conduct an unannounced inspection where EWSI has reasonable grounds to believe that theft of Water Services or interference

	with Facilities (including but not limited to a water Meter) has occurred or is occurring’ and (v) take necessary corrective action to safeguard and maintain the Waterworks System.
Proposed:	(a) EWSI’s employees, agents and other representatives shall have the right to enter a Customer’s premises at all reasonable times, or at any time during an event of Force Majeure, for the purpose of installing, maintaining, replacing, testing, monitoring, reading or removing EWSI’s Facilities and for any other purpose incidental to the provision of Water Services. A Customer shall not prevent or hinder EWSI’s entry to the Customer’s premises for any such purpose. Without limiting the generality of the foregoing, EWSI has the right to enter a Customer’s premises at any reasonable hour in order to: (i) install, inspect, test, read, repair, replace or remove Facilities; (ii) perform necessary maintenance to Facilities; (iii) investigate or respond to a Customer complaint or inquiry; (iv) conduct an unannounced inspection where EWSI has reasonable grounds to believe that theft of Water Services or interference with Facilities (including but not limited to a water Meter) has occurred or is occurring~~’~~; and (v) take necessary corrective action to safeguard and maintain the Waterworks System.
Rationale:	This proposed change is to clarify that EWSI may enter a Customer’s premises to read a Meter.

Reference:	5.2 Right of Entry
Current:	(c) EWSI may charge a “no access fee” sufficient to cover EWSI’s reasonable costs, if EWSI’s lawful entry to a Customer’s premises is prevented or hindered, whether by a Customer not keeping a scheduled appointment or for any other cause.
Proposed:	(c) EWSI may charge a “no access fee” sufficient to cover EWSI’s reasonable costs, if EWSI’s lawful entry to a Customer’s premises is

	prevented or hindered, including without limitation where EWSI determines, in its sole discretion, the access to be unsafe, whether by a Customer not keeping a scheduled appointment or for any other cause.
Rationale:	This proposed change is to clarify that EWSI will charge a "no access fee" in situations where EWSI has determined that the access is unsafe.

Reference:	5.3 Access to Waterworks System
Current:	(c) EWSI, in its sole discretion, may consider the presence of a dog to be an obstruction or a hindrance to access to any Facilities and may notify the Customer of any conditions or actions required to enable access to the Facility by appointment with the Customer.
Proposed:	(c) EWSI, in its sole discretion, may consider a safety issue as ~~the presence of a dog to be~~ an obstruction or a hindrance to access to any Facilities and may notify the Customer of any conditions or actions required to enable access to the Facility ~~by appointment with the Customer~~.
Rationale:	This proposed change is to clarify that EWSI may consider a safety issue as an obstruction or hindrance to access. The second change is to align the Terms and Conditions with EWSI's processes as EWSI does not make appointments for Meter reading.

Article 8.0 – Meters

Reference:	8.1 Installation of Meters
Current:	(a) Provision and Ownership EWSI shall supply, install, and seal one or more Standard Meters for the purpose of measuring the volume of water delivered to a Customer by way of a Service Connection subject to the following exceptions: (i) a Customer may decline the installation of a Standard Meter on request to EWSI provided that: (a) the Customer receives Water Services at a site that is a dwelling or Multiple Dwelling without a multiple-meter installation; and (b) EWSI has regular, ongoing and safe access to the Non-Standard Meter. (ii) a Customer may request that a Standard Meter be replaced with a Non-Standard Meter on written request to EWSI provided that:

	(a) the Customer receives Water Services at a site that is a dwelling or Multiple Dwelling without a multiple-meter installation; and (b) EWSI has regular, ongoing and safe access to the Non-Standard Meter. The Standard Meter, Non-Standard Meter and related metering equipment shall remain the sole property of EWSI, regardless of whether the Customer has paid or reimbursed all or any part of EWSI's costs of supply and installation. Any Customer that is subject to the exceptions listed in (i) and (ii) above shall be required to pay the Non-Standard Meter Reading Fee as set out in Schedule 1. Any Customer that is subject to the exception listed in (ii) above shall be required to pay the Non-Standard Meter Installation Fee as set out in Schedule 1. A Customer at a site that is metered by a Non-Standard Meter that has declined the installation of a Standard Meter may at any time request that EWSI install a Standard Meter at that site.
Proposed:	(a) Provision and Ownership EWSI shall supply, install, and seal one or more Standard Meters for the purpose of measuring the volume of water delivered to a Customer by way of a Service Connection subject to the following exceptions: (i) a Customer may decline the installation of a Standard Meter on request to EWSI provided that: (a) the Customer receives Water Services at a site that is a ~~d~~Dwelling or Multiple Dwelling without a multiple-meter installation; and (b) EWSI has regular, ongoing and safe access to the Non-Standard Meter.

	(ii) a Customer may request that a Standard Meter be replaced with a Non-Standard Meter on written request to EWSI provided that: (a) the Customer receives Water Services at a site that is a ~~d~~Dwelling or Multiple Dwelling without a multiple-meter installation; and (b) EWSI has regular, ongoing and safe access to the Non-Standard Meter. The Standard Meter, Non-Standard Meter and related metering equipment shall remain the sole property of EWSI, regardless of whether the Customer has paid or reimbursed all or any part of EWSI's costs of supply and installation. Any Customer that is subject to the exceptions listed in (i) and (ii) above shall be required to pay the Non-Standard Meter Reading Fee as set out in Schedule 1. In addition, a Customer shall be required to pay the Non-Standard Meter Reading Fee as set out in Schedule 1 upon a Customer's deemed refusal of the installation of a Standard Meter. A Customer is deemed to have refused the installation of a Standard Meter if the Customer does not respond to EWSI's reasonable communication efforts, as determined by EWSI, for the installation of the Standard Meter. Any Customer that is subject to the exception listed in (ii) above shall be required to pay the Non-Standard Meter Installation Fee as set out in Schedule 1. A Customer at a site that is metered by a Non-Standard Meter that has declined the installation of a Standard Meter may at any time request that EWSI install a Standard Meter at that site.
Rationale:	This proposed change is required to reflect the implementation of the AMI deployment project, if approved, and the Non-Standard Metering Reading Fee that a Customer will be required to pay if the Customer declines the installation of the Standard Meter, which shall be the Meter with AMI capabilities. Pursuant to the proposed change, EWSI will make reasonable efforts to contact the Customer prior to the Customer being charged the Non-Standard Meter Reading Fee.

Reference:	8.1 Installation of Meters
Current:	(b) Responsibility of Customer

	Each Customer shall ensure that a location on or in the Customer's premises for Meter installation is provided, complete with an EWSI approved meter setting, as prescribed by Design and Construction Standards, and that safe and easy access to the Meter is provided for the purpose of reading or servicing the Meter, in accordance with all applicable requirements of the Water Services Guidelines as amended from time to time. The Meter location shall provide protection from freezing and physical damage. All Meter installations, including placement, shall comply with EWSI's approved meter settings as prescribed by the Design and Construction Standards. Where the Customer fails to comply with the Design and Construction Standards, the Customer shall be subject to Turn Off in accordance with Article 10.2.
Proposed:	(b) Responsibility of Customer Each Customer shall ensure that a location on or in the Customer's premises for Meter installation is provided, complete with an EWSI approved meter setting, as prescribed by Design and Construction Standards, and that safe and easy access to the Meter is provided for the purpose of reading or servicing the Meter, in accordance with all applicable requirements of the Water Services Guidelines as amended from time to time. The Meter location shall provide protection from freezing and physical damage. The Customer shall be liable for all Water Services received in connection with a burst Customer Meter resulting from inadequate protection. All Meter installations, including placement, shall comply with EWSI's approved meter settings as prescribed by the Design and Construction Standards. Where the Customer fails to comply with the Design and Construction Standards, the Customer shall be subject to Turn Off in accordance with Article 10.2.
Rationale:	The proposed change clarifies the responsibility of a Customer for water that passes through a burst Meter, which results from a failure by the Customer to provide the adequate protection for the Meter required by Section 8.1(b).

Article 11 – Closing an Account

Reference:	11 – Closing an Account
Current:	Upon receipt of a valid notice to close an Account, EWSI shall make reasonable efforts to read the Customer's Meter at a time requested by the Customer. EWSI shall conduct a final reading of the Customer's Meter within a reasonable time. The Customer shall pay all fees and charges remaining on the account including all Water Services provided up to the time of the final reading and any further fees and charges that accrue prior to the point at which the site is enrolled with a subsequent Customer.
Proposed:	~~Upon receipt of a valid notice to close an Account, EWSI shall make reasonable efforts to read the Customer's Meter at a time requested by the Customer. EWSI shall conduct a final reading of the Customer's Meter within a reasonable time.~~ The Customer shall pay all fees and charges remaining on the account including all Water Services provided up to the time of the ~~final reading~~ Customer's requested end-of-service date and any further fees and charges that accrue prior to the point at which the site is enrolled with a subsequent Customer.
Rationale:	This proposed change is to align the process in the Terms and Conditions with EWSI's practice. The current practice is for the Customer's charges to stop on the Customer's requested end-of-service date and generally, EWSI does not do a final reading of the Meter.

2.3 Schedule 3 Performance Based Water Rates

2.3.1 Overview

The following table provides a summary of proposed revisions to the Water System Service Quality performance indices in Section 3.0 of Schedule 3, including updates and the rationale for changes, as appropriate. Generally, the performances indices and the underlying metrics have been updated based on historical trending. Minimal changes are proposed in order to maintain a relatively consistent metrics program from the current term. EWSI is commited to maintaining high service quality during the investment rebalancing proposed for the 2022-2026 PBR term. The detailed background and rationale for all metrics is detailed in the Water Application.

2.3.2 Inflation Factor

Reference:	Schedule 3 Section 2.1 Inflation Factor
Current:	For the purposes of this adjustment calculation, inflation will be determined on the basis of two components:

	a) a Consumer Price Index ("CPI") component, weighted at 65%, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Services V41694625 – CPI, 2005 Basket, 2002 = 100, Alberta, All Items and b) a Labour Cost component, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Series V1603533, weighted at 35%.
Proposed:	For the purposes of this adjustment calculation, inflation will be determined on the basis of two components: a) a Consumer Price Index ("CPI") component, weighted at 60%, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Services V41694625 – CPI, 2005 Basket, 2002 = 100, Alberta, All Items and b) a Labour Cost component, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Series V1603533, weighted at 40%.
Rationale:	This proposed amendment adjusts the weighting of labour versus non-labour costs. The previous weighting was based on the combination of Water and Wastewater Treatment Services costs. The revised weighting is based on Water Services costs.

2.3.3 Special Rate Adjustments for Water Services

Reference:	2.3.1 Special Rate Adjustments for Re-Basing
Current:	In the 2017-2021 PBR term a Special Rate Adjustment for Re-Basing was added to the Consumption Charge and Fixed Monthly Service Charge as an annual adjustment over the PBR term.
Proposed:	In the 2022-2026 PBR term a Special Rate Adjustment for Re-Basing will be added to the Consumption Charge and Fixed Monthly Service Charge as an annual adjustment over the PBR term.
Rationale:	In the 2017-2021 PBR application EWSI proposed a one year rebasing adjustment in 2017. At the request of the City EWSI smoothed the re-basing adjustment as an annual adjustment over the PBR term. EWSI has proposed to continue the Special Rate Adjustment for Re-Basing as an annual adjustment over the 2022-2026 PBR term.

Reference:	2.3.2 Special Rate Adjustments to Increase the Monthly Service Connection Fee
Current:	Not Applicable

Proposed:	A Special Rate Adjustment to increase the fixed portion and decrease the variable portion of the rate for the year 2022.
Rationale:	A Special Rate Adjustment to Increase the Monthly Service Connection Fee is required to bring the fixed versus variable ratio of Water Rates more closely in line with comparable communities and to help decrease the long term consumption impacts related to the decline in consumption for future PBR applications. This proposed adjustment will be added to the Fixed Monthly Service Charges and a corresponding decrease will be reflected in the Consumption Charges in Schedule 1, Part I – Water Rates.

Reference:	2.3.3 Special Rate Adjustments for the 90 Day Deferral Program
Current:	Not Applicable
Proposed:	A Special Rate Adjustment in 2022 to be applied to the Fixed Monthly Service Charges in Schedule 1, Part I – Water Rates for the 90 Day Deferral Program to recover the costs for administering the deferral of customer payments, interest expenses and any incremental bad debt costs.
Rationale:	The Special Rate Adjustment for the 90 Day Deferral Program has been structured to be in compliance with the provincial *Utility Payment Deferral Program Act*, SA 2020 C U-4 which applies to electricity and gas customers. This is a temporary program responding to the extraordinary impact of the COVID-19 pandemic on customers' ability to make utility bill payments. This Special Rate Adjustment will be removed from Customer bills in 2023.

Reference:	2.3.4 Special Rate Adjustment for the Public Fire Protection Program
Current:	Not Applicable
Proposed:	A Special Rate Adjustment for the Public Fire Protection Program to be added to the Public Fire Protection Monthly Charge in Schedule 1, Part I – Water Rates in 2022 to commence collection of the public fire protection revenue requirement through Water Rates.
Rationale:	This Special Rate Adjustment for the Public Fire Protection Program is required for compliance with Edmonton City Council's direction to recover public fire protection costs directly through Water Rates.

2.3.4 Water Services Quality Metrics

Article 3 of Schedule 3 sets out the Water Services Quality metrics. In addition to the detailed changes described in the tables below, EWSI has further amended the Water Service Quality metrics in a non-substantive way by adding sections and headings. These changes align with the Drainage metrics format and allow for more clarity.

Reference:	3.1 Water Quality Index and 3.2 Customer Service Index
Current:	The Water Quality Index and Customer Service Index are assigned a maximum value of 25 points and 20 points respectively.
Proposed:	The Water Quality Index and Customer Service Index are assigned a maximum value of 30 points and 15 points respectively.
Rationale:	The relative weightings have been revised in response to feedback obtained during the stakeholder engagement process on stakeholder priorities.

Reference:	3.1 Water Quality Index
Current:	A maximum of 0.5 bonus points is available for the water quality index based on the formula.
Proposed:	Removed
Rationale:	Bonus points will no longer be applied to the Water Quality Index to clarify that points earned from other performance metrics cannot be used to offset water quality performance that is below the prescribed standard for any given year.
Reference:	3.2 Customer Service Index, 3.3 Reliability and Optimization Index, 3.4 Environmental Index and 3.5 Safety Index
Current:	A maximum of 3 bonus points is available for the customer service index based on the formula. A maximum of 3.5 bonus points is available for the reliability and optimization index based on the formula. A maximum of 1.5 bonus points is available for the environmental index based on the formula. A maximum of 1.5 bonus points is available for the safety index based on the formula.
Proposed:	A maximum of 2.25 bonus points is available for the customer service quality index based on the formula. A maximum of 3.25 bonus points is available for the reliability and optimization index based on the formula. A maximum of 2.25 bonus points is available for the environmental index based on the formula. A maximum of 2.25 bonus points is available for the safety index based on the formula.
Rationale:	The bonus points have been adjusted based on changes to the index's relative weightings in response to feedback obtained during the stakeholder engagement process.

The following are changes, additions and deletions to the specific measures that comprise the five performance indices:

		Current Standard	Proposed Standard	Rationale for Change
Section 3.3	SYSTEM RELIABILITY and OPTIMIZATION INDEX			
Section 3.3.1	Water Main Break Factor	419	365	Proposed standard based on current standard adjusted by the average EWSI decline since the first PBR term (12.5%).
Section 3.3.2	Water Main Break Repair Duration Factor	93.7%	95.4%	Proposed standard based on an updated 10-year average. Current standard determined in the same manner.
Section 3.3.3	Water Loss Factor	2.0	1.23	Proposed standard based on 8 year historical result. Current standard based on 4 year historic result and management judgement.
Section 3.3.4	System Energy Efficiency Factor	309	281	Proposed standard based on 10 year historical result. Current standard determined in the same manner.
Section 3.1	WATER QUALITY INDEX	99.7%	99.7%	Reflects stable value in the range of that observed over the last five years. Cost effective methods of improving further have not been able to be identified.
Section 3.2	CUSTOMER SERVICE INDEX			
Section 3.2.1	Post Audit Service Factor	74.9%	75.0%	Proposed standard is based on the minimum level established by the Alberta Utilities Commission (AUC), as the customer service measure calculation method has been adjusted to align with the AUC transactional measure. Current standard is based on the 10 year average.
Section 3.2.3	Response Time Factor	25 minutes	25 minutes	Proposed standard based on geographic expansion of City and

		Current Standard	Proposed Standard	Rationale for Change
				increased traffic. Current standard determined in the same manner.
Section 3.2.2	Home Sniffing Factor	94.4%	94.4%	Proposed standard maintains current level. Current standard is based on the 10 year average.
Section 3.2.4	Planned Construction Impact Factor	95.8%	95.8%	Proposed standard based on 8-year average of historical results. Current standard based on 4-year average of historic results.
Section 3.4	ENVIRONMENTAL INDEX			
Section 3.4.2	Environment Incident Factor	6	5	Proposed standard based on an updated 10 year average. Current standard based on historic performance and management judgement.
Section 3.4.1	Water Conservation Factor	17.2 m^3	16.8 m^3	Proposed standard based on an updated 10 year average. Current standard determined in the same manner.
Section 3.4.3	Solids Residual Management Factor	120 days	120 days	Proposed and current standard based on AEP commitment.
Section 3.5	SAFETY INDEX			
Section 3.5.2	Worksite Inspection Factor	1,032	1,032	Proposed standard maintains current standard. Current standard based on an updated 10-year average.
Section 3.5.3	Lost Time Frequency Factor	0.57	0.40	Proposed standard based on an updated 10 year average. Current standard determined in the same manner.
Section 3.5.4	All Injury Frequency Factor	1.54	1.00	Proposed standard based on an updated 10 year average. Current standard determined in the same manner.

		Current Standard	Proposed Standard	Rationale for Change
Section 3.5.1	Near Miss Reporting Factor	550	550	Current and proposed standards based on an average of 1.25 per employee annually.

2.3.5 Non-Routine Adjustments

Article 4 of Schedule 3 sets out the events that would warrant a non-routine adjustment to EWSI's revenue requirement in the 2022-2026 PBR term. The following contains explanations for the proposed changes to Article 4 of Schedule 3.

Reference:	4.4 Deterioration of Waterworks System
Current:	If there is significant deterioration to the Waterworks System or Wastewater Treatment facilities, beyond reasonable projections, remediation costs will be considered as non-routine.
Proposed:	If there is significant deterioration to the Waterworks System ~~or Wastewater Treatment facilities~~, beyond reasonable projections, remediation costs will be considered as non-routine. Without limiting the foregoing, these circumstances may include unanticipated asset failure or deterioration requiring immediate repair or remediation.
Rationale:	This proposed addition clarifies the circumstances that constitute significant deterioration to the Waterworks System.

Reference:	4.9 Grant Funding
Current:	N/A
Proposed:	Cost reductions from the approved revenue requirement resulting from the receipt of grants or recognition of approved grants shall be considered as a negative non-routine adjustment.
Rationale:	This proposed new addition allows EWSI to have received grants and approved grants considered as negative non-routine adjustments. This proposed adjustment is for instances where grant funding is received for projects that are already included in rates. The reduction in rates through a negative non-routine adjustment will eliminate duplicate funding of a single project.

APPENDIX A – Part 2

SUMMARY OF THE EPCOR DRAINAGE AND WASTEWATER SERVICES BYLAW AND KEY CHANGES

3.0 OVERVIEW OF PROPOSED DRAINAGE AND WASTEWATER SERVICES BYLAW

○ **Overview**

Through the Drainage and Wastewater Services Bylaw, EWSI seeks approval for the following:

(l) Extension of the PBR from April 1, 2022 to March 31, 2025.

(m) Inclusion of a PBR formula to set rates based on routine and non-routine adjustments commencing April 1, 2023.

(n) The addition of four new Service Charges (Schedule 1 Part III).

(o) The deletion of two Service Charges.

(p) Updated Terms and Conditions of Drainage and Wastewater Service that govern the relationship between EWSI and its customers. The majority of the proposed changes add clarity, improve consistency and readability and eliminate duplication. Details of the proposed amendments (except changes of a more minor nature) are summarized in the table below. The remaining minor changes are set out in the blacklined version of the Bylaw. These changes add clarity, improve consistency and readability, and eliminate duplication.

(q) Special Rate Adjustments for Drainage and Wastewater Services including special rate adjustments for: (i) the fixed and variable charges to rebase the revenue requirement based on forecast costs for the PBR term; (ii) the 90-day utility bill deferral program established for the deferral of sanitary and stormwater utility bill payments for customers in need; (iii) the Stormwater rate to recover costs for SIRP and (iv) the sanitary variable charges to recover costs for CORe;

(r) The Inflation factor applied each year to prior year's drainage rates to be calculated based on a weighting of 40% non-labour component and 60% labour component to represent Drainage Services' internal cost structure (Schedule 3).

(s) The Inflation factor applied each year to prior year's wastewater treatment rates to be calculated based on a weighting of 65% non-labour component and 35%

labour component to represent Drainage Services' internal cost structure (Schedule 3).

(t) Maintain the Efficiency factor from the previous PBR term at 0.25%.

(u) Updated Drainage and Wastewater Services performance standards to ensure that the standards continue to be appropriate and achievable but also sufficiently rigorous to result in a high level of customer service. Substantive changes to the Performance Measures are described in detail in the table below and are in Schedule 3 of the Bylaw.

(v) Revisions to non-routine adjustment clauses to: (i) clarify that circumstances for the deterioration of the Drainage or Wastewater Treatment Systems may include unanticipated asset failure or deterioration requiring immediate repair or remediation; and (ii) to allow for negative non-routine adjustments related to grants (Schedule 3).

4.0 CHANGES FROM CURRENT DRAINAGE SERVICES BYLAW TO PROPOSED DRAINAGE AND WASTEWATER SERVICES BYLAW

- **Schedule 1 Price Schedule**

4.1.1. Drainage Rates

EWSI is proposing significant changes to Schedule 1, Part I of the Bylaw. Rather than detailing each proposed change (which is set out in the Blackline Version of the Bylaw), the information below identifies the substantive changes and provides a rationale for each change.

Reference:	Schedule I, Part I – Sanitary and Stormwater Utility Charges
Proposed:	• Plain language setting out the basis for the charge • Statement that the published bylaw rates are the "going-in rates" for 2022
Rationale:	The proposed changes are designed to add clarity to the Sanitary Utility Charge and to demonstrate that the charge is comprised of two components: a flat and variable charge.

Reference:	Schedule I, Part I –Stormwater and Stormwater Utility Charges

<table>
<tr><td>Proposed:</td><td>

Addition of language clarifying that Stormwater Utility Charges are payable by:

all persons who receive Water Service
All persons who receive Drainage Services; and
All persons that receive the benefit, directly or indirectly, of the conveyance of Stormwater.

Clarification that “zoning” on which the Stormwater utility charge is based is the “effective zoning” designation as it appears on the tax roll for a premises.
Authorization for EWSI to use a zoning designation to approximate a property’s effective zoning designation.
Authorization for EWSI to adjust Stormwater billing factors in accordance with cost of service principles.
Statement that the published bylaw rate is the “going-in rate” for 2022.

</td></tr>
<tr><td>Rationale:</td><td>The proposed changes are designed to add clarity to the applicability of the Stormwater Utility Charge to all property owners, occupants and tenants within the city of Edmonton and are consistent with City Council’s intention that Stormwater Utility charges are charges applicable to all properties.
The proposed changes also provide EWSI with some flexibility and discretion related to Stormwater charges. This will allow EWSI to consider the potentially unique characteristics of a property and its contribution to the Stormwater system.</td></tr>
</table>

4.1.2. Service Charges

The following contains explanations for the changes to Schedule 1 – Part II Service Fees and Charges.

<table>
<tr><td>Reference:</td><td>Schedule I, Part II – Service Fees and Charges</td></tr>
<tr><td>Current:</td><td>
1. Application Fees
<table>
<tr><th>Application Type</th><th>2018 Fee</th><th>2019 Fee</th><th>2020 Fee</th><th>2021 Fee</th><th>2022 Fee</th></tr>
<tr><td>Application to release matter</td><td>$354.32</td><td>$364.95</td><td>$375.90</td><td>$387.18</td><td>$398.79</td></tr>
<tr><td>Application to approve a compliance program</td><td>$354.32</td><td>$364.95</td><td>$375.90</td><td>$387.18</td><td>$398.79</td></tr>
</table>
</td></tr>
</table>

Records search	$110.21	$113.52	$116.92	$120.43	$124.04
Application for sewer metering approval	$329.60	$339.49	$349.67	$360.16	$370.97
Application for reduction in stormwater utility intensity development factor	$329.60	$339.49	$349.67	$360.16	$370.97
Application for utility credit	$329.60	$339.49	$349.67	$360.16	$370.97
Application for large wholesale designation	$329.60	$339.49	$349.67	$360.16	$370.97

Proposed:

Application Type	**2022 Fee**
Application to release matter	$189.58
Application to approve a compliance program	Subject to estimate based on cost of service.
Records search	$142.06
Application for reduction in Stormwater utility credit Initial application Renewal application	$400.00 $225.00
Application for sanitary utility credit	$400.00

Rationale: EWSI proposes to remove two services that are no longer applicable to Drainage Services due to the absence of customers that might require either sewer metering or large wholesale designation. Additionally, EWSI proposes to change the name of the credit application programs.

Reference:	Schedule I, Part II – Service Fees and Charges
Current:	Other Service Charges – EWSI proposes to add the following new Service Charge Schedule 1, Part II
Proposed:	**Missed Appointment Fee** To all customers who do not keep a scheduled appointment with an EWSI representative Missed Flood Assessment Appointment Fee Missed Obstruction Removal Appointment Fee **No-Access Fee** To all Customers who request EWSI to investigate sewer trouble but fail to provide access to the sanitary cleanout as required by EWSI's Drainage Services Guidelines. No-Access Fee — $200.00* *This is fee is subject to waiver or reimbursement if the Customer provides access to the sanitary cleanout as required by EWSI's Drainage Services Guidelines within 30 days of the initial investigation request. **Investigation Fee** To all Customers who request EWSI to investigate sewer trouble where the result of the investigation indicates that the sewer trouble is caused by a private plumbing issue. Investigation Fee — $200.00 **Service Connection Fees** The fee for new sewer connections is calculated on a cost of service basis in accordance with the Drainage Services Guidelines.
Rationale:	EWSI proposes three new service charges to allow for cost recovery in situations where EWSI costs are directly attributable to a specific customer. EWSI proposes a change to the Service Connection fees from a flat fee to a fee based on actual costs of service. This change aligns with the principle that directly attributable costs should be paid by the user of the service.

4.1.3. Wastewater Treatment Rates

The following contains explanations for the more substantive changes to Schedule 1, Part III – Wastewater Treatment Rates:

Reference:	Schedule I, Part III – Wastewater Treatment Rates
Current:	**Wastewater Treatment Rate: Sewer Metering** **Applicable** To non-residential wastewater treatment service customers discharging more than 50,000 m^3 per month to the City's sanitary sewer system and who wish to apply for sewer metering in place of water meter readings. The customer must submit a written application to The City, following the terms and processes outlined in the City of Edmonton Bylaw 9675, Sewers Use Bylaw, as amended.
Proposed:	Delete entire provision.
Rationale:	EWSI proposes to delete this provision as there are no customers for whom this provision is relevant.

Reference:	Schedule I, Part III – Wastewater Treatment Rates
Current:	**Wastewater Treatment Rate: Sanitary Utility Credit** **Applicable** To non-residential wastewater treatment service customers who can clearly demonstrate that there is a water loss experience between their water consumed and their discharges to the sanitary sewer system on a continuous monthly basis. The customer must submit a written application to The City, following the terms and processes outlined in the City of Edmonton Bylaw 9675.
Proposed:	**Wastewater Treatment Rate: ~~Sewer~~ Sanitary Utility Credit** **Applicable** To non-residential wastewater treatment service Customers who can clearly demonstrate that there is a water loss experience between their water consumed and their discharges to the sanitary sewer system on a continuous monthly basis.

	The customer must submit a written application to ~~The City, following the terms and processes outlined in the City of Edmonton Bylaw 9675.~~EPCOR as required by Schedule 2 to the Bylaw.
Rationale:	EWSI proposes to amend this provision to reflect that this process is an EPCOR, rather than City process.
Reference:	Schedule I, Part III – Wastewater Treatment Rates
Current:	**Residential Wastewater Treatment Service** **Applicable** To all domestic service Customers and multi-residential service Customers located within the city of Edmonton which are serviced by or connected to the City's sewerage system. A domestic service and multi-residential service are defined in Part I of this Schedule.
Proposed:	**Residential Wastewater Treatment Service** **Applicable** To all domestic service Customers and multi-residential service Customers located within the city of Edmonton which are serviced by or connected to the City's sewerage system. ~~A domestic service and multi-residential service are defined in Part I of this Schedule.~~ A domestic service is defined as a service supplied to premises used primarily for domestic purposes, where no more than four separate dwelling units are metered by a single water meter and the service line to the premises is not greater than 50 millimeters in diameter. If a business is conducted from premises that otherwise fall within the above definition of a domestic service, Commercial Wastewater Treatment Service rates apply; provided however, that if a portion of the premises from which the business is conducted is separately metered, then a Commercial Wastewater Treatment Services rate will apply only to that portion of the premises.
Rationale:	EWSI proposes to amend this provision to reflect the inclusion of Wastewater Treatment Rates in the Drainage and Wastewater Treatment Services Bylaw.

○ **Schedule 2 Terms and Conditions of Drainage and Wastewater Treatment Services**

The following contains explanations for the more substantive changes to Schedule 2 – Terms and Conditions of Water Services.

Article 1 – Definitions and Interpretation

Reference:	1.1 Definitions
Current:	
Proposed:	"**Authorized Agent**" means a person who has a valid EWSI access permit as set out in the Drainage Services Guidelines.
Rationale:	This item is added to provide clarity regarding persons who can access EWSI facilities.

Reference:	1.1 Definitions
Current:	"**Subsurface Water**" means water at a depth of not more than 15 metres beneath the surface of the ground.
Proposed:	"**Subsurface Water**" means ~~means water at a depth of not more than 15 metres beneath the surface of the ground~~ naturally occurring that collects or flows beneath the ground surface filling the porous space of sediment, soil and rocks;
Rationale:	This item is added to provide clarity.

Reference:	2.3 Drainage Services Guidelines
Current:	
Proposed:	The document entitled " EPCOR Drainage Services Water and Sewer Connections Guidelines"
Rationale:	EWSI proposes to add an additional document to its Drainage Services Guidelines to provide details related to Service connections.

Reference:	4.3 Flow Monitoring Points
Current:	(d) This section does not apply to: (i) residential properties discharging only Wastewater from domestic sources; or (ii) minor redevelopments exempted by EWSI.
Proposed:	(d) Unless exempted by EWSI, this section applies to all premises except single-family or duplex properties that discharge only Wastewater from domestic sources.

Rationale:	This amendment expands possible exemption from flow monitoring to duplex properties.

Reference:	4.6 Screening and Pretreatment
Current:	The Owner of a premises shall install screens or pretreatment facilities within the Private Drainage System for the premises when required to do so by the EWSI.
Proposed:	The Owner of a premises shall install screens or pretreatment facilities or modify pretreatment processes, within the Private Drainage System for the premises when required to do so by the EWSI.
Rationale:	This amendment expands EWSI's ability to require owners to modify their existing pretreatment processes.

Reference:	4.12 Stormwater Management Facilities
Current:	
Proposed:	(c) A Person shall not facilitate any of the activities prohibited by this section.
Rationale:	This proposed addition better enables EWSI to enforce the provisions of the Bylaw by including persons who facilitate prohibited activities.

Reference:	5.5 Waste Management
Current:	
Proposed:	(b) A Person who keeps or stores a Prohibited or Restricted Waste shall ensure that those material are sequestered through secondary containment, barriers and/or distance to ensure that the Prohibited or Restricted Waste is not Released into the Sewerage System.
Rationale:	This proposed addition provides clarification related to the storage of Prohibited or Restricted Waste and is sought to reduce the risks associated with these materials.

Reference:	5.17 Release Control

Current:	
Proposed:	(c) prevent future releases of matter other than those permitted in this Article.
Rationale:	This proposed addition allows EWSI to require persons to take preventative measures to ensure that further releases do not occur.

Reference:	8.1 Protection of EWSI's Facilities and Property of Other Customers
Current:	Only an employee or authorized agent of EWSI shall remove, operate, or maintain EWSI Facilities. A Customer shall not obstruct access to or interfere with any Facility or permit the same to be done by any Person other than an employee or authorized agent of EWSI. If a Customer or a Person authorized by a Customer fails to comply with this provision, the Customer is responsible to pay the cost of repairing or otherwise remedying any damage to or loss of Facilities located on the Customer's premises or premises controlled by the Customer, unless caused by circumstances, as determined in EWSI's sole discretion, to have been beyond the Customer's control.
Proposed:	Only an EWSI employee or Authorized Agent shall remove, operate, enter, access, attach affix to or maintain EWSI Facilities. A Customer shall not obstruct access to or interfere with any Facility or permit the same to be done by any Person other than an employee or authorized agent of EWSI. If a Customer or a Person authorized by a Customer fails to comply with this provision, the Customer is responsible to pay the cost of repairing or otherwise remedying any damage to or loss of Facilities located on the Customer's premises or premises controlled by the Customer, unless caused by circumstances, as determined in EWSI's sole discretion, to have been beyond the Customer's control.
Rationale:	The purpose of this amendment is to clarify that only EWSI employees or persons authorized by EWSI can perform work on EWSI's Facilities.

Reference:	13.2 Discontinuation of Water Service
Current:	In addition to any other remedy or penalty, EWSI may discontinue the provision of water services as provided by EPCOR Water Services and Wastewater Treatment Bylaw to any premises if the Customer of that premises is in breach of these Terms and Conditions and no less than forty-

	eight hours advance notice of the discontinuance is provided to the Customer of the premises.
Proposed:	In addition to any other remedy or penalty, EWSI may, in its sole discretion, discontinue or limit the provision of water services as provided by EPCOR Water Services and Wastewater Treatment Bylaw to any premises if the Customer of that premises is in breach of these Terms and Conditions and no less than forty-eight hours advance notice of the discontinuance is provided to the Customer of the premises.
Rationale:	This provision will allow EWSI to limit, rather than fully discontinue, water supply where customers are in breach of the Terms and Conditions of Service.

Reference:	15.4 Powers of EWSI
Current:	15.4 (c) take any steps or carry out any actions required to remedy a contravention of this bylaw;
Proposed:	15.4 (c) take any steps or carry out any actions required to remedy a contravention or release which, in EWSI's reasonable opinion, appears to be a contravention of this bylaw;
Rationale:	The purpose of this amendment is to expand EWSI's authority to take action where, based on reasonable belief, there appears to a bylaw contravention.

2.4 Schedule 3 Performance Based Water Rates

2.4.1 Overview

EWSI is proposing significant changes to Schedule 3 of the Bylaw. Rather than detailing each proposed change (which is set out in the Blackline Version of the Bylaw), the information below identifies the substantive changes and provides a rationale for each change. The majority of these changes are driven by the introduction rate adjustments consistent with Performance Based Rates and Special Rate Adjustments.

2.4.2 Section 1.0 Rate adjustments

Reference:	Schedule 3, Section 1.0
Current:	
Proposed:	• Provision for a three-year PBR term • Inclusion of a PBR formula which allows for the adjustment of variable rates, consumption charges, fixed and flat monthly service charges, service charges and fees, Wastewater Overstrength Surcharges. • Provision for routine rate adjustments including an Inflation Factor, Efficiency Factor and Special Rate Adjustments.
Rationale:	The purpose of these amendments is to ensure that Sanitary, Stormwater and Wastewater Treatment rates reflect Performance Based Rates.

Reference:	Schedule 3, Section 2.1
Current:	N/A for Drainage
Proposed:	The inflation factor for Drainage is proposed to be determined on the basis of two components: a) a Consumer Price Index ("CPI") component, weighted at 40%, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Services V41694625 – CPI, 2005 Basket, 2002 = 100, Alberta, All Items; and b) a Labour Cost component, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Series V1603533, weighted at 60%. The inflation factor for Wastewater is proposed to be determined on the basis of two components: a) a Consumer Price Index ("CPI") component, weighted at 65%, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Services V41694625 – CPI, 2005 Basket, 2002 = 100, Alberta, All Items; and

	b) a Labour Cost component, based on the annual Conference Board of Canada's forecast for Statistics Canada CANSIM Series V1603533, weighted at 35%.
Rationale:	This proposed amendment adjusts the weighting of labour versus non-labour costs.

2.4.3 Special Rate Adjustments for Drainage and Wastewater Treatment Services

Reference:	2.3.1 and 2.3.2 Special Rate Adjustments for Re-Basing
Current:	In the 2017-2021 PBR term for Drainage, a provision for Re-Basing was not included as 2017 was the "going-in" year. In the 2017-2021 PBR term for Wastewater Treatment Service, a Special Rate Adjustment for Re-Basing was added to the Consumption Charge and Fixed Monthly Service Charge as an annual adjustment over the PBR term.
Proposed:	In the 2022-2024 PBR term, a Special Rate Adjustment for Re-Basing will be added to the Sanitary and Stormwater Rates and to the Flat Monthly Service Charges as an annual adjustment over the PBR term. In the 2022-2024 PBR term a Special Rate Adjustment for Re-Basing will be added to the Consumption Charge, Fixed Monthly Service Charge, Wastewater Surcharge and Wastewater Overstrength Charge as an annual adjustment over the PBR term.
Rationale:	In the 2017-2021 Wastewater PBR application EWSI proposed a one year rebasing adjustment in 2017. At the request the City EWSI smoothed the re-basing adjustment as an annual adjustment over the PBR term. EWSI has proposed to continue the Special Rate Adjustment for Re-Basing as an annual adjustment over the PBR term.

Reference:	2.3.3 Special Rate Adjustments for the 90 Day Deferral Program
Current:	Not Applicable
Proposed:	A Special Rate Adjustment in 2022 to be applied to the Stormwater Utility Rate Schedule 1, Part 1 and the Fixed Monthly Service Charge for Wastewater in Schedule 1, Part III for the 90 Day Deferral Program to recover the costs for administering the deferral of customer payments, interest expenses and any incremental bad debts costs.

Rationale:	The Special Rate Adjustments for the 90 Day Deferral Program, which has been structured to be in compliance with the provincial *Utility Payment Deferral Program Act*, SA 2020 C U-4 which applies to electricity and gas customers. This is a temporary program responding to the extraordinary impact of the COVID-19 pandemic on customers' ability to make utility bill payments. This Special Rate Adjustment will be removed from Customer bills in 2023.

Reference:	2.3.4 Special Rate Adjustment for the CORe Program
Current:	Not Applicable
Proposed:	A Special Rate Adjustment to be added to the Sanitary Utility Rate over the PBR 2022-2024 term for the CORe Program to recover the costs to prevent the formation of hydrogen sulfide gas which will reduce odour impacts and lengthen the life of the sewer network through corrosion mitigation.
Rationale:	This Special Rate Adjustment is part of a robust strategy to address odour issues which are often precursors to more serious corrosion and premature failure of sewer assets. The Special Rate Adjustment is structured as part of a multi-stage program that EWSI proposes to implement through successive PBR periods.

Reference:	2.3.5 Special Rate Adjustment for SIRP
Current:	Not Applicable
Proposed:	A Special Rate Adjustment to be added to the Stormwater Utility Rate over the PBR 2022-2024 term for the SIRP Program to recover the costs of a flood mitigation program.
Rationale:	This Special Rate Adjustment is structured as part of a 20-30 year strategy to mitigate flood risk by reducing the health and safety, financial and social risks of flooding. Initial implementation of the SIRP program was funded through an approved non-routine adjustment. EWSI is proposing to implement SIRP in stages at each successive PBR period.

2.4.4 Non-Routine Adjustments

Reference:	2.4 Non-routine adjustments
Current:	Commencing January 1st, 2019 and for each subsequent year on that date the variable charge for the Sanitary Utility Charge, and/ or the Stormwater Utility Rate may be adjusted in accordance with the non-routine adjustment clause, Article 4.0 herein, as applicable.

Proposed:	Commencing January 1st, 2023 ~~19~~ and for each subsequent year on that date the ~~variable~~ flat charge for the Sanitary ~~Utility Charge~~ and/ or the Stormwater utility ~~Rate~~service and/or the fixed charge for Wastewater Treatment service may be adjusted in accordance with the non-routine adjustment clause, Article 5.0 herein, as applicable. .
Rationale:	The purpose of this amendment is to change the charge on which to apply any non-routine adjustments related to Sanitary or Stormwater service from the variable to the flat charge. In addition, this amendment also includes Wastewater Treatment, as applicable.

2.4.5 Drainage Services Quality

The following table provides a summary of proposed revisions to the Drainage System Service Quality performance indices in Section 3.0 of Schedule 3, including updates and the rationale for changes, as appropriate. The current performance metrics for Drainage Services were introduced in January of 2020 and have not yet completed a full reporting cycle. EWSI is thus proposing largely maintain the existing program for the 2022-2024 PBR term subject to the following revisions:

Reference:	3.1 Environmental Index and 3.3 System Reliability / Optimization Index
Current:	The Environmental Index and system Reliability/Optimization Index are assigned a maximum value of 30 points and 35 points respectively.
Proposed:	The Environmental Index and System Reliability / Optimization Index are assigned a maximum value of 35 points and 30 points respectively.
Rationale:	The relative weightings have been revised in response to feedback obtained during the stakeholder engagement process on stakeholder priorities.

Reference:	3.1 Environmental Index
Current:	The current Green Hectares standard is 22.
Proposed:	EWSI proposes a phased increase to this standard as follows: 2022: 45 2023: 90 2024: 180
Rationale:	EWSI is proposing to set the performance standard at a successively higher number each year to recognize the planned installation of green infrastructure.

Reference:	3.2.4 Customer Service Index
Current:	The current sewer odour hotspot factor is 16%.
Proposed:	EWSI proposes a phased change to this standard as follow 15.0% 2022: 15.0% 2023: 14.5% 2024: 14%
Rationale:	EWSI is proposing to set the performance standard at a successively more challenging target each year to recognize the planned CORe Strategy.

2.4.6 Wastewater Treatment Service Quality

In addition to the detailed changes described in the tables below, EWSI has further amended the Wastewater Treatment Service Quality metrics in a non-substantive way by adding sections and heading. These changes align with the Drainage metrics format and allow for more clarity.

Reference:	4.1 Water Quality Environmental Index and 4.3 System Reliability / Optimization Index
Current:	The Water Quality Environmental Index and System Reliability/Optimization Index are assigned a maximum value of 55 points and 15 points respectively.
Proposed:	The Water Quality Environmental Index and System Reliability/Optimization Index are assigned a maximum value of 45 points and 25 points respectively..
Rationale:	The relative weightings have been revised in response to feedback obtained during the stakeholder engagement process on stakeholder priorities.

Reference:	4.1.1 Water Quality Factor
Current:	The current water quality standard is 28.
Proposed:	EWSI proposes the new water quality standard as 26.
Rationale:	EWSI is proposing to set a more stringent standard, recognizing both increasing performance standards and that continued improvements in plant operations be come more difficult to achieve due to factors outside of EWSI’s control.

Reference:	4.1.2 Environment Incident Factor

Current:	The current environment incident factor is 10.
Proposed:	EWSI proposes the environment incident factor as 5.
Rationale:	EWSI is proposing to set a more stringent standard, recognizing both increasing performance standards and that continued improvements in plant operations be come more difficult to achieve due to factors outside of EWSI's control.

Reference:	4.2.1 H_2S – 1 Hour Exceedance Factor
Current:	The current H_2S Exceedance factor is 6.
Proposed:	EWSI proposes the 1 Hour H_2S Exceedance Factor at 4.
Rationale:	EWSI is proposing to set a more stringent standard, recognizing increasing performance standards.

Reference:	4.2.2 H_2S – 24 Hour Exceedance Factor
Current:	The current 24 Hour H_2S Exceedance factor is 2.
Proposed:	EWSI proposes the H_2S 24 hour Exceedance Factor at 1.
Rationale:	EWSI is proposing to set a more stringent standard, recognizing increasing performance standards

Reference:	4.2.3 Scrubber Uptime Factor
Current:	The current Scrubber Uptime Factor is 90%.
Proposed:	EWSI proposes the Scrubber Uptime Factor at 96%.
Rationale:	EWSI is proposing to set a more stringent standard which reflects an increase in performance and is a reflection of the last three years of performance.

Reference:	4.3.1 Enhanced Primary Treatment Factor
Current:	The current Enhanced Primary Treatment Standard is 80%
Proposed:	EWSI proposes the updated Enhanced Primary Treatment Standard at 94%.
Rationale:	EWSI is proposing to set a more stringent standard which reflects an increase in performance and is based on the 8-year average of historic performance.

Reference:	4.3.2 Bio-Solids Inventory Reduction
Current:	The current Bio-Solids Inventory Reduction is 1.10.
Proposed:	EWSI proposes the updated Bio-Solids Inventory Reduction at 1.05.
Rationale:	EWSI is proposing to set a more stringent standard which reflects an increase in performance and is based on a rolling average that will provide a degree of smoothing to the variability that occurs in year over year results that is beyond EWSI's control.

Reference:	4.3.3 Energy Efficiency Factor
Current:	The current Energy Efficiency standard is 534.
Proposed:	EWSI proposes the Energy Efficiency standard at 508.
Rationale:	EWSI is proposing to set a more stringent standard which reflects an increase in performance and is a reflection of historic average of the past 9 years.

Reference:	All Injury Frequency Factor
Current:	The current All Injury Frequency Factor is 1.5.
Proposed:	EWSI proposes the updated All Injury Frequency Factor at 1.00.
Rationale:	EWSI is proposing to set a more stringent standard which reflects EWSI's commitment to health and safety for all employees.

2.4 Non-Routine Adjustments

Article 5 of Schedule 3 sets out the events that would warrant a non-routine adjustment to EWSI's revenue requirement in the 2022-2024 PBR term. The following contains explanations for the proposed changes to Article 4 of Schedule 3.

Reference:	5.3 Deterioration of Drainage or Wastewater Treatment Systems
Current:	If there is significant deterioration to the Drainage System facilities, beyond reasonable projections, remediation costs will be considered as non-routine.

Proposed:	If there is significant deterioration to the Drainage System or Wastewater Treatment facilities, beyond reasonable projections, remediation costs will be considered as non-routine. Without limiting the foregoing, these circumstances may include unanticipated asset failure or deterioration requiring immediate repair or remediation.
Rationale:	This proposed addition clarifies the circumstances that constitute significant deterioration to the Drainage System or Wastewater Treatment facilities.

Reference:	5.9 Non-Routine Adjustments
Current:	N/A
Proposed:	Cost reductions to the approved revenue requirement resulting from the receipt or recognition of approved grants will be considered as a negative non-routine adjustment.
Rationale:	This proposed new addition allows EWSI to have grants considered as negative non-routine adjustments. This proposed adjustment is for instances where grant funding is received for projects that are already included in rates. The reduction in rates through a negative non-routine adjustment will eliminate duplicate funding of a single project.

Appendix B

EPCOR WATER SERVICES INC.

Utility Committee Motions and Directives

February 16, 2021

APPENDIX B
UTILITY COMMITTEE MOTIONS

1.0 UTILITY COMMITTEE MOTIONS

1. The Utility Committee issued two motions over the period of the 2017-2021 PBR regarding the upcoming PBR Applications. Additionally, EWSI has complied with the requirements of Bylaw 12294 with respect to presenting a public awareness and engagement plan 18 months in advance of the effective date of the proposed rate adjustments in its PBR Applications.

1.1 Efficiency Ratio and Rate Structure

2. On October 14, 2016, the Utility Committee passed the following motion:

> *"That Administration work with EPCOR on the following:*
> - *Establish appropriate methodology to calculate the Efficiency Ratio prior to next Performance Based Rates.*
> - *Possible changes to rate structures to deal with changes in volume.."*

3. EWSI has complied with this motion as presented to the Utility Committee on December 5th. Section 1.6.2 of each of the Applications describe EWSI's proposed efficiency factor, while Section 1.7.2 of the Water Application describe EWSI's proposed rate structure changes.

1.2 PBR Renewal

4. On August 30, 2017, Utility Committee provided the following direction:

> *"That Administration work with EPCOR to bring back the next Performance Based Rates application in time for approval by September 2021."*

5. EWSI confirms that, in compliance with this motion, the PBR Applications for Water Services, Wastewater Treatment Services and Drainage Services have been submitted to the City in February 2021.

Appendix D

EPCOR WATER SERVICES INC.

Return on Common Equity Memorandum

February 16, 2021

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1.0 OVERVIEW

1. In the 2017-2021 PBR application for Water and Wastewater, both EPCOR Water Services Inc.'s (EWSI) rate of return expert and Grant Thornton (GT), the City of Edmonton's (City) consultant, recognized that:

   i) EWSI's business risks are greater than the average Alberta electric and gas utility[1], and
   ii) It is reasonable to add a risk premium to the Alberta Utility Commission's generic cost of capital to derive the allowed return on equity for EWSI.

2. The Utility Committee observed that prior PBR decisions had not specifically quantified the appropriate risk premium and suggested that EWSI work with City Administration to quantify the risk premium in advance of the next PBR application.

3. In mid-2019, EWSI and City Administration began discussions towards developing an approach to quantify an appropriate risk premium. This culminated in the development of a formal "Request for Information" (RFI) that was circulated to the consulting community. The intent of the RFI was to seek guidance and input from industry experts to fully define the risk premium approach. The RFI defined the risk premium approach as identifying and most importantly quantifying the various risk factors that support the need for an equity risk premium for EWSI above the Alberta Utility Commission's approved generic cost of capital.

4. The information from the RFI was planned to be used in seeking approval of the final approach from the Utility Committee and to inform the eventual "Request for Proposal" (RFP). The RFP would then be issued to select a consultant to complete the actual assessment and quantification of the risks and the development of the return on equity recommendation.

5. The RFI submissions were received in January, 2020. Unfortunately, only two firms responded. Neither response adequately defined a method that would lead to the intended outcome of quantifying the various risk factors. Subsequent conversations with the consultants revealed that the quantified risk premium approach, while theoretically sound, is difficult to enact as there is no basis to adequately quantify and justify the risk factors. At best, the assessment could be completed with business risks being identified and aggregated into larger "buckets" and then the associated risk premium subjectively determined. Both consultants indicated that this approach is not an established

[1] Page 143, Grant Thornton, EPCOR Performance Based Regulation 2017-2021 Filing Review, December 22, 2016.

industry practice. Based on these discussions, EWSI concluded that reliance on more traditional approaches (Capital Asset Pricing Model, Discounted Cash Flows and Risk Premium Model) for the determination of a proposed return on equity was warranted.

6. In previous applications, EWSI contracted an external industry expert to develop such an analysis based on accepted financial approaches and financial market conditions at the time. However, with the onset of the global COVID 19 pandemic and the associated impact on financial markets, EWSI determined that traditional approaches to determining a return on equity were not appropriate for the 2022-2024/2026 applications. The fiscal and monetary policies introduced to diminish the economic impact of the pandemic resulted in changes to financial market data used to estimate common equity rates of return and impacted the viability of the traditional approaches.

7. EWSI instead proposes that an update of Grant Thornton's 2016 analysis (used to set the 2017-2021 PBR term's common equity return) be used to establish the 2022-2024/2026 PBR common equity rate of return (ROE). A formulaic extension of this approach is seen as the most straightforward approach and best aligns with the City's desire to determine a risk premium to the Alberta Utility Commission's generic cost of capital to derive the allowed rate of return on equity for EWSI. The update to this approach is fully detailed in a subsequent section of this Memorandum. EWSI has also provided commentary to document the differences in the risk profile of EWSI's businesses in relation to those regulated by the AUC to justify the risk premium over the generic allowed return on equity and to satisfy Utility Committee's original request to the greatest degree possible.

2.0 BACKGROUND

2.1 Cost of Capital Composition

8. "Cost of Capital" is a fundamental concept in both financial theory and public utility regulation. At the highest level, cost of capital is an opportunity cost, meaning that investing in any asset (or security) implies a foregone opportunity to invest in an alternative asset (or security). For any investment to make financial sense, the expected return of that investment must be equal to the return available in other investments assuming that both investments are of comparable risk. Because investments with similar risks should offer similar returns, the opportunity cost of an investment should equal the return available on an investment of comparable risk. The higher (or lower) the risk, the higher (or lower) the investor's expected return.

9. From a utility perspective, total cost of capital is a central component of the revenue requirement. In most instances, the total cost of capital is the combination of the cost of debt, the cost

of common equity and the capital structure (the allowed percentage of debt and equity). The rate of return is developed from the cost of capital by weighting each of these components by the allowed capital structure to derive the weighted average cost of capital (WACC)[2]. Generally, regulators focus their reviews on the cost of equity and the capital structure while debt rates are generally determined by financial market information.

2.2 The Fair Return Standard

10. Under the PBR's constructs, EWSI is allowed to recover the operating expenses and depreciation deemed reasonable in the rates approval process as well as a fair return on the assets utilized in providing service to rate-payers. The assets utilized is the rate base or, in other words, the amount of property deemed to be "used and useful" in providing service. The concept of a fair return is defined within the EPCOR Edmonton Regulated Utilities Bylaw (Bylaw 12294) which stipulates in the Guiding Objectives through which rates will be assessed:

> EPCOR is entitled to a reasonable margin of profit from operations in relation to the provision of utility services within the boundaries of the city of Edmonton (S. 5a Bylaw 12294, September 12, 2017).

11. The principles that underlie a "reasonable margin of profit" or a "fair rate of return" for any regulated utility have been established through both regulatory and legal proceedings. The Supreme Court of Canada, in Northwestern Utilities v. City of Edmonton (1929) found:

> By a fair return is meant that the company will be allowed as large a return on the capital invested in the enterprise (which will be net to the company) as it would receive if it were investing the same amount in other securities possessing an attractiveness, stability and certainty equal to that of the company's enterprise.

12. This concept, known as the Fair Return Standard has been interpreted many times in both the US and Canada. In Canada, the National Energy Board provided its interpretation of the standard in its RH-2-2004 Phase II Decision and more recently reinforced that interpretation in its Trans Quebec & Maritimes Pipeline Inc. RH-1-2008 Decision.

[2] While often used interchangeably, "rate of return" and "cost of capital" are distinct and actually represent two separate concepts. Rate of return refers to an *ex post* accounting concept that is effectively the return earned on an asset (rate base on the regulatory environment). It is measure of profitability that is usually determined through accounting records. Cost of capital is an *ex ante* economic and financial concept of expected or required return. It is an opportunity cost must be estimated from economic and financial data, rather the measured.

> The Board is of the view that the fair return standard can be articulated by having reference to three particular requirements. Specifically, a fair or reasonable return on capital should:
>
> - be comparable to the return available from the application of the invested capital to other enterprises of like risk (the comparable investment standard);
> - enable the financial integrity of the regulated enterprise to be maintained (the financial integrity standard); and
> - permit incremental capital to be attracted to the enterprise on reasonable terms and conditions (the capital attraction standard).
>
> In the Board's view, the determination of a fair return in accordance with these enunciated standards will, when combined with other aspects for the Mainline's revenue requirement, result in tolls that are just and reasonable.

13. In its 2009 Generic Cost of Capital Order, The Ontario Energy Board interpreted the standard by indicating that all three requirements must be met, and that none ranks in priority to the others.

> The Board affirms its view that the Fair Return Standard frames the discretion of the regulator, by setting out the three requirements that must be satisfied by the cost of capital determinations of the tribunal. Meeting the standard is not optional; it is a legal requirement. Notwithstanding this obligation, the Board notes that the Fair Return Standard is sufficiently broad that the regulator that applies it must still use informed judgement and apply its discretion in the determination of a rate regulated entity's cost of capital.
>
> … all three standards or requirements (comparable investment, financial integrity, and capital attraction) must be met and none ranks in priority to the others. The Board agrees with the comments made to the effect that the cost of capital must satisfy all three requirements which can be measured through specific test and that focusing on meeting the financial integrity and capital attraction test without giving adequate comparability to the comparability to the comparable investment test is not sufficient to meet the [Fair Return Standard].

14. Whether the fair return standard has been met is normally assessed by the determination of the required returns by investors for investments of comparable risk. In other words, for a given level of risk, there is a corresponding return that investors expect or they will place capital elsewhere. That

return is often referred to as the "opportunity cost" or the "investor required" return. A fair return must be set at that opportunity cost. In addition, the return must be sufficient to maintain the utility's credit metrics in order to maintain the organization's credit rating and provide assurances to lenders that debt obligations can be met. The fair return must also be sufficient to attract capital on reasonable terms. Ultimately, it is the risk assessment that is central in the determination of the fair return.

2.3 Risk in a Regulated Utility

15. The risk of a regulated utility can be assessed from two primary perspectives: business risk and financial risk. Business risk encompasses the specific attributes and circumstances of the utility's operations. This includes customers served, nature of the services provided, size of service territory, impact of weather and climate on the business, volume and demand risk, economic conditions, etc. In a regulated environment, business risk also includes regulatory risk as determined by both the manner prudently incurred costs are recovered as well as the timelines over which that occurs. Regulatory risk is generally determined by the regulatory constructs established by the regulator. Business risks result in variability in both cash flow and earnings that impact the ability to recover costs and earn the awarded fair return.

16. Financial risk relates primarily to the manner in which a business is financed or, in other words, the relative percentage of debt and equity in the capital structure. Businesses with a higher level of debt are generally viewed as riskier as they require a higher level of net income to cover the interest obligations. As debt holders take precedence in payment, risk to equity shareholders is increased.

17. For a regulated utility, risks can be both long-term and near-term in nature. Near-term risks are often seen in year over year variability in earnings. Given the typical long lived aspects of regulated assets, longer term risks associated with any impaired ability to recover on and of capital for these assets is also present. Regulated utilities assume additional risks not normally seen in other businesses based on their obligation to serve. Unlike other businesses, regulated utilities must provide service at all times including responding to unexpected asset failures and operational issues that are specific to the asset base of the utility. Regulated businesses must also make the required capital investments to maintain their level of service irrespective of the underlying economic conditions and cost of external funds.

3.0 RISK COMPARISON EWSI VS. AUC

18. In the 2017-2021 PBR application, EWSI's cost of capital expert (Sussex Economic Advisors, LLC) and Grant Thornton, the City's expert, recognized that EWSI's risk is greater than the gas and

electric utilities regulated by the AUC. Sussex also concluded that water and wastewater treatment utilities experience greater levels of business risk relative to natural gas and electric utilities[3]. Grant Thornton indicated that their evidence of greater business risk was conflicting and could not support or refute that conclusion[4]. However, both consultants were aligned in the risk comparison of EWSI's PBR with that of the AUC. This is noted in Grant Thornton's commentary as follows:

> We have considered the elements of EWSI's PBR in contrast to the Alberta Utilities PBR's and concur with the findings of the Sussex Report regarding the EWSI PBR having greater inherent risk compared to other Alberta Utilities[5].

19. As a result of these conclusions, both consultants concluded that a risk premium above the AUC generic was warranted. Even though the risks were not specifically individually quantified in the 2017-2021 proceeding, Sussex concluded a 2.2% premium was warranted, while Grant Thornton concluded a 1.83% premium was warranted, both using transition cost of capital studies.

20. The following discussion presents the major risk factors that contribute to EWSI bearing more risk than an electricity or gas utility regulated by the AUC. The risks are described as distinct from one another, but it is recognized that there is often some degree of overlap among the various risks. For example, the risk associated with water being a consumable product overlaps with the risk of changing regulations intended to ensure the safety of the product. Further, when risks are realized, their actual impacts are often inter-related and may combine to increase the overall impact or they may counteract one other, depending upon the circumstances and economic conditions at the time. The challenge in adequately defining the risks and their distinct underlying drivers is the primary reason that quantification of individual risks is not an established practice.

3.1 Business Risk

3.1.1 Water is a Consumable Product Risk

21. While all utility products are seen as essential to life, only water is actually ingested by the end user. It is incumbent upon the water utility to ensure that appropriate processes and procedures are maintained to provide proper treatment and that the product remains safe and within strict regulatory guidelines. This challenge is compounded by high variability in the source water, depending on

[3] Page 20, Sussex Economic Advisors, Opinion and Report on the Rate of Return, June 6, 2016.
[4] Page 142, Grant Thornton, EPCOR Performance Based Regulation 2017-2021 Filing Review, December 22, 2016.
[5] Page 143, Grant Thornton, EPCOR Performance Based Regulation 2017-2021 Filing Review, December 22, 2016.

weather, time of year and other non-controllable factors. Irrespective of these changes, EWSI is required to maintain the quality and safety of the final product.

As an example, in the summer of 2019, higher than average precipitation resulted in increased surface run off and ultimately unusually high colour in the river. EWSI had to respond to these changes by increasing chemical use (alum and caustic soda) well above historic and planned levels. In addition to absorbing the costs resulting from these types of event, which appear to be becoming more frequent, EWSI must also ensure the operational changes are continually made to maintain water quality.

22. In addition to the consumable product risk, EWSI also bears the risk associated with the collection and treatment of the resulting wastewater. Due to its nature, wastewater has health and safety concerns that must be carefully managed in order to protect both the public and EWSI's employees. As its end product is of paramount importance to the health and well-being of its customers, EWSI bears more risk than is seen in the electric and gas utilities as it ultimately bears responsibility for the safety of the product.

3.1.2 Health and Environmental Regulations Risk

23. All three EWSI utilities are faced with increasingly stringent health and/or environmental standards as determined by regulatory agencies. In most cases, these changes necessitate additional capital investment to meet the new requirements in addition to process and reporting changes to ensure adherence to the standards. As an environmental example, in 2009 Environment Canada enforcement of the Federal Fisheries Act determined that a discharge of any chlorinated water to any water body frequent by fish would be a contravention of the act and subject to significant penalties (fines and more). This compelled EWSI to build and operate de-chlorination systems for waste streams at both water treatment plants and to implement de-chlorination procedures in distribution and transmission and drainage when water is released from pipes. Since that time, this regulatory change has resulted in increased capital and operating costs.

24. Compared to electric and gas utilities, EWSI faces additional risk due to higher frequency of regulatory changes for both environmental and public health standards placing increased pressure on cash flow to fund new infrastructure as well as complete upgrades to existing assets to meet those regulations.

3.1.3 Revenue Risk

25. Water consumption is subject to considerable short-term variation, particularly in the summer months where weather patterns impact outdoor use. Additionally, water consumption over the long-term has continued to decline on a per capita basis over the last 10-20 years. The decline can be associated with a number of things including highly efficient appliances and effective conservation measures. Electricity and gas consumption is also subject to variation, driven primarily by broader economic factors as well as weather. While all utilities bear some revenue variability due to variation in consumption, the extent to which that variability impacts the profitability and risk profiles of the business is markedly different.

26. EWSI's rate structure is comprised of a very high portion of volumetric rates indicating the revenue fluctuates with changes in consumption. In contrast, electric and gas utilities in Alberta have a much lower percentage of volumetric rates implying that their revenues fluctuate less for a given level of consumption changes as a result of their greater percentage of fixed revenue. A critical factor in determining the impact of the consumption variations on revenue is the proportion of revenues derived from fixed rates (per customer, per meter or capacity charges) relative to the proportion of revenue derived from variable rates (consumption charges). For EWSI, the combination of a high percentage of fixed costs, which are not connected with consumption, and a lower percentage of fixed rates, means that consumption changes result in considerable risk of increased variability of earnings.

27. Table 3.1.3-1 below presents the percentage of fixed revenue as a percentage of total revenue for Alberta Utilities. EWSI data is presented for the individual utilities, the simple average of those results as well as for Total EWSI which is determined by the three utilities combined. This latter number normalises for the differing size of the utilities and is seen as the most representative. As illustrated, EWSI averaged 15.1% fixed revenue in 2014-2017, prior to the Drainage Services transfer. The percentage of fixed revenue then increased to 31.37% over the 2018 and 2019 period given that Drainage Services stormwater rates are 100% fixed. In contrast, the gas and electric utilities averaged 71.9% fixed revenue over the 2014-2019 period. Transmission utilities have not been included in this analysis as their revenue is not determined by direct charges to consumers and would be considered 100% fixed.

Table 3.1.3-1
Alberta Utilities - Percentage of Fixed Revenue[6]

		A	B	C	D	E	F	G	H
		2014	2015	2016	2017	2018	2019	2014-17 Average	2018-2019 Average
1	**EPCOR Water Services Inc.**								
2	Water	14.2%	14.0%	14.9%	15.0%	14.1%	14.3%	14.5%	14.2%
3	Wastewater	16.0%	16.2%	17.0%	16.9%	16.3%	16.8%	16.5%	16.5%
4	Drainage	N/A	N/A	N/A	N/A	54.8%	56.1%	N/A	55.4%
5	Average	15.1%	15.1%	15.9%	16.0%	28.4%	29.1%	15.5%	28.7%
6	Total EWSI	14.7%	14.7%	15.5%	15.6%	30.8%	31.8%	15.1%	31.3%
7									
8	**Electric and Gas Utilities**								
9	EPCOR E-Dis	72.9%	72.9%	72.9%	72.9%	75.2%	75.2%	72.9%	75.2%
10	ATCO E-Dis	73.0%	73.0%	73.0%	73.0%	68.5%	68.5%	73.0%	68.5%
11	Enmax E-Dis	73.3%	73.3%	73.3%	73.3%	75.9%	75.9%	73.3%	75.9%
12	Fortis E-Dis	86.1%	86.1%	86.1%	86.1%	83.9%	83.9%	86.1%	83.9%
13	Atco Gas	71.2%	71.2%	71.2%	71.2%	70.9%	70.9%	71.2%	70.9%
14	Alta Gas	55.3%	55.3%	55.3%	55.3%	56.4%	56.4%	55.3%	56.4%
15	Average	72.0%	72.0%	72.0%	72.0%	71.8%	71.8%	72.0%	71.8%

28. As its revenue is primarily based on volumetric rates, EWSI experiences higher revenue volatility than is seen in a gas or electric utility. As a result EWSI bears greater risk of revenue volatility.

3.1.4 Capital Recovery Risk - Depreciation

29. Water and wastewater utility assets typically have longer lives than electric and gas utilities. The resulting lower depreciation rates mean that reliance on depreciation as one of the sources of internal cash flow is lower. In addition, the longer capital recovery period results in water and wastewater utilities facing greater risk from inflation which result in a higher replacement cost per dollar of net plant. In many instances, especially as assets age and approach end of life, increased risk in operating those assets is seen as a result of unexpected asset failures or additional operational costs to inspect assets or to perform maintenance.

30. Table 3.1.4-1 below presents the Composite Lives of Assets for Alberta Utilities. Composite Life equals the Mid-year Plant in Service divided by the Annual Depreciation, and is the average number of years assets are expected to last. As above, EWSI data is presented for the individual utilities and for Total EWSI which is determined by the three utilities combined in order to normalize for the differing size of the utilities.

[6] Source: EWSI financial statements and AUC filings. 2015/2016/2018 or 2019 rate applications have been used to extrapolate the level of fixed revenue for AUC regulated utilities.

31. As illustrated, Total EWSI averaged 46.1 years in 2014-2017, prior to the Drainage Services transfer. This then increased to 57.3 years over the 2018 and 2019 period given that Drainage assets are predominately pipes which have a longer life than water or wastewater plant assets. In contrast, the Alberta gas and electric utilities averaged 32.6 years over the 2014-2019 period.

Table 3.1.4-1
Alberta Utilities – Composite Life[7]

		A	B	C	D	E	F	G	H
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2014-17 Average**	**2018-19 Average**
1	**EPCOR Water Services Inc**								
2	Water	49.3	50.2	52.5	51.7	52.8	52.5	50.9	52.7
3	Wastewater	38.7	38.4	34.6	34.7	33.5	32.3	36.6	32.9
4	Drainage	n/a	n/a	n/a	n/a	65.2	66.4	n/a	65.8
5	Average	44.0	44.3	43.6	43.2	50.5	50.4	43.7	50.4
6	Total EWSI	45.9	46.3	45.8	46.4	57.2	57.4	46.1	57.3
7									
8	**Electric and Gas Utilities**								
9	EPCOR - EDI	32.4	31.9	31.3	31.1	31.0	31.4	31.7	31.2
10	EPCOR - ETI	39.5	38.7	37.8	37.9	46.5	46.1	38.5	46.3
11	ATCO E-Dis	31.8	38.7	34.8	44.5	35.6	37.5	37.5	36.5
12	ATCO E-Tran	31.8	38.7	34.8	44.5	35.6	37.5	37.5	36.5
13	Enmax E-Dis*	30.7	30.5	30.2	29.6	29.5	30.4	30.2	30.0
14	Enmax E-Tran	26.8	37.0	35.0	35.4	34.9	35.5	33.6	35.2
15	Fortis E-Dis *	24.5	25.6	24.2	24.4	25.4	25.7	24.7	25.6
16	Atco Gas	27.2	27.3	27.4	27.9	26.4	28.1	27.5	27.3
17	Alta Gas	32.1	32.8	31.9	35.2	34.9	26.5	33.0	30.7
18	Alta Link	28.6	29.5	28.1	30.7	30.7	31.3	29.2	31.0
19	Average	30.5	33.1	31.6	34.1	33.1	33.0	32.3	33.0

32. As a result of the longer asset lives, EWSI bears greater risk than the gas and electric utilities regulated by the AUC.

3.1.5 Level of Contributed Assets Risk

33. EWSI utilities, particularly Drainage, have a greater percentage of contributed assets. These are assets that are not paid for by ratepayers though rates, and are typically constructed by third parties and transferred to EWSI ownership at commissioning. Once these assets are transferred, EWSI is obligated to operate, manage and maintain the assets. The utility assumes all liabilities in exactly the same manner as rate-funded assets. Operationally, EWSI makes no distinction between the two asset types. However, EWSI does not earn a return on equity on contributed assets. Further, any variability in operational costs are borne strictly by the utility, with no RoE compensation for the variability. As a result, EWSI bears greater risk than is seen in electric and gas utilities.

[7] Source: EWSI financial statements and AUC filings.

34. Table 3.1.5-1 below presents the historic cumulative percentage of contributed assets for EWSI and AUC regulated gas and electric utilities. This table details Mid Year Net Contributed Assets as a percentage of the Gross Mid Year Rate Base (net mid year property plus working capital and materials and supplies). EWSI data is presented for the utilities individually and combined or as Total EWSI which normalises for the differing size of the utilities and is seen as the most representative for comparison.

35. As illustrated, Total EWSI averages 27.8.8% contributed assets over 2015 to 2017, which then increases to an average of 52.8% contributed in 2018 and 2019 with the addition of Drainage (which has 68.5% contributed assets). In contrast, the AUC regulated utilities average 15.9% over 2015-2019. Overall, EWSI has a far higher level of contributed assets compared to electric and gas utilities in Alberta, particularly with the addition of Drainage Services.

Table 3.1.5-1
Alberta Utilities – Percentage of Contributed Assets[8]

		A 2015	B 2016	C 2017	D 2018	E 2019	F 2015-17 Average	G 2018-19 Average
1	**EPCOR Water Sevices Inc.**							
2	Water Services	32.4%	32.6%	32.7%	32.2%	31.9%	32.6%	32.1%
3	Wastewater Treatment	7.9%	6.9%	6.2%	5.5%	4.9%	7.0%	5.2%
4	Drainage	n/a	n/a	n/a	68.6%	68.5%	n/a	68.6%
5	Average	20.1%	19.8%	19.4%	35.5%	35.1%	19.8%	35.3%
6	Total EWSI	28.0%	27.9%	27.7%	52.8%	52.7%	27.8%	52.8%
7								
8	**Electric and Gas Utilities**							
9	EPCOR - EDI	13.2%	12.0%	11.1%	11.2%	11.3%	12.1%	11.2%
10	EPCOR - ETI	8.6%	8.3%	8.0%	7.8%	7.9%	8.3%	7.8%
11	ATCO Electric - Distribution	24.9%	25.2%	24.6%	24.1%	23.7%	24.9%	23.9%
12	ATCO Electric - Transmission	8.2%	8.8%	9.2%	9.3%	9.3%	8.7%	9.3%
13	Enmax Electric - Distribution	22.4%	22.6%	23.1%	22.5%	21.8%	22.7%	22.2%
14	Enmax Electric - Transmission	26.3%	25.1%	26.8%	27.4%	26.4%	26.1%	26.9%
15	FortisAlberta - Distribution	14.5%	13.6%	12.9%	12.5%	12.3%	13.7%	12.4%
16	ATCO Gas - Distribution	17.6%	17.2%	16.7%	16.3%	16.2%	17.2%	16.3%
17	AltaGas	20.4%	18.5%	16.7%	15.5%	14.5%	18.5%	15.0%
18	AltaLink Transmission	10.8%	9.0%	8.9%	9.2%	9.4%	9.6%	9.3%
19	Average	16.7%	16.0%	15.8%	15.6%	15.3%	16.2%	15.4%

36. The AUC has provided its view that increased levels of contributions or Contributions in Aid of Construction (CIAC) increases risk. This view was expressed in decisions resulting from utilities proposing a management fee to compensate them for their contributed assets. In its 2011 Generic Cost of Capital decision, the AUC commented as follows:

[8] Source: EWSI financial statements and AUC filings.

> 495. *Nonetheless, even though the management fee proposed by the Utilities is not warranted, the Commission agrees with the Utilities that CIAC-funded assets contribute to business risk. In general, business risk would be expected to rise in proportion to assets. The Commission agrees with the Utilities that, without an increase in equity, CIAC-funded assets would cause an increase in financial risk and operating leverage risk. As outlined in Section 5 above, it has been the practice of the Commission and its predecessor to adjust for any differences in risk among the utilities by adjusting their individual equity ratios. The Commission has reaffirmed its adherence to this approach in this decision.* [9].

37. In her testimony on the cost of capital for EWSI's 2012-2016 PBR Application, Ms. McShane explained the need for compensation on contributed assets as follows:

> *EWSI has the obligation to manage, operate and replace, bear all the liabilities for and face business risks related to assets that are financed by CIAC. By failing to provide any compensation (margin or return) on assets that are funded by CIAC, the current regulatory model effectively requires EWSI to provide valuable services and assume risks on a significantly larger asset base than it is rewarded for. Some form of compensation for providing service and bearing the risks of ownership, operation and management of those assets should be afforded EWSI.*[10]

3.1.6 Determination of Return on Equity Risk

38. The City's PBR process is based on 5 year terms (with 3 year terms in this application as a one-time measure to stagger future applications) with EWSI's rate of return on equity fixed for that entire period. In contrast, the AUC's rate of return is adjusted more frequently based on their generic cost of capital proceedings. As EWSI is effectively "locked in" to the established return on equity irrespective of changes to the underlying financial market drivers and conditions, this represents an additional risk to EWSI.

[9] Alberta Utilities Commission, *Decision 2011-474*, December 8, 2011, Paragraph 495, page 92.
[10] Page 84, Opinion on Cost of Debt, Capital Structure and Return on Equity for EPCOR Water Services Inc., Prepared by Kathleen C. McShane, Foster Associates Inc., April 2011.

3.1.7 Debt Recovery Risk

39. Under EWSI's PBR Framework, the risk of interest rate fluctuations relative to forecast is entirely borne by EWSI and is not passed on to its customers. Under the AUC PBR Framework, Alberta electric and gas distribution utilities pass on interest rate risk to their customers through rate adjustments. As such, this risk factor represents another component of the EWSI risk premium above the AUC's Generic Cost of Capital

3.1.8 Adjustment Factor Risks (Y, Z and K Factors)

40. A component of any PBR structure, including both the AUC's and EWSI's, are adjustment factors that allow rate increases outside of the i-x formula. As these factors mute the incentive mechanisms that are inherent within a PBR structure, the circumstances where they are approved are generally limited. These factors do serve to mitigate risk to some degree and a discussion of them is included here for completeness. However, as is noted below, EWSI has not reached a definitive conclusion as to the relative risk implications between the AUC's PBR and EWSI's PBR from an adjustment factor perspective given the different manners in which the adjustment factors are applied and both PBR structures require the utility to bear various capital and operating cost forecast risks.

41. Once the PBR application is approved, EWSI bears the risk resulting from changes from the underlying capital and operating cost forecasts. There are no deferral accounts or other mechanisms that allow EWSI to recover operating cost increases. Significant and unexpected differences between actual and forecast costs which are outside of EWSI's control such as power or chemical costs, interest rates, etc. are therefore borne by EWSI. Similarly, EWSI bears capital forecast risk for all projects including both City and developer determined projects, where the capital expenditure is not subject to EWSI's internal control. EDTI bears growth risk as well, as there are no mechanism to go back and collect additional funding if there is greater system growth than initially projected.

42. The single adjustment factor in EWSI's PBR is the non-routine adjustment process. This process does allow some exogenous costs to be recovered but they must be either directed by the City or EWSI must demonstrate that the reason for the additional costs are beyond its control. In addition to these criteria, the defined financial materiality threshold must also be met. That is, once other qualifying criteria are met, a non–routine adjustment must demonstrate an annual revenue impact of greater than $500,000 in order to qualify. In the case of capital projects, this represent a very high threshold.

43. As an example, for a typical pipe project, a $500,000 revenue requirement is derived only when a $17.75 million capital expenditure is reached (assuming a 40 year depreciation rate, current

debt and equity rates and current franchise fees). Any capital variance under this level, including projects directed by the City or resulting from developer activities, is borne by EWSI. In the current PBR term, the Network Private Development Transmission Main program is projected to exceed the $14.4 million approved budget by $11.2 million for a total projected expenditure of $25.6 million over 2017-2021. Since developers determine both the timing of their projects and the areas to be developed, expenditures on this program have proven difficult to forecast and the resulting overage is borne by EWSI. As the overage is below the non-routine financial threshold, EWSI has no ability to seek compensate for the additional capital expenditures and this represents a considerable risk.

44. The AUC adjustment mechanisms consists of Y, Z and K factors which allow recovery of certain qualifying costs and flow-through items above the i-x mechanism. In effect, these adjustments allow a utility to recover the costs associated with unforeseen events. These factors are defined as follows:

- **Y factor -** Y factor costs are costs that are flowed through to customers. For costs to be eligible for Y factor treatment, all of the following criteria must be met:
  (i) The costs must be attributable to events outside management's control.
  (ii) The costs must be material. They must have a significant influence on the operation of the distribution utility; otherwise the costs should be expensed or recognized as income, in the normal course of business.
  (iii) The costs should not have a significant influence on the inflation factor in the PBR formulas.
  (iv) The costs must be prudently incurred.
  (v) All costs must be of a recurring nature.

  Examples of costs allowed under the Y factor adjustment include: AESO costs, AUC assessment fees, intervener costs, costs associated with Commission-directed tariff billing and load settlement changes and property, business and linear taxes. The primary driver for inclusion of these costs is that they can vary significantly year to year and are outside of the utility's control.

- **Z factor -** Z factors allow for an adjustment to a distribution utility's rates to account for a significant financial impact (either positive or negative) of an exogenous event outside of the control of the utility and for which the utility has no other reasonable opportunity to recover the costs within the PBR formula. The following criteria are used to evaluate whether the impact of an exogenous event qualifies for Z factor treatment:

(i) The impact must be attributable to some event outside management's control.

(ii) The impact of the event must be material. It must have a significant influence on the operation of the distribution utility; otherwise the impact should be expensed or recognized as income, in the normal course of business.

(iii) The impact of the event should not have a significant influence on the inflation factor in the PBR formula.

(iv) All costs claimed as an exogenous adjustment must be prudently incurred.

(v) The impact of the event was unforeseen.

- **K factors** – K factors, also referred to as Capital Trackers, allow for adjustments for certain types of capital that cannot reasonably be covered by the i-x formula. Only projects that meet the following criteria are eligible for capital tracker treatment: The project must be a type of project that the distribution utility had not previously undertaken and the project must also be required by a third party. In addition, the project must have a material effect on the company's finances. AUC approval of a capital tracker occurs subsequent to the costs being incurred and any revenue requirement impact is subject to true-up.

45. A comparison of AUC PBR adjustment factors to EWSI's PBR is presented in Table 3.1.6-1 below:

Table 3.1.6-1

Comparison of AUC Y, Z and K Factors to EWSI PBR

		A	B
	AUC Adjustment Factors	**AUC PBR**	**EWSI PBR**
1	Y-Factor	Similar to a deferral account mechanism and used to flow through certain recurring costs to customers.	No deferral account mechanisms.
2	Z-Factor	Adjustment mechanism for exogenous events meeting certain criteria including a defined materiality threshold	Non–routine adjustment mechanism for exogenous events meeting the NRA criteria including a defined materiality threshold.
3	K-Factor	Utilities bear the forecast risk on all capital expenditures except those under K-factor. The K-factor is an adjustment mechanism for supplementary capital funding for capital that qualifies for capital tracker treatment. All other capital is funded by under the Commission's approved K-bar mechanism which sets a provides a revenue requirement for capital based on the level of capital additions at a level that is consistent with the amount deployed between 2013 and 2016.	All EWSI capital is based on forecast costs. Utilities bear the forecast risk for capital expenditures except in limited circumstances where capital expenditures qualify for a NRA.

46. When assessing the risk mitigation impact of adjustment mechanisms between the AUC PBR and EWSI's PBR, it must be recognized that, while similar, the PBR structures are not identical and treat a number of areas differently. The AUC PBR structure is comparatively new and some of the basic tenets have changed from the 1st iteration to the current 2nd iteration. Additionally, one key difference is that the AUC method for determining revenue requirement is based on historical costs while EWSI's is based on forecast cost. These considerations complicate a direct determination of the risk mitigation impacts of the adjustment mechanisms, given the differences in approaches to capital, materiality thresholds and considerations unique to the specific situation at the time when the various adjustments are applied. Despite these limitations, EWSI contends that the availability of adjustment mechanisms reduces a utility's risk.

3.2 Financial Risk

47. As noted above, Financial Risk relates primarily to the manner in which a business is financed or, in other words, the relative percentage of debt and equity in the capital structure. Businesses with a higher level of debt are generally viewed as riskier as they require a higher level of net income to cover the interest obligations. As debt holders take precedence in payment, risk to equity shareholders is increased.

48. The deemed capital structure of EWSI and Alberta gas and electric utilities are generally within the same range, with AUC regulated utilities carrying slightly more debt (gas and electrics average 37% equity compared to EWSI at 40% equity). On an equivalent basis, investors would view these higher debt levels as carrying greater risk. It is noted, however, that the AUC process adjusts the capital structure to recognize risk differences among the utilities, as opposed to changing the return on equity awarded, and investors would not assess capital structure and returns on equity separately.

3.3 Summary

49. Overall, EWSI contends that the risk profile it assumes under a PBR structure is higher than that of electric and gas utilities regulated by the AUC and a ROE risk premium over the AUC generic is warranted. Based on the preceding analysis, EWSI is risker on the aspects of:

- Public health risk of consumable product;
- Health and environmental risk;
- Revenue risk;
- Capital recovery risk;

- Contributed asset risk; and
- Fixed return on equity and cost of debt risk.

50. In other aspects, a definitive conclusion was not reached. Specifically, EWSI and AUC regulated utilities appear to have similar risks on PBR adjustment factors, but the final result would depend on the specific circumstances at the time the adjustment was determined. AUC has somewhat higher financial risk due to higher average deemed debt ratios (37% vs. 40%). On balance, there are several risk factors that are higher for EWSI compared to the electric/gas utilities and some of these risk factors are substantially greater. As will be demonstrated below, the risk of EWSI's business has increased since the 2017-2021 period with the inclusion of Drainage and therefore a proposed 1.83% risk premium represents the low end of an acceptable range.

4.0 COMMON EQUITY RATES OF RETURN FOR THE 2022-2024/2026 PERIOD

4.1 Overview

51. The City of Edmonton determined that a 10.175% common equity rate of return was reasonable for EWSI for the 2017–2021 PBR term. This decision was based, in part, on evidence submitted by EWSI and reports prepared by Grant Thornton (GT) and Mr. W. J. Beckett (WJB) in 2016.

52. EWSI proposes that an update of Grant Thornton's 2016 analysis be used to address the 2022 – 2024/2026 PBR common equity rate of return. EWSI believes this is the most straightforward approach and best aligns with the City's desire to determine a risk premium to the Alberta Utility Commission's generic cost of capital to derive the allowed rate of return on equity for EWSI. The following topics will be addressed to provide additional background and rationale to support this proposal.

- Impact of the Global Pandemic.
- The Relationship Between Risk Premiums and Bond Yields.
- Updating the Grant Thornton Analysis · Pre-Pandemic Conditions.
- Updating the Grant Thornton Analysis · Consensus 2022 Conditions.
- EWSI's Proposal to Moderate Drainage Rate Increases.
- Summary of Conclusions.

4.2 Impact of the Global Pandemic

53. In late February/early March 2020, investors and share markets reacted negatively to announcements surrounding the COVID-19 global pandemic. Many countries, including Canada,

began to "lock down" their economies; and federal governments and central banks used fiscal and monetary policy initiatives to diminish the economic devastation of the lockdowns on citizens and businesses.

54. These unprecedented changes lead to a number of questions regarding the impact to traditional approaches to the determination of a rate of return on common equity. Specifically: What is the qualitative impact of these changes on data used to estimate capital costs and appropriate common equity rates of return? Will the consequences of these lockdowns persist for some while or prove to be a short-term phenomenon? How should the impact of the global pandemic be reflected in estimated capital cost rates? Or should it be reflected in them at all? These questions are addressed in the following section.

Impact of the Pandemic *on Data Used to Estimate Capital Cost Rates*

55. There are virtually no financial ratios, interest rates or other capital cost inputs or indicia which have remained stable throughout 2020, making reliance on these "roller coaster" 2020 data problematic in applying traditional methods for estimating capital cost rates.

56. In *Decision 24110-D01-2020* (released October 13, 2020), the Alberta Utilities Commission (the Commission) refers on several occasions to the impact of the global pandemic on capital markets.

> Subsequent to evidence being filed, the Commission received a motion on March 17, 2020, from the Office of the Utilities Consumer Advocate (UCA) requesting that the proceeding be suspended in light of the extraordinary turmoil and uncertainty in financial markets at the time on account of the COVID-19 pandemic. The UCA requested a six-month suspension with an opportunity for all parties to update their evidentiary submissions thereafter. On March 19, 2020, the Commission suspended the proceeding and indicated that it would review and reassess its decision every 30 to 60 days, unless circumstances changed dramatically and called for earlier action.[11]
>
> The Commission's last communication with registered parties in this proceeding was on August 7, 2020, at which time the Commission acknowledged that all parties, except for the Consumers' Coalition of Alberta, maintained their positions

[11] *Decision 24110-D01-2020*, paragraph 5.

> that the ongoing COVID-19 pandemic and related economic and financial market uncertainty/volatility continued to preclude the immediate successful resumption of the proceeding.[12]
>
> The partially developed record, combined with the unprecedented and ongoing turmoil in global financial markets, provided no reasonable basis for the Commission to extend its previous GCOC findings on a *final* basis for 2021, without regulatory due process.[13]

57. The increased uncertainty associated with economic prospects, Government deficits and increased capital market volatility have increased investors' required rates of return in 2020 compared to, say, 2019. Because public utility common equity rates of return are based largely on investors' required market rates of return with an adjustment for common equity flotation costs, it follows that fair rates of return under conditions prevailing in 2020 are higher than fair rates of return under the conditions prevailing in 2019.

What Will Be the Duration of the Pandemic's Impact?

58. Will the pandemic's economic impact be short-term? Will we return to the world of late 2019? Or will the pandemic affect capital markets and elevate required market rates of return for some time to come?

59. At this time, there is no reasonably definitive answer to any of these questions.

Should the Impact of the Pandemic Be Reflected In Estimated Capital Cost Rates?

60. If the pandemic continues to exert upward pressure on capital cost rates for some while, it would then be appropriate to reflect these new conditions in costs of capital for regulatory purposes. Alternatively, if the pandemic's impact largely dissipates – especially between now and when EWSI's 2022–2026 PBR period begins – then it would be more appropriate to rely on estimates that exclude the impact of the pandemic.

61. To avoid placing reliance on capital cost estimates that may be unduly inflated by temporary pandemic conditions which will not apply during the PBR period, EWSI proposes that the City and its

[12] *Decision 24110-D01-2020*, paragraph 7.
[13] *Decision 24110-D01-2020*, paragraph 10.

advisors exclude the adverse impact of the pandemic by assuming that conditions will return to "normal" by the time EWSI's 2022–2026 PBR period commences. This exclusion is practically accomplished in this Memorandum by avoiding the use of post-2019 data.[14] The exclusion of post-2019 information also addresses the data stability problems described above. In short, this approach does not capture the greater uncertainties, risks and higher capital costs that prevail in 2020 on the assumption that these higher capital costs will have moderated by the time EWSI's 2022 rates come into effect.

4.3 The Relationship Between Risk Premiums and Bond Yields

62. An understanding of the relationship between risk premiums and bond yields is an important prerequisite to updating GT's 2016 analysis in respect of EWSI's common equity rate of return. As a result of the differential taxation of interest versus dividends/capital gains, risk premiums tend to compress as bond yields rise and expand as bond yields decline. Another way of expressing the same phenomenon is that common equity rates of return rise by less than the increase in bond yields and decline by less than the decrease in bond yields. To illustrate, if bond yields rise by 1%, then common equity rates of return will tend to rise by less than 1%; and if bond yields decline by 1%, then common equity rates of return will tend to decline by less than 1%.

63. Historically, Canadian regulators have assumed that the degree to which common equity rates of return vary as interest rates decline or rise is in the approximate range of 75% – 80%, with the focus at 75%.[15] Thus, if bond yields decline by 1%, then the tendency is for common equity rates of return

[14] Inasmuch as the pandemic gripped capital markets starting in the first quarter of 2020, the final quarter of largely pre-pandemic conditions is the fourth quarter of 2019.

[15] In *Decision 2004-052*, the Alberta Energy and Utilities Board adopted an Annual Adjustment Mechanism for rate of return that assumed a 75% compression/expansion factor (see *Decision 2004-052*, page 32). The Board stated that: "…most parties favored an adjustment formula with the ROE changing by 75% of the change in the forecast long-Canada bond yield, provided that the Board accepted their starting positions on ROE. The Board also notes Dr. Evan's evidence that a change based on 75% of the change in the long-term Canada bond yield is driven by the differential tax rates between bonds and equity." (*Decision 2004-052*, page 31) A survey conducted at the time Dr. Evans' evidence was prepared in the proceeding that led to *Decision 2004-052* indicates that a 75% compression/expansion factor was used by the National Energy Board (*Decision RH-2-94*, March 1995, pages 30-33), the Ontario Energy Board (*Draft Return on Equity Guidelines*, March 1997, pages 1-2) and the Quebec Regie de l'energie (*Re Gaz Metropolitain*, February 10, 1999, pages 48-50). An 80% compression/expansion factor was used by the Newfoundland Board of Commissioners of Public Utilities (*Re Newfoundland Power Inc.*, July 31, 1998, pages 105-106) and the Public Utilities Board of Manitoba (*Order 49/95*, May 5, 1995, pages 50-52). The situation in British Columbia is not as clear. In *Return on Common Equity for a Benchmark Utility*, August 26, 1999, page 24, the British Columbia Utilities Commission adjusted "one-for-one" at bond yields of 6.0%

to decline by 0.75% - i.e., risk premiums expand by 0.25%. And if bond yields rise by 1%, then the tendency is for common equity rates of return to rise by 0.75% - i.e., risk premiums contract by 0.25%. The rationale for the expansion/compression of risk premiums is the maintenance of constant after-tax risk premia for taxable investors. Attachment A to this Memorandum provides hypothetical examples of this phenomenon using Alberta and Ontario 2020 income tax rates.

64. The analyses in the next two parts of this Memorandum assumes that common equity rates of return vary by 75% of the change in bond yields. This is consistent with the views of the Alberta Energy and Utilities Board and most Canadian regulators.

4.4 Update the Grant Thornton Analysis – Pre-Pandemic Conditions

65. In 2016, GT prepared an *EPCOR Performance Based Regulation Filing Review*. In light of the practical limitations and concerns with applying traditional rate of return methods in the current pandemic environment and in an effort to avoid controversy, EWSI has updated the analysis in the GT Report to reflect the 2019 pre-pandemic generic cost of capital determined by the Alberta Utilities Commission and bond yield changes, having regard for the compression and expansion of risk premiums.

66. EWSI proposed an ROE of 10.5% in the 2017-2021 PBR application[16]. This represented a decrease of 0.375% from the 2012-2016 application approved amount of 10.875%. GT noted that an ROE of 10.5% represented a risk premium of 2.20% above the AUC generic of 8.3% at that time. Their conclusions indicated they viewed that an appropriate risk premium is within a range of .08% to 0.66% lower than the 2.20%[17]. This would result in a risk premium range of 1.54% to 2.12% with a mid point of 1.83%. Both the EWSI and GT analysis was based on 3 different methods and supporting data. The Utility Committee ultimately determined a risk premium of 1.875% for the 2017-2021 PBR term. This

or below and at 80% of the change in bond yields for bond yields above 6.0%. The BCUC subsequently elected not to use a rate of return adjustment formula and then reinstated a new formula in *Re Generic Cost of Capital Proceeding*, May 10, 2013, page 90. The new formula assumed a compression/expansion factor of 50% *vis-à-vis* yields on long-term Government of Canada bonds subject to a "floor" of 3.8% on the bond yield. However, the formula also included a 50% adjustment for changes in the spread between yields on long-term public utility bonds and long-term Government of Canada bonds.

[16] Three methods were applied to determine the rate of return include Capital Asset Pricing Model (CAPM), Discounted Cash Flow (DCF) and Risk Premium Model (RPM). The recommendations for EWSI's return on equity were derived from the results of applying each of these methods to both the US water utility proxy group and the Canadian utility proxy group.

[17] GT Report, page 145.

was the same risk premium as was determined for the 2012-2016 PBR term and EWSI believes was based on GT comment that "We have not identified additional risks or considerations that would warrant an increase in the risk premium from the 2012 PBR[18]."

67. For the 2017-2021 update of the GT approach, EWSI has used a risk premium of 1.83% as it was based on three formal methods and is more supportable than carrying a single point estimate from a prior period forward. EWSI believes, however, that the risk of the overall business has increased since the 2017-2021 period and a 1.83% risk premium represents the low end of an acceptable range. The inclusion of the Drainage business in the 2022-2026 PBR period with the same 40% common equity ratio as the Water and Wastewater businesses implies that EWSI's investment risks are higher today than they were in 2016.[19] Thus, the appropriate premium *vis-à-vis* the Commission's generic cost of capital is no less than 1.83% today.

68. In *Decision 22570-D01-2018*, the Commission found that an 8.5% common equity rate of return was reasonable for test years 2018, 2019 and 2020.[20] All things equal, the indicated common equity rate of return for EWSI based on the GT Report and the 8.5% for generic Alberta utilities is therefore 10.33% (= 8.5% + 1.83%). However, the Commission's 8.5% in *Decision 22570-D01-2018* was predicated on a 2.3% yield on long-term Government of Canada bonds.[21] In contrast, the 2019 pre-pandemic yield on long-term Government of Canada bonds is 1.8%.[22] The lower 2019 bond yield suggests that a downward adjustment should be made to the 10.33% common equity rate of return but with recognition given to the fact that risk premiums expand as bond yields decline.

[18] GT Report, page 145.

[19] The Drainage business has a longer capital recovery period, a greater proportion of non-productive contributed assets (i.e., not paid for by rate payers) and higher operating leverage (cash operating costs to total revenue) than the Water and Wastewater businesses. Thus, the addition of the Drainage business to the EWSI portfolio increases EWSI's overall business risk profile. If the Drainage assets are financed with the same 40% common equity ratio as the Water and Wastewater businesses, it then follows that the investment risks – the combination of business and financial risks – have increased. The assumption of a 40% common equity ratio for EWSI's overall operations is consistent with the September 3, 2020 DBRS rating report (see Appendix C – EWSI Credit Report) that states: "Over the long-term, DBRS Morningstar expects leverage for EWSI to be at the approved capital structure of 60% debt."

[20] Alberta Utilities Commission, *Decision 22570-D01-2018*, August 2, 2018, Paragraph 500, page 104. In its recently-released *Decision 24110-D01-2020*, the Commission did not provide a detailed rate of return analysis. Nevertheless, the 8.5% common equity rate of return from *Decision 22570-D01-2018* was extended through 2021 on a final basis. See *Decision 24110-D01-2020*, Paragraphs 14 and 20.

[21] Alberta Utilities Commission, *Decision 22570-D01-2018*, August 2, 2018, Paragraph 299, page 65.

[22] The average of the daily 2019 yields reported by the Bank of Canada for Series V39056 is 1.80%.

69. The indicated common equity rate of return for EWSI is currently no less than 9.95% based on a 75% risk premium compression/expansion factor, the Commission's 8.5% 2019 generic cost of capital, GT's 1.83% risk premium from 2016 and the change in bond yields subsequent to the Commission's decision. The 9.95% should be regarded as a minimum, because it does not consider the increased business risks of the Drainage business, which was not part of EWSI's asset portfolio when the GT Report was prepared.

70. The formal calculations that lead to the 9.95% conclusion are set out in Table 4.4-1 below.

Table 4.4-1
Indicated Common Equity Rate of Return
Based on Grant Thornton 2016 EWSI Risk Premium,
AUC 2019 Generic Rate of Return,
2019 Pre-Pandemic Long-Term Bond Yield
And 75% Risk Premium Compression/Expansion Factor

2019 Yield on Long-Term Government of Canada Bond	1.80%
Less: Yield on Long-Term Government of Canada Bond in *Decision 22570-D01-2018*	<u>(2.30%)</u>
Bond Yield Change	(0.50%)
x 75% Compression/Expansion Factor	<u>x 0.75</u>
Change in Common Equity Rate of Return	(0.38%)
AUC 2019 Generic Cost of Capital	8.50%
Plus: Grant Thornton 2016 Premium for EWSI Risk	1.83
Less: Change in Common Equity Rate of Return	<u>(0.38)</u>
Indicated Common Equity Rate of Return Based on Pre-Pandemic Conditions	9.95%

4.5 Updating the Grant Thornton Analysis Consensus 2022 Conditions

71. The analysis in Table 4.4-1 is based on the Commission's 8.50% generic rate of return and long-term Government of Canada bond yields during the pre-pandemic conditions of 2019. EWSI proposes the City and its advisors accept this approach for reasons set out in the discussion of the *Impact of the Global Pandemic*.

Alternatively, however, EWSI observes that the same result coincidentally arises from using the Commission's 8.5% 2021 generic rate of return from *Decision 24110-D01-2020* and an analysis of consensus 2022 yields on long-term Government of Canada bonds.

72. Based on the October 12, 2020 issue of *Consensus Forecasts*, the consensus yields on ten-year Government of Canada bonds are 1.10% (October 2021), 1.60% (December 31, 2022), 2.00% (December 31, 2023), 2.40% (December 31, 2024), 2.70% (December 31, 2025) and 2.90% (December 31, 2026). The average 2022 ten-year yield on Government of Canada bonds from the *Consensus Forecasts* survey is 1.35%. The relevance of 2022 is that it is the first year of the PBR period.

73. Yields on long-term Government of Canada bonds are typically higher than yields on ten-year bonds. The difference – the "maturity premium" – varies with market conditions. In *Decision 22570-D01-2018*, the Commission remarked: "…the spread between 10-year and 30-year GOC bonds is likely to be lower than the historical average by some 50 bps that the Commission has accepted in past GCOC decisions."[23] Thus, the Commission indicates that the "historical average" maturity premium has been approximately 50 basis points; however, the Commission adopted an unspecified lower maturity premium in *Decision 22570-D01-2018*. A reasonable inference is that this lower maturity premium was in the range of 0 – 50 basis points. More recently, differences between yields on long-term and ten-year Government of Canada bonds have exceeded the 50 basis points historical average.[24]

74. Giving equal weight to the 50 basis points historical average, the 25 basis points midpoint of the 0 – 50 basis points range and the current yield difference of 59 basis points, the indicated average maturity premium is 45 basis points.

[23] *Decision 22570-D01-2018*, Paragraph 297, page 65.

[24] Based on Bank of Canada data for the five trading days ending October 29, 2020, the average maturity premium is 59 basis points.

75. The sum of the 1.35% consensus 2022 yield on ten-year Government of Canada bonds and the 45 basis points maturity premium is 1.80%. Coincidentally, the 1.80% is the same as the actual average yield on long-term Government of Canada bonds for 2019. Thus, the assumption that investors expect that long-term bond yields will return to 2019 pre-pandemic levels by 2022 is supported by an independent analysis of those expectations as captured in the *Consensus Forecasts* survey.

76. The indicated common equity rate of return for EWSI from this alternative analysis is 9.95% as shown in Table 4.5-1.

Table 4.5-1
Indicated Common Equity Rate of Return
Based on Grant Thornton 2016 EWSI Risk Premium,
AUC 2021 Generic Rate of Return,
2022 Consensus Long-Term Bond Yield
And 75% Risk Premium Compression/Expansion Factor

Consensus 2022 Yield on Long-Term Government of Canada Bond	1.80%
Less: Yield on Long-Term Government of Canada Bond in *Decision 22570-D01-2018*	(2.30%)
Bond Yield Change	(0.50%)
x 75% Compression/Expansion Factor	x 0.75
Change in Common Equity Rate of Return	(0.38%)
AUC 2021 Generic Cost of Capital	8.50%
Plus: Grant Thornton 2016 Premium for EWSI Risk	1.83
Less: Change in Common Equity Rate of Return	(0.38)
Indicated Common Equity Rate of Return Based on Consensus 2022 Bond Market Conditions	9.95%[25]

4.6 EWSI's Proposal to Moderate Drainage Rate Increase

77. EWSI acquired the Drainage business in 2017 and has been striving to improve service dependability, the quality of asset maintenance and the profitability of the business while not exposing

[25] The analysis in Table 4.5-1 uses a 1.35% consensus 2022 yield on ten-year Government of Canada bonds as the point of departure. Appendix C, however, reports a sharp increase in the consensus yield over the 2022-2026 period. The annual average yields rise from 1.35% in 2022 to 1.80% in 2023, 2.20% in 2024, 2.55% in 2025 and 2.80% in 2026. The average yield on ten-year Government of Canada bonds for the 2022 – 2026 PBR period is 2.14%. The addition of a 45 basis points

customers to overly-aggressive rate increases. EWSI proposes to continue this program throughout the 2022–2026 PBR period; and in its effort to balance the need to replace failing infrastructure with moderate rate increases, EWSI proposes to accept a 5.50% common equity rate of return on its "Base" Drainage operations in 2022 and ramp up the return on equity in a linear fashion by 1.1% per year to achieve a 9.95% fair return on equity by 2026.[26]

78. The impact on EWSI's consolidated rate of return from moderating rate increases in this fashion is shown in Table 4.6-1.

Table 4.6-1
Business Unit and Consolidated Rates of Return on Common Equity
2022–2026

		A	B	C	D	E	F
	Year	**Water**	**Wastewater**	**Drainage Base**	**Drainage SIPR/CORe**	**Drainage Consolidated**	**Total Consolidated**
1	2022	9.95%	9.95%	5.50%	9.95%	5.85%	7.97%
2	2023	9.95%	9.95%	6.61%	9.95%	7.09%	8.52%
3	2024	9.95%	9.95%	7.73%	9.95%	8.13%	9.01%
4	2025	9.95%	9.95%	8.84%	9.95%	9.07%	9.48%
5	2026	9.95%	9.95%	9.95%	9.95%	9.95%	9.95%
6	2022-2026	9.95%	9.95%	7.83%	9.95%	8.19%	9.05%

Note: Calculations are based on forecast 2022–2026 annual rate bases and Drainage rates of return calculated using the method described above.

79. EWSI recognizes the current economic climate is creating financial hardship for many customers and is voluntarily reducing the applied-for rate of return for Drainage Services in this Application. As a result of accepting a rate of return on equity on base operations that is far lower than the fair return, EWSI has reduced costs to ratepayers by over $66 million for the 2022-2024 PBR term. SIRP and CORe differ significantly from the programs included in the base revenue requirements, because of their size, complexity and duration which contributes to higher levels of business and execution risks. EWSI is proposing a fair return of 9.95% return on equity for these two major strategic

maturity premium leads to a consensus yield on long-term Government of Canada bonds for the 2022 – 2026 PBR period of 2.59% (= 2.14% + 0.45%). If the 2022 – 2026 2.59% yield on long-term Government of Canada bonds were used in the Table 2 analysis rather than the 2022 value of 1.80%, then EWSI's indicated common equity rate of return would rise to 10.55% (= 8.50% + 1.83% + ((2.59% - 2.30%) x 75%)).

[26] Base Drainage operations do not include capital expenditures in respect of the Storm Water Integrated Resource Plan and the Corrosion and Odour Reduction Strategy. A 9.95% common equity rate of return is used to develop revenue requirements for the Storm Water Integrated Resource Plan and the Corrosion and Odour Reduction Strategy.

initiatives which will require significant capital expenditures for which EWSI must receive a fair return and be in a financial position to obtain debt financing at reasonable terms.

80. Three conclusions are drawn from the data in Table 3. First, with the exception of the 2026 rate of return, each of the forecast consolidated rates of return in the final column are less than the 9.95% indicated common equity rates of return from Tables 1 and 2.

81. Second, the average consolidated rate of return of 9.05% is materially less than the 9.95% from Tables 1 and 2 and provides a premium above the Commission's 8.50% generic cost of capital of approximately 50 basis points, whereas the premium for EWSI's risks from the GT Report is 1.83%.

82. Third, the 9.05% is modest in the context of straightforward market-derived 2019 benchmarks. To illustrate, the 2019 average and median earnings-price ratios of the five Tier 1 chartered banks including a traditional 50 basis points flotation allowance are 9.8% and 9.5% respectively. These earnings-price ratios understate the benchmark cost applicable to EWSI for two reasons. First, the 2019 average and median market-to-book ratios for the banks were 154% and 140% respectively; and the earnings-price ratio understates the investors' required rate of return if the market-to-book ratio is greater than 1.0.[27] Second, EWSI is undeniably exposed to greater investment risks than the Tier 1 chartered banks.[28]

4.7 Summary of Conclusions

83. The appropriate common equity rate of return for EWSI's 2022–2026 PBR period should conservatively reflect pre-pandemic conditions rather than the higher capital cost rates arising from the greater uncertainties and risks in 2020. This approach avoids needless controversy about the longevity of the pandemic and the use of highly-variable 2020 data which render the reliable estimation of capital cost rates extraordinarily difficult if not entirely problematic. Use of pre-pandemic 2019 data is consistent with the assumption that capital market conditions will "normalize" prior to 2022.

[27] Gordon, Myron J. and Eli Shapiro, "Capital Equipment Analysis: The Required Rate of Profit," *Management Science,* 1956, pages 107-108.

[28] Although this Memorandum gives no weight to 2020 post-pandemic data, the current (October 29, 2020) average and median earnings-price ratios for the Tier 1 chartered banks including the traditional 50 basis points flotation allowance are 9.5% and 9.2% respectively with average and median market-to-book ratios of 114% and 110% respectively. The indicated cost of capital based on Tier 1 bank earnings-price ratios is therefore greater than 9.2-9.5%. Thus, irrespective of whether 2019 or 2020 data are used, the 9.02% five-year average consolidated rate of return is less than the indicated cost of capital based on Tier 1 bank benchmarks.

84. EWSI has updated the analysis in the 2016 GT Report to reflect the most recent generic cost of capital determined by the Alberta Utilities Commission and recent bond yield changes, having regard for the compression and expansion of risk premiums. The compression and expansion of risk premiums as bond yields rise and decline is well-accepted in regulatory circles.

85. Based on a 75% risk premium compression/expansion factor, the Commission's 8.5% generic cost of capital, GT's 1.83% risk premium from 2016 and the 2019 pre-pandemic bond yields, the indicated common equity rate of return for EWSI is currently no less than 9.95%. The 9.95% should be regarded as a minimum, because it does not reflect the increased business risks of the Drainage business. Drainage was not part of EWSI's asset portfolio when the GT Report was prepared.

86. Alternatively, EWSI undertook a similar analysis using the 8.5% generic rate of return approved by the Commission for 2021 pursuant to *Decision 24110-D01-2020* and a consensus long-term Government of Canada bond yield for 2022 developed from data reported by *Consensus Forecasts.* Coincidentally, the alternative analysis also leads to a 9.95% indicated common equity rate of return for EWSI.

87. Finally, in an effort to moderate Drainage rate increases, EWSI proposes that the common equity rate of return for "Base" Drainage operations be established at 5.50% for 2022 and "ramped up" in a linear fashion by 1.1% per year to achieve a 9.95% fair return by 2026. Based on this plan, the forecast five-year average common equity rate of return for EWSI's consolidated operations is 9.05%.

88. The 9.05% is materially less than the 9.95% indicated common equity rate of return from the updated GT analyses. Moreover, with the exception of the final year, the EWSI consolidated rates of return for each year of the PBR period are all less than 9.95%.

89. The 9.05% is also modest when tested by reference to the 2019 average and median earnings-price ratios of the Tier 1 chartered banks of 9.8% and 9.5% respectively.[29] For reasons set out earlier in this Memorandum these earnings-price ratios understate the benchmark cost applicable to EWSI.

[29] Including a traditional 50 basis points flotation allowance.

Attachment A
EPCOR Water Service Inc.
Hypothetical Examples of Risk Premium Compression/Expansion
Using 2020 Marginal Tax Rates

	Alberta Taxable Investors		Ontario Taxable Investors	
	Over $314,928	**$97,069 - 131,220**	**Over $220,000**	**$97,069 - 150,000**
Tax on Interest	48.00%	36.00%	53.53%	43.41%
Tax on Capital Gains	24.00%	18.00%	26.76%	21.70%
Tax on Eligible Dividends	31.71%	15.15%	39.34%	25.38%
Pre-Tax Equity Rate of Return	10.00%	10.00%	10.00%	10.00%
Less: Pre-Tax Debt Rate of Return	(4.00%)	(4.00%)	(4.00%)	(4.00%)
Pre-Tax Risk Premium	6.00%	6.00%	6.00%	6.00%
After-Tax Equity Rate of Return	7.21%	8.34%	6.70%	7.65%
Less: After-Tax Debt Rate of Return	(2.08%)	(2.56%)	(1.86%)	(2.26%)
After-Tax Risk Premium	5.13%	5.78%	4.84%	5.38%
Assume that Bond Yields Decline by 1% · Pre-Tax Debt Rates of Return Decline from 4.00% to 3.00%				
Pre-Tax Debt Rate of Return	3.00%	3.00%	3.00%	3.00%
After-Tax Debt Rate of Return	1.56%	1.92%	1.39%	1.70%
Plus: After-Tax Risk Premium	5.13%	5.78%	4.84%	5.38%
After-Tax Equity Rate of Return	6.69%	7.70%	6.23%	7.08%
Pre-Tax Equity Rate of Return	9.28%	9.23%	9.31%	9.26%
Less Pre-Tax Debt Rate of Return	(3.00%)	(3.00%)	(3.00%)	(3.00%)
Pre-Tax Risk Premium	6.28%	6.23%	6.31%	6.26%
Change in Pre-Tax Equity Rate of Return	(0.72%)	(0.77%)	(0.69%)	(0.74%)
divided by: Change in Pre-Tax Debt Rate of Return	(1.00%)	(1.00%)	(1.00%)	(1.00%)
Risk Premium Compression/Expansion Factors	72.08%	76.72%	69.41%	74.01%

Note: The equity rate of return tax calculations assume that 50% of the income is derived from dividends and 50% of the income is derived from capital gains. The impact of varying this proportion is not material.

Source: The 2020 combined Federal/Provincial tax rates are taken from www.taxtips.ca.

2017 – 2021 Performance Based Regulation

Water and Wastewater Treatment Services

PROVIDING MORE EPCOR

Table of Contents

1 Executive Summary

This report provides an annual update to the City of Edmonton on the operational and financial results for the year ended December 31, 2017 for water services ("In-City Water") and wastewater treatment services ("Wastewater") provided within Edmonton by EPCOR Water Services Inc. ("EWSI"). These services are regulated by the City of Edmonton City Council in accordance with the Performance Based Regulation ("PBR") Plan approved in the EPCOR Water Services and Wastewater Treatment Bylaw No. 17698 (the "Bylaw").

1.1 Financial Performance

In-City Water and Wastewater's net income and return on equity for 2017 are summarized on Tables 1.1-1 and 1.1-2 below[1]:

Table 1.1-1
Net Income Return on Equity
($ millions)

		A	B
	In-City Water	**2017**	
		PBR Forecast	**Actual**
1	Revenue	190.1	187.4
2	Operating expenses	(100.7)	(98.8)
3	Depreciation and amortization	(25.6)	(25.9)
4	Interest	(26.6)	(27.0)
5	**Net Income**	**37.1**	**35.7**
6	Mid-year equity portion of rate base	365.1	364.1
7	**Return on Equity**	**10.175%**	**9.80%**

In 2017, In-City Water realized a 9.80% rate of return on equity, slightly less than its forecast return of 10.175%, as revenues were impacted by lower than forecast consumption and lower than forecast inflation adjustments to rates.

[1] Consistent with the 2017-2021 PBR Application, all financial data in this report, including totals and sub-totals, are rounded to the nearest $0.1 million. This practice ensures continuity of data between tables and between years. However, the sum of the rounded detailed data in certain tables may not be equal to the related rounded total or sub-total.

Table 1.1-2
Net Income and Return on Equity - Wastewater
($ millions)

		A	B
	Wastewater	**2017**	
		PBR Forecast	**Actual**
1	Revenue	94.0	90.8
2	Operating expenses	(54.0)	(47.1)
3	Depreciation and amortization	(13.9)	(14.4)
4	Interest	(10.0)	(10.2)
5	**Net Income**	**16.1**	**19.1**
6	Mid-year equity portion of rate base	158.0	151.9
7	**Return on Equity**	**10.175%**	**12.60%**

Wastewater's revenues were also affected by lower than forecast inflation adjustments and lower than forecast consumption, but lower than forecast operating expenses and a lower than forecast mid-year equity portion of rate base resulted in a return on equity of 12.60%.

The factors affecting In-City Water and Wastewater's 2017 financial performance and financial results are explained in detail in sections 2.3 and 3.3, respectively.

1.2 Capital Expenditures

In-City Water and Wastewater's capital expenditures for 2017 and for the five year term of the PBR Plan (the "2017-2021 PBR term") are summarized in Table 1.2 below:

Table 1.2
Capital Expenditures
($ millions)

		A	B	C	D
		2017		**2017-2021**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Current Projection**
1	In-City Water	108.1	98.1	475.8	563.5
2	Wastewater	54.5	46.8	235.4	238.7

In-City Water's capital expenditures were $10.0 million less than forecast for 2017. Much of this difference relates to EWSI's decision to defer the planned $16.0 million expansion of the Water Distribution and Transmission facility until the completion of an EPCOR-wide real estate review.

EWSI currently forecasts that In-City Water's total capital expenditures over the 2017-2021 PBR term will exceed the PBR forecast by $87.8 million. The increase in capital expenditures, beyond what was in the PBR forecast, consists of: $14.7 million for water main relocations to accommodate LRT expansion; $29.9 million to meet customer and developer requirements for growth, most of which results from changes to the Private Development Transmission Mains program (additional costs of $13.5 million) and the Water Main Cost Sharing Program (additional costs of $7.7 million); and $10.7 million to address unanticipated needs for reliability and life cycle replacements. Besides these projects and programs, the increase in capital expenditures also includes a significant new project, the $32.4 million E.L. Smith Solar Farm, designed to replace approximately 10% of conventional power with locally produced renewable power. This project is currently funded through rates and does not increase In-City Water's revenue requirements over the 2017-2021 PBR term.

Wastewater's lower ($7.7 million) capital expenditures in 2017 are not attributable to any single project, but reflect changes to project timing and changes in project scope needed to address revised asset condition assessments identified during preliminary engineering, as well as external factors including a longer than anticipated rezoning timeframe for the Mid-Point Operations Centre, a key component of Wastewater's 2017-2021 capital program.

Wastewater's total capital expenditures over the 2017-2021 PBR term are projected to be slightly higher than the PBR forecast ($3.3 million). Although the net change amounts to only 1.4% of Wastewater's capital program, this increase includes additional expenditures of $22.3 million to upgrade and replace sludge lines, $6.5 million to replace clarifier chains and $7.5 million to rehabilitate the concrete within the Diversion Structure. The additional costs of these projects are offset by cost reductions resulting from changes in the scope of projects, such as the Square 1 Gas Room Expansion ($9.0 million) and the Building and Site Rehab program ($7.3 million) and the Structural Rehab Programs ($5.5 million), which were identified during review of design options and value engineering. In addition, the Digester 4 Upgrade project has been deferred providing further reductions of $10.9 million. The remainder of the change in Wastewater's capital program results from reprioritization of reliability and life cycle replacements.

Detailed analysis of actual to forecast differences in capital expenditures for 2017, as well as approved to forecast differences for the 2017-2021 PBR term are provided in section 2.4 for In-City Water and in section 3.4 for Wastewater.

1.3 Operational Performance

In-City Water's operational performance is measured by the results of five indices prescribed in Schedule 3 of Bylaw 17698 with each index consisting of one or more performance measures. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all five performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard.

In 2017, In-City Water exceeded the performance standards for all five performance measure indices. Section 2.5 provides detailed discussions of the performance measures making up each of the indices and highlights of Wastewater's operational performance.

Table 1.3-1
2017 Performance Measures
Water System Service Quality

		A	B
Performance Measure Index - In-City Water		**Index Standard Points**	**Total Points Earned**
1	Water Quality Index	25.0	25.0
2	Customer Service Index	20.0	21.1
3	System Reliability and Optimization Index	25.0	28.5
4	Environmental Index	15.0	16.5
5	Safety Index	15.0	16.5
6	**Aggregate Points Earned**	**100.0**	**107.6**

Wastewater's operational performance is measured on a similar basis to Water's, but with four indices tailored to Wastewater's operations. As with Water, performance under each index is measured independently on a point basis with 100 base points available if the standards for all five performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard.

In 2017, Wastewater exceeded the performance standards for all four performance measure indices. Section 3.5 provides detailed discussions of the performance measures making up each of the indices and highlights of Wastewater's operational performance.

Table 1.3-2
2017 Performance Measures
Wastewater Treatment Services Quality

		A	B
Performance Measure Index - Wastewater		**Index Standard Points**	**Total Points Earned**
1	Water Quality and Environmental Index	55.0	60.5
2	Customer Service Index	15.0	16.5
3	System Reliability and Optimization Index	15.0	16.5
4	Safety Index	15.0	16.5
5	**Aggregate Points Earned**	**100.0**	**110.0**

1.4 Rates and Bill Comparisons

In 2017, EWSI's average residential customer's water bill, based on monthly consumption of 14.6 m^3, was **$36.40,** an increase of 1.6% from 2016, This increase consists of the 0.8% inflation adjustment discussed in Section 2.3.1 and the special rate adjustments approved in Bylaw 17698 for Environmental Initiatives (0.4%), Accelerated Programs (0.6%) and Rebasing (-0.2%).

The average residential customer's wastewater bill in 2017, again based on monthly consumption of 14.6 m^3, was **$16.54**, an increase of 5.0% from 2016. This increase includes the 0.8% inflation adjustment and special rate adjustments for rebasing of 4.2% needed to support Wastewater's 2017-2021 capital programs.

EWSI undertakes annual bill comparison surveys with various cities and local communities to ensure that the City's water and wastewater treatment rates are reasonable and competitive. Section 2.6 shows that EWSI's residential water rates are lower than most of the cities and communities included in the comparison, with only Vancouver having lower water rates.

Wastewater bills are more difficult to compare because of variations in the nature and extent of wastewater treatment, the inclusion of certain services in property taxes, and geographic and climatic factors which influence the level of investment in and approach to flood mitigation. Section 3.6 shows that Edmonton's combined drainage and wastewater treatment rates are competitive with those of other cities and communities with similar geographic and climatic conditions. Commercial bill comparisons for both water and wastewater show similar results to residential water and wastewater bills.

1.5 Non-Routine Adjustments

Non-routine adjustments are defined in Bylaw 17698 as "items which are unusual, significant in size or nature, and beyond the scope of control of EWSI". Bylaw 17698 allows EWSI to request adjustments to In-City Water and Wastewater's rates for non-routine adjustments from the City. These requests are provided to either the City Manager or City Council, depending on the impact of the non-routine adjustment on In-City Water and Wastewater's revenue requirements.

Although EWSI did not identify any non-routine adjustments that met the criteria outlined in Bylaw 17698, Schedule 3, Section 5.0 during review of its 2017 operations, EWSI committed to flow the benefits of any reductions in corporate shared service cost allocations resulting from the transfer of Drainage Services assets to EPCOR to In-City Water and Wastewater customers through a negative non-routine adjustment. EWSI calculated that, over the 2017-2021 PBR term, these reductions would amount to $11.4 million in savings for In-City Water customers and $4.2 million in savings for Wastewater customers. These savings were included in EWSI's request to the City Manager for non-routine adjustments to 2018 water rates.

The City Manager approved EWSI's request on March 13, 2018. The resulting non-routine adjustments have been applied to fixed monthly service charges commencing April 1 2018. The savings to In-City Water customers amount to $0.71 per 15mm (5/8") equivalent meter per month, providing savings of $8.56 for the average residential customer for the period from April

1, 2018 to March 31, 2019, and total savings of $35.28 over the 2017-2021 PBR term. For Wastewater customers, monthly savings amount to $0.31 per customer connection per month, providing savings of $3.72 per customer for the period from April 1, 2018 to March 31, 2019, and total savings of $15.34 over the 2017-2021 PBR term.

2 In-City Water

2.1 Accomplishments and Challenges

In 2017, In-City Water realized a 9.80% return on equity, slightly less than the PBR target of 10.175%, with decreases in In-City revenues largely offset by decreases in operating expenses. Lower than forecast revenues are attributable to lower than forecast consumption in the commercial and multi-residential customer classes, which accounted for $1.6 million of the $3.6 million difference and a lower than forecast inflation adjustment to water rates, which accounted for the remaining $2.0 million. The PBR inflation adjustment (see Table 2.3.1-2) consists of two components: (1) forecast inflation for 2017; and (2) the difference between forecast and actual inflation for 2016. Although forecast inflation for 2017 was 0.24% less than the PBR forecast, actual inflation for 2016 was 0.92% less than forecast, resulting in an inflation adjustment to 2017 rates of 0.84%, instead of the 2.02% PBR forecast adjustment.

Lower than forecast Corporate Shared Services costs accounted for $2.1 million of the $2.8 million difference between forecast and actual operating expenses. The remainder of the difference consists of lower power costs, reflecting both lower than forecast power consumption and lower than forecast wire charges, as well as lower than forecast staff costs and employee benefits resulting from reductions in fringe benefit rates and a one-time refund of long-term disability premiums. These lower than forecast costs were partially offset by higher than forecast chemical costs resulting from an early thaw which necessitated an early conversion from direct filtration to conventional water treatment, requiring much higher than forecast chemical use in the first half of the year.

In-City Water is undertaking an ambitious capital program over the 2017-2021 PBR term to replace existing assets, to lay the foundation for future growth, to meet environmental and health and safety goals, and to achieve improvements in performance and efficiency. EWSI's current projection is that capital expenditures over the 2017-2021 PBR term will exceed the PBR forecast by $87.8 million. This increase includes the $32.4 million E.L. Smith Solar Farm, designed to replace approximately 10% of conventional power with locally produced renewable power, $29.9 million to meet customer and developer requirements for growth, $14.7 million for water main relocations to accommodate LRT expansion, and $10.7 million to address unanticipated needs for reliability and life cycle replacements. These changes and their impacts on In-City Water's capital program are discussed in detail in Section 2.4.

In-City Water's financial performance, capital expenditures programs, and operational performance are discussed in detail in sections 2.2 to 2.5, with comparisons of In-City Water's average bills for residential and commercial customers to water bills in other western Canadian cities and local communities provided in section 2.6.

2.2 Customers and Consumption

In-City Water provides services to three customer classes: Residential; Multi-Residential; and Commercial. These classes are unchanged from the previous PBR term and are described in greater detail in Appendix A. Customer counts, total annual consumption and monthly consumption per customer are shown in Table 2.2 below:

Table 2.2
Customers, Consumption and Consumption per Customer

		A	B
	Customers and Consumption	**2017**	
		PBR Forecast	**Actual**
1	Annual Consumption (ML)		
2	Residential	45,057.0	45,477.9
3	Multi-Residential	18,370.0	17,828.8
4	Commercial	28,539.0	27,536.6
5	Total	91,966.1	90,843.2
6	Customers (Average Active Services per Month)		
7	Residential	256,306	259,335
8	Multi-Residential	3,746	3,752
9	Commercial	19,257	19,438
10	Total	279,310	282,524
11	Monthly Consumption per Customer* (m^3 per month)		
12	Residential	14.6	14.6
13	Multi-Residential	408.6	396.0
14	Commercial	123.5	118.1

*Monthly Consumption per Customer = (Annual Consumption x 1000) / (Customers x 12)

Although In-City Water's customer counts were 1.2% greater than forecast, total consumption was 1.2% less than forecast. The factors contributing to these results differ by customer class, as explained below:

- **Residential.** Higher than forecast customer counts in 2017 reflect greater than expected resilience of residential markets. In 2016, when the PBR forecast was prepared, EWSI assumed that economic conditions would limit annual residential customer growth to 1.9% for the 2016 to 2021 period. Actual residential growth in 2016 remained strong at 2.8%, before declining to 2.1% in 2017. Since actual consumption per customer in 2016 was within 0.1 m^3 of forecast, the increase in residential customers resulted in a 0.9% increase in total residential consumption volumes.

- **Multi-Residential.** Although customer counts were within 0.1% of forecast, lower than forecast consumption per customer meant that total consumption was 2.9% less than forecast. The actual to forecast difference in consumption per customer in 2017, while appearing high in absolute terms, is well within the limits of historical variation in consumption per customer, reflecting factors including weather conditions, vacancy rates, renovation of older buildings, and the number of units in new multi-residential buildings.

- **Commercial.** Consumption in the commercial customer class was 3.5% less than forecast, despite a 0.9% increase in customer counts. These results reflect the lack of homogeneity of commercial customers. This class includes a large number of customers, such as offices and retail stores, that consume very little water and a small number of customers, including businesses in the food and beverage processing industry, large shopping malls and hospitals, with very high levels of consumption. For example, in 2017, 290 (1.3%) of commercial customers accounted for 50% of commercial consumption. Therefore, increases in customer counts, which tend to be low water-consuming small businesses, will not necessarily result in a proportional increase in consumption for the commercial class. These conditions result in considerable year-over-year variation in consumption per customer.

EWSI notes that there were no comparable differences between actual and forecast consumption per customer in the Residential customer class. In response to higher than forecast declines in per customer consumption over the past two PBR terms, EWSI developed a new consumption forecasting model for the 2017-2021 PBR term incorporating time series analysis and weather normalization to better capture long-term trends in residential water consumption. While one year does not make a trend, the results of the residential forecasting model appear promising. Accordingly, EWSI is currently considering how to similarly enhance its forecast methodology for the Multi-Residential and Commercial customer classes.

2.3 Financial Performance

In-City Water's net income is derived from the provision of water services within Edmonton's boundaries. Besides these services, EWSI provides water services to surrounding communities under bulk water supply agreements with regional water service commissions ("Regional Customers"), and fire protection services to the City of Edmonton under a service agreement ("Fire protection").

EWSI's water system is fully integrated, with services jointly provided to In-City Water, Regional Customers and Fire Protection. Therefore, operating costs, depreciation, rate base and capital expenditures are presented and analyzed on a total system basis. In-City Water's share of these expenses, as well as its returns on rate base, are calculated in accordance with a cost of service model developed jointly by EWSI, the regional water service commissions and the City of Edmonton, and are shown as separate line items on each applicable table.

2.3.1 Revenue

In-City Water's rate revenues include fixed monthly services charges which vary by meter size and consumption charges applied to each cubic meter of water consumed. Besides rate revenue, In-City Water revenues also include other revenue derived from temporary services, connection fees, water permits, late payment charges and other incidental services. Table 2.3.1-1 below provides a comparison of 2017 In-City Water revenues to the PBR forecast:

Table 2.3.1-1
In-City Water Revenue
($ millions)

		A	B
	In-City Water Revenue	**2017**	
		PBR Forecast	**Actual**
1	Fixed Monthly Service Charges		
2	Residential	22.3	22.1
3	Multi-Residential	1.3	1.3
4	Commercial	3.9	4.0
5	Total Fixed Monthly Service Charge Revenue	27.5	27.3
6	Consumption Charges		
7	Residential	93.4	92.0
8	Multi-Residential	28.8	27.8
9	Commercial	35.5	34.5
10	Total Consumption Charge Revenue	157.8	154.3
11	In-City Water Rate Revenue	185.3	181.7
12	Other Revenue	5.0	5.7
13	**Total In-City Water Revenue**	**190.2**	**187.4**

The difference between 2017 actual and forecast rate revenue is attributable to two key factors. First, lower than forecast consumption, partially offset by higher than forecast customer counts, as explained in Section 2.2, accounted for $1.6 million of the $3.6 million difference between actual and forecast rate revenues. The remainder of the difference in revenue is attributable to the lower than forecast annual inflation adjustment to water rates. This adjustment, shown in Table 2.3.1-2, was 0.84%, compared to the PBR forecast rate of 2.02%. This difference is primarily attributable to the 0.92% difference between forecast and actual inflation for 2016, as the Alberta economy grew at a slower than expected rate in 2016.

Table 2.3.1-2
2017 PBR Inflation Adjustment

		A	B
	PBR Inflation Adjustment to 2017 In-City Water and Wastewater Rates	**2017**	
		PBR Forecast	**Actual**
1	2017 Forecast Inflation		
2	CPI	2.20%	2.20%
3	Labour	2.40%	1.70%
4	Weighted Inflation (65% CPI, 35% Labour)	2.27%	2.03%
5	Less: Efficiency Factor	-0.25%	-0.25%
6	2017 Year Forecast Inflation	2.02%	1.78%
7	2016 Actual to Forecast Inflation Adjustment	-	-0.92%
8	**PBR Inflation Adjustment (line 6 x line 7)**	**2.02%**	**0.84%**

Besides rate revenues, In-City Water earned $5.7 million in other revenue in 2017. The forecast to actual difference in 2017 results from a one-time charge of $0.4 million to EPCOR Distribution and Transmission Inc. ("EDTI") for meter reading services as part of the transfer of EPCOR's meter reading function from EDTI to EWSI, and fees of $0.3 million charged to private developers for water main flushing for new developments.

2.3.2 Operating Expenses by Function

Table 2.3.2 below provides a comparison of EWSI's total water system operating expenses for 2017 to the PBR forecast.

Table 2.3.2
Operating Expenses by Function
($ millions)

		A	B
		2017	
	Function and Sub-function	**PBR Forecast**	**Actual**
1	Power, Other Utilities and Chemicals		
2	Power	11.4	10.9
3	Natural Gas	0.6	0.6
4	Power and Other Utilities	12.0	11.6
5	Chemicals	7.2	8.4
6	Power, Other Utilities and Chemicals	19.2	20.0
7	Water Operations		
8	Water Treatment Plants	18.8	17.4
9	Water Distribution and Transmission	24.6	25.7
10	Operational Support Services	7.3	6.8
11	Quality Assurance and Environment	5.4	5.4
12	Capitalized Overhead Costs	(7.1)	(7.1)
13	Water Operations Expenses	49.0	48.3
14	Billing, Meters and Customer Service		
15	Billing and Collections	7.8	7.8
16	Meter Reading, Repairs and Maintenance	3.1	2.7
17	Customer Service	0.8	0.6
18	Billing, Meters and Customer Service Expenses	11.7	11.2
19	EWSI Shared Services		
20	EWSI Shared Services	9.8	10.0
21	Incentive and Other Compensation	3.1	2.8
22	EWSI Shared Services Expenses	12.9	12.8
23			
24	Corporate Shared Services	15.0	12.9
25			
26	Franchise Fees and Property Taxes		
27	Franchise Fees	14.5	14.3
28	Property Taxes	0.4	0.2
29	Franchise Fees and Property Taxes	15.0	14.6
30	**Total Operating Expenses by Function**	**122.6**	**119.8**
31	In-City Water Share - %	82.1%	82.4%
32	**In-City Water Share - $**	**100.7**	**98.8**

Overall, total operating expenses for 2017 were $2.8 million lower than the PBR forecast. Key factors contributing to this difference include:

- **Power and Other Utilities** ($0.5 million less than forecast). Over 90% of EWSI power costs relate to the costs of pumping water from the North Saskatchewan River to its water treatment plants and from the plants though the distribution network to its customers. In 2017, the favourable variance in power costs is attributable to lower than forecast wire charges and lower than forecast power requirements.

- **Chemicals** ($1.2 million greater than forecast). EWSI incurs a large portion of its chemical costs to mitigate turbidity, odour and colour during spring run-off. An unusual thaw in February 2017 resulted in EWSI experiencing two spring run-off events in 2017, requiring EWSI to stop direct filtration in February, rather than in March or April, and extending the use of chemicals (carbon, alum and caustic soda) in the water treatment process. After the second spring run-off event, EWSI maintained chemical usage at more normal levels and, in the fall, was able to reduce chemical usage through early conversion to direct filtration.

- **Water Treatment Plants** ($1.4 million less than forecast). This function includes the operation, maintenance and repair of reservoirs and water treatment plants. Lower than forecast costs in 2017 are attributable to several factors, including: a higher than forecast proportion of internal labour on capital projects, which increased capital recoveries ($0.5 million); reductions in fringe benefit costs, primarily associated with lower pension contribution rates, which provided additional savings in salary costs ($0.3 million); and capitalization of filter media costs, which had previously been considered an operating expense ($0.2 million). The remainder of the forecast to actual difference is made up of numerous small items, none of which exceed $0.1 million.

- **Water Distribution and Transmission** ($1.1 million greater than forecast). This function includes operations, repairs, maintenance and management of the distribution network. Although Water Distribution and Transmission also benefitted from the reduction in fringe benefit rates, the freeze thaw cycles in the spring of 2017 led to a high volume of emergency repairs, contributing to increased overtime costs of $0.4 million and higher levels of contractor costs of $0.7 million.

- **Operational Support Services** ($0.4 million less than forecast). The variance in this function, which includes Project and Asset Management, Supply Chain Management, and Water Operations Management, reflects lower Staff Costs and Employee Benefit expenses, resulting from lower fringe benefit costs and delays in filling unanticipated staff vacancies in Project and Asset Management.

- **Meter Reading, Repairs and Maintenance** ($0.4 million less than forecast). Staff Costs and Employee Benefit expenses, related to the decrease in fringe benefit rates, were $0.3 million lower than forecast for this function. The remainder of the forecast to actual difference is made up of numerous small items, none of which exceed $0.1 million.

- **Corporate Shared Services ($2.1 million less than forecast).** This difference is attributable to several factors, including: reductions in corporate cost allocations of $1.0 million resulting from the transfer of Drainage Services from the City of Edmonton to EPCOR Utilities Inc.; lower than forecast allocation factors; and decreases in corporate rent, higher staff vacancies and lower incentive costs**.** As noted in Section 1.5, the reductions to corporate shared services costs arising from the transfer of Drainage Services will be returned to In-City water customers through a non-routine adjustment to 2018 water rates.

- **Franchise Fees and Property Taxes** ($0.4 Million less than forecast). EWSI pays a franchise fee to the City of Edmonton of 8% of its rate revenues. Therefore, lower than forecast result resulted in a $0.2 million reduction in franchise fees. Lower than forecast property taxes relate to the deferral of the Distribution and Transmission facility which had been expected to increase Water Services' property taxes by $0.2 million annually commencing in 2017.

Variances in other operating expense functions and sub-functions are not significant, either individually or in aggregate.

In 2017, In-City Water's share of operating expenses was $98.8 million, compared to $100.7 million in the PBR forecast. This result reflects both lower total operating expenses for Edmonton Water Services, as explained above, partially offset by In-City Water's 0.2% higher share of operating expenses determined through the cost of service model.

2.3.3 Operating Expenses by Cost Category

Table 2.3.3 below shows operating expenses by cost category for Water Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 2.3.2.

Table 2.3.3
Operating Expenses by Cost Category
($ millions)

		A	B
	Cost Category	**2017 PBR Forecast**	**2017 Actual**
1	Water Operations		
2	Staff Costs and Employee Benefits	33.5	32.1
3	Contractors and Consultants	6.7	7.1
4	Vehicles	1.5	1.4
5	Materials and Supplies	3.0	3.3
6	Other	4.3	4.5
7	Water Operations Expenses	49.0	48.3
8	Billing, Meters and Customer Service		
9	CUS Charges	7.8	7.8
10	Staff Costs and Employee Benefits	6.6	6.3
11	Contractors and Consultants	0.5	0.4
12	Vehicles	0.3	0.3
13	Other	0.5	0.3
14	Meter Reading Services (Recoveries)	(4.1)	(3.9)
15	Billing, Meters and Customer Service Expenses	11.7	11.2
16	EWSI Shared Services		
17	EWSI Shared Services Allocation	9.8	9.6
18	Staff Costs and Employee Benefits	3.2	3.4
19	Contractors and Consultants	0.2	0.1
20	Other	(0.3)	(0.2)
21	EWSI Shared Services Expenses	12.9	12.8

The information presented in this table supports the explanations of differences between 2017 actual and forecast expenses provided in Section 2.3.2. Accordingly, no additional explanations are considered necessary.

2.3.4 Depreciation and Amortization

EWSI total system depreciation expense and amortization of contributed assets for 2017 are shown in Table 2.3.4 below:

Table 2.3.4
Depreciation and Amortization
($ millions)

		A	B
	Depreciation and Amortization	**2017**	
		PBR Forecast	**Actual**
1	Provision for depreciation	42.2	43.1
4	Gains (losses) on disposal of property, plant and equipment	-	(0.1)
3	Depreciation expense	42.2	42.9
2	Amortization of contributions	(9.7)	(10.3)
5	**Depreciation and Amortization**	**32.5**	**32.6**
6	In-City Water Share - %	78.9%	79.1%
7	**In-City Water Share - $**	**25.6**	**25.9**

Depreciation expense and amortization of contributions are both higher than forecast reflecting higher than forecast levels of developer-funded assets, explained in section 2.3.5 below. These impacts are offsetting, so actual depreciation expense, net of amortization, is within $0.1 million of forecast.

In-City Water's share of 2017 depreciation expense is 0.2% higher than forecast. The proportion of depreciation and amortization expense allocated to In-City Water through the cost of service model varies in proportion to demands on the total water system. The 0.2% difference in 2017 is consistent with actual to forecast differences in the base and max day peaking factors used to allocate depreciation expense in functional cost categories to In-City customer classes versus that charged to the RWCG.

2.3.5 Rate Base

In 2017, EWSI's total water system rate base, shown in Table 2.3.5 below, was $1.2 million less than forecast, with the higher than forecast gross rate base offset by higher than forecast contributions.

Table 2.3.5
Mid-Year Rate Base
($ millions)

		A	B
		2017	
	Components of Mid-Year Rate Base	**PBR Forecast**	**Actual**
1	Plant in Service		
2	Balance, beginning of year	2,148.1	2,192.3
3	Additions - EPCOR-funded	103.6	90.3
4	Additions - Developer-funded	6.0	22.7
5	Retirements and adjustments	-	(5.5)
6	Balance, end of year	2,257.4	2,299.8
7	Mid-Year Plant in service (= (line 1 + line 6)/2)	2,202.7	2,246.1
8	Accumulated Depreciation		
9	Balance, beginning of year	518.7	525.0
10	Depreciation expense	42.2	43.1
11	Retirements and adjustments	-	(5.4)
12	Balance, end of year	560.9	562.7
13	Mid-Year Accumulated Depreciation(= (line 8 + line 12)/2)	539.8	543.8
14	Other Rate Base Items		
15	Working Capital	20.5	20.2
16	Materials and Supplies	2.9	3.3
17	**Gross Mid-Year Rate Base** (= line 7 + line 13 + line 15 + line 16)	**1,686.3**	**1.725.8**
19	Contributions		
20	Balance, beginning of year	674.6	707.6
21	Contributions in aid of construction	6.0	22.7
23	Balance, end of year	680.6	730.2
24	Mid-Year Contributions (= (line 20 + line 23)/2)	677.6	718.9
25	Accumulated Amortization		
26	Balance, beginning of year	148.6	148.9
27	Amortization of contributions	9.7	10.3
28	Balance, end of year	158.3	159.2
29	Mid-Year Accumulated Amortization (= (line 26 + line 28)/2)	153.5	154.0
30	**Mid-Year Contributions** (= line 24 + line 29)	**524.1**	**564.9**
31	**Net Mid-Year Rate Base (= line 17 + line 30)**	**1,162.1**	**1,160.9**

The gross rate base reflects higher than forecast levels of developer-funded assets, both in 2016, which increased the opening balance of plant in service, as well as in 2017, offsetting lower than forecast EPCOR-funded capital additions, as discussed in Section 2.4.

Developers are responsible for construction of distribution infrastructure in new subdivisions. When these assets are placed into service, ownership of the assets is transferred to EWSI, where the assets, together with offsetting contributions in aid of construction, are added to the rate base. Therefore, in 2017, since higher than forecast developer-funded asset additions were fully offset by a corresponding increase in contributions, the net rate base remained within 0.1% of the PBR forecast.

2.3.6 Return on Rate Base

In-City Water's returns on rate base are based on its share of the total water system rate base, its deemed capital structure and its costs of debt and equity. Returns on rate base are summarized on Table 2.3.6-1 below:

Table 2.3.6-1
Return on In-City Water Share of Mid-Year Rate Base
($ millions)

		A	B
	Return on Rate Base	**2017**	
		PBR Forecast	**Actual**
1	Net Mid-Year Rate Base	1,162.1	1,160.9
2	In-City Water Share - %	78.5%	78.4%
3	In-City Water Share - $	912.6	910.3
4	Deemed Capital Structure		
5	Debt	60.00%	60.00%
6	Equity	40.00%	40.00%
7	Total	100.00%	100.00%
8	Cost Rates		
9	Debt	4.87%	4.95%
10	Equity	10.18%	9.80%
11	Weighted Average Cost of Capital (WACC)	6.99%	6.89%
12	Return on Rate Base		
13	Debt	26.6	27.0
14	Equity	37.1	35.7
15	**Total Return on In-City Water Rate Base**	**63.8**	**62.7**

In-City Water's share of the total system net mid-year rate base is 0.1% less than forecast, which is consistent with the change in In-City Water's demands on water system relative to that of Regional Customers. When combined with a total system rate base that was also very close to forecast, the In-City Water net mid-year rate base is within 0.1% of the amount forecast.

Returns on rate base are calculated separately for the debt-financed and equity-financed portions of In-City Water's net rate base. The rate of return on debt is equal to the embedded cost of debt for EWSI's total water system, as calculated in Table 2.3.6-2 below:

Table 2.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B
	Interest Expense and Cost of Debt	**2017**	
		PBR Forecast	**Actual**
1	Interest expense		
2	Interest on short-term debt	1.0	1.3
3	Interest on City of Edmonton debentures	0.9	0.9
4	Interest on intercompany debentures	31.5	31.2
5	Total interest expense	33.3	33.4
6	Mid-year debt and other long-term liabilities		
7	Mid-Year Short-term debt	36.3	27.9
8	Mid-Year Long-term debt	644.1	644.1
9	Mid-Year Other Long-term liabilities	4.0	2.1
10	Total mid-year debt and other long-term liabilities	684.4	674.1
11	**Embedded Cost of Debt**	**4.87%**	**4.95%**

The embedded cost of debt is slightly higher than forecast, reflecting a lower than forecast mid-year balance of short-term debt and, therefore, a higher proportion of higher cost long-term debt.

In-City's actual rate of return on equity, calculated as regulated net income in Section 1.1, is 0.3% less than approved ROE, reflecting EWSI's actions to control operating costs in response to the lower than forecast inflation component of 2017 rate increases.

2.3.7 Transactions with Affiliates

In-City Water derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EWSI business units. Table 2.3.7 provides a summary of In-City Water's 2017 actual and forecast transactions with affiliates, together with references to the schedules in this report where these transactions are reported.

Table 2.3.7
Transactions with Affiliates
($ millions)

		A	B
	Affiliate and Service	**2017**	
		PBR Forecast	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**		
2	Public Fire Protection	10.8	11.1
3	Water sales (Table 2.3.1-1, lines 4 and 9)	3.2	3.3
4	Other (Table 2.3.1-1, line 12)	0.2	0.1
5	Total	14.2	14.4
6	**Services provided by (recovered from):**		
7	**City of Edmonton**		
8	Franchise Fees (Table 2.3.2, line 27)	14.5	14.3
9	Property Taxes (Table 2.3.2, line 28)	0.4	0.2
10	Interest on City of Edmonton Debentures (Table 2.3.6-2, line 3)	0.9	0.9
11	Mobile equipment services (Table 2.3.3, lines 4 and 12)	1.8	2.2
12	Other services (Table 2.3.3, lines 6, 13 and 20)	1.3	0.7
13	Meter Reading Recoveries (Table 2.3.3, line 14)	-	(1.4)
14	Total	19.0	17.0
15	**EPCOR Utilities Inc.**		
16	Corporate Shared Service Costs (Table 2.3.2, line 24)	15.0	12.9
17	Interest on Intercompany Debentures (Table 2.3.6-2, line 4)	31.5	31.2
18	Interest on Short-term debt (Table 2.3.6-2, line 2)	1.0	1.3
19	Total	47.4	45.4
20	**EPCOR Distribution and Transmission Inc.**		
21	Meter Reading Service Revenue (Table 2.3.1-1, line 12)	-	(0.4)
22	Other services (Table 2.3.3, line 13)	0.1	-
23	Total	0.1	(0.4)
24	**EPCOR Technologies Inc.**		
25	Hydrovac Charges and Space Rentals (Table 2.3.3, line 3)	0.9	1.2
26	**EPCOR Energy Alberta LP**		
27	Customer Billing and Collection Services (Table 2.3.3, line 9)	7.8	7.8
28	**Other EWSI Business Units**		
29	EWSI Shared Services Allocation (Table 2.3.3, line 19)	9.8	9.6
30	Water Sales to Wastewater (Table 2.3.1-1, lines 4 and 9)	(0.4)	(0.5)
31	Meter Reading Recoveries from Wastewater (Table 2.3.3, line 14)	(2.1)	(2.1)
32	Meter Reading Recoveries from Drainage Services (Table 2.3.3, line 14)	(2.1)	(0.4)
33	Customer Service Fees from Drainage Services (Table 2.3.3, line 13)	-	0.1
34	Total	5.4	6.7
35	**Expenditures on capital projects arising from services provided by:**		
36	City of Edmonton	3.0	1.5
37	EPCOR Technologies Inc.	3.8	4.7
38	EPCOR Utilities Inc.	-	0.7
39	EPCOR Drainage Services	-	0.8
40	EPCOR Distribution and Transmission Inc.	0.1	0.4
41	Total	6.9	8.2

2.4 Capital Programs – In City Water

In-City Water's approved capital program for the 2017-2021 PBR term amounts to $475.8 million and includes over 200 projects in six major project categories. Over the course of the PBR term, changes to the capital program will be required in response to changes in regulatory or operational requirements, customer demands or other unforeseen circumstances. These changes are coordinated through EWSI's Project Management Office and are reviewed and approved by EWSI's Capital Project Steering Committee, EUI's Financial Review Council, or EPCOR's Board of Directors, depending on the significance of the change.

2.4.1 Capital Expenditures

Table 2.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2017 for each project with approved capital expenditures in excess of $5.0 million over the 2017-2021 PBR term, as well as for each project category. Table 2.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI's current capital forecast.

Although capital expenditures for In-City water were $10.0 million less than the amounts approved for 2017, EWSI estimates that, over the 2017-2021 PBR term, the total cost of EWSI's capital program, including the cost of new projects, and the cost of changes in scope for existing projects, will exceed PBR approved amounts by $87.8 million. These changes are explained in detail below Table 2.4.1.

Table 2.4.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	
		2017			2017-2021			
		PBR Forecast	Actual	Increase (Decrease)	PBR Forecast	Current Projection	Increase (Decrease)	
1	**Regulatory**							
2	Water Services Replace/Refurbish	1.9	1.9	(0.1)	10.2	10.1	-	
3	Projects < $5 Million	0.3	0.6	0.3	1.5	2.3	0.8	
4	Subtotal	2.2	2.5	0.2	11.6	12.3	0.8	
5	**Growth/Customer Requirements**							
6	Water Services Connections	4.0	5.0	1.0	23.6	24.8	1.2	
7	PD Construction Coordination	2.7	2.7	-	15.4	14.1	(1.3)	
8	Network PD Transmission Mains	3.5	6.8	3.3	14.4	27.9	13.5	1
9	New Meter Purchase/Installation	2.1	2.0	(0.1)	13.2	12.9	(0.2)	
10	LRT Relocates	5.5	5.3	(0.3)	10.4	25.1	14.7	2
11	New Water Distribution Mains	1.7	1.6	(0.1)	8.8	10.1	1.3	
12	Distribution System Modifications	1.4	1.3	(0.1)	6.0	5.1	(0.9)	
13	Water Main Cost Sharing Program	0.8	0.8		3.0	10.8	7.7	3
14	Projects < $5 Million	1.6	3.2	1.6	2.6	8.2	5.6	4
15	Subtotal	23.4	28.8	5.4	97.5	139.1	41.6	
16	**Health, Safety & Environment**							
17	E.L. Smith - Deep Bed Filtration	-	-	-	22.3	22.6	0.3	
18	Projects < $5 Million	0.7	0.8	-	4.3	4.5	0.2	
19	Subtotal	0.7	0.8	-	26.6	27.1	0.4	
20	**Reliability & Life Cycle Improvements**							
21	Water Main Reactive Renewal	8.4	9.6	1.2	54.7	52.3	(2.3)	5
22	Meter Change Outs	2.6	2.9	0.3	25.6	17.3	(8.4)	6
23	Water Main Proactive Renewal	3.4	3.7	0.2	18.0	18.0	(0.0)	
24	Transmission Mains Replace/Refurbish	2.4	2.8	0.3	13.3	13.7	0.4	
25	Vehicle & Fleet Additions	3.7	3.7	-	11.8	11.9	0.1	
26	E.L. Smith - Bypass (Ring) Main	-	-	-	7.0	7.3	0.3	
27	Cell/Pumphouse Roof Replacement	2.7	1.5	(1.2)	6.3	2.9	(3.4)	7
28	SCADA System Upgrade Program	2.3	0.9	(1.4)	5.7	4.0	(1.7)	
29	Network Valve Chamber Refurbishment	1.1	1.2	0.1	5.6	5.7	0.2	
37	Electrical Upgrades - Reservoirs	1.1	0.4	(0.7)	5.3	4.3	(1.0)	
38	Electrical Upgrades -- Rossdale	0.6	0.6	(0.6)	5.2	5.3	0.1	
30	Obsolete Hydrants	0.8	1.3	0.4	4.4	7.4	3.0	8

		A	B	C	D	E	F	
		2017			2017-2021			
		PBR Forecast	Actual	Increase (Decrease)	PBR Forecast	Current Projection	Increase (Decrease)	
31	Obsolete Valves	0.8	1.5	0.7	4.1	7.6	3.5	9
32	Rossdale Filter Underdrains	1.1	2.2	1.0	4.7	8.1	3.4	10
33	Rossdale Clarifier C1-2 Upgrade	3.0	1.2	(1.7)	4.3	6.2	1.8	
34	ELS Mechanical Upgrades Program	1.2	1.1	(0.2)	4.9	6.2	1.3	
35	ELS Chemfeed Upgrades Program	0.8	1.2	0.4	4.0	5.2	1.2	
36	Rossdale Chemfeed Upgrades Program	0.9	1.9	1.0	4.0	5.5	1.5	
39	Projects < $5 Million	16.5	14.3	(1.5)	73.4	86.7	13.3	11
40	Subtotal	53.6	52.0	(1.6)	262.4	275.6	13.2	
41	**Performance Efficiency & Improvement**							
42	Water Main Cathodic Protection	4.0	3.8	(0.2)	21.0	19.4	(1.7)	
43	Water D&T Facility Expansion	16.0	-	(16.0)	16.0	16.0	(0.0)	12
44	Projects < $5 Million	1.4	1.0	(0.3)	7.1	6.4	(0.7)	
45	Subtotal	21.4	4.8	(16.6)	44.1	41.7	(2.4)	
46	**Accelerated**							
47	Accelerated Water Main Renewal	9.9	9.7	(0.2)	51.9	54.5	2.6	13
48	Accelerated Fire Protection	2.9	3.7	0.8	15.9	12.0	(3.9)	14
49	Subtotal	12.8	13.4	0.6	67.8	66.5	(1.3)	
50								
51	**E.L Smith Solar Farm**	-	1.5	1.5	-	32.5	32.5	15
52								
53	**Capital Expenditures before contributions**	**114.1**	**103.7**	(10.4)	**510.1**	**594.9**	84.8	
54								
55	**Contributions**							
56	Water Services Connections	(4.0)	(3.9)	0.1	(23.6)	(19.7)	3.9	16
57	New Water Distribution Mains	(1.7)	(1.4)	0.3	(8.8)	(9.4)	(0.6)	
58	Other contributions	(0.3)	(0.3)	0.0	(1.9)	(2.2)	(0.3)	
59	Subtotal	**(6.0)**	**(5.6)**	0.4	**(34.3)**	**(31.3)**	2.9	
60	**Capital Expenditures**	**108.1**	**98.1**	**(10.0)**	**475.8**	**563.5**	**87.8**	

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million or 20% on individual projects with total costs in excess of $5.0 million, as well as for project categories in aggregate include:

1. **Network Private Development Transmission Mains** –$13.5 million (93.9%) greater than forecast. This program includes the costs of developer-constructed transmission mains (450mm in diameter and larger), with developers determining both the timing of projects and the areas to be developed. Therefore, changes to the projected cost of this program result from changes to developers' plans,

   EWSI's current projection of the costs of this program are based on transmission mains anticipated in upcoming development areas, and incorporate approved neighborhood structure plans, submitted drawings and discussions with the development community. Significant additions to this program include transmission main projects for Ellerslie Road, east of 127 St, scheduled for construction in 2019, and the Horse Hills industrial area scheduled for construction in 2020.

2. **LRT Relocates** – $14.7 million (141.2%) greater than forecast. This category includes the costs of moving infrastructure to accommodate LRT expansion. The costs approved in the PBR application were based on EWSI's understanding of track alignment and project timing at the time the PBR application was prepared. Subsequent changes to both the Southeast and West lines have resulted in significantly increases to projected costs. As these changes were beyond EWSI's control, EWSI believes that they meet the criteria for a non-routine adjustment. Once the associated costs are more fully known, EWSI will review the applicability of a non-routine adjustment with City Administration.

3. **Water Main Cost Sharing Program** - $7.7 million (255.5%) greater than forecast. This program is driven by developer activity. The increase in the cost of this program results from higher than forecast increases in developer activity.

4. **Growth and Customer Requirements less than $5.0 million** – $5.6 million (217.8%) greater than forecast. The projected increase in this category results from a new booster station project needed to address development in a high elevation area ($1.4 million); additional costs to acquire water mains from a regional water commission following city expansion ($2.4 million) and changes to projected costs for other growth projects amounting to $1.8 million.

5. **Water Main Reactive Renewal** - $2.3 million (4.3%) less than forecast. In this program, water mains are replaced if they meet criteria around main break frequency, materials, age and other pertinent factors. The forecast decrease in project costs results from a lower than forecast number of water mains qualifying for replacement.

6. **Meter Change-Outs** - $8.4 million (32.9%) less than forecast. The decrease in the projected cost of this program results from an increase in the expected lives of water meters, resulting

from improvements to manufacturing processes for the batteries used in the meters. Accordingly, the forecast costs of this program have been reduced, since fewer meters are expected to require replacement.

7. **Cell/Pumphouse Roof Replacement -** $3.4 million (53.8%) less than forecast. This decrease reflects lower costing from contractors, as well as consolidation of this project with the Reservoir Structural Upgrades Program to enhance project management and project coordination, and to achieve delivery efficiencies.

8. **Obsolete Hydrants** - $3.0 million (67.5%) greater than forecast. EWSI has adjusted its hydrant replacement schedule due to higher than expected rates of deterioration, so that backlogs are reduced and fire protection service levels maintained.

9. **Obsolete Valves** - $3.5 million (84.4%) greater than approved. As with Obsolete Hydrants, higher than expected rates of deterioration have led to increased backlog, requiring adjustments to valve replacement schedules. Although the projected cost of this program has increased substantially, improving overall valve operability in the system reduces isolation time, lessens the potential for property damage and mitigates customer impacts during emergency main break response.

10. **Rossdale Filter Underdrain Upgrades** - $3.4 million (71.9%) greater than forecast. Both the scope and cost of this project have increased following close inspection of the filter underdrain system that identified that each filter would require unforeseen upgrades to air scour systems.

11. **Reliability and Life Cycle Improvements less than $5.0 million** – $13.3 million (18.1%) greater than forecast. Unexpected asset failures and updated asset condition assessments have resulted in increases to both the scope and cost of work needed to complete rehabilitation projects and life cycle replacements.

12. **Water D&T Facility Expansion.** Although the projected cost of this project has not changed, this $16.0 million project has been deferred from 2017 to 2019 pending completion of EPCOR's corporate wide real estate review, which was initiated following the transfer of Drainage Services to EPCOR.

13. **Accelerated Water Main Renewal Program** - $2.6 million (5.0%) greater than forecast. EWSI has identified an increased number of sub-projects that meet the criteria for accelerated renewal, especially to accommodate water main replacement in conjunction with the City of Edmonton's Alley Paving program. The increase in costs for this program will be entirely offset by lower than approved expenditures on Accelerated Fire Protection.

14. **Accelerated Fire Protection Program** - $3.9 million (24.5%) less than forecast. Although 2017 expenditures were higher than approved, EWSI expects that expenditures over the

remainder of the 2017-2021 PBR term will be less than approved amounts, due to a smaller number of potential sub-projects meeting the Accelerated Fire Protection Program criteria.

15. **E.L. Smith Solar Farm** - $32.5 million (new project). The special rate adjustment for environmental initiatives includes a proposal to replace 10% of EWSI's conventional power with locally produced renewable energy at an annual cost of $1.9 million. After assessing a number of alternatives, rather than purchasing local green power, EWSI has initiated a new project to construct a solar farm on land adjacent to the E.L. Smith Water Treatment Plant reserved for future treatment plant expansion.

16. **Water Services Connections Contributions** - $3.9 million (16.3%) less than forecast. EWSI has revised its contributions forecast to align more closely with actual cost recoveries from prior years. Contributions for individual service installations are based on set service application rates and are intended to cover the full construction cost of an individual service installation. However, EWSI has found that after accounting for all program costs, including variations in construction costs, program administration, and service removals, contributions only account for 72.5% of the costs of individual service installations. Accordingly, current projections have been revised to reflect EWSI's actual experience.

2.4.2 Construction Work in Progress

In-City Water's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. In 2017, as shown on Table 2.4.2, the balance in Construction Work in Progress was $6.6 million greater than forecast, of which $3.5 million was attributable to higher than forecast carry-over projects from 2016, with the remainder attributable to carry-over projects for 2017.

Table 2.4.2
Construction Work in Progress
($ millions)

		A	B
		2017	
	Construction Work in Progress	**PBR Forecast**	**Actual**
1	Balance, beginning of year	0.3	3.8
2	Capital Expenditures	108.1	98.1
4	Capital Additions	(103.3)	(90.3)
7	**Balance, end of year**	**5.0**	**11.6**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2017, AFUDC included in capital expenditures on eligible projects amounted to $0.3 million, compared to the PBR forecast amount of $0.1 million.

2.5 Operational Performance

Water System Service Quality is measured by the results of five indices prescribed in Bylaw 17698. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all five performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard. The performance measurement process for the 2017-2021 PBR term is similar to that of previous PBR term, with enhancements made to:

- Align metrics with the City of Edmonton's The Way We Green/Grow strategies, including the introduction of energy efficiency, water conservation, solids residual management, and other environmentally-focused metrics;
- Revise scoring, so that below-standard performance for Water Quality and Wastewater Quality cannot be offset with bonus points earned on other measures;
- Eliminate metrics within EPCOR's control (e.g. safety meetings); and
- Update targets to 10 year historic average (with a few exceptions).

2.5.1 Water Quality Index

The Water Quality index is calculated as the percentage of water quality test results that meet EPCOR's internal water standards. Water quality standards are established by both the federal and provincial governments and are incorporated into EWSI's Approval to Operate from Alberta Environment and Parks. In some cases, EWSI sets even stricter limits for critical parameters that are identified in EWSI Quality Standards, to provide early warnings of potential water quality problems; so that corrective actions can be taken before external standards are not met.

Table 2.5.1
Water Quality Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Index	The percentage of the total number of water quality tests taken in the period that do not yield suspect results	99.7%	99.8%	1.001
			Average Index	1.001
			Index Standard Points	25.0
			Total Actual Points	25.0
			Maximum Available Points Including Bonus Points	25.5
			Total Points Earned	**25.0**

2017 Highlights

- EWSI met all Guidelines for the Canadian Drinking Water Quality health-based limits and AEP Approval water quality testing requirements. Additionally, EPCOR's internal targets were not met in only 94 of 59,915 tests conducted on treated water.

- EWSI's efforts in improving the water quality in areas with cast iron piping and low flow due to low water use resulted in an improvement in failed distribution system tests for low chlorine and/or high turbidity from 154 in 2016 to 84 in 2017.

2017 Areas for Improvement

- EWSI's Process Development Team will continue to work on identifying cold weather treatment factors related to the removal of *Cryptosporidium* and *Giardia* during direct filtration operation. This project will be completed in early 2018.

- Turbidity and Chlorine in the distribution system have been identified for future water quality opportunities. There continue to be localized areas in the distribution system that experience high turbidity or low chlorine at times, and result in water quality complaints. These are typically in older areas with cast iron piping and dead end flow. These will be addressed in the short term by actively investigating complaints and flushing where required, and in the longer term by identifying priority areas for water main renewals or lining.

2.5.2 Customer Service Index

The customer service index is a composite measure of the customers' perception of satisfaction with EWSI service, the aesthetic quality of water and speed of response to customer issues.

Table 2.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Post Service Audit Factor	The percentage of the customers responding as "completely" or "very satisfied" in the level of service received from the EWSI Emergency group.	74.9%	72.5%	0.968
Home Sniffing Factor	The percentage result of customer satisfaction for the home sniffing survey.	94.4%	94.5%	1.001
Response Time Factor	The average number of minutes needed to confirm a water main break from the time a call is received at EWSI's dispatch office.	25	18.3	1.268
Planned Construction Impact Factor	The percentage of the total planned construction events where EWSI complies with required construction notification procedures.	95.8%	93.3%	0.974
			Average Index	1.053
			Index Standard Points	20.0
			Total Actual Points	21.1
			Maximum Available Points Including Bonus Points	23.0
			Total Points Earned	**21.1**

<u>2017 Highlights/</u>

- **Home Sniffing Factor.** EWSI has increased water quality monitoring and laboratory-scale treatment testing to help optimize powdered activated carbon dose and remove odour causing compounds during the spring runoff period. EWSI has also initiated a research program for 2018 with University of Waterloo to characterize the organic content of the river water. This program is intended to increase EWSI's understanding of the complex chemistry that results in odour in the treated water during spring run-off and lead to better operational strategies at the water treatment plants.

<u>2017 Areas for Improvement</u>

- **Post Service Audit Factor**. This factor is very dependent on timely and effective responses to customers. For 2018, the Water Call Centre has developed internal tracking systems to provide more timely analysis of Call Centre data and to identify upcoming issues earlier and has implemented customer service training programs to improve customer experience

- **Planned Construction Impact Factor**. EWSI has provided training to all project teams to ensure appropriate notification timelines are followed for work in 2018. Additional improvements include implementation of proactive construction communication plans and enhancements to field systems to improve real-time tracking of construction dates and project completion progress.

2.5.3 System Reliability and Optimization Index

The System Reliability Index is a measure of the confidence that customers can place in the reliability of the waterworks system.

Table 2.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Main Break Factor	The number of water main breaks that occurred in the reporting period.	419	256	1.389
Water Main Break Repair Duration Factor	The percentage of water main breaks repaired and confirmed by EWSI within 24 hours from the time that the flow of water is shut off, excluding main breaks on arterial or collector roads	93.7%	95.7%	1.022
Water Loss Factor	The Infrastructure Leakage Index, a performance indicator quantifying how well a water distribution system is managed for the control of “real” water losses (i.e. leakage).	2.0	1.06	1.470
System Energy Efficiency Factor	The energy used at all water facilities in kWh divided by the average annual water production per residential customer account (ML/kWh/customer).	309	263	1.175
			Average index	1.264
			Index Standard Points	25.0
			Total Actual Points	31.6
			Maximum Available Points Including Bonus Points	28.5
			Total Points Earned	**28.5**

<u>2017 Highlights</u>

- **Water Loss Factor (ILI).** EWSI’s ILI of 1.06 significantly exceeded the PBR standard and is near the theoretical lowest level of leakage expected given the water supply system characteristics. An AWWA Water Audit Validation exercise is being considered to provide additional understanding of the system and identification of potential opportunities for further system improvement.

2.5.4 Environment Index

The environmental index measures the success of programs and policies designed to mitigate and report adverse environmental impacts.

Table 2.5.4
Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Conservation Factor	The actual 10 year rolling average monthly Edmonton residential consumption per household	17.2	16.1	1.068
Environment Incident Factor	The number of reportable and preventable environmental incidents	6	3	2.000
Solids Residual Management Factor	The average number of days that the Rossdale and E.L. Smith water treatment plants are operating in direct filtration mode.	120	129	1.077
			Average index	1.382
			Index Standard Points	15.0
			Total Actual Points	20.7
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2017 Highlights

- **Environment Incidents.** Procedures to identify chlorinated waste streams have been improved and have resulted in fewer releases to the river and the drainage system. In addition, operations are now applying additional controls for dechlorination of smaller waste streams which has resulted in fewer incidents. The Water Distribution and Transmission system achieved registration of their Environmental Management System to the international standard ISO14001. Now the entire Edmonton Water System is registered to ISO14001. This will help lead to further improvements environmental performance.
- **Solids Residual Management Factor.** Despite the operational challenges of an early spring run-off in February, high colour in the fall, and customer demand, the water treatment plants were still able to achieve 129 days in direct filtration operation. Increased use of direct filtration reduced total solids discharged to the North Saskatchewan River by 25% during the months of January to February and November to December 2017, compared to baseline conventional operation. This result was a significant improvement over 2016 when the reduction was limited to 11.5% during these months.

2017 Areas for Improvement

- **Solids Residual Management Factor,** EWSI continues to trial different types of polymer and to investigate different strategies for dosing during transition from conventional treatment to direct filtration at its water treatment plants in an effort to extend the number of days in direct filtration and reduce solids discharged to the North Saskatchewan River.

2.5.5 Safety Index

The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public.

Table 2.5.5
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	550	1,119	2.035
Work Site Inspections and Observations Factor	Number of Work Site Inspections and observations completed per year.	1,032	2,036	1.973
Lost Time Frequency Factor	The actual lost time frequency rate.	0.57	0.38	1.500
All Injury Frequency Factor	The actual all injury frequency rate	1.54	1.33	1.158
			Average index	1.666
			Index Standard Points	15.0
			Total Actual Points	25.0
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2017 Highlights

- **Near Miss Reporting Factor.** Near Miss reporting effectively assisted employees with identification and mitigation of hazards that had potential to become incidents. Continued focus on near miss reporting in 2018 is expected to further assist employees in identifying and mitigating hazards that have the potential to become incidents.

- **Work Site Inspections and Observations.** These leading indicators assisted employees in identifying changes needed to improve existing processes and procedures.

2017 Areas for Improvement

- **All Injury Frequency Factor**. Although EWSI achieved better than standard results for this factor, EWSI will be introducing a new program in 2018 to prevent musculoskeletal injuries. This program will encourage employees to engage in specific pre and periodic stretching exercises throughout their work day.

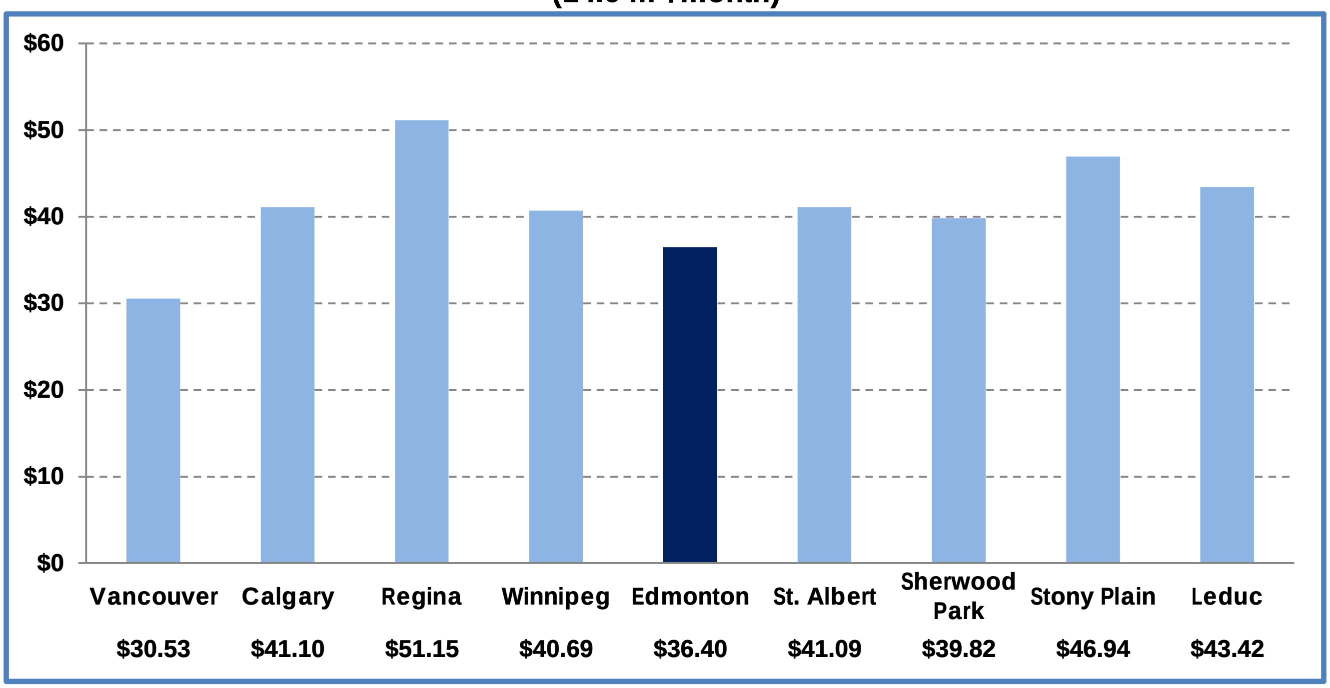
2.6 Rates and Bill Comparisons

Water bill comparisons for 2017 are based on the published water rates for Calgary, Vancouver, Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

2.6.1 Residential Water Bills

Figure 2.6.1 provides a comparison of residential household water bills for residential household consumption of 14.6 m^3 per month, the average residential customer consumption per month in Edmonton in 2017. Comparison of residential water bills shows that Edmonton's water bills are lower than all of the cities and local communities surveyed, except for Vancouver. This result is not unexpected; Vancouver has an excellent raw water source and, therefore, has lower needs for water treatment than Edmonton.

Figure 2.6.1
2017 Monthly Residential Water Bill Comparison
(14.6 m^3/month)



2.6.2 Commercial Water Bills

Table 2.6.2 provides a comparison of the water bills for commercial customer of various sizes. This table shows that water bills for EWSI's commercial customers are lower than all of the other surrounding communities and other major cities in western Canada, except for higher volume customers in Vancouver.

Table 2.6.2
Commercial Monthly Water Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	25.79	272.86	1,135	5,406
3	Calgary	41.92	381.67	1,279	6,570
4	Regina	42.50	503.30	2,141	10,087
5	Winnipeg	32.50	461.80	1,846	9,059
6	**Edmonton**	**24.44**	**358.55**	**1,409**	**5,918**
7	St. Albert	33.64	422.44	1,637	8,117
8	Sherwood Park	28.96	595.36	2,365	11,805
9	Stony Plain	37.22	544.18	2,128	10,578
10	Leduc	30.84	547.20	2,284	10,826

3 Wastewater

3.1 Accomplishments and Challenges

Wastewater realized a 12.60% return on equity, compared to the 10.175% return on equity forecast for the 2017-2021 PBR Plan. Wastewater's return on equity reflects both higher net income, largely attributable to lower than forecast operating expenses, which more than offset lower than forecast revenues, as well as a lower than forecast equity portion of the rate base. Wastewater also benefitted from reductions in corporate shared services cost allocations following the transfer of Drainage Services from the City of Edmonton to EPCOR, reductions in fringe benefit rates, a one-time refund of long-term disability premiums, and increases in capital transfers and capitalized overhead associated with a higher than forecast proportion of internal labour on capital projects. Since most of the reductions in operating expenses are non-recurring, EWSI expects that returns over the remainder of the 2017-2021 PBR term will align more closely with the PBR forecast.

Wastewater's capital program for the 2017-2021 PBR term focuses on projects and programs needed to address reliability and rehabilitation issues at the Gold Bar Wastewater Treatment Plant. Wastewater's 2017-2021 capital program is currently forecast to be $238.7 million, an increase of $3.3 million (1.4%) from the PBR forecast. Although the net change amounts is relatively small, the current projection includes additional expenditures of $22.3 million to upgrade and replace sludge lines, $6.5 million to replace clarifier chains, and $7.5 million to rehabilitate the concrete within the Diversion Structure. Review of design options and value engineering enabled Wastewater to identify cost reductions to offset most of the additional costs. These cost reductions included changes to the scope of projects, such as the Square 1 Gas Room Expansion ($9.0 million), the Building and Site Rehab program ($7.3 million) and the Structural Rehab Program ($5.5 million), as well as deferral of the Digester 4 Upgrade project, providing further reductions of $10.9 million over the 2017-2021 PBR term. The remainder of the change in Wastewater's capital program results from reprioritization of reliability and life cycle replacements.

Wastewater's financial performance, capital expenditures programs, and operational performance are discussed in detail in sections 3.2 to 3.5, with comparisons of Wastewater's average bills for residential and commercial customers to water bills in other western Canadian cities and local communities provided in section 3.6.

3.2 Consumption and Customers

Wastewater's customer counts, consumption and consumption per customer are similar to those of In-City Water. Differences in customer counts, which are almost entirely within the commercial customer class, are attributable to "water-only" customers who are not tied into the City's drainage system, such as businesses in industrial parks that are served by septic systems, as well as seasonal water customers, such as commercial lawn watering services and golf courses. Table 3.2 below provides a comparison of 2017 forecast to actual customer counts and consumption per customer.

Table 3.2
Consumption, Customer Counts and Consumption per Customer

		A	B
	Customers and Consumption	**2017 PBR Forecast**	**2017 Actual**
1	Annual Consumption - ML		
2	Residential	45,035.7	45,368.7
3	Multi-Residential	18,378.1	17,794.9
4	Commercial	24,775.0	23,798.3
5	Total	88,188.8	86,961.9
6	Customers (Average Active Services per Month)		
7	Residential	256,191	259,237
8	Multi-Residential	3,746	3,752
9	Commercial	16,537	16,629
10	Total	276,474	279,617
11	Monthly Consumption per Customer* (m^3 per month)		
12	Residential	14.6	14.6
13	Multi-Residential	408.8	395.2
14	Commercial	124.8	119.3

*Monthly Consumption per Customer = (Annual Consumption x 1000) / (Customers x 12)

Actual to forecast differences in Wastewater's customer counts and consumption are attributable to the same factors discussed in Section 2.2.

3.3 Financial Performance

3.3.1 Revenue

Wastewater's rate revenues include fixed monthly services charges applied on a per connection basis, and consumption charges applied to each cubic metre of consumption. Besides rate revenues, Wastewater also has a relatively small amount of other revenue. Table 3.3.1 below provides a comparison of Wastewater's 2017 actual and forecast revenue.

Table 3.3.1
Wastewater Revenue
($ millions)

		A	B
		2017	
	Wastewater Revenue	**PBR Forecast**	**Actual**
1	Fixed Monthly Service Charges		
2	Residential	13.4	13.3
3	Multi-Residential	0.2	0.2
4	Commercial	0.9	0.9
5	Total Fixed Monthly Service Charge Revenue	14.4	14.3
6	Consumption Charges		
7	Residential	37.4	37.1
8	Multi-Residential	15.3	14.6
9	Commercial	19.5	18.6
10	Total Consumption Charge Revenue	72.2	70.3
11	Wastewater Rate Revenue	86.6	84.6
12	Other Revenue	6.2	6.2
13	**Total Wastewater Revenue**	**92.8**	**90.8**

In 2017, Wastewater's rate revenues were $2.0 million less than forecast. This difference is attributable to the factors discussed in Section 2.3.1, including lower than forecast per customer consumption ($1.2 million) and lower than forecast inflation ($0.8 million). About one-half of Wastewater's other revenues, which were equal to the PBR forecast, are derived from overstrength surcharges to commercial customers with high concentrations of certain constituent components of wastewater. The remainder of Wastewater's other revenues are incidental revenues derived from sales of by-products, treatment of effluent from the Alberta Capital Regional Wastewater Commission, late payment fees and miscellaneous charges.

3.3.2 Operating Expenses by Function

Wastewater's operating expenses are presented and analyzed on both functional and cost category bases. Actual and forecast operating expenses by function are shown in Table 3.3.2 below:

Table 3.3.2
Operating Costs by Operational Function
($ millions)

		A	B
		2017	
	Function and Sub-function	**PBR Forecast**	**Actual**
1	Power, Other Utilities and Chemicals		
2	Power and Other Utilities	5.2	4.7
3	Chemicals	1.6	1.0
4	Power, Other Utilities and Chemicals	6.8	5.8
6	Wastewater Treatment		
7	Wastewater Treatment Plant	18.4	17.2
8	Operations Support Services	7.9	6.5
9	Capitalized Overhead	(2.3)	(3.1)
10	Wastewater Treatment Expenses	24.0	20.6
12	Billing, Meters and Customer Service		
13	Billing and collections	3.2	3.3
14	Meter reading	2.3	2.1
15	Regulatory Services	1.0	1.0
16	Billing, Meters and Customer Service Expenses	6.5	6.4
18	EWSI Shared Services		
19	EWSI Shared Services	3.3	3.2
20	Incentive and Other Compensation	1.1	(0.1)
21	EWSI Shared Services Expenses	4.4	3.2
22			
23	Corporate Shared Services	4.8	4.0
24			
25	Franchise Fees and Property Taxes		
26	Franchise Fees	6.8	6.6
27	Property Taxes	0.6	0.6
28	Franchise Fees and Property Taxes	7.4	7.2
29	**Total Operating Expenses by Function**	**54.0**	**47.1**

Overall, Wastewater's operating expenses were $6.9 million less than forecast. Key factors contributing to this difference include:

- **Power** ($0.5 million less than forecast). Lower than forecast power costs are almost entirely attributable to lower power prices obtained in Wastewater's new power contract. The benefits of lower than forecast power prices are expected to continue for the remainder of the 2017-2021 PBR term.

- **Chemicals** ($0.5 million less than forecast). Lower than forecast chemical costs are attributable to two factors. First, the initialization; development and optimization of the Ostara nutrient removal process, resulted in lower chemical usage throughout most of 2017. Second, Wastewater achieved significant reductions in alum usage from process and dosing optimization.

- **Wastewater Treatment Plant** ($1.2 million less than forecast). Lower than forecast costs reflect a higher than forecast proportion of internal labour on capital projects ($0.7 million), resulting from adjustments to the capital program (see section 2.4), where projects with a high component of contractor costs were replaced by capital maintenance and repair projects completed by Wastewater personnel. Staff costs and employee benefit costs were also affected by savings from lower than forecast fringe benefit rates ($0.3 million), primarily associated with pension contributions, and lower than forecast overtime costs ($0.1 million) resulting from decreases in breakdown call outs.

- **Operations Support Services** ($1.4 million less than forecast). As with Wastewater Treatment Plants, lower than forecast costs reflect a higher than forecast proportion of internal labour on capital projects ($0.4 million) and lower than forecast fringe benefit rates ($0.1 million). The favourable variance is also attributable to delays in filling vacancies in Wastewater's engineering areas, which further reduced Staff Costs and Employee Benefits expenses ($0.2 million). The remainder of the actual to forecast difference is made up of numerous small items, none of which exceed $0.1 million.

- **Capitalized Overhead** ($0.8 million greater than forecast). This function includes a portion of the salaries and benefits for managers and administrators in areas where staff work on both operational and capital projects. Higher than forecast capitalized overheads is consistent with the higher than forecast levels of internal labour on capital projects noted in both the Wastewater Treatment Plant and Operations Support Services functions.

- **EWSI Shared Services** ($1.3 million less than forecast). This function includes Wastewater's share of the costs of centrally-provided services, including: Information Services; Finance; Health, Safety and Environment; Technical Training; Regulatory Services; EWSI Executive Administration. To maintain employee confidentiality, this function also includes costs, such as incentives, termination payments and long-term disability.

  Lower than forecast costs in this category result from two adjustments to long-term disability, including a $0.6 million one-time premium refund, and a $0.4 million annual true-up, related to the low number of staff receiving long-term disability support. Besides these adjustments, the allocation of EWSI Shared Services costs to Wastewater was $0.3 million less than forecast due to the transfer of Drainage Services to EPCOR.

- **Corporate Shared Services** ($0.8 million less than forecast). This difference reflects both the reduction in corporate cost allocations resulting from the transfer of Drainage Services from the City of Edmonton to EPCOR Utilities Inc., as well as cost savings in corporate functions. As with In-City Water, the cost reductions arising from the transfer of Drainage Services will be returned to Wastewater customers through a non-routine adjustment to 2018 water rates.

- **Franchise Fees and Property Taxes** ($0.2 million less than forecast). As with water, lower than forecast franchise fees reflect lower than forecast revenues.

3.3.3 Operating Expenses by Cost Category

Table 3.3.3 shows operating expenses by cost category for Wastewater Treatment Plant Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 3.3.2.

Table 3.3.3
Operating Costs by Cost Category
($ millions)

		A	B
	Cost Category	2017 PBR Forecast	2017 Actual
1	Wastewater Treatment		
2	Staff Costs and Employee Benefits	17.2	14.2
3	Contractors and Consultants	3.9	3.9
4	Materials and Supplies	2.0	2.4
5	Other	1.0	0.1
6	Wastewater Treatment Expenses	24.0	20.6
7	Billing, Meters and Customer Service		
8	CUS Charges	3.2	3.3
9	Contractors and Consultants	3.3	3.1
10	Billings, Meters and Customer Services Expenses	6.5	6.4
11	EWSI Shared Services		
12	EWSI Shared Services Allocation	3.1	2.8
13	Staff Costs and Employee Benefits	1.2	0.3
14	Other	0.1	0.1
15	EWSI Shared Services Expenses	4.4	3.2

The information presented in this table supports the explanations of differences between 2017 actual and forecast expenses provided in Section 3.3.3. Accordingly, no additional explanations are considered necessary.

3.3.4 Depreciation Expense

Wastewater's depreciation expense and amortization of contributed assets for 2017 are shown in Tables 3.3.4 below:

Table 3.3.4
Depreciation and Amortization
($ millions)

		A	B
	Depreciation and Amortization	**2017**	
		PBR Forecast	**Actual**
1	Gross depreciation expense	14.9	15.3
2	Amortization of contributions	(0.9)	(0.9)
3	**Depreciation, net**	**13.9**	**14.4**

Wastewater's 2017 depreciation expense was $0.5 million greater than forecast, even though plant in service (see Table 3.3.5 below) was less than forecast. This result is attributable to two factors:

- Depreciation on asset overhauls completed in 2017 ($0.2 million). In 2017, Wastewater completed approximately 30 asset overhauls at an average cost of $0.2 million per overhaul. Since asset overhauls only add to the useful life of an existing asset, capital additions related to asset overhauls have higher effective depreciation rates than capital additions related to new assets. In the PBR forecast, depreciation expense was calculated as if all asset additions were new assets, rather than overhauls of existing assets; and

- Additional depreciation on Grit Tanks 4 & 5 ($0.2 million). In the PBR forecast, depreciation expense on this project was calculated as a single asset with a 44 year useful life. When this project was completed in 2016, the actual costs of the project were broken down into asset components, some of which had much shorter useful lives, reducing the average life of Grit Tanks 4 & 5 and, therefore, increasing annual depreciation expense.

3.3.5 Rate Base

Wastewater's 2017 mid-year rate base, shown in Table 3.3.5 below, was $15.5 million less than forecast, reflecting lower opening balances of plant in service and accumulated depreciation, as well as lower than forecast capital additions. Differences in opening balances result from lower than forecast capital expenditures in 2016, as well as a higher balance of carry-in projects in construction work in progress (see Table 3.4.2, line 1). Lower than forecast capital additions reflect lower than forecast capital expenditures and delays in completing projects, and the adjustments to the capital program discussed in Section 3.4.1.

Table 3.3.5
Mid-Year Rate Base
($ millions)

		A	B
		2017	
	Components of Mid-Year Rate Base, net of Contributions	PBR Forecast	Actual
1	Plant in Service		
2	Balance, beginning of year	526.1	512.8
3	Capital additions	61.0	44.4
5	Retirements and adjustments	-	(9.4)
6	Balance, end of year	587.1	547.8
7	Mid-Year Plant in service	556.6	530.3
8	Accumulated Depreciation		
9	Balance, beginning of year	(136.3)	(130.2)
10	Depreciation expense	(14.9)	(15.3)
11	Retirements and adjustments	-	9.4
12	Balance, end of year	(151.2)	(136.2)
13	Mid-Year Accumulated Depreciation	(143.7)	(133.2)
14	Other Rate Base Items		
15	Working Capital	5.2	5.5
16	Materials and Supplies	1.9	1.9
17	**Gross Mid-Year Rate Base**	**420.0**	**404.5**
19	Contributions		
20	Balance, beginning of year	(41.0)	(41.0)
21	Contributions in aid of construction	-	-
23	Balance, end of year	(41.0)	(41.0)
24	Mid-Year Contributions	(41.0)	(41.0)
25	Accumulated Amortization		
26	Balance, beginning of year	15.6	15.6
27	Amortization of contributions	0.9	0.9
29	Balance, end of year	16.5	16.5
30	Mid-Year Accumulated Amortization	16.1	16.1
31	**Mid-Year Contributions**	**(24.9)**	**(24.9)**
32	**Mid-Year Rate Base**	**395.1**	**379.6**

Unlike In-City Water, where contributions relate primarily to developer-funded assets, contributions included in Wastewater's rate base offset the cost of non-utility assets included in Wastewater's plant in service. This treatment ensures that the capital costs associated with these assets are not borne by utility rate payers. The cost of operating these assets, as well as any related revenues are also excluded from Wastewater's financial results.

3.3.6 Return on Rate Base

Wastewater's returns on rate base are its deemed capital structure and its costs of debt and equity. Returns on rate base are summarized on Table 3.3.6-1 below. As with In-City Water, returns on rate base are calculated separately for the debt-financed and equity-financed portions of Wastewater's rate base.

Table 3.3.6-1
Return on Rate Base
($ millions)

		A	B
	Return on Rate Base	**2017**	
		PBR Forecast	**Actual**
1	Mid-year Rate Base	395.1	379.6
2	Capital Structure		
3	Debt (%)	60.00%	60.00%
4	Equity (%)	40.00%	40.00%
5	Total	100.00%	100.00%
6	Cost of Capital		
7	Cost of Debt	4.23%	4.46%
8	Cost of Equity	10.175%	12.60%
9	Weighted Average Cost of Capital	6.61%	7.71%
10	Return on Mid-Year Rate Base		
11	Return on Rate Base Financed by Debt	10.0	10.2
12	Return on Rate Base Financed by Equity	16.1	19.1
13	Return on Mid-year Rate Base	**26.1**	**29.3**

The rate of return on debt is equal to the embedded cost of debt, as calculated in Table 3.3.6-2 below. Wastewater's embedded cost of debt is 0.23% higher than forecast, reflecting a lower than forecast mid-year balance of short-term debt, related to lower than forecast operating expenses and lower than forecast capital expenditures. The result of this decrease is that, even with a $10.0 million reduction in long-term debt issuances, Wastewater had greater reliance on higher cost long-term debt, resulting in higher embedded cost of debt.

Table 3.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B
	Interest Expense and Cost of Debt	**2017**	
		PBR Forecast	**Actual**
1	Interest Expense		
2	Interest on short-term debt	1.0	1.1
3	Interest on City of Edmonton debentures	3.4	3.4
4	Interest on intercompany debentures	6.0	5.8
5	Total Interest expense	10.4	10.3
6	Mid-year debt and other long-term liabilities		
7	Mid-Year Short-term debt	35.0	26.0
8	Mid-Year Long-term debt	209.3	204.3
9	Mid-Year Other Long-term liabilities	0.5	0.5
10	Total Mid-year debt and other long-term liabilities	244.8	230.9
11	**Embedded cost of Debt**	**4.23%**	**4.46%**

In 2017, Wastewater's actual return on equity was $3.0 million greater than forecast. Higher than forecast net income, combined with a lower than forecast rate base, enabled Wastewater to earn a 12.60% return on equity in 2017, significantly greater than its forecast return on 10.175%. Wastewater's returns on equity are expected to decrease over the remainder of the 2017-2021 PBR term as Wastewater accelerates work on its capital program.

3.3.7 Transactions with Affiliates

Wastewater derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EPCOR Water Services Inc. business units. Table 3.3.7 provides a summary of Water Services 2017 actual and forecast transactions with affiliates, together with references to the schedules in this report where these transactions are presented.

Table 3.3.7
Transactions with Affiliates
($ millions)

		A	B
		2017	
	Affiliate and Service	PBR Forecast	Actual
1	**Revenues from the provision of services to the City of Edmonton**		
2	Wastewater Treatment Services (Table 3.3.1, lines 4 and 9)	1.0	1.1
3	Other Services (Table 3.3.1, line 12)	0.2	0.3
4	Total	1.2	1.3
5	**Services provided by (recovered from):**		
6	**City of Edmonton**		
7	Franchise Fees (Table 3.3.2, line 26)	6.8	6.6
8	Property Taxes (Table 3.3.2, line 27)	0.6	0.6
9	Interest on Long Term Debt (Table 3.3.6-2, line 3)	3.4	3.4
10	Regulatory Services (Table 3.3.2, line 15)	1.0	0.7
11	Other Services (Table 3.3.3, lines 5)	0.2	0.2
12	Total	11.9	11.4
13	**EPCOR Utilities Inc.**		
14	Corporate Shared Service Costs (Table 3.3.2, line 23)	4.8	4.0
15	Interest on Intercompany Loans (Table 3.3.6-2, line 4)	6.0	5.8
16	Interest on Short-term debt (Table 3.3.6-2, line 2)	1.0	1.1
17	Total	11.8	10.9
18	**EPCOR Distribution and Transmission Inc.**		
19	Maintenance and other services (Table 3.3.3, line 3)	0.1	0.2
20	**EPCOR Technologies Inc.**		
21	Hydrovac Charges (Table 3.3.3, line 3)	-	0.1
22	**EPCOR Energy Alberta LP**		
23	Billing and Collection Services (Table 3.3.3, line 9)	2.9	2.9
24	**Other EWSI Business Units**		
25	EWSI Shared Services Allocation (Table 3.3.3, line 13)	3.1	2.8
26	Meter reading services from In-City Water (Table 3.3.2, line 14)	2.3	2.1
27	Water purchases from In-City Water (Table 3.3.2, line 2)	0.4	0.4
28	Regulatory services from Drainage Services (Table 3.3.2, line 15)	2.9	0.4
29	Project engineering recoveries from Drainage Services (Table 3.3.2, line 8)		(0.8)
30	Laboratory services recoveries from Drainage Services (Table 3.3.2, line 8)		(0.1)
31	Total	8.6	4.7

3.4 Capital Expenditures - Wastewater

Wastewater's approved capital program for the 2017-2021 PBR term amounts to $235.4 million and includes over 50 projects in six major project categories. As part of the 2017-2021 PBR application, EWSI provided the City Utility Committee with comprehensive business cases for all capital projects greater than $5.0 million. The Gold Bar Wastewater Treatment Plant's aging infrastructure poses challenges to capital planning, since is often difficult to accurately assess asset condition and the scope of rehabilitation needed before commencing work on a project. Therefore, over the course of the PBR term, changes to the program may be required in response to address unforeseen needs for repairs or rehabilitation. Changes may also be required to changes in regulatory or operational requirements, customer demands or other external factors. These changes are coordinated through EWSI's Project Management Office and are reviewed and approved by EWSI's Capital Project Steering Committee, EUI's Financial Review Council, or EPCOR's Board of Directors, depending on the significance of the change.

3.4.1 Capital Expenditures

Overall, Wastewater's 2017 actual capital expenditures were $7.7 million less than the PBR-forecast. This shortfall is primarily a result of lower than planned costs to complete the Hydrovac Sanitary Grit Recovery Facility and delays in the Operations Centre at Mid-Point Entrance project.

EWSI's current projection is that, over the 2017-2021 PBR term, the total cost of Wastewater's capital program, including the cost of new projects, as well as the cost of changes in scope for existing projects, will exceed the PBR forecast by $3.3 million. Although EWSI's current projected costs are not significantly different from the PBR forecast, the Gold Bar Wastewater Treatment Plant's aging infrastructure poses challenges to capital planning, since, in many cases, it is difficult to accurately assess asset condition and the scope of rehabilitation work needed to ensure the high level of performance and reliability needed to safely and effectively treat wastewater.

Table 3.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2017 for each project with approved capital expenditures in excess of $5.0 million over the 2017-2021 PBR term, as well as for each project category. Table 3.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI's current capital forecast.

Table 3.4.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	
		PBR Forecast	Actual	Increase (Decrease)	Forecast	Current Projection	Increase (Decrease)	
1	**Reliability and Life Cycle Improvements**							
2	Site Ventilation Rehabilitation	3.0	4.5	1.4	31.5	29.6	(1.9)	
3	Ops Centre at Mid-Point Entrance	4.0	0.5	(3.5)	19.4	16.0	(3.4)	1
4	Structural Rehab Secondaries 1-8	3.3	4.3	1.0	17.6	18.4	0.9	
5	Mechanical Rehab Program	3.5	5.1	1.6	15.6	15.4	(0.2)	
6	Square 1 Gas Room Expansion	-	-	-	15.6	6.6	(9.0)	2
7	Utility Hot Water System Rehab	1.3	0.3	(1.0)	13.9	13.8	(0.1)	
8	Buildings and Site Rehab	1.1	1.0	(0.1)	12.8	5.4	(7.3)	3
9	Digester 4 Upgrades	-	1.0	1.0	12.0	1.1	(10.9)	4
10	Digester 3 Upgrades	6.9	5.1	(1.8)	11.3	10.9	(0.4)	
11	Structural Rehab Program	1.5	0.7	(0.8)	7.7	2.2	(5.5)	5
12	Electrical Rehab Program	2.8	1.1	(1.7)	7.2	5.0	(2.1)	6
13	Headworks & Primary Upgrades	0.6	0.1	(0.5)	6.7	3.8	(2.9)	7
14	Replace 2.5 km of Sludge lines	-	0.2	0.2	-	14.7	14.7	8
15	Sludge Line Upgrades	1.1	3.0	1.9	3.4	11.0	7.6	9
16	Clarifier Chain Replacement	1.2	1.3	0.1	4.1	10.6	6.5	10
17	Diversion Structure Structural Rehab	-	-	-	-	7.5	7.5	11
18	Projects < $5 million	10.2	8.9	(1.3)	25.0	34.7	9.8	12
19	Subtotal	40.5	36.9	(3.6)	203.4	206.8	3.4	
20								
21	**Hydrovac Sanitary Grit Facility**	8.4	6.7	(1.8)	8.4	7.2	(1.2)	
22								
23	**Performance Efficiency & Improvement**							
24	Projects < $5 million	3.3	2.3	(1.0)	17.6	16.0	(1.6)	
25								
26	**Growth/Customer Requirements**							
27	Projects < $5 million	1.5	-	(1.5)	1.5	1.5	-	
28								
29	**Health, Safety and Environment**							
30	Projects < $5 million	0.8	1.0	0.2	4.5	7.2	2.7	13
31	**Capital Expenditures, net**	**54.5**	**46.8**	**(7.7)**	**235.4**	**238.7**	**3.3**	

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million or 20% on individual projects with total costs in excess of $5.0 million, as well as for project categories in aggregate include:

1. **Operations Centre at Mid-Point Entrance** - $3.4 million (57.8%) less than forecast. This project has been delayed due to additional design reviews and scope adjustments as well as significantly higher public consultation efforts than originally expected...

2. **Square 1 Gas Room Expansion** - $9.0 million (57.8%) less than forecast. Review of design options and value engineering resulted in reductions to the scope of this project and significant reductions in projected costs.

3. **Buildings and Site Rehab** - $7.4 million (57.5%) less than forecast. The variance reflects reductions in the scope of this program. An updated asset condition assessment determined that some of the sub-projects included in this program were of lower priority than originally believed and, therefore, could be safely deferred, allowing resources to be focused on unanticipated, higher-priority projects.

4. **Digester 4 Upgrades** - $10.9 million less than forecast. Upgrades to Digester 4 have been delayed as a result of necessary design reviews and the successful rehabilitation of Digester 3, which has provided sufficient capacity to delay upgrades to Digester 4.

5. **Structural Rehab Program** - $5.5 million (71.8%) less than forecast. Similar to Building and Site Rehab, the decrease in the projected costs of this program reflect reprioritization of identified projects against new unanticipated projects allowing resources to be focused on unanticipated, higher-priority projects.

6. **Electrical Rehab Program** - $2.2 million (29.8%) greater than forecast. The main reason for the overage is due to higher cost than planned for the Standby Generator project and an unidentified MCC (motor control centre) in the Blower building requiring immediate replacement.

7. **Headworks & Primary Upgrades** - $2.9 million (43.1%) less than forecast. The variance is due to timing change to allow additional time for review of various options before a final design was selected. This led to a projected reduction of $3 million in the total cost of the project.

8. **Replace 2.5 km of Sludge lines** - $ 14.7 million (new). This project provides for replacement of 2.5 km of sludge pipeline. This section of the sludge pipelines was found to be in such poor condition that repairs and/or rehabilitation was not financially viable.

9. **Sludge Line Upgrades** - $7.6 million (227.3%) greater than forecast. This project included the costs of cleaning and inspecting the sludge lines, with only minimal costs forecast for

repairs. Inspections have since shown that the sludge lines are in poor condition and require significant expenditures to ensure that they can continue to operate with minimal risk of leakage.

10. **Clarifier Chain Replacement** - $6.5 million (160.5%) greater than forecast. Wastewater has experienced premature failure of stainless steel clarifier chains due to unexpected localized corrosion. These chains are being replaced with plastic and loop chains which have a better record of performance at Gold Bar. Is this not 4.9??

11. **Diversion Structure Structural Rehab** $7.5 million (new). This new project is required to rehabilitate the concrete within the Diversion Structure. Inspection of the concrete structure was recently completed and the condition of the concrete found to be very poor with structural failure possible within two to five years.

12. **Reliability and Life Cycle Improvement Projects < $5 million** - $9.7 million (39.2%) greater than forecast. The large variance is attributable to greater than anticipated rehabilitation and replacement requirements, particularly for Channel work and Odour Control Projects.

13. **Health, Safety and Environment Projects < $5 million** - $2.7 million (59.6%) greater than forecast. The variance is attributable to two unplanned safety-related projects, including projects to modify biogas systems and install safety and equipment davits to further minimize risks of injury.

3.4.2 Construction Work in Progress

Wastewater's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. The 2017 year-end balance of Wastewater's Construction Work in Progress is $12.3 million greater than forecast, of which $3.4 million is attributable to higher than forecast carry-over project from 2016, with the remainder attributable to projects which were not completed in 2017 and, therefore, remained in Construction Work in Progress.

Table 3.4.2
Construction Work in Progress
($ millions)

		A	B
		2017	
	Construction Work in Progress	**PBR Forecast**	**Actual**
1	Balance, beginning of year	19.2	22.6
2	Capital Expenditures	54.5	46.8
4	Capital Additions	(61.0)	(44.4)
7	**Balance, end of year**	**12.7**	**25.0**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction (“AFUDC”). In 2017, AFUDC included in capital expenditures on eligible projects amounted to $1.7 million, compared to the PBR forecast amount of $1.3 million.

3.5 Operational Performance

Wastewater System Service Quality is measured by the results of four indices prescribed in Bylaw 17698. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all five performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard.

The performance measurement process for the 2017-2021 PBR term is similar to that of previous PBR term, with enhancements made to combine the Water Quality and Environment categories into a single index to recognize that the environment and the quality of water (or effluent) returned to the river are directly linked. As well, the System Reliability index has been expanded to include Operational Optimization metrics to more clearly align this category with the City of Edmonton’s *The Way Ahead* strategies by adding metrics for energy utilization to track decreasing energy demands through conservation and efficiency programs.

In 2017, Wastewater had strong operational performance, exceeding standards for each performance measure in each of its four indices and earning maximum bonus points.

3.5.1 Water Quality and Environmental Index

The Water Quality and Environmental index is a composite measure intended to assess EWSI’s impact on the environment through the quality of the wastewater effluent returned back to the North Saskatchewan River and the effectiveness of environmental management programs.

Table 3.5.1
Water Quality and Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Factor	The value of the Wastewater Effluent Limit Performance, which measure the percentage of the discharge limit for five parameters in the Gold Bar wastewater treatment plant's final effluent.	28.0%	22.0%	1.270
Environmental Incident Factor	The actual number of environmental incidents that are both reportable and preventable	10	3	3.333
			Average Index	2.302
			Index Standard Points	55.0
			Total Actual Points	126.6
			Maximum Available Points Including Bonus Points	60.5
			Total Points Earned	**60.5**

2017 Highlights

- **Wastewater Effluent Limit Performance Index.** This index was negatively impacted by significant snow melt and rain early in the year during the months of February to April. However, sustained focus on BNR operations allowed the plant to recover and improve its performance through the remainder of the year.

- **Environment Incident Management.** Root cause investigations of three events (release from a transfer line, a secondary bypass and sampling timing) provided information that resulted in improved operating procedures.

2017 Areas for Improvement

- **Wastewater Effluent Limit Performance Index.** Studies to assess ammonia side stream treatment at Clover Bar with the objective of reducing ammonia loading to the plant and in turn improving over-all treatment effective are already underway.

3.5.2 Customer Service Index

Wastewater's customer service index for the 2017-2021 PBR term includes three equally weighted odour metrics. These metrics recognize that Wastewater's customer interactions typically relate to odour concerns from customers located close to the Gold Bar Wastewater Treatment Plant.

Table 3.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
H_2S - 1 Hour Exceedance Factor	The average of the number of exceedances of the 1 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	6	1	6.000
H_2S - 24 Hour Exceedance Factor	The average of the number of exceedances of the 24 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	2	0	1.000
Scrubber Uptime Factor	The percentage of time that the scrubbers are on line.	90%	97.4%	1.082
			Average Index	2.694
			Index Standard Points	15.0
			Total Actual Points	40.4
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2017 Highlights

- **H2S - 1 and 24 Hour Exceedance Factor.** Success in meeting the targets set for these two measures was accomplished through close attention to contributing operating factors such as housekeeping (keeping doors closed to contain foul air so that it could be directed to the scrubbers) and regular sampling which ensured optimal chemical application to the foul air scrubbers.

- **Scrubber Uptime Factor.** Scrubber uptime was maximized by scheduling multiple capital upgrades and maintenance simultaneously and by performing corrective maintenance on a priority basis to minimize downtime.

2017 Areas for Improvement

- Capital projects intended to address operational issues have been initiated to address the following issues:
    - Improving foul air collection from process areas through air balancing;
    - Improving scrubber reliability by providing redundant chemical injection pumps; and
    - Improving EPT source capture of foul air to maximize scrubbing operations.

3.5.3 System Reliability and Optimization Index

The system reliability and optimization index is a measure of the performance of the Gold Bar Wastewater Treatment Plant and the degree to which the wastewater treatment system is optimized to minimize its impact on the environment.

Table 3.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Enhanced Primary Treatment Factor	The percentage of time that the enhanced primary treatment facility ran during wet weather events where the influent flow rate exceeded the EPT event threshold.	80.0%	100.0%	1.250
Biogas Utilization Factor	The percentage of biogas utilized, calculated as the volume of biogas produced less the volume flared divided by the volume produced.	60.0%	84.2%	1.403
Energy Efficiency Factor	The energy used in all wastewater facilities in kWh divided by the volume of wastewater effluent that either receives ultraviolet (UV) treatment or is membrane plant effluent.	514	497	1.034
			Average Index	1.229
			Index Standard Points	15.0
			Total Actual Points	18.4
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2017 Highlights

- **Enhanced Primary Treatment (EPT).** EPT clarifiers are now operated year round and maintenance is only performed on two of the four clarifiers at any given time. This ensures maximum availability of the clarifiers during wet weather events.
- **Biogas Utilization Factor.** Wastewater achieved a significant increase in the use of biogas for heating needs relative to natural gas usage.
- **Energy Efficiency Factor.** Wastewater achieved reductions in energy consumption in two processes that consume a significant portion of energy at the site (blowers sending foul air to the scrubbers and UV disinfection operations).

2017 Areas for Improvement

- **Enhanced Primary Treatment (EPT).** In 2018, covers will be installed to cover the EPT clarifiers to more effectively direct that foul air to the scrubbers. The objective will be to further minimize both odour and H2S issues originating in the building.
- **Biogas Utilization Factor.** Operations will continue to maximize biogas utilization to run boilers used for system heating demand.
- **Energy Efficiency Factor.** Operations will optimize the UV disinfection dose set point which is expected to reduce energy consumption.

3.5.4 Safety Index

EPCOR and EWSI are committed to a safe, healthy lifestyle and demonstrate this through care and concern for people. The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public

Table 3.5.4
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	220	327	1.486
Work Site Inspection Factor	Number of Work Site Inspections and observations completed per year.	919	1,088	1.184
Lost Time Frequency Factor	The actual lost time frequency rate.	0.75	0.00	1.000
All Injury Frequency Factor	The actual all injury frequency rate	1.50	1.92	0.781
			Average Index	1.113
			Index Standard Points	15.0
			Total Actual Points	16.7
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2017 Highlights

- **Near Miss Reporting Factor.** Near Miss reporting effectively assisted employees with identification and mitigation of hazards that had potential to become incidents. Continued focus on near miss reporting in 2018 is expected to further assist employees in identifying and mitigating hazards that have the potential to become incidents.

- **Work Site Inspections and Observations.** These leading indicators assisted employees in identifying changes needed to improve existing processes and procedures.

2017 Areas for Improvement

- **All Injury Frequency Factor**. EWSI will be introducing a new program in 2018 to prevent musculoskeletal injuries. This program will encourage employees to engage in specific pre and periodic stretching exercises throughout their work day.

3.6 Rates and Bill Comparisons

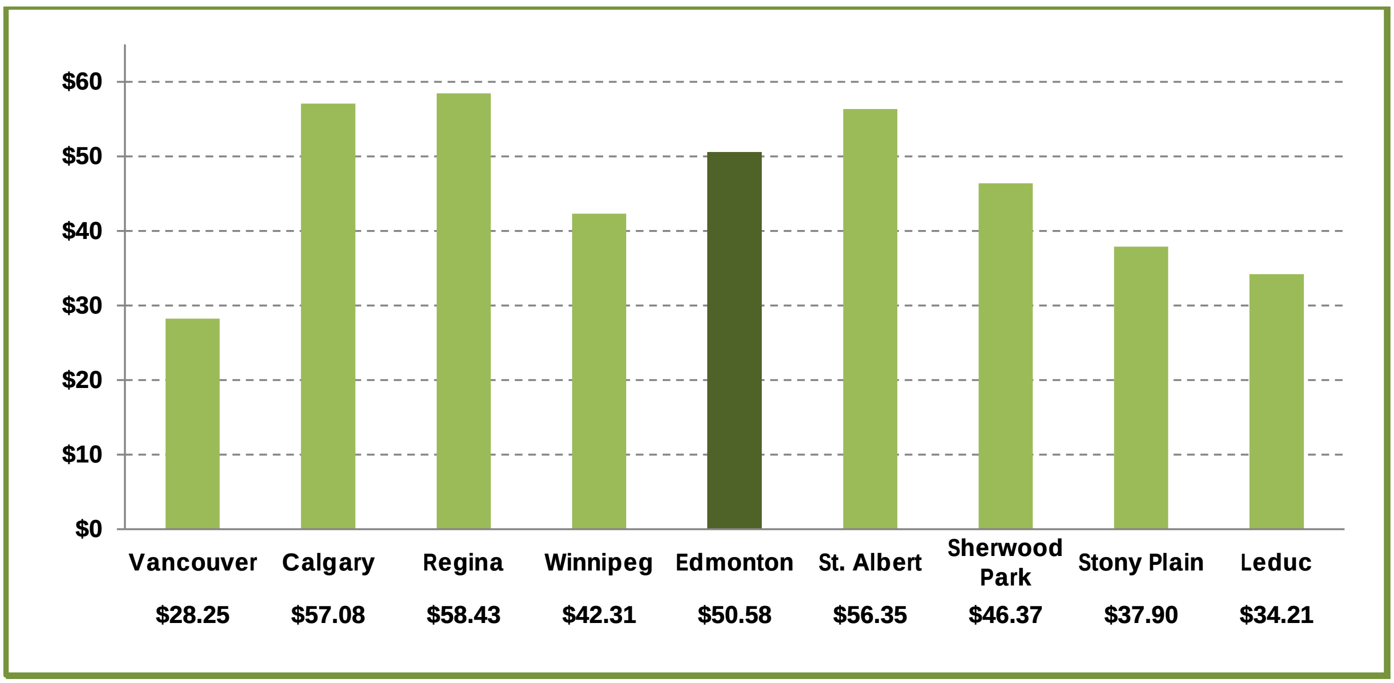
Wastewater bill comparisons for 2017 are based on the published drainage and wastewater treatment rates for Calgary, Vancouver Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

Unlike most cities, where wastewater treatment services and drainage services are combined, Wastewater is only responsible for wastewater treatment; the operations and maintenance of sanitary, storm and combined sewer systems are provided through EPCOR Drainage Services. Accordingly, wastewater bill comparisons are based on blended EWSI wastewater treatment and City drainage rates.

3.6.1 Residential Wastewater Bills

Figure 3.6.1 provides a comparison of residential household wastewater bills for residential household consumption of 14.6 m^3 per month, the average residential customer consumption per month in Edmonton in 2017.

Figure 3.6.1
2017 Monthly Residential Drainage and Wastewater Comparison
(14.6 m^3/month)



Unlike water services which are relatively consistent among cities and communities, the nature and extent of wastewater treatment and drainage services vary significantly because of differences in the extent of wastewater treatment between different cities and municipalities, the inclusion of certain services in property taxes, and geographic and climatic factors which affect the level of investment in and approach to flood mitigation and storm water services.

Edmonton's $50.58 average monthly bill from Figure 3.6.1 includes Wastewater charges of $16.54 and Drainage Services charges of $34.03. While the total bill is higher than Vancouver and Winnipeg, it is lower than Calgary and Regina, the two cities where drainage and wastewater treatments are most comparable to Edmonton.

3.6.2 Commercial Wastewater Bills

Table 3.6.2 provides a comparison of the wastewater bills for commercial customers of various sizes. This table shows that combined wastewater and drainage bills for commercial customers are competitive with surrounding communities and with major cities in western Canada, although Edmonton's relative ranking varies with the size of the customers with larger customers receiving relatively high monthly bills. These results reflect differences in rate structures between cities and municipalities, as well as differences in the extent of wastewater treatment and drainage services provided.

Table 3.6.2
Commercial Monthly Wastewater Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	24	234	978	4,624
3	Calgary	52	371	1,369	6,688
4	Regina	51	461	1,913	9,087
5	Winnipeg	26	638	2,550	12,750
6	**Edmonton**	**42**	**487**	**1,964**	**10,311**
7	St. Albert	75	483	1,758	8,558
8	Sherwood Park	39	432	1,659	8,204
9	Stony Plain	31	414	1,611	7,994
10	Leduc	27	380	1,483	7,363

Appendix A: PBR Plan 2017-2021

A.1 PBR Framework

EWSI's In-City Water and Wastewater rates for the 2017-2021 PBR term are regulated in accordance with the PBR Plan approved in Bylaw 17698. This plan encompasses rates, performance measures, and return on equity. The relationships between these components, discussed below, ensure that capital and operating cost decisions provide a balance between operational performance, rates, and return on equity, while safeguarding system reliability and service quality, providing fair, stable, predictable rates to rate payers, and providing a basis for the future development of the water and wastewater treatments system.

- **PBR Rates.** Annual changes to In-City Water and Wastewater rates are limited to inflation, less an efficiency factor, plus special rate adjustments and, in rare cases, non-routine adjustments. The determination of PBR rates is described in Schedule 3, Sections 1, 2 and 5 of the bylaw. The use of a formulaic approach for calculating and setting utility rates acts as a "price cap" providing ratepayers with stable and predictable rates. The efficiency factor, set at 0.25% for the 2017-2021 PBR term, requires EWSI to increase productivity and achieve efficiencies in excess of inflation if it is to meet it targeted return on equity.

- **Performance Measures.** EWSI's PBR framework includes performance measures for water and wastewater treatment system service quality as described in Schedule 3, Sections 3 and 4 of the bylaw. EWSI faces financial penalties if it does not meet or exceed performance measure standards, providing assurance to customers that water and wastewater treatment system service quality will not be sacrificed to keep rates low or increase returns to EWSI. EWSI's performance measures are audited annually by an independent accounting firm.

- **Return on Equity.** The PBR plan incorporates a forecast rate of return on equity commensurate with consumption, cost and other risks that allows EWSI to finance its operational and capital programs, to provide its customers with high levels of service quality and reliability, and to provide "just and reasonable" returns to its shareholder. Achieving this return is dependent on EWSI achieving operating cost efficiencies, meeting or exceeding performance standards, and developing the utility infrastructure needed to provide service to its customers. For the 2017-2021 PBR term, returns on equity are based on a deemed capital structure of 60% debt and 40% equity and a 10.175% rate of return on equity, a decrease of 0.7% from the 10.875% rate of return on equity approved for the 2012-2016 PBR term.

A.2 Risks and Incentives

The PBR framework provides incentives for EWSI to improve operational performance while achieving cost savings through process improvements and other means. Under this framework, EWSI also assumes the risks associated with water consumption, operating costs, financing costs and capital costs, ensuring that customers are provided with stable and predictable rate increases. These risks and EWSI's strategies to mitigate them include:

- **Water Consumption Risk.** Under PBR, EWSI bears all of the risks associated with weather-related fluctuations in water consumption and water quality, as well as the longer-term risks associated with declining consumption per customer. While EWSI expects the impacts of short-term weather-related volatility to even out over the five year PBR term, longer term declines are of greater concern. In the 2012-2016 PBR term, per customer consumption was significantly lower than forecast, resulting in substantial revenue shortfalls. Accordingly, EWSI revised its consumption forecast methodology for its 2017–2021 PBR forecast to better capture long term trends in water consumption.

- **Operating Cost Risk**. EWSI actively works to minimize fluctuations in input prices through long-term power contracts, chemical optimization processes, and continuous efforts to implement cost reduction strategies in all areas of its operations.

- **Interest Risk.** Fluctuations in short-term interest rates, long-term debt issue costs and in the level of capitalized interest have significant impacts on EWSI's net income and return on equity. EWSI mitigates interest risk through timing of long-term debt issuances and optimizing working capital.

- **Capital Cost Risk.** In-City Water and Wastewater's operations are capital intensive. Over the 2012-2016 period, EWSI found that a much higher than forecast level of capital replacements was required at the Gold Bar Wastewater Treatment Plant to maintain plant reliability. EWSI seeks to minimize these risks through comprehensive capital project and asset management programs, ensuring that new projects or changes to existing projects are justified and that there is an appropriate level of management, senior management and executive oversight over capital spending.

A.3 In-City Water

A.3.1 In-City Water Customer Classes

In-City Water rates consist of fixed monthly service charges that vary with meter size and variable charges applied to each cubic metre of water consumed. Consumption charges differ for each of In-City Water's customer classes. These classes and their rate structures include:

- **Residential Customer Class.** Residential customers are charged based on an inclining rate structure with three consumption blocks. The inclining rate structure is intended to promote water conservation and provide incentives for residential customers to use water efficiently.

- **Multi-Residential Customer Class.** Multi-residential customers are charged based on a declining rate structure with three consumption blocks. EWSI has found that the cost of providing water to individual multi-residential customers declines as the size of the multi-residential building increases. As well, there is a wide range of consumption volumes for multi-residential customers. Accordingly, a declining rate structure best reflects the cost characteristics of this customer class.

- **Commercial Customer Class.** Similar to multi-residential customers, commercial customers are charged based on a declining rate structure, but with five consumption blocks to recognize the wide range of average consumption volumes within this customer class.

A.3.3 In-City Water Special Rate Adjustments

The 2017-2021 PBR Plan includes three special rate adjustments for In-City Water:

- **Special Rate Adjustment for Rebasing**. The In-City Water revenue requirement was rebased at the beginning of the 2017-2021 PBR term. The resulting rebasing adjustment to rates includes the on-going benefits to rate-payers of efficiency gains realized in the 2012-2016 PBR term, the impacts of higher than forecast capital expenditures during the 2012-2016 PBR term; and increases in the capital expenditure programs for the 2017-2021 PBR term (discussed in section 3.4). Also included in the rebasing adjustments is the impact of EWSI's cost of service study which has resulted in redistribution of revenue requirements from the Residential and Multi-Residential customer classes to the Commercial customer class.

- **Special Rate Adjustment for Accelerated Programs.** These special rate adjustments support the acceleration of the replacement of water mains as part of the City of Edmonton's neighbourhood renewal program and the upgrade of water mains to increase fire protection capacity in neighbourhoods experiencing increased densities as a result of infill development.

- **Special Rate Adjustments for Environmental Programs.** EWSI is undertaking two significant environmental initiatives during the 2017-2021 PBR term. The first initiative is an extensive River Monitoring Project to regularly monitor, evaluate and report on a number of water quality variables from several sampling sites in the river for 2018-2021. This program is forecast to have annual costs of $1.0 million starting in 2018. The second initiative, which aligns with the City's *"The Way We Green"* strategy, is a Green Power Initiative to replace approximately 10% of EWSI's total power volumes with energy from locally produced renewable sources starting in 2018. This initiative is forecast to cost $1.9 million annually commencing in 2018.

A.4 Wastewater

A.4.1 Wastewater Customer Classes

Wastewater treatment rates consist of fixed monthly service charges that are applied equally to each customer and variable charges applied to each cubic meter of water consumed. Wastewater has two customer classes:

- **Residential Customer Class.** Unlike In-City Water, there are no separate rates for multi-residential customers. Instead, customers who would be multi-residential water customers are subject to the same rates as residential wastewater customers. The common rate structure for residential and multi-residential customers recognizes that the costs of wastewater treatment are very similar for residential and multi-residential customers. Accordingly, charges to Residential customers are based on a flat rate structure with a single consumption block.

- **Commercial Customer Class.** Consumption charges for commercial customers are based on a declining rate structure with three consumption blocks to recognize that there are economies of scale in wastewater treatment for larger commercial customers. In addition, commercial customers are charged overstrength fees for prescribed materials that exceed the concentrations shown in Section 4 of Schedule 1 to Bylaw 17698.

A.4.2 Wastewater Special Rate Adjustments

The 2017-2021 PBR Plan includes a single special rate adjustment for rebasing. Similar to In-City Water, Wastewater's revenue requirement was rebased at the beginning of the 2017-2021 PBR term to reflect efficiency gains realized in the 2012-2016 PBR term, as well as the substantial increases in capital spending needed to deal with the challenges of the aging infrastructure at the Gold Bar Wastewater Treatment Plant.

2017 – 2021 Performance Based Regulation

Water Services, Wastewater Treatment Services and Drainage Services

Table of Contents

1 Executive Summary

This report provides an annual update to the City of Edmonton on the operational and financial results for the year ended December 31, 2018 for water services (“In-City Water”), wastewater treatment services (“Wastewater”), and, for the first time, sanitary and storm water sewer services (“Drainage”) provided within Edmonton by EPCOR Water Services Inc. (“EWSI”). The City of Edmonton City Council regulates In-City Water and Wastewater in accordance with the Performance Based Regulation (“PBR”) Plan approved in the EPCOR Water Services and Wastewater Treatment Bylaw No. 17698 (“Bylaw 17698”) and Drainage in accordance with the PBR Plan approved in EPCOR Drainage Services Bylaw No. 18100 (“Bylaw 18100”).

1.1 Financial Performance

In-City Water, Wastewater and Drainage’s financial performance for 2018 are summarized in Table 1.1 below[1]:

Table 1.1
Revenue and Return on Equity
($ millions)

		A	B	C	D
		2018		**2017-2018**	
	Revenue and Return on Equity	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
	In-City Water				
1	Revenue	197.8	192.5	388.1	380.0
2	Return on Equity	39.1	40.2	76.3	75.9
3	Rate of Return on Equity	10.18%	10.51%	10.18%	10.17%
	Wastewater				
4	Revenue	99.0	96.0	191.9	186.8
5	Return on Equity	17.8	20.0	33.9	39.2
6	Rate of Return on Equity	10.18%	12.14%	10.18%	12.37%
	Drainage				
7	Revenue	196.6	194.7	196.6	194.7
8	Return on Equity	36.2	32.9	36.2	32.9
9	Rate of Return on Equity	6.48%	5.68%	6.48%	5.68%

In 2018, In-City Water achieved a 10.51% rate of return on equity (10.17% for 2017-2018), compared to its forecast rate of return of 10.175%. These returns were achieved through reductions in operating expenses, offsetting the effects of lower than forecast consumption, lower than forecast inflation adjustments to rates, and a negative non-routine adjustment to 2018 rates related to the transfer of Drainage to EPCOR.

[1] Consistent with the 2017-2021 PBR Application, all financial data in this report, including totals and sub-totals, are rounded to the nearest $0.1 million. This practice ensures continuity of data between tables and between years. However, the sum of the rounded detailed data in certain tables may not be equal to the related rounded total or sub-total.

Wastewater's revenues have been affected by the same factors as In-City Water, with lower than forecast operating expenses, combined with a lower than forecast rate base, enabling Wastewater to achieve a 12.14% rate of return in 2018 (12.37% for 2017-2018), compared to its forecast rate of return of 10.175%.

In 2018, Drainage realized a 5.68% rate of return on equity, 0.80% less than its forecast rate of return. This difference is attributable to both lower revenues, resulting from lower than forecast consumption, and higher than forecast operating expenses. Since Drainage does not have a City of Edmonton-approved PBR forecast, Drainage's actual financial performance for 2018 has been compared to its EPCOR budget, adjusted (1) to remove one-time costs related to the transition of Drainage to EPCOR, and (2) from IFRS to a regulatory accounting basis. The adjusted budget, escalated at an appropriate inflation rate, will serve as the basis for comparison of actual to forecast financial results for the remainder of the 2017-2021 PBR term.

Detailed analyses of In-City Water, Wastewater and Drainage's financial performance for 2018 and for the 2017-2018 period are provided in sections 2.3, 3.3 and 4.3, respectively.

1.2 Capital Expenditures

In-City Water, Wastewater and Drainage's capital expenditures for 2018 and for the five year term of the PBR Plan (the "2017-2021 PBR term") are summarized in Table 1.2 below:

Table 1.2
Capital Expenditures
($ millions)

		A	B	C	D
Capital Expenditures		**2018**		**2017-2021**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Current Projection**
1	In-City Water	81.2	96.4	475.8	614.8
2	Wastewater	57.9	52.5	235.4	236.3
3	Drainage	122.6	103.8	642.9	878.5

Over the course of the PBR term, changes to capital programs are required to address unforeseen needs for repairs or rehabilitation, changes in regulatory or operational requirements, customer demands, and other external factors. These changes are coordinated through EWSI's Project Management Office and are authorized by EWSI's Capital Project Steering Committee, EUI's Financial Review Council, or EPCOR's Board of Directors, depending on the amount of the expenditure. EWSI also presents information on its capital programs, as well as business cases supporting significant new capital projects to the Utility Committee throughout the year.

1. **In-City Water's** 2017-2021 projected capital expenditures of $614.8 million are $139.0 million (29%) greater than the PBR forecast. Significant projects contributing to this variance include: the E.L. Smith Solar Farm ($33.1 million), which is funded through the special rate adjustment for Environmental Initiatives; Plant Flood Protection ($7.4 million), which has been advanced to recognize the vulnerability of the plants and to maximize available grant funding opportunities; and changes to the scope of the Water D&T Facility Expansion, which adds an additional $11.9 million to its cost. Besides these projects, there are three projects that EWSI has submitted to the City for consideration as non-

routine adjustments, including: (i) an enhanced Lead Mitigation Program ($21.5 million) needed to conform to new Health Canada Guidelines; (ii) additional costs of LRT Relocations ($14.7 million) needed to realign distribution network infrastructure; and (iii) the purchase of the Discovery Park Reservoir ($7.8 million), following the City of Edmonton's annexation of land in Leduc County. The remainder of the increase in capital expenditures results from additional expenditures on projects and programs needed to accommodate growth ($28.4 million) and additional expenditures on rehabilitation and repairs ($14.3 million).

- **Wastewater's** 2017-2021 projected capital expenditures of $236.3 million are $0.9 million (0.4%) greater than the PBR forecast. The Gold Bar Wastewater Treatment Plant's aging infrastructure poses challenges to capital planning. Since the plant cannot be shut-down for maintenance it is often difficult to accurately assess asset condition and the scope of rehabilitation needed before commencing work on a project. During preliminary engineering in 2017 and 2018, EWSI identified significant needs for repairs to critical infrastructure that had not been anticipated in the PBR forecast. EWSI reviewed design options and employed value engineering to reprioritize reliability and life cycle replacements. These efforts have ensured that current projections of the total cost of the 2017-2021 capital expenditures program remains essentially unchanged from the PBR forecast.

- **Drainage's** 2017-2021 projected capital expenditures of $878.5 million are $235.6 million (39%) greater than its long term plan. This increase includes three programs which EWSI will submit to the City for consideration as non-routine adjustments (see Section 1.5), including: LRT Relocations ($57.4 million); the Stormwater Integrated Resource Plan ($97.6 Million); and Odour Mitigation ($50.7 million). Besides these programs, this increase also includes a joint EPCOR Water and Drainage real estate initiative ($50.0 million), as well higher capital expenditures in Drainage System Rehabilitation to address asset condition, mitigate the risk of failure, and maintain required service levels.

Detailed explanations for differences between capital expenditures in PBR forecast and EWSI's current projections are provided in Sections 2.4, 3.4 and 4.4.

1.3 Operational Performance

In-City Water's and Wastewater's operational performance is measured by the results of indices prescribed in Schedule 3 of Bylaw 17698 with each index consisting of one or more performance measures. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard.

In 2018, In-City Water exceeded the performance standards for all five performance of its measure indices and Wastewater exceeded the performance standards for all four of its performance measure indices. Detailed discussions of the performance measures making up each of the indices and operational performance highlights are provided in Section 2.5 for In-City Water and Section 3.5 for Wastewater.

Table 1.3-1

2018 Performance Measures

		A	B	C	D
Performance Index		**In-City Water**		**Wastewater**	
		Standard	**Actual Score**	**Standard**	**Actual Score**
1	Water Quality Index(1)	25.0	25.0	55.0	60.5
2	Customer Service Index	20.0	20.6	15.0	16.5
3	System Reliability and Optimization Index	25.0	28.5	15.0	16.5
4	Environmental Index(1)	15.0	16.5	n/a	n/a
5	Safety Index	15.0	16.5	15.0	16.5
6	**Aggregate Points Earned**	**100.0**	**107.1**	**100.0**	**110.0**

[1] Water Quality and Environmental are combined into one index for Wastewater's operational performance

Drainage's operational performance is measured by the results of four indices prescribed in Schedule 3 of Bylaw 18100 with each index consisting of one or more performance measures. These performance measures are patterned after previous Drainage Utility service quality metrics and do not include a scoring system similar to those of In-City Water and Wastewater. Pursuant to Bylaw 18100, EWSI will report on these metrics until December 31, 2019, when new performance metrics with a scoring system will be defined for the remainder of the 2018-2022 PBR period.

In 2018, Drainage met or exceeded performance standards for eleven of fourteen performance measures included in the four performance measure indices. Detailed discussions of the performance measures making up each of index and highlights of Drainage's operational performance are provided in Section 4.5.

1.4 Rates and Bill Comparisons

In 2018, the average monthly bill for In-City Water customers, based on 2018 average monthly consumption per residential customer of 14.4 m^3, was **$36.15,** an increase of 0.5% from 2017. This increase consists of the 1.1% inflation adjustment discussed in Section 2.3.1, and special rate adjustments approved in Bylaw 17698 for Environmental Initiatives (0.3%), Accelerated Programs (0.4%) and Rebasing (0.6%), less a 1.9% negative non-routine rate adjustment approved by the City Manager in March 2018, related to lower corporate allocations associated with the transfer of Drainage assets to EPCOR.

The average residential customer's wastewater treatment bill in 2018, also based on monthly consumption of 14.4 m^3, was **$16.96**, an increase of 3.5% from 2018. This increase includes the 1.1% inflation adjustment, the special rate adjustment for rebasing of 4.3% needed to support Wastewater's 2017-2021 capital programs, and the 1.9% negative non-routine rate adjustment related to lower corporate allocations associated with the transfer of Drainage assets to EPCOR.

The average residential customer's drainage bill in 2018, again based on monthly consumption of 14.4 m^3, was **$34.89**, an increase of 3.0% from 2017. Drainage rates from January 1, 2018 to March 31, 2022 have been set in Bylaw 18100, which, except for Non-Routine Adjustments (Section 1.5), limits average annual bill increases to 3.0%.

EWSI undertakes annual bill comparison surveys with various cities and local communities. Section 2.6 shows that EWSI's residential water rates are lower than most of the cities and communities included in the comparison, with only Vancouver having lower water rates. Drainage and Wastewater bills are more difficult to compare because of variations in the nature and extent of wastewater treatment, the inclusion of certain services in property taxes, and geographic and climatic factors which influence the level of investment in and approach to flood mitigation. Section 3.6 shows that Edmonton's combined Drainage and Wastewater treatment rates are competitive with those of other cities and communities with similar geographic and climatic conditions. Commercial bill comparisons for both water and wastewater show similar results to residential water and wastewater bills.

1.5 Non-Routine Adjustments

Non-routine adjustments for In-City Water and Wastewater are defined in Bylaw 17698, and for Drainage in Bylaw 18100, as "items which are unusual, significant in size or nature, and beyond the scope of control of EWSI". Bylaws 17698 and 18100 allow EWSI to request adjustments to In-City Water, Wastewater and Drainage rates for non-routine adjustments from the City Manager or City Council, depending on the impact of the non-routine adjustment on In-City Water, Wastewater or Drainage's revenue requirements.

During its review of 2018 operations, EWSI identified the following projects that it believes meet the criteria for non-routine adjustments outlined in Bylaw 17698, Schedule 3, Section 5.0 for Water and Wastewater, or for Drainage, in Bylaw 18100, Schedule 3 Section 4.1. Accordingly, EWSI has requested non-routine adjustments to rates to offset the incremental revenue requirements arising from these projects. If approved, these non-routine adjustments will be included in Drainage rates commencing January 1, 2020 and in January 1, 2021 and will be included in In-City Water rates commencing April 1, 2020 and escalating by inflation less productivity factor in April 1, 2021.

- **Lead Mitigation (In-City Water)** – On March 22, 2019, EWSI presented a new lead mitigation strategy to the Utility Committee. This strategy is designed to meet new Health Canada Guidelines that reduce the maximum concentration of lead in drinking water at the tap from 10 parts per billion to 5 parts per billion. EWSI has applied for non-routine adjustments to water rates commencing April 1, 2020 to recover the costs of implementing this strategy. The additional cost to an average Residential In-City Water customer is forecast to be $0.40 per month commencing April 1, 2020 ($9.77 over the remainder of the 2017-2021 PBR term).

- **Stormwater Integrated Resource Plan (Drainage)** – On May 10, 2019, EWSI presented its Stormwater Integrated Resource Plan alternatives to the Utility Committee, recommending a 20 year focus for implementation, commencing in 2019, with investments incorporated into future PBR rate applications. EWSI intends to apply for approval of a non-routine adjustment to stormwater rates beginning January 1, 2020 to recover the increase in its stormwater revenue requirements from the beginning of the implementation until March 31, 2022. The additional cost to the average Residential Drainage customer is forecast to be $0.56 per month commencing January 1, 2020 and $0.56 per month commencing January 1, 2021 ($15.12 over the remainder of the 2018-2021 PBR term).

- **LRT Relocations (In-City Water and Drainage)** – EWSI has identified the work needed to accommodate water main, hydrant and sewer relocations for the West Valley Line and Metro Line

Northwest Phase I LRT projects. EWSI will be requesting that non-routine adjustments be applied to water rates for In-City Water customers commencing April 1, 2020 and to sanitary utility and storm water utility rates for Drainage customers commencing January 1, 2020. The additional cost to the average Residential In-City Water customer is $0.17 per month commencing April 1, 2020 ($4.19 over the remainder of the PBR term). The average monthly bill increase for Residential Drainage customers is forecast to be $0.15 per month commencing January 1, 2020 and $0.52 per month commencing in January 1, 2021 ($9.70 over the remainder of the 2018-2021 PBR term).

- **Odour Mitigation (Drainage)** – EWSI has developed a new odour mitigation strategy to address long-standing concerns regarding sewer odours. The first phase of this strategy, commencing in 2019 and continuing to 2026, is to implement sewer odour mitigation projects in neighbourhoods where the processes causing persistent sewer odour issues are well understood and where the proposed mitigation efforts will have a known long-term beneficial effect. The proposed strategy also includes comprehensive monitoring and sewer characterization to support continued odour mitigation assessments across the city and identify locations where operational improvements can be rapidly applied for beneficial downstream reductions in odour intensity. The additional cost to the average Residential Drainage customer is forecast to be $0.58 per month commencing January 1, 2020 and $0.90 per month commencing in January 1, 2021 ($20.52 over the remainder of the PBR term).

- **South Annexation (In-City Water)** – On November 27 2018, the Government of Alberta approved the City of Edmonton's annexation of 8,260 hectares from Leduc County. As part of the annexation, EWSI will acquire the existing water infrastructure within the annexed area, including a reservoir, pump house and booster station, as well as transmission mains and a small distribution system, at a cost of $9.5 million which is comprised of $7.8 million for the Discovery Park reservoir and the remainder for a pipeline and booster station. EWSI plans to apply for a non-routine adjustment to water rates on June 28, 2019. The additional cost to the average Residential In-City Water customer is forecast to be approximately $0.26 per month commencing April 1, 2020 ($6.38 over the remainder of the PBR term).

2 In-City Water Services

2.1 Accomplishments and Challenges

In 2018, In-City had significant accomplishments, including:

- Developing a new Lead Mitigation Strategy to meet new Health Canada Guidelines for Canadian Drinking Water Quality. This new strategy is intended to reduce lead levels in over 4,400 homes with lead service lines and over 23,000 homes with high lead levels related to lead plumbing and plumbing fixtures, ensuring that EWSI provides safe drinking water to the citizens of Edmonton;
- Launching a new North Saskatchewan River Monitoring program in conjunction with Alberta Environment and Parks. This program utilizes a network of monitoring stations and sampling points from the river's headwaters to the Saskatchewan border to provide EWSI with a better understanding of the non-point sources of loading in the watershed, to determine linkages between land use, land cover and water quality, to understand the health of the aquatic community, and to capture peak runoff events. In 2018, EWSI completed the scientific and technical design of the monitoring system, purchased equipment for all monitoring stations, upgraded nine existing monitoring stations, and identified locations for eight new stations that will be installed in early 2019 to complete the monitoring network
- Obtaining AUC approval, subject to the requirement for EWSI to file a compliance plan, for the E.L. Smith Solar Farm, designed to replace over 20% of conventional power with locally produced renewable power, far greater than the 10% commitment in the 2017-2021 PBR application;
- Successfully obtaining over $10 million in federal and provincial grant funding for a battery storage system to support the E.L. Smith Solar Farm;
- In conjunction with Infill developers and City Administration, developing a cost sharing mechanism for infill infrastructure (hydrants, services, etc.). Currently, infill developers are obligated to pay for all system upgrades resulting from their development, including those that benefit the surrounding residents and community. The revised approach will limit developer's costs to those directly related to their projects with the broader system improvement being paid by either the rate payer or through the Fire Services Contract. The program will be presented to Urban Planning committee June 25, 2019 (CR_6170). Assuming approval, the initial two year "trial" period of the program will be funded with a reallocation of $2.4 million from an existing program (Accelerated Fire Hydrant Replacement) already approved under the PBR;
- Successfully negotiating new 20 year water supply agreements with the Regional Water Customer Group (RWCG). This customer group represents approximately 27% of the consumption from the overall water system; and
- Creating cross-functional teams within Water and Drainage to begin the process of identifying and developing efficiencies between the two businesses.

2.2 Customers and Consumption

In-City Water provides services to three customer classes: Residential; Multi-Residential; and Commercial (see Appendix A). These classes are unchanged from the previous PBR term and are described in greater detail in Appendix A. Customer counts, total annual consumption and monthly consumption per customer are shown in Table 2.2 below:

Table 2.2
Customers, Consumption and Consumption per Customer

		A	B	C	D
	Customers and Consumption	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Customers				
1	Residential	261,176	264,485	258,741	261,910
2	Multi-Residential	3,791	3,765	3,769	3,758
3	Commercial	19,508	19.680	19,382	19,559
4	**Total**	**284,475**	**287,930**	**281,892**	**285,227**
	Consumption per Customer (m^3 per month)				
5	Residential	14.4	14.4	14.5	14.5
6	Multi-Residential	408.6	390.4	408.6	393.2
7	Commercial	121.9	115.3	122.7	116.7
	Annual Consumption (ML)				
8	Residential	45,133.9	45,832.1	90,191.0	91,309.9
9	Multi-Residential	18,590.5	17,638.9	36,960.5	35,467.7
10	Commercial	28,534.2	27,227.9	57,073.2	54,764.5
11	**Total**	**92,258.6**	**90,698.9**	**184,224.6**	**181,542.1**

The factors contributing to actual to forecast differences for 2018 and for 2017-2018 differ by customer class, as explained below:

- **Residential.** Customer counts in 2018 are 1.2% greater than forecast, primarily because of higher than expected actual customer counts at the beginning of the 2017-2021 PBR term. Actual consumption per customer is essentially equal to the PBR forecast, confirming the robust residential forecasting methodology developed for the 2017-2021 PBR forecast. The combined effect of these factors is that total residential consumption for 2018 is 1.5% greater than forecast (1.2% greater for 2017-2018).

- **Multi-Residential.** Although multi-residential customer counts were within 0.7% of forecast, lower than forecast consumption per customer meant that total consumption was 5.1% less than forecast. Lower than forecast consumption per customer is not attributable to a specific cause, but reflects a variety of factors, including: vacancy rates, renovations of older buildings; and the number of units in new multi-residential buildings.

- **Commercial.** Consumption in the commercial customer class was 4.6% less than forecast, despite a 0.9% increase in customer counts. This class includes a large number of customers that use very little water and a small number of customers with very high levels of consumption. In 2018, EWSI's billing system data showed that 220 (1.1%) of commercial customers accounted for 50% of commercial consumption. Therefore, the loss of a large customer can cause large shifts in consumption per customer for the entire class. As well, since new customers tend to be low water consumers, increases in customer counts may not have significant effects on consumption for the commercial customer class. Accordingly, EWSI is exploring opportunities to expand the application of the forecasting methodology developed for the residential class to the commercial and multi-residential customer classes.

2.3 Financial Performance

In-City Water's net income is derived from the provision of water services within Edmonton's boundaries. Besides these services, EWSI provides water services to surrounding communities under bulk water supply agreements with regional water service commissions ("RWCG" or "Regional Customers"), and fire protection services to the City of Edmonton under a service agreement ("Fire Protection").

EWSI's water system is fully integrated, with services jointly provided to In-City Water, Regional Customers and Fire Protection. Therefore, in sections 2.3.1 to 2.3.7, operating costs, depreciation, rate base and capital expenditures are presented and analyzed on a total system basis. In-City Water's share of these expenses, as well as its returns on rate base, are calculated in accordance with a cost of service model developed jointly by EWSI, the regional water service commissions and the City of Edmonton, and are shown as separate line items on each applicable table. In-City Water's total revenue and revenue requirements are summarized in Table 2.3 below:

Table 2.3
In-City Water Revenue Requirements
($ millions)

		A	B	C	D
	Summary of Revenue Requirements	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	In-City Water Rate Revenue[(1)]	192.9	187.1	378.2	368.7
2	In-City Water Revenue Requirement				
3	Operating expenses	106.0	97.2	206.7	196.0
4	Other revenue	(4.9)	(5.5)	(9.9)	(11.2)
5	Depreciation and amortization	27.1	27.1	52.7	53.0
6	Return on rate base financed by debt	28.3	28.1	54.9	55.1
7	Return on rate base financed by equity	39.1	40.2	76.3	75.9
8	In-City Water Revenue Requirement*	195.6	187.1	380.7	368.7
9	**Return on Rate Base Financed by Equity**	**10.18%**	**10.51%**	**10.18%**	**10.17%**

[1] In the PBR forecast, rebasing and other special rate adjustments have been smoothed over the PBR term. Therefore, although forecast revenue is equal to the revenue requirement over the 2017-2021 PBR term, in any year within the PBR term, forecast revenue may be greater or less than the revenue requirement.

2.3.1 Revenue

In-City Water's rate revenues include fixed monthly services charges which vary by meter size and consumption charges applied to each cubic meter of water consumed. Besides rate revenue, In-City Water revenues also include other revenue derived from temporary services, connection fees, water permits, late payment charges and other incidental services. Table 2.3.1-1 below provides a comparison of 2018 In-City Water revenues to the PBR forecast:

Table 2.3.1-1
In-City Water Revenue
($ millions)

		A	B	C	D
		2018		**2017-2018**	
	In-City Water Revenue	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
1	Fixed Monthly Service Charges				
2	Residential	23.1	21.0	45.3	43.1
3	Multi-Residential	1.5	1.3	2.8	2.7
4	Commercial	4.3	4.0	8.3	8.0
5	Fixed Monthly Service Charges	28.9	26.4	56.4	53.7
6	Consumption Charges				
7	Residential	97.0	96.5	190.4	188.5
8	Multi-Residential	30.0	28.4	58.9	56.1
9	Commercial	37.0	35.9	72.5	70.4
10	Consumption Charges	164.0	160.7	321.8	315.0
11	In-City Water Rate Revenue	192.9	187.1	378.2	368.7
12	Other Revenue	4.9	5.5	9.9	11.2
13	**Total In-City Water Revenue**	**197.8**	**192.5**	**388.1**	**380.0**

In-City rate revenues were $5.8 million less than forecast in 2018, and $9.5 million less than forecast over the 2017-2018 PBR period. This difference is attributable to the following factors:

- Lower than forecast inflation - $1.2 million in 2018 ($3.2 million for 2017-2018). The PBR plan limits Water and Wastewater's annual routine rate adjustments to inflation less an efficiency factor (see Appendix A.1). As shown in Table 2.3.1-2, actual PBR inflation adjustments for 2018 and 2017-2018 are significantly less than forecast. The effect of lower than forecast inflation in 2017 and 2018 will continue to impact revenues throughout the remainder of the 2017-2021 PBR term;

Table 2.3.1-2
2018 PBR Inflation Adjustment

		A	B	C	D
		2018		**2017-2018**	
	PBR Inflation Adjustment to In-City Water and Wastewater Rates	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
1	Forecast Inflation				
2	CPI	2.20%	1.90%	4.45%	4.14%
3	Labour	2.40%	1.70%	4.86%	3.43%
4	Weighted Inflation (65% CPI, 35% Labour)	2.27%	1.83%	4.59%	3.89%
5	Less: Efficiency Factor	-0.25%	-0.25%	-0.50%	-0.50%
6	Forecast Inflation	2.02%	1.58%	4.08%	3.39%
7	Actual to Forecast Inflation Adjustment	-	-0.46%	-	-1.43%
8	**PBR Inflation Adjustment**	**2.02%**	**1.11%**	**4.08%**	**1.96%**

- Lower than forecast consumption (see section 2.2) resulted in a $2.8 million decrease in 2018 revenues ($4.7 million for 2017-2018). These decreases were partially offset by slight increases in customer counts which resulted in a $0.4 million increase in revenue in 2018 ($0.7 million for 2017-2018; and
- A negative non-routine adjustment to 2018 water rates decreased revenues by $2.2 million in 2018. As described in the 2017 PBR Progress Report, this non-routine adjustment fulfills EPCOR's commitment to the City to flow the benefits of any reductions in corporate shared service cost

allocations resulting from the transfer of Drainage Services assets to EPCOR to In-City Water and Wastewater customers through a negative non-routine adjustment.

Besides rate revenues, In-City Water earned $5.5 million in other revenue in 2018, $0.6 million greater than forecast ($1.3 million greater for 2017-2018). This increase includes $0.3 million in fees charged to private developers for water main flushing for new developments ($0.6 million for 2017 to 2018), and $0.3 million in additional customer service revenue ($0.7 million for 2017 to 2018).

2.3.2 Operating Expenses by Function

Table 2.3.2 below provides a comparison of EWSI's total water system operating expenses for 2018 to the PBR forecast.

Table 2.3.2
Operating Expenses by Function
($ millions)

		A	B	C	D
		2018		**2017-2018**	
	Function and Sub-function	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
1	Power, Other Utilities and Chemicals				
2	Power and Other Utilities	14.1	10.0	26.0	21.6
3	Chemicals	7.3	7.9	14.5	16.3
4	Power, Other Utilities and Chemicals	21.4	17.9	40.5	37.9
5	Water Operations				
6	Water Treatment Plants	19.2	19.1	38.0	36.5
7	Water Distribution and Transmission	25.1	26.7	49.7	52.4
8	Operational Support Services	7.4	7.1	14.7	13.9
9	Quality Assurance and Environment	6.5	6.7	11.8	12.1
10	Capitalized Overhead Costs	(7.3)	(7.5)	(14.3)	(14.6)
11	Water Operations	50.9	51.9	99.9	100.3
12	Billing, Meters and Customer Service				
13	Billing and Collections	8.1	7.9	15.9	15.7
14	Meter Reading, Repairs and Maintenance	3.1	1.3	6.2	4.0
15	Customer Service	0.7	0.7	1.5	1.3
16	Billing, Meters and Customer Service	12.0	9.9	23.6	21.0
17	EWSI Shared Services				
18	EWSI Shared Services	10.0	8.8	19.8	18.8
19	Incentive and Other Compensation	3.2	3.3	6.3	6.1
20	EWSI Shared Services	13.2	12.1	26.1	25.0
21	Corporate Shared Services	15.3	12.0	30.3	24.9
22	Franchise Fees and Property Taxes				
23	Franchise Fees	15.4	14.8	29.9	29.1
24	Property Taxes	0.4	0.2	0.9	0.5
25	Franchise Fees and Property Taxes	15.8	15.0	30.8	29.6
26	**Total Operating Expenses by Function**	**128.5**	**118.8**	**251.2**	**238.6**
27	In-City Water Share - %	82.5%	81.8%	82.3%	82.1%
28	**In-City Water Share - $**	**106.0**	**97.2**	**206.7**	**196.0**

Overall, total operating expenses for 2018 were $9.7 million lower than the PBR forecast, and $12.5 million lower over the 2017-2018 PRB period. Key factors contributing to this difference include:

- **Power and Other Utilities** – $4.1 million less than forecast in 2018 ($4.5 million less for 2017-2018) due to lower than forecast power prices ($2.2 million in 2018 and $2.6 million for 2017-2018) and

$1.9 million related to the purchase of locally produced renewable energy. The PBR forecast included annual renewable power purchases of $1.9 million annually, starting in 2018. Rather than purchasing locally produced renewable energy, EWSI plans to construct a solar farm on land adjacent to the E.L. Smith water treatment plant. Therefore, after the solar farm is completed, the savings in green power purchases will be offset by higher operations, maintenance, depreciation and returns on EWSI's investment in the solar farm project.

- **Chemicals –** $0.6 million greater than forecast in 2018 ($1.9 million greater than forecast for 2017-2018). In 2018, higher than forecast costs are attributable to unusually high colour in the river in the fall causing a delay in conversion to direct filtration and extending the use of chemicals (alum and caustic soda) in the water treatment process. Higher than forecast costs for the 2017-2018 PBR period are also attributable to unexpected changes in river water quality, including early spring run offs and high colour in the fall.
- **Water Treatment Plants** – $0.1 million less than forecast in 2018 ($1.5 million less than forecast for 2017-2018). Lower than forecast costs for 2017-2018 are attributable to several factors, including: a higher than forecast proportion of internal labour on capital projects, which increased capital recoveries by $0.5 million, reductions in fringe benefit costs, primarily lower pension contribution rates, which provided savings of $0.3 million; and capitalization of filter media costs, which had previously been considered an operating expense of $0.2 million. The remainder of the actual to forecast difference consists of numerous small items, none of which are individually significant.
- **Water Distribution and Transmission** – $1.6 million greater than forecast in 2018 ($2.7 million greater for 2017-2018). Seasonal freeze-thaw cycles resulted in higher than normal volumes of emergency repairs (main breaks and frozen services) in both 2017 and 2018, resulting in increased overtime costs of $0.9 million ($1.4 million for 2017 to 2018), higher contractor costs of $1.2 million ($1.7 million for 2017-2018), and additional material costs of $0.6 million ($1.1 million for 2017 to 2018). These increases were partially offset by reductions in fringe benefit costs of $0.8 million in 2018 ($1.5 million for 2017-2018).
- **Operational Support Services** – $0.1 million less than forecast in 2018 ($0.5 million less for 2017-2018). The 2017-2018 variance in this function is primarily due to lower than forecast legal costs of $0.4 million, as less external legal support was required.
- **Meter Reading, Repairs and Maintenance** – $2.1 million less than forecast in 2018 ($2.6 million less for 2017-2018). Meter reading process improvements provided cost savings in staff costs of $1.2 million ($1.6 million for 2017-2018), and $0.3 million in vehicle expenses ($0.5 million for 2017-2018). Higher than forecast recoveries from Wastewater and Drainage provided a further reduction of $0.4 million in 2018 ($0.2 million for 2017-2018). The remainder of the actual to forecast difference consists of numerous small items, none of which are individually significant.
- **EWSI Shared Services –** $1.1 million less than forecast in 2018 ($1.1 million less than forecast for 2017-2018). The favorable variance in this category reflects EWSI's continuing efforts to manage shared services costs, with savings of $0.6 million arising from delays in filling vacant positions in Regulatory Services, a $0.3 million decrease in technical training charges from EPCOR Distribution and Transmission Inc., and $0.3 million of recoveries from Drainage, as organization changes are gradually consolidating functions from each of EWSI's business units into a single EWSI's shared services area.

- **Corporate Shared Services** – $3.3 million less than forecast in 2018 ($5.4 million less than forecast for 2017-2018). These differences reflect both the reduction in corporate shared services cost allocations resulting from the transfer of Drainage from the City of Edmonton to EPCOR, which are fully offset by the non-routine adjustment to rates described in Section 2.1.1, as well as cost savings in EPCOR Utilities Inc.'s corporate functions**.**
- **Franchise Fees and Property Taxes** – $0.8 million less than forecast in 2018 ($1.2 million less than forecast for 2017-2018). Lower than forecast revenue resulted in a $0.6 million reduction in franchise fees in 2018 ($0.8 million for 2017-2018). Lower than forecast property taxes relate to the deferral of the Distribution and Transmission facility which had been expected to increase Water Services property taxes by $0.2 million annually commencing in 2017.

Variances in other operating expense functions and sub-functions are not significant, either individually or in aggregate.

In 2018, In-City Water's share of operating expenses was $97.2 million (81.8%), compared to $106.0 million (82.5%) in the PBR forecast. This result reflects both lower total operating expenses for EWSI's total water system and a 0.7% decreases in In-City Water's share of operating expenses determined through the cost of service model.

2.3.3 Operating Expenses by Cost Category

Table 2.3.3 below shows operating expenses by cost category for Water Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 2.3.2.

Table 2.3.3
Operating Expenses by Cost Category
($ millions)

		A	B	C	D
		2018		2017-2018	
	Cost Category	PBR Forecast	Actual	PBR Forecast	Actual
1	Water Operations				
2	Staff Costs and Employee Benefits	41.4	40.6	82.0	79.7
3	Contractors and Consultants	7.8	9.4	14.5	16.5
4	Vehicles	1.5	1.2	3.0	2.5
5	Materials and Supplies	3.1	3.9	6.1	7.2
6	Other	4.3	4.4	8.6	8.9
6	Capitalized Overhead Costs	(7.3)	(7.5)	(14.3)	(14.6)
7	Water Operations	50.9	51.9	99.9	100.3
8	Billing, Meters and Customer Service				
9	CUS Charges	8.1	7.9	15.9	15.7
10	Staff Costs and Employee Benefits	6.7	5.6	13.3	11.9
11	Contractors and Consultants	0.5	0.4	1.0	0.8
12	Vehicles	0.3	0.1	0.6	0.4
13	Other	0.5	0.4	1.0	0.7
14	Meter Reading Services (Recoveries)	(4.2)	(4.6)	(8.3)	(8.5)
15	Billing, Meters and Customer Service	12.0	9.9	23.6	21.0
16	EWSI Shared Services				
17	EWSI Shared Services Allocation	10.0	9.2	19.9	18.8

		A	B	C	D
Cost Category		2018		2017-2018	
		PBR Forecast	Actual	PBR Forecast	Actual
18	Staff Costs and Employee Benefits	3.2	3.1	6.4	6.4
19	Contractors and Consultants	0.2	0.1	0.4	0.3
20	Other	(0.3)	(0.3)	(0.5)	(0.5)
21	EWSI Shared Services	13.2	12.1	26.1	25.0

The information presented in this table supports the explanations of differences between 2018 actual and forecast expenses provided in Section 2.3.2. Accordingly, no additional explanations are considered necessary.

2.3.4 Depreciation and Amortization

EWSI total system depreciation expense and amortization of contributed assets for 2018 are shown in Table 2.3.4 below:

Table 2.3.4
Depreciation and Amortization
($ millions)

		A	B	C	D
Depreciation and Amortization		2018		2017-2018	
		PBR Forecast	Actual	PBR Forecast	Actual
1	Gross depreciation expense	44.1	44.2	86.3	87.3
2	Amortization of contributions	(9.8)	(9.9)	(19.5)	(20.2)
3	**Depreciation, net**	**34.3**	**34.3**	**66.8**	**67.1**
4	In-City Water Share - %	78.8%	79.0%	78.8%	79.2%
5	**In-City Water Share - $**	**27.1**	**27.1**	**52.7**	**53.0**

Depreciation expense and amortization of contributions are both slightly higher than forecast reflecting higher than forecast levels of developer-funded assets, explained in section 2.3.5 below. These impacts are offsetting, so actual depreciation expense, net of amortization, is within $0.1 million of forecast.

In-City Water's share of 2018 depreciation expense is 0.2% higher than forecast. The 0.2% difference is consistent with actual to forecast differences in the base and max day peaking factors used to allocate depreciation expense in functional cost categories to In-City customer classes versus that charged to the RWCG.

2.3.5 Rate Base

In 2018, EWSI's total water system rate base, shown in Table 2.3.5 below, was $1.7 million less than forecast, with the higher than forecast gross rate base offset by higher than forecast contributions.

Table 2.3.5
Mid-Year Rate Base
($ millions)

		A	B
	Components of Mid-Year Rate Base	**2018**	
		PBR Forecast	**Actual**
1	Plant in Service		
2	Balance, beginning of year	2,257.4	2,299.8
3	Additions - EPCOR-funded	83.1	94.9
4	Additions - Developer-funded	6.4	29.9
5	Retirements and adjustments	-	(11.4)
6	Balance, end of year	2,346.9	2,413.1
7	Mid-Year Plant in service	2,302.1	2,356.5
8	Accumulated Depreciation		
9	Balance, beginning of year	560.9	562.7
10	Depreciation expense	44.1	44.2
11	Retirements and adjustments	-	(11.4)
12	Balance, end of year	605.1	595.5
13	Mid-Year Accumulated Depreciation	583.0	579.1
14	Other Rate Base Items		
15	Working Capital	21.3	21.2
16	Materials and Supplies	2.9	3.5
17	**Gross Mid-Year Rate Base**	**1,743.3**	**1,802.1**
19	Contributions		
20	Balance, beginning of year	680.6	730.2
21	Contributions in aid of construction	6.4	29.9
23	Balance, end of year	687.1	760.2
24	Mid-Year Contributions	683.8	745.2
25	Accumulated Amortization		
26	Balance, beginning of year	158.3	159.2
27	Amortization of contributions	9.8	9.9
28	Balance, end of year	168.1	169.1
29	Mid-Year Accumulated Amortization	163.2	164.1
30	**Mid-Year Contributions**	**520.6**	**581.1**
31	**Net Mid-Year Rate Base**	**1,222.7**	**1,221.0**

The gross rate base reflects significantly higher than forecast levels of developer-funded assets over the 2016 to 2018 period. Developers are responsible for construction of distribution infrastructure in new subdivisions. When these assets are placed into service, ownership of the assets is transferred to EWSI, where the assets, together with offsetting contributions in aid of construction, are added to the rate base. Therefore, in 2018, since higher than forecast developer-funded asset additions were fully offset by a corresponding increase in contributions, the net rate base remained within 0.1% of the PBR forecast.

2.3.6 Return on Rate Base

In 2018, In-City Water's return on equity was $3.7 million (0.3%) greater than forecast and $0.4 million (0.0%) less for 2017-2018. In 2018, this increase was almost entirely attributable to higher than forecast net income, reflecting EWSI's actions to control operating costs in response to lower than forecast revenue.

Table 2.3.6-1
Return on In-City Water Share of Mid-Year Rate Base
($ millions)

		A	B	C	D
	Return on Rate Base	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Net Mid-Year Rate Base	1,222.7	1,221.0	2,384.8	2,381.9
2	In-City Water Share - %	78.7%	78.3%	78.6%	78.3%
3	In-City Water Share - $	961.7	955.6	1,874.4	1,865.9
4	Deemed Capital Structure				
5	Debt	60.00%	60.00%	60.00%	60.00%
6	Equity	40.00%	40.00%	40.00%	40.00%
7	Total	100.00%	100.00%	100.00%	100.00%
8	Cost Rates				
9	Debt	4.91%	4.90%	4.88%	4.92%
10	Equity	10.18%	10.51%	10.18%	10.17%
11	Weighted Average Cost of Capital (WACC)	7.01%	7.14%	7.00%	7.02%
12	Return on Rate Base				
13	Debt	28.3	28.1	54.9	55.1
14	Equity	39.1	40.2	76.3	75.9
15	**Total Return on In-City Water Rate Base**	**67.4**	**68.3**	**131.2**	**131.0**

In-City Water's share of the total system net mid-year rate base is 0.4% less than forecast, which is consistent with the change in In-City Water's demands on water system relative to that of Regional Customers. When combined with a total system rate base that was also very close to forecast, the In-City Water net mid-year rate base is within 0.6% of the forecast amount.

Returns on rate base are calculated separately for the debt-financed and equity-financed portions of In-City Water's net rate base. The rate of return on debt is equal to the embedded cost of debt for EWSI's total water system, as calculated in Table 2.3.6-2 below:

Table 2.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B		
	Interest Expense and Cost of Debt	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Interest expense				
2	Interest on short-term debt	1.0	1.2	2.0	2.5
3	Interest on City of Edmonton debentures	0.7	0.7	1.6	1.6
4	Interest on intercompany debentures	33.7	32.8	65.2	64.0
5	Total interest expense	35.5	34.7	68.8	68.0
6	Mid-year debt and other long-term liabilities				
7	Mid-Year Short-term debt	38.1	17.7		
8	Mid-Year Long-term debt	683.0	688.0		
9	Mid-Year Other Long-term liabilities	1.8	2.3		
10	Total mid-year debt and other long-term liabilities	722.8	708.0		
11	**Embedded Cost of Debt**	**4.91%**	**4.90%**	**4.89%**	**4.92%**

The embedded cost of debt is slightly lower than forecast. Although, EWSI issued more long term debt than forecast, which is more expensive that short term debt, due to favorable economic conditions EWSI was able to issue the long term debt at lower than forecast rates in both 2017 and 2018.

2.3.7 Transactions with Affiliates

In-City Water derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EWSI business units. Table 2.3.7 provides a summary of In-City Water's 2018 actual and forecast transactions with affiliates.

Table 2.3.7
Transactions with Affiliates
($ millions)

		A	B	C	D
		2018		2017-2018	
	Affiliate and Service	PBR Forecast	Actual	PBR Forecast	Actual
1	**Revenues from the provision of services to the City of Edmonton**				
2	Public Fire Protection	11.4	11.3	22.2	22.3
3	Water sales	3.2	3.5	6.4	6.9
4	Other	0.2	0.0	0.4	0.1
5	Total	14.9	14.8	29.0	29.3
6	**Services provided by (recovered from):**				
7	**City of Edmonton**				
8	Franchise Fees	15.4	14.8	29.9	29.1
9	Property Taxes	0.4	0.2	0.9	0.5
10	Interest on City of Edmonton Debentures	0.7	0.7	1.6	1.6
11	Mobile equipment services	1.9	2.3	3.7	4.5
12	Other services	1.3	0.7	2.6	1.4
13	Meter Reading Recoveries	-	-	-	(1.4)
14	Total	19.7	18.7	38.7	35.6
15	**EPCOR Utilities Inc.**				
16	Corporate Shared Service Costs	15.3	12.0	30.3	24.9
17	Interest on Intercompany Debentures	33.7	32.8	65.2	64.0
18	Interest on Short-term debt	1.0	1.2	2.0	2.5
19	Total	50.0	46.0	97.5	91.4
20	**EPCOR Distribution and Transmission Inc.**				
21	Meter Reading Service Revenue	-	(0.0)	-	(0.5)
22	Other services	0.1	0.0	0.3	0.0
23	Total	0.1	(0.0)	0.3	(0.5)
24	**EPCOR Technologies Inc.**				
25	Hydrovac Charges and Space Rentals	0.9	1.7	1.8	2.9
26	**EPCOR Energy Alberta LP**				
27	Customer Billing and Collection Services	8.1	8.1	15.9	16.0
28	**EPCOR Power Development**				
29	Other Services (Recoveries)	-	(0.1)	-	(0.1)
30	**EPCOR Commercial Services**				
31	Commercial Services Rent Recoveries	-	(0.3)	-	(0.3)
32	**Other EWSI Business Units**				
33	EWSI Shared Services Allocation	10.0	9.2	19.9	18.8
34	Water Sales to Wastewater	(0.4)	(0.4)	(0.7)	(0.8)
35	Meter Reading Recoveries from Wastewater	(2.1)	(2.4)	(4.2)	(4.5)
36	Meter Reading Recoveries from Drainage Services	(2.1)	(2.4)	(4.2)	(2.8)

		A	B	C	D
		2018		2017-2018	
	Affiliate and Service	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
37	Customer Service Fees from Drainage Services	-	0.4	-	0.5
38	Quality Assurance Lab Testing and Other Services from Other EWSI Business Units	-	0.2	-	0.2
39	Total	5.5	4.6	10.8	11.4
40	**Expenditures on capital projects arising from services provided by:**				
41	City of Edmonton	3.1	0.4	6.1	1.9
42	EPCOR Technologies Inc.	3.9	4.0	7.7	8.7
43	EPCOR Utilities Inc.	-	0.9	-	1.6
44	EPCOR Drainage Services	-	3.3	-	4.2
45	EPCOR Distribution and Transmission Inc.	0.1	0.3	0.2	0.7
40	Other EPCOR Business Units	-	0.1	-	0.1
41	Total	7.0	8.9	14.1	17.2

2.4 Capital Programs

2.4.1 Capital Expenditures

Table 2.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2018 for each project with approved capital expenditures in excess of $5.0 million over the 2017-2021 PBR term, as well as for each project category. Table 2.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI’s current capital forecast.

Table 2.4.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	
		2018			2017 to 2021			
		PBR Forecast	Actual	Increase (Decrease)	PBR Forecast	Current Projection	Increase (Decrease)	
1	**Regulatory**							
2	Water Services Replace/Refurbish	2.0	1.8	(0.2)	10.2	9.6	(0.6)	
3	Projects < $5 Million	0.3	0.4	0.1	1.5	2.1	0.7	
4	Subtotal	2.3	2.2	(0.1)	11.6	11.7	0.1	
5	**Growth/Customer Requirements**							
6	LRT Relocates (NRA)	0.3	1.7	1.4	10.4	25.1	14.7	1
7	Network PD Transmission Mains	2.3	2.3	(0.1)	14.4	28.6	14.2	2
8	Discovery Park Reservoir (NRA)	-	0.0	0.0	-	7.8	7.8	3
9	Water Services Connections	4.4	7.2	2.8	23.6	27.5	3.9	4
10	Water Main Cost Sharing Program	0.5	1.7	1.2	3.0	5.8	2.8	5
11	New Water Distribution Mains	1.7	2.7	1.0	8.8	10.7	1.9	
12	New Meter Purchase/Installation	2.1	2.4	0.2	13.2	12.9	(0.3)	
13	Distribution System Modifications	1.5	0.7	(0.8)	6.0	4.9	(1.1)	
14	PD Construction Coordination	2.8	2.5	(0.3)	15.4	13.6	(1.9)	
15	Projects < $5 Million	0.2	3.0	2.8	2.6	9.1	6.6	6
16	Subtotal	15.8	24.2	8.4	97.5	146.0	48.5	
17	**Health, Safety & Environment**							
18	Accelerated Lead Service Replacement (NRA)	-	-	-	-	12.2	12.2	7
19	Phosphoric Injection for Lead Control (NRA)	-	0.1	0.1	-	9.3	9.3	7
20	E.L. Smith - Deep Bed Filtration	-	0.3	0.3	22.3	0.3	(22.0)	8
21	Projects < $5 Million	0.7	0.5	(0.3)	4.3	6.7	2.4	9
22	Subtotal	0.7	0.9	0.1	26.6	28.5	1.9	
23	**Reliability & Life Cycle Improvements**							
24	Structural Rehab Program - E.L. Smith	-	0.3	0.3	2.0	20.0	18.0	8
23	Plant Flood Protection (net)	-	0.0	0.0	-	7.4	7.4	10
26	Distribution Mains Obsolete Valve Replacement	0.8	1.3	0.5	4.1	9.7	5.6	11
27	Structural Upgrades - Reservoir	-	0.7	0.7	1.7	6.0	4.3	12
28	Electrical Upgrades – E.L Smith	-	0.7	0.7	4.7	8.9	4.2	13
29	Obsolete Hydrants Replacement Program	0.9	1.8	1.0	4.4	8.3	4.0	14
30	Chemfeed Upgrades – E.L Smith	1.0	1.1	0.0	4.0	7.4	3.4	15
31	Rossdale Filter Underdrain Upgrades	1.2	3.5	2.3	4.7	8.0	3.2	16
32	Transmission Mains Replacement/Refurbish	2.5	3.2	0.6	13.3	16.1	2.8	17
33	Chemfeed Upgrades - Rossdale	0.9	0.8	(0.1)	4.0	6.8	2.7	18
34	Mechanical Upgrades – E.L Smith	1.2	1.9	0.7	4.9	6.6	1.7	

		A	B	C	D	E	F	
		2018			2017 to 2021			
		PBR Forecast	Actual	Increase (Decrease)	PBR Forecast	Current Projection	Increase (Decrease)	
35	E.L. Smith - Bypass (Ring) Main	0.3	0.2	(0.1)	7.0	8.6	1.6	
36	Rossdale Clarifier C1-2 Upgrade	1.4	4.2	2.8	4.3	5.5	1.1	
37	Network Valve Chamber Refurbishment	1.1	1.2	0.1	5.6	5.9	0.3	
38	Water Main Reactive Renewal	9.6	12.0	2.4	54.7	54.7	0.1	
39	Water Main Proactive Renewal	3.5	3.8	0.3	18.0	18.0	(0.0)	
40	Vehicle & Fleet Additions	1.4	0.4	(1.0)	11.8	11.8	(0.0)	
41	Electrical Upgrades - Reservoirs	1.2	1.2	(0.0)	5.3	4.2	(1.1)	
42	Electrical Upgrades - Rossdale	0.9	0.9	(0.1)	5.2	3.7	(1.5)	
43	SCADA System Upgrade Program	1.1	1.2	0.1	5.7	4.0	(1.7)	
44	Cell/Pumphouse Roof Replacement	-	0.0	0.0	6.3	3.4	(2.9)	10
45	Water Meter Change Out Program	3.0	3.0	(0.0)	25.6	17.5	(8.2)	19
46	Projects < $5 Million	15.1	15.5	0.4	65.0	66.8	1.8	
47	Subtotal	47.2	58.9	11.6	262.4	309.2	46.9	
48	**Performance Efficiency & Improvement**							
49	Water D&T Facility Expansion	-	-	-	16.0	27.9	11.9	20
50	Water Main Cathodic Protection	4.1	3.2	(0.9)	21.0	18.6	(2.4)	21
51	Projects < $5 Million	3.3	0.7	(2.6)	7.1	6.9	(0.2)	
52	Subtotal	7.4	3.9	(3.5)	44.1	53.4	9.3	
53	**Accelerated**							
54	Accelerated Water Main Renewal	10.1	9.9	(0.3)	51.9	54.4	2.5	22
55	Accelerated Fire Protection	4.1	1.7	(2.4)	15.9	10.5	(5.5)	23
56	Subtotal	14.2	11.5	(2.7)	67.8	64.9	(3.0)	
57								
58	**E.L. Smith Solar Farm and Battery Storage (net)**	-	2.2	2.2	-	33.1	33.1	24
59	**Capital Expenditures before contributions**	87.7	103.8	16.1	510.1	646.8	136.7	
60	**Contributions**							
61	Water Services Connections	(1.7)	(4.3)	(2.5)	(23.6)	(20.6)	2.9	4
62	New Water Distribution Mains	(0.3)	(2.8)	(2.4)	(8.8)	(9.6)	(0.8)	
63	Other contributions	(4.4)	(0.3)	4.1	(1.9)	(1.7)	0.2	
64	Subtotal	(6.4)	(7.4)	(0.9)	(34.3)	(32.0)	2.3	
65	**Capital Expenditures**	**81.2**	**96.4**	**15.2**	**475.8**	**614.8**	**139.0**	

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million on individual projects with total costs in excess of $5.0 million, as well as for project categories in aggregate include:

1. **LRT Relocates (NRA)** – $14.7 million (141%) greater than forecast. Changes to track alignments, as well as the accelerated construction schedule for the West Valley Line LRT project have resulted in increases to the projected costs of utility relocations. As noted in Section 1.5, EWSI plans to request a non-routine adjustment to rates to offset the revenue requirement impacts of the additional work needed to accommodate water main, hydrant and sewer relocations for this project
2. **Network PD Transmission Mains** – $14.2 million (100%) greater than forecast. Since developers determine both the timing of projects and the areas to be developed, expenditures on this program have proven difficult to forecast. Significant additions to this program include transmission main projects for Ellerslie Road, 28th Avenue SW, and the Horse Hills/Marquis industrial area.
3. **Discovery Park Reservoir (NRA)** – $7.8 million (new project). This project includes the cost of infrastructure (reservoir, pump house and transmission mains) in land annexed by the City of Edmonton. As noted in Section 1.5, EWSI plans to request a non-routine adjustment to rates to offset the revenue requirement impacts of this project.
4. **Water Services Connections (net of contributions)** – $6.8 (100%) million greater than forecast. Contributions from private developers are meant to recover 100% of the cost of for new water service connections. In 2018, EWSI found that after accounting for all program costs, its service application rates provided for recovery of less than 75% of the cost of new services. EWSI is currently reviewing the program to determine if modifications to the program are required.
5. **Water Main Cost Sharing Program** – $2.8 million (92%) greater than forecast. Similar to Network PD Transmission Mains, the costs of this program are driven by developer activity. The increase in the costs of this program result from higher than forecast increases in developer activity.
6. **Growth and Customer Requirements < $5.0 million** – $6.6 million (256%) greater than forecast. The projected increase in this category results from a new booster station project needed to address development in a high elevation area ($1.7 million); additional costs to acquire water mains from regional water commissions following city expansion ($4.6 million); and changes to projected costs for other growth projects amounting to $0.3 million.
7. **Accelerated Lead Service Replacement & Phosphoric Injection for Lead Control (NRA)** – $21.5 million (new projects). These projects are required to implement EWSI's lead mitigation strategy, including introducing orthophosphate into drinking water to inhibit corrosion and accelerating the replacement of lead service lines in high priority homes. As noted in Section 1.5, in April 2018, EWSI submitted a request for a non-routine adjustment to rates to offset the revenue requirement impacts of these projects.
8. **E.L. Smith - Deep Bed Filtration** – $22.0 million (99%) less than forecast and **Structural Rehab Program - E.L. Smith** – $18.0 million (895%) greater than forecast. During engineering inspections in 2018, EWSI identified immediate needs for structural rehabilitation of the E.L. Smith filter chambers. Accordingly, the conversion to deep bed has been postponed until after the end of the current PBR term, so that the required structural rehabilitation and upgrades can be completed.
9. **Health, Safety and Environment < $5.0 million** – $2.4 million (55%) more than forecast. This increase is largely attributable to a new low lift pump house chlorinated waste cross connection

project at EL Smith ($2.7 million). This project will reduce the likelihood of chlorinated water being released into the river during screen flushing.

10. **Plant Flood Protection (net)** – $7.4 million (new project). This program is designed to improve the water treatment plants' resiliency in the event of a flood, so that the plants are protected from catastrophic damage, and that water treatment can be resumed as quickly as possible after a flood event. Forecast costs are net of anticipated funding from the Alberta Community Resilience Program and the Disaster Mitigation and Adaptation Fund. The timing of this project has been advanced from future periods both to recognize the vulnerability of the water treatment plants and to maximize available grant funding.
11. **Distribution Mains Obsolete Valve Replacement** – $5.6 million (136%) greater than forecast. Higher than expected rates of deterioration have led to increased backlog, requiring adjustments to valve replacement schedules. Although the projected cost of this program has increased substantially, improving overall valve operability in the system reduces isolation time, lessens the potential for property damage and mitigates customer impacts during emergency main break response.
12. **Structural Upgrades - Reservoir** – $4.3 million (251%) greater than forecast and **Cell and Pumphouse Roof Replacement** – $2.9 million (46%) less than forecast. These differences are largely due to changes to the scope of these programs which have resulted in reclassifying reservoir roof replacement projects to structural upgrades. This change allows for more efficient project delivery and improvements to project management and coordination.
13. **Electrical Upgrades – E.L Smith** – $4.2 million (90%) greater than forecast. This increase is due to an anticipated need to construct a new electrical room to allow for replacement of end-of-life electrical equipment.
14. **Obsolete Hydrant Replacement Program** – $4.0 million (91%) greater than forecast. Similar to the obsolete valve replacement program, higher than expected rates of deterioration have led to increased backlogs. EWSI has adjusted its hydrant replacement schedule to clear backlogs and ensure fire protection service levels maintained.
15. **Chemfeed Upgrades – E.L Smith** – $3.4 million (84%) greater than forecast. Higher than estimated costs for a large fluoride room upgrade to replace end-of-life equipment, and unanticipated upgrades to the sodium hypochlorite room, including new generation cells, are the primary factors contributing to increases in the cost of this program.
16. **Rossdale Filter Underdrain Upgrades** – $3.2 million (69%) greater than forecast. Both the scope and cost of this project have increased following an inspection of the filter underdrain system that identified unforeseen needs for upgrades to air scour systems.
17. **Transmission Mains Replacement/Refurbishment** – $2.8 million (21%) greater than forecast. Construction costs have been higher than originally anticipated due to adverse conditions in the field and increased complexity of the work needed to refurbish aging transmission mains.
18. **Chemfeed Upgrades - Rossdale** – $2.7 million (68%) greater than forecast. EWSI identified significant health, safety and environmental needs, requiring extensive upgrades to the sodium bisulphite room.

19. **Water Meter Change out Program** – $8.2 million (32%) less than forecast. The decrease in the projected cost of this program results from an improvement in the expected lives of the batteries used in the meters. As a result, fewer meters are expected to require replacement.

20. **Water D&T Facility Expansion** – $11.9 million (74%) greater than forecast. Completion of the D&T Facility was originally planned for 2017. This project has been re-scoped following the transfer of Drainage to EPCOR and the completion of an EPCOR-wide real estate review. Instead of a stand-alone Water D&T facility, the review concluded that a consolidated solution for Water and Drainage would provide long-term synergies and operational efficiencies that would outweigh its additional capital costs. Design of the consolidated facility is currently underway and construction is forecast to be substantially complete in 2021.

21. **Water Main Cathodic Protection** – $2.4 million (12%) less than forecast. The reduction in the project costs of the program result from adoption of more efficient anode installation processes.

22. **Accelerated Water Main Renewal –** $2.5 million (5%) greater than forecast. EWSI has identified an increased number of sub-projects that meet the criteria for accelerated renewal, especially to accommodate water main replacement in conjunction with the City of Edmonton's Alley Paving program. The increase in costs for this program will be entirely offset by lower than approved expenditures on Accelerated Fire Protection.

23. **Accelerated Fire Protection –** $5.5 million (34%) less than forecast. EWSI expects that expenditures over the remainder of the 2017-2021 PBR term will be less than approved amounts, due to a smaller number of potential sub-projects meeting the Accelerated Fire Protection Program criteria.

24. **E.L. Smith Solar Farm and Battery Storage (net of contributions)** – $32.6 million (new project). As noted in section 2.3.2, instead of purchasing locally produced renewable power at an annual cost of $1.9 million, EWSI plans to construct a solar farm at E.L. Smith. Current plans for the solar farm include a battery storage system that would be almost entirely grant-funded.

2.4.2 Construction Work in Progress

In-City Water's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. In 2018, as shown on Table 2.4.2, the balance in Construction Work in Progress was $10.1 million greater than forecast, of which $1.7 million was attributable to higher than forecast carry-over projects from 2017, $3.7 million was attributable to the E.L. Smith solar project, with the remainder attributable to carry-over projects for 2018.

Table 2.4.2
Construction Work in Progress
($ millions)

		A	B	C	D
Construction Work in Progress		**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Balance, beginning of period	5.0	11.7	0.3	3.8
2	Capital Expenditures	81.2	96.4	189.2	194.5
3	Capital Additions	(83.1)	(94.9)	(186.4)	(185.1)
4	**Balance, end of period**	**3.1**	**13.2**	**3.1**	**13.2**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2018, AFUDC included in capital expenditures on eligible projects amounted to $0.6 million, compared to the PBR forecast amount of $0.2 million.

2.5 Operational Performance

2.5.1 Water Quality Index

The Water Quality index is calculated as the percentage of water quality test results that meet EWSI's internal water standards. Water quality standards are established by both the federal and provincial governments and are incorporated into EWSI's Approval to Operate from Alberta Environment and Parks (AEP). In some cases, EWSI sets even stricter limits for critical parameters that are identified in EWSI Quality Standards, to provide early warnings of potential water quality problems; so that corrective actions can be taken before external standards are not met.

Table 2.5.1
Water Quality Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Index	The percentage of the total number of water quality tests taken in the period that do not yield suspect results	> 99.7%	99.8%	1.001
			Average Index	1.001
			Index Standard Points	25.0
			Total Actual Points	25.0
			Maximum Available Points Including Bonus Points	25.5
			Total Points Earned	**25.0**

<u>2018 Highlights</u>

- EWSI met all Health Canada Drinking Water Quality Guidelines and AEP water quality testing requirements in 2018. EWSI collected 60,610 samples of treated drinking water in 2018. Of those samples only 114 (0.2%) did not meet EWSI internal water quality standards.

- The majority of variances from EWSI internal water quality standards in 2018 were related to temporary increases in turbidity and/or decreases in chlorine concentrations in samples collected from the distribution system following main break repairs and other maintenance work.

2019 Areas for Improvement

- EWSI is developing a rapid-field test for ensuring the microbial quality of water levels related to distribution main flushing activities. This test will support required Total Coliforms (TC) and *E. coli* (EC) testing while ensuring effective flushing. The new test is expected to reduce the number of variances in EC/TC testing and decrease the time of water outages.

2.5.2 Customer Service Index

The customer service index is a composite measure of the customers' perception of satisfaction with EWSI service, the aesthetic quality of water and speed of response to customer issues.

Table 2.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Post Service Audit Factor	The percentage of the customers responding as "completely" or "very satisfied" in the level of service received from the EWSI Emergency group.	> 74.9%	71.3%	0.952
Home Sniffing Factor	The percentage result of customer satisfaction for the home sniffing survey.	> 94.4%	92.8%	0.983
Response Time Factor	The average number of minutes needed to confirm a water main break from the time a call is received at EWSI's dispatch office.	< 25	20.7	1.171
Planned Construction Impact Factor	The percentage of the total planned construction events where EWSI complies with required construction notification procedures.	> 95.8%	96.2%	1.004
			Average Index	1.028
			Index Standard Points	20.0
			Total Actual Points	20.6
			Maximum Available Points Including Bonus Points	23.0
			Total Points Earned	**20.6**

2018 Highlights

- **Planned Construction Impact Factor**. In 2018, EWSI introduced process improvements, including: providing training to project teams to ensure that appropriate notification timelines are followed; streamlining the notification process between in-house crews and contractors; implementing proactive construction communication plans; and enhancing field systems to improve real-time tracking of construction dates and project completion progress. Additional improvements are planned for 2019 to improve construction timelines and maintain customer service as a priority.

2019 Areas for Improvement

- **Post Service Audit Factor**. After a decline in results in 2017, EWSI conducted a root cause analysis that identified a need to create a customer service culture with a focus on quality reviews and coaching. Process improvements designed to improve the customer experience were implemented in 2018, with survey results improving during the latter part of the year. In 2019, EWSI will pursue further improvements in the areas of timely response and first call resolution, and will continue its comprehensive review of processes and procedures related to customer interactions, and how employees interact with customers on a daily basis.
- **Home Sniffing Factor.** In 2018 the Home Sniffing Factor was significantly challenged. The Home Sniffing program is designed to measure the impact of spring run-off in the river and the effectiveness of water treatment during the run-off period at mitigating spring-run off related odours at the tap. For reasons that are still unknown, a small number of the approximately 100 customers that participated in the survey responded negatively to odours in their water in March, well before the occurrence of spring run-off in April. This resulted in a reduction in the overall % satisfaction score and inability to meet the target for the three month campaign. This performance measure at the target of 94.4% is sensitive to the responses of a relatively small number of customers. In 2019, EWSI will be doubling the size of the home sniffing panel to increase the statistical robustness of the calculated performance measure.

2.5.3 System Reliability and Optimization Index

The System Reliability Index is a measure of the confidence that customers can place in the reliability of the waterworks system.

Table 2.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Main Break Factor	The number of water main breaks that occurred in the reporting period.	< 419	345	1.177
Water Main Break Repair Duration Factor	The percentage of water main breaks repaired and confirmed by EWSI within 24 hours from the time that the flow of water is shut off, excluding main breaks on arterial or collector roads	> 93.7%	96.0%	1.024
Water Loss Factor	The Infrastructure Leakage Index, a performance indicator quantifying how well a water distribution system is managed for the control of “real” water losses (i.e. leakage).	< 2.0	0.90	1.550
System Energy Efficiency Factor	The energy used at all water facilities in kWh divided by the average annual water production per residential customer account (ML/kWh/customer).	< 309	257	1.203
			Average index	1.238
			Index Standard Points	25.0
			Total Actual Points	30.9
			Maximum Available Points Including Bonus Points	28.5

Index Component	PBR Performance Measure	Standard	Actual Score	Index
			Total Points Earned	28.5

2018 Highlights

- **Water Main Break Factor.** EWSI experienced 345 water main breaks in 2018, 74 less than the PBR standard of 419. This result highlights the effectiveness of EWSI's water main replacement programs, which are expected to further reduce the number of main breaks in future years.
- **Water Main Break Repair Duration Factor.** In 2018, 98.3% of main breaks were repaired within 24 hours, exceeding the PBR standard of 96%. When a water main break repair approaches 20 hours in duration EWSI has a triage process that includes providing additional communication to affected customers. If required. EWSI also aims to provide temporary water supply support via water tanks, hose hook ups or delivery of water jugs to affected customers.
- **Water Loss Factor (ILI).** EWSI's ILI of 0.90 significantly exceeded the PBR standard and is near the theoretical lowest level of leakage expected given the water supply system characteristics. An AWWA Water Audit Validation exercise was conducted to provide additional understanding of the system and identification of potential opportunities for further system improvement.
- **System Energy Efficiency Factor.** EWSI's major energy efficiency initiatives focused on three main aspects: continue to improve building envelops for higher energy efficiency and GHG emission reduction; implement operational changes to assist in the monitoring of operations and equipment performance; and develop plans for implementing solar generation or green energy for operations.

2.5.4 Environment Index

The environmental index measures the success of programs and policies designed to mitigate and report adverse environmental impacts.

Table 2.5.4
Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Conservation Factor	The actual 10 year rolling average monthly Edmonton residential consumption per household	<17.2	15.8	1.089
Environment Incident Factor	The number of reportable and preventable environmental incidents	<6	4	1.463
Solids Residual Management Factor	The average number of days that the Rossdale and E.L. Smith water treatment plants are operating in direct filtration mode.	> 120	95.8	0.799
			Average index	1.117
			Index Standard Points	15.0
			Total Actual Points	16.8
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	16.5

2018 Highlights

- **Environment Incidents.** The Environmental Compliance Assurance Program (ECAP) was implemented at EPCOR Water in late 2017 and included elements such as tracking of compliance obligations, approvals and permits, and project reviews. With ECAP in place, only four environmental incidents, that met the preventable criteria, were reported in 2018. All four incidents were investigated to determine root causes and corrective actions were assigned.

2019 Areas for Improvement

- **Solids Residual Management Factor.** In 2018, the water treatment plants were only able to achieve 96 days in direct filtration operation relative to the target of 120 days, due to naturally occurring high colour in the river during the fall and early winter. In 2019, EWSI will continue to trial different types of polymer and investigate strategies for dosing during transition from conventional treatment to direct filtration in an effort to extend the number of days in direct filtration and further reduce solids discharged to the North Saskatchewan River from the water treatment plants.

2.5.5 Safety Index

The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public.

Table 2.5.5
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	>550	855	1.555
Work Site Inspections and Observations Factor	Number of Work Site Inspections and observations completed per year.	>1,032	2,720	2.636
Lost Time Frequency Factor	The actual lost time frequency rate.	<0.57	0.38	1.500
All Injury Frequency Factor	The actual all injury frequency rate	< 1.54	1.72	0.895
			Average index	1.646
			Index Standard Points	15.0
			Total Actual Points	24.7
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2018 Highlights

- EWSI's continued focus on safety has enabled In-City Water to earn maximum points on the safety index, with EWSI experiencing only two lost time injury events: a reaction to an insect bite; and a slip and fall. Even so, the all injury frequency rate ended higher than target, with In-City Water. Internal investigation showed that these injuries were the result of lower risk situational hazards. In 2019, In-City Water will focus on improving safe work planning to incorporate situational awareness and focusing on low risk hazards when going to and from the job.

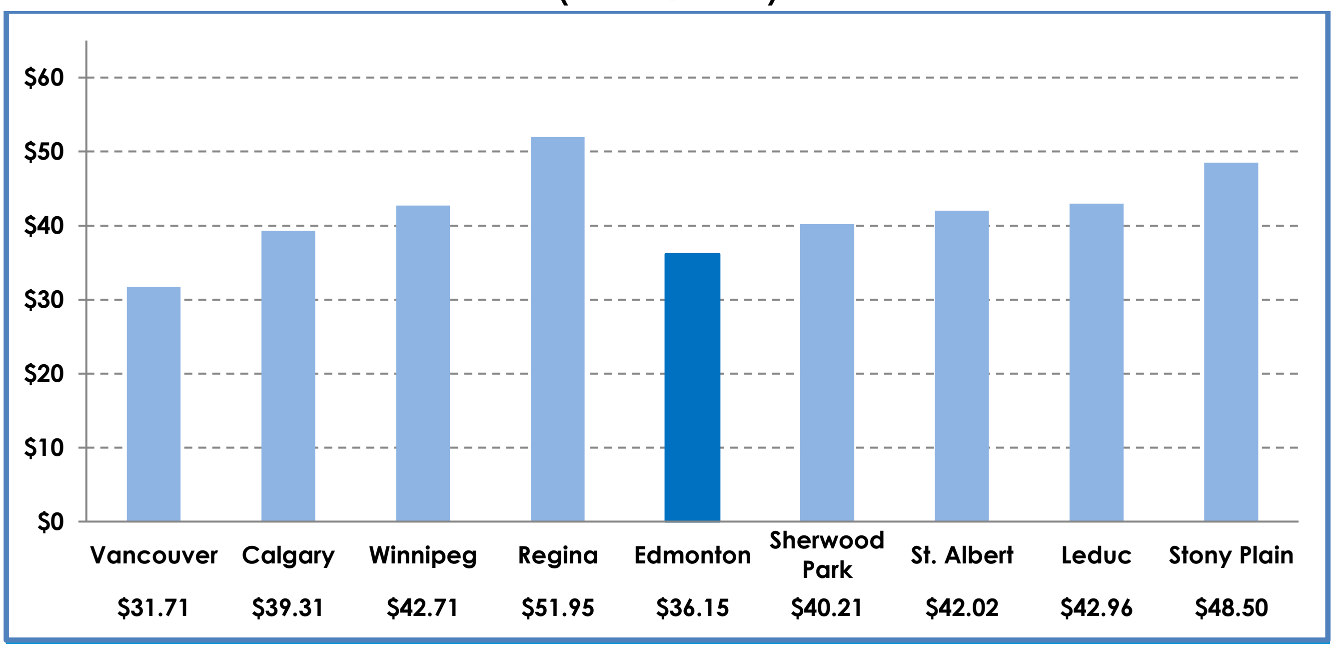
2.6 Rates and Bill Comparisons

Water bill comparisons for 2018 are based on the published water rates for Calgary, Vancouver, Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

2.6.1 Residential Water Bills

Figure 2.6.1 provides a comparison of residential household water bills for residential household consumption of 14.4 m^3 per month, the average residential customer consumption per month in Edmonton in 2018. Comparison of residential water bills shows that Edmonton's water bills are lower than all of the cities and local communities surveyed, except for Vancouver. This result is not unexpected; Vancouver has an excellent raw water source and, therefore, has lower needs for water treatment than Edmonton which has a naturally highly variable water source in the North Saskatchewan River.

Figure 2.6.1
2018 Monthly Residential Water Bill Comparison
(14.4 m^3/month)



2.6.2 Commercial Water Bills

Table 2.6.2 provides a comparison of the water bills for commercial customer of various sizes. This table shows that water bills for EWSI's commercial customers are lower than all of the other surrounding communities and other major cities in western Canada, except for higher volume customers in Vancouver and mid sized customers in Calgary.

Table 2.6.2
Commercial Monthly Water Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	26.91	288.78	1,199	5,720
3	Calgary	44.54	389.65	1,471	7,545
4	Regina	43.50	513.90	2,187	10,305
5	Winnipeg	34.70	473.60	1,892	9,271
6	**Edmonton**	**25.40**	**390.34**	**1,557**	**6,562**
7	St. Albert	34.67	435.47	1,688	8,368
8	Sherwood Park	29.56	610.36	2,425	12,105
9	Stony Plain	37.22	544.18	2,128	10,578
10	Leduc	32.84	597.20	2,484	11,826

3 Wastewater Treatment Services

3.1 Accomplishments and Challenges

In 2018, Wastewater's key accomplishments included:

- Undertaking a detailed review and update of Wastewater's long term Integrated Resource Plan (IRP). Wastewater's IRP encompasses: customer growth; changes to provincial regulatory frameworks; technology; asset management; and health, safety and environmental considerations. The IRP provides a roadmap for enabling Wastewater to meet Edmonton's future growth demands and potential future effluent quality standards, within the existing footprint of the plant;
- Enhancing planning and design of the Gold Bar Operations Centre, including: mitigating safety concerns by relocating non-process functions from the center of the plant, alleviating congestion on site, providing proper hygiene facilities for employees; and incorporating feedback received during public consultation;
- Initiating an assessment of opportunities to increase biogas utilization. Currently, Wastewater is able to use only 30% to 70% of the biogas produced on site for heating. Wastewater is exploring opportunities to capture, clean and inject unutilized biogas into ATCO's natural gas distribution system, offsetting the use of non-renewable natural gas, and almost entirely eliminating flaring of biogas; and
- Continuing to focus on internal labour to deliver capital projects has allowed Wastewater to leverage in house expertise, reduce reliance on external contractors, thereby providing significant cost saving in engineering and maintenance functions.

3.2 Customers and Consumption

Wastewater's customer counts, consumption and consumption per customer are similar to those of In-City Water. Differences in customer counts, almost entirely within the commercial customer class, are attributable to "water-only" customers who are not tied into the City's drainage system, such as businesses in industrial parks that are served by septic systems, as well as seasonal water customers, such as commercial lawn watering services and golf courses. Table 3.2 below provides a comparison of 2018 and 2017-2018 forecast to actual customer counts and consumption per customer.

Table 3.2
Customers, Consumption and Consumption per Customer

		A	B	C	D
		2018		**2017-2018**	
	Customers and Consumption	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
	Customers				
1	Residential	261,058	264,381	258,624	261,809
2	Multi-Residential	3,791	3,765	3,769	3,758
3	Commercial	16,752	16,846	16,644	16,738
4	Total	281,601	284,992	279,037	282,305

		A	B	C	D
		2018		2017-2018	
Customers and Consumption		PBR Forecast	Actual	PBR Forecast	Actual
	Monthly Consumption per Customer				
5	Residential	14.4	14.5	14.5	14.5
6	Multi-Residential	408.8	391.3	408.8	393.3
7	Commercial	122.9	117.1	123.8	118.2
	Annual Consumption - ML				
8	Residential	45,112.6	45,900.9	90,148.3	91,269.6
9	Multi-Residential	18,598.6	17,679.2	36,976.7	35,474.1
10	Commercial	24,695.5	23,675.1	49,470.4	47,473.4
11	Total	88,406.7	87,255.2	176,595.5	174,217.1

Actual to forecast differences in Wastewater's customer counts and consumption are attributable to the same factors discussed in Section 2.2.

3.3 Financial Performance

Wastewater's revenue requirements are summarized on Table 3.3 below.

Table 3.3
Wastewater Revenue Requirements
($ millions)

		A	B	C	D
		2018		2017-2018	
Summary of Revenue Requirements		PBR Forecast	Actual	PBR Forecast	Actual
1	Wastewater Rate Revenue*	92.5	89.8	179.2	174.4
	Wastewater Revenue Requirement				
2	Operating expenses	55.6	49.1	109.6	96.2
3	Other revenue	(6.5)	(6.2)	(12.7)	(12.4)
4	Depreciation and amortization	15.7	16.0	29.6	30.4
5	Return on rate base financed by debt	11.5	10.9	21.5	21
6	Return on rate base financed by equity	17.8	20.0	33.9	39.2
7	Wastewater Revenue Requirement*	94.1	89.8	181.9	174.4
8	**Return on Rate Base Financed by Equity**	**10.18%**	**12.14%**	**10.18%**	**12.37%**

* In the PBR forecast, rebasing and other special rate adjustments have been smoothed over the PBR term. Therefore, although forecast revenue is equal to the revenue requirement over the 2017-2021 PBR term, in any year within the PBR term, forecast revenue may be greater or less than the revenue requirement

Detailed explanations for forecast to actual variances for each of the elements of the revenue requirement are provided in sections 3.3.1 to 3.3.6.

3.3.1 Revenue

Wastewater's rate revenues include fixed monthly services charges applied on a per connection basis, and consumption charges applied to each cubic metre of consumption. Besides rate revenues, Wastewater also has a relatively small amount of other revenue, about 60% of which relates to overstrength surcharges that are subject to the same rate adjustment mechanism as Wastewater's rate revenue. Table 3.3.1 below provides a comparison of Wastewater's 2018 actual and forecast revenue.

Table 3.3.1
Wastewater Revenue
($ millions)

		A	B	C	D
	Wastewater Revenue	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Fixed Monthly Service Charges				
1	Residential	14.5	13.5	27.8	26.8
2	Multi-Residential	0.2	0.2	0.4	0.4
3	Commercial	0.9	0.9	1.8	1.7
4	Fixed Monthly Service Charges	15.6	14.6	30.0	28.9
	Consumption Charges				
5	Residential	39.9	40.2	77.3	77.3
6	Multi-Residential	16.4	15.4	31.7	30.0
7	Commercial	20.7	19.7	40.1	38.2
8	Consumption Charges	76.9	75.2	149.2	145.5
9	Wastewater Rate Revenue	92.5	89.8	179.2	174.4
10	Other Revenue	6.5	6.2	12.7	12.4
11	**Total Wastewater Revenue**	**99.0**	**96.0**	**191.9**	**186.8**

Wastewater's revenues were $3.0 million less than forecast in 2018, and $4.7 million less than forecast over the 2017-2018 PBR period. This difference is attributable to three factors:

- Lower than forecast inflation resulted in a $1.0 million decrease in revenue in 2018 ($1.9 million for 2017-2018). Since rate increases are capped at inflation less the efficiency factor ("i-x"), lower than forecast inflation in 2017 and 2018 will continue to impact revenues throughout the remainder of the 2017-2021 PBR term;
- Lower than forecast consumption (2018 - $1.2 million, 2017-2018 $2.4 million). As with Water, while residential consumption per customer is unchanged from the PBR forecast, unexpected decreases in per customer consumption in the commercial and multi-residential customer classes continue to be a source of concern. Accordingly, EWSI is working to enhance consumption forecasting processes for the commercial and multi-residential customer classes; and
- The non-routine adjustment related to the transfer of Drainage Services to EPCOR (see Section 1.5) has reduced revenues by $0.8 million in 2018 (also $0.8 million in 2017-2018).

3.3.2 Operating Expenses by Function

Wastewater's operating expenses are presented and analyzed on both functional and cost category bases. Actual and forecast operating expenses by function are shown in Table 3.3.2 below:

Table 3.3.2
Operating Expenses by Function
($ millions)

		A	B	C	D
	Function and Sub-function	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Power, Other Utilities and Chemicals				
1	Power and Other Utilities	5.3	4.7	10.6	9.4
2	Chemicals	1.6	1.2	3.2	2.2
3	Power, Other Utilities and Chemicals	6.9	5.9	13.7	11.6
	Wastewater Treatment				
4	Wastewater Treatment Plant	18.8	17.7	37.2	34.9
5	Operations Support Services	8.2	6.3	16.1	12.8
6	Capitalized Overhead	(2.4)	(2.9)	(4.7)	(6.0)
7	Wastewater Treatment	24.6	21.1	48.6	41.7
	Billing, Meters and Customer Service				
8	Billing and collections	3.3	3.1	6.5	6.4
9	Meter reading	2.4	2.4	4.7	4.5
10	Regulatory Services	1.0	1.4	2.0	2.4
11	Billing, Meters and Customer Service	6.7	6.9	13.2	13.4
	EWSI Shared Services				
12	EWSI Shared Services	3.4	3.1	6.7	6.3
13	Incentive and Other Compensation	1.1	0.8	2.3	0.8
14	EWSI Shared Services	4.5	3.9	9.0	7.0
15	Corporate Shared Services	5.0	3.8	9.8	7.9
	Franchise Fees and Property Taxes				
16	Franchise Fees	7.1	7.0	14.0	13.6
17	Property Taxes	0.8	0.6	1.4	1.2
18	Franchise Fees and Property Taxes	8.0	7.6	15.3	14.8
19	**Total Operating Expenses by Function**	**55.7**	**49.1**	**109.7**	**96.3**

Overall, Wastewater's operating expenses for 2018 were $6.5 million less than forecast ($13.3 million less for 2017-2018). Key factors contributing to this difference include:

- **Power and Other Utilities** - $0.6 million less than forecast in 2018, ($1.2 million less for 2017-2018), due to lower than forecast power prices.
- **Chemicals -** $0.4 million less than forecast in 2018 ($1.0 million less for 2017-2018), primarily attributable to two factors. First, the Ostara nutrient removal facility was offline more than expected, resulting in lower chemical usage throughout 2017 and 2018. Second, process and dosing optimization enabled Wastewater to achieve significant reductions in alum usage in both 2017 and 2018.
- **Wastewater Treatment** - $3.5 million less than forecast in 2018 ($6.9 million less for 2017-2018). The favourable variance is primarily attributable to adjustments to the capital program, where projects with a high component of contractor costs have been replaced by capital maintenance and repair projects completed by Wastewater personnel. These changes have led to capitalization of an additional $2.0 million of internal labour costs that would otherwise have been expensed ($3.9 million for 2017-2018) and additional capitalized overheads of $0.5 million in 2018 ($1.3 million for 2017-2018). Besides these changes, the favourable variance also reflects lower than forecast fringe benefits costs of $0.5 million in 2018 ($0.9 million for 2017-2018) related to lower pension

contributions, and $0.6 million in savings in contractor costs ($0.7 million for 2017-2018) resulting from dissolution of the Centre for Excellence. The remainder of the variance results from numerous small items, none of which are individually significant.

- **EWSI Shared Services** - $0.7 million less than forecast in 2018 ($1.9 million less for 2017-2018). Lower than forecast costs in this category reflect a $0.4 million reduction in business unit allocations related to the transfer of Drainage Services to EPCOR ($0.7 for 2017-2018), and $0.2 million of savings in long term disability premiums ($0.6 million for 2017-2018). The remainder of the variance results from numerous small items, none of which are individually significant.
- **Corporate Shared Services** - $1.1 million less than forecast in 2018 ($1.9 million less for 2017-2018). These differences reflects both the reduction in corporate cost allocations resulting from the transfer of Drainage from the City of Edmonton to EPCOR Utilities Inc., as well as cost savings in corporate functions. As with In-City Water, the cost reductions arising from the transfer of Drainage Services have been returned to Wastewater customers through a non-routine adjustment to 2018 water rates.
- **Franchise Fees and Property Taxes** - $0.4 million less than forecast in 2018 ($0.6 million less for 2017-2018). As with water, lower than forecast franchise fees reflect lower than forecast revenues.

3.3.3 Operating Expenses by Cost Category

Table 3.3.3 shows operating expenses by cost category for Wastewater Treatment Plant Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 3.3.2.

Table 3.3.3
Operating Costs by Cost Category
($ millions)

		A	B	C	D
	Cost Category	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Wastewater Treatment				
1	Staff Costs and Employee Benefits	17.5	15.0	34.6	29.2
2	Contractors and Consultants	4.1	3.6	8.0	7.5
3	Materials and Supplies	2.0	2.0	4.0	4.4
4	Other	1.0	0.5	2.0	0.6
5	Wastewater Treatment Expenses	24.6	21.1	48.6	41.7
	Billing, Meters and Customer Service				
6	CUS Charges	3.3	3.1	6.5	6.4
7	Contractors and Consultants	3.4	3.8	6.7	6.9
8	Billings, Meters and Customer Services Expenses	6.7	6.9	13.2	13.4
	EWSI Shared Services				
9	EWSI Shared Services Allocation	3.1	2.7	6.2	5.5
10	Staff Costs and Employee Benefits	1.3	1.1	2.5	1.4
11	Other	0.1	0.1	0.2	0.1
12	EWSI Shared Services Expenses	4.5	3.9	9.0	7.0

The information presented in this table supports the explanations of differences between 2017 actual and forecast expenses provided in Section 3.3.3. Accordingly, no additional explanations are considered necessary.

3.3.4 Depreciation and Amortization

Wastewater's depreciation expense and amortization of contributed assets for 2018 are shown in Tables 3.3.4 below:

Table 3.3.4
Depreciation and Amortization
($ millions)

		A	B	C	D
	Depreciation and Amortization	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Gross depreciation expense	16.6	17.0	31.5	32.3
2	Amortization of contributions	(0.9)	(0.9)	(1.9)	(1.9)
3	**Depreciation, net**	**15.7**	**16.0**	**29.6**	**30.8**

Wastewater's 2018 depreciation expense was $0.4 million greater than forecast ($0.8 million greater for 2017-2018), even though plant in service was $47.4 million (8%) less than forecast at December 31, 2018 (Table 3.3.5, line 4). This difference results from adjustments to Wastewater's capital program where asset replacement projects were replaced with capital maintenance and repair projects, which have higher effective depreciation rates than asset replacements. In the PBR forecast depreciation expense was calculated as if all asset additions related to new assets, rather than repair or to overhauls of existing assets. EWSI expects that the effect of higher than forecast depreciation rates will continue through the remainder of the 2017-2021 PBR term.

3.3.5 Rate Base

Wastewater's 2018 mid-year rate base, shown in Table 3.3.5 below, was $24.1 million less than forecast, reflecting lower than forecast capital additions in 2017 resulting from project deferrals and the other adjustments to the capital program described in Section 3.4.1.

Table 3.3.5
Mid-Year Rate Base
($ millions)

		A	B
		2018	
	Components of Mid-Year Rate Base, net of Contributions	**PBR Forecast**	**Actual**
	Plant in Service		
1	Balance, beginning of year	587.1	547.8
2	Capital additions	52.3	52.1
3	Retirements and adjustments	-	(8.0)
4	Balance, end of year	639.4	592.0
5	Mid-Year Plant in service	613.3	569.9
	Accumulated Depreciation		

		A	B
		2018	
	Components of Mid-Year Rate Base, net of Contributions	**PBR Forecast**	**Actual**
6	Balance, beginning of year	151.2	136.2
7	Depreciation expense	16.6	17.0
8	Retirements and adjustments	-	(8.0)
9	Balance, end of year	167.8	145.1
10	Mid-Year Accumulated Depreciation	159.5	140.6
	Other Rate Base Items		
11	Working Capital	5.7	5.9
12	Materials and Supplies	1.7	1.7
13	**Gross Mid-Year Rate Base**	**461.2**	**436.8**
	Contributions		
14	Balance, beginning of year	41.0	41.0
15	Contributions in aid of construction	-	-
16	Balance, end of year	41.0	41.0
17	Mid-Year Contributions	41.0	41.0
18	Accumulated Amortization	16.5	16.5
19	Balance, beginning of year	0.9	0.9
20	Amortization of contributions	17.5	17.5
21	Balance, end of year	17.0	17.0
22	Mid-Year Accumulated Amortization	16.5	16.5
23	**Mid-Year Contributions**	**24.0**	24.0
24	**Mid-Year Rate Base**	**437.3**	**412.8**

Unlike In-City Water, where contributions relate primarily to developer-funded assets, contributions included in Wastewater's rate base offset the cost of non-utility assets included in Wastewater's plant in service. This treatment ensures that the capital costs associated with these assets are not borne by utility rate payers. The cost of operating these assets, as well as any related revenues are also excluded from Wastewater's financial results.

3.3.6 Return on Rate Base

In 2018, Wastewater's return on equity was $2.2 million (1.86%) greater than forecast and $5.3 million (2.19%) greater for 2017-2018. In 2018, higher than forecast net income accounted for 1.36% of this increase (1.68% for 2017-2018), with a lower than forecast rate base accounting for the remainder. EWSI expects that operating cost savings (see section 3.3.2) will continue to drive higher than forecast returns on equity for the remainder of the 2017-2021 PBR term.

Table 3.3.6-1
Return on Rate Base
($ millions)

	Return on Rate Base	2018 PBR Forecast	2018 Actual	2017-2018 PBR Forecast	2017-2018 Actual
1	Mid-year Rate Base	437.3	412.8	832.3	792.4
	Capital Structure				
2	Debt (%)	60.00%	60.00%	60.00%	60.00%
3	Equity (%)	40.00%	40.00%	40.00%	40.00%
	Cost of Capital				
4	Cost of Debt	4.37%	4.38%	4.30%	4.42%
5	Cost of Equity	10.18%	12.14%	10.18%	12.37%
6	Weighted Average Cost of Capital	6.69%	7.48%	6.65%	7.60%
	Return on Mid-Year Rate Base				
7	Return on Rate Base Financed by Debt	11.5	10.9	21.5	21.0
8	Return on Rate Base Financed by Equity	17.8	20.0	33.9	39.2
9	**Return on Mid-year Rate Base**	**29.3**	**30.9**	**55.4**	**60.2**

Wastewater's weighted average cost of debt calculation, shown in Table 3.3.6-2 below, yields average debt costs that are very close to forecast, as Wastewater has reduced issuances of new long-term debt in response to lower than forecast capital expenditures. Accordingly, lower than forecast interest expense is attributable to lower than forecast debt issuances.

Table 3.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B	C	D
	Interest Expense and Cost of Debt	2018 PBR Forecast	2018 Actual	2017-2018 PBR Forecast	2017-2018 Actual
	Interest Expense				
1	Interest on short-term debt	0.9	1.0	1.8	2.1
2	Interest on City of Edmonton debentures	3.1	2.8	6.4	6.2
3	Interest on intercompany debentures	7.9	7.2	13.9	13.0
4	Total Interest expense	11.8	10.9	22.1	21.2
	Mid-year debt and other long-term liabilities				
5	Mid-Year Short-term debt	31.1	23.8		
6	Mid-Year Long-term debt	238.2	225.7		
7	Mid-Year Other Long-term liabilities	0.5	0.2		
8	Total Mid-year debt and other long-term liabilities	269.8	249.7		
9	**Embedded cost of Debt**	**4.37%**	**4.38%**	**4.30%**	**4.42%**

3.3.7 Transactions with Affiliates

Wastewater derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EPCOR Water Services Inc. business units. Table 3.3.7 summarizes Wastewater's transactions with affiliates.

Table 3.3.7
Transactions with Affiliates
($ millions)

		A	B	C	D
	Affiliate and Service	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**				
2	Wastewater Treatment Services	1.0	1.2	2.0	2.3
3	Other Services	0.2	0.0	0.5	0.3
4	Total	1.2	1.3	2.5	2.6
5	**Services provided by (recovered from):**				
6	**City of Edmonton**				
7	Franchise Fees	7.1	7.0	14.0	13.6
8	Property Taxes	0.8	0.6	1.4	1.2
9	Interest on Long Term Debt	3.1	2.8	6.4	6.2
10	Regulatory Services	1.0	-	2.0	0.7
11	Other Services	0.2	0.2	0.4	0.4
12	Total	12.2	10.6	24.1	22.0
13	**EPCOR Utilities Inc.**				
14	Corporate Shared Service Costs	5.0	3.8	9.8	7.9
15	Interest on Intercompany Loans	7.9	7.2	13.9	13.0
16	Interest on Short-term debt	0.9	1.0	1.8	2.1
17	Total	13.7	12.0	25.5	22.9
18	**EPCOR Distribution and Transmission Inc.**				
19	Maintenance and other services	0.1	0.0	0.1	0.2
20	**EPCOR Technologies Inc.**				
21	Hydrovac Charges	-	0.1	-	0.2
22	**EPCOR Energy Alberta LP**				
23	Billing and Collection Services	3.0	2.8	5.8	5.7
24	**Other EWSI Business Units**				
25	EWSI Shared Services Allocation	3.1	2.7	6.2	5.5
26	Meter reading services from In-City Water	2.4	2.4	4.7	4.5
27	Water purchases from In-City Water	0.4	0.4	0.7	0.8
28	Regulatory services from Drainage Services	3.0	1.4	5.8	1.8
29	Project engineering recoveries from Drainage	-	(0.3)	-	(1.2)
30	Laboratory services recoveries from Drainage	-	(0.3)	-	(0.4)
31	Total	8.9	6.3	17.5	11.0
32	**Expenditures on capital projects arising from services provided by:**				
33	EPCOR Technologies Inc.	-	0.2	-	0.2
34	EPCOR Utilities Inc.	-	0.2	-	0.2
35	Total	-	0.4	-	0.4

3.4 Capital Programs

3.4.1 Capital Expenditures

Table 3.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2018 for each project with approved capital expenditures in excess of $5.0 million over the 2017-2021 PBR term, as well as for each project category. Table 3.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI's current capital forecast.

Table 3.4.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	
		2018			**2017-2021**			
		PBR Forecast	**Actual**	**Increase (Decrease)**	**PBR Forecast**	**Current Projection**	**Increase (Decrease)**	
1	**Reliability and Life Cycle Improvements**							
2	GB - Sludge Line Upgrades	1.1	3.8	2.7	3.4	8.1	4.7	1
3	GB - Replace 2.5km of Sludge Line	-	1.1	1.1	-	7.5	7.5	2
4	GB - Clarifier Chain Replacement	0.4	3.6	3.2	4.1	9.9	5.8	3
5	GB - Structural Rehab Program	1.5	1.8	0.3	7.7	12.7	5.0	4
6	GB - Build Pipe Racks	-	0.0	0.0	-	5.0	5.0	5
7	GB - Structural Rehab Secondaries 1-8	3.4	4.0	0.6	17.6	21.5	3.9	6
8	GB - Electrical Rehab Program	0.5	1.7	1.3	7.2	10.7	3.6	7
9	GB - Mechanical Rehab Program	4.1	6.9	2.8	15.6	18.9	3.3	8
10	GB - Distribution Chamber Reconstruction	2.7	2.6	(0.0)	3.8	6.5	2.7	9
11	GB - Utility Hot Water System Rehabilitation	5.9	4.2	(1.8)	13.9	13.9	0.0	
12	GB - Operations Center at Mid-Point Entrance	4.6	0.5	(4.1)	19.4	8.4	(10.9)	10
13	GB - Digester 4 Upgrades	-	0.2	0.2	12.0	1.2	(10.7)	11
14	GB - Site Ventilation Rehabilitation	8.9	4.9	(4.0)	31.5	24.8	(6.7)	12
15	GB - Headworks and Primary Aeration System Upgrades	5.5	0.1	(5.4)	6.7	1.3	(5.4)	13
16	GB - Buildings and Site Rehab	4.6	1.1	(3.4)	12.8	7.9	(4.9)	14
17	GB - Digester 3 Upgrades	4.4	4.6	0.2	11.3	11.0	(0.3)	
18	GB - Square 1 Gas Room Expansion	-	0.0	0.0	15.6	15.6	(0.0)	
19	Projects < $5 million	3.7	6.6	2.8	21.2	22.8	1.6	
20	Subtotal	51.3	47.8	(3.4)	203.4	207.6	4.3	
21	**Hydrovac Sanitary Grit**							
22	GB - Hydrovac Sanitary Grit Treatment Facility	-	0.6	0.6	8.4	7.3	(1.1)	
23	**Performance Efficiency and Improvement**							
24	Projects < $5 million	5.0	3.6	(1.4)	17.6	18.0	0.4	
25	**Growth/Customer Requirements**							
26	Projects < $5 million	-	0.0	0.0	1.5	0.2	(1.3)	
27	**Health, Safety and Environment**							
28	Projects < $5 million	1.6	0.5	(1.2)	4.5	3.2	(1.3)	
29	**Capital Expenditures, net of Contributions**	**57.9**	**52.5**	**(5.4)**	**235.4**	**236.3**	**0.9**	

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million include:

1. **Sludge Line Upgrades –** $4.7 million (140%) greater than forecast. The forecast cost of this project included only the costs of cleaning and inspecting the sludge lines between Gold Bar and the Clover Bar lagoons. Inspections have since shown that the sludge lines are in poor condition and require significant expenditures to ensure that they can continue to operate with minimal risk of leakage.
2. **Replace 2.5 km of Sludge lines** – $7.5 million (new project). This project provides for replacement of a 2.5 km section of the sludge line between the Clover Bar lagoons at the NSR. This section of the sludge line was found to be in such poor condition that repairs and/or rehabilitation was not financially viable.
3. **Clarifier Chain Replacement** – $5.8 million (143%) greater than forecast. The costs of this project have increased significantly following the premature failure of stainless steel clarifier chains due to unexpected localized corrosion. These chains are being replaced with plastic loop chains which have a better record of performance at Gold Bar.
4. **Structural Rehabilitation Program –** $5.0 million (66%) greater than forecast, primarily due to the costs of addressing severe concrete deterioration at the Gold Bar Diversion Structure caused by long-term H2S gas exposure ($9.0 million). This increase has been partially offset by deferral of lower priority structural rehabilitation sub-projects.
5. **Build Pipe Racks –** $5.0 million (new project). This project provides for construction of an above-ground pipe rack network to allow the relocation of biogas piping, glycol heating lines and electrical circuits out of underground tunnels. Moving these utilities above ground will reduce tunnel ventilation upgrade costs, enable future expansion of process piping and facilitate compliance with building and fire codes.
6. **Structural Rehabilitation Secondaries 1-8 –** $3.9 million (22%) greater than forecast. Following the rehabilitation of the clarifier, EWSI updated the forecast costs of this project to reflect current expectation of asset condition and the cost of required repairs. These revised cost estimates have been applied to all remaining in-scope Secondaries and Bioreactors.
7. **Electrical Rehabilitation Program** – $3.6 million (50%) greater than forecast, reflecting the costs of constructing a new West Scrubber electrical building to isolate electrical equipment from corrosive environment ($2.0 million), and evaluating, rehabilitating and upgrading biogas flow meters ($1.0 million).
8. **Mechanical Rehabilitation Program** – $3.3 million (21%) greater than forecast, reflecting expenditures on emergency repairs. The most significant repairs included repair of a leaking glycol heating line ($1.9 million), and replacement of six aluminum gates on Screens 4 – 6 ($1.0 million) to allow tank isolation and maintenance.
9. **Distribution Chamber Reconstruction –** $2.7 million (72%) greater than forecast. The increase in the forecast cost of this project results from higher than expected competitive bids from contractors, as well as higher than expected costs to demolish the distribution chamber and to construct the lift station tie-ins.
10. **Operations Centre at Mid-Point Entrance –** $10.9 million (57%) less than forecast. Changes to the costs and timing of this project reflect design reviews and scope adjustments incorporating the results

of public consultation and on-going negotiations with the City of Edmonton regarding a “land swap” in Gold Bar Park.

11. **Digester 4 Upgrades** – $10.7 million (90%) less than forecast, as lower than expected increases in solids loading to the plant have provided sufficient capacity to delay upgrades to Digester 4.
12. **Site Ventilation Rehabilitation Program** – $6.7 million (21%) less than forecast, primarily due to changes to the design of the ventilation of the EPT Building.
13. **Headworks and Primary Aeration System Upgrades** – $5.4 million (81%) less than forecast, reflecting a reduction in the scope of this project following EWSI’s determination that restoring aeration in the main influent channels was not required.
14. **Buildings and Site Rehabilitation Program** – $4.9 million (38%) less than forecast. The scope of this project was reduced following an internal review which concluded that certain sub-projects could be safely deferred, allowing resources to be focused on unanticipated, higher-priority projects.

3.4.2 Construction Work in Progress

Wastewater’s rate base consists of plant in service. If a capital project has not been completed (i.e. not placed into service) during the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. The 2018 year-end balance of Wastewater’s Construction Work in Progress is $7.1 million greater than forecast, reflecting changes in the timing of project completion.

Table 3.4.2
Construction Work in Progress
($ millions)

		A	B	C	D
	Construction Work in Progress	**2018**		**2017-2018**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Balance, beginning of period	12.7	25.0	19.2	22.6
2	Capital Expenditures	57.9	52.5	112.3	99.3
4	Capital Additions	(52.3)	(52.1)	(113.3)	(96.5)
7	**Balance, end of period**	**18.3**	**25.4**	**18.2**	**25.4**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction (“AFUDC”). In 2018, because of the higher average balance of Construction Work in Progress, AFUDC included in capital expenditures on eligible projects amounted to $1.7 million, compared to the PBR forecast amount of $0.9 million.

3.5 Operational Performance

3.5.1 Water Quality and Environmental Index

The Water Quality and Environmental index is a composite measure intended to assess EWSI's impact on the environment through the quality of the wastewater effluent returned back to the North Saskatchewan River and the effectiveness of environmental management programs.

Table 3.5.1
Water Quality and Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Factor	The value of the Wastewater Effluent Limit Performance, which aggregates measures of the percentage of the discharge limit for five parameters in the Gold Bar wastewater treatment plant's final effluent.	> 28.0%	27.2%	1.029
Environmental Incident Factor	The actual number of environmental incidents that are both reportable and preventable	< 10	2	5.000
			Average Index	3.014
			Index Standard Points	55.0
			Total Actual Points	165.8
			Maximum Available Points Including Bonus Points	60.5
			Total Points Earned	**60.5**

2018 Highlights

- **Wastewater Effluent Limit Performance Index.** Sustained focus on Biological Nutrient Removal ("BNR") operations enabled Wastewater to maintain performance throughout the year, even when the clarifiers were offline for unplanned maintenance. Continuous improvement of preventative maintenance programs, including inspections of chains and drive mechanisms in secondary clarifiers, are expected to further reduce unplanned downtime over the remaining years of the 2017-2021 PBR term.

- **Environment Incident Management.** Root cause investigations were carried out on three reportable events (wastewater release from a digested sludge line, partial failure of the ultra violet disinfection system operation and an underground glycol leak). Two of these events were determined to preventable after review (partial failure of UV disinfection, glycol leak). These investigations provided information that resulted in improvements to operating, maintenance and asset management practices.

3.5.2 Customer Service Index

Wastewater's customer service index for the 2017-2021 PBR term includes three equally weighted odour metrics. These metrics recognize that Wastewater's customer interactions typically relate to odour concerns from customers located close to the Gold Bar Wastewater Treatment Plant.

Table 3.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
H_2S - 1 Hour Exceedance Factor	The average of the number of exceedances of the 1 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	< 6	2	3.000
H_2S - 24 Hour Exceedance Factor	The average of the number of exceedances of the 24 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	< 2	0	2.000
Scrubber Uptime Factor	The percentage of time that the scrubbers are on line.	> 90%	90.8%	1.009
			Average Index	2.003
			Index Standard Points	15.0
			Total Actual Points	30.04
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2018 Highlights

- **H_2S - 1 and 24 Hour Exceedance Factor.** Improved odour monitoring tools, such as fence line H_2S monitoring, and processes enabled timely identification of process abnormalities, allowing operators to intervene and avoid exceedances. Fugitive emission odours were also reduced by covering the Enhanced Primary Clarifiers and improving ventilation through the facility. Scrubber uptime was also improved.
- **Scrubber Uptime Factor.** Redundant scrubber chemical feed pumps and instrumentation were added in 2018 to three of the four scrubbers on-site, improving reliability and performance scrubber operations.

3.5.3 System Reliability and Optimization Index

The system reliability and optimization index is a measure of the performance of the Gold Bar Wastewater Treatment Plant and the degree to which the wastewater treatment system is optimized to minimize its impact on the environment.

Table 3.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Enhanced Primary Treatment Factor	The percentage of time that the enhanced primary treatment facility ran during wet weather events where the influent flow rate exceeded the EPT event threshold.	> 80.0%	98.7	1.234
Biogas Utilization Factor	The percentage of biogas utilized, calculated as the volume of biogas produced less the volume flared divided by the volume produced.	> 60.0%	75.6%	1.260
Energy Efficiency Factor	The energy used in all wastewater facilities in kWh divided by the volume of wastewater effluent that either receives ultraviolet (UV) treatment or is membrane plant effluent.	< 514	503.6	1.021
			Average Index	1.272
			Index Standard Points	15.0
			Total Actual Points	17.6
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2018 Highlights

- **Enhanced Primary Treatment (EPT).** Proactive planning of maintenance activities related to EPT processes have minimized downtime and maximized availability.
- **Biogas Utilization Factor.** Optimization of flare and boiler set points increased biogas utilization in the boilers and heating loops throughout 2018. Further optimization is planned for 2019.
- **Energy Efficiency Factor.** New operating software improved operating efficiency of the UV disinfection system in 2018. Operations will continue to optimize the UV disinfection dose set points in 2019 to further reduce energy consumption while still meeting wastewater disinfection targets.

3.5.4 Safety Index

EPCOR and EWSI are committed to a safe, healthy lifestyle and demonstrate this through care and concern for people. The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public

Table 3.5.4
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	>220	241	1.095
Work Site Inspection Factor	Number of Work Site Inspections and observations completed per year.	>919	971	1.057
Lost Time Frequency Factor	The actual lost time frequency rate.	<0.75	0.00	2.000

Index Component	PBR Performance Measure	Standard	Actual Score	Index
All Injury Frequency Factor	The actual all injury frequency rate	<1.50	0.00	2.000
Average Index				1.538
Index Standard Points				15.0
Total Actual Points				23.1
Maximum Available Points Including Bonus Points				16.5
Total Points Earned				**16.5**

2018 Highlights

- **Lost Time Frequency Factor** and **All Injury Frequency Factor.** Wastewater had no lost time events since 2011 and no injuries requiring medical treatment since 2016. Wastewater will continue to build on this success in 2019, focusing on improving safe work planning to incorporate situational awareness; and focusing on low risk hazards when going to and from the job.

3.6 Rates and Bill Comparisons

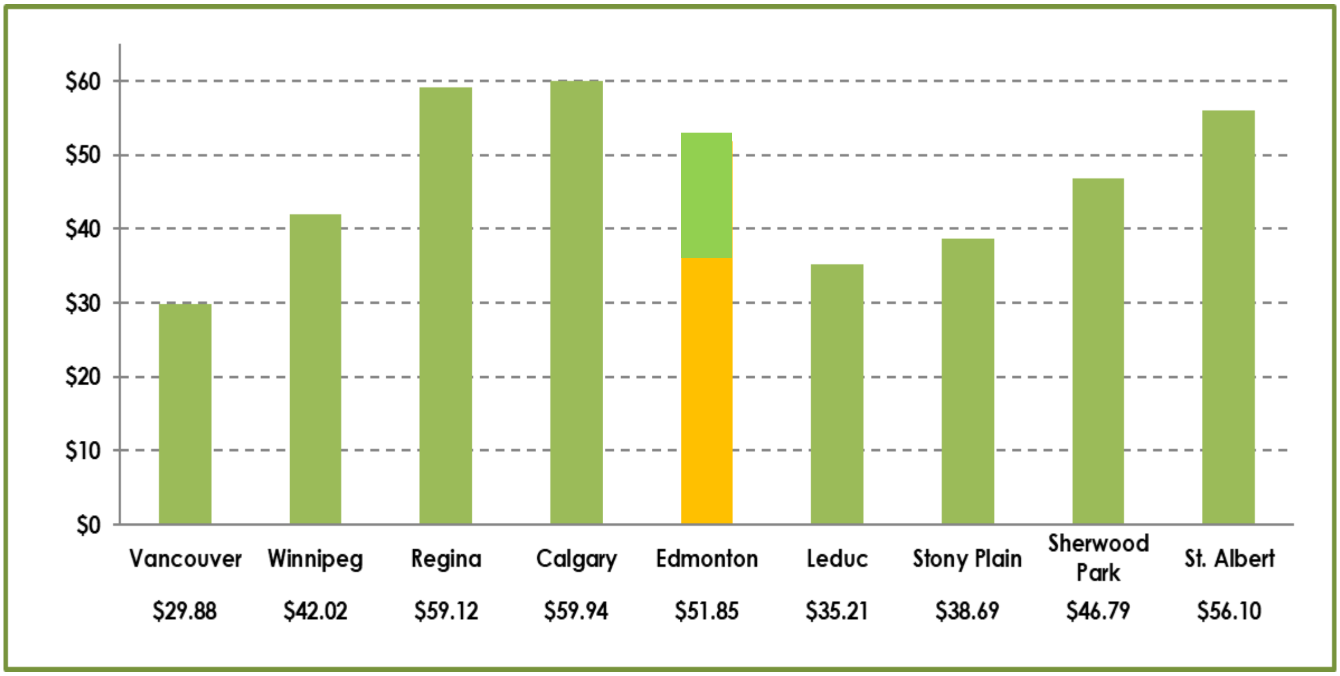
Wastewater and Drainage bill comparisons for 2018 are based on the published drainage and wastewater treatment rates for Calgary, Vancouver Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

Unlike most cities, where wastewater treatment services and drainage services are combined, Wastewater is only responsible for wastewater treatment; the operations and maintenance of sanitary, storm and combined sewer systems are provided through EPCOR Drainage Services. Accordingly, wastewater bill comparisons are based on blended EWSI wastewater treatment and drainage rates.

3.6.1 Residential Wastewater and Drainage Bills

Figure 3.6.1 provides a comparison of residential household wastewater and drainage bills for residential household consumption of 14.4 m^3 per month, the average residential customer consumption per month in Edmonton in 2018.

Figure 3.6.1
2018 Monthly Residential Wastewater and Drainage Bill Comparison
(14.4 m^3/month)



Unlike water services which are relatively consistent among cities and communities, the nature and extent of wastewater treatment and drainage services vary significantly between cities and communities, because of differences in wastewater treatment processes, the inclusion of certain services in property taxes, and geographic and climatic factors which affect the level of investment in and approach to flood mitigation and storm water services.

Edmonton's $51.85 average monthly bill from Figure 3.6.1 includes Wastewater charges of $16.96 and Drainage Services charges of $34.89. While the total bill is higher than Vancouver and Winnipeg, it is lower than Calgary and Regina, the two cities where drainage and wastewater treatments are most comparable to Edmonton. EWSI notes that cities across Canada are experiencing increased flooding related to climate change and that substantial investments are needed to assess and address climate change-related flood mitigation.

3.6.2 Commercial Wastewater and Drainage Bills

Table 3.6.2 provides a comparison of the wastewater bills for commercial customers of various sizes. This table shows that combined wastewater and drainage bills for commercial customers are competitive with surrounding communities and with major cities in western Canada, although Edmonton's relative ranking varies with the size of the customers with larger customers receiving relatively high monthly bills. These results reflect differences in rate structures between cities and municipalities, as well as differences in the extent of wastewater treatment and drainage services provided.

Table 3.6.2
2018 Monthly Commercial Wastewater and Drainage Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	25.64	256.93	1,071	5,083
3	Calgary	54.74	390.66	1,440	7,039
4	Regina	51.30	462.00	1,916	9,098
5	Winnipeg	29.18	729.50	2,918	14,590
6	**Edmonton**	**44.20**	**514.75**	**2,106**	**10,502**
7	St. Albert	75.38	495.38	1,808	8,808
8	Sherwood Park	39.36	444.48	1,710	8,462
9	Stony Plain	30.56	413.58	1,611	7,994
10	Leduc	28.35	402.75	1,573	7,813

4 Drainage Services

4.1 Accomplishments and Challenges

On September 1, 2017, the City of Edmonton transferred Drainage to EPCOR. The principles governing the transfer are documented in a Letter of Intent developed by City Administration and EPCOR, and presented to City Council on April 11, 2017. In 2018, EPCOR focused on integrating Drainage with its other business units, laying the foundation for future efficiency gains. This work included: establishing new organizational structures, clarifying accountabilities and implementing EPCOR systems and processes. Significant accomplishments in 2018 included:

- Establishing a Project Management Office and a Capital Steering Committee, similar to those in Water and Wastewater, to monitor compliance to processes for capital project delivery, to track project progress, to identify schedule or budget variances, and to address challenges impacting project completion;
- Developing an Odour Mitigation Strategy and a Stormwater Integrated Resource Plan to address key challenges facing EPCOR's rate payers. The business case for the Stormwater Integrated Resource Plan was presented to the Utility Committee on May 10, 2019, with the Odour Mitigation Strategy presentation scheduled for June 28, 2019. As noted in Section 1.5, EWSI plans to submit requests for non-routine adjustments for both programs to the City Manager later in 2019;
- Merging Water and Drainage's Private Development inspection teams, so that rather than having separate Water and Drainage inspectors, only a single inspector is needed at a new developments:
- Creating a single point of contact within Drainage for managing infill applications for both Water and Drainage;
- Forming an Environmental Management Committee and achieving ISO 14001 certification, providing the framework and requirements needed for an effective environmental management system; and
- Completing the transfer of Drainage's Approval to Operate from the City of Edmonton in May 2018.

Drainage was included in EPCOR's 2018 Employee Engagement Survey and, despite the challenges inherent in large-sale organizational change, achieved an employee engagement score of 82%, with an overall positive rating across all functional areas. These results have been communicated to all employees and cross-functional teams have been created to create action plans on key engagement drivers to further improve the level of engagement.

4.2 Operating and Capital Cost Efficiencies

As part of the commitments made by EPCOR leading to the transfer of Drainage from the City of Edmonton, Operating Cost Efficiencies and Capital Cost Efficiencies were identified. As noted in the Grant Thornton Report "City of Edmonton 2016 EPCOR Proposal for the Drainage Transfer Analysis" these were defined as:

- Operating Cost Efficiencies: EPCOR assumes that it will be able to generate operating cost efficiencies: 1% reduction in 2017, growing by 1% annually to a maximum of 5% for the duration of the forecast year (approximately $5 million by 2021).
- Capital Cost Efficiencies: EPCOR assumes that it will be able to generate at least 10% cost efficiency on new, utility financed capital beginning immediately in 2017.

4.2.1 Operating Cost Efficiencies

The 2016 Grant Thornton report estimated operating cost efficiencies based on the City of Edmonton drainage budget that was current at the time. As illustrated in Table 4.2.1-1, by the end of 2022, the total drainage operations cost was projected to be $102.7 million versus an original City budget of $108.1 million or a total cost saving of $5.4 million.

Table 4.2.1-1
Grant Thornton Report 2016 –Operating Cost Efficiencies
($ millions)

		A	B	C	D	E	F
	Initial Estimate Cost Efficiencies	**2017 A**	**2018 A**	**2019 F**	**2020 F**	**2021 F**	**2022 F**
1	City OPEX Budget (Including Local Access fee)	96.3	98.5	101.1	103.4	105.7	108.1
2	Target OPEX Savings %	1.0%	2.0%	3.00%	4.0%	5.0%	5.0%
3	Target OPEX Savings S	1.0	2.0	3.0	4.1	5.3	5.4
4	EPCOR Target OPEX (including Local Access Fee)	95.3	96.5	98.1	99.3	100.4	102.7

Since the transfer has been completed, EPCOR has determined that a number of accounting differences between City accounting standards and EPCOR's leads to difficulty in performing an "apples to apples" comparison. These differences include large differences in whether costs are categorized as being capital or operating expenses. As part of the PBR submission these costs will be categorized into true costs differences versus those caused by differences in accounting policies.

A significant amount of work has been directed toward identification of cost efficiency opportunities in order to address the target. These range from smaller "quick wins" which have already been executed to larger opportunities that will require a substantial realignment of work responsibilities and methods. The largest opportunities, and the ones that will yield the greatest cost savings, are in alignment of work planning and execution with water services. Several additional operational opportunities have also been identified and are currently being explored including capital execution processes, engineering, etc. The two foundational requirements to exploit these opportunities are a real estate strategy that would see co-location of water and drainage functions/personnel and a common information systems platform for the identification and management of work assignments. Both of these requirements are currently in process and are anticipated to be completed over the next two years.

To date, $3.9 million of operating efficiencies have been identified. These efficiencies are from a number of operational improvements and synergies gained both within Drainage Services and from coordination with water services. These include reductions in facilities maintenance costs from outsourcing (contractor), reduction in contractor costs in planning, reduction in communication costs, biosolids savings and combining water and drainage resources for real estate and inspections. Recently (early 2019), Training and Development and Public and Government Affairs (communications) has been consolidated into a common reporting stream in order to foster additional synergies and remove redundancies. Similarly, drainage's Supply Chain (procurement, inventory management and stores) have been consolidated with water services in order to develop common processes and approaches and drive cost savings.

As Drainage is currently finalizing plans to meet the cost efficiency target, it is also noted that additional costs were required to address immediate issues post transfer. Specifically, additional safety and technical training resources were added in order to address the need to improve safety performance for both staff and the public. Staff compensation also saw adjustments through both collective agreement alignment and the addition of incentive plans to align drainage services with other EPCOR business units. Additional finance, purchasing and consultation resources were added in 2017 to support the transition to EPCOR but now those positions are being rationalized through the water drainage synergies initiative. Drainage is committing to finding efficiencies to achieve a net savings of 5%, so any costs added to address immediate issues will be offset with additional efficiencies.

From a customer's rates perspective, the achievement of operational cost efficiencies is an important component of the rebase adjustment moving into the next PBR term. That is, as the current drainage rate structure has been fixed at an average 3% increase, not achieving the planned cost savings in the initial years of the term does not impact customer rates. It is only at the transition to the next PBR term where these costs would be incorporated into customer rates as part of a special rate adjustment for rebasing. It is therefore incumbent on Drainage Services to continue to identify cost saving opportunities and ensure that the planned target is reached before the next PBR application. All cost efficiencies will be fully identified in the PBR application.

4.2.2 Capital Cost Efficiencies

Capital Cost Efficiencies identified in the Grant Thornton report were predicated on delivering the 10 year forecast Capital Program at a 10% lower cost which equated to $193.4 million over the 10 year forecast period. To date, a number of capital cost efficiencies have been enacted. These include:

- Master Agreements – the majority of capital procurement is completed under master agreements where suppliers provide fixed pricing in exchange for preferred status. This approach generally results in lower product and services acquisition costs and lower administration costs. Since the transition of drainage to EPCOR, all master agreements under renewal have included the requirements for both drainage and water. Overtime, further consolidation of the combined spend will result in greater efficiencies.
- Project Management Methodology Review – a comprehensive review and realignment of project management processes is currently underway in order to streamline project execution while ensuring consistency of approaches and toolsets while maintaining appropriate governance. This initiative will encompass water services in order to drive addition efficiencies across all capital projects.
- Capital Execution Synergies – as with operational cost efficiency opportunities, a number of larger capital execution synergies have been identified particularly through greater coordination with water services. These opportunities start with coordinated capital planning to reduce duplication of work and extend to include common crews and other delivery mechanisms. These

opportunities are currently being more fully developed but, like the significant operational synergies, are generally contingent on co-location of teams through the real estate strategy and a common information systems platform. It is anticipated that the capital opportunities will be executed over the next two years.

While the more significant capital efficiency opportunities will evolve overtime, capital efficiency savings have been achieved to date, particularly with the Stormwater Integration Resource Plan. Drainage Services has developed an approach to address stormwater flooding not previously considered and as result, is projected to complete the underlying projects for $1.6 billion. In comparison to previous approaches, which ranged for $2.2 to $4.5 billion, the Drainage Services approach represents a direct cost saving of between $0.6 billion to $2.9 billion.

4.3 Customers and Consumption

Drainage provides services to the same customers served by Wastewater. Therefore, actual customer counts, consumption per customer and total consumption are the same as those of Wastewater and actual to forecast differences in Drainage's customer counts and consumption are attributable to the same factors.

4.4 Financial Basis of Comparison

Although a PBR forecast will be developed as part of Drainage's upcoming 2022-2026 PBR application, currently Drainage does not have a City of Edmonton-approved PBR forecast to serve as the basis of comparison for financial performance. Therefore, Drainage's 2018 EPCOR drainage budget (adjusted) is used as a proxy for a PBR forecast and is the basis upon which 2018 actual financial performance has been assessed. The 2018 budget has been adjusted to a regulated basis (from IFRS) and to remove one time costs related to the transition of drainage to EPCOR. The adjusted 2018 budget, escalated at an appropriate inflation rate, will serve as the basis of comparison of actual to forecast financial results for the remainder of the 2017-2021 PBR term.

4.5 Financial Performance

Drainage's revenue requirements are summarized on Table 4.5 below. Explanations of forecast to actual variances are provided in sections 4.5.1 to 4.5.6.

Table 4.5
Drainage Revenue Requirements
($ millions)

		A	B
Summary of Revenue Requirements		**2018**	
		Budget	**Actual**
1	Drainage Rate Revenue	188.3	184.6
	Drainage Revenue Requirement		
2	Operating expenses	110.4	111.0
3	Other Revenue	(8.3)	(10.1)
4	Depreciation and amortization	29.1	32.0
5	Return on rate base financed by debt	20.8	18.7
6	Return on rate base financed by equity	36.2	32.9
7	Drainage Revenue Requirement	188.3	184.6
8	**Return on Rate Base Financed by Equity**	**6.48%**	**5.68%**

4.5.1 Revenue

Drainage's rate revenues are derived from both sanitary utility and stormwater utility services. Sanitary utility revenues are comprised of variable monthly charges based on monthly metered water consumption and flat monthly service charges based on the meter size. Stormwater utility revenues are based on area, development intensity, and zoning for individual land parcels. Rates for both sanitary and stormwater utility services from January 1, 2018 to March 31, 2022 are prescribed in Bylaw 18100 and incorporate an average annual rate increases of 3%.

Table 4.5.1 below provides a comparison of 2018 Drainage revenues to the budget:

Table 4.5.1
Drainage Revenue
($ millions)

		A	B
	Drainage Revenue	**2018**	
		Budget	**Actual**
1	Sanitary Utility		
2	Flat Monthly Service Charges		
3	Residential	35.5	31.1
4	Multi-Residential	0.5	2.1
5	Commercial	2.7	5.4
6	Flat Monthly Service Charges	38.7	38.6
7	Variable Monthly Charges		
8	Residential	45.3	44.5
9	Multi-Residential	17.7	17.0
10	Commercial	23.9	22.0
11	Variable Monthly Charges	86.9	83.5
12	Sanitary Utility Revenue	125.6	122.1
13	Storm Water Utility		
14	Residential	33.1	34.0
15	Multi-Residential	3.2	3.5
16	Commercial	26.4	25.0
17	Storm Water Utility Revenue	62.7	62.5
18	Drainage Rate Revenue	188.3	184.6
19	Other Revenue	8.3	10.1
20	**Total Drainage Revenue**	**196.6**	**194.7**

In 2018, Drainage's rate revenues were $3.9 million less than budget. This difference is primarily attributable to lower than budget consumption as discussed in section 2.3.1. This decrease is partially offset by higher than budget Other Revenues of $1.9 million reflecting increases in project cost recoveries and charges to Wastewater for compliance monitoring services.

Besides rate revenues, Drainage has Other Revenue derived from application and connection fees, wastewater transfer station services, late payment fees, miscellaneous fees pursuant to third party agreements, and other incidental services.

4.5.2 Operating Expenses by Function

Table 4.5.2 below compares Drainage's 2018 actual operating expenses to its budget:

Table 4.5.2
Operating Expenses by Function
($ millions)

		A	B
	Function and Sub-function	**2018**	
		Budget	**Actual**
1	Drainage Operations		
2	Maintenance	27.5	27.6
3	Biosolids	15.9	13.3
4	Monitoring and Compliance	4.8	4.9
5	Operations Administration	2.2	2.6
6	Drainage Operations	50.4	48.4

	Function and Sub-function	A 2018 Budget	B 2018 Actual
7	Planning and Project Support		
8	Planning	12.2	9.2
9	Project Support	0.6	3.5
10	Planning and Project Support	12.8	12.7
11	Billing and Meter Reading		
12	Meter Reading	5.9	6.3
13	CUS Charges	0.4	1.3
14	Billing and Meter Reading	6.3	7.6
15	Drainage Services Administration		
16	Shared Services	12.8	15.0
17	Incentive and Other Compensation	2.1	1.4
18	Drainage Services Administration	14.9	16.4
19	Corporate Shared Services	15.8	16.1
20	Franchise Fees and Property Taxes		
21	Franchise Fees	10.2	8.9
22	Property Taxes	0.0	0.9
23	Franchise Fees and Property Taxes	10.2	9.8
24	**Total Operating Expenses by Function**	**110.4**	**111.0**

Total operating expenses for 2018 were $0.6 million higher than budget. Key factors contributing to this difference include:

- **Maintenance -** $0.1 million greater than budget. This function includes pipeline, pumping and general maintenance. The higher than budgeted expenses reflect a lower than planned vacancy factor of $1.8 million, which is partially offset by the capitalization of $1.7 million of staff costs and materials for pump well, catch basin and manhole maintenance projects, which had been budgeted as operating expenses.
- **Biosolids** - $2.6 million less than budget. This function includes the storage and management of biosolids generated by the Gold Bar and Alberta Capital Regional wastewater treatment plants. The lower than budgeted expenses were due to lower contractor costs of $ 1.5 million due to lower activity as a result of the composter outage, and an additional $1.1 million in reduced costs was realized due to lower than planned processed biosolids volumes and improved operating efficiencies.
- **Operations Administration** - $0.4 million greater than budget. This function includes the costs of management and administration support for Drainage Operations. The higher than budget expenses of $0.5 million reflects the increased quantity of locates requested.
- **Planning -** $3.0 million less than budget. This function includes infrastructure, system and administration planning, as well as costs of surveying and engineering inspections. The lower than budget expenses includes savings of $1.7 million related to lower than anticipated contractor costs, the capitalization of staff costs of $1.4 million that were budgeted as operating costs, and savings of $0.9 million as a result of transferring lot grading inspection services back to the City of Edmonton. The lot grading inspection cost savings were offset with a proportionate decrease in associated revenues. The above noted cost savings were partially offset by additional costs of $0.6 million for administration of the Stormwater Integrated Resource Plan, as well as $0.4 million for lower than planned vacancy factor.

- **Project Support -** $2.9 million greater than budget. This function includes engineering (conceptual, preliminary design or detailed design), project management, in-house construction, and emergency repairs. The higher than budget expenses were mainly due to higher design and construction costs of $4.0 million that were recorded as operating expenses and had been budgeted as capital expenditures. These costs were partially offset by higher equipment utilization in operations, resulting in an improved cost recovery on equipment of $1.5 million.

  The remainder of the actual to budget difference was made up of numerous minor variances related to staff and contractor costs.

- **Billing and Meter Reading -** $1.3 million greater than budget. Actual costs are higher than budget due to higher than budgeted metering and customer service support costs, as well as unbudgeted call centre support costs from the City of Edmonton.

- **Drainage Services Administration -** $2.2 million greater than budget. This function includes costs for Finance and Administration, Human Resources and Training, Business Process, Supply Chain Management, and Health, Safety and Environment. The higher than forecast costs include $2.0 million related to the delay in realizing planned operating cost efficiencies as discussed in Section 4.2.1 and noted in Table 4.2.1-3.

  The remainder of the actual to budget difference is made up of minor variances related to lower staff costs, offset by higher than planned rent, utilities and rebranding costs.

- **Incentive and Other Compensation -** $0.7 million less than budget. The lower than budget expenses is mainly due to the capitalization of incentive payments; partially offset by higher than anticipated employee benefit costs.

- **Franchise Fees and Property Taxes -** $0.4 million less than budget. As with Water and Wastewater, lower than forecast franchise fees reflect lower than forecast revenues. This is partially offset by higher property taxes, which were not included in the budget as no accurate cost estimate was available at the time of budget preparation.

Variances in other operating expense functions and sub-functions are not significant, either individually or in aggregate.

4.5.3 Operating Expenses by Cost Category

Table 4.5.3 below shows operating expenses by cost category for Drainage Operations, Planning, Project Support Costs and Drainage Services Administration, where cost categories differ from the sub-functions in Section 4.5.2.

Table 4.5.3
Operating Expenses by Cost Category
($ millions)

		A	B
	Cost Category	**2018**	
		Budget	**Actual**
1	Drainage Operations		
2	Staff Costs and Employee Benefits	23.8	26.3
3	Contractors and Consultants	19.2	15.5
4	Materials and Supplies	0.2	0.1
5	Other	7.2	6.5
6	Drainage Operations	50.4	48.4
7	Planning and Project Support		
8	Staff Costs and Employee Benefits	3.2	7.9
9	Contractors and Consultants	10.2	6.2
10	Other	(0.6)	(1.4)
11	Planning	12.8	12.7
12	Drainage Shared Services		
13	Staff Costs and Employee Benefits	10.5	9.9
14	Contractors and Consultants	4.9	3.7
15	Other	(0.5)	2.8
16	Drainage Shared Services	14.9	16.4

The information presented in this table supports the explanations of differences between 2018 actual and budget expenses provided in Section 4.5.2. Accordingly, no additional explanations are considered necessary.

4.5.4 Depreciation and Amortization

Drainage's depreciation expense and amortization of contributed assets for 2018 are shown in Table 4.5.4 below:

Table 4.5.4
Depreciation and Amortization
($ millions)

		A	B
	Depreciation and Amortization	**2018**	
		Budget	**Actual**
1	Provision for depreciation	64.4	69.5
2	Amortization of contributions	(35.3)	(37.5)
3	**Depreciation, net**	**29.1**	**32.0**

Drainage's net depreciation expense is $2.9 million greater than budget. At the time the 2018 budget was prepared, Drainage had not completely finalized asset componentization and other adjustments needed for its regulated accounting. As a result, during 2018, Drainage found that actual deprecation rates, averaging 1.5%, were slightly higher than the average budget rate of 1.4%. Higher depreciation and amortization also reflect higher opening balances of property plant and equipment, as well as higher than forecast contributed and developer-funded assets, explained in section 4.5.5 below.

4.5.5 Rate Base

Drainage's mid-year rate base, shown in Table 4.5.5 below, was $21.8 million is less than budget, reflecting lower than forecast capital additions in 2018 as discussed in in Section 4.6.1.

Table 4.5.5
Mid-Year Rate Base
($ millions)

		A	B
	Components of Mid-Year Rate Base	**2018**	
		Budget	**Actual**
1	Plant in Service		
2	Balance, beginning of year	4,386.6	4,386.6
3	Additions - EPCOR-funded	124.5	84.4
4	Additions - Contributed	117.5	202.4
5	Retirements (vehicle fleet) and adjustments	0.0	(0.3)
6	Balance, end of year	4,628.6	4,673.1
7	Mid-Year Plant in service	4,507.6	4,529.9
8	Accumulated Depreciation		
9	Balance, beginning of year	853.7	853.7
10	Depreciation expense	64.4	69.5
11	Retirements (vehicle fleet) and adjustments	0.0	(0.3)
12	Balance, end of year	918.1	922.9
13	Mid-Year Accumulated Depreciation	885.9	888.3
14	Other Rate Base Items		
15	Working Capital	15.3	14.7
16	Materials and Supplies	1.4	1.7
17	**Gross Mid-Year Rate Base**	**3,638.4**	**3,657.9**
18	Contributions		
19	Balance, beginning of year	(2,887.2)	(2,887.2)
20	Contributions in aid of construction	(117.5)	(202.4)
21	Balance, end of year	(3,004.7)	(3,089.7)
22	Mid-Year Contributions	(2,946.0)	(2,988.5)
23	Accumulated Amortization		
24	Balance, beginning of year	(459.4)	(459.4)
25	Amortization of contributions	(35.3)	(37.5)
26	Balance, end of year	(494.7)	(496.8)
27	Mid-Year Accumulated Amortization	(477.0)	(478.1)
28	**Mid-Year Contributions**	**(2,469.0)**	**(2,510.4)**
29	**Net Mid-Year Rate Base**	**1,169.4**	**1,147.6**

Although the gross rate base is higher than budget, lower than forecast EPCOR-funded capital additions (see Section 4.6) and higher than budget contributed (developer-funded) capital additions, resulted in a lower than budget rate base. The value of contributed assets is difficult to forecast since developers are responsible for construction of distribution infrastructure in new subdivisions and the pace of construction can vary significantly. As well, EWSI receives contribution funding from the Sanitary Servicing Strategy Fund ("SSSF") to support drainage development throughout the City of Edmonton. The amount of SSSF funding also varies significantly in response to the level of developer activity on SSSF-eligible projects.

4.5.6 Return on Rate Base

In 2018, Drainage's return on equity was $3.3 million (0.79%) less than forecast. Lower than forecast net income accounted for 0.56% of this decrease, with a lower then budget debt to equity capital structure, and lower than forecast rate base accounting for the remainder of the difference.

Table 4.5.6-1
Return on Mid-Year Rate Base
($ millions)

		A	B
	Return on Rate Base	**2018**	
		Budget	**Actual**
1	Net Mid-Year Rate Base	1,169.4	1,147.6
2	Deemed Capital Structure		
3	Debt	52.24%	49.52%
4	Equity	47.76%	50.48%
5	Total	100.00%	100.00%
6	Cost Rates		
7	Debt	3.41%	3.29%
8	Equity	6.48%	5.55%
9	Weighted Average Cost of Capital (WACC)	4.87%	4.43%
10	Return on Rate Base		
11	Debt	20.8	18.7
12	Equity	36.2	32.9
13	**Total Return on Drainage Rate Base**	**57.0**	**51.6**

Returns on rate base are calculated separately for the debt-financed and equity-financed portions of Drainage's net rate base. The rate of return on debt is equal to the embedded cost of debt for Drainage, as calculated in Table 4.5.6-2 below:

Table 4.5.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B
	Interest Expense and Cost of Debt	**2018**	
		Budget	**Actual**
1	Interest expense		
2	Interest on short-term debt	1.1	0.7
3	Interest on City of Edmonton debentures	19.2	16.4
4	Interest on intercompany debentures	-	1.7
5	Total interest expense	20.3	18.8
6	Mid-year debt and other long-term liabilities		
7	Mid-Year Short-term debt	25.2	(12.6)
8	Mid-Year Long-term debt	569.3	584.2
9	Mid-Year Other Long-term liabilities	-	-
10	Total mid-year debt and other long-term liabilities	594.5	571.6
11	**Embedded Cost of Debt**	**3.41%**	**3.29%**

4.5.7 Transactions with Affiliates

Drainage derives a portion of its revenues and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries. Table 4.5.7 provides a summary of Drainage's 2018 actual transactions with affiliates.

Table 4.5.7
Transactions with Affiliates
($ millions)

		A	B
		2018	
	Affiliate and Service	**Budget**	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**		
2	Regulated Revenue	2.9	2.9
3	Other	0.9	1.5
4	Total	3.8	4.4
5	**Services provided by (recovered from):**		
6	**City of Edmonton**		
7	Franchise Fees	10.2	8.9
8	Property Taxes	-	0.9
9	Interest on City of Edmonton debentures	19.2	16.4
10	Other services	9.2	13.1
11	Total	38.6	39.3
12	**EPCOR Utilities Inc.**		
13	Corporate Shared Service Costs	15.7	16.0
14	Interest on short-term debt and intercompany debentures	1.1	2.4
15	Total	16.8	18.4
16	**EPCOR Energy Alberta LP**		
17	Customer Billing and Collection Services	3.9	3.9
18	Other services	-	0.3
19	Total	3.9	4.2
20	**EPCOR Distribution and Transmission Inc.**		
21	Technical Training	0.9	0.8
22	**EPCOR Commercial Services Inc.**		
23	Stormwater Planning Strategies	-	0.4
24	**Other EWSI Business Units**		
25	Customer Billing and Collection Services	2.0	2.4
26	Other services	-	0.9
27	Total	2.0	3.3
28	**Expenditures on capital projects arising from services provided by:**		
29	City of Edmonton	(33.1)	(22.3)
30	EPCOR Technologies Inc.	-	2.8
31	EPCOR Utilities Inc.	0.6	0.6
32	EPCOR Energy Services	0.3	0.3
33	EPCOR Distribution and Transmission Inc.	-	0.1
34	EPCOR Water Services Inc.	(3.2)	(3.2)
35	Total	(35.4)	(21.7)

4.6 Capital Programs

4.6.1 Capital Expenditures

Drainage's capital program is based on the long term plan for 2018 to 2021 that was used in the independent third party report assessing the transition of the Utility to EPCOR (Grant Thornton report CR_8300). Table 4.6.1 compares forecast to actual capital expenditures for 2018 for each project with approved capital expenditures in excess of $10.0 million over the 2018-2021 term, as well as for each project category. Table 4.6.1 also provides a comparison of total forecast capital expenditures for 2018 to 2021 from the long term plan to EWSI's current capital projection.

Table 4.6.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	
	Capital Project or Program	**2018**			**2018-2021**			
		Budget	**Actual**	**Increase (Decrease)**	**Long Term Plan**	**Current Projection**	**Increase (Decrease)**	
1	Drainage Neighbourhood Renewal	15.0	25.9	10.9	119.8	109.8	(10.0)	1
2	Drainage System Expansion	14.3	19.1	4.8	84.7	77.8	(6.9)	
3	Drainage System Rehabilitation	51.1	44.0	(7.1)	261.7	291.7	30.0	2
4	Environmental Quality Enhancement	16.4	6.6	(9.8)	33.2	24.6	(8.6)	3
5	Flood Mitigation	25.8	13.2	(12.6)	161.4	139.6	(21.8)	4
6	SSSF Projects	28.1	23.4	(4.7)	131.4	121.8	(9.6)	5
7	Real Estate	-	-	-	-	50.0	(50.0)	6
8	**Capital Expenditures before contributions**	**150.7**	**132.2**	**(18.5)**	**792.1**	**815.3**	**23.2**	
9	**Contributions**							
10	Drainage System Expansion	-	(7.5)	(7.5)	(25.0)	(26.3)	(1.3)	
11	Sanitary Servicing Strategy Fund Projects	(28.1)	(20.9)	7.2	(124.2)	(116.2)	8.0	
12	Subtotal	(28.1)	(28.4)	(0.3)	(149.2)	(142.5)	6.7	7
13	**Capital Expenditures**	**122.6**	**103.8**	**(18.8)**	**642.9**	**672.8**	**29.9**	
14	**Non-Routine Adjustments**							
15	Stormwater Integrated Resource Plan	-	-	-	-	97.6	97.6	
16	LRT Relocates	-	-	-	-	57.4	57.4	
17	Sanitary Odour Mitigation	-	-	-	-	50.7	50.7	
18	Subtotal	-	-	-	-	205.7	205.7	8
19	**Total Capital Expenditures**	**122.6**	**103.8**	**(18.8)**	**642.9**	**878.5**	**235.6**	

Explanations for differences between the Drainage's long term plan and the current projections are as follows:

1. **Drainage Neighbourhood Renewal** – $55.1 million (31.3%) lower than long-term plan. This category includes the costs of neighbourhood drainage asset renewal to align with the City of Edmonton's Building Great Neighbourhoods program. Lower projected costs are due to the timing of capital expenditures, as many of the projects that had been included in this category have been deferred based on anticipated renewal and replacement of sanitary and storm sewers, which will continue to align with the City of Edmonton's current programs.
2. **Drainage System Rehabilitation** – $198.0 million (166.1%) higher than long-term plan. This category includes all work required to complete rehabilitation and life cycle replacements to address asset condition. The higher projected costs are to mitigate the risk of failure and maintain service levels. Significant projects in this category includes the rehabilitation of 151 Street and 99 Avenue Sanitary Trunk, Groat Road, and Large Trunk Rehabilitation – Area S-1 and S-2a, where some projects span to the next PBR term.
3. **Environmental Quality Enhancement** – $71.3 million (70.7%) lower than long-term plan. This category includes capital expenditures that mitigate the impacts of the drainage system on the environment, such as sewer overflows, river loading, and beneficial reuse of biosolids. The lower projected costs are due to the timing of capital expenditures, as certain projects included in this category span into the next PBR term. Note that Sanitary Odour Mitigation is included as part of the Non-Routine Adjustments projects category.
4. **Flood Mitigation** – $154.4 million (62.4%) lower than long-term plan. This category includes development of drainage infrastructure and program improvements to decrease flood risks. Major projects in this category include: the Malcolm Tweddle, Edith Rogers, Lauderdale West, Newton and Kenilworth Dry Ponds; as well as the Tweddle Place sewer separations. Lower projected costs are due to timing of the capital expenditures and the inclusion of the Stormwater Integrated Resource Plan in the Non-Routine Adjustments project category
5. **Sanitary Servicing Strategy Fund (SSSF) Projects** – $16.0 million (11.6%) lower than long-term plan. The SSSF finances major sanitary trunk construction to service new development areas. EWSI works with the SSSF Management Committee to coordinate design, construction, schedules and budgets for various projects. EWSI's current forecast aligns with the SSSF Management Committee's five year construction plan (2018-2022) to support orderly, cost effective development based on population and employment projections, as well input from the development industry. Lower projected costs are due to the timing of capital expenditures on large multi-year projects.
6. **Real Estate** – $50.0 million (new project). Following the transfer of Drainage to EPCOR, an EPCOR-wide real estate review was initiated to evaluate the number of physical locations currently occupied by Water and Drainage and identify how locations could be consolidated to contribute to the cost reduction and efficiency commitments made as part for the Drainage transfer. Several options are currently under consideration and the project scope will be refined and adjusted as further information becomes available and key decisions are made.
7. **Contributions** – $55.4 million (28.0%) lower than long-term plan. Drainage has revised its contributions forecast to align with actual cost recoveries from prior years. Accordingly, current projections have been reduced to reflect Drainage's actual experience.

8. **Non Routine Adjustments –** $252.7 million (new projects). As discussed in section 1.5, Drainage expects to file three requests for non-routine adjustments to rates with the City Manager or City Council for three capital expenditures programs, including: LRT Relocations; Sanitary Odour Mitigation; and Stormwater Integrated Resource Plan. Projected capital expenditures for each of these programs represent EWSI's current estimates of capital required in the 20158-2021 PBR term. Additional spending requirements will be included in the future PBR applications.

4.6.2 Construction Work in Progress

Drainage's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base.

Table 4.6.2
Construction Work in Progress
($ millions)

		A	B
	Construction Work in Progress	**2018**	
		Budget	**Actual**
1	Balance, beginning of year	32.8	32.8
2	Capital Expenditures	122.6	104.5
3	Cancelled costs/Write-offs	0.0	(0.7)
4	Capital Additions	(124.5)	(84.4)
5	**Balance, end of year**	**30.9**	**52.2**

The PBR allows Drainage to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2018, AFUDC included in capital expenditures on eligible projects amounted to $1.7 million.

4.7 Operational Performance

4.7.1 Water Quality and Environmental Index

One of EPCOR's core commitments is to prevent pollution and reduce our environmental impacts, including those contributing to climate change and affecting the ecosystems in which we operate. Drainage Services' approvals with Alberta Environment and Parks for the collection system and associated regulatory requirements to develop and implement environmental strategies to reduce the impact of the drainage systems on the North Saskatchewan River is one way this core commitment is demonstrated. Continuous monitoring and quantification of discharges is integral to evaluating the environmental performance of Drainage strategies. The Edmonton Watershed Contaminant Reduction Index and the Total Suspended Solids Total Loading are two metrics used to quantify the discharges from the City of Edmonton.

Table 4.7.1
Water Quality and Environmental Index

	Index Metric	Measure	Target	Actual
1	Edmonton Watershed Contaminant Reduction Index Score	Index score that measures contaminants released to the North Saskatchewan River from the City of Edmonton.	> 6.9	7.5
2	Total Loading – Total Suspended Solids	Total suspended solids loading (kg/d) contributed to the North Saskatchewan River from the storm sewer system, combined sewer system, and Gold Bar Wastewater Treatment Plant.	< 50,000	45,900

2018 Highlights

- The 2018 Edmonton Watershed Contaminant Reduction Index score is 7.5. The rainfall that Edmonton experienced in 2018 was quite moderate with no large, intense rainfall events contributing to large loading levels. This index uses a 5-year rolling average in the calculation. 2013 was one of the highest load years on record and no longer influences the 5-year average starting in 2018. Implementation of Combined Sewer Overflow controls is continuously improving the capture and treatment of wet weather flows. 2019 will be the final year of reporting the EWCRI.

- The Total Suspended Solids Total Loading for 2018 (5-yr average) was 45,900 kg/d. This was lower than the target 50,000 kg/d and can be largely attributed to the rainfall events that fell on Edmonton in 2018. There were no large, intense rainfall events in 2018 to cause large loading events. Also, the 5-year rolling average used in the calculation dropped off 2013, one of the highest load years on record. Implementation of Combined Sewer Overflow controls is continuously improving the capture and treatment of wet weather flows.

4.7.2 Customer Service Index

The customer service index is a composite measure of the customers' perception of satisfaction with EWSI service, the speed of response and quality service level to customer issues.

Table 4.7.2
Customer Service Index

	Index Metric	Measure	Target	Actual
1	Emergencies Responded to Within Two hours	The efficiency in responding to customer reports or complaints that require an emergency response. The emergency repair crew is given 2 hours to respond and be on site from the time the report is received.	> 87.0%	N/A Data not available
2	Number of Blocked Mainline Sewers	The number of blockages in the mainline per 100km of pipe.	< 2.1	1.3
3	Mature Neighbourhoods at 1:100	The percentage of neighbourhoods	> 16.0%	15.0%

	Index Metric	Measure	Target	Actual
	Service Level	that are protected against a 100 year storm flood out of the 157 identified at-risk mature neighbourhoods.		
4	Odour Complaints	The number of odour complaint received from customers.	< 647	723

2018 Highlights

- The percent of mature neighbourhoods at a 1:100 service level metric is 1.0% below target. As PBR metrics for 2020 are identified, EWSI plans to introduce new performance measures focusing on the number of sub-basins protected, rather than mature neighbourhoods.
- Although the number of odour complaints increased by 76 from 2017, these results include all general odour complaints, not just those attributable to sewer odour. EWSI plans to address sewer odour issues through the new Odour Mitigation Strategy discussed in Section 1.5.

4.7.3 Reliability and Optimization Index

The System Reliability Index is a measure of the confidence that customers can place in the reliability of the drainage sanitary and stormwater systems.

Table 4.7.3
Reliability and Optimization Index

	Index Metric	Measure	Target	Actual
1	Pipe Capacity Rating - Sanitary	The percentage of linear infrastructure assessed as having a hydraulic condition rating of 2 (or B) or better. Measured separately for sanitary, storm, and combined sewer infrastructure. Measures the number of blockages in the mainline per 100km of pipe.	96.0%	96.0%
2	Pipe Capacity Rating - Storm		50.0%	50.0%
3	Pipe Capacity Rating - Combined Sewer Overflow		80.0%	80.0%
4	Infrastructure at or Above the Minimum Level of Condition Rating	The percentage of all infrastructure (including non-linear) assessed at or above the minimum level of condition rating.	90.0%	90.4%
5	Capital (as rehabilitation) Re-invested Compared to Total System Replacement	The percentage of investment dollars spent on renewal/rehabilitation work on aging drainage infrastructure compared to the total system replacement value.	0.81%	0.37%

2018 Highlights

- Although the percentage of capital reinvested compared to the total system replacement value is 0.44% below target, 2018 results only account for the rehabilitation of existing infrastructure and do not include system upgrades. EWSI is currently developing a more representative performance measure for network reliability.

4.7.4 Safety Index

The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public.

Table 4.7.4
Safety Index

	Index Metric	Measure	Target	Actual
1	Employee Engagement (survey every 2 years)	The level of employee engagement within Drainage Services as a percentage.	70.0%	82.0%
2	Employee Turnover (excluding retirements)	The percentage of employees leaving Drainage Services compared to the overall headcount. This excludes retirements. This includes voluntary, involuntary departures, and transfers to other business areas.	6.0%	4.2%
3	Lost Time Frequency Factor	The number of lost time hours resulting from a workplace injury related to the total number of hours worked (200,000 hr) in a specific time period.	0.50	0.49

<u>2018 Highlights</u>

- The employee engagement survey results reported favourable rating of 82.0% for Drainage. The results in each individual operational are also exceeded the 2018 target, and Drainage's overall results exceed the overall EPCOR engagement score of 78%.
- The employee turnover rate is lower than target by 1.8%.
- The lost time frequency index metric meets target for the year. Continued safety focus will contribute to continued improvement in this index metric in future years.

4.8 Rates and Bill Comparisons

Unlike most cities, where wastewater treatment services and drainage services are combined, EWSI currently has separate bills for wastewater treatment services and for drainage services. Accordingly, in order to provide a better basis for comparison with other cities and communities, bill comparisons in Section 3.6 utilize EWSI's blended wastewater and drainage bills.

5 2018 Annual Operating Plans

5.1 Water Services and Wastewater Treatment Services

Water Services presented the 2018 Annual Operational plan to Utility Committee on April 23, 2018. The purpose of that document was to provide Edmonton City Council, Utility Committee and stakeholders a high level perspective of the major activities and initiatives that Water Services was undertaking to meet its overarching goal of providing customers with safe and reliable water and wastewater treatment services while meeting or exceeding all environmental requirements, delivering value and achieving a fair return. The initiatives planned for 2018 are organized within six strategic focus areas:

- IMPROVE OPERATIONAL PERFORMANCE
- SERVE CUSTOMERS BETTER
- MAKE SAFETY A PRIORITY IN ALL THINGS
- PROTECT PUBLIC HEALTH AND THE ENVIRONMENT
- PLAN FOR THE FUTURE
- DEVELOP A KNOWLEDGEABLE, CAPABLE AND ENGAGED TEAM.

A comprehensive update of progress on the various initiatives was provided to Utility Committee on October 25, 2018. As most of the initiatives were still in progress at that time, the focus of the report was on activities completed to date, next steps and a description of any variation from the original intentions. Some of the larger, more complex initiatives, such as the Lead Mitigation Strategy and the E.L. Smith Solar project, warranted a separate report and presentation to Utility Committee which was completed.

In keeping with the Utility Committee Reporting Framework (presented to Utility Committee February 23, 2018), this Progress Report presents the final update on the 2018 Operational Plan. Given that the mid-year update was presented late in the year, the update herein is intended to be higher level. All initiatives have been described as either: 1) Completed, indicating that the activities are finished and the initiative is closed, 2) In-progress, indicating that work continues and the initiatives has been continued in the 2019 Operational Plan (as many initiatives are multi–year), or 3) On-going, indicating that the initiatives will never be formally completed as business requirements continue to change (e.g. operational improvement).

INITIATIVE	Year End Status
IMPROVE OPERATIONAL PERFORMANCE	
1 ASSET RELIABILITY	
Asset Management Framework and Plans - methodology and processes to ensure accurate and comprehensive information about assets – particularly the costs and risks associated with operating and maintaining those assets	• In progress – significant progress has been made in developing the overall framework and methodology. Current activities are intended to “operationalize” the approach across all areas of water services to determine future capital spending requirements in preparation of the upcoming PBR application.

INITIATIVE	Year End Status
Water Treatment Plant & Transmission System Reliability - achieve increasing water treatment plant and transmission system reliability.	• Complete - A Master plan for water treatment plants has been completed. The next steps outlined in the plan, which include more detailed studies of specific topics such as residuals treatment and a long-term capital plan to tactically build towards the future scenarios described in the Master Plan are in process. • In progress – Master Plan for Transmission and Distribution system is in development. Plan will review immediate reliability issues (pipe condition and materials) in addition to a longer term outlook based on projected growth.
2 OPERATIONAL PROCESS OPTIMIZATION	
Coordination with City of Edmonton - explore opportunities to better align and coordinate between Water D&T, City of Edmonton and EPCOR Drainage priorities and planned work.	• On-going - initiatives to improve coordination with CoE have commenced and will continue to be optimized – examples include Roadways, LRT planning and charging for water infrastructure in infill development. New requirements will evolve as both organization introduce new processes.
Fleet Management System - improvement in the safety of drivers and efficiency of the fleet through the telematics fleet management system to monitor vehicle operation.	• Complete – fleet management system has been fully implemented and reporting of performance has commenced.
Truck Fill Decommissioning - plan to assess the decommissioning of some or all of the truck fills.	• In progress – truck fill strategy presented to Utility Committee on May 10, 2019 – strategy currently being implemented.
Innovation Strategy – development of a consistent and sustainable framework for applying innovative thinking.	• Complete - innovation tool kit rolled out to all staff, all managers attended a session of fostering innovative ideas within their teams
3 ADMINISTRATIVE AND MANAGEMENT PROCESS IMPROVEMENT	
Financial Review of Efficiency and Effectiveness Project & Chart of Accounts (COA) Review and Variance Reporting - improve cost effectiveness of the finance function and improve reporting through better process and a revised Chart of Account (COA)	• Complete – Finance effectiveness review resulted in the implementation of the Adaptive financial system to facilitate improved automated financial reporting • Complete – Chart of Accounts project – revised chart of accounts developed and implemented across all areas – allows greater visibility and consistency of financial reporting
Laboratory Process Improvements – develop a systematic approach to process improvement	• In-progress – initial six sigma training completed. Internal courses to broaden the

INITIATIVE	Year End Status
to improve efficiency for Analytical Operations (i.e. analytical testing, consultation, interpretation, technical resources, etc.)	knowledge in improvement techniques underway. Initial process improvement initiatives have commenced.
Trade Agreement Compliance – ensure compliance with CETA (Comprehensive Economic Trade Agreement) and CFTA (Canadian Free Trade Agreement).	• Completed – education sessions completed to ensure awareness of requirements. Internal processes re-aligned to support compliance.
4 CAPITAL PROJECT EXECUTION PROCESSES	
Contractor Performance Program - establish a formal mechanism to manage contract performance on a consolidated, comprehensive basis across all of Water Services.	• Complete – vendor performance criteria and measurement approach developed and implemented. Reviews conducted on a “trial” basis before expanding to all major contractors.
SERVE CUSTOMERS BETTER	
Customer Centric Strategy - improve customer service and reduce customer escalations by identifying recurring issues and develop escalation and process improvements through a Customer Insights Panel**.**	• In progress – initial scope of customer insights panel completed and research firm identified. 2019 Operational plan will see the formation of the plan and development of improvement opportunities.
Community Engagement – develop an engagement approach that aligns with the City of Edmonton’s new Public Engagement Policy in order to improve relationships with the community and gain insight on expectations.	• Complete – EPCOR Stakeholder Engagement Strategy presented to Utility Committee June 8, 2018. This strategy is consistent across all of water services and drainage and has formed the framework on which all stakeholder engagement is based.
MAKE SAFETY A PRIORITY IN ALL THINGS	
1 SAFETY CULTURE	
Safety Culture Action Plan – develop a health and safety culture that has evolved to include proactive measures to address hazards and minimize incidents.	• On-going – safety awareness and communication continues to be fostered through regular safety summits, incident reviews, email summaries of incidents and general safety awareness campaigns.
2 **SAFETY SYSTEMS**	
Health, Safety & Environment Management Systems - Edmonton Water Treatment Plants, Distribution and Transmission and Gold Bar will maintain certification for their health and safety management system to OHSAS 18001:2007 and environmental management system ISO 14001:2015.	• In-progress – Water Treatment plants will register for ISO 45001 in 2019, Distribution and Transmission will conduct its next surveillance audit in 2019 and full re-registration audit in 2020. Gold Bar completed certification in 2018.
Ergonomics Plan – support employee wellness through education on how to incorporate healthy movement into everyday tasks in both field and	• Complete – all water services employees have been trained on the EPCOR Athletes program to improve ergonomic wellness.

INITIATIVE	Year End Status
office environments. Also, update existing Job Demands Analysis (JDA's).	Regular daily stretching now incorporated in most area's daily activities. • On-going – regular update of JDAs will continue as requirements evolve
Event Reporting System (ERS) Implementation – implement an Event Reporting System as the means to capture health and safety, environment, security, public health incidents and near miss data.	• Complete - ERS system has been installed and is operational across all EPCOR business units. Employees have been trained on the new application and understand how to operate ERS and track health and safety incidents and near miss reporting.
Contractor Safety Performance – ensure contractors maintain the same level of accountability and follow the same safety standards and procedures as employees.	• On-going – Contractor safety meetings completed to convey expectations. Regular on-going discussions with contractors particularly if performance does not meets expectations. In 2018 contractors achieved an all injury frequency incident rate of 0.37 versus a target of 2.15.
PROTECT PUBLIC HEALTH AND THE ENVIRONMENT	
Climate Change Strategy – develop a climate change adaption plan to ensure reliable drinking water supply for several decades into the future.	• In progress – A comprehensive climate change strategy has been completed. The strategy addresses anticipated and unanticipated changes in the source water quantity and quality and ranked areas of greatest risk – with flooding being the highest. The strategy is now being operationalized through a number of initiatives and capital plans for the facilities.
Flood Plan - WTP assets are at risk from flooding and can be impacted at flood levels below a 1:100 year event. A detailed flood protection plan will be completed and capital projects for flood protection of assets will be identified	• In progress – the Climate Change Strategy identified flooding as the highest risk. Plans are currently being developed to mitigate flood risks at the plants. Grant funding has been awarded to offset a portion of the associated costs.
1 ENVIRONMENTAL PROGRAMS	
Environmental Compliance Assurance Program - improve environmental performance across Water Services by ensuring compliance to environmental legal requirements and demonstrating environmental due diligence.	• On-going – An environmental compliance obligations registry and environmental incident reporting processes were developed in 2017. 2018 activities were focused on ensuring all capital projects aligned with these expectations and in developing compliance audit plans for the various facilities. Ensuring water services remains aligned with compliance expectations will be continual initiative given changing operational requirements, capital projects and regulatory expectations.

INITIATIVE	Year End Status
Environmental Management Systems 14001 - Environmental Management Systems (EMS) are required at facilities and treatment systems across Water Services. Those facilities/systems with an Environmental Management Systems built to meet the old standard are required to transition and conform to the new ISO 14001:2015.	• Complete – all Water Service facilities operate under a common Environmental Management system. This will be sustained on an on-going basis through maintenance of 14001 registration.
Residuals Management – develop a strategy for the continued reduction of residuals loading to the North Saskatchewan River and elimination of chlorinated discharges to the river. The main strategy for meeting this commitment is to maximize the time that the treatment plants operate in Direction Filtration (DF) mode.	• In-progress - initial scoping for the initiative has been completed. It has been determined that a triple bottom line (social, environmental and financial) review should be completed in order to provide a comprehensive assessment. Currently in progress.
Lead Program – develop a proactive means of reducing public health risks to customers from lead and to ensure compliance with the new guidelines for lead in drinking water.	• In-progress – Lead Mitigation Strategy developed and presented to Utility Committee March 22, 2019. Program detailed a targeted proactive lead service line replacement program and the addition of orthophosphate corrosion control to reduce lead concentrations from all sources. Programs are currently in the design and implementation phase.
River Monitoring - develop and execute a comprehensive, integrated and sustained monitoring program for the North Saskatchewan River for a four year period starting in 2018. The program will enable the determination of loading rates of various contaminants into the river and to link contaminant concentrations to land uses and facility discharges.	• In-progress – 18 of 22 planned monitoring stations have been installed in time to collect spring run-off water samples throughout the basin. Compilation of data planned for mid-2019 to determine initial results. Planned presentation to Utility Committee later in 2019 on status of the monitoring system, some initial results and long-term plan,
2 INCIDENT MANAGEMENT	
Release Response Plan – develop a response plan based on the 2017 report that assessed the impact of exposures to the Edmonton water systems from upstream (hydrocarbon) spills. Evaluate the treatability and response preparedness to these events.	• Complete – Release response plan has been updated to provide guidance for longer duration spills. Testing completed to determine effectiveness of treatment process on contaminated water. Alternative sources of potable water have been investigated and provisional sourcing contracts established.
PLANNING FOR THE FUTURE	
Master Plan/Integrated Resource Plan Updates – develop a comprehensive 40 year plan for all water facilities to ensure that longer	• In-progress – As noted above, water treatment plants and distribution and transmission are developing master plans that address longer term requirements within their respective

INITIATIVE	Year End Status
term population and other trends as well as new technologies are appropriately assessed.	areas. These will then be consolidated into a larger IRP that addresses long term growth and operational/service requirements on a more holistic basis. The plan includes a comprehensive review of technology and treatment processes. The Gold Bar master plan will also be combined within longer term drainage plans to ensure a consolidated approach as well.
Integrated Water Research Initiative - articulate the future research direction of Water Services from 2019 to 2021 as well as to prioritize and coordinate Water Services core funding with other collaborative investment approaches.	• In Progress – an integrated water research strategy is being developed that will allow for a coordinated approach for understanding and addressing public health, environmental and corporate priorities through a multi-faceted approach to facilitate knowledge transfer.
Annexation Plan for City of Edmonton: transition of water and drainage assets located in the lands annexed from Leduc County from the City of Edmonton.	• In-progress – a number of different initiatives have been identified and each is proceeding. Includes: acquisition of pipeline and booster station from Capital Region Southwest Water Commission and Discovery Park Reservoir from Remington Development. Additional initiatives include the customer transition and transfer of sanitary assets. Presentation to Utility Committee on June 28, 2019 to review fill scope of requirements.
Green Energy Projects - investment in two key green energy projects: • **Water Treatment Solar Energy Projects -** install solar energy at E.L. Smith. • **Gold Bar Biogas Project** - install a biogas cogeneration project at the Gold Bar wastewater treatment plant. .	• In-progress – the E.L. Smith Solar project has completed AUC and other required government approvals. Utility Committee has received a number of updates as the project has progressed. Re-zoning application to be presented to City Council in mid-2019. • In progress – project review revealed better opportunities to develop renewable natural gas instead of a co-generation project. Project in initial stages of development.
Drainage Coordination/Integration – identify synergies to drive operating and capital efficiencies realized in both water services and drainage services.	• In-progress – several short term opportunities for synergies have been identified and implemented. Detailed analysis has been completed to address larger opportunities to move towards a more consolidated approach across water and drainage. The central drivers to maximizing these opportunities are a real estate strategy and development common information systems platforms. These initiatives are in development and will be rolled–out over the next 2-3 years
DEVELOP A KNOWLEDGEABLE, CAPABLE & ENGAGED TEAM	

INITIATIVE	Year End Status
Onboarding Program for New Employees - develop and implement an Onboarding Program for new employees to foster engagement from the start of employment.	• In-progress – Review of current on-boarding program and associated improvement opportunities has been completed. Proposal outlining changes required to current process approved and currently being rolled out across the company.
Engagement Survey Action Plan - deliver a bi-annual engagement survey – develop action plan to address the top key drivers and opportunities identified in the engagement survey results.	• Complete – Engagement survey completed with water services maintaining overall high level of engagement. Water Service as a whole and each functional areas individually have developed actions plans to identified noted areas of improvement - currently being implemented.
Water Services Training Mandate Implementation - ensure Water Services improves its operational efficiencies and cross-department synergies related to training - support developing a knowledgeable, capable, and engaged team.	• Complete – all identified opportunities to ensure efficiencies and cross department synergies have been completed. Training and development has recently been consolidated with other training areas from across the company to drive even greater level of efficiencies and consistency.
Succession Planning Framework - development succession paths through competency identification and personal assessments through the Professional Growth Initiative as the basis for an integrated succession planning process.	• In-Progress – Professional Growth Initiative has been rolled out through successive levels of management starting at the top. Currently being implemented at the Manager level. Development plans completed for majority of staff.

5.2 Drainage Services

Drainage Services also presented a 2018 Annual Operational plan to Utility Committee on April 23, 2018. The purpose of that document was the same as Water Services. The drainage initiatives planned for 2018 were organized within six strategic focus areas:

- OPERATIONAL EXCELLENCE
- CUSTOMERS AND STAKEHOLDERS
- HEALTH AND SAFETY
- ENVIRONMENT
- PEOPLE
- SHAREHOLDER VALUE

A comprehensive update of progress on the various initiatives was provided to Utility Committee on October 25, 2018. As most of the initiatives were still in progress at that time, the focus of the report was on activities completed to date, next steps and a description of any variation for the original intentions. Some of the larger, more complex initiatives, such as the Odour Mitigation Strategy and the Stormwater Integrated Resource Plan (SIRP) warranted separate reports and presentations to Utility Committee which have been completed.

The following update is intended to be at a high level as a comprehensive mid-year update was provided to Utility Committee at the same time as Water Services. All initiatives below have been described as either: 1) Completed, indicating that the activities are finished and the initiative is closed, 2) In-progress, indicating that work continues and the initiatives has been continued in the 2019 Operational Plan (as many initiatives are multi–year), or 3) On-going, indicating that the initiatives will never be formally completed as business requirements continue to change (e.g. operational improvement).

Initiatives and Objectives	Year End Status
OPERATIONAL EXCELLENCE	
Develop rigorous project planning, delivery, and reporting to support completing capital projects on time and on budget.	
i) Develop rigorous project planning, delivery and reporting. Complete projected capital projects on time and on budget.	• Complete – project financial reporting. • In-progress – comprehensive capital project management and delivery process review underway. Will incorporate water as it evolves. • Complete - Capital Construction Strategy – currently being implemented
ii) Develop a longer term plan to achieve allowed return.	• In-progress – water/drainage synergies plan is being implemented - planned roll- out over 2 years. Foundational elements include a real estate and technology strategy in addition to immediate opportunities already implemented.
iii) Pursue technology improvements.	• In-progress – project to align drainage and water geo-spatial /technical platforms underway. Planned completion: drainage - 2019, water - 2020.
iv) Improve asset management practices.	• In-progress – asset condition focused capital plans in development - will continue over the next 2 years and beyond in order to provide basis for 2022-2026 PBR capital plans and future PBR capital plans.
v) Continue to work effectively with the City as a stakeholder.	• On-going – initiatives to improve coordination with CoE have commenced and will continue to be optimized. New requirements will evolve as both organization introduce new processes.
CUSTOMERS AND STAKEHOLDERS	
Develop the Stormwater Integrated Resource Plan and the Odour Control Strategy. Improve customer service and stakeholder communication.	
i) Develop the Stormwater Integrated Resource Plan and the Odour Control Plan as committed during transfer discussions.	• Complete – Final Stormwater Integrated Resource Plan presented to Utility Committee May 10, 2019

Initiatives and Objectives	Year End Status
	• Complete – Final odour Control plan to be presented to Utility Committee June 28, 2019
ii) Improve service to customers through lower service connection times, efficient project delivery and streamlined customer processes.	• On-going – service connection process reviewed to strengthen accountabilities and clarify roles and responsibilities with the result being an increase in overall performance. This initiative will continue as customer needs and internal processes continue to evolve.
iii) Improve customer and stakeholder communications and relationships.	• Complete – Public Engagement strategy developed and presented to Utility Committee June 8, 2018. Strategy now forms the basis for all on-going customer and stakeholder engagements.
HEALTH AND SAFETY	
Create a proactive safety culture by providing employees with the training, processes and systems to reduce injuries and to ensure public safety.	
i) Experience fewer injuries each year, moving towards safety performance similar to other EPCOR business units for both employees and contractors.	• On-going – metrics indicate an improvement in safety awareness/performance: • Near miss: 1611 versus target of 750 • All Injury Frequency of 3.8
ii) Create a proactive safety culture where employees feel supported and participate fully in safety improvements.	• On-going – several initiatives completed to develop a strong safety culture including training, revision of process, near miss and other reporting metrics as well as programs to increase general awareness. These programs will continue indefinitely to ensure the safety culture continues to build.
iii) Provide all employees with training and documentation to support safe work.	• On-going – a significant amount of safety and other training was completed for all drainage staff. Compliance course (i.e. legislated) completion achieved 93.5%, while conformance (EPCOR initiated) achieved 88.7%. Refreshers and new courses will be completed as requirements dictate.
iv) Implement a safety management system and develop and maintain associated processes.	• Complete – EPCOR Health Safety and Environment system roll-out. Provides a consistent approach to management safety incidents across all EPCOR business units.
v) Implement strategies to ensure public safety.	• On-going – greater public awareness was achieved through a number of public education programs such as Stormwater Ice Safety and stormwater facilities safety programs at schools. Phase 1 and 2 of Stormwater Facility Safety review resulted in

Initiatives and Objectives	Year End Status
	a number of recommendations for design standards, signage, and customer engagement initiatives that are currently underway.
ENVIRONMENT	
Implement the required environmental approvals and management systems while demonstrating environmental leadership through innovation.	
i) Implement required environmental approvals and management systems.	• Complete - Approval to Operate moved to EPCOR May, 2018 • Complete – Implementation of Environmental Management System and associated processes – aligned with other EPCOR business units • Complete – ISO 14001-2015 registration
ii) Maintain environmental leadership through innovative improvements to environmental programs.	• On-going – Total Loading Strategy – includes a review/update of existing 10 year loading strategy – planned completion Q3 2019 • In Progress – Climate Change Strategy - in addition the Stormwater Integrated Resource Plan, additional initiatives are being developed in conjunction with the CoE Climate Change Adaption plan
PEOPLE	
Support Drainage employees through role clarification, leadership development, workforce planning and implementing processes for people management.	
i) Clarify roles, accountabilities, and processes related to people.	• On-going – accountabilities, authorities and position descriptions clarified and review with staff starting at senior levels. This review will continue as the business requirements and underlying processes evolve and are further integrated with EPCOR operations.
ii) Improve leadership skills.	• On-going – Professional Growth Initiative (PGI) being roll-out to allow individuals to assess their current leadership skills and form development plans. PGI will continue to be implemented at successive levels of management over the next 2 years and will become a continuing cycle.
iii) Implement workforce planning across the business.	• Complete – Classification allocations for all union position to align with EPCOR Collective Agreements. • In progress – Initiatives to identify workforce synergies with Water Services – planned completion over the next 2-3 years.

Initiatives and Objectives	Year End Status
iv) Implement supporting processes for people management.	• Complete – Employee Engagement Survey revealed very high level of engagement. Programs to enhance engagement being implemented and will roll-out over the next year.
SHAREHOLDER VALUE	
Pursue efficiencies and processes related to cost, regulatory process and operations as they relate to Performance Based Rates (PBR).	
i) Pursue cost efficiencies as committed to during the transfer discussions with City Council.	• Completed – transitioned several areas to a combined model with water services/corporate to gain efficiencies including: Procurement, Inventory, Public and Government Affairs, Land Administration and Inspectors. • In progress – development and implementation of a comprehensive plan to combine operational areas with water services – conditional upon the real estate and technology strategies. Planned roll-out over the next 2-3 years.
ii) Add rigor and structure to regulatory process.	• Completed – in conjunction with water services, presented a Utility Committee reporting framework to Utility Committee in Feb., 2018. Regular reporting on initiatives and progress aligned with that framework. • Completed – established various governance groups to ensure progress and compliance - including Capital Project Steering Committee and Operational Excellence Council
iii) Adapt business processes to operate efficiently and effectively within a PBR.	• In progress – PBR Metrics program aligned with the approach used in water services including scoring system and financial penalties to be presented to Utility Committee in Sept. 2019.

Appendix A: PBR Plan 2017-2021

A.1 In-City Water and Wastewater

A.1.1 PBR Framework

EWSI's In-City Water and Wastewater rates for the 2017-2021 PBR term are regulated by Edmonton City Council in accordance with the PBR Plan approved in Bylaw 17698. This plan encompasses rates, performance measures, and return on equity. The relationships between these components are designed to ensure that capital and operating cost decisions provide a balance between operational performance, rates, and return on equity, while safeguarding system reliability and service quality, providing fair, stable, predictable rates to rate payers, and providing a basis for the future development of the water and wastewater treatments system.

- **PBR Rates.** Annual changes to In-City Water and Wastewater rates are limited to inflation, less an efficiency factor, plus special rate adjustments and, in rare cases, non-routine adjustments. The use of a formulaic approach for calculating and setting utility rates acts as a "price cap" providing ratepayers with stable and predictable rates. The efficiency factor, set at 0.25% for the 2017-2021 PBR term, requires EWSI to increase productivity and achieve efficiencies in excess of inflation if it is to meet it targeted return on equity.

- **Performance Measures.** EWSI's PBR framework includes performance measures for water and wastewater treatment system service quality as described in Schedule 3, Sections 3 and 4 of the bylaw. EWSI faces financial penalties if it does not meet or exceed performance measure standards, providing assurance to customers that water and wastewater treatment system service quality will not be sacrificed to keep rates low or increase returns to EWSI. EWSI's performance measures are audited annually by an independent accounting firm.

- **Return on Equity.** The PBR plan incorporates a forecast rate of return on equity commensurate with consumption, cost and other risks that allows EWSI to finance its operational and capital programs, to provide its customers with high levels of service quality and reliability, and to provide "just and reasonable" returns to its shareholder. Achieving this return is dependent on EWSI achieving operating cost efficiencies, meeting or exceeding performance standards, and developing the utility infrastructure needed to provide service to its customers. For the 2017-2021 PBR term, returns on equity are based on a deemed capital structure of 60% debt and 40% equity and a 10.175% rate of return on equity.

A.1.2 Risks and Incentives

The PBR framework provides incentives for EWSI to improve operational performance while achieving cost savings through process improvements and other means. Under this framework, EWSI also assumes the risks associated with water consumption, operating costs, financing costs and capital costs, ensuring that customers are provided with stable and predictable rate increases. These risks and EWSI's strategies to mitigate them include:

- **Water Consumption Risk.** Under PBR, EWSI bears all of the risks associated with weather-related fluctuations in water consumption and water quality, as well as the longer-term risks associated with declining consumption per customer. EWSI seeks to mitigate consumption risk through the use of robust forecasting methodologies incorporating long term trends in water consumption.

- **Operating Cost Risk**. EWSI actively works to minimize fluctuations in input prices through long-term power contracts, chemical optimization processes, and continuous efforts to implement cost reduction strategies in all areas of its operations.

- **Interest Risk**. Fluctuations in short-term interest rates, long-term debt issue costs and in the level of capitalized interest have significant impacts on EWSI's net income and return on equity. EWSI mitigates interest risk through timing of long-term debt issuances and optimizing working capital.

- **Capital Cost Risk.** In-City Water and Wastewater's operations are capital intensive and it is often difficult to forecast required levels of capital replacements, both at the plants and in the water distribution and transmission network. EWSI seeks to minimize these risks through comprehensive capital project and asset management programs, ensuring that new projects or changes to existing projects are justified and that there is an appropriate level of management, senior management and executive oversight over capital spending.

A.1.3 Customer Classes and Rate Structure

A.1.3.1 In-City Water

In-City Water rates consist of fixed monthly service charges that vary with meter size and variable charges applied to each cubic metre of water consumed. Consumption charges differ for each of In-City Water's customer classes. These classes and their rate structures include:

- **Residential Customer Class.** Residential customers are charged based on an inclining rate structure with three consumption blocks. The inclining rate structure is intended to promote water conservation and provide incentives for residential customers to use water efficiently.

- **Multi-Residential Customer Class.** Multi-residential customers are charged based on a declining rate structure with three consumption blocks. EWSI has found that the cost of providing water to individual multi-residential customers declines as the size of the multi-residential building increases. As well, there is a wide range of consumption volumes for multi-residential customers. Accordingly, a declining rate structure best reflects the cost characteristics of this customer class.

- **Commercial Customer Class.** Similar to multi-residential customers, commercial customers are charged based on a declining rate structure, but with five consumption blocks to recognize the wide range of average consumption volumes within this customer class.

The 2017-2021 PBR Plan includes three special rate adjustments for In-City Water:

- **Special Rate Adjustment for Rebasing**. The In-City Water revenue requirement was rebased at the beginning of the 2017-2021 PBR term. The resulting rebasing adjustment to rates includes the on-going benefits to rate-payers of efficiency gains realized in the 2012-2016 PBR term, the impacts of higher than forecast capital expenditures during the 2012-2016 PBR term; and increases in the capital expenditure programs for the 2017-2021 PBR term. Also included in the rebasing adjustments is the impact of EWSI's cost of service study which has resulted in redistribution of revenue requirements from the Residential and Multi-Residential customer classes to the Commercial customer class.

- **Special Rate Adjustment for Accelerated Programs.** These special rate adjustments support the acceleration of the replacement of water mains as part of the City of Edmonton's neighbourhood renewal program and the upgrade of water mains to increase fire protection capacity in neighbourhoods experiencing increased densities as a result of infill development.

- **Special Rate Adjustments for Environmental Programs.** EWSI is undertaking two significant environmental initiatives during the 2017-2021 PBR term. The first initiative is an extensive River Monitoring Project to regularly monitor, evaluate and report on a number of water quality variables from several sampling sites in the river for 2018-2021. This program is forecast to have annual costs of $1.0 million starting in 2018. The second initiative, which aligns with the City's *"The Way We Green"* strategy, is a Green Power Initiative to replace approximately 10% of EWSI's total power volumes with energy from locally produced renewable sources starting in 2018. This initiative is forecast to cost $1.9 million annually commencing in 2018.

A.1.3.2 Wastewater

Wastewater treatment rates consist of fixed monthly service charges that are applied equally to each customer and variable charges applied to each cubic meter of water consumed. Wastewater has two customer classes:

- **Residential Customer Class.** Unlike In-City Water, there are no separate rates for multi-residential customers. Instead, customers who would be multi-residential water customers are subject to the same rates as residential wastewater customers. The common rate structure for residential and multi-residential customers recognizes that the costs of wastewater treatment are very similar for residential and multi-residential customers. Accordingly, charges to Residential customers are based on a flat rate structure with a single consumption block.

- **Commercial Customer Class.** Consumption charges for commercial customers are based on a declining rate structure with three consumption blocks to recognize that there are economies of scale in wastewater treatment for larger commercial customers. In addition, commercial customers are charged overstrength fees for prescribed materials that exceed the concentrations shown in Section 4 of Schedule 1 to Bylaw 17698.

The 2017-2021 PBR Plan includes a single special rate adjustment for rebasing. Similar to In-City Water, Wastewater's revenue requirement was rebased at the beginning of the 2017-2021 PBR term to reflect efficiency gains realized in the 2012-2016 PBR term, as well as the substantial increases in capital spending needed to deal with the challenges of the aging infrastructure at the Gold Bar Wastewater Treatment Plant.

A.2 Drainage

A.2.1 PBR Framework

EWSI's Drainage rates for the 2018-2022 PBR term are regulated by Edmonton City Council in accordance with the PBR Plan approved in the EPCOR Drainage Services Bylaw 18100. Similar to In-City Water and Wastewater, Drainage's 2018-2022 PBR plan encompasses rates and performance measures, but the mechanisms used to achieve a balance between rates and operational performance differ in important respects, as follows:

- **PBR Rates.** Bylaw 18100 prescribes drainage fees and charges for the period from January 1, 2018 to March 31, 2022. These fees and charges reflect EWSI's commitment to limit average annual rate increases to 3%. Besides these scheduled rate increases, Bylaw 18100 also includes a mechanism for non-routine adjustments to rates related to emergent City-directed needs.

- **Performance Measures.** Bylaw 18100 requires Drainage to measure operational performance for the period from January 1, 2018 to December 31, 2019 using performance measures for drainage system service quality modeled after previous City Drainage Services quality metrics. After that time, for the remainder of the 2018-2021 PBR term, Drainage's operational performance will be measured against new performance measures that will be developed jointly by Drainage and approved by the Utility Committee. Similar to Water and Wastewater, the new performance measures will have a scoring system with financial penalties applied if Drainage does not meet or exceed performance standards. As with Water and Wastewater, the performance measures scorecard will be audited annually by an independent accounting firm. The performance measure results, together with Drainage's commentary on highlights and areas for improvements

A.2.2 Customer Classes and Rate Structure

Drainage has Residential, Multi-Residential and Commercial Customer classes, using the same customer definitions as Water. Drainage's rate revenues are derived from both Sanitary Utility and Stormwater Utility services.

- Sanitary Utility revenues are comprised of flat monthly service charges based on meter size and variable monthly charges based on monthly metered water consumption. Drainage has a simple rate structure, with flat monthly service charges varying only by meter size regardless of customer class and the same monthly variable rate per cubic meter applicable to all customers, regardless of customer class, except for the U of A which has a unique rate, intended to recognize its lower servicing cost.

- Stormwater Utility revenues are based on the area of the customer's property, development intensity, and zoning, also with common rates regardless of customer class.

2017 – 2021 Performance Based Regulation

Water Services,
Wastewater Treatment Services,
and Drainage Services

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1 Executive Summary

This report provides an annual update to the City of Edmonton on the operational and financial results for the year ended December 31, 2019 for water services ("In-City Water"), wastewater treatment services ("Wastewater"), and, sanitary and storm water sewer services ("Drainage") provided within Edmonton by EPCOR Water Services Inc. ("EWSI"). The City of Edmonton City Council regulates In-City Water and Wastewater in accordance with the Performance Based Regulation ("PBR") Plan approved in the EPCOR Water Services and Wastewater Treatment Bylaw No. 17698 ("Bylaw 17698") and Drainage in accordance with the PBR Plan approved in EPCOR Drainage Services Bylaw No. 18100 ("Bylaw 18100").

1.1 Financial Performance

In-City Water, Wastewater and Drainage's financial performance for 2019 are summarized in Table 1.1 below[1]:

Table 1.1
Revenue and Return on Equity
($ millions)

		A	B	C	D
	Revenue and Return on Equity	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	**In-City Water**				
2	Revenue	205.8	191.3	593.9	571.2
3	Return on Equity	40.8	34.4	117.1	110.2
4	Rate of Return on Equity	10.18%	8.56%	10.18%	9.61%
5	**Wastewater**				
6	Revenue	105.6	99.1	297.4	286.0
7	Return on Equity	19.2	19.3	53.0	58.5
8	Rate of Return on Equity	10.18%	10.93%	10.18%	11.84%
9	**Drainage**				
10	Revenue	202.4	199.0	399.0	393.6
11	Return on Equity	22.8	28.5	58.9	61.4
12	Rate of Return on Equity	3.98%	4.76%	5.21%	5.21%

In 2019, In-City Water achieved an 8.56% rate of return on equity (9.61% for 2017-2019), compared to its forecast rate of return of 10.175%. In-City Water returns were challenged by lower than forecast revenue driven by lower than forecast inflation adjustments to rates, and lower than forecast consumption, partially attributable to higher than average precipitation over the summer months. Operating expense reductions achieved by In-City Water ($8.9 million) were unable to fully offset reductions to revenue.

[1] Consistent with the 2017-2021 PBR Application, all financial data in this report, including totals and sub-totals, are rounded to the nearest $0.1 million. This practice ensures continuity of data between tables and between years. However, the sum of the rounded detailed data in certain tables may not be equal to the related rounded total or sub-total.

Wastewater's revenues have been affected by the same factors as In-City Water, with lower than forecast operating expenses, combined with a lower than forecast rate base, enabled Wastewater to achieve a 10.93% rate of return in 2019 (11.84% for 2017-2019), compared to its forecast rate of return of 10.175%.

In 2019, Drainage realized a 4.76% rate of return on equity, 0.78% greater than its forecast rate of return. Lower revenues resulting from lower than forecast consumption was offset by lower than forecast operating expenses and lower than forecast rate base. Since Drainage does not have a City of Edmonton-approved PBR forecast, Drainage's actual financial performance for 2018 has been compared to its EPCOR budget, adjusted (1) to remove one-time costs related to the transition of Drainage to EPCOR, and (2) from IFRS to a regulatory accounting basis. The adjusted budget, escalated at an appropriate inflation rate, will serve as the basis for comparison of actual to forecast financial results for the remainder of the 2017-2021 PBR term.

Detailed analyses of In-City Water, Wastewater and Drainage's financial performance for 2019 and for the 2017-2019 period are provided in sections 2.3, 3.3, and 4.3, respectively.

1.2 Capital Expenditures

In-City Water, Wastewater and Drainage's capital expenditures for 2019 and for the five-year term of the PBR Plan (the "2017-2021 PBR term") are summarized in Table 1.2 below:

Table 1.2
Capital Expenditures
($ millions)

		A	B	C	D	E	F
Capital Expenditures		2019		2017-2019*		2017-2021	
		PBR Forecast	Actual	PBR Forecast	Actual	PBR Forecast	Current Projection
1	In-City Water	87.0	113.0	276.4	307.6	475.8	574.1
2	Wastewater	53.3	49.3	165.6	148.5	235.4	238.6
3	Drainage	169.1	141.9	291.7	250.9	667.4	711.6

* Drainage Forecast and Actual results only include 2018-2019, 2018 is the first full year of Drainage operation following the transfer to EPCOR in September 2017.

Over the course of the PBR term, changes to capital programs are required to address unforeseen needs for repairs or rehabilitation, changes in regulatory or operational requirements, customer demands, and other external factors. These changes are coordinated through EWSI's Project Management Office and are authorized by EWSI's Capital Project Steering Committee, EUI's Financial Review Council, or EPCOR's Board of Directors, depending on the amount of the expenditure. EWSI also presents information on its capital programs, as well as business cases supporting significant new capital projects to the Utility Committee throughout the year.

1. **In-City Water's** 2017-2021 projected capital expenditures of $574.1 million are $98.4 million (20.7%) greater than the PBR forecast. Significant projects contributing to this variance includes the E.L. Smith Solar Farm ($35.3 million), which is funded through the special rate adjustment for Environmental Initiatives; changes to the scope of the Water D&T Facility Expansion, which adds an additional $8.8 million to its cost. Besides these projects, there are three projects that the City has approved as non-

routine adjustments, including: (i) an enhanced Lead Mitigation Program ($25.3 million) needed to conform to new Health Canada Guidelines; (ii) additional costs of LRT Relocations ($12.2 million) needed to realign distribution network infrastructure; and (iii) the acquisition of the Discovery Park Reservoir and Capital Region Southwest Water Services Commission (CRSWSC) Water Pipeline ($9.5 million), following the City of Edmonton's annexation of land in Leduc County. Compared to the prior year forecast, the 2017-2021 projected capital expenditures have decreased by $40.7 million. This reduction reflects the preliminary impacts of the ongoing COVID-19 pandemic on In-City Water's capital program.

- **Wastewater's** 2017-2021 projected capital expenditures of $238.6 million are $3.2 million (1.4%) greater than the PBR forecast. The Gold Bar Wastewater Treatment Plant's aging infrastructure poses challenges to capital planning. Since the plant cannot be shutdown for maintenance, it is often difficult to accurately assess asset condition and the scope of rehabilitation needed before commencing work on a project. During preliminary engineering in 2017 and 2018, EWSI identified significant needs for repairs to critical infrastructure that had not been anticipated in the PBR forecast. EWSI reviewed design options and employed value engineering to reprioritize reliability and life cycle replacements. These efforts have ensured that changes to projections of the total cost of the 2017-2021 capital expenditures program have resulted in only a slight increase from the PBR forecast.

- **Drainage's** 2018-2021 projected capital expenditures of $667.4 million are $44.2 million (7%) greater than its long-term plan. This increase includes a $37.3 real estate initiative (a combined water and drainage facility – also referenced in water's capital expenditure section above), as well as substantial shifts of projected costs between programs as drainage continues to refine and reprioritize its overall capital expenditures program to address asset condition, mitigate the risk of failure, and maintain required service levels**.**

Detailed explanations for differences between capital expenditures in PBR forecast and EWSI's current projections are provided in Sections 2.4, 3.4 and 4.4.

1.3 Operational Performance

In-City Water's and Wastewater's operational performance is measured by the results of indices prescribed in Schedule 3 of Bylaw 17698 with each index consisting of one or more performance measures. Performance under each index is measured independently on a point basis with 100 base points available if the standards for all performance measure indices are achieved. Bonus points are available for performance above standards and financial penalties are applied if EWSI does not meet the 100 base point standard.

In 2019, In-City Water exceeded the performance standards for all five of its performance measure indices and Wastewater exceeded the performance standards for all four of its performance measure indices. Detailed discussions of the performance measures making up each of the indices and operational performance highlights are provided in Section 2.5 for In-City Water and Section 3.5 for Wastewater.

Table 1.3-1
2019 Performance Measures

		A	B	C	D
Performance Index		In-City Water		Wastewater	
		Standard	Actual Score	Standard	Actual Score
1	Water Quality Index[(1)]	25.0	25.0	55.0	60.5
2	Customer Service Index	20.0	21.0	15.0	16.5
3	System Reliability and Optimization Index	25.0	28.5	15.0	16.5
4	Environmental Index[(1)]	15.0	16.5	n/a	n/a
5	Safety Index	15.0	16.5	15.0	16.5
6	**Aggregate Points Earned**	**100.0**	**107.5**	**100.0**	**110.0**

[1] Water Quality and Environmental are combined into one index for Wastewater's operational performance

Drainage's operational performance is measured by the results of four indices prescribed in Schedule 3 of Bylaw 18100 with each index consisting of one or more performance measures. These performance measures are patterned after previous Drainage Utility service quality metrics and do not include a scoring system similar to those of In-City Water and Wastewater.

In 2019, Drainage met or exceeded performance standards for ten of thirteen performance measures included in the four performance measure indices. Detailed discussions of the performance measures making up each of index and highlights of Drainage's operational performance are provided in Section 4.5.

2019 is the last year Drainage Services will be reporting on these performance measures. Pursuant to City Council's approval of amendments to Bylaw 18100 on February 19, 2020, EWSI introduced new PBR performance metrics, scoring and penalties beginning in 2020. The new proposed PBR metrics program is effective for the remainder of the PBR term (2020 and 2021), and is patterned after the water and wastewater PBR metrics and meets the requirements of the Letter of Intent developed for the transition of Drainage Services from the City to EPCOR.

1.4 Rates and Bill Comparisons

In 2019, the average monthly bill for In-City Water customers, based on 2019 average monthly consumption per residential customer of 13.8 m^3, was **$36.15,** an increase of 2.8% from 2018. This increase consists of the 1.2% inflation adjustment discussed in Section 2.3.1, and special rate adjustments approved in Bylaw 17698 for Environmental Initiatives (0.3%), Accelerated Programs (0.5%) and Rebasing (0.8%).

The average residential customer's wastewater treatment bill in 2019, also based on monthly consumption of 13.8 m^3, was **$17.33**, an increase of 5.5% from 2018. This increase includes the 1.2% inflation adjustment, and the special rate adjustment for rebasing of 4.3% needed to support Wastewater's 2017-2021 capital programs.

The average residential customer's drainage bill in 2019, again based on monthly consumption of 13.8 m^3, was **$34.55**, an increase of 3.0% from 2018. Drainage rates from January 1, 2018 to March 31, 2022 have been set in Bylaw 18100, which, except for Non-Routine Adjustments (Section 1.5), limits average annual bill increases to 3.0%.

EWSI undertakes annual bill comparison surveys with various cities and local communities. Section 2.6 shows that EWSI's residential water rates are lower than most of the cities and communities included in the comparison, with only Vancouver having lower water rates. Drainage and Wastewater bills are more difficult to compare because of variations in the nature and extent of wastewater treatment, the inclusion of certain services in property taxes, and geographic and climatic factors which influence the level of investment in and approach to flood mitigation. Section 3.6 shows that Edmonton's combined Drainage and Wastewater treatment rates are competitive with those of other cities and communities with similar geographic and climatic conditions. Commercial bill comparisons for both water and wastewater show similar results to residential water and wastewater bills.

1.5 Non-Routine Adjustments

Non-routine adjustments for In-City Water and Wastewater are defined in Bylaw 17698, and for Drainage in Bylaw 18100, as "items which are unusual, significant in size or nature, and beyond the scope of control of EWSI". Bylaws 17698 and 18100 allow EWSI to request adjustments to In-City Water, Wastewater and Drainage rates for non-routine adjustments from the City Manager or City Council, depending on the impact of the non-routine adjustment on In-City Water, Wastewater or Drainage's revenue requirements.

In 2019, EWSI received approval to increase In-City Water and Drainage rates for the following projects that qualified as non-routine adjustments outlined in Bylaw 17698, Schedule 3, Section 5.0 for Water and Wastewater, or in Bylaw 18100, Schedule 3 Section 4.1 for Drainage. These non-routine adjustments will be included in Drainage rates commencing January 1, 2020, January 1, 2021, and January 1, 2022, and will be included in In-City Water rates commencing April 1, 2020 and escalating by inflation less the productivity factor in April 1, 2021.

- **Lead Mitigation Strategy (In-City Water)** – On March 22, 2019, EWSI presented a new lead mitigation strategy to the Utility Committee. This strategy is designed to meet new Health Canada Guidelines that reduce the maximum concentration of lead in drinking water at the tap from 10 parts per billion to 5 parts per billion. On July 16, 2019, EWSI received approval to apply the non-routine adjustments to In-City water rates commencing April 1, 2020 to recover the costs of implementing this strategy. The additional cost to an average Residential In-City Water customer will be $0.40 per month commencing April 1, 2020 (or a total of $10.91 over the remainder of the 2017-2021 PBR term).

- **Leduc County Annexation (In-City Water)** – On November 27 2018, the Government of Alberta approved the City of Edmonton's annexation of 8,260 hectares from Leduc County. As part of the annexation, EWSI will acquire the existing water infrastructure within or required to service the annexed area, including a reservoir, pump house and booster station, as well as transmission mains and a small distribution system, at a cost of $9.5 million which is comprised of $7.8 million for the Discovery Park reservoir and the remainder for a pipeline and booster station. On November 7, 2019, EWSI received approval to apply the non-routine adjustments to In-City water rates commencing April 1, 2020 to recover the costs related to the annexation. The additional cost to the average Residential

In-City Water customer will be $0.26 per month commencing April 1, 2020 ($7.09 over the remainder of the PBR term).

- **LRT Relocations (In-City Water and Drainage)** – EWSI has identified work needed to accommodate water main, hydrant and sewer relocations for the West Valley Line and Metro Line Northwest Phase I LRT projects. On November 7, 2019, (Drainage) and December 23, 2019 (In-City Water) EWSI received approvals to apply the non-routine adjustments to water rates for In-City Water customers commencing April 1, 2020 and to sanitary utility and storm water utility rates for Drainage customers commencing January 1, 2020. The additional cost to the average Residential In-City Water customer is $0.17 per month commencing April 1, 2020 ($4.64 over the remainder of the PBR term). The average monthly bill increase for Residential Drainage customers is $0.14 per month commencing January 1, 2020, an additional $0.37 per month commencing in January 1, 2021, and an additional $0.31 per month commencing on January 1, 2022 (or a total of $10.26 over the remainder of the 2018-2021 PBR term).

- **Stormwater Integrated Resource Plan (Drainage)** – On May 10, 2019, EWSI presented its Stormwater Integrated Resource Plan (SIRP) alternatives to the Utility Committee. The plan includes a mix of capital and operational program investments to mitigate flood risks across the City using a mix of grey and green infrastructure components installed within the public right-of-way or within City or EPCOR owned parcels. The SIRP approach allows for a lower overall capital investment than seen with traditional engineering approaches through the inclusion of operational programs that support the overall community in responding to flooding events. On December 2, 2019, EWSI received approval to apply the non-routine adjustments to storm water utility rates commencing January 1, 2020. The additional cost to the average Residential Drainage customer is $0.51 per month commencing January 1, 2020, an additional $0.15 per month commencing January 1, 2021, and an additional $0.03 commencing January 1, 2022 (or a total of $16.11 over the remainder of the 2018-2021 PBR term).

- **Corrosion and Odour Reduction Strategy (Drainage)** – On June 28 2019, EWSI presented its Corrosion and Odour Reduction Strategy to the Utility Committee. The Corrosion and Odour Reduction Strategy was developed using similar principles and approaches to EWSI's SIRP to determine an optimized mix of operational and capital solutions to reduce corrosion and odour. The strategy expands the previous plan by focusing on preventing the formation of hydrogen sulphide gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Areas of focus within the strategy include: prevent the formation of hydrogen sulphide gas in the sewer system, control the release of air from the sewer system, and adapt the system using real-time monitoring technologies and improved inspection data. On December 2, 2019, EWSI received approval to apply the non-routine adjustments to sanitary utility rates commencing January 1, 2020. The additional cost to the average Residential Drainage customer is $0.53 per month commencing January 1, 2020, an additional $0.42 per month commencing January 1, 2021, and an additional $0.06 per month commencing January 1, 2022 (or a total of $20.79 over the remainder of the PBR term).

Table 1.5 summarizes the average Residential customer monthly bill impact for all non-routine adjustment that have been approved over the 2017-2021 PBR term. These non-routine adjustments include the five non-routine adjustments detailed above, plus the negative non-routine adjustment approved in 2018, passing on reductions in corporate shared service cost allocations resulting from the transfer of Drainage Services assets to EPCOR to In-City Water and Wastewater customers.

Table 1.5
Non-Routine Adjustments
Monthly Residential Bill Impacts
($)

		A	B	C
	Non-Routine Adjustment	**2020**	**2021**	**2022* (Jan to Mar)**
1	Corporate Cost Reduction (Drainage Transfer)	(1.04)	(1.05)	(1.05)
2	Lead Mitigation Strategy	0.40	0.41	0.41
3	Leduc County Annexation	0.26	0.26	0.26
4	LRT Relocations	0.31	0.68	0.99
5	Corrosion and Odour Reduction Strategy	0.53	0.95	1.01
6	Stormwater Integrated Resource Plan	0.51	0.66	0.69
7	**Total Monthly Bill Impact**	**0.97**	**1.91**	**2.31**

* EWSI's current bylaws expire on March 31, 2022. New bylaws with updated rates would be in effect for the remainder of 2022.

2 In-City Water Services

2.1 Accomplishments and Challenges

In 2019, In-City water had significant accomplishments, including:

- In June, at the American Water Works Association's (AWWA) Annual Conference and Exposition Edmonton's tap water was named the People's Choice Winner of AWWA Tap Water Taste Test, as voted by thousands of water experts who attended the AWWA conference;
- In partnership with Alberta Environment and Parks, the City of Edmonton and the North Saskatchewan Watershed Alliance, The WaterSHED (Water: Saskatchewan Headwaters, Edmonton and Downstream) Monitoring Program was launched. In 2019 installation and upgrades were completed on a network of 19 monitoring stations along the North Saskatchewan River, from its headwaters in the Columbia Icefields to the Saskatchewan border. As Alberta's most extensive water quality monitoring and sampling program, it will improve understanding of how the river functions, how it is being impacted by land-use decisions and actions, and how it may change in the future;
- In February, Edmonton experienced one of the coldest months in nearly 40 years. This colder than average temperate resulted in a significant increase in the number of frozen services in 2019. EWSI's D&T crews identified innovative methods to quickly and cost effectively thaw frozen service lines, and restore service to affected customers;
- In early 2019, EWSI received approval, from the City of Edmonton Utility Committee, to proceed with its comprehensive Lead Mitigation Strategy to meet new Health Canada Guidelines for Canadian Drinking Water Quality. This strategy is intended to reduce lead levels in over 4,400 homes with lead service lines and over 23,000 homes with high lead levels related to lead plumbing and plumbing fixtures ensuring that EWSI provides safe drinking water to the citizens of Edmonton;
- Additional accomplishments are included in the 2019 Operating Plan below.

2.2 Customers and Consumption

In-City Water provides services to three customer classes: Residential; Multi-Residential; and Commercial (see Appendix A). These classes are unchanged from the previous PBR term and are described in detail in Appendix A. Customer counts, total annual consumption and monthly consumption per customer are shown in Table 2.2 below:

Table 2.2
Customers, Consumption and Consumption per Customer

		A	B	C	D
Customers and Consumption		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Customers				
1	Residential	266,138	269,842	261,207	264,554
2	Multi-Residential	3,837	3,779	3,792	3,765
3	Commercial	19,761	19,918	19,509	19,679
4	**Total**	**289,736**	**293,539**	**284,507**	**287,998**
	Consumption per Customer (m^3 per month)				
5	Residential	14.2	13.8	14.4	14.3
6	Multi-Residential	408.6	391.8	408.6	392.7
7	Commercial	120.3	109.3	121.9	114.2
	Annual Consumption (ML)				
8	Residential	45,215.1	44,603.1	135,406.1	135,913.0
9	Multi-Residential	18,813.6	17,766.6	55,774.0	53,234.2
10	Commercial	28,529.4	26,133.3	85,602.5	80,897.8
11	**Total**	**92,558.0**	**88,502.9**	**276,782.7**	**270,045.0**

The factors contributing to actual to forecast differences for 2019 and for 2017-2019 differ by customer class, as explained below:

- **Residential.** Customer counts in 2019 are 1.4% greater than forecast, primarily because of higher than expected actual customer counts at the beginning of the 2017-2021 PBR term. In 2019, consumption per customer was 2.7% lower than forecast, primarily attributable to higher than average precipitation over the summer months. Over the 2017-2019 period actual consumption per customer is slightly lower then the PBR forecast, confirming the robust residential forecasting methodology developed for the 2017-2021 PBR forecast. The combined effect of these factors is that total residential consumption for 2019 is 1.4% lower than forecast (0.4% greater for 2017-2019).

- **Multi-Residential.** Growth in the multi-residential customer counts continue to be lower than forecast, in 2019 customer counts decreased to 1.5% lower than forecast (from 0.7%). Lower than forecast consumption per customer, combined with lower customer counts, meant that total consumption was 5.6% less than forecast. Lower than forecast consumption per customer is not attributable to a specific cause, but reflects a variety of factors, including: vacancy rates, renovations of older buildings; and the number of units in new multi-residential buildings.

- **Commercial.** Consumption in the commercial customer class was 8.4% less than forecast, despite a 0.8% increase in customer counts. This class includes a large number of customers that use very little water (offices, convenience stores, etc.) and a small number of customers with very high levels of consumption (food and beverage producers, malls, etc.). In 2019, EWSI's billing system data showed that 217 (1.1%) of commercial customers accounted for 50% of commercial consumption. Therefore, the loss of a large customer can cause significant shifts in consumption per customer for the entire class. As well, since new customers tend to be low water consumers, increases in customer counts may not have significant effects on overall consumption for the commercial customer class. Accordingly, EWSI is exploring opportunities to expand the application of the forecasting methodology developed for the residential class to the commercial and multi-residential customer classes for future PBR periods.

2.3 Financial Performance

In-City Water's net income is derived from the provision of water services within Edmonton's boundaries. Besides these services, EWSI provides water services to surrounding communities under bulk water supply agreements with regional water service commissions ("RWCG" or "Regional Customers"), and fire protection services to the City of Edmonton under a service agreement ("Fire Protection").

EWSI's water system is fully integrated, with services jointly provided to In-City Water, Regional Customers and Fire Protection. Therefore, in sections 2.3.1 to 2.3.7, operating costs, depreciation, rate base and capital expenditures are presented and analyzed on a total system basis. In-City Water's share of these expenses, as well as its returns on rate base, are calculated in accordance with a cost of service model developed jointly by EWSI, the regional water service commissions and the City of Edmonton, and are shown as separate line items on each applicable table. In-City Water's total revenue and revenue requirements are summarized in Table 2.3 below:

Table 2.3
In-City Water Revenue Requirements
($ millions)

		A	B	C	D
	Summary of Revenue Requirements	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	In-City Water Rate Revenue[1]	200.8	185.8	579.0	554.5
2	In-City Water Revenue Requirement				
3	Operating expenses	108.1	99.5	314.8	295.5
4	Other revenue	(5.0)	(5.5)	(14.9)	(16.8)
5	Depreciation and amortization	28.4	28.4	81.1	81.3
6	Return on rate base financed by debt	29.4	29.0	84.3	84.2
7	Return on rate base financed by equity	40.8	34.4	117.1	110.2
8	In-City Water Revenue Requirement*	201.6	185.8	582.4	554.5
9	**Return on Rate Base Financed by Equity**	**10.18%**	**8.56%**	**10.18%**	**9.61%**

[1] In the PBR forecast, rebasing and other special rate adjustments have been smoothed over the PBR term. Therefore, although forecast revenue is equal to the revenue requirement over the 2017-2021 PBR term, in any year within the PBR term, forecast revenue may be greater or less than the revenue requirement.

2.3.1 Revenue

In-City Water's rate revenues include fixed monthly services charges which vary by meter size and consumption charges applied to each cubic meter of water consumed. Besides rate revenue, In-City Water revenues also include other revenue derived from temporary services, connection fees, water permits, late payment charges and other incidental services. Table 2.3.1-1 below provides a comparison of 2019 In-City Water revenues to the PBR forecast:

Table 2.3.1-1
In-City Water Revenue
($ millions)

		A	B	C	D
In-City Water Revenue		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Fixed Monthly Service Charges				
2	Residential	24.2	21.4	69.6	64.5
3	Multi-Residential	1.5	1.4	4.3	4.0
4	Commercial	4.5	3.9	12.8	11.9
5	Fixed Monthly Service Charges	30.3	26.6	86.7	80.3
6	Consumption Charges				
7	Residential	100.6	95.2	291.1	283.7
8	Multi-Residential	31.5	29.1	90.4	85.3
9	Commercial	38.4	34.8	110.9	105.2
10	Consumption Charges	170.5	159.2	492.3	474.2
11	In-City Water Rate Revenue	200.8	185.8	579.0	554.5
12	Other Revenue	5.0	5.5	14.9	16.8
13	**Total In-City Water Revenue**	**205.8**	**191.3**	**593.9**	**571.2**

In-City rate revenues were $15.0 million less than forecast in 2019, and $24.5 million less than forecast over the 2017-2019 PBR period. This difference is attributable to the following factors:

- Lower than forecast inflation resulted in a $6.1 million decrease in 2019 ($11.0 million for 2017-2019). The PBR plan limits Water and Wastewater's annual routine rate adjustments to inflation less an efficiency factor (see Appendix A.1). As shown in Table 2.3.1-2, actual PBR inflation adjustments for 2019 and 2017-2019 are significantly less than forecast. The effect of lower than forecast inflation from 2016 to 2019 will continue to impact revenues throughout the remainder of the 2017-2021 PBR term.

Table 2.3.1-2
2018 PBR Inflation Adjustment

		A	B	C	D
PBR Inflation Adjustment to In-City Water and Wastewater Rates		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Forecast Inflation				
2	CPI	2.20%	2.10%	6.75%	6.33%
3	Labour	2.40%	1.20%	7.37%	4.67%
4	Weighted Inflation (65% CPI, 35% Labour)	2.27%	1.79%	6.97%	5.75%
5	Less: Efficiency Factor	-0.25%	-0.25%	-0.75%	-0.75%
6	Forecast Inflation	2.02%	1.54%	4.08%	3.39%
7	Actual to Forecast Inflation Adjustment	-	-0.35%	-	-1.72%
8	**PBR Inflation Adjustment**	**2.02%**	**1.18%**	**4.08%**	**1.96%**

- Lower than forecast consumption (see section 2.2) resulted in a $6.3 million decrease in 2019 revenues ($9.3 million for 2017-2019). These decreases were partially offset by slight increases in customer counts which resulted in a $0.4 million increase in revenue in 2019 ($1.0 million for 2017-2019; and

- A negative non-routine adjustment to 2018 water rates decreased revenues by $3.0 million in 2019 ($5.1 million for 2017-2019). This non-routine adjustment fulfills EPCOR's commitment to the City to flow the benefits of any reductions in corporate shared service cost allocations resulting from the transfer of Drainage Services assets to EPCOR to In-City Water and Wastewater customers through a negative non-routine adjustment.

Besides rate revenues, In-City Water earned $5.5 million in other revenue in 2019, $0.5 million greater than forecast ($1.8 million greater for 2017-2019). This increase includes $0.2 million in fees charged to private developers for water main flushing for new developments ($0.8 million for 2017-2019), and $0.3 million in additional customer service revenue ($1.0 million for 2017-2019).

2.3.2 Operating Expenses by Function

Table 2.3.2 below provides a comparison of EWSI's total water system operating expenses for 2019 to the PBR forecast.

Table 2.3.2
Operating Expenses by Function
($ millions)

		A	B	C	D
	Function and Sub-function	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Power, Other Utilities and Chemicals				
2	Power and Other Utilities	14.4	10.3	40.4	31.8
3	Chemicals	7.4	11.7	21.9	28.0
4	Power, Other Utilities and Chemicals	21.8	22.0	62.3	59.9
5	Water Operations				
6	Water Treatment Plants	19.6	18.9	57.6	55.4
7	Water Distribution and Transmission	25.6	26.5	75.3	78.9
8	Operational Support Services	7.6	6.9	22.2	20.8
9	Quality Assurance and Environment	6.6	6.8	18.5	18.9
10	Capitalized Overhead Costs	(7.4)	(8.3)	(21.8)	(22.9)
11	Water Operations	52.0	50.9	151.9	151.2
12	Billing, Meters and Customer Service				
13	Billing and Collections	8.4	7.8	24.3	23.6
14	Meter Reading, Repairs and Maintenance	2.8	2.2	9.0	6.2
15	Customer Service	0.9	0.4	2.3	1.7
16	Billing, Meters and Customer Service	12.1	10.4	35.7	31.4
17	EWSI Shared Services				
18	EWSI Shared Services	10.2	9.1	29.9	27.9
19	Incentive and Other Compensation	3.3	2.9	9.6	9.0
20	EWSI Shared Services	13.4	12.0	39.6	36.9
21	Corporate Shared Services	15.6	12.1	45.9	37.0
22	Franchise Fees and Property Taxes				
23	Franchise Fees	15.8	14.7	45.7	43.8
24	Property Taxes	0.4	0.2	1.3	0.7
25	Franchise Fees and Property Taxes	16.3	14.9	47.1	44.5
26	**Total Operating Expenses by Function**	**131.2**	**122.3**	**382.4**	**361.0**
27	In-City Water Share - %	82.4%	81.4%	82.3%	81.9%
28	**In-City Water Share - $**	**108.1**	**99.5**	**314.8**	**295.5**

Overall, total operating expenses for 2019 were $8.9 million lower than the PBR forecast, and $21.4 million lower over the 2017-2019 PRB period. Key factors contributing to this difference include:

- **Power and Other Utilities** – $4.1 million less than forecast in 2019 ($8.6 million less for 2017-2019) due to lower than forecast power prices ($2.2 million in 2019 and $4.8 million for 2017-2019) and $1.9 million in savings associated with the green energy premium ($3.8 million for 2017-2019) that was included in the PBR forecast. The PBR forecast included annual renewable (green energy) power purchases of $1.9 million annually, starting in 2018. Rather than purchasing locally produced renewable energy, EWSI plans to construct a solar farm on land adjacent to the E.L. Smith water treatment plant.
- **Chemicals** – $4.3 million greater than forecast in 2019 ($6.1 million greater than forecast for 2017-2019). In 2019, higher than average precipitation (surface run off) resulted in unusually high colour in the river over the summer months requiring the use of more chemicals (alum and caustic soda) in the water treatment process. The unusually high colour continued into the fall causing a significant delay in the conversion to direct filtration and extending the use of chemicals in the water treatment process. Higher than forecast costs for the 2017-2019 PBR period are also attributable to unexpected changes in river water quality, including early spring run offs and high colour in the fall.
- **Water Treatment Plants** – $0.7 million less than forecast in 2019 ($2.2 million less than forecast for 2017-2019). Lower than forecast costs for 2017-2019 are attributable to several factors, including: a higher than forecast proportion of internal labour working on capital projects, which increased capital recoveries by $2.0 million, reductions in fringe benefit costs, primarily due to lower pension contribution rates, which provided savings of $0.6 million; capitalization of filter media costs, which had previously been considered an operating expense of $0.2 million; which is partially offset by higher salary costs of $1.0 million attributable to an increase in head count. The remainder of the actual to forecast difference consists of numerous small items, none of which are individually significant.
- **Water Distribution and Transmission** – $0.9 million greater than forecast in 2019 ($3.6 million greater for 2017-2019). Seasonal freeze-thaw cycles in 2017 and 2018 combined with a colder than average winter in 2019 resulted in higher than normal volumes of emergency repairs (main breaks and frozen services) over the 2017 to 2019 period, resulting in increased overtime costs of $0.7 million ($2.1 million for 2017-2019), higher contractor costs of $1.8 million ($3.5 million for 2017-2019), and additional material costs of $0.6 million ($1.7 million for 2017-2019). These increases were partially offset by reductions in fringe benefit costs of $1.0 million in 2019 ($2.5 million for 2017-2019), and an increase in the recovery of fleet costs attributable to an increase in capital work of $0.6 million in 2019 ($0.7 million for 2017-2019) The remainder of the actual to forecast difference consists of numerous small items, none of which are individually significant.
- **Operational Support Services** – $0.7 million less than forecast in 2019 ($1.4 million less for 2017-2019). The 2017-2019 variance in this function is primarily attributable to lower staff costs of $0.9 million related to vacant positions within the Project and Asset Management functions and a transfer of the Knowledge Management function to Corporate Shared Service in 2019, combined with lower than forecast legal costs of $0.4 million, as less external legal support was required.
- **Billing, Meters, and Customer Service** – $1.7 million less than forecast in 2019 ($4.3 million less for 2017-2019). Meter reading process improvements provided cost savings in staff costs of $1.0 million ($2.6 million for 2017-2019), $0.3 million in vehicle expenses ($0.7 million for 2017-2019), and $0.6 million in lower billing and customer service charges from EPCOR Energy Alberta LP ($0.7

million for 2017-2019). The remainder of the actual to forecast difference consists of numerous small items, none of which are individually significant.

- **EWSI Shared Services** – $1.4 million less than forecast in 2019 ($2.7 million less than forecast for 2017-2019). The 2019 favorable variance in this category reflects EWSI's continuing efforts to manage shared services costs, with savings of $0.3 million arising from delays in filling vacant positions in Regulatory Services, a $0.5 million decrease in technical training charges from EPCOR Distribution and Transmission Inc. (training functions consolidated to Corporate Shared Service in 2019), and $0.4 million of recoveries from Drainage, as the organization is gradually consolidating functions from each of EWSI's business units into a single EWSI's shared services area.
- **Corporate Shared Services** – $3.5 million less than forecast in 2019 ($8.9 million less than forecast for 2017-2019). These differences reflect both the reduction in corporate shared services cost allocations resulting from the transfer of Drainage from the City of Edmonton to EPCOR, which are fully offset by the non-routine adjustment to rates described in Section 2.1.1, as well as cost savings in EPCOR Utilities Inc.'s corporate functions**.**
- **Franchise Fees and Property Taxes** – $1.4 million less than forecast in 2019 ($2.6 million less than forecast for 2017-2019). Lower than forecast revenue resulted in a $1.2 million reduction in franchise fees in 2019 ($2.0 million for 2017-2019). Lower than forecast property taxes relate to the deferral of the Distribution and Transmission facility which had been expected to increase Water Services property taxes by $0.2 million annually commencing in 2017.

Variances in other operating expense functions and sub-functions are not significant, either individually or in aggregate.

In 2019, In-City Water's share of operating expenses was $99.5 million (81.4%), compared to $108.1 million (82.4%) in the PBR forecast. This result reflects both lower total operating expenses for EWSI's total water system and a 1.0% decrease in In-City Water's share of operating expenses determined through the cost of service model.

2.3.3 Operating Expenses by Cost Category

Table 2.3.3 below shows operating expenses by cost category for Water Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 2.3.2.

Table 2.3.3
Operating Expenses by Cost Category
($ millions)

		A	B	C	D
		2019		**2017-2019**	
	Cost Category	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
1	Water Operations				
2	Staff Costs and Employee Benefits	42.2	40.6	124.2	120.3
3	Contractors and Consultants	8.0	9.3	22.5	25.8
4	Vehicles	1.5	1.1	4.5	3.6
5	Materials and Supplies	3.2	3.9	9.3	11.1
6	Other	4.5	4.3	13.1	13.2
6	Capitalized Overhead Costs	(7.4)	(8.3)	(21.8)	(22.9)
7	Water Operations	52.0	50.9	151.9	151.2
8	Billing, Meters and Customer Service				
9	CUS Charges	8.4	7.8	24.3	23.6
10	Staff Costs and Employee Benefits	7.0	6.0	20.4	17.9
11	Contractors and Consultants	0.5	0.4	1.6	1.2
12	Vehicles	0.3	0.1	0.9	0.6
13	Other	0.6	0.7	1.6	1.4
14	Meter Reading Services (Recoveries)	(4.8)	(4.6)	(13.1)	(13.1)
15	Billing, Meters and Customer Service	12.1	10.4	35.7	31.4
16	EWSI Shared Services				
17	EWSI Shared Services Allocation	10.2	9.4	30.1	28.1
18	Staff Costs and Employee Benefits	3.3	2.8	9.6	9.2
19	Contractors and Consultants	0.2	0.1	0.6	0.4
20	Other	(0.3)	(0.3)	(0.8)	(0.8)
21	EWSI Shared Services	13.4	12.0	39.6	36.9

The information presented in this table supports the explanations of differences between 2019 actual and forecast expenses provided in Section 2.3.2. Accordingly, no additional explanations are considered necessary.

2.3.4 Depreciation and Amortization

EWSI total system depreciation expense and amortization of contributed assets for 2019 are shown in Table 2.3.4 below:

Table 2.3.4
Depreciation and Amortization
($ millions)

		A	B	C	D
		2019		**2017-2019**	
	Depreciation and Amortization	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
1	Gross depreciation expense	45.8	47.2	132.2	134.2
2	Amortization of contributions	(9.9)	(11.0)	(29.4)	(31.2)
3	**Depreciation, net**	**35.9**	**36.2**	**102.8**	**103.0**
4	In-City Water Share - %	78.9%	78.4%	78.9%	78.9%
5	**In-City Water Share - $**	**28.4**	**28.4**	**81.1**	**81.3**

Depreciation expense and amortization of contributions are both slightly higher than forecast reflecting higher than forecast levels of developer-funded assets, explained in section 2.3.5 below. These impacts are offsetting, so actual depreciation expense, net of amortization, is within $0.2 million of forecast.

In-City Water's share of 2019 depreciation expense is 0.5% lower than forecast, 0.7% of this difference is attributable to higher than forecast assets additions for fire protection related assets (hydrants). The remaining 0.2% difference is consistent with actual to forecast differences in the base and max day peaking factors used to allocate depreciation expense between In-City customer classes versus that charged to the RWCG.

2.3.5 Rate Base

In 2019, EWSI's total water system rate base, shown in Table 2.3.5 below, was $12.8 million more than forecast, with the higher than forecast gross rate base offset by higher than forecast contributions.

Table 2.3.5
Mid-Year Rate Base
($ millions)

		A	B
		2019	
	Components of Mid-Year Rate Base	**PBR Forecast**	**Actual**
1	Plant in Service		
2	Balance, beginning of year	2,346.9	2,413.1
3	Additions - EPCOR-funded	85.5	105.4
4	Additions - Developer-funded	6.9	35.8
5	Retirements and adjustments	-	(9.0)
6	Balance, end of year	2,439.3	2,545.4
7	Mid-Year Plant in service	2,393.1	2,479.3
8	Accumulated Depreciation		
9	Balance, beginning of year	605.1	595.5
10	Depreciation expense	45.8	47.2
11	Retirements and adjustments	-	(8.9)
12	Balance, end of year	650.9	633.8
13	Mid-Year Accumulated Depreciation	628.0	614.7
14	Other Rate Base Items		
15	Working Capital	22.3	21.0
16	Materials and Supplies	2.9	3.6
17	**Gross Mid-Year Rate Base**	**1,790.3**	**1,889.1**
19	Contributions		
20	Balance, beginning of year	687.1	760.2
21	Contributions in aid of construction	6.9	35.8
23	Balance, end of year	693.9	795.9
24	Mid-Year Contributions	690.5	778.0
25	Accumulated Amortization		
26	Balance, beginning of year	168.1	169.1
27	Amortization of contributions	9.9	11.0
28	Balance, end of year	178.0	180.1
29	Mid-Year Accumulated Amortization	173.1	174.6
30	**Mid-Year Contributions**	**517.4**	**603.5**
31	**Net Mid-Year Rate Base**	**1,272.9**	**1,285.7**

The gross rate base reflects significantly higher than forecast levels of developer-funded assets over the 2016 to 2019 period. Developers are responsible for construction of distribution infrastructure in new subdivisions. When these assets are placed into service, ownership of the assets is transferred to EWSI, where the assets, together with offsetting contributions in aid of construction, are added to the rate base.

In 2019, the net mid-year rate base is $12.8 million or 1.0% more than forecast. This increase in rate base is driven by higher than forecast capital expenditures as discussed in section 2.4.1.

2.3.6 Return on Rate Base

In 2019, In-City Water's return on equity was $5.6 million (1.6%) less than forecast and $6.9 million (0.6%) less for 2017-2019. In 2019, this decrease was attributable to lower than forecast net income, reflecting a significant decline in revenue which is partially offset by EWSI's actions to control operating costs.

Table 2.3.6-1
Return on In-City Water Share of Mid-Year Rate Base
($ millions)

		A	B	C	D
	Return on Rate Base	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Net Mid-Year Rate Base	1,272.9	1,285.7		
2	In-City Water Share - %	78.8%	78.0%		
3	In-City Water Share - $	1,003.0	1,002.8		
4	Deemed Capital Structure				
5	Debt	60.00%	60.00%		
6	Equity	40.00%	40.00%		
7	Total	100.00%	100.00%		
8	Cost Rates				
9	Debt	4.88%	4.83%	4.88%	4.89%
10	Equity	10.18%	8.56%	10.18%	9.61%
11	Weighted Average Cost of Capital (WACC)	7.00%	6.32%	7.00%	6.77%
12	Return on Rate Base				
13	Debt	29.4	29.0	84.3	84.2
14	Equity	40.8	34.3	117.1	110.2
15	**Total Return on In-City Water Rate Base**	**70.2**	**63.3**	**201.4**	**194.4**

In-City Water's share of the total system net mid-year rate base is 0.8% less than forecast, of this difference 1.1% is attributable to higher than forecast asset additions for fire protection related assets (hydrants). The remaining 0.3% difference is consistent with the change in In-City Water's demands on water system relative to that of Regional Customers. When combined with a total system rate base the In-City Water net mid-year rate base is within 0.02% of the forecast amount.

Returns on rate base are calculated separately for the debt-financed and equity-financed portions of In-City Water's net rate base. The rate of return on debt is equal to the embedded cost of debt for EWSI's total water system, as calculated in Table 2.3.6-2 below:

Table 2.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B	C	D
	Interest Expense and Cost of Debt	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Interest expense				
2	Interest on short-term debt	0.9	1.2	3.0	3.7
3	Interest on City of Edmonton debentures	0.6	0.6	2.1	2.1
4	Interest on intercompany debentures	35.0	34.1	100.2	98.1
5	Total interest expense	36.5	35.9	105.3	103.9
6	Mid-year debt and other long-term liabilities				
7	Mid-Year Short-term debt	33.9	2.9		
8	Mid-Year Long-term debt	713.5	738.5		
9	Mid-Year Other Long-term liabilities	1.8	2.0		
10	Total mid-year debt and other long-term liabilities	749.1	743.4		
11	**Embedded Cost of Debt**	**4.88%**	**4.83%**	**4.88%**	**4.89%**

The embedded cost of debt is slightly lower than forecast in 2019. Although, EWSI issued more long term debt than forecast, which is more expensive that short term debt, due to favorable economic conditions EWSI was able to issue the long term debt at lower than forecast rates over the 2017 to 2019 period.

2.3.7 Transactions with Affiliates

In-City Water derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EWSI business units. Table 2.3.7 provides a summary of In-City Water's 2019 actual and forecast transactions with affiliates.

Table 2.3.7
Transactions with Affiliates
($ millions)

		A	B	C	D
	Affiliate and Service	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**				
2	Public Fire Protection	11.8	11.5	34.0	33.8
3	Water sales	3.3	3.3	9.7	10.2
4	Other	0.2	-	0.7	0.1
5	Total	15.3	14.9	44.3	44.2
6	**Services provided by (recovered from):**				
7	**City of Edmonton**				
8	Franchise Fees	15.8	14.7	45.7	43.8
9	Property Taxes	0.4	0.2	1.3	0.7
10	Interest on City of Edmonton Debentures	0.6	0.6	2.1	2.1
11	Mobile equipment services	1.9	2.3	5.7	6.8
12	Other services	1.4	0.6	4.0	2.0
13	Meter Reading Recoveries	-	-	-	(1.4)
14	Total	20.2	18.4	58.9	54.1
15	**EPCOR Utilities Inc.**				

		A	B	C	D
		2019		2017-2019	
	Affiliate and Service	PBR Forecast	Actual	PBR Forecast	Actual
16	Corporate Shared Service Costs	15.6	12.1	45.9	37.0
17	Interest on Intercompany Debentures	35.0	34.1	100.2	98.1
18	Interest on Short-term debt	0.9	1.2	3.0	3.7
19	Other Services	-	0.3	-	0.3
20	Total	51.5	47.7	149.0	139.1
21	**EPCOR Distribution and Transmission Inc.**				
22	Meter Reading Service Revenue	-	-	-	(0.5)
23	Other services	0.1	-	0.4	-
24	Total	0.1	-	0.4	(0.5)
25	**EPCOR Technologies Inc.**				
26	Hydrovac Charges and Space Rentals	0.9	1.8	2.7	4.8
27	Other Services (Recoveries)	-	(0.1)	-	(0.1)
28	Total	0.9	1.7	2.7	4.6
29	**EPCOR Energy Alberta LP**				
30	Customer Billing and Collection Services	8.4	7.8	24.3	23.6
31	Meter Data Management	-	0.3	-	0.5
32	Trouble Call Support Services	-	0.3	-	0.3
33	Total	8.4	8.4	24.3	24.4
34	**EPCOR Power Development**				
35	Other Services (Recoveries)	-	(0.3)	-	(0.4)
36	**EPCOR Commercial Services**				
37	Commercial Services Rent Recoveries	-	(0.3)	-	(0.6)
38	**Other EWSI Business Units**				
39	EWSI Shared Services Allocation	10.2	9.4	30.1	28.1
40	Water Sales to Wastewater	(0.4)	(0.4)	(1.1)	(1.3)
41	Meter Reading Recoveries from Wastewater	(2.4)	(2.4)	(6.6)	(6.9)
42	Meter Reading Recoveries from Drainage Services	(2.4)	(2.4)	(6.6)	(5.2)
43	Customer Service Fees from Drainage Services	-	0.4	-	0.9
44	Other Services provided to Drainage Services	-	(0.2)	-	(0.2)
45	Meter Reading Recoveries from Other EWSI Business Units	-	-	-	(0.1)
46	Quality Assurance Lab Testing and Other Services from Other EWSI Business Units	-	-	-	0.2
47	Total	5.1	4.1	15.9	15.5
48	**Expenditures on capital projects arising from services provided by:**				
49	City of Edmonton	3.2	0.6	9.3	2.4
50	EPCOR Technologies Inc.	4.0	4.2	11.7	12.8
51	EPCOR Utilities Inc.	-	1.2	-	2.8
52	EPCOR Drainage Services	-	2.3	-	6.5
53	EPCOR Distribution and Transmission Inc.	0.1	0.3	0.4	1.0
54	Other EPCOR Business Units	-	0.1	-	0.2
55	Total	7.1	8.6	21.3	25.8

2.4 Capital Programs

2.4.1 Capital Expenditures

Table 2.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2019 for each project with approved or forecast capital expenditures in excess of $5.0 million over the

2017-2021 PBR term, as well as for each project category. Table 2.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI's current capital forecast.

Table 2.4.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	G	H	I	
		2019			2017-2019			2017-2021			
		PBR Forecast	Actual	Difference	PBR Forecast	Actual	Difference	PBR Forecast	Current Projection	Difference	
1	**Regulatory**										
2	Water Services Replace/Refurbish	0.3	0.5	0.2	0.9	1.5	0.7	1.5	2.2	0.7	
3	Projects < $5 Million	2.0	2.4	0.4	6.0	6.0	0.1	10.2	9.4	(0.8)	
4	**Subtotal**	**2.3**	**2.9**	**0.6**	**6.8**	**7.6**	**0.7**	**11.6**	**11.6**	**(0.1)**	
5	**Growth/Customer Requirements**										
6	LRT Relocates (NRA)	0.2	6.4	6.2	6.1	13.4	7.4	10.4	22.6	12.2	1
7	Network PD Transmission Mains	2.2	8.5	6.3	8.1	17.6	9.5	14.4	24.2	9.8	2
8	Discovery Park Reservoir & CRSWSC Pipe Line (NRA)	-	0.3	0.3	-	0.3	0.3	-	9.5	9.5	3
9	Water Services Connections	4.8	5.1	0.4	13.1	17.3	4.2	23.6	27.8	4.3	4
10	Water Main Cost Sharing Program	0.5	1.6	1.2	1.7	4.2	2.5	3.0	6.2	3.2	5
11	New Water Distribution Mains	1.8	2.6	0.8	5.2	6.9	1.7	8.8	10.6	1.7	
12	Distribution System Modifications	1.1	1.6	0.5	4.0	3.6	(0.4)	6.0	7.0	1.0	
13	New Meter Purchase/Installation	2.9	2.5	(0.4)	7.1	6.8	(0.2)	13.2	12.1	(1.1)	
14	PD Construction Coordination	2.8	2.7	(0.2)	8.3	7.9	(0.4)	15.4	13.5	(2.0)	
15	Projects < $5 Million	0.2	0.3	0.0	2.1	6.5	4.4	2.6	8.6	6.1	6
16	**Subtotal**	**16.4**	**31.6**	**15.1**	**55.6**	**84.5**	**28.9**	**97.5**	**142.1**	**44.6**	
17	**Health, Safety & Environment**										
18	Phosphoric Injection for Lead Control (NRA)	-	1.2	1.2	-	1.3	1.3	-	16.3	16.3	7
19	Accelerated Lead Services Replacement (NRA)	-	-	-	-	-	-	-	9.0	9.0	7
20	Deep Bed Filtration Conversion – E.L. Smith	1.3	0.0	(1.3)	1.3	0.3	(0.9)	22.3	0.3	(22.0)	8
21	Projects < $5 Million	0.8	1.0	0.2	2.3	2.3	(0.0)	4.3	3.3	(1.0)	
22	**Subtotal**	**2.1**	**2.2**	**0.1**	**3.6**	**3.9**	**0.3**	**26.6**	**29.0**	**2.3**	
23	**Reliability & Life Cycle Improvements**										
24	Structural Rehab Program – E.L. Smith	0.4	0.8	0.3	1.1	1.5	0.4	2.0	10.0	8.0	8
25	Chemfeed Upgrades – Rossdale	1.0	3.3	2.3	2.9	6.0	3.1	4.0	9.1	5.1	9
26	Bypass (Ring) Main – E.L. Smith	1.5	0.4	(1.1)	1.8	0.6	(1.2)	7.0	11.9	4.8	10
27	Obsolete Hydrants Replacement Program	0.9	2.1	1.2	2.6	5.2	2.6	4.4	8.9	4.6	11
28	Obsolete Valve Replacement Program	0.8	1.9	1.1	2.4	4.7	2.3	4.1	8.3	4.2	12
29	Chemfeed Upgrades – E.L Smith	1.3	2.0	0.7	3.1	4.3	1.1	4.0	7.5	3.5	13
30	Filter Underdrain Upgrades – Rossdale	1.2	2.4	1.2	3.5	8.0	4.5	4.7	8.2	3.5	14
31	Structural Upgrades – Reservoirs	0.5	0.5	0.0	1.1	2.3	1.3	1.7	4.2	2.5	15
32	HVAC Upgrades – E.L Smith	0.6	3.8	3.2	2.2	4.8	2.6	3.4	5.0	1.7	
33	Mechanical Upgrades – E.L Smith	0.9	1.7	0.8	3.4	4.7	1.4	4.9	6.0	1.2	
34	Clarifier C1-2 Upgrade – Rossdale	-	-	-	4.3	5.5	1.1	4.3	5.5	1.1	
35	Network Valve Chamber Refurbishment	1.1	1.1	0.0	3.3	3.6	0.3	5.6	5.4	(0.2)	
36	Water Main Proactive Renewal	3.6	3.8	0.2	10.5	11.3	0.7	18.0	17.4	(0.6)	
37	Vehicle & Fleet Additions	2.8	1.7	(1.0)	7.9	5.8	(2.1)	11.8	11.0	(0.8)	

		A	B	C	D	E	F	G	H	I	
		2019			**2017-2019**			**2017-2021**			
		PBR Forecast	**Actual**	**Difference**	**PBR Forecast**	**Actual**	**Difference**	**PBR Forecast**	**Current Projection**	**Difference**	
38	Transmission Mains Replacement/Refurbish	2.7	2.6	(0.0)	7.7	8.6	1.0	13.3	12.4	(0.9)	
39	Electrical Upgrades – Rossdale	1.0	1.7	0.7	2.6	3.2	0.6	5.2	4.3	(0.9)	
40	SCADA System Upgrade Program	0.9	0.8	(0.1)	4.3	2.8	(1.4)	5.7	4.5	(1.2)	
41	Electrical Upgrades – Reservoirs	1.0	0.6	(0.4)	3.3	2.2	(1.0)	5.3	2.7	(2.6)	16
42	Cell/Pumphouse Roof Replacement	2.2	-	(2.2)	4.9	1.5	(3.4)	6.3	3.2	(3.1)	15
43	Water Main Reactive Renewal	10.9	12.8	2.0	28.9	34.5	5.6	54.7	50.3	(4.4)	17
44	Water Meter Change Out Program	6.4	2.9	(3.5)	12.1	8.8	(3.3)	25.6	13.8	(11.9)	18
45	Projects < $5 Million	12.9	16.1	3.2	41.6	44.1	2.5	66.3	69.9	3.5	19
46	**Subtotal**	**54.5**	**63.1**	**8.7**	**155.4**	**174.1**	**18.7**	**262.4**	**279.4**	**17.0**	
47	**Performance Efficiency & Improvement**										
48	Water D&T Facility Expansion	-	0.0	0.0	16.0	0.0	(16.0)	16.0	24.8	8.8	20
49	Water Main Cathodic Protection	4.2	3.0	(1.2)	12.3	10.0	(2.4)	21.0	15.9	(5.1)	21
50	Projects < $5 Million	1.4	1.2	(0.2)	6.1	3.0	(3.1)	7.1	6.2	(0.9)	
51	**Subtotal**	**5.6**	**4.2**	**(1.4)**	**34.4**	**13.0**	**(21.4)**	**44.1**	**46.9**	**2.7**	
52	**Accelerated**										
53	Accelerated Water Main Renewal	10.4	11.0	0.6	30.4	30.5	0.1	51.9	48.1	(3.8)	22
54	Accelerated Fire Protection	2.5	2.1	(0.4)	9.5	7.5	(2.0)	15.9	9.9	(6.0)	23
55	**Subtotal**	**12.9**	**13.1**	**0.2**	**39.9**	**38.0**	**(1.9)**	**67.8**	**58.0**	**(9.8)**	
56											
57	**E.L. Smith Solar Farm and Battery Storage (net)**	-	0.7	0.7	-	4.4	4.4	-	35.3	35.3	24
58	**Capital Expenditures before contributions**	**93.9**	**117.9**	**24.0**	**295.7**	**325.4**	**29.7**	**510.1**	**602.2**	**92.2**	
59	**Contributions**										
60	Water Services Connections	(4.8)	(2.7)	2.0	(13.1)	(10.9)	2.3	(23.6)	(17.4)	6.1	4
61	Private Development Contributions	(0.3)	(0.1)	0.2	(1.0)	(0.8)	0.2	(1.9)	(1.4)	0.5	
62	New Water Distribution Mains	(1.8)	(2.0)	(0.3)	(5.2)	(6.2)	(1.0)	(8.8)	(9.3)	(0.5)	
63	**Subtotal**	**(6.9)**	**(4.9)**	**1.9**	**(19.3)**	**(17.8)**	**1.5**	**(34.3)**	**(28.1)**	**6.2**	
64	**Capital Expenditures**	**87.0**	**113.0**	**26.0**	**276.4**	**307.6**	**31.2**	**475.8**	**574.1**	**98.4**	

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million on individual projects with total costs in excess of $5.0 million, as well as for project categories in aggregate include:

1. **LRT Relocates (NRA)** – $12.2 million (117%) greater than forecast. Changes to track alignments, as well as the accelerated construction schedule for the West Valley Line LRT project have resulted in increases to the projected costs of utility relocations. In 2019, the City of Edmonton approved a non-routine adjustment to increase rates to offset the revenue requirement impacts of a $14.5 million increase in capital expenditures for this project.
2. **Network PD Transmission Mains** – $9.8 million (68%) greater than forecast. Since developers determine both the timing of projects and the areas to be developed, expenditures on this program have proven difficult to forecast. Significant additions to this program include transmission main projects for Ellerslie Road Arterial Twinning Project, 28th Avenue SW/Whitemud Creek Crossing, the Horse Hills Creek/Meridian Street Crossing, 199th Street from 23rd Avenue to 35th Avenue, and Aurum Road 9th Street to 17th Street.
3. **Discovery Park Reservoir and CRSWSC Water Pipeline Acquisition (NRA)** – $9.5 million (new project). This project includes the cost of infrastructure (reservoir, pump house, transmission mains and booster station) located in, or required to service, land annexed by the City of Edmonton. In 2019, the City of Edmonton approved a non-routine adjustment to increase rates to offset the revenue requirement impacts of a $9.2 million increase in capital expenditures for these projects.
4. **Water Services Connections (net of contributions)** – $10.4 million (100%) greater than forecast. Contributions from private developers were forecast to recover 100% of the construction costs for new water service connections. EWSI found that after accounting for all program costs, its service application rates provide for recovery of less than 75% of the total program costs. EWSI is currently reviewing the program to determine if modifications to the program and rates are required.
5. **Water Main Cost Sharing Program** – $3.2 million (105%) greater than forecast. Similar to Network PD Transmission Mains, the costs of this program are driven by developer activity. The increase in the costs of this program result from higher than forecast developer activity during the PBR period.
6. **Growth and Customer Requirements < $5.0 million** – $6.1 million (236%) greater than forecast. The projected increase in this category results primarily from a new booster station project needed to address development in a high elevation area (Laurel neighborhood, southeast Edmonton) ($1.7 million); additional costs to acquire water mains from the Capital Region Northeast Water Service Commission following city expansion ($2.7 million); and changes to projected costs for other growth projects amounting to $1.7 million.
7. **Phosphoric Injection for Lead Control and Accelerated Lead Services Replacement (NRA)** – $25.3 million (new projects). These projects are required to implement EWSI's lead mitigation strategy, including introducing orthophosphate into drinking water to inhibit corrosion, and accelerating the replacement of lead service lines in high priority homes. In 2019, the City of Edmonton approved a non-routine adjustment to increase rates to offset the revenue requirement impacts of a $15.6 million increase in capital expenditures for these projects.
8. **Deep Bed Filtration Conversion – E.L Smith** – $22.0 million (99%) less than forecast and **Structural Rehabilitation Program – E.L Smith** – $8.0 million (398%) greater than forecast. During engineering inspections in 2018, EWSI identified immediate needs for structural rehabilitation of the

E.L. Smith Stage 1 and Stage 2 filter plenums (12 filters in total). Accordingly, the conversion to deep bed filters has been postponed until after the end of the current PBR term, so that the required structural rehabilitation repairs and upgrades can be completed to both Stage 1 and Stage 2 Filters.

9. **Chemfeed Upgrades – Rossdale** – $5.1 million (128%) greater than forecast. EWSI identified significant health, safety and environmental needs, requiring extensive upgrades to the sodium bisulphite room.
10. **Bypass Main (Ring Main) – E.L Smith** – $4.8 million (69%) greater than forecast. In 2019, a historical resource impact assessment confirmed the presence of cultural materials within the proposed construction area, requiring archaeological mitigation and increasing total project costs. Further design also identified the requirement for additional manual isolation valves to improve operational flexibility and redundancy.
11. **Obsolete Hydrant Replacement Program** – $4.6 million (104%) greater than forecast. Higher than expected rates of deterioration have led to increased backlog, requiring adjustments to hydrant replacement schedules. EWSI has adjusted its hydrant replacement schedule to clear backlogs and ensure fire protection service levels are maintained.
12. **Obsolete Valve Replacement Program** – $4.2 million (102%) greater than forecast. Similar to the obsolete hydrant replacement program, higher than expected rates of deterioration have led to increased backlog, requiring adjustments to valve replacement schedules. Although the projected cost of this program has increased substantially, improving overall valve operability in the system reduces isolation time, lessens the potential for property damage and mitigates customer impacts during emergency main break response.
13. **Chemfeed Upgrades – E.L Smith** – $3.5 million (87%) greater than forecast. Higher than estimated costs for a significant fluoride room upgrade to replace end-of-life equipment, and unanticipated upgrades to the sodium hypochlorite room, including new generation cells, are the primary factors contributing to the increase in the costs of this program.
14. **Filter Underdrain Upgrades – Rossdale** – $3.5 million (73%) greater than forecast. Both the scope and cost of this project have increased following an inspection of the filter underdrain system that identified unforeseen needs for upgrades to air scour systems, combined with an unexpected increase in the price of steel.
15. **Structural Upgrades – Reservoirs** – $ $2.5 million (145%) greater than forecast and Reservoir Cell and Pumphouse Roof Replacement – $3.1 million (50%) less than forecast. Due to shutdown requirements, roof replacement work and interior structural work needed to happen at the same time. As a result, the scope from the roof replacement program was added to the structural upgrades program. This change allows for more efficient project delivery and improvements to project management and coordination.
16. **Electrical Upgrades Program – Reservoirs** – $2.6 million (49%) less than forecast due to the deferral of lower priority electrical upgrades to a future PBR period.
17. **Water Main Reactive Renewal Program** – $4.4 million (8%) less than forecast. The decrease is primarily attributable to the ongoing COVID-19 pandemic, which is expected to result in the deferral of lower priority renewals to the next PBR period.

18. **Water Meter Change out Program** – $11.9 million (46%) less than forecast. The decrease in the projected cost of this program results from an improvement in the expected lives of the batteries used in the meters. As a result, fewer meters are expected to require replacement during the current PBR period.
19. **Reliability and Life Cycle Improvements < $5.0 million** – $3.5 million (5%) greater than forecast. The projected increase in this category results primarily from the combination of the increased scope of the Rossdale stilling basin upgrade project ($3.0 million); unanticipated Rossdale ring main rehabilitation requirements ($1.8 million); net flood protection capital expenditures not covered by provincial and federal funding ($1.6 million); and the new Transmission Main Inspection program ($1.2 million). These increases were offset by the deferral of lower priority Rossdale roof replacements ($2.0 million) and a significant portion of the E.L. Smith High Level Pump #5 upgrades to the next PBR period ($2.5 million)
20. **Water D&T Facility Expansion** – $8.8 million (55%) greater than forecast. Completion of the D&T Facility was originally planned for 2017. This project has been re-scoped following the transfer of Drainage to EPCOR and the completion of an EPCOR-wide real estate review. The review concluded that a consolidated solution for Water and Drainage would provide long-term synergies and operational efficiencies that would outweigh the additional capital costs.
21. **Water Main Cathodic Protection** – $5.1 million (24%) less than forecast. The reduction in the costs of the program result from adoption of more efficient anode installation processes combined with delays attributable to the ongoing COVID-19 pandemic.
22. **Accelerated Water Main Renewal** – $3.8 million (7%) less than forecast. The reduction is primarily attributable to the ongoing COVID-19 pandemic, which is expected to result in the deferral of lower priority accelerated renewals to the next PBR period.
23. **Accelerated Fire Protection** – $6.0 million (38%) less than forecast. EWSI expects that expenditures over the remainder of the 2017-2021 PBR term will be less than approved amounts, due to a smaller number of potential sub-projects meeting the Accelerated Fire Protection Program criteria. EWSI has allocated a portion of the additional funding towards the Infill funding program that was introduced in the past year. This is a trail program that offsets the costs of infrastructure upgrades in infill areas and was developed in conjunction with IDEA and the City of Edmonton. Additionally, funding has also been directed to critical work which has been identified in areas such as Distribution System Modifications (for City-driven relocates) and Transmission Main inspection work where capital expenditures are expected to exceed levels in the PBR forecast.
24. **E.L. Smith Solar Farm and Battery Storage (net of contributions)** – $35.3 million (new projects). As noted in section 2.3.2, instead of purchasing locally produced renewable power at an annual cost of $1.9 million, EWSI plans to construct a solar farm at E.L. Smith. Current plans for the solar farm include a battery storage system that would be almost entirely grant-funded.

2.4.2 Construction Work in Progress

In-City Water's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. In 2019, as shown on Table 2.4.2, the balance in Construction Work in Progress was $16.0 million greater than forecast, of which $4.9 million was attributable to the E.L.

Smith solar project, with the remainder primarily attributable to carry-over projects at the Water Treatment Plants including the Rossdale sodium bisulfate room upgrade (de-chlorination), the E.L. Smith fluoride room upgrade, E.L. Smith high lift pump house surge protection, and the orthophosphate system (Lead Mitigation Strategy).

Table 2.4.2
Construction Work in Progress
($ millions)

		A	B	C	D
	Construction Work in Progress	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Balance, beginning of period	3.3	13.2	0.3	3.8
2	Capital Expenditures	87.0	113.0	276.4	307.5
3	Capital Additions	(85.5)	(105.4)	(271.9)	(290.6)
4	**Balance, end of period**	**4.7**	**20.7**	**4.7**	**20.7**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2019, AFUDC included in capital expenditures on eligible projects amounted to $0.9 million, compared to the PBR forecast amount of $0.3 million.

2.5 Operational Performance

2.5.1 Water Quality Index

The Water Quality index is calculated as the percentage of water quality test results that meet EWSI's internal water standards. Water quality standards are established by both the federal and provincial governments and are incorporated into EWSI's Approval to Operate from Alberta Environment and Parks (AEP). In some cases, EWSI sets even stricter limits for critical parameters that are identified in EWSI Quality Standards, to provide early warnings of potential water quality problems; so that corrective actions can be taken before external standards are not met.

Table 2.5.1
Water Quality Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Index	The percentage of the total number of water quality tests taken in the period that do not yield suspect results	> 99.7%	99.8%	1.001
			Average Index	1.001
			Index Standard Points	25.0
			Total Actual Points	25.0
			Maximum Available Points Including Bonus Points	25.5
			Total Points Earned	**25.0**

2019 Highlights

- **Water Quality Index.** EWSI met all Health Canada Drinking Water Quality Guidelines and AEP water quality testing requirements in 2019. During the year, EWSI collected 62,329 samples of treated drinking water. Of those samples only 114 (0.2%) did not meet internal water quality standards.

  The majority (57%) of variances from internal water quality standards in 2019 were related to temporary increases in turbidity and / or decreases in chlorine concentrations in samples collected from the distribution system. Customer water quality inquires (representing 23% of the overall variances in 2019) were also related to increased turbidity and / or decreased chlorine.

2020 Areas for Improvement

Water Quality Index: EWSI is planning to use a rapid-field test (ATP) for ensuring the microbial quality of water levels related to distribution main flushing activities in 2020. This will continue to support required Total Coliforms (TC) and E. coli (EC) testing while ensuring more effective flushing and a resultant reduction of variances related to low chlorine and high turbidly samples (both observed in customer inquiries and the distribution system).

It should be noted that with the Covid-19 pandemic, challenges can be expected in the collection of samples from customers and public locations.

2.5.2 Customer Service Index

The customer service index is a composite measure of the customers' perception of satisfaction with EWSI service, the aesthetic quality of water and speed of response to customer issues.

Table 2.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Post Service Audit Factor	The percentage of the customers responding as "completely" or "very satisfied" in the level of service received from the EWSI Emergency group.	> 74.9%	74.5%	0.995
Home Sniffing Factor	The percentage result of customer satisfaction for the home sniffing survey.	> 94.4%	95.5%	1.011
Response Time Factor	The average number of minutes needed to confirm a water main break from the time a call is received at EWSI's dispatch office.	< 25	20.4	1.184
Planned Construction Impact Factor	The percentage of the total planned construction events where EWSI complies with required construction notification procedures.	> 95.8%	97.1%	1.013
			Average Index	1.051
			Index Standard Points	20.0
			Total Actual Points	21.0
			Maximum Available Points Including Bonus Points	23.0
			Total Points Earned	**21.0**

2019 Highlights

- **Post Service Audit (PSA) Factor**. In 2019, EWSI focused on enhancing the customer service culture by focusing on customer contact quality reviews and coaching. As a result, EWSI saw improvement to the PSA compared to 2018 and 2017. EWSI also implemented a new telephony system and processes for call handling. Working with EPCOR Drainage and Power, EWSI implemented a joint phone number and new call menu options for customers to call with any water, drainage, or power related emergencies.
- **Home Sniffing Factor**. The Home Sniffing program is designed to measure the impact of spring run-off in the river and the effectiveness of water treatment during this period, particularly in terms of mitigating run-off related odours at the tap. Spring runoff and associated treatment challenges started during the third week of March, and the water treatment plants were well prepared to manage taste and odour concerns effectively.

  EWSI increased recruitment of the number of home sniffers compared to 2018 numbers. This resulted in smoother data trends and increased statistical robustness of the calculated performance measure compared to previous years.

  A major improvement in 2019 was having Home Sniffers' results available online as feedback to water plant operators.

  Following the 3-month customer monitoring period, the calculated 2019 customer satisfaction factor was 95.5%, which exceeded the established target of 94.4%.

2020 Areas for Improvement

- **Post Service Audit (PSA) Factor**. In 2020, EWSI will be focused on continuing to grow the customer service culture by focusing on first call resolution and continuing to build customer service skills.
- **Home Sniffing Factor**. In 2020, EWSI is looking to further improve results by encouraging home sniffers to enter results daily. This will allow more closely represent real-time conditions feedback for water treatment practices to be adjusted accordingly. Weekend updating of online results will also allow for major off-hours changes in treatment.

  EWSI reviews spring run-off performance data and outcomes every year and includes this new information to update water treatment strategy. This provides opportunities to better respond to future run-offs.
- **Response Time Factor.** EWSI continues to focus on maintaining the response time factor.

2.5.3 System Reliability and Optimization Index

The System Reliability Index is a measure of the confidence that customers can place in the reliability of the waterworks system.

Table 2.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Main Break Factor	The number of water main breaks that occurred in the reporting period.	< 419	298	1.289
Water Main Break Repair Duration Factor	The percentage of water main breaks repaired and confirmed by EWSI within 24 hours from the time that the flow of water is shut off, excluding main breaks on arterial or collector roads.	> 93.7%	95.2%	1.016
Water Loss Factor	The Infrastructure Leakage Index, a performance indicator quantifying how well a water distribution system is managed for the control of “real” water losses (i.e. leakage).	< 2.0	1.19	1.405
System Energy Efficiency Factor	The energy used at all water facilities in kWh divided by the average annual water production per residential customer account (ML/kWh/customer).	< 309	250	1.234
			Average index	1.236
			Index Standard Points	25.0
			Total Actual Points	30.9
			Maximum Available Points Including Bonus Points	28.5
			Total Points Earned	**28.5**

2019 Highlights

- **Water Main Break Factor.** EWSI experienced 298 water main breaks in 2019, 121 less than the PBR standard of 419. This result is attributed to the effectiveness of on-going water main replacement programs.
- **Water Main Break Repair Duration Factor.** In 2019, 95.24% of main breaks were repaired within 24-hours, exceeding the PBR standard of 93.7%. When water main break repairs approached 20 hours in duration, EWSI provided additional communication to affected customers and when required, temporary water supply support via water tanks, hose hook ups and / or delivery of water jugs to affected customers.
- **Water Loss Factor (ILI).** In 2019, EWSI’s Infrastructure Leak Index (ILI) exceeded the PBR standard. A “real-loss” component analysis was also conducted. This increased understanding of the system’s real losses and identification of potential opportunities for further system improvements.
- **System Energy Efficiency Factor.** EWSI continued to focus on energy efficiency improvement and GHG reduction. Projects identified included:
    - Optimization of high-lift pump performance at both Rossdale and EL Smith water treatment plants which included maintaining pumping above 75 MLD at the Rossdale plant
    - Shifting production to the EL Smith WTP to take advantage of energy efficiencies
    - Implementing a 15℃ temperature target at reservoirs when not occupied

2020 Areas for Improvement

- **Water Main Break Factor.** EWSI will be continuing with cast iron replacement programs in 2020.
- **Water Main Break Repair Duration Factor.** EWSI will investigate using 24-hour rolling shifts on specific water outages to facilitate quicker repairs and thereby reduce water service outage times for affected customers.
- **Water Loss Factor (ILI).** EWSI will continue to look for additional areas of water loss that may be monitored and mitigated.
- **System Energy Efficiency Factor.** EWSI will investigate options to improve operational efficiency through automation, data analysis of existing systems and asset management processes.

2.5.4 Environment Index

The environmental index measures the success of programs and policies designed to mitigate and report adverse environmental impacts.

Table 2.5.4
Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Conservation Factor	The actual 10 year rolling average monthly Edmonton residential consumption per household.	<17.2	15.3	1.124
Environment Incident Factor	The number of reportable and preventable environmental incidents.	<6	3	2.000
Solids Residual Management Factor	The average number of days that the Rossdale and E.L. Smith water treatment plants are operating in direct filtration mode.	> 120	79	0.659
			Average index	1.261
			Index Standard Points	15.0
			Total Actual Points	18.9
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2019 Highlights

- **Water Conservation Factor.** Residential water consumption per customer continues to decline due to changes in habits and technology. In the past, habits such as turning the tap off while brushing teeth lowered consumption. Currently, technology continues to contribute to declining consumption through increasing use of higher efficiency appliances and low flush toilets. 2019 was also one of the coldest and wettest summers in history. This resulted in very low summer water consumption.
- **Environment Incident Management Factor.** Focus on reducing reportable incidents across EWSI continued through 2019. Three environmental incidents that were both preventable and reportable occurred. All three incidents were investigated to determine root causes. Corrective actions were subsequently assigned and completed. One incident involved a leak of chlorinated water to the North Saskatchewan River during maintenance activities, one involved a late report of a water quality

incident, and one involved a release of water from a transmission repair that resulted in erosion in a ditch.

- **Solids Residual Management Factor.** In 2019, unusually high raw water color in late fall and early winter created challenges for EWSI operations. As a result of these conditions, the treatment plants only achieved 79 days in Direct Filtration. However, total solids discharged to the North Saskatchewan River were still reduced by 15.4% as a result of operating in direct filtration relative to baseline conventional treatment.

2020 Areas for Improvement

- **Water Conservation Factor.** In 2020, COVID-19 is expected to result in higher than usual yearly residential consumption per customer due to people staying home. Based on results to date, the high residential consumption is being partially offset by lower commercial consumption.
- **Environment Incident Management Factor.** Environmental incident investigations will be targeting root cause identification. Enhanced erosion control processes will also be put in place for maintenance activities.
- **Solids Residual Management Factor.** EWSI will continue to investigate polymer and dosing strategies for effective transitioning between conventional treatment and direct filtration. The goal will be to further reduce solids discharged to the North Saskatchewan River.

2.5.5 Safety Index

The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public.

Table 2.5.5
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	>550	894	1.625
Work Site Inspections and Observations Factor	Number of Work Site Inspections and observations completed per year.	>1,032	3,217	3.117
Lost Time Frequency Factor	The actual lost time frequency rate.	<0.57	0.00	2.000
All Injury Frequency Factor	The actual all injury frequency rate	< 1.54	0.97	1.585
			Average index	2.082
			Index Standard Points	15.0
			Total Actual Points	31.2
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2019 Highlights

- **Near Miss Reporting Factor.** Near miss and hazard identification reporting continued to be an effective means to proactively identify hazards and implement corrective actions to mitigate potential harm to employees, contractors and members of the public.
- **Work Site Inspections / Observations Factor.** Work site inspections and observations continued to be a successful leading indicator that provided leaders the opportunity to engage in field activities, to proactively identify areas of improvement and to verify conformance to EPCOR requirements.
- **Lost Time Frequency Rate Factor.** In 2019, EWSI exceeded the lost time frequency rate factor by having no lost time events.
- **All Injury Frequency Rate Factor.** EWSI had 5 recordable incidents (Medical Treatment). Two involved employees being rear-ended while driving for work, one involved a back strain, one involved dust in an eye and one involved a dog bite.

2020 Areas for Improvement

- **Near Miss Reporting Factor.** With consideration of the impact of COVID-19 pandemic, there will be a heighted focus on the reporting of near miss and hazard identification throughout 2020 to ensure employees keep their mind on task and continue with proactive reporting.
- **Work Site Inspections / Observations Factor.** With consideration of the impact of COVID-19 pandemic, the opportunity to conduct work site inspections might be reduced. EWSI will monitor inspection activities and look for opportunities to conduct proactive field engagements.
- **All Injury Frequency Rate Factor.** EPCOR will be broadening the internal Safety program to capture Significant Incidents or Fatality Potential (SIFP) events. Monitoring for SIFP events is intended to assist in the identification of situations that could have life altering or fatality potential. The objective will be to ensure that root causes are identified and effective actions are established to prevent recurrence.

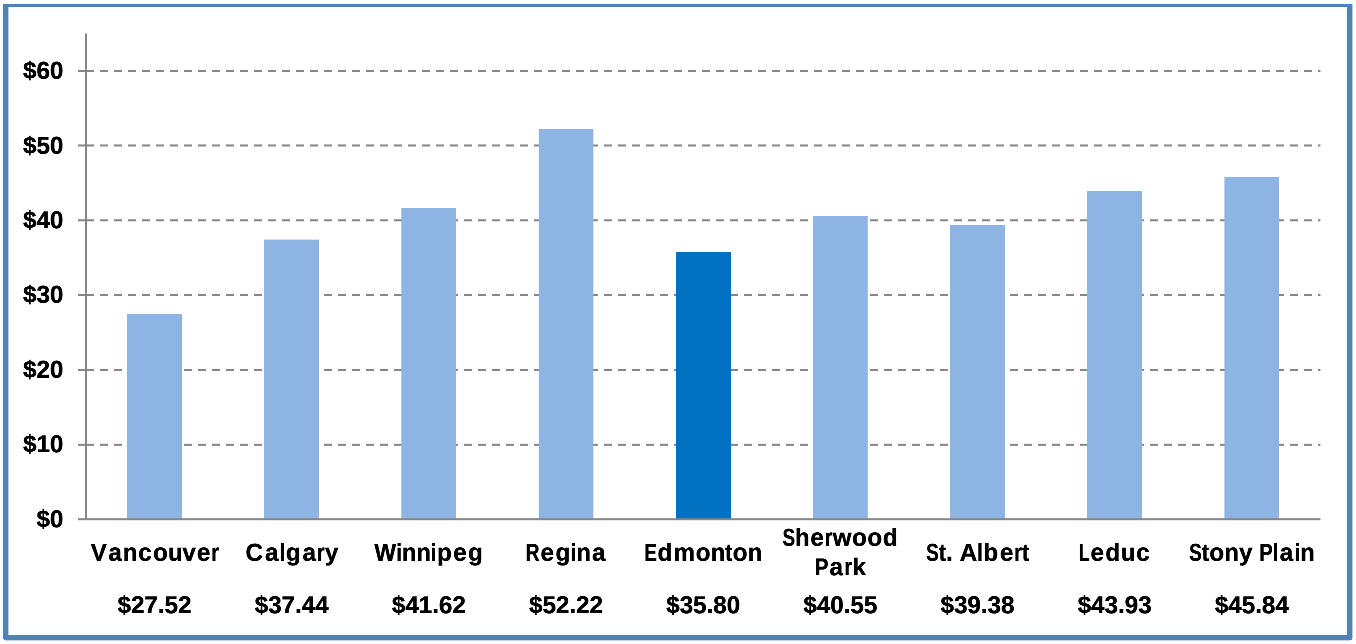
2.6 Rates and Bill Comparisons

Water bill comparisons for 2019 are based on the published water rates for Calgary, Vancouver, Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

2.6.1 Residential Water Bills

Figure 2.6.1 provides a comparison of residential household water bills for residential household consumption of 13.8 m^3 per month, the average residential customer consumption per month in Edmonton in 2019. Comparison of residential water bills shows that Edmonton's water bills are lower than all of the cities and local communities surveyed, except for Vancouver. This result is not unexpected; Vancouver has an excellent raw water source and, therefore, has lower needs for water treatment than Edmonton which has a naturally highly variable water source in the North Saskatchewan River.

Figure 2.6.1
2019 Monthly Residential Water Bill Comparison
(13.8 m³/month)



2.6.2 Commercial Water Bills

Table 2.6.2 provides a comparison of the water bills for commercial customer of various sizes. This table shows that water bills for EWSI's commercial customers are lower than all of the other surrounding communities and other major cities in western Canada, except for Vancouver and mid sized customers in Calgary.

Table 2.6.2
Commercial Monthly Water Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	22.97	310.20	1,270	6,164
3	Calgary	44.04	382.19	1,577	8,117
4	Regina	44.70	529.80	2,254	10,622
5	Winnipeg	34.70	473.60	1,892	9,271
6	**Edmonton**	**26.09**	**401.89**	**1,603**	**6,753**
7	St. Albert	33.03	433.83	1,686	8,366
8	Sherwood Park	30.86	642.86	2,555	12,755
9	Stony Plain	33.22	830.40	3,322	16,608
10	Leduc	34.54	639.70	2,654	12,676

3 Wastewater Treatment Services

3.1 Accomplishments and Challenges

In 2019, Wastewater's key accomplishments included:

- Completion of Wastewater's long term Integrated Resource Plan (IRP). Wastewater's IRP encompasses: customer growth; changes to provincial regulatory frameworks; technology; asset management; and health, safety and environmental considerations. The IRP provides a roadmap for enabling Wastewater to meet Edmonton's future growth demands and potential future effluent quality standards, within the existing footprint of the plant;
- EWSI entered an agreement with SYLVIS Environmental Service Inc. in which EWSI's biosolids will be used as part of a coal mine reclamation project at the Paintearth Mine near Forestburg, AB;
- The Gold Bar Stakeholder consultation plan was developed and executed through 2019 and provides the public with balanced and objective information to assist them in understanding the problems, alternatives, opportunities and/or solutions at the wastewater treatment plant. Several meetings with stakeholders were held. Shared outcomes and design principles were developed in collaboration with stakeholders that will drive and inform activities at the site. Going forward, the stakeholder engagement program will build upon the success of the work done in 2019
- Additional accomplishments are included in the 2019 Operating Plan below.

3.2 Customers and Consumption

Wastewater's customer counts, consumption and consumption per customer are similar to those of In-City Water. Differences in customer counts, almost entirely within the commercial customer class, are attributable to "water-only" customers who are not tied into the City's drainage system, such as businesses in industrial parks that are served by septic systems, as well as seasonal water customers, such as commercial lawn watering services and golf courses. Table 3.2 below provides a comparison of 2019 and 2017-2019 forecast to actual customer counts and consumption per customer.

Table 3.2
Customers, Consumption and Consumption per Customer

		A	B	C	D
	Customers and Consumption	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Customers				
1	Residential	266,018	269,736	261,089	264,451
2	Multi-Residential	3,837	3,779	3,791	3,765
3	Commercial	16,970	17,063	16,753	16,846
4	Total	**286,825**	**290,578**	**281,633**	**285,063**
	Monthly Consumption per Customer				
5	Residential	14.2	13.8	14.4	14.3
6	Multi-Residential	408.8	391.8	408.8	392.8

		A	B	C	D
Customers and Consumption		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
7	Commercial	120.9	112.4	122.8	116.2
	Annual Consumption - ML				
8	Residential	45,193.7	44,579.8	135,342.1	135,849.4
9	Multi-Residential	18,821.8	17,766.8	55,798.5	53,240.9
10	Commercial	24,616.3	23,010.6	74,086.7	70,484.0
11	Total	**88,631.8**	**85,357.2**	**265,227.3**	**259,574.3**

Actual to forecast differences in Wastewater's customer counts and consumption are attributable to the same factors discussed in Section 2.2.

3.3 Financial Performance

Wastewater's revenue requirements are summarized on Table 3.3 below.

Table 3.3
Wastewater Revenue Requirements
($ millions)

		A	B	C	D
Summary of Revenue Requirements		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Wastewater Rate Revenue*	98.8	92.3	278.0	266.7
	Wastewater Revenue Requirement				
2	Operating expenses	57.1	50.3	166.7	146.6
3	Other revenue	(6.8)	(6.9)	(19.5)	(19.3)
4	Depreciation and amortization	17.4	18.0	47.0	48.4
5	Return on rate base financed by debt	12.6	11.5	34.1	32.5
6	Return on rate base financed by equity	19.2	19.3	53.0	58.5
7	Wastewater Revenue Requirement*	99.5	92.3	281.4	266.7
8	**Return on Rate Base Financed by Equity**	**10.18%**	**10.93%**	**10.18%**	**11.84%**

* In the PBR forecast, rebasing and other special rate adjustments have been smoothed over the PBR term. Therefore, although forecast revenue is equal to the revenue requirement over the 2017-2021 PBR term, in any year within the PBR term, forecast revenue may be greater or less than the revenue requirement

Detailed explanations for forecast to actual variances for each of the elements of the revenue requirement are provided in sections 3.3.1 to 3.3.6.

3.3.1 Revenue

Wastewater's rate revenues include fixed monthly services charges applied on a per connection basis, and consumption charges applied to each cubic metre of consumption. Besides rate revenues, Wastewater also has a relatively small amount of other revenue, about 60% of which relates to overstrength surcharges that are subject to the same rate adjustment mechanism as Wastewater's rate revenue. Table 3.3.1 below provides a comparison of Wastewater's 2019 actual and forecast revenue.

Table 3.3.1
Wastewater Revenue
($ millions)

		A	B	C	D
	Wastewater Revenue	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Fixed Monthly Service Charges				
1	Residential	15.7	14.3	43.5	41.1
2	Multi-Residential	0.2	0.2	0.6	0.6
3	Commercial	1.0	0.9	2.8	2.6
4	Fixed Monthly Service Charges	16.9	15.5	46.9	44.4
	Consumption Charges				
5	Residential	42.4	40.7	119.7	118.0
6	Multi-Residential	17.7	16.2	49.4	46.2
7	Commercial	21.9	19.9	62.0	58.1
8	Consumption Charges	81.9	76.8	231.1	222.3
9	Wastewater Rate Revenue	98.8	92.3	278.0	266.7
10	Other Revenue	6.8	6.9	19.5	19.3
11	**Total Wastewater Revenue**	**105.6**	**99.1**	**297.4**	**286.0**

Wastewater's revenues were $6.5 million less than forecast in 2019, and $11.3 million less than forecast over the 2017-2019 PBR period. This difference is attributable to three factors:

- Lower than forecast inflation resulted in a $2.7 million decrease in 2019 ($5.0 million for 2017-2019). Since rate increases are capped at inflation less the efficiency factor ("i-x"), lower than forecast inflation from 2016 to 2019 will continue to impact revenues throughout the remainder of the 2017-2021 PBR term;
- Lower than forecast consumption resulted in a $3.0 million decrease in 2019 ($4.9 million for 2017-2019). As with Water, residential consumption per customer was 2.7% lower than the PBR forecast primarily attributable to higher than average precipitation over the summer months. Unexpected decreases in per customer consumption in the commercial and multi-residential customer classes continue to be a source of concern. Accordingly, EWSI is working to enhance consumption forecasting processes for the commercial and multi-residential customer classes; and
- The non-routine adjustment related to the transfer of Drainage Services to EPCOR (see Section 1.5) has reduced revenues by $1.1 million in 2019 ($1.9 million for 2017-2019).

3.3.2 Operating Expenses by Function

Wastewater's operating expenses are presented and analyzed on both functional and cost category bases. Actual and forecast operating expenses by function are shown in Table 3.3.2 below:

Table 3.3.2
Operating Expenses by Function
($ millions)

		A	B	C	D
	Function and Sub-function	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
	Power, Other Utilities and Chemicals				
1	Power and Other Utilities	5.4	5.3	16.0	14.7
2	Chemicals	1.6	1.2	4.8	3.5
3	Power, Other Utilities and Chemicals	7.1	6.6	20.8	18.2
	Wastewater Treatment				
4	Wastewater Treatment Plant	19.2	17.3	56.3	52.2
5	Operations Support Services	8.3	6.3	24.4	19.1
6	Capitalized Overhead	(2.4)	(3.1)	(7.1)	(9.1)
7	Wastewater Treatment	25.0	20.5	73.6	62.2
	Billing, Meters and Customer Service				
8	Billing and collections	3.4	3.3	9.9	9.7
9	Meter reading	2.4	2.4	7.2	6.9
10	Regulatory Services	1.0	1.4	3.0	3.9
11	Billing, Meters and Customer Service	6.9	7.1	20.1	20.5
	EWSI Shared Services				
12	EWSI Shared Services	3.5	3.3	10.1	9.6
13	Incentive and Other Compensation	1.2	1.0	3.4	1.8
14	EWSI Shared Services	4.6	4.3	13.6	11.4
15	Corporate Shared Services	5.1	4.0	14.9	11.9
	Franchise Fees and Property Taxes				
16	Franchise Fees	7.5	7.2	21.5	20.8
17	Property Taxes	1.0	0.6	2.4	1.8
18	Franchise Fees and Property Taxes	8.5	7.8	23.9	22.6
19	**Total Operating Expenses by Function**	**57.2**	**50.4**	**166.9**	**146.7**

Overall, Wastewater's operating expenses for 2019 were $6.8 million less than forecast ($20.2 million less for 2017-2019). Key factors contributing to this difference include:

- **Power and Other Utilities** - $0.1 million less than forecast in 2019, ($1.3 million less for 2017-2019), due to lower than forecast power prices.
- **Chemicals -** $0.4 million less than forecast in 2019 ($1.3 million less for 2017-2019), primarily attributable to two factors. First, the Ostara nutrient removal facility was offline more than expected, resulting in lower chemical usage over the 2017 to 2019 period. Second, process and dosing optimization enabled Wastewater to achieve significant reductions in alum usage over the 2017 to 2019 period.
- **Wastewater Treatment** - $4.5 million less than forecast in 2019 ($11.4 million less for 2017-2019). The favourable variance is primarily attributable to adjustments to the capital program, where projects with a high component of contractor costs have been replaced by capital maintenance and repair projects completed by Wastewater personnel. These changes have led to capitalization of an additional $1.7 million of internal labour costs that would otherwise have been expensed ($4.8 million for 2017-2019) and additional capitalized overheads of $0.7 million in 2019 ($2.0 million for 2017-2019). Besides these changes, the favourable variance also reflects lower than forecast fringe benefits costs of $0.8 million in 2019 ($1.8 million for 2017-2019) related to lower pension

contributions, and $1.1 million in savings in contractor costs ($1.4 million for 2017-2019) resulting from dissolution of the Centre for Excellence, lower maintenance costs, and the completion of fewer engineering studies in 2019. The remainder of the variance results from numerous small items, none of which are individually significant.

- **EWSI Shared Services** - $0.3 million less than forecast in 2019 ($2.2 million less for 2017-2019). Lower than forecast costs in this category reflect a $0.3 million reduction in business unit allocations related to the transfer of Drainage Services to EPCOR ($1.0 for 2017-2019). The 2017-2019 variance includes $0.8 million of savings in long term disability premiums, the remainder of the variance results from numerous small items, none of which are individually significant.
- **Corporate Shared Services** - $1.1 million less than forecast in 2019 ($3.0 million less for 2017-2019). These differences reflect both the reduction in corporate cost allocations resulting from the transfer of Drainage from the City of Edmonton to EPCOR Utilities Inc., as well as cost savings in corporate functions. As with In-City Water, the cost reductions arising from the transfer of Drainage Services have been returned to Wastewater customers through a non-routine adjustment to 2018 water rates.
- **Franchise Fees and Property Taxes** - $0.7 million less than forecast in 2019 ($1.3 million less for 2017-2019). Lower than forecast revenue resulted in a $0.3 million reduction in franchise fees in 2019 ($0.7 million for 2017-2019). Lower than forecast property taxes relate to the deferral of capital projects, including the Operations Center at Mid-point Entrance project, which had been forecast to increase property taxes.

3.3.3 Operating Expenses by Cost Category

Table 3.3.3 shows operating expenses by cost category for Wastewater Treatment Plant Operations, Billing Meters and Customer Service, and EWSI Shared Services, where cost categories differ from the sub-functions in Section 3.3.2.

Table 3.3.3
Operating Costs by Cost Category
($ millions)

		A	B	C	D
		2019		**2017-2019**	
	Cost Category	**PBR Forecast**	**Actual**	**PBR Forecast**	**Actual**
	Wastewater Treatment				
1	Staff Costs and Employee Benefits	17.8	14.3	52.5	43.5
2	Contractors and Consultants	4.1	2.8	12.1	10.3
3	Materials and Supplies	2.1	2.2	6.0	6.6
4	Other	1.0	1.3	3.0	1.8
5	Wastewater Treatment Expenses	25.0	20.5	73.6	62.2
	Billing, Meters and Customer Service				
6	CUS Charges	3.4	3.3	9.9	9.7
7	Contractors and Consultants	3.5	3.8	10.2	10.8
8	Billings, Meters and Customer Services Expenses	6.9	7.1	20.1	20.5
	EWSI Shared Services				
9	EWSI Shared Services Allocation	3.2	2.9	9.4	8.4

	Cost Category	A	B	C	D
		2019		2017-2019	
		PBR Forecast	Actual	PBR Forecast	Actual
10	Staff Costs and Employee Benefits	1.3	1.3	3.8	2.7
11	Other	0.1	0.1	0.4	0.2
12	EWSI Shared Services Expenses	4.6	4.3	13.6	11.4

The information presented in this table supports the explanations of differences between 2019 actual and forecast expenses provided in Section 3.3.3. Accordingly, no additional explanations are considered necessary.

3.3.4 Depreciation and Amortization

Wastewater's depreciation expense and amortization of contributed assets for 2019 are shown in Tables 3.3.4 below:

Table 3.3.4
Depreciation and Amortization
($ millions)

	Depreciation and Amortization	A	B	C	D
		2019		2017-2019	
		PBR Forecast	Actual	PBR Forecast	Actual
1	Gross depreciation expense	18.3	19.0	49.8	51.2
2	Amortization of contributions	(0.9)	(0.9)	(2.8)	(2.8)
3	**Depreciation, net**	**17.4**	**18.0**	**47.0**	**48.4**

Wastewater's 2019 depreciation expense was $0.7 million greater than forecast ($1.4 million greater for 2017-2019), even though plant in service was $54.9 million (8%) less than forecast at December 31, 2019 (Table 3.3.5, line 4). This difference results from adjustments to Wastewater's capital program where asset replacement projects were replaced with capital maintenance and repair projects, which have higher effective depreciation rates than asset replacements. In the PBR forecast depreciation expense was calculated as if all asset additions related to new assets, rather than repair or to overhauls of existing assets. EWSI expects that the effect of higher than forecast depreciation rates will continue through the remainder of the 2017-2021 PBR term.

3.3.5 Rate Base

Wastewater's 2019 mid-year rate base, shown in Table 3.3.5 below, was $28.3 million less than forecast, reflecting lower than forecast capital additions in 2017 and 2019 resulting from project deferrals and other adjustments to the capital program described in Section 3.4.1.

Table 3.3.5
Mid-Year Rate Base
($ millions)

		A	B
		2019	
	Components of Mid-Year Rate Base, net of Contributions	**PBR Forecast**	**Actual**
	Plant in Service		
1	Balance, beginning of year	639.4	592.0
2	Capital additions	47.2	40.8
3	Retirements and adjustments	-	(1.1)
4	Balance, end of year	686.6	631.7
5	Mid-Year Plant in service	663.0	611.8
	Accumulated Depreciation		
6	Balance, beginning of year	167.8	145.1
7	Depreciation expense	18.3	19.0
8	Retirements and adjustments	-	(1.1)
9	Balance, end of year	186.1	163.0
10	Mid-Year Accumulated Depreciation	176.9	154.1
	Other Rate Base Items		
11	Working Capital	6.2	6.0
12	Materials and Supplies	1.6	1.7
13	**Gross Mid-Year Rate Base**	**493.8**	**465.5**
	Contributions		
14	Balance, beginning of year	41.0	41.0
15	Contributions in aid of construction	-	-
16	Balance, end of year	41.0	41.0
17	Mid-Year Contributions	41.0	41.0
18	Accumulated Amortization		
19	Balance, beginning of year	17.5	17.5
20	Amortization of contributions	0.9	0.9
21	Balance, end of year	18.4	18.4
22	Mid-Year Accumulated Amortization	17.9	17.9
23	**Mid-Year Contributions**	**23.0**	**23.0**
24	**Mid-Year Rate Base**	**470.8**	**442.5**

Unlike In-City Water, where contributions relate primarily to developer-funded assets, contributions included in Wastewater's rate base offset the cost of non-utility assets included in Wastewater's plant in service. This treatment ensures that the capital costs associated with these assets are not borne by utility rate payers. The cost of operating these assets, as well as any related revenues are also excluded from Wastewater's financial results.

3.3.6 Return on Rate Base

In 2019, Wastewater's return on equity was $0.1 million (0.75%) greater than forecast and $5.5 million (1.66%) greater for 2017-2019. In 2019, higher than forecast net income accounted for 0.10% of this increase (1.10% for 2017-2019), with a lower than forecast rate base accounting for the remainder. EWSI expects that operating cost savings (see section 3.3.2) will continue to offset any reductions in revenue and drive higher than forecast returns on equity for the remainder of the 2017-2021 PBR term.

Table 3.3.6-1
Return on Rate Base
($ millions)

	Return on Rate Base	2019 PBR Forecast	2019 Actual	2017-2019 PBR Forecast	2017-2019 Actual
1	Mid-year Rate Base	470.8	442.5		
	Capital Structure				
2	Debt (%)	60.00%	60.00%		
3	Equity (%)	40.00%	40.00%		
	Cost of Capital				
4	Cost of Debt	4.45%	4.32%	4.36%	4.38%
5	Cost of Equity	10.18%	10.93%	10.18%	11.84%
6	Weighted Average Cost of Capital	6.74%	6.96%	6.68%	7.36%
	Return on Mid-Year Rate Base				
7	Return on Rate Base Financed by Debt	12.6	11.5	34.1	32.5
8	Return on Rate Base Financed by Equity	19.2	19.3	53.0	58.5
9	**Return on Mid-year Rate Base**	**31.7**	**30.8**	**87.1**	**90.9**

Wastewater's weighted average cost of debt calculation, shown in Table 3.3.6-2 below, yields average debt costs that are very close to forecast, as Wastewater has reduced issuances of new long-term debt in response to lower than forecast capital expenditures. Accordingly, lower than forecast interest expense over the 2017 to 2019 period is primarily attributable to lower than forecast debt issuances.

Table 3.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B	C	D
	Interest Expense and Cost of Debt	2019 PBR Forecast	2019 Actual	2017-2019 PBR Forecast	2017-2019 Actual
	Interest Expense				
1	Interest on short-term debt	0.9	1.1	2.7	3.2
2	Interest on City of Edmonton debentures	2.8	-	9.2	6.2
3	Interest on intercompany debentures	9.2	10.7	23.1	23.6
4	Total Interest expense	12.9	11.8	35.1	33.0
	Mid-year debt and other long-term liabilities				
5	Mid-Year Short-term debt	32.8	20.6		
6	Mid-Year Long-term debt	257.6	252.6		
7	Mid-Year Other Long-term liabilities	0.5	0.2		
8	Total Mid-year debt and other long-term liabilities	290.8	273.3		
9	**Embedded cost of Debt**	**4.45%**	**4.32%**	**4.36%**	**4.38%**

3.3.7 Transactions with Affiliates

Wastewater derives a significant proportion of its revenue and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries, and other EPCOR Water Services Inc. business units. Table 3.3.7 summarizes Wastewater's transactions with affiliates.

Table 3.3.7
Transactions with Affiliates
($ millions)

		A	B	C	D
	Affiliate and Service	**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**				
2	Wastewater Treatment Services	1.0	1.3	3.1	3.6
3	Other Services	0.2	-	0.7	0.3
4	Total	1.3	1.3	3.7	3.9
5	**Services provided by (recovered from):**				
6	**City of Edmonton**				
7	Franchise Fees	7.5	7.2	21.5	20.8
8	Property Taxes	1.0	0.6	2.4	1.8
9	Interest on Long Term Debt	2.8	-	9.2	6.2
10	Regulatory Services	1.0	-	3.0	0.7
11	Biosolids Contractor Service	-	4.6	-	4.6
12	Other Services	0.2	0.2	0.5	0.6
13	Total	12.6	12.6	36.7	34.6
14	**EPCOR Utilities Inc.**				
15	Corporate Shared Service Costs	5.1	4.0	14.9	11.9
16	Interest on Intercompany Loans	9.2	10.7	23.1	23.6
17	Interest on Short-term debt	0.9	1.1	2.7	3.2
18	Other Services	-	0.1	-	0.1
19	Total	15.2	15.9	40.7	38.8
20	**EPCOR Distribution and Transmission Inc.**				
21	Maintenance and other services	0.1	-	0.2	0.2
22	**EPCOR Technologies Inc.**				
23	Hydrovac Charges	-	-	-	0.2
24	**EPCOR Energy Alberta LP**				
25	Billing and Collection Services	3.1	2.9	8.9	8.6
26	**Other EWSI Business Units**				
27	EWSI Shared Services Allocation	3.2	2.9	9.4	8.4
28	Meter reading services from In-City Water	2.4	2.4	7.2	6.9
29	Water purchases from In-City Water	0.4	0.5	1.1	1.3
30	Regulatory services from Drainage Services	3.1	1.4	8.9	3.2
31	Project engineering recoveries from Drainage	-	-	-	(1.2)
32	Laboratory services recoveries from Drainage	-	(0.4)	-	(0.8)
33	Total	9.1	6.8	26.6	17.8
34	**Expenditures on capital projects arising from services provided by:**				
35	EPCOR Technologies Inc.	-	-	-	0.3
36	EPCOR Utilities Inc.	-	0.1	-	0.3
37	Total	-	0.1	-	0.6

3.4 Capital Programs

3.4.1 Capital Expenditures

Table 3.4.1 compares approved capital expenditures from the PBR forecast to actual capital expenditures for 2019 for each project with approved capital expenditures in excess of $5.0 million over the 2017-2021

PBR term, as well as for each project category. Table 3.4.1 also provides a comparison of total 2017-2021 approved capital expenditures to EWSI's current capital forecast.

Table 3.4.1
Capital Expenditures
($ millions)

		A	B	C	A	B	C	D	E	F
		2019			**2017 to 2019**			**2017 to 2021**		
		PBR Forecast	**Actual**	**Difference**	**PBR Forecast**	**Actual**	**Difference**	**PBR Forecast**	**Current Projection**	**Differen ce**
1	**Reliability and Life Cycle Improvements**									
2	Build Pipe Racks	-	2.1	2.1	-	2.1	2.1	-	9.7	9.7
3	Replace 2.5km of Sludge Line	-	5.9	5.9	-	7.1	7.1	-	7.5	7.5
4	Clarifier Chain Replacement	1.2	2.2	1.0	2.8	7.1	4.4	4.1	9.9	5.8
5	Sludge Line Upgrades	1.1	0.2	(0.9)	3.4	7.9	4.6	3.4	8.0	4.7
6	Mechanical Rehab Program	3.7	4.2	0.5	11.3	15.2	4.0	15.6	19.6	4.0
7	Structural Rehab Program	1.5	3.2	1.7	4.5	5.6	1.1	7.7	11.4	3.7
8	Distribution Chamber Reconstruction	0.5	2.5	2.0	3.8	6.8	3.0	3.8	6.8	3.0
9	Digester 3 Upgrades	-	1.6	1.6	11.3	11.4	0.0	11.3	13.6	2.3
10	Electrical Rehab Program	0.5	2.0	1.5	3.7	5.1	1.3	7.2	8.6	1.4
11	Structural Rehab Secondaries 1-8	3.7	5.1	1.5	10.4	13.4	3.1	17.6	18.8	1.3
12	Operations Center at Mid-Point Entrance	8.8	0.1	(8.7)	17.4	1.1	(16.3)	19.4	6.9	(12.5)
13	Digester 4 Upgrades	5.4	0.1	(5.3)	5.4	1.3	(4.0)	12.0	1.3	(10.7)
14	Headworks and Primary Aeration System Upgrades	0.6	1.1	0.5	6.7	1.3	(5.4)	6.7	1.4	(5.3)
15	Buildings and Site Rehab	4.7	1.9	(2.8)	10.4	4.0	(6.3)	12.8	8.5	(4.3)
16	Square 1 Gas Room Replacement	1.0	0.4	(0.6)	1.0	0.4	(0.6)	15.6	11.3	(4.3)
17	Utility Hot Water System Rehabilitation	4.7	2.3	(2.4)	11.9	6.7	(5.2)	13.9	10.1	(3.8)
18	Site Ventilation Rehabilitation	8.8	4.7	(4.0)	20.7	14.2	(6.6)	31.5	28.2	(3.3)
19	Projects < $5 million	2.9	3.3	0.4	16.2	16.8	0.7	21.2	24.7	3.6
20	**Subtotal**	49.0	43.0	(6.0)	140.7	127.7	(13.0)	203.4	206.3	2.9
21	**Hydrovac Sanitary Grit**									
22	Hydrovac Sanitary Grit Treatment Facility	-	(0.0)	(0.0)	8.4	7.3	(1.1)	8.4	7.3	(1.1)
23	**Performance Efficiency and Improvement**									
24	Plant Improvements*	2.6	2.6	0.0	6.9	7.6	0.7	10.6	12.3	1.7
25	Projects < $5 million	0.8	2.2	1.5	4.7	3.3	(1.4)	7.0	4.7	(2.3)
26	**Subtotal**	**3.4**	**4.9**	**1.5**	**11.6**	**10.9**	**(0.8)**	**17.6**	**17.0**	**(0.6)**
27	**Growth/Customer Requirements**									
28	Projects < $5 million	-	1.0	1.0	1.5	1.0	(0.5)	1.5	1.6	0.0
29	**Health, Safety and Environment**									
30	Projects < $5 million	0.9	0.5	(0.4)	3.4	1.7	(1.7)	4.5	5.0	0.5
31	**Regulatory**									
32	Projects < $5 million	-	-	-	-	-	-	-	1.5	1.5
33	**Capital Expenditures, net of Contributions**	**53.3**	**49.3**	**(4.0)**	**165.6**	**148.5**	**(17.1)**	**235.4**	**238.6**	**3.2**

* Plant Improvements project is a consolidation of the individual plant improvements ($2.9M), control system upgrades ($1.0M), control system operational improvements program ($2.6M), and instrumentation upgrades ($4.1M) projects approved in the 2017 to 2021 PBR.

Explanations for differences between PBR forecast capital expenditures for 2017 to 2021 and EWSI's current projection in excess of $2.0 million include:

1. **Build Pipe Racks** – $9.7 million (new project). This project provides for construction of an above-ground pipe rack network to allow the relocation of biogas piping, glycol heating lines and electrical circuits out of underground tunnels at the Gold Bar Plant. Moving these utilities above ground will reduce tunnel ventilation upgrade costs, enable future expansion of process piping, facilitate compliance with building and fire codes, and provide a safer working environment.
2. **Replace 2.5 km of Sludge lines** – $7.5 million (new project). This project provides for replacement of a 2.5 km section of the sludge line between the Clover Bar lagoons and the North Saskatchewan River. Upon inspection this section of the sludge line was found to be in such poor condition that repairs and/or rehabilitation was not financially viable and full replacement was required.
3. **Clarifier Chain Replacement** – $5.8 million (144%) greater than forecast. The costs of this project have increased significantly following the premature failure of stainless steel clarifier chains due to unexpected localized corrosion. These chains are being replaced with plastic loop chains which have a better performance record at Gold Bar.
4. **Sludge Line Upgrades** – $4.7 million (139%) greater than forecast. The PBR forecast only included the costs of cleaning and inspecting the sludge lines between Gold Bar WWTP and the Clover Bar Lagoons. Inspections on older sections showed that the sludge lines were in poor condition and required significant additional capital expenditure under this project for rehabilitation/replacement to ensure that these pipelines can continue to operate with minimal risk of leakage.
5. **Mechanical Rehabilitation Program** – $4.0 million (26%) greater than forecast, reflecting expenditures on emergency repairs. The most significant repairs included repair of a leaking glycol heating line ($1.9 million), and replacement of six aluminum gates on Screens 4 – 6 ($1.0 million) to allow tank isolation and maintenance.
6. **Structural Rehabilitation Program** – $3.7 million (49%) greater than forecast, primarily attributable to the costs of addressing greater than expected concrete deterioration at the Gold Bar Diversion Structure caused by long-term H2S gas exposure ($9.0 million). This increase has been partially offset by deferral of lower priority structural rehabilitation sub-projects.
7. **Distribution Chamber Reconstruction** – $3.0 million (79%) greater than forecast. The increase in the forecast cost of this project results from higher than expected competitive bids from contractors, as well as higher than expected costs to demolish the distribution chamber and to construct the lift station tie-ins.
8. **Digester 3 Upgrades** – $2.3 million (20%) greater than forecast, which are primarily due to the costs associated with addressing unanticipated leakage from the structure identified during commissioning tests.
9. **Operations Centre at Mid-Point Entrance** – $12.5 million (64%) less than forecast. Changes to the costs and timing of this project reflect design reviews and scope adjustments incorporating the results of significant public consultation.
10. **Digester 4 Upgrades** – $10.7 million (89%) less than forecast. Revised solids loading forecasts suggest sufficient digestion capacity at the current time, which allows for the deferral of upgrades to Digester 4 to future PBR periods.

11. **Headworks and Primary Aeration System Upgrades** – $5.3 million (80%) less than forecast, reflecting a reduction in the scope of this project following EWSI's determination that restoring aeration in the main influent channels was not required.
12. **Buildings and Site Rehabilitation Program** – $4.3 million (34%) less than forecast. The scope of this project was reduced following an internal review which concluded that certain sub-projects could be safely deferred, allowing resources to be focused on unanticipated, higher-priority projects.
13. **Square 1 Gas Room Replacement** – $4.3 million (27%) less than forecast, reflecting scope and design changes that are expected to more efficiently resolve the identified process safety risks, at a lower total cost.
14. **Utility Hot Water System Rehabilitation** – $ 3.8 million (27%) less than forecast. The decrease is primarily due to the ongoing COVID-19 pandemic, which is expected to result in the deferral of additional significant portions of the Loop 5 and 7 upgrades ($2.1 million) to the next PBR period. The remaining decrease relates to the deferral of other utility hot water system rehabilitation and upgrade work to a future PBR period, allowing resources to be focused on unanticipated, higher-priority projects.
15. **Site Ventilation Rehabilitation Program** – $3.3 million (11%) less than forecast, primarily due to changes to the design of the ventilation of the EPT Building, along with the deferral of lower priority projects to future years as a result of the COVID-19 pandemic.
16. **Reliability and Life Cycle Improvements < $5.0 million** – $3.6 million (24%) greater than forecast. The projected increase in this category results primarily from the purchase and installation of new onsite emergency back up power generation ($2.0 million); unanticipated preliminary scope and design costs associated with a new Dewatering Facility ($2.9 million); and changes to projected costs for other growth projects amounting to a $1.3 million reduction in costs.
17. **Performance Efficiency and Improvement < $5.0 million** - $2.3 million (33%) less than forecast. The projected decrease in this category results primarily from the cancellation of the channel access improvements program ($2.1 million).

3.4.2 Construction Work in Progress

Wastewater's rate base consists of plant in service. If a capital project has not been completed (i.e. not placed into service) during the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base. The 2019 year-end balance of Wastewater's Construction Work in Progress is $9.5 million greater than forecast, reflecting changes in the timing of project completion.

Table 3.4.2
Construction Work in Progress
($ millions)

		A	B	C	D
Construction Work in Progress		**2019**		**2017-2019**	
		PBR Forecast	**Actual**	**PBR Forecast**	**Actual**
1	Balance, beginning of period	18.2	25.4	19.2	22.6
2	Capital Expenditures	53.3	49.3	165.6	148.6
3	Capital Additions	(47.2)	(40.8)	(160.5)	(137.3)
4	**Balance, end of period**	**24.3**	**33.8**	**24.3**	**33.8**

The PBR plan allows EWSI to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2019, because of the higher average balance of Construction Work in Progress, AFUDC included in capital expenditures on eligible projects amounted to $1.9 million, compared to the PBR forecast amount of $1.1 million.

3.5 Operational Performance

3.5.1 Water Quality and Environmental Index

The Water Quality and Environmental index is a composite measure intended to assess EWSI's impact on the environment through the quality of the wastewater effluent returned back to the North Saskatchewan River and the effectiveness of environmental management programs.

Table 3.5.1
Water Quality and Environmental Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Water Quality Factor	The value of the Wastewater Effluent Limit Performance, which aggregates measures of the percentage of the discharge limit for five parameters in the Gold Bar wastewater treatment plant's final effluent.	< 28.0%	25.3%	1.108
Environmental Incident Factor	The actual number of environmental incidents that are both reportable and preventable	< 10	3	3.333
			Average Index	2.220
			Index Standard Points	55.0
			Total Actual Points	122.1
			Maximum Available Points Including Bonus Points	60.5
			Total Points Earned	**60.5**

2019 Highlights

- **Wastewater Effluent Limit Performance Index.** Ongoing maintenance of secondary clarifier chains and drive mechanisms continued through 2019. Although there was a short setback due to elevated solids loading in May when two clarifiers were undergoing maintenance, the plant recovered within a few days and maintained improved performance for the remainder of 2019.

- **Environment Incident Management.** There were three reportable and preventable incidents attributed to Gold Bar operations in 2019. However, none of these incidents were the result of poor effluent quality and none had any effect on the North Saskatchewan River.

  One incident involved a missed fence line odour sample, one involved a bio-solids application spill from a contractor's truck and the third resulted from a mechanical failure that resulted in some overflow to soil at a park next to the Gold Bar plant.

2020 Areas for Improvement

- **Wastewater Effluent Limit Performance Index.** There will be a continued focus on preventative maintenance programs to limit unplanned downtime through 2020.
- **Environment Incident Management.** Quality assurance and quality control procedures for daily manual air quality samples will be reviewed to improve data analysis for incident reviews.

3.5.2 Customer Service Index

Wastewater's customer service index for the 2017-2021 PBR term includes three equally weighted odour metrics. These metrics recognize that Wastewater's customer interactions typically relate to odour concerns from customers located close to the Gold Bar Wastewater Treatment Plant.

Table 3.5.2
Customer Service Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
H_2S - 1 Hour Exceedance Factor	The average of the number of exceedances of the 1 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	< 6	0	2.000
H_2S - 24 Hour Exceedance Factor	The average of the number of exceedances of the 24 hour limit registered at the Gold Bar and Beverly air quality monitoring stations.	< 2	0	2.000
Scrubber Uptime Factor	The percentage of time that the scrubbers are on line.	> 90%	98.8%	1.098
			Average Index	1.699
			Index Standard Points	15.0
			Total Actual Points	25.5
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2019 Highlights

- **H_2S - 1 and 24 Hour Exceedance Factor.** Fence line H_2S monitoring continued through 2019. This enhanced monitoring ability for Gold Bar operations to intervene prior to elevated levels of H_2S and thereby avoid exceedances.

- **Scrubber Uptime Factor.** Redundant chemical feed pumps and instrumentation were added in 2018. This improved scrubber uptime for 2019 which, in turn, minimized H_2S exceedances.

2020 Areas for Improvement

- **H_2S - 1 and 24 Hour Exceedance Factor.** Recently installed odour modelling software will be configured in 2020 to provide alerts for odour plumes that could result in H_2S exceedances. These alerts are expected to permit early intervention to avoid potential exceedances.

  Two new localized scrubbers at the grit and screening buildings will be commissioned during 2020.

  Design of an air quality monitoring station at Gold Bar will continue through 2020 with expected installation in 2021.

- **Scrubber Uptime Factor.** The preventative maintenance program will be continued and can be expected to further limit unplanned scrubber downtime.

3.5.3 System Reliability and Optimization Index

The system reliability and optimization index is a measure of the performance of the Gold Bar Wastewater Treatment Plant and the degree to which the wastewater treatment system is optimized to minimize its impact on the environment.

Table 3.5.3
System Reliability and Optimization Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Enhanced Primary Treatment Factor	The percentage of time that the enhanced primary treatment facility ran during wet weather events where the influent flow rate exceeded the EPT event threshold.	> 80.0%	100.0%	1.250
Biogas Utilization Factor	The percentage of biogas utilized, calculated as the volume of biogas produced less the volume flared divided by the volume produced.	> 60.0%	84.2%	1.403
Energy Efficiency Factor	The energy used in all wastewater facilities in kWh divided by the volume of wastewater effluent that either receives ultraviolet (UV) treatment or is membrane plant effluent.	< 514	500	1.028
			Average Index	1.227
			Index Standard Points	15.0
			Total Actual Points	18.4
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2019 Highlights

- **Enhanced Primary Treatment (EPT) Factor.** EPT clarifiers were proactively cleaned and inspected in 2019. This minimized clarifier downtime and maximized availability for primary treatment.

- **Biogas Utilization Factor.** Improvements to the glycol heat recirculation system resulted in more consistent boiler supply and return temperature control.
- **Energy Efficiency Factor.** Even though energy consumption was at a peak in 2019, higher effluent flow rates during wet weather resulted in an improved efficiency factor.

2020 Areas for Improvement

- **Enhanced Primary Treatment (EPT) Factor.** The EPT asset management plan will be reviewed to identify assets nearing end of life. This will result in reduced unplanned downtime.
- **Biogas Utilization Factor.** Boiler operations will be reviewed to further optimize boiler utilization.
- **Energy Efficiency Factor.** Blower upgrades and process air systems are to be reviewed for optimization opportunities.

3.5.4 Safety Index

EPCOR and EWSI are committed to a safe, healthy lifestyle and demonstrate this through care and concern for people. The safety index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public

Table 3.5.4
Safety Index

Index Component	PBR Performance Measure	Standard	Actual Score	Index
Near Miss Reporting Factor	The number of near miss reports entered in the ESS system.	>220	241	1.095
Work Site Inspection Factor	Number of Work Site Inspections and observations completed per year.	>919	1061	1.155
Lost Time Frequency Factor	The actual lost time frequency rate.	<0.75	0.00	2.000
All Injury Frequency Factor	The actual all injury frequency rate	<1.50	0.63	2.388
			Average Index	1.659
			Index Standard Points	15.0
			Total Actual Points	24.9
			Maximum Available Points Including Bonus Points	16.5
			Total Points Earned	**16.5**

2019 Highlights

- **Near Miss Reporting Factor.** Near miss and hazard identification reporting continued to be an effective means to proactively identify hazards and implement corrective actions to mitigate potential harm to employees, contractors and members of the public.
- **Work Site Inspections / Observations Factor.** Work site inspections and observations continued to be a successful leading indicator that provided leaders the opportunity to engage in field activities, to proactively identify areas of improvement and to verify conformance to EPCOR requirements.

- **Lost Time Frequency Rate Factor.** In 2019, Gold Bar exceeded the lost time frequency expectation by having no lost time events.
- **All Injury Frequency Rate Factor.** Gold Bar had 1 recordable incident (Medical Treatment) when a worker caught their finger in a belt on a fan.

2020 Areas for Improvement

- **Near Miss Reporting Factor.** With consideration of the impact of COVID-19 pandemic, there will be a heighted focus on the reporting of near miss and hazard identification throughout 2020 to ensure employees keep their mind on task and continue with proactive reporting.
- **Work Site Inspections / Observations Factor.** With consideration of the impact of COVID-19 pandemic, the opportunity to conduct work site inspections might be reduced. EWSI will monitor inspection activities and look for opportunities to conduct proactive field engagements.
- **All Injury Frequency Rate Factor.** EPCOR will be broadening the internal Safety program to capture Significant Incidents or Fatality Potential (SIFP) events. Monitoring for SIFP events is intended to assist in the identification of situations that could have life altering or fatality potential. The objective will be to ensure that root causes are identified and effective actions are established to prevent recurrence.

3.6 Rates and Bill Comparisons

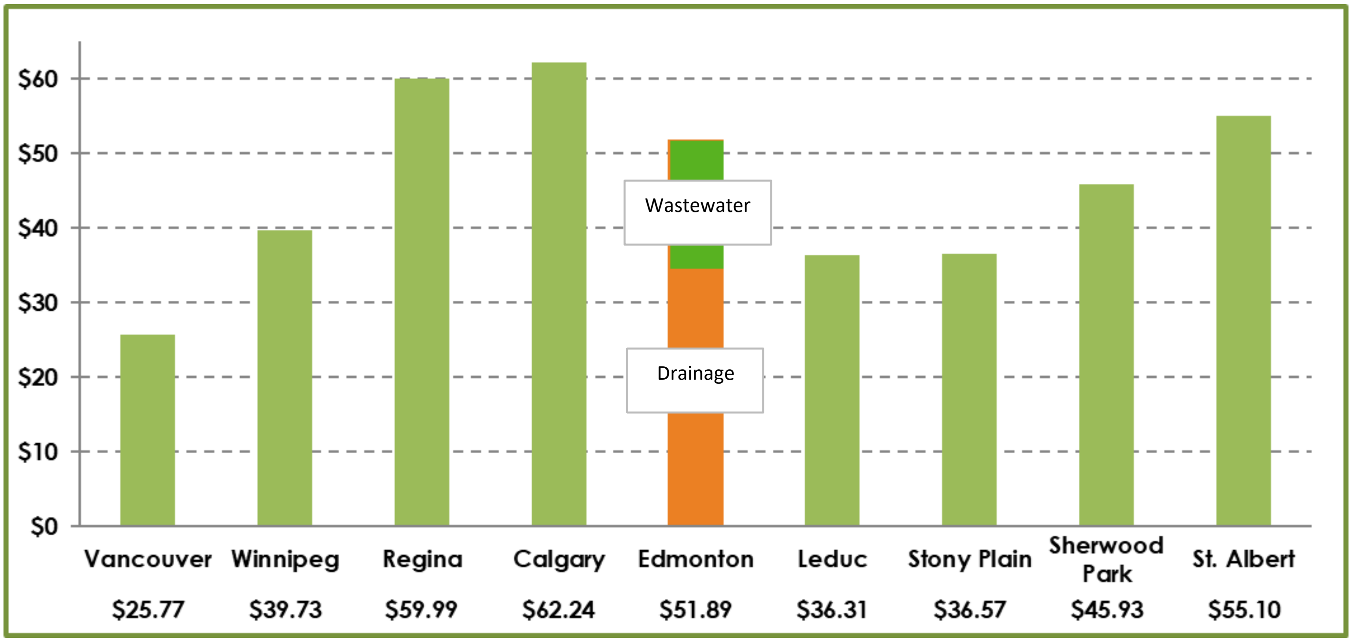
Wastewater and Drainage bill comparisons for 2019 are based on the published drainage and wastewater treatment rates for Calgary, Vancouver, Winnipeg and Regina, as well as four local communities. These bill comparisons represent the total cost to the customer and include fixed charges, consumption charges and any other applicable surcharges.

Unlike most cities, where wastewater treatment services and drainage services are combined, Wastewater is only responsible for wastewater treatment; the operations and maintenance of sanitary, storm and combined sewer systems are provided through EPCOR Drainage Services. Accordingly, wastewater bill comparisons are based on blended EWSI wastewater treatment and drainage rates.

3.6.1 Residential Wastewater and Drainage Bills

Figure 3.6.1 provides a comparison of residential household wastewater and drainage bills for residential household consumption of 13.8 m^3 per month, the average residential customer consumption per month in Edmonton in 2019.

Figure 3.6.1
2019 Monthly Residential Wastewater and Drainage Bill Comparison
(13.8 m^3/month)



Unlike water services which are relatively consistent among cities and communities, the nature and extent of wastewater treatment and drainage services vary significantly between cities and communities, because of differences in wastewater treatment processes, the inclusion of certain services in property taxes, and geographic and climatic factors which affect the level of investment in and approach to flood mitigation and storm water services. In particular, stormwater charges are often included as a component of taxes.

Edmonton's $51.89 average monthly bill from Figure 3.6.1 includes Wastewater charges of $17.34 and Drainage Services charges of $34.55 (inclusive of both sanitary and storm charges). While the total bill is higher than Vancouver and Winnipeg, it is lower than Calgary and Regina, the two cities where drainage and wastewater treatments are most comparable to Edmonton. EWSI notes that cities across Canada are experiencing increased risk of flooding related to climate change and that substantial investments are needed to assess and address climate change-related flood mitigation.

3.6.2 Commercial Wastewater and Drainage Bills

Table 3.6.2 provides a comparison of the wastewater bills for commercial customers of various sizes. This table shows that combined wastewater and drainage bills for commercial customers are competitive with surrounding communities and with major cities in western Canada, although Edmonton's relative ranking varies with the size of the customers with larger customers receiving relatively high monthly bills. These results reflect differences in rate structures between cities and municipalities, as well as differences in the extent of wastewater treatment and drainage services provided.

Table 3.6.2
2019 Monthly Commercial Wastewater and Drainage Bill Comparison
($ per month)

		A	B	C	D
	Monthly Bill - $ per month	**Small**	**Medium**	**Large**	**Extra Large**
1	**Monthly Consumption** - m^3	**10**	**250**	**1,000**	**5,000**
2	Vancouver	21.70	278.51	1,143	5,530
3	Calgary	58.28	448.59	1,668	8,173
4	Regina	53.30	483.50	2,004	9,522
5	Winnipeg	28.79	719.67	2,879	14,393
6	**Edmonton**	**44.69**	**525.77**	**2,148**	**10,718**
7	St. Albert	75.32	502.52	1,838	8,958
8	Sherwood Park	39.28	459.28	1,772	8,772
9	Stony Plain	26.50	662.50	2,650	13,250
10	Leduc	30.00	428.40	1,673	8,313

4 Drainage Services

4.1 Accomplishments and Challenges

In 2019, Drainage Services a number of had significant accomplishments, including:

- Developing a Corrosion and Odour Reduction Strategy and a Stormwater Integrated Resource Plan to address key challenges facing EPCOR's rate payers. The business case for the Stormwater Integrated Resource Plan was presented to the Utility Committee on May 10, 2019, and Corrosion and Odour Reduction Strategy presentation on June 28, 2019. Both these programs entailed considerable technical planning and stakeholder engagement. Both programs received non-routine adjustments which were approved by in 2019.
- Project Management Methodology Review (known as OPM – Organizational Project Management) – a comprehensive, EPCOR wide, review and realignment of project management processes is currently underway. The intent is to streamline project execution while ensuring consistency of approaches and toolsets while maintaining appropriate governance. This initiative will encompass water services in order to drive additional efficiencies across all capital projects. This initiative is a key component in facilitating the integration of Drainage with other EPCOR business units.
- Metrics Program - Drainage services introduced a PBR style metrics program in 2019. This program is aligned with similar programs in water and wastewater treatment and features the same metrics framework, points system to assess performance and financial penalties for performance below the defined standards. The need for such a program was defined with the transfer letter of intent and was approved by City Council through a bylaw amendment.
- Continued identification of Operational and Capital Cost Savings - As part of the commitments made by EPCOR leading to the transfer of Drainage from the City of Edmonton, Operating Cost Efficiencies and Capital Cost Efficiencies were identified for realization after transfer. A significant amount of work continues to be directed toward the realization of cost efficiency opportunities as follows (note - a number of other accomplishments are detailed in the 2019 Operating Plan review is a subsequent section):

  - ***Operating Cost Efficiencies:***

    Smaller operational efficiency "quick wins" continue to be identified and are generally implemented in a relatively short time period upon identification. More substantial opportunities that require a realignment of work responsibilities and methods have been identified, but generally take considerably longer to implement. These opportunities, and in particular the ones that will yield the greatest cost savings, are in the alignment of work planning and execution with water services. Several additional operational opportunities specific to drainage services have also been identified and are currently being explored including capital execution processes, engineering, etc. The two foundational requirements to exploit many of these opportunities are a real estate strategy that would see co-location of water and drainage functions/personnel and a common information systems platform for the identification and management of work assignments. Both of these requirements are currently in process and are anticipated to be completed over the next two years.

A more complete review of these cost savings will be included in the upcoming PBR application including a financial reconciliation to the targets noted in the Grant Thornton Report "City of Edmonton 2016 EPCOR Proposal for the Drainage Transfer Analysis." In that report, operating cost efficiencies estimated at approximately $5 million by 2022 were identified based on an annual 1% reduction from the 2017 City of Edmonton Drainage budget (i.e. pre-transfer budget). While the total quantum of cost efficiencies is still seen as reasonable, it must be noted that the reconciliation will include adjustments to the identified total operating cost target, which was similarly based on the City of Edmonton budget. Specifically, the conversion of the financials from the City of Edmonton's format to that of EPCOR revealed accounting treatment differences that must be adjusted for, particularly in relation to differences in approaches to capitalization. These changes, in addition to inconsistences in the treatment of vacant positions, adjustment for revenue leakage and other factors will be fully reconciled in the PBR application.

- ***Capital Cost Efficiencies:***

  The Grant Thornton report also identified that EPCOR will be able to generate at least 10% cost efficiency on new, utility financed capital beginning immediately in 2017. These savings were predicated on delivering the 10-year forecast Capital Program at a 10% lower cost which equated to $193.4 million over the 10-year forecast period. To date, a number of capital cost efficiencies have been enacted including: Master Agreements in conjunction with Water Services, Project Management Methodology Review as noted above, and various smaller capital execution synergies.

  While the more significant capital efficiency opportunities will evolve overtime, capital efficiency savings have been achieved to date, particularly with the Stormwater Integration Resource Plan. Drainage Services has developed an approach to address stormwater flooding not previously considered and as result, is projected to complete the underlying projects for $1.6 billion. In comparison to previous approaches, which ranged for $2.2 to $4.5 billion, the Drainage Services approach represents a direct cost saving of between $0.6 billion to $2.9 billion.

  A number of other accomplishments are detailed in the 2019 Operating Plan review below.

4.2 Customers and Consumption

Drainage provides sanitary services to the same customers served by Wastewater (Drainage storm customer' charges are based on land size and other factors). Therefore, actual customer counts, consumption per customer and total consumption are the same as those of Wastewater and actual to forecast differences in Drainage's customer counts and consumption are attributable to the same factors.

4.3 Financial Performance

Although a PBR forecast will be developed as part of Drainage's upcoming 2022-2026 PBR application, currently Drainage does not have a City of Edmonton-approved PBR forecast to serve as the basis of comparison for financial performance. Therefore, Drainage's 2018 EPCOR drainage budget (adjusted) is used as a proxy for a PBR forecast and is the basis upon which 2018 actual financial performance has been assessed. The 2019 budget has been adjusted to a regulated basis (from IFRS) and to remove one time costs related to the transition of drainage to EPCOR.

Drainage's revenue requirements are summarized on Table 4.3 below. Explanations of forecast to actual variances are provided in sections 4.3.1 to 4.3.6.

Table 4.3
Drainage Revenue Requirements
($ millions)

		A	B	C	D
	Summary of Revenue Requirements	**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Drainage Rate Revenue				
2	Sanitary Utility Revenue	129.3	123.5	254.8	245.5
3	Stormwater Utility Revenue	64.6	66.8	127.4	129.4
4	Drainage Rate Revenue	193.9	190.4	382.2	374.9
5	Drainage Revenue Requirement				
6	Operating expenses	118.7	116.5	229.1	227.5
7	Other Revenue	(8.5)	(8.6)	(16.8)	(18.7)
8	Depreciation and amortization	34.6	32.7	63.7	64.7
9	Return on rate base financed by debt	26.4	21.3	47.3	40.0
10	Return on rate base financed by equity	22.8	28.5	58.9	61.4
11	Drainage Revenue Requirement	193.9	190.4	382.2	374.9
12	**Return on Rate Base Financed by Equity**	**3.98%**	**4.76%**	**5.21%**	**5.21%**

4.3.1 Revenue

Drainage's rate revenues are derived from both sanitary utility and stormwater utility services. Sanitary utility revenues are comprised of variable monthly charges based on monthly metered water consumption and flat monthly service charges based on the meter size. Stormwater utility revenues are based on area, development intensity, and run-off coefficients based on the zoning of individual land parcels. Rates for both sanitary and stormwater utility services from January 1, 2018 to March 31, 2022 are prescribed in Bylaw 18100 and incorporate an average annual rate increases of 3%.

Table 4.3.1 below provides a comparison of 2019 and 2018-2019 Drainage revenues to the budget:

Table 4.3.1
Drainage Revenue
($ millions)

		A	B	C	D
Drainage Revenue		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Sanitary Utility				
2	Flat Monthly Service Charges				
3	Residential	36.5	32.3	72.0	63.4
4	Multi-Residential	0.5	2.2	1.0	4.3
5	Commercial	2.7	5.5	5.4	10.9
6	Flat Monthly Service Charges	39.8	40.0	78.5	78.5
7	Variable Monthly Charges				
8	Residential	46.6	44.1	91.9	88.6
9	Multi-Residential	18.3	17.6	38.4	34.6
10	Commercial	24.6	21.8	46.1	43.8
11	Variable Monthly Charges	89.5	83.5	176.4	167.0
12	Sanitary Utility Revenue	129.3	123.5	254.8	245.5
13	Stormwater Utility				
14	Residential	34.1	36.0	67.2	70.0
15	Multi-Residential	3.3	3.8	6.5	7.4
16	Commercial	27.3	27.0	53.6	52.0
17	Stormwater Utility Revenue	64.6	66.8	127.4	129.4
18	**Drainage Rate Revenue**	**193.9**	**190.4**	**382.2**	**374.9**
19	Other Revenue	8.5	8.6	16.8	18.7
20	**Total Drainage Revenue**	**202.4**	**198.9**	**399.0**	**393.6**

In 2019, Drainage's rate revenues were $3.5 million less than budget ($7.3 million less for 2018-2019). This difference is attributable to lower than budget consumption as discussed in section 2.3.1., partially offset by an increase in stormwater utility revenues. Besides rate revenues, Drainage has Other Revenue derived from biosolids management services provided to the Alberta Capital Region Wastewater Treatment Commission, application and connection fees, wastewater transfer station services, late payment fees, miscellaneous fees pursuant to third party agreements, and other incidental services.

4.3.2 Operating Expenses by Function

Table 4.3.2 below compares Drainage's 2019 actual operating expenses to its budget:

Table 4.3.2
Operating Expenses by Function
($ millions)

		A	B	C	D
Function and Sub-Function		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Drainage Operations				
2	Maintenance	30.6	30.1	58.1	57.7
3	Biosolids	16.7	14.0	32.6	27.4
4	Monitoring and Compliance	4.2	3.7	9.0	8.6
5	Other	0.5	0.5	2.7	3.2
6	Drainage Operations	52.0	48.4	102.4	97.0
7	Planning and Project Support				

		A	B	C	D
	Function and Sub-Function	**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
8	Planning	10.2	8.1	22.5	17.2
9	Project Support	4.6	8.6	5.3	12.1
10	Planning and Project Support	14.9	16.6	27.7	29.2
11	Billing and Meter Reading				
12	Meter Reading	6.5	6.4	12.5	12.7
13	CUS Charges	0.6	0.7	1.0	2.0
14	Billing and Meter Reading	7.1	7.1	13.5	14.7
15	Drainage Services Administration				
16	Drainage Shared Services	15.9	15.1	28.6	30.1
17	Incentive and Other Compensation	2.1	2.3	4.3	3.6
18	Drainage Services Administration	18.0	17.4	32.9	33.7
19	Corporate Shared Services	16.3	16.9	32.0	33.0
20	Franchise Fees and Property Taxes				
21	Franchise Fees	9.3	9.2	19.5	18.2
22	Property Taxes	1.0	0.8	1.0	1.7
23	Franchise Fees and Property Taxes	10.4	10.0	20.6	19.8
24	**Total Operating Expenses by Function**	**118.7**	**116.5**	**229.1**	**227.5**

Total operating expenses for 2019 were $2.2 million less than budget ($1.6 million less for 2018-2019). Key factors contributing to this difference include:

- **Biosolids** - $2.7 million less than budget ($5.2 million less for 2018-2019). This function includes the storage and management of biosolids generated by the Gold Bar and Alberta Capital Regional wastewater treatment plants. As in 2018, lower than budgeted expenses are primarily attributable to lower than planned activity and lower processed volumes resulting from the composter outage. In addition, in 2019, EWSI capitalized $1.0 million of costs related to storage cell relining.

- **Planning -** $2.1 million less than budget ($5.3 million less for 2018-2019). This function includes infrastructure, system and administration planning. Lower than budget expenses reflect lower than anticipated contractor costs of $1.5 million ($3.2 million for 2018-2019) and capitalization of a higher than anticipated portion of staff costs of $0.6 million ($1.1 million for 2018-2019) in association with capital projects. The 2018-2019 variance also includes savings of $0.9 million related to the transfer of lot grading inspection services back to the City of Edmonton in 2018. The lot grading inspection cost savings were offset with a proportionate decrease in associated revenues.

- **Project Support -** $4.0 million greater than budget ($6.8 million greater for 2018-2019). This function includes surveying and engineering (conceptual, preliminary design or detailed design), project management, in-house construction, and emergency repairs. Higher than budgeted expenses include: $3.4 million of additional salary costs ($7.1 million for 2018-2019) related to design and construction work that had originally been budgeted as capital expenditures; and $0.5 million of higher than anticipated contractor costs ($1.2 million for 2018-2019), primarily related to project management. The 2018-2019 variance also includes $1.5 million of cost recoveries resulting from higher equipment utilization in operations in 2018. This category of costs illustrates the impact of the differences in accounting treatment between the City of Edmonton and EPCOR. Specifically, the PBR budget was prepared using Drainage's capitalization policies which included capitalizing preliminary design costs (i.e. the costs incurred before there was a specific project). The actual results reflect EWSI capitalization policies, where most preliminary design costs are expensed, but also where additional costs – capital overhead, higher salary burden, major inspections, abandonments, etc., are capitalized.

- **Billing and Meter Reading -** $1.2 million greater than budget for 2018-2019. Although these costs were on budget for 2019, the 2018-2019 variance includes higher than budgeted metering and customer service support costs from EPCOR Energy Services and unbudgeted call centre support costs from the City of Edmonton.

1) **Franchise Fees and Property Taxes -** $0.4 million less than budget ($0.8 million less for 2018-2019). As with Water and Wastewater, lower than forecast franchise fees reflect lower than forecast revenues. This is partially offset by higher property taxes, which were not included in the budget as no accurate cost estimate was available at the time of budget preparation.

Variances in other operating expense functions and sub-functions are not significant, either individually or in aggregate.

4.3.3 Operating Expenses by Cost Category

Table 4.3.3 below shows operating expenses by cost category for Drainage Operations, Planning, Project Support Costs and Drainage Services Administration, where cost categories differ from the sub-functions in Section 4.3.2.

Table 4.3.3
Operating Expenses by Cost Category
($ millions)

		A	B	C	D
	Cost Category	**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Drainage Operations				
2	Staff Costs and Employee Benefits	26.3	25.1	50.0	49.4
3	Contractors and Consultants	21.2	18.6	40.4	36.3
4	Materials and Supplies	0.2	0.2	0.4	0.3
5	Other	4.3	4.5	11.6	11.0
6	Drainage Operations	52.0	48.4	102.4	97.0
7	Planning and Project Support				
8	Contractors and Consultants	9.2	12.3	13.5	19.3
9	Staff Costs and Employee Benefits	6.4	6.2	15.6	13.2
10	Other	(0.7)	(1.8)	(1.3)	(3.2)
11	Planning and Project Support	14.9	16.6	27.7	29.2
12	Drainage Shared Services				
13	Staff Costs and Employee Benefits	11.5	11.9	22.0	21.7
14	Contractors and Consultants	4.7	4.8	9.6	8.5
15	Other	1.8	0.7	1.3	3.5
16	Drainage Shared Services	18.0	17.4	32.9	33.7

The information presented in this table supports the explanations of differences between 2019 actual and budget expenses provided in Section 4.3.2. Accordingly, no additional explanations are considered necessary.

4.3.4 Depreciation and Amortization

Drainage's depreciation expense and amortization of contributed assets for 2019 are shown in Table 4.3.4 below:

Table 4.3.4
Depreciation and Amortization
($ millions)

		A	B	C	D
	Depreciation and Amortization	**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Provision for depreciation	73.4	73.0	137.8	142.5
2	Amortization of contributions	(38.8)	(40.3)	(74.1)	(77.8)
3	**Depreciation, net**	**34.6**	**32.7**	**63.7**	**64.7**

Drainage's net depreciation expense is $1.9 million less than budget ($1.0 million greater for 2018-2019). The difference in 2019 is almost entirely applicable to higher than budgeted contributed assets. The 2018-2019 difference also includes a $1.5 million variance related to changes in depreciation rates in 2018. At the time the 2018 budget was prepared, Drainage had not completely finalized asset componentization and other adjustments needed for its regulated accounting. As a result, during 2018, Drainage found that actual depreciation rates, averaging 1.5%, were slightly higher than the average budget rate of 1.4%, resulting in higher-than-budgeted deprecation expense in 2018. The revised rates are reflected in the budget amounts for 2019 and future years.

4.3.5 Rate Base

Drainage's mid-year rate base, shown in Table 4.3.5 below, is $41.6 million less than forecast, reflecting lower than forecast capital additions in 2019 as discussed in in Section 4.3.1.

Table 4.3.5
Mid-Year Rate Base
($ millions)

		A	B
	Mid-Year Rate Base	**2019**	
		Budget	**Actual**
1	Plant in Service		
2	Balance, beginning of year	4,628.6	4,673.1
3	Additions - EPCOR-funded	145.8	145.5
4	Additions - Contributed	138.2	199.6
5	Retirements and adjustments	-	(8.2)
6	Balance, end of year	4,912.7	5,010.1
7	Mid-Year Plant in service	4,770.6	4,841.6
8	Accumulated Depreciation		
9	Balance, beginning of year	(918.1)	(922.9)
10	Depreciation expense	(73.4)	(73.0)
11	Retirements and adjustments	-	8.0
12	Balance, end of year	(991.5)	(987.9)
13	Mid-Year Accumulated Depreciation	(954.8)	(955.4)
14	Other Rate Base Items		
15	Working Capital	14.1	14.8

		A	B
Mid-Year Rate Base		**2019**	
		Budget	**Actual**
16	Materials and Supplies	1.5	1.6
17	Other Rate Base Items	15.6	16.4
18	**Gross Mid-Year Rate Base**	**3,831.4**	**3.902.6**
29	Contributions		
20	Balance, beginning of year	(3,004.7)	(3,089.7)
21	Contributions in aid of construction	(138.2)	(199.6)
22	Balance, end of year	(3,142.8)	(3,289.3)
23	Mid-Year Contributions	(3,073.8)	(3,189.5)
24	Accumulated Amortization		
25	Balance, beginning of year	494.6	496.8
26	Amortization of contributions	38.8	40.3
27	Balance, end of year	533.5	537.0
28	Mid-Year Accumulated Amortization	514.0	516.9
39	**Mid-Year Contributions**	**(2,559.8)**	**(2,672.6)**
30	**Net Mid-Year Rate Base**	**1,271.6**	**1,230.0**

Although the gross rate base is higher than budget, higher than budget contributed (developer-funded) capital additions result in a lower than budget net rate base. The value of contributed assets is difficult to forecast since developers are responsible for construction of distribution infrastructure in new subdivisions and the pace of construction can vary significantly. As well, EWSI receives contribution funding from the Sanitary Servicing Strategy Fund ("SSSF") to support drainage development throughout the City of Edmonton. The amount of SSSF funding also varies significantly in response to the level of developer activity on SSSF-eligible projects.

4.3.6 Return on Rate Base

In 2019, Drainage's total return on rate base is $0.6 million greater than budget ($4.8 million less for 2018-2019). These returns reflect lower returns on the portion of the rate base financed by debt, resulting from both the lower than forecast debt portion of Drainage's capital structure and historically low debt issue costs, and higher than forecast equity returns with operational costs savings, lower depreciation and lower finance costs in 2019 offsetting lower than forecast revenue.

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Table 4.3.6-1
Return on Mid-Year Rate Base
($ millions)

		A	B	C	D
Return on Rate Base		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Net Mid-Year Rate Base	1,271.6	1,230.0		
2	Capital Structure				
3	Debt	55.00%	51.36%		
4	Equity	45.00%	48.64%		
5	Total	100.00%	100.00%		
6	Cost Rates				
7	Debt	3.78%	3.38%	3.76%	3.48%
8	Equity	3.98%	4.76%	5.03%	5.07%
9	Weighted Average Cost of Capital (WACC)	3.87%	4.05%	4.35%	4.27%
10	Return on Rate Base				

		A	B	C	D
Return on Rate Base		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
11	Debt	26.4	21.3	49.3	41.7
12	Equity	22.8	28.5	56.9	59.7
13	**Total Return on Drainage Rate Base**	**49.2**	**49.8**	**106.2**	**101.4**

Returns on rate base are calculated separately for the debt-financed and equity-financed portions of Drainage's net rate base. The rate of return on debt is equal to the average (embedded) cost of debt for Drainage, as calculated in Table 4.3.6-2 below:

Table 4.3.6-2
Interest Expense and Cost of Debt
($ millions)

		A	B	C	D
Interest Expense and Cost of Debt		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	Interest expense				
2	Interest on short-term debt	2.8	1.5	3.9	2.2
3	Interest on City of Edmonton debentures	-	-	21.1	18.1
4	Interest on intercompany debentures	18.9	20.2	18.9	21.8
5	Total interest expense	21.7	21.7	43.9	42.2
6	Mid-year debt and other long-term liabilities				
7	Mid-Year Short-term debt	25.2	25.7		
8	Mid-Year Long-term debt	546.8	616.6		
9	Total mid-year debt	572.0	642.3		
10	**Embedded Cost of Debt**	**3.78%**	**3.38%**		

In 2019, Drainage's average cost of debt is 0.4% less than budget, reflecting historically low debt issuance costs in 2018 and 2019. In Q4 2018, Drainage's City of Edmonton debentures were replaced with long-term intercompany notes issued by EPCOR Utilities Inc. Interest rates and terms of the loans are substantially the same as the City of Edmonton debentures that they replaced.

4.3.7 Transactions with Affiliates

Drainage derives a portion of its revenues and expenses from transactions with affiliates, including the City of Edmonton, EPCOR Utilities Inc. and its subsidiaries. Table 4.3.7 provides a summary of Drainage's 2019 and 2018-2019 transactions with affiliates.

Table 4.3.7
Transactions with Affiliates
($ millions)

		A	B	C	D
Affiliate and Service		**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
1	**Revenues from the provision of services to the City of Edmonton**				
2	Utility Services	3.0	3.4	5.9	6.3
3	Other Revenue	0.9	0.1	1.8	1.6
4	Total	3.9	3.5	7.7	7.9

		A	B	C	D
	Affiliate and Service	**2019**		**2018-2019**	
		Budget	**Actual**	**Budget**	**Actual**
5	**Services provided by (recovered from):**				
6	**City of Edmonton**				
7	Franchise Fees	9.3	9.2	19.5	18.2
8	Property Taxes	1.0	0.8	1.0	1.7
9	Interest on City of Edmonton debentures	-	-	21.1	18.1
10	Other services	8.0	7.0	15.8	20.1
11	Total	18.4	17.0	57.5	58.1
12	**EPCOR Utilities Inc.**				
13	Corporate Shared Service Costs	16.3	16.9	32.0	33.0
14	Interest on short-term debt	18.9	20.2	18.9	21.8
15	Interest on intercompany debentures	2.8	1.5	3.9	2.2
16	Total	37.9	38.6	54.8	57.1
17	**Other Affiliates**				
18	EPCOR Energy Alberta LP	4.0	4.1	7.9	8.3
19	EPCOR Distribution and Transmission Inc.	0.9	0.1	1.8	0.9
20	EPCOR Technologies Inc.	-	(0.2)	-	(0.2)
21	EPCOR Commercial Services Inc.	-	0.2	-	0.6
22	Other EWSI Business Units	2.0	1.6	4.0	4.9
23	Total	6.9	5.9	13.7	14.5
24	**Expenditures (Contributions) on capital projects arising from services provided by:**				
25	City of Edmonton	(43.1)	(14.6)	(76.1)	(36.9)
26	EPCOR Technologies Inc.	-	4.5	-	7.3
27	EPCOR Utilities Inc.	2.3	2.3	2.9	2.9
28	EPCOR Energy Services	(2.2)	(2.2)	(5.4)	(5.4)
29	EPCOR Distribution and Transmission Inc.	-	0.3	-	0.4
30	EPCOR Water Services Inc.	0.2	0.2	0.5	0.5
31	Total	(42.9)	(9.5)	(78.2)	(31.2)

4.4 Capital Programs

4.4.1 Capital Expenditures

Drainage's capital program is based on the long term plan for 2018 to 2021 that was used in the independent third party report assessing the transition of the Utility to EPCOR (Grant Thornton report CR_8300). Table 4.4.1 compares forecast to actual capital expenditures for 2019 for each project with approved capital expenditures in excess of $10.0 million over the 2018-2021 term, as well as for each project category. Table 4.4.1 also provides a comparison of total forecast capital expenditures for 2018 to 2021 from the long term plan to EWSI's current capital projection.

Table 4.5.1
Capital Expenditures
($ millions)

		A	B	C	D	E	F	G	H	I	
	Capital Project or Program	2019			2018-2019			2018 - 2021			
		Annual Budget	Actual	Difference	Annual Budget	Actual	Difference	LTP	Current Projection	Difference	
1	Drainage Neighbourhood Renewal	29.8	24.6	(5.1)	44.8	50.6	5.8	175.8	115.9	(59.9)	1
2	Drainage System Expansion	12.7	24.2	11.5	27.0	43.3	21.5	84.2	90.6	6.4	2
3	Drainage System Rehabilitation										
4	151S/99A SanTrunk OP-001940-01	0.3	0.7	0.4	0.3	1.1	0.8	-	25.4	25.4	
5	Groat Rd Trunk S OP-001639-01	14.4	15.8	1.4	29.3	21.3	(8.0)	-	33.6	33.6	
6	NewBuenaVista PS OP-002062-01	3.9	0.5	3.5	4.2	0.9	(3.3)		10.0	10.0	
7	Projects under $15 million	68.3	53.8	(14.4)	104.2	91.0	(13.2)	119.2	201.3	82.1	
8	Drainage System Rehabilitation	86.8	70.7	(16.1)	138.0	114.2	(23.8)	119.2	270.4	151.2	3
9	Environmental Quality Enhance										
10	Clover Bar Cell 1-4	6.0	1.5	(4.5)	6.3	1.5	(4.8)	-	18.1	18.1	
11	Kinnard OSS	0.0	0.2	0.2	0.0	0.2	0.2		10.9	10.9	
11	Projects under $15 million	4.9	3.4	(1.6)	21.0	9.9	(11.1)	100.8	30.0	(70.8)	
12	Environmental Quality Enhance	10.9	5.1	(5.9)	27.3	11.7	(15.6)	100.8	48.1	(52.7)	4
13	Flood Mitigation										
13	Tweddle Place OP-001334-01	6.5	4.1	(2.4)	13.7	9.1	(4.6)	-	17.1	17.1	
14	Malcolm Twed & Ed OP-001695-01	5.6	1.8	(3.8)	12.0	1.8	(10.3)	-	10.5	10.4	
15	Projects under $15 million	19.5	8.2	(11.3)	31.6	16.4	(15.2)	247.5	59.9	(187.6)	
16	Flood Mitigation	31.6	14.0	(17.5)	57.4	27.2	(30.1)	247.5	87.4	(160.1)	5
17	SSSF Projects										
18	SESS SW4 OP-001336-01	7.0	3.5	(3.6)	17.6	12.2	(5.5)	-	22.3	22.3	
19	NEST NC2 & NC3 OP-001795-01	13.0	9.0	(4.0)	21.4	17.8	(3.6)	-	35.6	35.6	
20	SESS SA10A CP-002993-01	12.6	8.8	(3.9)	20.3	13.2	(7.1)	-	35.7	35.7	
21	Projects under $15 million	1.6	0.8	(0.8)	3.1	2.3	(0.8)	137.8	10.7	(127.1)	
22	SSSF Projects	34.3	22.1	(12.3)	62.4	45.4	(17.0)	137.8	104.3	(33.5)	6
23	Real Estate	-	-	-	-	-	-	-	37.3	37.3	7
24	NRA-LRT										
25	West Valley LRT	0.7	5.3	4.6	0.7	5.8	4.6	-	42.5	42.5	
23	Metro LRT	-	0.1	0.1	-	0.1	0.1	-	8.7	8.7	
27	NRA-LRT Projects	0.7	5.4	4.7	0.7	5.9	4.7	-	51.2	51.2	8
28	NRA-CORe	-	1.2	1.2	-	1.2	1.2	-	31.8	31.8	8
29	**Total Capital Expenditures**	**206.8**	**167.3**	**(39.4)**	**357.5**	**299.6**	**(52.7)**	**865.3**	**836.8**	**(28.5)**	
30	**Contributions**										
31	**Drainage System Expansion**	**(4.8)**	**(4.8)**	**0.0**	**(4.8)**	**(12.4)**	**(7.5)**	**(60.1)**	**(23.1)**	**37.0**	2
32	**Flood Mitigation**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**(4.7)**	**(4.7)**	5

		A	B	C	D	E	F	G	H	I	
	Capital Project or Program	**2019**			**2018-2019**			**2018 - 2021**			
		Annual Budget	**Actual**	**Difference**	**Annual Budget**	**Actual**	**Difference**	**LTP**	**Current Projection**	**Difference**	
33	SSSF Projects										
34	SESS SW4 OP-001336-01	(7.0)	(3.5)	3.6	(17.6)	(12.2)	5.5	-	(22.3)	(22.3)	
35	NEST NC2 & NC3 OP-001795-01	(13.0)	(9.1)	3.9	(21.4)	(17.9)	3.5	-	(35.6)	(35.6)	
36	SESS SA10A CP-002993-01	(12.6)	(8.8)	3.8	(20.3)	(13.2)	7.1	-	(35.7)	(35.7)	
37	Projects under $15 million	(0.1)	0.7	0.9	(1.6)	1.8	3.4	(137.8)	(3.9)	133.9	
38	**SSSF Projects**	**(32.8)**	**(20.6)**	**12.2**	**(60.9)**	**(41.4)**	**19.5**	**(137.8)**	**(97.5)**	**40.3**	**6**
39	**Total Contributions**	**(37.7)**	**(25.4)**	**12.2**	**(65.8)**	**(53.8)**	**12.0**	**(197.9)**	**(125.2)**	**72.7**	
40	**Capital Expenditures, net**	**169.1**	**141.9**	**(27.2)**	**291.7**	**245.8**	**(46.0)**	**667.4**	**711.6**	**44.2**	

The impact of the unusually wet weather in 2019 led to significant delays to capital project execution which led to the deferral of certain projects from 2019 to 2020. In addition to the weather impact, during 2019, Drainage continued to refine and reprioritize its overall 2018 – 2021 capital expenditures program, which now encompass the approved NRA capital spending for LRT and CORe. The current projections for 2020 also include an initial estimate for potential delays and reduction in scope on annual programs following the global outbreak of COVID-19. As changes to processes and project management have become established Drainage has increased its overall capital expenditures year over year by 36% from $103.8 million in 2018 to $141.9 million at the end of 2019 (net of contributions).

Explanations for significant differences between forecast and actual in capital spending in 2019, as well as differences between Drainage's long term plan ("LTP") and its current projections for 2018 to 2021 are as follows:

1) **Drainage Neighbourhood Renewal** – 2019 – $5.1 million less than budget, 2018-2021 - $59.9 million less than LTP. This category includes the costs of neighbourhood drainage asset renewals and is aligned with the timing of the City of Edmonton's Building Great Neighbourhoods program. Therefore, project timing is largely driven by the City of Edmonton's neighbourhood renewal schedules. Accordingly, lower than budget spending in 2019 results from advancement of projects from 2019 to 2018 to align with City of Edmonton neighbourhood renewal schedules and lower than LTP projections are primarily attributable to the timing of capital expenditures, as a number of neighbourhood renewal projects have been deferred to 2022 and later years, partly due to a conservative reflection of the impact of COVID-19. Favourable pricing on open cut and relining contracts also contributes to lower than LTP projected expenditures.
2) **Drainage System Expansion** – 2019 - $11.5 million greater than budget, 2018-2021- $43.4 million greater than long-term plan (net of contributions). Increases in 2019 actual and 2018-2021 projected expenditures in this partially-contributed program are attributable to higher levels of service connections and developer driven inspections. The level of developer contributions to service connection projects has also fallen as fees to developers have not kept pace with cost increases. Additional scope increases on Imagine Jasper and 105 Avenue Streetscape projects to reduce the SIRP rankings have also contributed to the variance compared to the original LTP target. Drainage's current projection for 2018-2021, while greater than the LTP, will continue to be refined and revised in response to COVID-19 impacts on new developments and system expansion.
3) **Drainage System Rehabilitation.** This category includes system replacements, rehabilitation and renewal projects required to mitigate the risk of failure and maintain service levels.
   a) **151S/99A Sanitary Trunk** – projected cost $25.4 million, $0.4 million greater than budget in 2019 as contractor delays in 2018 were caught up in 2019.
   b) **Groat Road Storm Trunk Rehabilitation** – projected cost $33.6 million. $1.4 million greater than budget in 2019. Contractor delays in 2018 were caught up in 2019, combined with earlier than anticipated receipt of pipe and completion of two shafts ahead of schedule.
   c) **New Buena Vista Pump Station** – projected cost $10.0 million, $3.5 million lower than budget in 2019 due to delays in land acquisition.
   d) **Projects < $15 Million** – 2019 - $14.4 million less than budget, 2018-2021 - $82.1M greater than LTP. Major project delays include Clareview Sanitary Trunk ($1.0 million) due to access

restrictions and deferral of relining pending completion of emergency work, Gold Bar Utilidor ($3.0 million) delays due to weather impacting ability to divert flows to ACRWC and needs completion of Clareview project to progress, and Trunk Sewer Rehab ($3.0 million) due to procurement delays have contributed to underspending in 2019. Even so, Drainage's projected expenditures over the 2018-2021 period will exceed the LTP by $92.0 million in order to address significant rehabilitation needs identified by asset condition assessments.

4) **Environmental Quality Enhancement.** This category includes capital expenditures that mitigate the impacts of the drainage system on the environment, including sewer overflows, river loading, and reuse of biosolids.

   a) **Clover Bar Cell 1-4** – 2019 - $4.5 million less than budget, 2018-2021 projected cost $18.1 million. Lower than budget expenditures in 2019 reflect a reduction in the scope of this project to focus on Cell 3E with 2019 activities focussed on site preparation and main relining activities now scheduled for 2020. The remaining cells will be completed by Wastewater within their next PBR application.

   b) **Kinnaird Sewer Separation** – 2019 - $0.2 million greater than budget, 2018 – 2021 projected cost $10.9 million. The increased cost in 2018 – 2021 which now estimate this project over $10 million in the 2018-2021 period reflects a change in scope to microtunnelling along with an increase in costs following bid tendering. This project also supports flood mitigation.

   c) **Project< $15 million** – 2019 - $1.6 million less than budget, 2018-2021 - $70.8 million less than LTP. Projected expenditures in this category have been reduced significantly due to the cancellation of the Mill Creek End of Pipe Facility project and the Steinauer-Duggan Odour projects.

5) **Flood Mitigation.** This category includes development of drainage infrastructure and program improvements to decrease flood risks, including capital expenditures on projects related to the Stormwater Integrated Resource Plan describe in Section 1.5. Major projects in this category include:

   a) **Tweddle Place Sewer Separations** - 2019 – $2.4 million less than budget as weather delays have resulted in deferral of construction until 2020. 2018-2021 projected costs of this multi-year project remain at $17.1 million.

   b) **Malcolm Tweddle Dry Pond** – 2019 - $3.9 million less than budget as delays in finalizing land agreement combined with heavy rainfall have led to deferral of construction. 2018-2021 projected cost of this multi year project remain $10.4 million before contributions.

   c) **Projects < $15 million** – 2019 - $11.3 million less than budget, 2018-2021 - $187.6 million less than original LTP. The updated 2018 – 2021 forecast includes grant recoveries of $8 million received to date from the ACRP and NBCF grants and a projected further $19 million from the new Disaster Mitigation and Adaptation Fund. Lower than budgeted expenditures result from different causes, including: cancelled projects ($6 million); Steinhauer-Ermineksin construction delays ($3 million); delays in receiving designs from consultants for Aldergrove ($2 million); re-evaluation of Hurstwood under SIRP criteria as a wet pond ($2m); and delays in obtaining land agreement for Parkallen ($1 million). Drainage has consolidated management of flood mitigation projects under SIRP and, while the continuing projected underspend is consistent with 2018 reporting, the post-2021 expenditures have been aligned to meet the commitments given in the SIRP projections in the non-routine adjustment approved in 2019.

d) **Contributions** in this category, projected to be $5.2 million over the 2018-2021 period, represent provincial and federal grant funding in respect of flood mitigation projects, primarily ($4.8 million) in respect of the Malcolm Tweddle project.

6) **Sanitary Servicing Strategy Fund (SSSF) Projects.** The SSSF finances major sanitary trunk construction to service new development areas. Drainage works with the SSSF Management Committee to coordinate design, construction, schedules and budgets for various projects. While significantly less than the LTP, Drainage's current projected expenditures align with the SSSF Management Committee's five year construction plan (2018-2022) to support orderly, cost effective development based on population and employment projections, as well input from the development industry. Major projects in this category include:

   a) **SESS SW4 OP-001336-01** – 2019 - $3.6 million less than budget due to delays pending approval of the fiberglass liner by the Board and SSSF oversight committee. Total projected costs of $22.3 million over the 2018-2021 period will be fully funded through the SSSF.

   b) **NEST NC2 & NC3 OP-001795-01** – 2019 - $4.0 less than budget because of flooding caused by the wet weather which prevented tunnelling over the summer combined with lost time due to surveys needed to confirm the tunnel alignment. Total projected costs of $35.6 million over the 2018-2021 period will be fully funded through the SSSF.

   c) **SESS SA10A CP-002993-01** - 2019 - $3.9 million less than budget due to weather delays and a review of safety procedures and switch to contractors due to the switch in use to an earth pressure tunnel boring machine due to the site conditions. Total projected costs of $35.7 million will be fully funded through the SSSF.

   d) **Projects < $15 Million** – 2019 - $0.8 million less than budget. Total projected expenditures of $10.7 million over the 2018-2021 period will be funded through SSSF contributions of $3.9 million, with the $6.8 million difference attributable to SSSF Management fees not originally included in 2018 budget

7) **Real Estate** – $37.3 million (new project). Following the transfer of Drainage to EPCOR, an EPCOR-wide real estate review was undertaken to identify and evaluate alternatives for consolidating the many physical locations occupied by Water and Drainage and to identify the alternative which would maximize the contribution to the cost reduction and efficiency commitments made as part for the Drainage transfer. The projected expenditures for this project are supported by a comprehensive business case prepared prior to the COVID 19. Accordingly, the business case and costs of this project will be refined and adjusted as further information becomes available and key decisions are made.

8) **NRAs.** As discussed in section 1.5, Drainage has received approval for three non-routine adjustments to rates: SIRP, which is considered part of the Flood Mitigation category explained above; LRT relocations; and Corrosion and Odour Reduction (CORe). Projected capital expenditures for these programs represent EWSI's current estimates of capital required in the 2018-2021 PBR term. Additional spending requirements will be included in the future PBR applications.

   a) **LRT** – 2019 - $4.6 million greater than budget due to advancement of work required by the City of Edmonton on Priority Areas 1 and 2, originally planned for 2020. Total projected capital expenditures on LRT projects over the 2018-2021 period amount to $51.2 million, compared to

$53.8 million in the NRA application, primarily because of the deferral of construction on the West Valley Line LRT into 2022 and future years.

b) **CORe** – $1.2 million greater than budget due to advancement of work on the Accelerated Access Manhole project. Total projected capital expenditures over the 2018-2021 period are $31.8 million.

4.4.2 Construction Work in Progress

Drainage's rate base consists of plant in service. If a capital project is not completed (i.e. not placed into service) in the year, the capital expenditures on that project remain in Construction Work in Progress and are excluded from the rate base.

Table 4.4.2
Construction Work in Progress
($ millions)

		A	B
Construction Work in Progress		2019	
		Budget	Actual
1	Balance, beginning of period	30.9	52.2
2	Capital Expenditures	169.1	141.9
3	Cancelled costs/Write-offs	-	(1.3)
4	Capital Additions	(145.8)	(145.9)
5	**Balance, end of period**	**54.2**	**46.9**

The PBR allows Drainage to capitalize the costs of financing certain projects remaining in Construction Work in Progress, using an allowance for funds utilized during construction ("AFUDC"). In 2019, AFUDC included in capital expenditures on eligible projects amounted to $3.9 million.

4.5 Operational Performance

4.5.1 Water Quality and Environmental Index

One of EPCOR's core commitments is to prevent pollution and reduce its environmental impacts. Drainage Services' collection system approvals from Alberta Environment and Parks include regulatory requirements to develop and implement strategies to reduce the impact of the drainage systems on the North Saskatchewan River. The Edmonton Watershed Contaminant Reduction Index and the Total Suspended Solids Total Loading are two metrics used to quantify discharges to the North Saskatchewan River and assess the environmental performance of Drainage strategies.

Index Metric		Measure	Target	Actual
1	Edmonton Watershed Contaminant Reduction Index Score	Index score that measures contaminants released to the North Saskatchewan River from the City of Edmonton.	> 6.9	7.6
2	Total Loading – Total Suspended Solids	Total suspended solids loading (kg/d) contributed to the North Saskatchewan River from the storm sewer system, combined sewer system, and Gold Bar Wastewater Treatment Plant.	< 50,000	46,900

<u>2019 Highlights</u>:

- Although Edmonton experienced above average rainfall in 2019, implementation of Combined Sewer Overflow controls helped to ensure that total loadings remained relatively constant, enabling Drainage to exceed performance standards for both Water Quality and Environmental Index metrics.

4.5.2 Customer Service Index

The Customer Service Index is a composite measure of the customers' perception of satisfaction with EWSI service, the speed of response and quality service level to customer issues.

Index Metric		Measure	Target	Actual
1	Emergencies Responded to Within Two hours	The efficiency in responding to customer reports or complaints that require an emergency response. The emergency repair crew is given 2 hours to respond and be on site from the time the report is received.	> 87.0%	94.81%
2	Number of Blocked Mainline Sewers	The number of blockages in the mainline per 100km of pipe.	< 2.2	2.37
3	Mature Neighbourhoods at 1:100 Service Level	The percentage of neighbourhoods that are protected against a 100 year storm flood out of the 157 identified at-risk mature neighbourhoods.	> 16.0%	17.7%
4	Odour Complaints	The number of odour complaint received from customers.	Reduction from Previous Year	519

<u>2019 Highlights:</u>

- The percent of mature neighbourhoods at 1:100 service level metric is 1.7% above target. This is an improvement from 2018 where the results were 1.0% below target.

- The number of odour complaints received from customer has decreased by 204 compared to last year. 723 complaints were received in 2018 compared to 519 in 2019.

4.5.3 Reliability and Optimization Index

The System Reliability Index is a measure of the confidence that customer can place in the reliability of the drainage sanitary and stormwater systems.

Index Metric		Measure	Target	Actual
1	Pipe Capacity Rating - Sanitary	The percentage of linear infrastructure assessed as having a hydraulic condition rating of 2 (or B) or better. Measured	96.0%	96.0%
2	Pipe Capacity Rating -		50.0%	50.0%

	Storm	separately for sanitary, storm, and combined sewer infrastructure.		
3	Pipe Capacity Rating – Combined Sewer Overflow	Measures the number of blockages in the mainline per 100km of pipe.	80.0%	80.0%
4	Infrastructure at or Above the Minimum Level of Condition Rating	The percentage of all infrastructure (including non-linear) assessed at or above the minimum level of condition rating.	90.0%	90.6%
5	Capital (as rehabilitation) Re-invested Compared to Total System Replacement	The percentage of investment dollars spent on renewal/rehabilitation work on aging drainage infrastructure compared to the total system replacement value.	0.81%	0.53%

2019 Highlights:

- Although the percentage of capital reinvested compared to the total system replacement value is 0.28% below target, 2019 results only account for the rehabilitation of existing infrastructure and do not include system upgrades. A more representative performance measure for network reliability has been identified for 2020.

4.5.4 Safety Index

The Safety Index is a measure of the success of programs and the application of policies that maximizes the safety of employees and the public.

Index Metric		Measure	Target	Actual
1	Employee Engagement (survey every 2 years)	The level of employee engagement within Drainage Services as a percentage.	N/A	N/A
	Employee Turnover (excluding retirements)	The percentage of employees leaving Drainage Services compared to the overall headcount. This excludes retirements. This includes voluntary, involuntary departures, and transfers to other business areas.	6.0%	6.7%
3	Lost Time Frequency Factor	The number of lost time hours resulting from a workplace injury related to the total number of hours worked (200,000 hr) in a specific time period.	0.50	0.33

2019 Highlights:

- There are no results for the Employee Engagement survey because it is conducted every 2 years. It was last conducted in 2018.

- The Lost Time Frequency Factor is better than target at 0.33. Improvements in hazard assessments, reporting of near misses and hazardous condition, worksite inspections, improved implementation of corrective actions and training all contributed to continued improvements in this metric.

4.6 Rates and Bill Comparisons

Unlike most cities, where wastewater treatment services and drainage services are combined, EWSI currently has separate bills for wastewater treatment services and for drainage services. Accordingly, in order to provide a better basis for comparison with other cities and communities, bill comparisons in Section 3.6 utilize EWSI's blended wastewater and drainage bills.

5 2019 Annual Operating Plans

5.1 Water Services and Wastewater Treatment Services

Water Services presented the 2019 Annual Operational plan to Utility Committee on February 1, 2019. The purpose of that document was to provide Edmonton City Council, Utility Committee and stakeholders a high level perspective of the major activities and initiatives that Water Services was undertaking to meet its overarching goal of providing customers with safe and reliable water and wastewater treatment services while meeting or exceeding all environmental requirements, delivering value and achieving a fair return. The initiatives planned for 2019 are organized within seven strategic focus areas:

- Customer Service
- Public Health and the Environment
- Employee and Public Safety
- Employee Development
- Operational Performance
- Growth
- Financial Performance

This PBR Progress Report provides an update on the 2019 Operational Plan. All initiatives have been described as either: 1) Completed, indicating that the activities are finished and the initiative is closed, 2) In-progress, indicating that work continues and the initiatives has been continued in the 2020 Operational Plan (as many initiatives are multi–year), or 3) On-going, indicating that the initiatives will never be formally completed as business requirements continue to change (e.g. operational improvement).

INITIATIVE	Year End Status
Customer Service	
Improve Customer Service in Edmonton Water – This initiative will create a customer service culture with focus on quality reviews and coaching and improve customer interactions handled by phone, in person and online.	**Ongoing** - In 2019, Water Services worked with the Drainage and Power to streamline processes through implementation of an improved call answering process where simpler calls are handled by a centralized team trained to handle power, water and drainage calls; a new phone system with an updated menu allowing for improved up front customer messaging and functionality and moving emergency calls to a single point of contact.
Improve Development Processes and Coordination with City of Edmonton and UDI/IDEA – Water Services will focus on better coordination with City Roadways, LRT, Development and Planning group for greenfield	**On-Going** - Initiatives to improve coordination with CoE have commenced and will continue to be optimized. Examples include Roadways, LRT planning and infill development. New requirements will evolve as both organization

INITIATIVE	Year End Status
and infill development work as well as local industry associations (UDI, IDEA).	introduce new processes. EWSI worked with the City and IDEA to develop the Infill Cost Sharing Program which is currently being piloted for 2020/2021 to support targeted infill development in Edmonton. Water Services is working with UDI to develop a principles based approach to sharing of utility infrastructure costs to mitigate rate increases, support growth and align to City growth objectives.
Improve Operational Coordination with the Regional Water Customer Group (RWCG) - This initiative will improve communication, planning and coordination of operational activities and unplanned events to ensure an effective and coordinated response to planned or unplanned events.	Ongoing - A secure FTP site has been set up where information such as reservoir levels, pressure data and other important operational information can be easily shared between parties, which will improve Water Services' ability to service the regional customers while providing more up to date information of the status of both systems. Continued coordination with the RWCG provides opportunities to plan work, manage emergent work, and realize cost efficiencies for both parties.
Develop and Implement a Gold Bar Stakeholder Consultation Plan – Water Services will provide the public with balanced and objective information to assist with understanding the problem, alternatives, opportunities and/or solutions and to solicit feedback on Gold Bar's long-term requirements at its site in the river valley.	Complete - The Gold Bar Stakeholder consultation plan was developed and executed through 2019 and provides the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions. Shared outcomes and design principles were developed in collaboration with stakeholders that will drive and inform activities at the site. Going forward, the stakeholder engagement program will build upon the success of the work done in 2019.
Public Health and the Environment	
Develop Climate Change Adaptation – River Flooding Resiliency Plan – Climate Change Strategy identified flooding as the highest risk. Conduct flood hazard analysis and develop a flood mitigation plan for Gold Bar and implement flood mitigation measures at the water treatment plants.	**In progress** – A comprehensive climate change strategy has been completed. The strategy is now being operationalized through a number of initiatives and capital plans for the facilities. Plans are currently being developed to mitigate flood risks at the plants. Grant funding has been awarded to offset a portion of the associated costs.
Develop Drinking Water Emergency Plan (Troubled Waters) - Water Services will finalize	**Ongoing –** EWSI finalized the BCP in 2019. In 2020, focus on sharing results with regional

INITIATIVE	Year End Status
plans for addressing drinking water emergencies and have in place a clear framework and a documented Business Continuity Plan (BCP) that addresses water supply or water quality emergencies.	customers. Completing Five year-plan of annual table top exercises to test the BCP.
Develop Enhanced Lead Management Program – Water Services will develop a proactive means of reducing public health risks to customers from lead and to ensure compliance with the new guidelines for lead in drinking water.	**In-progress** – Lead Mitigation Strategy developed and presented to Utility Committee March 22, 2019 and non-routine adjustment for this program approved by Council. Completing design of orthophosphate dosing systems at the WTPs followed by construction in 2020. Implementing targeted lead service line replacement program.
Move to Adopt ISO 14001 Across All Water Services Sites - Environmental Management Systems (EMS) are required at facilities and treatment systems across Water Services. Those facilities/systems with an Environmental Management Systems built to meet the old standard are required to transition and conform to the new ISO 14001:2015.	**Complete** – all Water Service facilities operate under a common Environmental Management system.
Complete E.L. Smith Solar Project and Smart Grid System - The E.L. Smith Solar Project is planned as a 12 MW solar farm that will provide renewable energy for water treatment plant operations. In conjunction, EWSI has received federal grant funding to build a Smart Grid System including a 4 MW battery energy storage system and micro-grid controls.	**Ongoing** - This project is in the final stages of approval after considerable public and stakeholder consultations. AUC approval was received in 2019 and the project is expected to receive final City approval for rezoning in fall 2020. Construction will commence in 2021 with an expected 2022 in-service date.
Execute Green Energy Purchase Agreement – In addition to the E.L. Smith Solar Project, another key component of Water Services' strategy to reduce its environmental footprint is to explore a competitive procurement for new renewable power from other Alberta sources for the remainder of the grid sourced electricity currently used by water operations.	**Ongoing** - A Request for Proposals (RFP) was issued in 2019 to solicit interest from renewable generation suppliers. Renewable Energy Systems Canada was selected as the successful proponent and will develop, design and construct the Hilda wind farm in south-eastern Alberta, which is expected to be operational by December 31, 2022. Water Services will acquire Renewable Energy Certificates for 20 years at a fixed price under the agreement.

INITIATIVE	Year End Status
Develop a Renewable Natural Gas Project at Gold Bar - The Gold Bar wastewater plant produces biogas as a by-product of the treatment process, which is currently used to heat the facility and any excess is flared. To lessen the environmental impact of this process, Water Services is investigating development of a cogeneration facility that would burn the biogas and produce electricity as well as heating.	**Ongoing -** The project has progressed to the conceptual design phase and would require public consultation as part of the development process if it were to proceed.
Develop a Proactive Residuals Strategy – Develop a strategy for the continued reduction of residuals loading to the North Saskatchewan River and elimination of chlorinated discharges to the river. This strategy will revisit options for the potential diversion of water treatment plants residuals to sanitary sewer, landfill or other solids disposal and will explore opportunities to further reduce solids loading to the river and expanding water plants residual solids management to other seasons. EWSI will study the net environmental benefit of various options.	**In-progress** – A consultant has prepared first draft of a triple bottom line (social, environmental and financial) study. This study will be completed in 2020 and used to develop EWSI's residuals strategy.
Employee and Public Safety	
Develop and Implement Company-wide Standard Operating Procedures for all High Hazard Activities –develop and implement company wide operating procedures for all high Hazard activities to effectively increase layers of protection for people and assets. This includes procedures for fall protection, hazardous energy isolation, confined space and lifting devices.	**On-going** – the initial development has focused on fall protection, hazardous energy isolation, confined space and lifting devices. This initiative is being developed in conjunction with the competency program as described below. Additional modules will be develop over time.
Move to Adopt ISO 45000 Across all Water Services Sites - Water Services has implemented and obtained registration to the OHSAS 18001 safety management system and is progressing to convert to the updated ISO 45001 safety management system to support continued safety performance improvement.	**On-going** – For its core Edmonton operations, Water Services has implemented and obtained registration to the OHSAS 18001 safety management system and is progressing to convert to the updated ISO 45001 safety management system to support continued safety performance improvement.
Review Effectiveness of Safe Work Planning Across All Water Services Sites – Safe work planning includes implementing a field level hazard assessment that effectively identifies	**On-going** - EWSI continues to develop and implement company wide assessments for six of the lifesaving rules and chemicals to effectively review existing procedures to ensure

INITIATIVE	Year End Status
hazards and implements controls to prevent potential injury to employees, contractors and the public. Water Services will review safe work planning for all locations to strengthen hazard assessment and reinforce safety integration into routine and non-routine tasks.	conformance to the EPCOR Standards and provincial legislative requirements
Employee Development	
Develop and Implement Company-Wide Competency Based Training for All High Hazard Activities – Competency training will include fall protection, hazardous energy isolation, confined space and lifting devices.	**On-going** – initial work has commenced on the identified modules. This approach will establish early learnings that will inform the subsequent development of additional modules over time.
Develop and Implement a Company-Wide Employee Rotation Program – To ensure a strong pool of talent now and into the future, this program will identify suitable candidates for job-to-job or project-to-project opportunities and support all aspects of the transition.	**On-going** - In 2019, all managers have completed the Professional Growth Initiative assessment and have development plans in place.
Improve Employee Engagement and Build a Respectful, Inclusive, Collaborative, Safe and Healthy Work Culture – Water Services will deliver a bi-annual engagement survey and interpret the results and implement action plans to address top drivers and opportunities for engagement. We will pursue a variety of activities through the Diversity Council including increasing awareness of diversity and inclusion at EPCOR, incorporating diversity into hiring practices, supporting employee resource groups and working with *Careers: The Next Generation* to provide work opportunities for indigenous youth.	**On-going** - In 2018 a Diversity Council was formed and in 2019, the Council, in concert with leaders across our Business Units, pursued a variety of activities and initiatives to drive this focus such as increasing awareness of diversity and inclusion at EPCOR and supporting employee resource groups.
Operational Performance	
Develop a Process Improvement Program to Support Productivity Increases - This initiative will develop standardized processes or continuous improvement programs to support productivity increases and service quality improvements. The program will encompass methods, techniques and tools and be used to design, control and analyze both business and	**On-going** – a team with six sigma credentials has been formed with the intent of that group both conducting process improvement projects themselves as well as developing educational materials to foster a process improvement orientation across the organization. Several process improvement projects have been identified and are under development. An

INITIATIVE	Year End Status
operational processes. It is critical that any approach chosen involves the people aspect of the process and integrates processes and systems.	educational program is in the final stages of development.
Develop a Standardized Approach to Asset Management Across Water Services by Confirming to ISO 55000 – The Asset Management Framework will be expanded and adapted to allow greater consistency in how it is applied across business units of Water Services by aligning with the international standard for asset management ISO 55000.	**On-going** - The Asset Management Methods Office has expanded and adapted the current Asset Management Framework to allow greater consistency in how it is applied across various Business Units of Water Services by aligning with the international standard for asset management, ISO 55000 including creation of a Strategic Asset Management Plan that outlines how Asset Management is to be approached across the business.
Develop Standardized Project Management Office/Capital Project Management Tools – This initiative will standardized the way project managers plan, execute and monitor their projects and programs. It involves creation of a project management methodology along with several processes, tools and templates.	**On-going** – a cross organizational team has been formed to review project management processes across all business units of EPCOR. The group has identified common process and re-developed many of the supporting documents. More detailed process modelling is currently underway as part of the introduction of the process into the respective business units.
Develop and Implement Strategies for Realizing Synergies between Water and Drainage – EPCOR has committed to a minimum of 1% annual operational efficiency savings for 2018-2022 and capital cost efficiencies of 10% by 2022 for Drainage Services. The initial focus of this initiative has been on integrating Drainage into EPCOR processes. Recent activities have focused on cross functional teams meeting to identify and prioritize efficiency opportunities in the areas of planning, capital and operations.	**On-going** - several short term opportunities for synergies have been identified and implemented. Detailed analysis has been completed to address larger opportunities to move towards a more consolidated approach across water and drainage. The central drivers to maximizing these opportunities may include real estate strategies and development common information systems platforms. These initiatives are in development and will be rolled–out over the next 2-3 years
Optimize Meter Reading Function – Water Services will seek to optimize the meter reading function through an analysis of current routing as well as the implementation of meter reading technologies to determine if they are viable from a cost benefit perspective. Analysis of the costs	**On-going** – Water Services is in the process of completing an analysis of the costs and benefits of introducing AMR and AMI technology and will incorporate the results of this analysis into its upcoming PBR plan.

INITIATIVE	Year End Status
and benefits of introducing Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) technology will be completed.	
Growth	
Develop and Maintain Master Plans / IRP's for All Sites – Each operational area of Water Services will develop/re-develop long-term plans of utility infrastructure to identify growth and operational service requirements along with review of technology and treatment processes: - Rossdale and E.L. Smith WTPs - Water Distribution and Transmission - Gold Bar	**On-going** –The Gold Bar IRP was presented to Utility Committee in 2019. The Water IRP will be presented to Utility Committee in 2020.
Develop Transfer Plan for Annexation Areas in South Edmonton – The proposed annexation areas south of the City will result in a substantial increase of the geographic area served by Water Services. The transfer of these areas include acquisition of a water pipeline and booster station from the southwest water Service commission and reservoir and related infrastructure in the county of Leduc and Discovery Park.	**Complete** – The acquisitions have been completed and transfer of the infrastructure is in progress. The City approved EWSI's non-routine adjustment for Annexation in late 2019.
Financial Performance	
Prepare for the 2022-2026 Edmonton PBR – The strategy will be developed to align Drainage under the same PBR Framework as Water and Gold Bar. EPCOR is proposing to renew the Water PBR rates for another five year term for the period 2022-2026. To stagger the future renewal periods, EPCOR will file the Gold Bar and Drainage PBR applications for a three-year term 2022-2024.	**On-going** – work is currently underway to determine the capital and operational plans underlying the PBR Applications, conduct stakeholder consultations and cost of service and rate design analysis. EPCOR aims to file the Applications with the City in early 2021 in order to complete the PBR hearing in advance of the 2021 municipal elections.

5.2 Drainage Services

Drainage Services also presented a 2019 Annual Operational plan to Utility Committee on February 1, 2019. The purpose of that document was the same as Water Services. The drainage initiatives planned for 2019 were organized within six strategic focus areas:

1. Safety
2. Environment
3. People
4. Operational Excellence
5. Customer and Stakeholder
6. Shareholder Value

This PBR Progress Report provides an update on the 2019 Operational Plan. All initiatives have been described as either: 1) Completed, indicating that the activities are finished and the initiative is closed, 2) In-progress, indicating that work continues and the initiatives has been continued in the 2020 Operational Plan (as many initiatives are multi–year), or 3) On-going, indicating that the initiatives will never be formally completed as business requirements continue to change (e.g. operational improvement).

Initiatives and Objectives	Year End Status
Safety	
Create a supportive culture where safety is our first priority and everyone has a voice.	
Reduce Tolerance towards safety related risks - Develop customized safe work plans for each unique work area. These will be in place for all groups by the end of 2019 Implement a new Contractor Management Program, including a framework and guidelines for managing prime contractor accountabilities	• **On-going** • Paper based customized safe work plans have been developed for each unique work area. Work is underway to integrate these into a Safe Work Plan App for use in the field. • The Contractor Management Program, including guidelines for managing prime contractor accountabilities and serious incident response plans, was reviewed and updated and rolled out to project managers.
Cultivate a culture of Safety Leadership – Ensure that incidents are reported accurately within our Event Reporting System (ERS), investigations are completed in a timely manner, and learnings are shared with all employees	• **On-going** • Several initiatives were completed to develop a strong safety culture including training, revision of process, near miss and other reporting metrics as well as programs to increase general awareness among staff. These programs will continue to ensure the safety culture continues to build. • For the year, 93% of recordable injuries and significant near misses were reported within 24 hours versus the target of 90%.
Encourage ownership of safety at all levels – This initiative includes: focus on hazard recognition and near miss reporting; training of all people leaders to lead an incident	• **On-going**

Initiatives and Objectives	Year End Status
investigation; developing an observation program to identify workplace hazards and recommend controls; rolling out driver report cards based on telematics; implementing workplace inspections across Drainage Services.	• Training of people leaders to lead incident investigations is underway and will continue into 2020. • The installation of fleet telematics was completed in December 2019. Monthly driver report cards are being produced and reviewed with staff. • Targets for workplace observations and inspections by managers and foremen were developed and are included in the 2020 work plan.
Train Staff for Competency and Confidence – This initiative includes creating and implementing Hazard Registries for all high risk work; establishing competency based assessments for high risk tasks; and implementing "EPCOR Athletes" – a program to learn about body mechanics and how to incorporate healthy movement into everyday tasks for both field works and office workers.	• **On-going** • Training for the EPCOR Athletes program was completed and both field and office staff continue to use the exercises on a daily basis. • The EPCOR Learning and Development team began the development of the formal Competency Assessment Project in 2019. Completion and roll out of the program will occur in 2020. • Hazard registries for all high risk work have been developed as part of the work to prepare ISO 45001 registration.
Roll out a Fully Functional Safety Management System to all Employees – This system will include hazard awareness, incident investigation and safety leadership. We will also focus on redefining critical procedures to ensure consistency, readability and accessibility.	• **Complete** – EPCOR Health Safety and Environment completed the system rollout which provides a consistent approach to management safety incidents across all EPCOR business units.
Environment	
Continuous improvement to meet or exceed societal and stakeholder expectations.	
Know what is important to Stakeholders and understand how we contribute – Drainage services will develop and implement the Odour Mitigation Strategy; expand on tools for environmental controls specific for Operations, Construction and Project Management to ensure proper data collection, and decrease our reliance on assumptions when discussing environmental	• **On-going** • A Water/Drainage Public Engagement strategy was developed and presented to Utility Committee June 8, 2018. This strategy was aligned with the City of Edmonton engagement strategy now forms the basis for all on-going customer and stakeholder engagements.

Initiatives and Objectives	Year End Status
performance; and update the Total Loading Strategy and obtain Alberta Environment and Parks approval through an amended Approval to Operate.	• The Total loading strategy update is on-going and work is underway with EPCOR Water to align this initiative with the residuals management strategies for the water and wastewater treatment plants and water distribution system. Coordinated discussions with Alberta Environment and Parks will occur in the later part of 2020 and any required amendments to the Approval to Operate will be determined in 2021. To support the Total loadings strategy, additional flow monitors have been installed at outfall locations and the SIRP strategy has incorporated high risk outfalls and environmental impacts into the SIRP risk ranking for the subbasins contributing loading to the environment.
Minimize Environmental Impact of Our Operations – This initiative includes updating the Combined Sewer Strategy and setting a CSO reduction target; ensuring that environmental work is aligned with projects in Planning and Engineering; and ensuring that all projects reflect considerations arising from the Stormwater Integrated Resource Plan (SIRP), our Odour Mitigation Strategy, and our goals to reduce flow to the river.	• **In-progress** - The combined sewer strategy goals have been incorporated into the overall SIRP program and are captured as individual flood mitigation projects are proposed. The introduction of low impact development alternatives to capture low flows at the source will reduce volumes reaching the river during low flow events thereby improving overall river water quality.
Adapt to Impact of Climate Change – Drainage Services will identify work that needs to be accomplished to reduce the impact of stormwater flow on Edmonton residents and businesses. We are also participating in the Flood Hazard Identification Program with Alberta Environment and Parks.	• **In progress** • Drainage Services completed the development of the SIRP strategy and is currently working through its implementation along the 5 themes of SLOW, MOVE, SECURE, PREDICT and RESPOND. This is a multi- year program with prioritization based on flooding risks and includes both capital and operational interventions with a particular focus on methods to support the property owner flood proofing their property to limit overall damage during an extreme storm event.

Initiatives and Objectives	Year End Status
	• In addition, the SIRP initiatives are being developed in conjunction with the CoE Climate Change Adaption plan. The focus for 2020 will be to expand the climate risk assessment to include risks due to urban wildfires and ice storm events.
People	
Engaged employees who are capable, confident and work as a team.	
Establish an environment that enables accountability, teamwork and sound business decisions – Drainage Services will facilitate an understanding of accountabilities and authorities at all levels of ensuring that 100% of people leaders have a position description that outlines their role and accountabilities. Drainage Services will create business plans for each unit outlining two year objectives that align with the goals and strategies of the Operational Plan.	• **On-going** – accountabilities, authorities and position descriptions clarified and reviewed with staff starting at senior levels. This review will continue as the business requirements and underlying processes evolve and are further integrated with EPCOR operations.
Create an environment where employees are engaged and their participation is valued – In 2019, this initiative includes communicating the results of the 2018 engagement survey; establishing cross-functional teams to develop and implement action plans on the top engagement drivers determined from the survey; identifying and implementing two diversity initiatives; ensuring that 100% of people leaders complete Mental Health training through the Mental Health Commission of Canada; and deploying necessary technology to ensure system connectivity for all field staff	• **On-going** • Drainage achieved an employee engagement score of 82%, with an overall positive rating across all functional areas. Results were communicated to all employees and cross-functional teams have been created to create action plans on key engagement drivers to further improve the level of engagement. These initiatives are on-going, leading to the next engagement survey in the fall of 2020. • Additionally, mental health training was conducted for all employees and drainage remains an active participant in EPCOR's diversity and inclusion initiatives.
Develop great leaders who embody EPCOR values – In 2019, critical objectives include providing regular feedback and coaching to employees informally and formally through the formal APfR process; rolling out the EPCOR mentorship program.	• **On-going** – Drainage services is now fully integrated into all EPCOR staff management programs including APFR's, mentorship programs and staff development plans. This initiative in on-going as staff and business change necessitate continued focus on developing the leadership pipeline.

Initiatives and Objectives	Year End Status
Facilitate cross-functional collaboration, remove silos, and focus on team outcomes – In 2019, this initiative includes defining clear behavioural expectations for cross functional collaboration by stratum based on EPCOR Values and developing processes and a responsibility matrix for key integration or hand-off points in end-to-end management.	• **On-going** • EPCOR Drainage and Water adopted the concept of One Water Planning late in 2019 and restructured to better align the strategic and active planning functions across both business units. Additional process mapping will occur in 2020 to further improve the overall development processes and prioritization for growth infrastructure aligned with City Plan. • The Organizational Project Management project (OPM) was launched to develop a new project delivery process for Drainage and EPCOR through a multi-disciplinary team. The EPCOR Capital Delivery Model (CDM) was developed through 2019 and a phase roll out will commence in early 2020. • Phase 1 of the Drainage Services Construction Strategy review was completed in 2019 with a decision to exit new tunnel construction following the completion of two remaining in-house projects in 2022. Future work of this nature will be contracted out. Phase 2 of the Construction Strategy will be completed in 2020. This will identify what work is critical and will be completed in-house, what work will be contracted out and also identify opportunities to develop in-house expertise in work that has fewer contractor/marketplace options and low barriers of entry. There will be no lay offs of Drainage Services staff as a result of this strategy review.
Promote development and career growth for every employee – In 2019, initiatives include leveraging relief postings for succession planning, cross functional skill development and knowledge development for in-scope positions and implementing successions planning through a professional growth initiative for out of scope positions.	• **On-going** – The Professional Growth Initiative (PGI) is being roll-out to allow individuals to assess their current leadership skills and form development plans. PGI will continue to be implemented at successive levels of management over the next 2 years and will become a continuing cycle.
Operational Excellence	

Initiatives and Objectives	Year End Status
Perform the right work the right way at the right time with the right resources.	
Develop and optimize end-to-end processes within Drainage – Key objectives include identifying projects that either define or optimize cross-functional processes; deploying telematics to assess vehicle utilization and optimize our fleet; develop a program management model building on the team delivery approach piloted in the control structure program; complete the field technology recommendation that ensures field staff have the platform and connectivity; build an information systems strategy that defines the systems of record and system integration strategy.	• **In progress** – A comprehensive process review program has commenced to identify process improvement opportunities from an "end to end" perspective. The program supports the identification, facilitation and realization of benefits of/from improvement opportunities across the Plan-Design-Build-Operate business cycle in Drainage. There is a particular focus on hand-offs between and within areas as this is when there is the greatest risk of miscommunication, poor transfer of responsibilities, or a breakdown in work continuity.
Build knowledge of industry best practices to support our decision making and program development - ensure employee attendance, participation or committee involvement in industry conferences, seminars, committees and research initiatives.	• **On-going** - EPCOR continues to actively participate in initiatives with the Water Research Foundation and the Canadian Water Network to further enhance the overall community and ensure that the strategies proposed are aligned with industry best practice. In 2019, Drainage in particular participated in a number of research projects in both Canada and the US related to Urban flooding and the SIRP strategy developed by EPCOR has been cited as one of the top strategies in North America in the resulting research papers published.
Identify and manage emerging risks – This initiative includes implementing a knowledge transfer program to mitigate the risk of losing technical expertise as well as addressing findings from internal audits to mitigate operational risks.	• **On-going** – Drainage continues to review and update operating procedures to ensure system knowledge is captured. All findings from the Construction Services Tunneling Construction and TBM Shop Operations internal audit have been addressed. The Operations and Maintenance internal audit was completed in November 2019 and the findings will be address through 2020.
CUSTOMERS AND STAKEHOLDERS	
Customers and Stakeholders trust us and value our services.	
Meet transfer commitments to City Council – Drainage Services committed to implement an Odour Mitigation Plan and a flood mitigation	• **Complete** – Final Stormwater Integrated Resource Plan presented to Utility Committee May 10, 2019.

Initiatives and Objectives	Year End Status
strategy. In 2019, Drainage Services will obtain approval of a Stormwater Integrated Resource Plan (SIRP) that will meet the needs of Edmontonians and reduce the risks associated with climate change and an Odour Mitigation Strategy that will reduce odours, particularly in "hotspot" areas where there are ongoing concentrated odour reports.	• **Complete** • Final Corrosion and Odour Reduction plan presented to Utility Committee June 28, 2019. • Non-routine adjustments to rates approved for these initiatives in late 2019. • Updated PBR Performance Measures for Drainage were approved by City Council in early 2020.
Build relationships with stakeholders to create trust and understanding – In 2019, Drainage Services will implement an approach to measure customer satisfaction build a stakeholder engagement plan that is aligned with the capital plan and review and prioritize public campaigns in order to meet all of strategic goals.	• **On-going** - Drainage Services has developed a stakeholder matrix tool for use with capital projects and other stakeholder oriented initiatives.
Build systems, processes and training to provide consistently good service that feels seamless to the customer - In 2019 we will evaluate sources of customer escalations and implement remedial actions; reduce the number of escalations and reduce customer service connection time.	• **On-going** • Customer escalations were reduced by 19% in 2019 compared to 2018. • Customer service connection completion time for 2019 averaged 4.9 weeks versus the target of 5 weeks.
SHAREHOLDER VALUE	
Improve financial performance to earn allowed return.	
Produce compelling rate applications for approval by the regulator – In 2019 this includes preparing for the 2022 rebase by evaluating rate structures to determine the appropriate balance between consumption and fixed rates; and developing a capital forecast that prioritizes spending to maintain service levels and ensure that any rate increases are affordable and reflect the priorities of Edmontonians.	• **Ongoing** – Drainage Services is in the process of developing its capital and operational plans underlying the 2022-2024 PBR application. Included in the PBR application will be an updated cost of service study and rate design analysis. Drainage Services aims to file the application in early 2021.
Pursue cost efficiencies as committed to during the Drainage transfer discussions with City Council As part of the transfer agreement with the City of Edmonton, EPCOR committed to no layoffs of existing staff,	• **Ongoing** – To the end of 2019, Drainage Services had identified and implemented over $1 M in operational savings. Additional overall operational savings of $18 M have been identified and incorporated into

Initiatives and Objectives	Year End Status
achieving operational savings of $11.9 M and reducing capital costs by 10% or 183 M over a ten year period.	operational budgets out to 2022. On the capital side, work on developing the SIRP program has already exceeded the committed $193.4 M reduction in capital costs, however management will continue to optimize both our capital and operating budgets to ensure the safe and reliable operation of the drainage system. This will all be accomplished with no staff layoffs.
Meet Operational and Capital Budget Targets – develop and execute realistic capital and operational budgets.	• For 2019, Drainage Services achieved a net income of $23.41 M versus a target of $24.61 M and a capital spend of $141.9 M versus the target of $169 M.

Appendix A: PBR Plan 2017-2021

A.1 In-City Water and Wastewater

A.1.1 PBR Framework

EWSI's In-City Water and Wastewater rates for the 2017-2021 PBR term are regulated by Edmonton City Council in accordance with the PBR Plan approved in Bylaw 17698. This plan encompasses rates, performance measures, and return on equity. The relationships between these components are designed to ensure that capital and operating cost decisions provide a balance between operational performance, rates, and return on equity, while safeguarding system reliability and service quality, providing fair, stable, predictable rates to rate payers, and providing a basis for the future development of the water and wastewater treatments system.

- **PBR Rates.** Annual changes to In-City Water and Wastewater rates are limited to inflation, less an efficiency factor, plus special rate adjustments and, in rare cases, non-routine adjustments. The use of a formulaic approach for calculating and setting utility rates acts as a "price cap" providing ratepayers with stable and predictable rates. The efficiency factor, set at 0.25% for the 2017-2021 PBR term, requires EWSI to increase productivity and achieve efficiencies in excess of inflation if it is to meet it targeted return on equity.

- **Performance Measures.** EWSI's PBR framework includes performance measures for water and wastewater treatment system service quality as described in Schedule 3, Sections 3 and 4 of the bylaw. EWSI faces financial penalties if it does not meet or exceed performance measure standards, providing assurance to customers that water and wastewater treatment system service quality will not be sacrificed to keep rates low or increase returns to EWSI. EWSI's performance measures are audited annually by an independent accounting firm.

- **Return on Equity.** The PBR plan incorporates a forecast rate of return on equity commensurate with consumption, cost and other risks that allows EWSI to finance its operational and capital programs, to provide its customers with high levels of service quality and reliability, and to provide "just and reasonable" returns to its shareholder. Achieving this return is dependent on EWSI achieving operating cost efficiencies, meeting or exceeding performance standards, and developing the utility infrastructure needed to provide service to its customers. For the 2017-2021 PBR term, returns on equity are based on a deemed capital structure of 60% debt and 40% equity and a 10.175% rate of return on equity.

A.1.2 Risks and Incentives

The PBR framework provides incentives for EWSI to improve operational performance while achieving cost savings through process improvements and other means. Under this framework, EWSI also assumes the risks associated with water consumption, operating costs, financing costs and capital costs, ensuring that customers are provided with stable and predictable rate increases. These risks and EWSI's strategies to mitigate them include:

- **Water Consumption Risk.** Under PBR, EWSI bears all of the risks associated with weather-related fluctuations in water consumption and water quality, as well as the longer-term risks associated with declining consumption per customer. EWSI seeks to mitigate consumption risk through the use of robust forecasting methodologies incorporating long term trends in water consumption.

- **Operating Cost Risk**. EWSI actively works to minimize fluctuations in input prices through long-term power contracts, chemical optimization processes, and continuous efforts to implement cost reduction strategies in all areas of its operations.

- **Interest Risk**. Fluctuations in short-term interest rates, long-term debt issue costs and in the level of capitalized interest have significant impacts on EWSI's net income and return on equity. EWSI mitigates interest risk through timing of long-term debt issuances and optimizing working capital.

- **Capital Cost Risk.** In-City Water and Wastewater's operations are capital intensive and it is often difficult to forecast required levels of capital replacements, both at the plants and in the water distribution and transmission network. EWSI seeks to minimize these risks through comprehensive capital project and asset management programs, ensuring that new projects or changes to existing projects are justified and that there is an appropriate level of management, senior management and executive oversight over capital spending.

A.1.3 Customer Classes and Rate Structure

A.1.3.1 In-City Water

In-City Water rates consist of fixed monthly service charges that vary with meter size and variable charges applied to each cubic metre of water consumed. Consumption charges differ for each of In-City Water's customer classes. These classes and their rate structures include:

- **Residential Customer Class.** Residential customers are charged based on an inclining rate structure with three consumption blocks. The inclining rate structure is intended to promote water conservation and provide incentives for residential customers to use water efficiently.

- **Multi-Residential Customer Class.** Multi-residential customers are charged based on a declining rate structure with three consumption blocks. EWSI has found that the cost of providing water to individual multi-residential customers declines as the size of the multi-residential building increases. As well, there is a wide range of consumption volumes for multi-residential customers. Accordingly, a declining rate structure best reflects the cost characteristics of this customer class.

- **Commercial Customer Class.** Similar to multi-residential customers, commercial customers are charged based on a declining rate structure, but with five consumption blocks to recognize the wide range of average consumption volumes within this customer class.

The 2017-2021 PBR Plan includes three special rate adjustments for In-City Water:

- **Special Rate Adjustment for Rebasing**. The In-City Water revenue requirement was rebased at the beginning of the 2017-2021 PBR term. The resulting rebasing adjustment to rates includes the on-going benefits to rate-payers of efficiency gains realized in the 2012-2016 PBR term, the impacts of higher than forecast capital expenditures during the 2012-2016 PBR term; and increases in the capital expenditure programs for the 2017-2021 PBR term. Also included in the rebasing adjustments is the impact of EWSI's cost of service study which has resulted in redistribution of revenue requirements from the Residential and Multi-Residential customer classes to the Commercial customer class.

- **Special Rate Adjustment for Accelerated Programs.** These special rate adjustments support the acceleration of the replacement of water mains as part of the City of Edmonton's neighbourhood renewal program and the upgrade of water mains to increase fire protection capacity in neighbourhoods experiencing increased densities as a result of infill development.
- **Special Rate Adjustments for Environmental Programs.** EWSI is undertaking two significant environmental initiatives during the 2017-2021 PBR term. The first initiative is an extensive River Monitoring Project to regularly monitor, evaluate and report on a number of water quality variables from several sampling sites in the river for 2018-2021. This program is forecast to have annual costs of $1.0 million starting in 2018. The second initiative, which aligns with the City's *"The Way We Green"* strategy, is a Green Power Initiative to replace approximately 10% of EWSI's total power volumes with energy from locally produced renewable sources starting in 2018. This initiative is forecast to cost $1.9 million annually commencing in 2018.

A.1.3.2 Wastewater Treatment

Wastewater treatment rates consist of fixed monthly service charges that are applied equally to each customer and variable charges applied to each cubic meter of water consumed. Wastewater has two customer classes:

- **Residential Customer Class.** Unlike In-City Water, there are no separate rates for multi-residential customers. Instead, customers who would be multi-residential water customers are subject to the same rates as residential wastewater customers. The common rate structure for residential and multi-residential customers recognizes that the costs of wastewater treatment are very similar for residential and multi-residential customers. Accordingly, charges to Residential customers are based on a flat rate structure with a single consumption block.

- **Commercial Customer Class.** Consumption charges for commercial customers are based on a declining rate structure with three consumption blocks to recognize that there are economies of scale in wastewater treatment for larger commercial customers. In addition, commercial customers are charged overstrength fees for prescribed materials that exceed the concentrations shown in Section 4 of Schedule 1 to Bylaw 17698.

The 2017-2021 PBR Plan includes a single special rate adjustment for rebasing. Similar to In-City Water, Wastewater's revenue requirement was rebased at the beginning of the 2017-2021 PBR term to reflect efficiency gains realized in the 2012-2016 PBR term, as well as the substantial increases in capital spending needed to deal with the challenges of the aging infrastructure at the Gold Bar Wastewater Treatment Plant.

A.2 Drainage

A.2.1 PBR Framework

EWSI's Drainage rates for the 2018-2022 PBR term are regulated by Edmonton City Council in accordance with the PBR Plan approved in the EPCOR Drainage Services Bylaw 18100. Similar to In-City Water and Wastewater, Drainage's 2018-2022 PBR plan encompasses rates and performance measures, but the mechanisms used to achieve a balance between rates and operational performance differ in important respects, as follows:

- **PBR Rates.** Bylaw 18100 prescribes drainage fees and charges for the period from January 1, 2018 to March 31, 2022. These fees and charges reflect EWSI's commitment to limit average annual rate increases to 3%. Besides these scheduled rate increases, Bylaw 18100 also includes a mechanism for non-routine adjustments to rates related to emergent City-directed needs.

- **Performance Measures.** Bylaw 18100 requires Drainage to measure operational performance for the period from January 1, 2018 to December 31, 2019 using performance measures for drainage system service quality modeled after previous City Drainage Services quality metrics. After that time, for the remainder of the 2018-2021 PBR term, Drainage's operational performance will be measured against new performance measures that will be developed Drainage and approved by the Utility Committee. Similar to Water and Wastewater, the new performance measures have a scoring system with financial penalties applied if Drainage does not meet or exceed performance standards. As with Water and Wastewater, the performance measures scorecard will be audited annually by an independent accounting firm.

A.2.2 Customer Classes and Rate Structure

Drainage has Residential, Multi-Residential and Commercial Customer classes, using the same customer definitions as Water. Drainage's rate revenues are derived from both Sanitary Utility and Stormwater Utility services.

- Drainage has a simple rate structure, with flat monthly service charges varying only by meter size regardless of customer class and the same monthly variable rate per cubic meter applicable to all customers, regardless of customer class, except for the U of A which has a unique rate, intended to recognize its lower servicing cost.

- Stormwater Utility revenues are based on the area of the customer's property, development intensity, and zoning, also with common rates regardless of customer class.

Appendix F1

EPCOR WATER SERVICES INC.

List of Water Programs and Projects in the 2022-2026 PBR

February 16, 2021

List of Water Programs and Projects in the 2022-2026 PBR
($ millions)

	Category	A Asset Area	B 2022-2026 PBR Plan
	Regulatory		
1	Water Service Replacement and Refurbishment Program	Distribution Mains	24.67
2	Fire Alarm System Replacement Project	Water Treatment Plants	0.81
3	**Sub-total: Regulatory**		**25.47**
	Growth/Customer Requirements		
4	Winterburn Booster Station Land Project	Reservoirs	0.50
5	Winterburn Booster Station Project	Reservoirs	6.70
6	LRT Relocates Program	Transmission Mains	10.25
7	Network PD Transmission Mains Program	Transmission Mains	15.00
8	Water Main Cost Sharing Program	Transmission Mains	3.00
9	QEII Highway 41 Ave Crossing Project	Transmission Mains	14.14
10	Winterburn Road CRPWSC Tie In Project	Transmission Mains	0.92
11	Franchise Agreement Relocates Program	Distribution Mains	11.00
12	Customer Infrastructure Requests Program	Distribution Mains	-
13	Private Development Construction Coordination Program	Distribution Mains	8.73
14	Water Service Connections Program	Distribution Mains	-
15	New Meter Installations Program	Metering	13.88
16	**Sub-total: Growth/Customer Requirements**		**84.13**
	Health, Safety and Environment		
17	Plants Equipment Upgrades Program	General Plants	1.31
18	E. L. Smith Chemical System Upgrades Program	Water Treatment Plants	3.53
19	Chemical Spill Room Upgrades Project	Water Treatment Plants	0.80
20	Rossdale Chemical System Upgrade Program	Water Treatment Plants	4.75
21	Battery Energy Storage System Project	Water Treatment Plants	(2.66)
22	**Sub-total: Health, Safety and Environment**		**7.74**
	Reliability and Life Cycle Improvements		
23	Site Facilities Upgrades Program	Reservoirs	1.47
24	Reservoir Electrical Upgrades Program	Reservoirs	1.74
25	Reservoir Mechanical Reliability Upgrades Program	Reservoirs	2.08
26	Structural Rehab and Roof Replacement Upgrades Program	Reservoirs	9.64
27	Rossdale Cell 1 Roof and Structural Upgrades Project	Reservoirs	4.11
28	E. L. Smith Pilot Plant Optimization Program	General Plants	1.15
29	Laboratory Equipment Program	General Plants	1.00
30	Corrosion Protection Program	General Plants	1.00
31	Major Inspections Program	General Plants	3.09
32	HVAC Upgrades Program	General Plants	2.50
33	WTP Site Facilities Upgrades Program	General Plants	3.24
34	WTP Electrical Upgrades Program	General Plants	4.41
35	Instrumentation and Analyzer Upgrades Program	General Plants	2.89
36	Structural Upgrades Program	General Plants	3.07
37	WTP Roof Replacements Program	General Plants	0.60
38	WTP Office Furniture and Equipment Program	General Plants	0.29
39	Flood Protection Project	General Plants	16.11
40	Distribution Equipment Purchases Program	General Plants	1.63
41	Distribution Site Upgrades Program	General Plants	1.57
42	Fleet and Vehicle Additions Program	General Plants	6.98

	Category	A Asset Area	B 2022-2026 PBR Plan
43	Water D&T Office Furniture and Equipment Program	General Plants	0.17
44	SCADA System Upgrade Program	IT SCADA	3.78
45	Microcomputers Program	IT General	1.34
46	Asset Management Decision Support Tool Project	IT General	0.36
47	LIMS Replacement/Upgrade Project	IT General	0.36
48	IVARA Upgrade Project	IT General	1.24
49	WTP Microstation Replacement Project	IT General	0.17
50	Water D&T Microstation Replacement Project	IT General	0.17
51	E. L. Smith Chemical Tank Upgrades Project	Water Treatment Plants	1.13
52	Rossdale Chemical Tank Upgrades Program	Water Treatment Plants	1.20
53	E. L. Smith Mechanical Reliability Program	Water Treatment Plants	3.60
54	High Lift Pump House Project	Water Treatment Plants	4.98
55	5 kV Upgrades Project	Water Treatment Plants	5.04
56	HLPH Transformer Upgrade Project	Water Treatment Plants	1.12
57	LLPH Electrical Upgrade Project	Water Treatment Plants	2.62
58	E. L. Smith Filter Upgrades Project	Water Treatment Plants	15.62
59	Clarifier Drain Line Upgrade	Water Treatment Plants	1.51
60	SBS Room Upgrades (Phase 1) Project	Water Treatment Plants	0.75
61	Reservoir Cell 2/3 Access House Upgrades Project	Water Treatment Plants	1.51
62	E. L. Smith Two Train Upgrade Project	Water Treatment Plants	3.98
63	E. L. Smith UV System Expansion Project	Water Treatment Plants	4.90
64	E. L. Smith New Power Feed Project	Water Treatment Plants	1.09
65	E. L. Smith Rebuild HLP4 Project	Water Treatment Plants	0.72
66	Rossdale Mechanical Reliability Program	Water Treatment Plants	4.00
67	Waste Streams 3 and 5 Upgrade Project	Water Treatment Plants	3.36
68	Waste Stream 7 Upgrades Project	Water Treatment Plants	0.56
69	Clarifier/Filter Building Assessment Project	Water Treatment Plants	0.74
70	Blow Off Cross Connection Control Program	Transmission Mains	1.83
71	Critical Pipeline Inspection Program	Transmission Mains	6.79
72	Transmission Mains and Appurtenances Program	Transmission Mains	10.68
73	Infill Fire Protection Program	Distribution Mains	20.20
74	Obsolete Valve Replacements Program	Distribution Mains	11.60
75	Obsolete Hydrant Replacements Program	Distribution Mains	8.44
76	Risk Based Renewals Program	Distribution Mains	28.95
77	Meter Change Outs Program	Metering	5.78
78	ProjectWise Upgrade Project	IT General	0.09
79	**Sub-total: Reliability and Life Cycle Improvements**		**228.99**
	Performance Efficiency and Improvement		
80	Water Main Cathodic Protection Program	Distribution Mains	15.08
81	Hydrant Meter Purchases Program	Metering	1.19
82	AMI Deployment Project	Metering	62.87
83	Other Water-IT BU Initiatives Program	IT General	1.12
84	Field Mobile Applications Project	IT General	0.63
85	Synergy Colocation Foundation Project	IT General	0.25
86	Customer Stakeholder Integration System Project	IT General	1.00
87	AMI Upgrade Project	IT General	0.87
88	**Sub-total: Performance Efficiency and Improvement**		**83.02**
89	**Total Capital Expenditures**		**429.35**

Appendix F2

EPCOR WATER SERVICES INC.

Water Services
5 kV Upgrades Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The 5 kilovolt (kV) electrical switchgear line-up at the E. L. Smith water treatment plant has surpassed its asset life cycle and needs to be replaced in order to ensure the plant can continue uninterrupted operation. Failure to maintain the electrical system may lead to unplanned shutdowns at Edmonton's water treatment plants. This in turn may compromise EWSI's ability to meet its Approval to Operate. Unplanned shut downs may result in drop in water pressure which impacts EWSI's customers and may be insufficient for firefighting. Decreases in water pressure also increase the risk to contamination of the water in the distribution system through intrusion and backflow, thereby increasing the risk to public health.

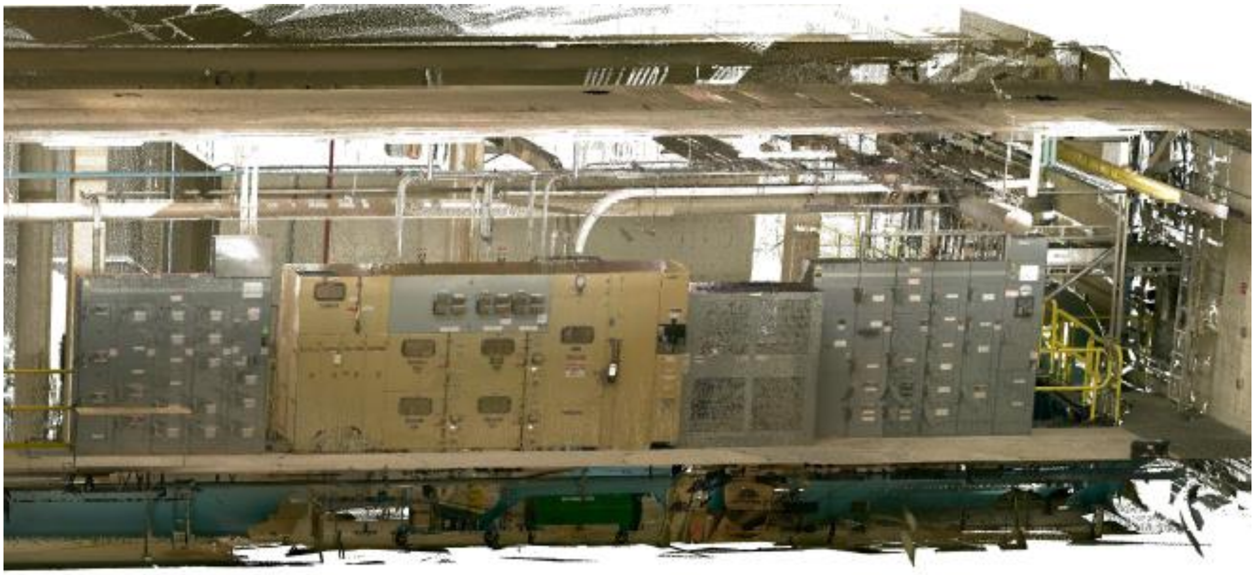
2. The 5 kV Upgrades Project is included in the reliability / life cycle category. EWSI has forecast total program capital expenditures during 2022-2026 at $5.04 million, in addition to the $1.22 million projected to have been spent within the 2017-2021 PBR term. Construction is planned for 2022, which is also the year in which the new switchgear line-up is scheduled to go into service.

2.0 PROJECT DESCRIPTION

2.1 Background

3. The 5 kV electrical switchgear line-up at E. L. Smith was installed in 1976. It has surpassed its asset life cycle and needs to be replaced in order to ensure the plant can continue uninterrupted operation. This switchgear line-up consists of electrical breakers for 4 High Lift Pumps (HLP), 3 Low Lift Pumps (LLP), 2 backwash pumps (BWP), UV system and blowers. All of this equipment is very critical to continuous Plant operation and therefore must perform with high reliability. This electrical gear is located in two separate locations of the Plant. The main gear is located in the High Lift Pump House Electrical Room and feeds auxiliary gear located in the Filter Building basement. The switchgear line-ups are shown in Figure 2.1-1 below.

Figure 2.1-1
5 kV Electrical Gear Line-ups



Filter Building Electrical Gear

HLPH Electrical Gear

4. An internal investigation was completed on this equipment through EWTP's Engineering Request process in 2016. The Engineering Request identified that the existing switchgear

components have surpassed their asset life cycle, as indicated by a history of failures including a major failure of a contactor due to breaker cell misalignment on the electrical bus connection in 2008 and failure of an auxiliary contact which damaged a HLP which required a pump rebuild in 2015.

5. In addition, the current electrical gear for critical plant equipment such as HLPs, BWPs and blowers puts EPCOR plant operation in a risk situation to either operate with only two HLPs or lose the ability to backwash and scour filters. This issue also limits the flexibility of how the HLPs are operated.

6. Existing switchgear components were manufactured between 1976 and 1982 that operate HLPs, LLPs, BWPs, blower motors and transformers. These components have exceeded their asset life expectancy which is 35 years. Statistically, that puts this equipment at a higher risk of failure. The gear in the Filter Building is not protected from fugitive chlorine gas that is emitted during filter backwash cycles and has sustained corrosion, leading to some failures.

7. The evaluation also deemed direct replacement in-situ is not feasible, due to the configuration of the current electrical loads. An extended electrical shutdown of this equipment significantly impacts the Plant's pumping capacity, preventing the ability to meet customer demand. The evaluation recommended that both the main HLP gear and the Filter Building ancillary gear be brought together into the same room or building as this would address all of the risks associated with replacement. Most importantly, new equipment can be installed and tested in a new room, prior to taking the old equipment out of service.

8. Further to the Engineering Request, EWSI completed an Asset Management Plan (AMP) for Electrical Asset Reliability for the E. L. Smith Plant in May 2020. The plan reviewed the specifications, condition and maintenance records of the key electrical assets to develop a comprehensive plan to be utilized for future maintenance and capital replacement guidance. The AMP recommended replacement of this equipment in phases between 2020 and 2023.

9. The 5 kV switchgear replacement scope was originally spread out over the years 2019-2021 in the 2017-2021 PBR Application as part of the Electrical Upgrade Program for E. L. Smith. The PBR plan was based on direct replacement of the gear split between individual years. However, it was determined this approach was not possible due to the amount of time it would take to replace, requiring a plant outage longer than can be accommodated. Therefore, the overall scope of the project was changed to install new switchgear in a new building while the existing gear continues to provide uninterrupted operation of major plant equipment.

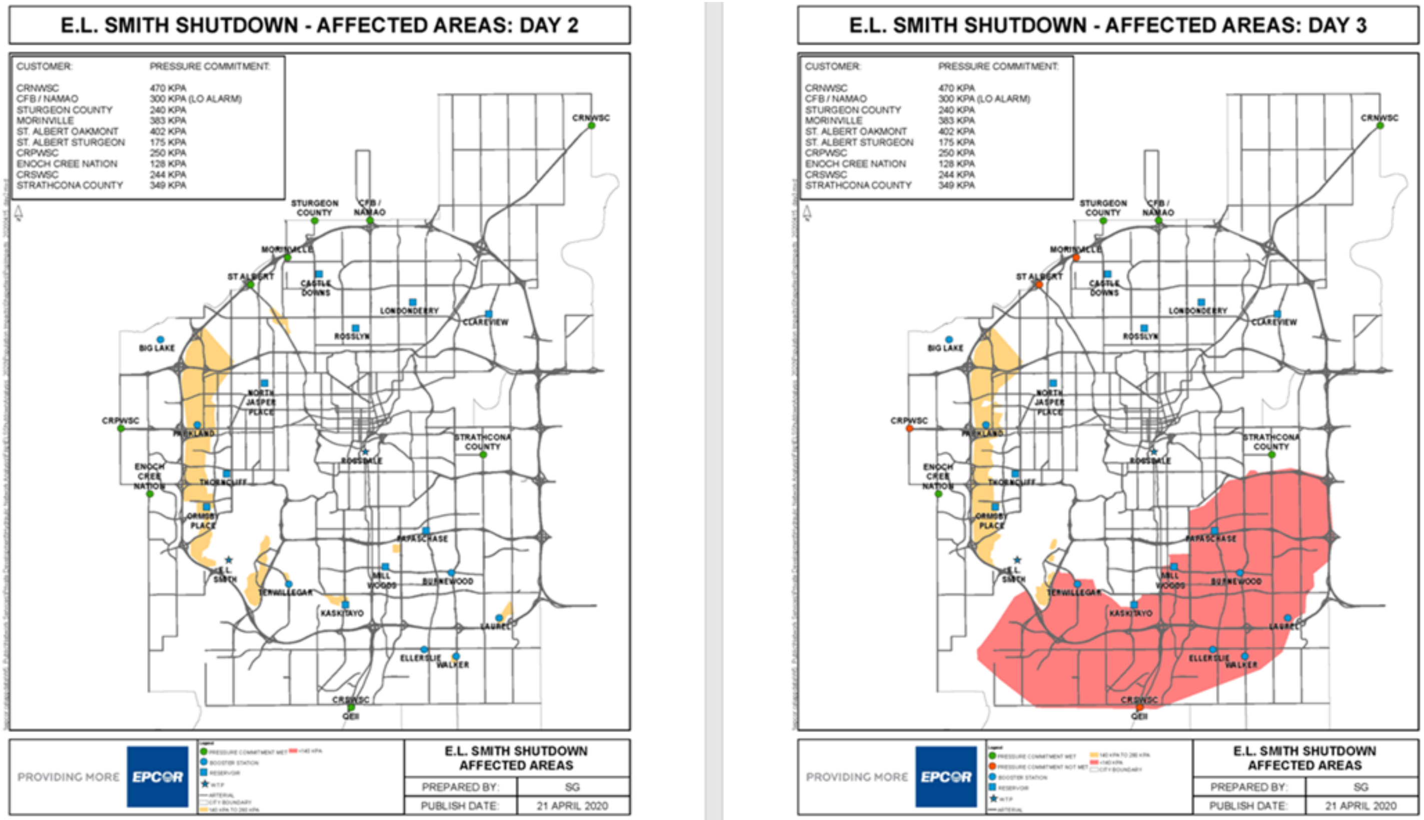
2.2 Project Justification

10. If this project were not completed, the existing 5 kV switchgear line-up (HLPs, backwash pumps, UV system, and blowers) would continue to age resulting in an unplanned electrical failure. It has already surpassed its asset life cycle (35 years) by as much as 9 years and, has experienced previous failures within the past 10 years. Reactively replacing or retrofitting equipment comes at a higher cost for design, procurement and fast-tracking. As well, lead times to secure replacement equipment cannot be avoided and would prolong the outage until it arrives. A custom breaker could take as much as 6-9 months to fabricate and install.

11. Furthermore, failures may result in the loss of high lift pumping capacity into the transmission system to offsite City reservoirs or to regional customers. It may also result in the loss of ability to backwash filters. If filters are not backwashed regularly, debris from the NSR begins to build up quickly, reducing the amount of water that can pass through them resulting in a much lower treatment capacity. Depending on the water demand, customers could be impacted by EWSI's demand management measures or, more severely, could be left with insufficient water pressure in as little as two days. Low water pressure also impacts the ability to fight fires, and may require emergency services to bring in water trucks to mitigate this risk. Low water pressure also increases the risk of contamination of the water in the distribution system through intrusion and backflow, thereby increasing the risk to public health.

12. The Rossdale plant cannot distribute water to areas within the west and southwest zones of the E. L. Smith plant service area. Figure 2.2-1 shows the effects on customers of an E. L. Smith outage at after two and three days.

Figure 2.2-1
Day 2 and Day 3 E. L. Smith Shut Down Impacts



Water Pressure at Critical Levels (140 – 280 kPa)

Water Pressure at Unacceptable Levels (< 140 kPa)

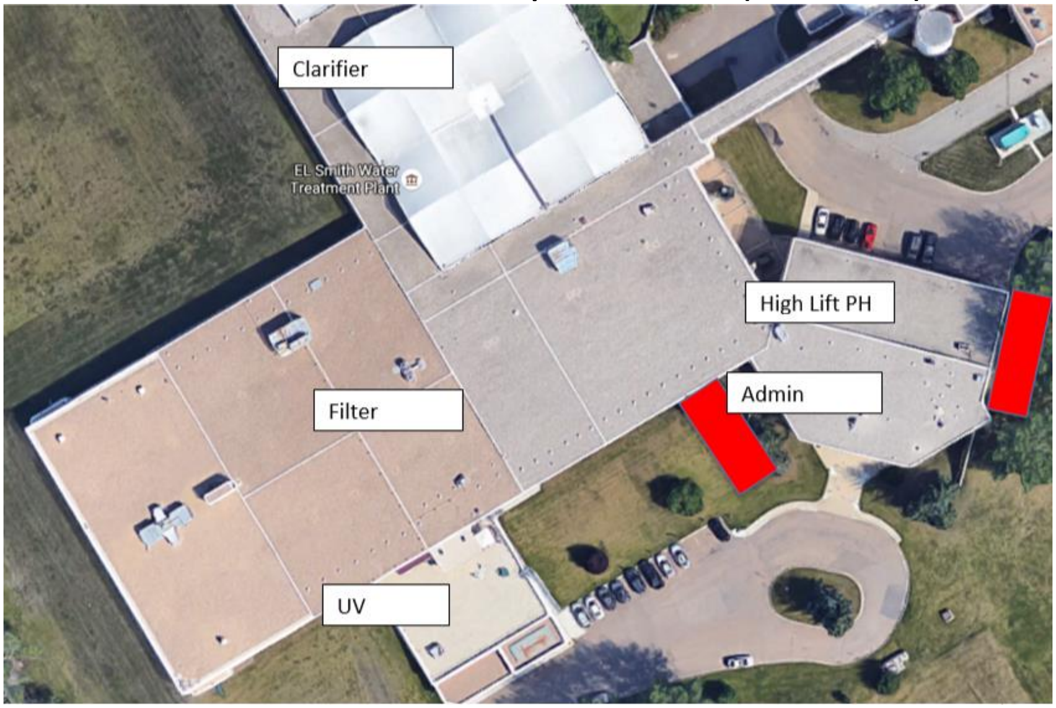
3.0 PROJECT DESCRIPTION

13. The proposed scope of this project is to reconfigure and upgrade the 5 kV switchgear lineup, including re-arranging the loads on the gear line up, to best meet operational scenarios and switching abilities. It will include locating the new switchgear in a new electrical room or stand-alone building.

14. The scope items will require shutdowns and coordination with operations in order to complete the work. Temporary power systems will be incorporated as necessary to maintain operation of critical equipment. With gear installed in a new building, individual loads will be transferred over to minimize impacts.

15. The location will need to be determined for the new electrical room. Figure 3.0-1 identifies two conceptual locations.

Figure 3.0-1
Electrical Room Conceptual Locations (noted in red)



16. The conceptual design review will evaluate location options and make a recommendation based on technical requirements and stakeholder feedback. During the detailed design phase, the future needs of the pumps and space requirements will be further evaluated and addressed.

17. The new building will require an Environmental Review Report, development and building permits, and the electrical installation will require a municipal electrical permit. Provincially, historical clearance will be required for the project through the *Historic Resource Act*.

18. The work and design for this project will be coordinated with other major E. L. Smith capital projects including the High Lift Pump House Transformer Upgrade, the High Lift Pump House Expansion and the Two Train Upgrade to ensure coordination of design and construction. Conceptual designs for those two projects and this one are currently underway.

Table 3.0-1
Program Phases

	A 2018	B 2019	C 2020	D 2021	E 2022
1 Initiation/Approvals	X				
2 Feasibility/Conceptual Design		X	X		
3 Detail Design			X	X	
4 Procurement				X	X
5 Construction					X
6 Commissioning					X
7 Close-out					X

19. Table 3.0-1 shows the program phases, with the in-service date scheduled for 2022.

4.0 ALTERNATIVE ANALYSIS

20. The following alternatives were assessed:

4.1 Alternative 1: Reconfigure and Replace Switchgear (Selected)

21. This option requires a new electrical room with new switchgear. The cost estimate for this alternative is $6.26 million.

22. Benefits:

- Provides the ability to place new equipment into service, while not causing a major service disruption to customers when the old equipment is decommissioned.
- Allows for reconfiguration of the electrical loads to address all operational scenarios. Currently, the plant cannot operate the two largest HLPs at the same time.
- New equipment is more technologically advanced and is safer to operate as it can be operated automatically.
- Disruption to the plant is minimized with no full plant shutdowns required.
- Provides additional building space for future loads or for pump speed drives, which could be incorporated in the future for increased pumping efficiency and more operational flexibility.
- Equipment in a new separate room or building will be protected from chlorine off-gassing with modern independent ventilation systems specifically designed for keeping the equipment cool.

23. Disadvantages:

- Higher cost
- Slightly expands E. L. Smith building footprint by approximately 140 m^2
- Requires historical assessment clearance

4.2 Alternative 2: Upgrade 5 kV line

24. This option maintains the existing transfer scheme with manual breakers. Obsolete equipment is addressed and the lifespan of the system is increased by 20 to 30 years. The cost estimate for this alternative is $2.70 million.

25. Benefits:

- Lower cost than Alternative 1 as there is no new building.
- Existing equipment is replaced with modern breakers, reducing the risk of unplanned failure.
- Modern breakers are safer to operate but do require more space than what may be available in the existing cabinet structure. This would require further evaluation during detailed design.

26. Disadvantages:

- The loads feeding the 4000 Hp high lift pumps cannot be separated into distinct electrical bus bar runs. Currently they are on the same bus bar and a reconfiguration to separate them would require an outage duration that exceeds the maximum 2 day timeframe before customers are impacted. Separation of these two pumps is required to address current operational limitations.
- If the electrical feed to the bus bar that supports both 4000 Hp HLPs is lost, the Plant will not be able to meet customer demands.
- Significant modifications are required to the electrical bus bar and cabinet structure, to enable new breakers to be installed. Detailed design is required to ascertain if this solution is viable. If it is not, the project will have to reconsider installing new equipment in another location.
- If this option turns out to be a viable alternative, many shutdowns would be required, as only one breaker could be replaced at a time. This puts the plant at risk and disrupts

operation for an extended duration. Depending on the time of year and customer demand, a shutdown may have to be postponed, further prolonging the project.

- No expandability for any future loads or for feeding the proposed HLPH #2 as the existing space is already cramped.
- Replacement in-situ of the ancillary 5 kV gear in the basement of the Filter Building, will continue to be subjected to chlorine off-gassing during Filter Backwash cycles resulting in premature corrosion of sensitive electrical and instrumentation components in the new gear.

4.3 Alternative 3: Retrofit Existing Breakers

27. This option maximizes the lifespan of the existing gear by replacing individual components in the breakers. No cost estimate was pursued for this option, as it does not meet any of the criteria established for viability.

28. Benefits:

- Lower cost than Alternative 1 as there is no new building.
- Components within the existing breakers that are more prone to failure are replaced, reducing the risk of unplanned failure.

29. Disadvantages:

- All of the disadvantages of Alternative 2.
- As the existing gear is now obsolete, custom components would have to be manufactured. This is expensive and may not be possible. As well, it will continue to be a future issue as individual replaced components begin to age.

4.4 Alternative 4: Status Quo

30. This option allows the 5 kV switchgear line-up to continue to age, running to failure.

31. Benefits:

- Maximizes the equipment life, even though it is beyond its projected asset life cycle.

32. Disadvantages:

- All of the disadvantages of Alternative 2.
- Puts the plant at major risk, in the event there is an unplanned failure.

- Eventually leads to implementation of one of the above options however, it would be in more of an emergent need, impacting Plant operation, driving up cost for design, customization or fast-tracking construction.

4.5 Conclusions

33. Alternative 1 was selected as it delivers all of the requirements identified as risks or needs of the plant. It allows the plant to continue to operate uninterrupted while the new gear is installed, tested and switched over. Due to the unpredictability of failures, status quo can lead to unscheduled repairs and unexpected capital expenditures in emergency situations. In addition, this alternative will provide safety and reliability benefits as modern switchgear is safer to operate as it incorporates arc flash resistant components and can be operated automatically, rather than manually. As well, many of the previous failure modes experienced on the existing gear have been eliminated in modern equipment design. This will ensure the plant does not experience unplanned outages that could affect its ability to meet customer water needs during high demand periods.

5.0 COST FORECAST

34. Costs for this project are shown in Table 5.0-1 and are based on the following:

- The cost of the main switchgear components to replace the existing 5 kV line-up are based on a similar project completed at the Rossdale plant in 2017.
- The cost of the building structure is based on a contractor estimate for a similar type of construction for a substation building completed for EPCOR's Electricity Distribution and Transmission.
- The cost of the detailed design is estimated based on a percentage (12%) of the construction estimate for a project with a higher complexity level.
- Internal costs are based on previous projects of similar size and complexity. The hours allocated are for project management, construction coordination, internal reviews and advisory services, commissioning assistance, software and hardware costs, and training support.

Table 5.0-1
5 kV Upgrades Project
2022-2026 Program Capital Expenditures
($ millions)

		A **2022**	B **Total**
	Direct Costs:		
1	Contractors	3.88	3.88
2	Internal Labour	0.09	0.09
3	Contingency	0.78	0.78
4	**Sub-total Direct Costs**	**4.75**	**4.75**
5	Capital Overhead and AFUDC	0.29	0.29
6	**Total Capital Expenditures**	**5.04**	**5.04**

35. EWSI's approach to minimize expenditures on this project include:

- Contracted services will be performed by pre-qualified external consultants and contractors which will be retained through a competitive bidding process.
- Work will be coordinated with other major capital projects to minimize costs. Currently, the conceptual design is being completed in conjunction with other proposed capital upgrades at E. L. Smith including the High Lift Pumphouse Expansion and the Two Treatment Train Upgrade. It is important to evaluate these together to ensure the future needs of the plant and any potential conflicts are considered.
- EWSI is expecting to use a previously designed building format that has become a standard within EPCOR Electricity Services for substations. This should help to reduce design fees and, because it has been standardized for construction, should have some efficiencies gained as well.

6.0 RISK AND MITIGATION PLANS

36. Regulatory Risk - The site location forms one of the risks of this project, as site conditions may present construction challenges. Depending on where the new building is located, there could be cultural mitigation requirements mandated through the Historic Resource Act. In 2018, EWSI included this project as part of the Historic Resource Impact Assessment for the Bypass Main project (currently under construction) and presented the findings in their application to Alberta Culture, Multiculturalism and Status of Women. Therefore, some preliminary work has been completed, in order to mitigate this risk.

37. Operational Risk - During commission and start-up of the new electrical gear, switching from old to new electrical equipment carries risk of power interruptions. Robust testing and commissioning of the new gear with assistance from the vendor will be paramount to avoid these

outages. Providing standby temporary power to critical loads during testing and commissioning will also help to mitigate this risk.

38. Financial Risk - Implementing this project over a five year period, and completing comprehensive detailed design, will help mitigate scheduling and financing risks by providing sufficient time for the proper planning and coordination of the 5 kV switchgear replacement. Currently, the project is undergoing a conceptual level design to evaluate future plant electrical needs, to evaluate building location options, and to understand how best to feed electricity at the 5 kV level for major plant process equipment.

Appendix F3

EPCOR WATER SERVICES INC.

Water Services
AMI Deployment Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The AMI Deployment Project will replace the current meter reading technology with Advanced Metering Infrastructure (AMI) meter reading technology over the 2022-2024 period. Under this option existing water meters will remain in service until the end of their useful lives.

2. This project is required for EWSI to ensure it is able to meet its obligations for service under Section 8.1, Schedule 2 of the EPCOR Water Services Bylaw #19626 (the Bylaw) which requires that EWSI meter the water consumption for all of its customers. EWSI is required to read and record consumption in order to bill the consumption charge outlined in Schedule 3 of the Bylaw. Should EWSI be unable to read meters, these sections of the Bylaw would not be met.

3. EWSI owns and operates approximately 300,000 water meters (mix of commercial, residential and multi-residential) located within the city of Edmonton. These meters are equipped with a mix of touchpad and radio frequency (RF) meter reading devices and each meter is read on a monthly basis by a team of water meter readers. The current meter reading equipment used by this team to read both touchpad and RF is no longer manufactured or supported by the vendor and is at risk of failure within the 2022-2026 PBR term. Should the meter reading equipment fail, EWSI would be unable to efficiently obtain timely meter readings and bill customers accurately. To ensure EWSI's ability to reliably and efficiently read meters, EWSI must replace the existing meter reading equipment.

4. With the current meter reading technology obsolete, EWSI explored two alternative meter reading options:

- AMI – a meter reading technology which reads meters through a smart over-the-air collection network; and
- Accelerated Automated Meter Reading (AMR) – a meter reading option which uses a more localized over-the-air RF technology to read meters.

5. Both options are described in detail in Sections 3.2 and 3.3. AMI deployment is the least costly alternative, both over the 2022-2026 period as well as long term. AMI deployment presents a unique opportunity in the city of Edmonton because EWSI will leverage the EPCOR Distribution & Transmission Inc.'s (EDTI) existing AMI network for power meter reads, reducing overall project costs compared to building a stand-alone network.

6. AMI deployment also provides a number of customer, safety and operational benefits as described in Section 3.2.

7. This project is included in the Reliability/Life Cycle Replacement category and the projected capital expenditure is $62.87 million, which is partially offset by a reduction of $8.06 million in the Meter Change Out Program over the 2022-2026 term, a reduction of 25% to long-term costs in the Meter Change Out Program beyond 2026 as outlined in Section 5, and lower long-term meter reading operating costs.

2.0 BACKGROUND

2.1 Meter Reading Overview

8. Water meter reading can be completed using different methods and technologies. The following three methods are discussed: touchpad, AMR and AMI.

9. Metered sites are divided into meter reading routes for billing purposes and so that a meter reader can walk or drive their route within the same day. Edmonton has approximately 300,000 water meters which are grouped into approximately 700 routes.

2.1.1 Touchpad Meter Reading

10. Touchpad meter reading is manually completed by a meter reader accessing a device known as a touchpad on the customer's property. Touchpads are found on the outside of customers' homes (typically on the back or side of the home), and inside the meter room in commercial properties. Touchpads enable meter reading to be completed without entering a private residence.

11. This type of meter reading requires two devices: one to read the touchpad and another to record the reading. Readings can be manually entered into the recording device, or some devices use BlueTooth technology to transmit the read from the touchpad reader to the recording device. At end of day, the recording device is plugged into the network at the office and the meter readings are uploaded to the meter reading software for billing purposes.

12. Meter readers walk from location to location and enter onto private property to access the touchpad. This poses a number of challenges:

- Access: These devices are typically located on the outside wall of the basement utility room, either outside or inside a fenced yard accessible through a gate which may be locked. Access issues create challenges to obtain reliable reads.
- Safety: Meter readers walk and drive through various conditions (ice, snow, heat, cold, poor air quality, aggressive individuals and dogs, insects, hidden debris), which can pose a number of safety challenges. It is difficult to mitigate all hazards/risks the meter readers may face while travelling to or on private property.
- Obsolescence: Touchpad meter reading devices are becoming obsolete as utilities move to other forms of meter reading such as AMR and AMI. Although there is equipment for purchase which still reads touchpads, there are fewer and fewer utilities installing these touchpad devices.

2.1.2 Advanced Metering Infrastructure (AMI)

13. With AMI, meter readings are collected through a fixed over-the-air network. Meter readings are transferred by signal to a series of collection devices that are mounted on power poles that collect the data and then transfer it to the utility’s network. These meter reading files are then loaded into the utility’s system for billing purposes.

14. AMI can provide for more frequent meter reading as data can be transmitted at regular time stamped intervals (e.g. daily or weekly). In addition to using the meter read for monthly billing purposes, daily data collection can be used to notify customers of consumption anomalies including leaks. More frequent data collection can be made available to customers through an on-line portal allowing them to monitor and manage their household usage, and also provides the utility with granular consumption data to resolve billing disputes and escalations.

15. AMI is widely used by electric utilities to collect interval meter readings. In addition to meter reads, AMI enables electric utilities to remotely turn on and off power to a site, collect power demand data, and identify power outages. This additional functionality helps to reduce operational costs by reducing the need to send crews to site. Widespread use of electric AMI was enabled by these operational savings offsetting AMI installation costs.

16. Water AMI adoption rates have been low since the introduction of this technology. The original water AMI infrastructure required battery replacement 1 to 2 times through the life of the meter. Remote connect/disconnect devices are available, but are costly and not as reliable as those for power. AMI installation costs were not offset by the expected operational cost

savings. Battery life has now improved and aligns with the normal lifespan of water meters. Although water AMI does not provide the same operational savings as it does for electricity (remote connect/disconnect), the extension of the battery life makes AMI a viable option for water utilities. As a result, water utilities in various jurisdictions have recently started to adopt AMI. Some Canadian examples are Okotoks, St. Albert, Lloydminster, and Toronto.

2.1.3 Automated Meter Reading (AMR)

17. AMR involves meter readers driving or walking by properties to capture meter readings. The meter is equipped with an AMR communicator which communicates with a meter reading recording device when within range. The signal can be picked up near the property or gathered at a fixed location on the street near the property. Either way, a meter reader is required to capture the read into their recording device. Similar to the touchpad readings, the handheld device is plugged into the utility's network at the end of day to upload readings to the meter reading software.

18. AMR reduces safety risks by minimizing entry onto private property. If a meter route is fully saturated with AMR, the meter reader no longer has to walk the route and can drive instead.

19. AMR reduces access issues as the meter reading can be accessed without entering the property, but still requires walking or driving data collection.

2.2 EWSI's Current State

20. EWSI owns approximately 300,000 water meters. Of these, 170,000 are equipped with AMR communicators and the remaining with touchpads. The city of Edmonton is divided into 700 meter reading routes. Edmonton has few fully saturated AMR routes, so meter readers walk the majority of routes to collect reads due to the mix of AMR and touchpad technologies on each route.

21. In 2007, EWSI began installing AMR enabled water meters when replacing or installing new meters. At the current pace of meter retirements, all remaining non-AMR (touchpad read) water meters in Edmonton would be replaced in the ordinary course by 2032.

2.2.1 Metering

22. As stated above, in 2007, EWSI began installing water meters with an AMR communicator attached. This change occurred as there were limited options to repair/replace touchpads when

these devices failed. The AMR communicator is manufactured as part of the meter. Almost all AMR meters have been installed when the existing (touchpad read) meter reached end of life. However, some AMR implementation, for safety or access reasons, required existing water meters to be replaced with AMR enabled meters prior to the end of their life.

2.2.2 Meter reading equipment

23. EWSI's current meter reading equipment has the functionality to read both AMR ***and*** touchpads. This equipment is obsolete and is no longer supported by the manufacturers. As a work-around, EWSI has had to source ways to repair the equipment, but struggles to find parts and cannot maintain this equipment or guarantee reliable repair. This has started to impact customers when EWSI has had to estimate routes and sites due to small scale equipment failure.

24. Available devices to replace this equipment do not read ***both*** touchpads and AMR. To continue with the current path of replacing remaining touchpad technology with AMR technology over the next 11 years, EWSI will be forced to acquire separate pieces of equipment to read touchpads and AMR increasing the number of devices a meter reader would need to carry. Meter readers already carry duplicates of some equipment due to battery issues and cold weather. Carrying additional devices would not be practical for reasons discussed in Section 3.1.

2.2.3 Meter reading software

25. EWSI's meter reading software, which assigns meter read requests to the field and processes the meter reads when they are completed, also needs to be replaced. This software is obsolete and no longer supported by the vendor and will need to be replaced regardless of whether we do nothing or AMR meter reading technology is adopted. New software would also be required with AMI.

2.2.4 Safety

26. Meter readers walk and drive throughout the City to obtain reads. As discussed above, due to limited AMR saturation, meter readers drive to a route, park their vehicle and walk their route. They walk a mix of sidewalks, roadways, private property, and back alleys. They are required to enter a high volume of uncontrolled sites on a daily basis in order to obtain reads.

27. It is challenging to mitigate all safety risks on private property and there are annual safety incidents with dogs, unsafe conditions related to the condition of the private property, and environmental conditions leading to slips/trips/falls, insect bites, etc. The location of the

touchpad can increase safety risks as it can be located where the customer does not maintain safe access to the touchpad. For example, in the winter months, the touchpad may be located away from any shoveled walkway and can cover hidden hazards such as a board with nails in it

28. As mentioned above, there are limited saturated AMR routes. When reading these routes, there exists a risk of distracted driving as the meter reader needs to pay attention to both their driving and their equipment to ensure it's working as expected.

29. There are also periodic incidents and injuries related to vehicle accidents while travelling to site. These incidents are historically "no-fault" incidents such as rear end collisions, which are hard to mitigate/control.

30. This role requires meter readers to walk long distances in challenging walking conditions. There has been an increase in short term disability claims related to meter readers being unable to meet the physical requirements of the role. On average the meter reading employees experience one WCB claim and five short term disability claims annually. In 2020, EWSI experienced two WCB claims and eight short term disability claims. These claims continue to increase and there is no evidence to support that this trend will decrease, despite a number of changes and implementations to improve the health and safety culture.

2.2.5 Customer Service

31. EWSI strives to read meters and bill customers monthly. If EWSI cannot obtain an actual meter read, the customer's bill is estimated based on historical consumption. The customer's bill will be credited or debited with actual consumption on their next bill that includes an actual meter read. Further, it is not always possible to read all meters monthly due to a mix of environmental conditions, safety, available workforce, and other operational considerations.

32. EWSI has experienced escalations when customers receive a "catch-up" bill with high consumption. These situations usually involve a significant increase in consumption resulting from a leak within the customer's private property (e.g., leaky toilet). Customers expect accurate monthly billing and will escalate as a result of a large "catch-up" bill resulting from an estimate (based on past usage) that turns out to be lower than the actual when captured. Historical usage does not always align to current usage causing customers to dispute the accuracy of their bill when the true-up is received. These types of escalations take significant time and effort to resolve.

33. Customers expect timely notification of possible leaks on private property. EWSI will notify customers after a high meter reading, but this notification is not in real time. As such customers could continue to have an unknown leak for one month or longer resulting in high bill(s).

3.0 METER READING ALTERNATIVES

34. As a result of the meter reading equipment and software needing to be replaced, EWSI began to review meter reading technology options in 2019, specifically AMI and AMR, in preparation for the 2022-2026 PBR.

3.1 Alternative 1 – Status Quo

35. Under this alternative EWSI would continue to walk routes reading the mix of touchpad and AMR until full AMR deployment is achieved in 2032, based on the current retirement program. Table 3.1-1 on the next page shows the meter inventory using this alternative.

Table 3.1-1
Status Quo Meter Inventory

		A **2020**	B **2021**	C **2022**	D **2023**	E **2024**	F **2025**	G **2026**	H **2027**	I **2028**	J **2029**	K **2030**	L **2031**	M **2032**
1	AMI Read	114	114	114	114	114	114	114	114	114	114	114	114	114
2	Non AMR/AMI Meters	130786	119786	108786	97786	86786	75786	64786	53786	42786	31786	20786	9786	600
3	AMR Meters	173064	189814	206564	223314	240064	256814	273564	290314	307064	323814	340564	357314	372250
4	New Meters Installed Annually	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750
5	**Total Meter Count**	**309714**	**315464**	**321214**	**326964**	**332714**	**338464**	**344214**	**349964**	**355714**	**361464**	**367214**	**372964**	**378714**

36. With the current meter reading equipment becoming obsolete, EWSI would need to source new equipment able to read both touchpad and AMR. EWSI's technology review in 2020 found that available equipment on the market is unable to read all EPCOR meter types. One device will no longer read both touchpad and AMR technologies. EWSI would need to purchase multiple devices for the meter readers to use in the field. Today, meter readers carry three devices to read meters and the replacement option would have them carrying four or more devices to read both technologies. As meter readers need to be mobile and walk for long periods of time, carrying this many devices would not be practical or feasible. There would also be additional safety concerns related to the ergonomics of carrying that many devices for long periods of time.

37. EWSI would need to continue to invest in touchpad meter reading equipment, as it is currently required to read half the meter inventory. As this equipment continues to become unsupported by manufacturers, EWSI is at risk of newly purchased equipment becoming unsupported as the industry moves to more automated options to read meters.

38. As mentioned above, in this option, EWSI moves to full AMR deployment by 2032. In order to meet the requirement to reliably read and bill customers, it is necessary to plan for future technology changes over the next 20 years. Based on the pace of technological changes in this sector, AMR technology is assumed to require full-scale replacement by 2033. As such, all AMR assets would begin to be replaced with AMI assets starting in 2034, prior to the end of the assets' expected physical useful life.

39. Status Quo has the following additional disadvantages:

- As highlighted previously, under this option EWSI expects a failure of meter reading systems and equipment even with upgrades as these items are obsolete at risk of critical failure.
- The requirement for a large operating budget to read meters remains under this alternative. This will remain after full AMR deployment in 2032 although reduced with a shift to fully driven routes.
- EWSI meter readers would continue to be exposed to a number of safety risks as outlined in Section 2.2.4.
- EWSI also has no opportunity to leverage more accurate or timely meter reading data in its other processes, or to support customers with consumption notifications and/or leak detection. Meter reading will continue monthly.

40. EWSI has concluded that Status Quo (gradual replacement of touch pads with AMR to 2032) is not feasible due to:

- the quantity of equipment meter readers would need to carry;
- the risk of additional investment in meter reading technology being required in this ageing meter reading technology and the likelihood of that new equipment becoming obsolete; and
- continued exposure of meter readers to health and safety risks.

41. Under this option, EWSI's ability to read meters and bill customers accurately will deteriorate over time.

3.2 Alternative 2 – AMI Deployment 2022-2024 (Recommended Option)

42. EWSI would install AMI communicators to the existing meter inventory (both non-AMR and AMR meters) over a three year period (2022-2024). The three year period was selected due to the risks with status quo's reliance on obsolete meter reading technology. With this technology no longer supported by the manufacturer, and options to replace with other equipment being impractical, EWSI needs to shift to a more reliable meter reading technology as soon as reasonably possible. Three years provides enough time to replace devices across the city.

43. More than 99% of EWSI's current meters are compatible with AMI. Once AMI technology is deployed, manual water meter reading operations will no longer be required, except for a small number of meters (<0.3%) The AMI communicators will transfer water consumption data at regular intervals that can be utilized for a variety of purposes, including billing EWSI

44. Deployment of AMI technology for water meters is especially attractive in the city of Edmonton because EPCOR Distribution and Transmission Inc. (EDTI) has built and implemented an AMI network. Rather than building a new and separate fixed AMI network, EWSI will be able to access the existing EDTI fixed network at minimal incremental cost. EWSI will be expected to pay an allocated share of the existing EDTI system. The benefit to EDTI resulting from that allocation will be reflected in future EDTI customer rates. Both Edmonton water and power customers will benefit through the shared use of the existing AMI assets.

45. Under this alternative, EWSI will leverage the existing AMI network currently in use by EDTI, reducing overall project costs compared to building a stand-alone network. The AMI communicator will transfer usage data from a customer's water meter to EDTI's AMI network once daily; with hourly consumption data. The data will be collected in EDTI's system and then

transferred to the meter data management system for storage. A monthly consumption reading will subsequently be transferred to EPCOR's Customer Information System (CIS) in accordance with the appropriate meter reading cycle. Customers will be billed in accordance with their billing cycle.

46. EWSI explored the feasibility of this option by completing an AMI deployment pilot project in 2020. The pilot included a mix of residential, multi-residential, and commercial customers and enabled EWSI to confirm device compatibility, installation times, and determine best practices for deployment. The pilot project was successful and EWSI was able to confirm its assumptions and will incorporate the lessons learned into a full-scale deployment. These customers' meters continue to be read by EDTI's fixed network. EDTI shares the consumption data with EWSI and a monthly meter read is used to bill these customers each month.

47. Unlike AMR technology, the AMI meter reading technology can be easily installed in the field with the AMI communicator being added to the existing conventional or AMR water meter with no need to change the existing meter. Therefore, all existing non-AMR and AMR meters will remain in use until they are scheduled for replacement, although the AMR communicators will no longer be required and will be retired prior to the end of their estimated service lives.

48. EWSI estimates that the undepreciated net book value of the AMR communicators that will be retired as part of the AMI deployment is approximately $7.5 million. Consistent with the depreciation policies and methodologies approved for the 2017-2021 PBR term and applied for in the 2022-2026 PBR term, EWSI will charge the loss on early retirement of the AMR communicators to capital and amortize the loss over their remaining lives.

49. EWSI will replace any meters scheduled for replacement over the 2022-2024 project execution period during the same home visit as the AMI communicator installation. Thus, the capital expenditures associated with the AMI Deployment Program include $8.06 million that would have otherwise been projected under the Meter Change Out Program. Because the AMI communicators will not need to be replaced when a meter is replaced, the Meter Change Out Program is reduced by 25% each year thereafter.

50. Similar to EDTI's AMI deployment project, this project would be implemented over a three year period starting in 2022. By the end of 2024, all meters will be affixed with AMI communicators. This information is shown in Table 3.2-1 on the next page.

Table 3.2-1
AMI Meter Inventory

		A **2020**	B **2021**	C **2022**	D **2023**	E **2024**	F **2025**	G **2026**	H **2027**	I **2028**	J **2029**	K **2030**	L **2031**	M **2032**
1	AMI Read	114	114	20000	170000	324864	330614	336364	342114	347864	353614	359364	365114	370864
2	non AMR/AMI meters (includes expected opt out customers)	130786	119786	99786	24786	2100	2100	2100	2100	2100	2100	2100	2100	2100
3	AMR Meters	173064	189814	195564	126314									
4	New Meters Installed Annually	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750
5	**Total Meter Count**	**309714**	**315464**	**321214**	**326964**	**332714**	**338464**	**344214**	**349964**	**355714**	**361464**	**367214**	**372964**	**378714**

51. AMI data will provide a number of customer benefits including accurate and timely billing, usage management such as early leak detection, usage notifications, along with the ability to provide customer self-serve benefits. It also provides a number of planning benefits, including improvements to: hydraulic modelling data; cost of service study (water rates); sanitary flow calculations (including inflow/infiltration); over-strength program inspections and monitoring; and the administration of several drainage rebate programs.

52. Once implemented, the AMI network completes all meter reading activity for customers with AMI meters. This largely eliminates the current manual process of reading meters on private property or by travelling routes, which as described above poses health and safety risks to employees that are otherwise difficult to mitigate.

3.3 Alternative 3 – Accelerated AMR Deployment

53. Under this alternative, EWSI accelerates the replacement of touchpads with AMR from 2022-2024. With routes fully saturated with AMR, meter readers would cease to walk routes and move to drive by meter reading. Software upgrades are required to EPCOR's existing systems, as the current software is at end of life.

54. This replacement would occur over a 3 year timeframe for the same reasons described under Section 3.2. The meter inventory for this option is shown in Table 3.3-1.

Table 3.3-1
AMR Meter Inventory

		A **2020**	B **2021**	C **2022**	D **2023**	E **2024**	F **2025**	G **2026**	H **2027**	I **2028**	J **2029**	K **2030**	L **2031**	M **2032**
1	AMI Read	114	114	114	114	114	114	114	114	114	114	114	114	114
2	Non AMR/AMI Meters	130786	119786	79786	39786	600	600	600	600	600	600	600	600	600
3	AMR Meters	173064	189814	235564	281314	326250	332000	337750	343500	349250	355000	360750	366500	372250
4	New Meters Installed Annually	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750	5750
5	**Total Meter Count**	**309714**	**315464**	**321214**	**326964**	**332714**	**338464**	**344214**	**349964**	**355714**	**361464**	**367214**	**372964**	**378714**

55. This alternative has a number of benefits:

- It is known technology that EWSI has used since 2007. EWSI has successfully read meters since AMR implementation.
- This option allows EWSI to obtain monthly meter readings while minimizing meter readers entering private property and needing to mitigate hazards on those sites.
- Similar to Status Quo, customers will continue to receive monthly meter readings with this option.

56. This alternative also has a number of disadvantages:

- Although this is reliable technology, this technology is at risk of becoming obsolete prior to the 20 year expected useful life of the asset, resulting in future customer rates containing a depreciation amount for obsolete technology in addition to the replacement technology.
- While meter readers would no longer face hazards on private property, they would still face safety risks due to the nature of driving and vehicle-based work. There is a risk of increased safety concerns with distracted driving as described above in Section 2.2.4 as routes become saturated.
- This option does not provide customers with additional benefits like leak detection or customer monthly usage monitoring as described in Section 3.2.
- Under this alternative, the meter is replaced along with the touchpad:
  - As such, half the water meters would now have the same lifespan, which is a financial and operational risk to EWSI. These meters would need to be retired at the same time.
  - Similar to the AMI alternative, certain assets would be retired prior to the end of their estimated service lives. The difference in this alternative is that there would be early retirements in 2022-2024 related to accelerating replacement of touchpad meters and reading devices with AMR-compliant meters; and, again, as described in Section 3.1, in 2034-2036 related to the retirement of AMR communicators following deployment of AMI. Further, given that the risk of obsolescence of the AMR communicators is known, EWSI considers it prudent to reduce the estimated service lives of the AMR communicator deployed in this alternative from 20 years to 15, thereby increasing depreciation expense.

Accordingly, the reduction in estimated service lives for these assets is reflected in the financial analysis provided in Section 4.0.

4.0 FINANCIAL ANALYSIS

57. The NPV analysis herein demonstrates that the AMI deployment option is the lowest cost alternative, both over the 2022-2026 period and long term, that ensures EWSI's ability to reliably and efficiently read meters. The Status Quo option is provided for comparison, but is not a viable option for the reasons explained in Section 2.2.

58. To align with the expected useful life of meters and the AMI communicators (20 years), the NPV analysis is conducted over a 20 year period. AMR costs are ***amortized*** over a 15 year period to account for the risk of the AMR technology becoming obsolete, and replaced with AMI technology thereafter.

59. The financial analysis is presented both at the EWSI level and at the EPCOR level, with the difference being the costs charged by EDTI to EWSI for meter reading services, which have been determined based on the methodology approved by the Alberta Utilities Commission. Assessing the results on an EPCOR-wide basis provides a better indication of the impact to customers in Edmonton, who pay both water and power bills.

4.1 NPV Results

60. Table 4.1-1 displays the cash costs and revenue requirements of all three options over the 2022-2026 PBR period (columns A, B and C) and the 20 year period (columns D, E and F).

61. Table 4.1-1 provides a comparison of the cash out flows and revenue requirements of each of the three options considered in this business case. The cash flow summary (lines 1 to 3) shows the annual capital and operating expenditures for each option from both the EWSI (Water Services, Wastewater Treatment and Drainage Services) perspective and the overall EPCOR perspective, where EDTI transactions are excluded. The revenue requirement summary (lines 4 to 7) presents EWSI and EPCOR's revenue needs determined on an accrual or utility basis, including: operating expenses; depreciation expense; and a fair return on investment. Table 4.1-1 clearly shows that on both cash flow and revenue requirements bases, and from both EWSI and EPCOR perspectives, AMI deployment is the least cost option.

Table 4.1-1
Cash Flow and Revenue Requirement Summary
($ millions)

		2022-2026*			20 year NPV		
		A **Status Quo**	B **AMI**	C **AMR**	D **Status Quo**	E **AMI**	F **AMR**
	Cash Flow						
1	EWSI Cash Out Flow	60.09	117.76	112.58	181.34	174.69	219.84
2	Less: Allocation of AMI Fixed Costs from EDTI	0.00	(5.64)	0.00	(4.57)	(13.97)	(4.57)
3	EPCOR Cash Out Flow	60.09	112.12	112.58	176.77	160.71	215.27
	Revenue Requirement						
4	EWSI Revenue Requirement	34.98	51.35	54.63	183.89	176.99	222.72
5	Less: Allocation of AMI Fixed Costs from EDTI	0.00	(5.64)	0.00	(4.57)	(13.97)	(4.57)
6	EPCOR Revenue Requirement	34.98	45.70	54.63	179.33	163.01	218.15

*Total nominal cost over the 2022-2026; not discounted to a Net Present Value.

62. Although Status Quo, as shown in column A is the lowest cost option for this PBR term, this option is shown for references purposes only as it is not a viable option. Of the remaining options, AMI and AMR, AMI is the lowest cost option in this PBR term. Over a 20 year period, AMI is the lower cost option compared to both Status Quo and AMR.

63. Additional details of the financial analysis are provided in Section 7.

4.2 Conclusion

64. The AMI Deployment Alternative is selected as it is the least expensive long term option that enables EWSI to meet its obligations under Section 8.1, Schedule 2 of the Bylaw, which requires that EWSI meter the water consumption for all of its customers. Further, it is required that EWSI read the meters and bill as per Schedule 3 of the Bylaw.

65. Additionally, leveraging EDTI's existing AMI network reduces long term project and operational costs. EWSI customers are also EDTI customers and are therefore already paying for EDTI's AMI network. EWSI will pay an allocated share of that existing network with any savings from the allocation being reflected in future EDTI power rates, resulting in a benefit to power and water customers in Edmonton. EDTI's ability to spread the costs of its network across a larger set of customers provides benefits to all customers.

5.0 COST FORECAST

66. The cost estimates are based on three sources. Vendor quotes form the basis of the purchase price of the AMI meter reading equipment and the IT project costs. EDTI costs are based on the expected water data register reads, transmission intervals, and an allocation of the AMI network assets. Internal costs such as labour are based on the results of EWSI's AMI pilot program. The costs per device are shown in Table 5.0-1.

Table 5.0-1
AMI Communicator Installation Costs
($ CAD)

		A
1	AMI Communicator	112
2	AMI Installation	38
3	Total AMI	150

67. The AMI communicator costs are based on quotes provided by the vendor. The AMI module installation costs are based on the timing completed in the AMI pilot study of ~39.4 minutes/device at a $45/hour cost, plus an extra 30% for benefits. This works out to a per unit rate of $38/device. $45/hour is a standard hourly cost for water meter installers.

68. Forecast capital expenditures are provided in Table 5.0-2.

Table 5.0-2
AMI Deployment Project
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs:				
1	Contractors	10.94	22.43	22.99	56.37
2	Internal Labour	0.28	0.76	0.78	1.82
3	Contingency	1.12	1.20	1.23	3.55
4	**Sub-total Direct Costs**	**12.35**	**24.39**	**25.00**	**61.73**
5	Capital Overhead and AFUDC	0.18	0.47	0.49	1.14
6	**Total Capital Expenditures**	**12.53**	**24.86**	**25.48**	**62.87**

69. In order to ensure the project stays within budget and cost overruns are minimal, EWSI will ensure the following:

- Pilot Study information and estimates by external vendors were used to create the projected costs for this project. During the material ordering and RFQ phase, any quotes or estimates will be validated against this information, to ensure accuracy.

- The contract with the third party vendor will provide clarity in its terms of what items are eligible for payment, set pricing, and how the force account process will work.
- The project manager will carefully review all invoices and budgetary items, to ensure that any payments are accurate and in line with set pricing and expectations.
- Any charges to the project by other parties within EWSI will be reviewed by the project manager, to ensure accuracy.
- Should legitimate cost overruns result in an impact to the budget, the project manager will duly inform all appropriate parties and come up with a strategy to mitigate these costs and their associated impact.

6.0 RISKS AND MITIGATION PLANS

70. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Safety – A meter installer (EPCOR or third party vendor) could be injured on the job, installing an AMI communicator.	• Detailed communications strategy • Third party vendor and EWSI staff must have detailed procedures, safe work planning, and hazard assessments. • Regular site inspections, observations, tailgate talks and near miss reporting will be completed.
2	Customer Service – A customer could refuse us entry and/or refuse to have an AMI communicator installed.	• External facing information such as mail outs, social media, website, tweets, etc. that communicate the purpose of the project, its benefits to customers, and next steps for customers. • Internal facing information, including scripting for call centre agents, escalations, dispatch, etc. • Detailed scripting for appointment scheduling for EWSI's Customer Service Team. • Detailed scripting for AMI communicator installers onsite, including third party contractor. • A process to escalate any customer concerns/inquiries to one central location, to ensure accurate messaging.
3	Financial – Device or vendor costs could be significantly different resulting in an increase to the overall project cost.	• Detailed quotes have been provided from vendors for services and devices and these are not expected to change significantly. • A timing study was done in order to provide installation cost estimates. A detailed procurement process will be completed for any 3rd party vendors. • Careful contract and project management will be undertaken to ensure the project stays on budget.

7.0 REFERENCE – NPV OF ALTERNATIVES

71. Table 7.0-1, Table 7.0-2 and Table 7.0-3 display the NPV of both cash costs and revenue requirement of all three alternatives.

Table 7.0-1
Breakdown of Costs Status Quo Alternative
($ millions)

		A	B	C	D	E	F	G	H
	Status Quo	**2022**	**2023**	**2024**	**2025**	**2026**	**2027-2031**	**2032-2042**	**NPV**
	Capital Expenditures								
1	Software[1]	1.5	-	-	-	-	1.7	2.0	3.5
2	Meter Reading Devices and Equipment[2]	1.4	-	-	-	-	1.6	107.5	47.0
3	Meters[3]	6.5	6.5	6.7	6.9	7.0	38.0	79.4	78.7
4	Operating expenses[4]	4.9	4.8	4.7	4.6	4.5	20.5	58.8	52.2
5	**Cash costs to EWSI (Water, Wastewater & Drainage)[5]**	**14.4**	**11.3**	**11.4**	**11.5**	**11.5**	**61.9**	**247.7**	**181.3**
6	Allocation of AMI Fixed Costs from EDTI[6]	-	-	-	-	-	-	(12.9)	(4.6)
7	**Cash costs to EPCOR[7]**	**14.4**	**11.3**	**11.4**	**11.5**	**11.5**	**61.9**	**234.7**	**176.8**
	Revenue Requirements								
8	Capital-Related[8]	0.6	1.6	2.3	3.1	3.9	32.3	316.8	131.7
9	Operating Expenses[9]	4.9	4.8	4.7	4.6	4.5	20.5	58.8	52.2
10	**EWSI Revenue Requirement (Water, Wastewater & Drainage)[10]**	**5.5**	**6.4**	**7.1**	**7.7**	**8.3**	**52.8**	**375.6**	**183.9**
11	Allocation of AMI Fixed Costs from EDTI[11]	-	-	-	-	-	-	(12.9)	(4.6)
12	**EPCOR Revenue Requirements[12]**	**5.5**	**6.4**	**7.1**	**7.7**	**8.3**	**52.8**	**362.7**	**179.3**

[1] Software costs for systems that plan and organize reading routes and process meter readings.
[2] 2022-2033 – includes costs for handheld devices to read and collect reads. 2034-2042 – includes costs for AMI meter reading devices and installation of those devices along with IT costs to implement AMI.
[3] 2022-2033 – includes manpower and device (meter and AMR meter reading device) costs of installing and changing meters. 2034-2042 – includes manpower and device (meter) costs of installing and changing meters.
[4] Operating expenses (salary, labour, vehicle, burdening).
[5] Total cash costs to EWSI (Water, Wastewater & Drainage).
[6] Removal of AMI Fixed costs from EDTI to EWSI.
[7] Total cash costs to EPCOR.
[8] Capital required revenue.
[9] Operating required revenue.
[10] Total required revenue for EWSI (Water, Wastewater, and Drainage).
[11] Removal of AMI Fixed revenue requirements from EDTI to EWSI.
[12] Total required revenue for EPCOR.

Table 7.0-2
Breakdown of Costs AMI Alternative
($ millions)

		A	B	C	D	E	F	G	H
	AMI	**2022**	**2023**	**2024**	**2025**	**2026**	**2027-2031**	**2032-2042**	**NPV**
	Capital Expenditures								
1	Software[1]	-	-	-	-	-	-	-	-
2	Meter Reading Devices and Equipment[2]	14.9	30.8	32.9	-	-	-	24.4	72.0
3	Meters[3]	2.8	2.1	1.3	6.0	6.2	33.3	64.9	60.5
4	Operating expenses[4]	5.6	5.2	4.3	3.0	2.7	14.8	45.8	42.2
5	**Cash costs to EWSI (Water, Wastewater & Drainage)[5]**	**23.2**	**38.1**	**38.5**	**9.0**	**8.9**	**48.0**	**135.2**	**174.7**
6	Allocation of AMI Fixed Costs from EDTI[6]	(1.1)	(1.1)	(1.1)	(1.1)	(1.2)	(6.2)	(15.5)	(14.0)
7	**Cash costs to EPCOR[7]**	**22.2**	**37.0**	**37.3**	**7.9**	**7.8**	**41.9**	**119.7**	**160.7**
	Revenue Requirements								
8	Capital-Related[8]	1.0	3.7	7.2	9.2	9.6	53.7	234.2	134.8
9	Operating Expenses[9]	5.6	5.2	4.3	3.0	2.7	14.8	45.8	42.2
10	**EWSI Revenue Requirement (Water, Wastewater & Drainage)[10]**	**6.5**	**8.9**	**11.5**	**12.2**	**12.3**	**68.5**	**280.1**	**177.0**
11	Allocation of AMI Fixed Costs from EDTI[11]	(1.1)	(1.1)	(1.1)	(1.1)	(1.2)	(6.2)	(15.5)	(14.0)
12	**EPCOR Revenue Requirements[12]**	**5.4**	**7.8**	**10.3**	**11.0**	**11.1**	**62.4**	**264.5**	**163.0**

[1] Software costs for systems that plan and organize reading routes and process meter readings. Not required for AMI alternative.
[2] 2022-2042 – includes costs for AMI meter reading devices and installation.
[3] 2022-2042 – includes manpower and device (meter) costs of installing and changing meters.
[4] Operating expenses (salary, labour, vehicle, burdening).
[5] Total cash costs to EWSI (Water, Wastewater & Drainage).
[6] Removal of AMI Fixed costs from EDTI to EWSI.
[7] Total cash costs to EPCOR.
[8] Capital required revenue.
[9] Operating required revenue.
[10] Total required revenue for EWSI (Water, Wastewater, and Drainage).
[11] Removal of AMI Fixed revenue requirements from EDTI to EWSI.
[12] Total required revenue for EPCOR.

Table 7.0-3
Breakdown of Costs AMR Alternative
($ millions)

		A	B	C	D	E	F	G	H
	AMR	**2022**	**2023**	**2024**	**2025**	**2026**	**2027-2031**	**2032-2042**	**NPV**
	Capital Expenditures								
1	Software[1]	1.5	-	-	-	-	1.7	2.0	3.5
2	Meter Reading Devices and Equipment[2]	1.4	-	-	-	-	1.6	107.5	47.0
3	Meters[3]	15.9	29.4	30.9	5.8	6.0	32.4	77.0	119.5
4	Operating expenses[4]	4.9	4.7	4.4	4.0	3.5	18.8	59.2	49.9
5	**Cash costs to EWSI (Water, Wastewater & Drainage)[5]**	**23.8**	**34.1**	**35.3**	**9.9**	**9.5**	**54.5**	**245.6**	**219.8**
6	Allocation of AMI Fixed Costs from EDTI[6]	-	-	0.0	0.0	-	-	(12.9)	(4.6)
7	**Cash costs to EPCOR[7]**	**23.8**	**34.1**	**35.3**	**9.9**	**9.5**	**54.5**	**232.7**	**215.3**
	Revenue Requirements								
8	Capital-Related[8]	1.2	4.1	7.8	9.8	10.2	58.8	335.9	172.9
9	Operating Expenses[9]	4.9	4.7	4.4	4.0	3.5	18.8	59.2	49.9
10	**EWSI Revenue Requirement (Water, Wastewater & Drainage)[10]**	**6.1**	**8.8**	**12.2**	**13.8**	**13.7**	**77.6**	**395.0**	**222.7**
11	Allocation of AMI Fixed Costs from EDTI[11]	-	-	(0.0)	(0.0)	-	-	12.9	(4.6)
12	**EPCOR Revenue Requirements[12]**	**6.1**	**8.8**	**12.2**	**13.8**	**13.7**	**77.6**	**408.0**	**218.2**

[1] Software costs for systems that plan and organize reading routes and process meter readings.
[2] 2022-2033 – includes costs for handheld devices to read and collect reads. 2034-2042 – includes costs for AMI meter reading devices and installation of those devices along with IT costs to implement AMI.
[3] 2022-2033 – includes manpower and device (meter and AMR meter reading device) costs of installing and changing meters. 2034-2042 – includes manpower and device (meter) costs of installing and changing meters.
[4] Operating expenses (salary, labour, vehicle, burdening).
[5] Total cash costs to EWSI (Water, Wastewater & Drainage).
[6] Removal of AMI Fixed costs from EDTI to EWSI.
[7] Total cash costs to EPCOR.
[8] Capital required revenue.
[9] Operating required revenue.
[10] Total required revenue for EWSI (Water, Wastewater, and Drainage).
[11] Removal of AMI Fixed revenue requirements from EDTI to EWSI.
[12] Total required revenue for EPCOR.

Appendix F4

EPCOR WATER SERVICES INC.

Water Services
Critical Pipeline Inspection Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The water transmission system in Edmonton plays a critical role in transporting water to the secondary and tertiary pressure zones, supplying regional customers, providing neighborhoods with high density fire flows, and providing adequate pressures during peak demand periods.

2. The severity and consequence of transmission main breaks have been increasing. Transmission main breaks have higher cost and environmental risk than distribution main breaks. This new program is being proposed in order to proactively seek to reduce the number of transmission main breaks in the future. The goal of the program is to identifying distressed material within critical transmission mains so it can be targeted for replacement prior to failure occurring.

3. EWSI became aware of other municipalities implementing similar programs, which led to EWSI conducting a pilot program in 2019, which experienced outstanding results. Three previously unknown leak locations were detected and an assessment was conducted of the material condition for each piece of pipe in the main. This led to the emergency replacement of one critical section that would not have been identified unless it had failed. Information of this type will ensure capital is spent correctly and the integrity of the transmission system is maintained at the highest standard, and large, devastating breaks that can become common as the transmission system ages are avoided.

4. The results of the 2019 pilot indicated that a section of the transmission main can be inspected and repaired for less than 5% of the cost of full replacement. As a result, EWSI has been able to reduce the capital expenditure projection on the Transmission Mains and Appurtenances Program by $8.21 million.

5. This new program is categorized as reliability / life cycle replacement. EWSI has forecast total program capital expenditures during 2022-2026 at $6.79 million. The scope of the Critical Pipeline Inspection Program is to inspect 10 km of pipeline annually.

2.0 BACKGROUND AND JUSTIFICATION

6. The water transmission system in Edmonton consists of approximately 510 km of water mains, which range in size from 350mm to 1530mm in diameter.

7. While breaks on the distribution system have been continually declining in response to EWSI’s proactive renewals strategy, transmission main break severity and consequences continued

to rise. The majority of these breaks occur on the cast iron and steel portions of the transmission system.

8. In 2019 and 2020, EWSI conducted a pilot study to inspect 40 km of transmission main at an estimated total cost of $5.00 million. Three leaks were detected and repaired. As a result, the system now has an additional 40 km of low risk transmission main, at less than 5% of the cost of replacement.

9. The impact of a transmission main break varies significantly with the type of break and the size and location of the main. Breaks resulting in potable water with residual chlorine can result in a reportable environmental event needing to be reported to Alberta Environment, and may lead to fines and further investigation. Breaks on the Wedgewood Ravine main (2006 & 2009) demonstrated the potential environmental impacts and significant repair costs ($0.35 million each time) that can result from a break. The water transmission main break at 108 Street and 109 Avenue in February 2011 made the national news. Roads and local residents' basements were flooded and it became necessary to provide affected residents with temporary shelters. The incident involved various City of Edmonton Emergency Response Departments. Significant potable water (with residual chlorine) was lost and resulted in costly maintenance response of approximately $0.90 million, cost to repair estimated to be $0.35 million and substantial damage claims from residents estimated at over $1.00 million. The third party strike to an EWSI-owned main at the Royal Glenora Club when the River Valley in that area was flooded demonstrated the potential property and environmental damage that can occur. In 2019, a 600 mm PVC main separated and flooded 104 Avenue, made local news, caused major traffic disruptions and damaged local businesses in the area. Claims from this break are still being settled. The large distance between control valves on transmission mains, as well as the fact that mains are most likely to be located under collector and arterial roads adds further risks to each main break.

10. Transmission main breaks can have environmental and customer service consequences. If a break occurs on a critical main, 0.05 to 0.50 million customers could be impacted. In fact, regional lines are in some cases the only source of water for customers serviced by the line. In terms of environmental impacts, large releases into the sewer system of bodies of water can become reportable events and can lead to fines and investigations. Additionally, with water releases of this size, reputational risks increase significantly.

11. By using asset management approaches to identify high and medium risk transmission mains to refurbish or replace proactively, potential devastating breaks or failure can be mitigated

before they can occur. Asset management involves desktop studies and in field inspections to determine the likelihood of failure for a main in order to evaluate the condition of the main and to determine where repairs are required. This program will execute the infield portion of the asset management approach by using multiple inspection techniques and technologies to evaluate pipe condition.

3.0 PROGRAM DESCRIPTION

12. The scope of this program includes the inspection of high risk transmission mains, 350mm in diameter or greater, that are determined to have a high consequence of failure or likelihood of failure. These inspections will involve the use of inline technologies that will be based on the main material and could include; inline radiographic or ultrasonic inspections, acoustic inspections, or pressure wave based analysis.

13. Insertion locations are required in order to insert the inline tool into the mains. Insertion locations will be created by hot taping the main and installing a 16 inch valve on the main where the insertion/extraction tubes can be attached. This involves excavation down to the main in at least two locations per inspection run.

14. New inspection technologies will also be evaluated for potential use as they become available.

15. 10 km of transmission mains are planned for inspection annually. For context, EWSI's entire water system contains approximately 500 km of transmission mains.

16. The following is considered out of scope for this project:

- Installation of brand new transmission mains that doesn't involve retiring, replacing or rehabilitating an existing main.
- Required repairs of mains identified by this program. These will be completed under another the Transmission Mains and Appurtenances Program.

4.0 ALTERNATIVES ANALYSIS

17. Using desktop methods, EWSI evaluated the risk of failure of transmission mains within the City of Edmonton based on service numbers, redundancy, location and material. The likelihood of failure was then evaluated based on age and material of the mains. However the likelihood of failure is very subjective based on the data available and mains may act differently in the real world.

The following options to address the need to determine better likelihood of failure for the mains are detailed below:

- Continue with the desktop studies of mains for Likelihood of Failure (LoF) values – gives a best estimate of pipe condition, does not give exact location of potential breaks and only deals with the main as a whole. Can gather better data to support these studies (soil qualities) but accuracy would still be based on a risk factor.
- Internally inspect high risk of failure mains to get an exact condition assessment of the main – gives detailed information on main condition, can pinpoint damaged or deteriorated sections of the mains for spot repairs.
- Wait until break occurs and repair main then – can lead to devastating impacts due to failures, economically, environmentally and reputationally.

18. Based on these options it was decided that using inline inspection technologies on high risk of failure would best meet the need for updating the condition knowledge of these mains.

5.0 COST FORECAST

19. The program cost estimates of $70 per meter are based on quotes provided by PURE technologies during the 2019 and 2020 pilot study. PURE Technologies is the sole provider of the inline technology to be utilized.

20. The cost of creating insertion and extraction points through hot taps is estimated based on the results of the pilot study. The cost of operations crew support for operating the valves throughout planning and the inspection itself are based on historical averages from other projects and programs.

21. The projected costs for this program are shown in Table 5.0-1.

Table 5.0-1
Critical Pipeline Inspection Program
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	0.95	0.97	0.99	1.02	1.04	4.97
2	Internal Labour	0.14	0.14	0.15	0.15	0.15	0.74
3	Vehicles and Equipment	0.02	0.02	0.03	0.03	0.03	0.12
4	Contingency	0.11	0.11	0.12	0.12	0.12	0.58
5	**Sub-total Direct Costs**	**1.22**	**1.25**	**1.28**	**1.31**	**1.35**	**6.41**
6	Capital Overhead and AFUDC	0.07	0.07	0.07	0.08	0.08	0.37
7	**Total Capital Expenditures**	**1.29**	**1.32**	**1.36**	**1.39**	**1.42**	**6.79**

22. Contingency of 10% is applied based on uncertainty around ground conditions, work space requirements, pipe conditions and actual inspection lengths.

23. EWSI will take the following approach to minimizing these expenditures.

- EWSI will attempt to coordinate with other regional customers who are also looking to execute inspections on their own infrastructure using these tools, this should reduce costs or potentially lead to cost sharing.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

24. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial – Inspections not able to be executed due to inoperable valves.	Valve inspections will be completed before inspections are executed. Valves will be repaired if need or other projects will be chosen
2	Financial – Tools becoming stuck in mains, leading to shut downs.	EWSI will preemptively run a small tool through the main prior to the larger tool runs to identify any issues that could arise. Detailed investigation of the main and as-built drawings prior to the tool run.

Appendix F5

EPCOR WATER SERVICES INC.

Drainage and Water Services
Real Estate Consolidation Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Real Estate Consolidation Project consolidates nine locations in Drainage and Water down to three, co-locating the Drainage Services and Water Services Distribution and Transmission ("Water D&T") workforce in a single service centre to maximize operational efficiencies across these areas. The project encompasses the purchase and redevelopment of land and industrial facilities at 2545 Aurum Road (the "Aurum Property") in northeast Edmonton, the termination of three property leases, and the sale of five owned properties (the "Consolidation Project").

2. This program is categorized as performance/efficiency improvement. EWSI projects total project capital expenditures of $55.09 million for the Consolidation Project, all of which will be spent prior to the start of the 2022-2026 PBR term. This project achieves the objectives set out for the capital expenditure funding that was approved in the current Water PBR and Drainage rates for real estate and facility improvements. EWSI requests approval of a further $37.76 million in capital expenditures to fund the balance of the Consolidation Project.

2.0 PROJECT DESCRIPTION

2.1 Background

3. EWSI received approval of $16.00 million in capital expenditures in the 2017-2021 PBR term for the Water D&T Facilities Expansion Project to address the following deficiencies with the existing Water properties:

- Constrained space issues
- No space available for workforce additions
- Insufficient security at McCauley and Montrose
- Insufficient yard space

4. On September 1, 2017, the City of Edmonton ("the City") transferred the responsibility for Drainage Services (sanitary and stormwater system) to EPCOR, including six properties. The City of Edmonton Drainage financial model included $4.70 million for Drainage Facility Upgrading.

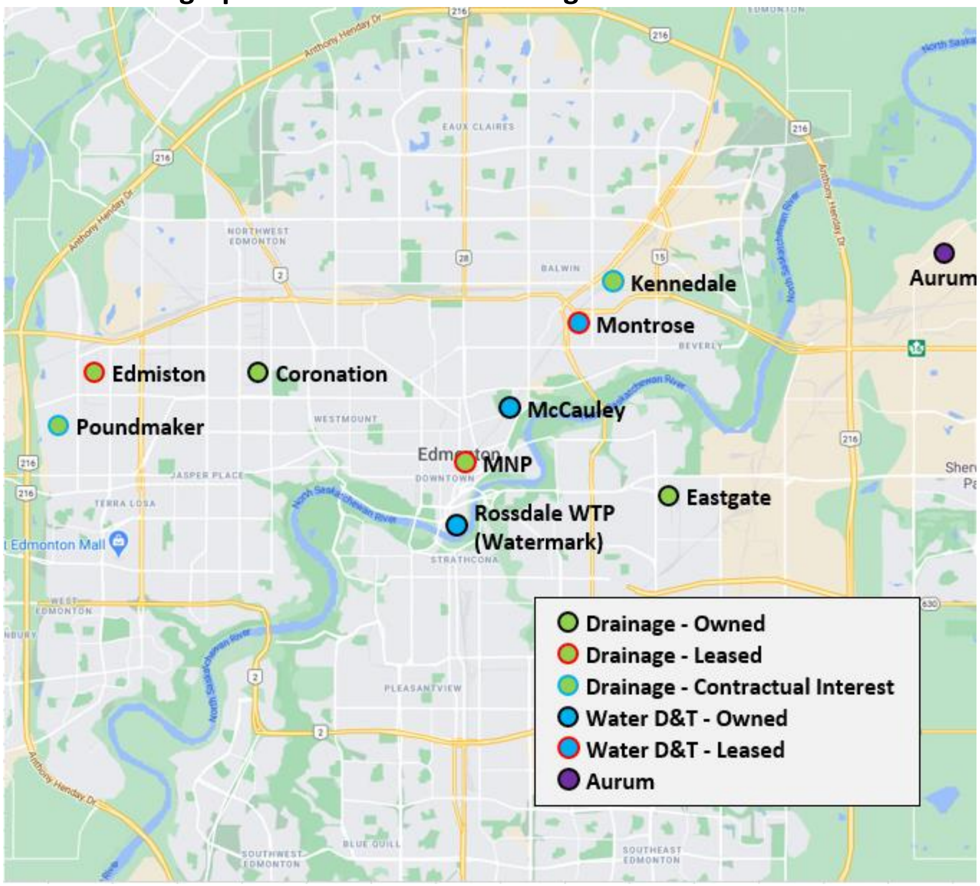
5. The transfer of Drainage Services was not anticipated at the time of the request for $16.00 million in the 2017-2021 Water PBR Application. However, once the transfer was approved, EWSI made the decision to refocus its work on the Water D&T Facilities Expansion Project in favour of

a broader EWSI real estate strategy to address the challenges within both Water Services and Drainage Services, as well as identify new opportunities.

6. The transfer of Drainage Services initiated a two-year long, intensive exercise to identify opportunities for synergies between the two businesses. A number of changes have already been implemented as discussed in Section 2.3.8 of the Water Application. In addition, it was concluded that the best way to drive long term synergies, thereby reducing Drainage and Water rates to customers, was through co-location of Drainage and Water D&T employees. As described in Section 4.2.1 below, this Project seeks to minimize the cost to the customer by enabling both cost reduction and cost avoidance by leveraging synergies between Water Services and Drainage Services.

7. As shown in Figure 2.1-1, Drainage Services, Water Services D&T, and Shared Services currently have staff in nine separate locations across the City consisting of over 45 acres of land and 300,000 square feet of combined building space. The Consolidation Project reduces Drainage Services and Water Services D&T's real estate footprint by 10 acres of land and 20,000 square feet of building space.

Figure 2.1-1
Geographical Locations of Existing and Future Facilities



2.1.1 Current Condition

8. The majority of the owned and leased properties require upgrades in the near future, and no longer meet EWSI's service requirements. A number of these properties have been in service for decades, without significant renovations or improvements.

9. Table 2.1.1-1 lists the Drainage Services properties (rows 1 to 6) and Water Services properties (rows 7 and 8), including the deficiencies at each property.

Table 2.1.1-1
Condition of Current Properties

Building	A Year	B Deficiencies	C Acres of Land
1 Edmiston (Leased)	Unknown	Lease expires in May of 2022 with only one extension for 1 year, insufficient office space	4.8
2 Coronation (Owned)	1993 (main office), 1952 (shop), 1980 (garage)	Older facility, upgrades required, no ability to grow	4.6
3 Kennedale (Owned[1])	1975 (main office), 2001 (shop), 2012 (garage)	No office space, overall site has additional capacity but limited by current layout, nearby trains make response times inconsistent	14.5
4 Poundmaker (Owned[1])		Undeveloped land currently used for material storage. Suitability for development and geotechnical and environmental condition unknown	15.3
5 MNP Tower (Leased)	Unknown	Lease expires in January 2023	
6 Eastgate (Owned)	1978	No space to grow, limited parking, upgrades required	1.1
7 McCauley (Owned)	1952	No space to grow, older facility, no office or parking space, security issues due to proximity to LRT tracks and station, and Commonwealth Stadium	2.2
8 Montrose (Leased)	Unknown	No space to grow, older facility	1.6
9 Watermark (Owned)	Original construction 1970's, Retrofitted to office in 2000's	No space for growth, not built for purpose, space better utilized for future WTP operations.	0.7

2.1.2 Timeline of Events

10. In 2017, EWSI retained WSP to assist in the development of a long-term real estate strategy for Drainage and Water that would minimize the ultimate cost to customers.

11. WSP conducted a series of interviews, site visits, third party Building Condition Assessments and met with the Consolidation Project's Steering Committee.

12. In its August 2017 Recommendation Report, WSP outlined a number of options. Purchasing an undeveloped property and constructing a new service centre to consolidate operations appeared to be the most cost effective option based on the high-level information available at that time. EWSI made the decision at that time to continue working with WSP to further refine the costing assumptions, and with CBRE to seek out opportunities for the purchase of property in Edmonton.

[1] Integrated parcel; land title registered to the City; EPCOR occupied portion is in EPCOR's balance sheet.

13. In June 2018, an RFI was sent out to Edmonton-based real estate developers requesting proposals to buy approximately 30 acres of greenfield land in Edmonton. The request identified that the property needed to be located close to major roadways and within 30 minutes of the downtown core.

14. In July 2018, WSP was engaged to produce an updated Recommendation Report assessing changes to business requirements, evaluating the RFI responses and providing recommendations. EWSI continued to pursue a number of greenfield and brownfield options, as described in Section 4.1.

15. In October 2019, EWSI received an unsolicited proposal for land and industrial facilities located at the Aurum Property.

16. On August 28, 2020, EWSI purchased the Aurum Property.

3.0 PROJECT DESCRIPTION

17. The Consolidation Project involves the planned renovation of the Aurum Property to meet EWSI's current and future facility requirements to consolidate Water D&T and Drainage staff, vehicles, material and equipment.

18. The Aurum Property includes seven buildings, with the majority of renovations occurring in three of the buildings as shown in Figure 3.0-1:

- Building 1 will be renovated to house EWSI's fleet vehicles, shop space, office space, crew space, lockers, shower facilities and warehouse space.
- Building 2 will be renovated to house a common lunchroom, washrooms, offices, open work space and additional support spaces.
- Building 3 will be renovated to bring the existing office space into alignment with EPCOR's standard sizes for office and support spaces.

Figure 3.0-1
Aerial View of the Aurum Property

4.0 ALTERNATIVE ANALYSIS

4.1 Presentation of Alternatives

19. ***Status Quo*** – In this option, Drainage and Water would continue to operate from all nine existing facilities. A condition assessment of the facilities has identified a capital investment need of $85.73 million, which is mainly building renovations and code upgrades to our owned facilities. In leased facilities it is assumed that the lease can be extended with a markup for inflation. Water D&T and Drainage Services will not realize the labour cost efficiencies or lower operating costs without consolidating properties. The existing water facility deficiencies recognized in the approval of $16.00 million in the 2017-2022 Water PBR remain unaddressed.

20. ***Aurum Property Option*** - This option is described in Section 3.0 and is the selected approach.

21. ***Greenfield Option*** – This option is to purchase a new greenfield site and construct a service centre for a full Water/Drainage consolidation. As explained in Section 2.1.2, EWSI sent out an RFI to pursue this option.

22. ***Kennedale and Greenfield Option*** - In this option EWSI considered workforce consolidation at two locations: Kennedale and a new greenfield site.

23. ***Kennedale and Poundmaker Option*** – Under this alternative, Kennedale would be redeveloped to support the field operations and Poundmaker would be redeveloped to support the office staff, technical training and be used for material storage. Due to the distance between the two service centre locations, the potential to realize operational efficiencies is limited. Material storage, equipment, vehicles and training are required at both locations. Efficiencies are also lost as management is required to travel between locations.

24. Table 4.1-1 provides a summary of the Net Present Value (NPV) of capital expenditures and operating costs for each alterative, over a 45-year period. The Status Quo and Aurum property alternatives require significantly lower capital investment than the other alternatives. As a result, only the Status Quo and the Aurum property alternatives were considered for further financial analysis completed in Section 4.2.2.

Table 4.1-1
NPV of Capital Expenditures
($ millions)

		A **Status Quo**	B **Aurum**	C **Greenfield Site**	D **Kennedale & Greenfield**	E **Kennedale & Poundmaker**
1	**Capital Expenditures:**					
2	Upfront Capital Expenditures	-	50.52	95.77	83.81	81.09
3	Sustaining Capital Expenditures	36.12	17.65	17.58	16.70	17.11
4	Sale Proceeds	-	(11.58)	(11.58)	(6.93)	(4.32)
5	**NPV of Capital Expenditures**	**36.12**	**56.59**	**101.77**	**93.58**	**93.87**
6	**Operating Expenses:**					
7	Facility Operating Cost	98.44	88.49	81.30	80.17	72.46
8	Labour Efficiency Savings	-	(32.52)	(32.52)	(32.52)	(21.68)
9	**NPV of Operating Expenses**	**98.44**	**55.97**	**48.79**	**47.65**	**50.78**
10	**Total Cash Out Flow**	**134.57**	**112.56**	**150.55**	**141.23**	**144.66**

4.2 Project Justification

4.2.1 Criteria

25. The purpose of the Consolidation Project is to address deficiencies at EWSI's properties, while maintaining the service quality level that EWSI currently delivers for the lowest overall cost to customers. An important enabler of cost minimization is synergies between Drainage Services and Water D&T, some of which are only possible through consolidation.

26. **Water Property Deficiencies** – Four main deficiencies were identified as drivers for the Water D&T Facilities Expansion Project approved in the 2017-2022 PBR. EWSI has been able to accommodate workforce additions in the Watermark building. However, the Water D&T facilities still have constrained space, insufficient security and insufficient yard space which cannot be addressed. In addition, the existing properties cannot accommodate required training, wash bay and operational equipment upgrades. The Consolidation Project addresses all of these deficiencies.

27. **Drainage Property Deficiencies** – Within the existing properties, Drainage has divided operations due to space limitation. Operations works from Kennedale and Eastgate; Maintenance/Construction works from Coronation, Edmiston and Poundmaker; Project Management and Engineering works from Coronation; and Planning works from the MNP Tower. This split in location results in operational inefficiencies due to increased need for travel time between locations, dead head time at the beginning of shifts due to travel between locations, and requirement for support services such as stores at multiple locations.

28. **Customer Impacts** – EWSI also considered whether the options would have an impact on the service it provides to customers. Although EWSI anticipates that opportunities to improve service may be identified as a result of co-location synergies, no improvements to service have been explicitly identified in this business case. While the Aurum Property has close proximity to the Anthony Henday Road, average travel times are anticipated to be 3-4 minutes longer from the Aurum Property than Poundmaker, Kennedale or McCauley. Thus, there is negligible impact of the Consolidation Project on the service that EWSI provides.

29. **Operational Efficiencies** – Cost reduction will be attained by not having to fill vacancies created through attrition with consolidation. Possible cost avoidance with consolidation includes improved and coordinated scheduling and planning of activities to reduce multiple trips to execute work.

30. The financial analysis below assumes a reduction of 30 positions over time due to duplicate positions that are no longer required once multiple facilities are consolidated into a single service centre. These positions will be eliminated through attrition over time. This project also creates the opportunity for the following operational benefits to be achieved over time:

- Facilitation of operating improvements and process streamlining, resulting from staff based out of fewer locations;
- Reduction in travel time for managers and supervisors due to fewer off site business meetings and meetings with crews; and,
- Improved communications between engineering and field construction with staff being located in the same service centre.

31. The Consolidation Project with the Aurum Property was selected because it meets each of the criteria listed above and, as shown in the following sections, is the lowest cost option for customers.

4.2.2 NPV of Revenue Requirement

32. A NPV analysis calculates the difference between the present value of cash inflows and the present value of cash outflows over a period of time. The NPV calculation demonstrates that the Consolidation Project is lowest cost alternative compared to maintaining the Status Quo in Water D&T and Drainage facilities. As outlined above, the Consolidated Project also achieves more of the facility improvement and operational efficiency criteria than the Status Quo option.

33. Table 4.2.2-1 provides the NPV of the revenue requirement for Status Quo compared to the Consolidation Project option. The NPV analysis spans a 45-year period starting in 2022, to align with the start of the upcoming Water and Drainage PBR periods.

34. Over the 45-year period, the Consolidation Project option results in a significantly lower revenue requirement than Status Quo. The lower capital expenditures, combined with labour efficiencies and the sale of existing properties, make the Consolidation Project option the lowest cost choice for EWSI's customers.

Table 4.2.2-1
NPV of Revenue Requirement
($ millions)

	Cost Item	A Status Quo	B Consolidation Project
1	Facility Operating Cost	84.74	65.37
2	Property Taxes	13.71	23.12
3	Franchise Fees Less Property Taxes	(3.36)	(14.26)
4	Labour Efficiency Savings	-	(32.52)
5	Depreciation	18.37	23.35
6	Return on Rate Base Financed by Debt	10.02	14.77
7	Return on Rate Base Financed by Equity	18.10	25.49
8	Terminal Value of Rate Base	1.87	2.35
9	**Total Revenue Requirement**	**143.45**	**107.66**
10	**Incremental Revenue Requirement**	**-**	**(35.79)**

4.2.3 Bill Impacts

35. Table 4.2.3-1 summarizes the long-term incremental bill impacts of the Project relative to Status Quo.

Table 4.2.3-1
Average Residential Bill Impacts
($ per month)

	A 2022-2026	B 2027-2031	C 2032-2036	D 2037-2041	E 2042-2046	F 45 Year Total Bill Impact
1 Consolidation Project	0.40	(0.27)	(0.65)	(0.59)	(0.65)	(240.68)

36. The shorter timeframe to complete this alternative compared to the Status Quo and other options considered results in a slightly higher revenue requirement in the early part of the 2022-2026 Water PBR period. As labour efficiencies and surplus land sales begin in 2023, the reduction to the real estate revenue requirement are passed on to customers, minimizing the bill impacts over the 2022-2026 PBR period. In future PBR periods, once labour efficiency and land sales are achieved, the Project will save the average residential customer approximately $0.54 per month, or $240.68 over a 45-year period, compared to Status Quo.

4.3 Approach

4.3.1 Assumptions

- Alternatives are evaluated over a 45-year period;
- Water Canada’s Weighted Average Cost of Capital (WACC) is 6.2%;

- Drainage's WACC increases from 3.43% to 6.23% over the 2019 to 2026 period;
- The allocation of capital expenditures between Water and Drainage will be based on headcount and is assumed herein to be 40% and 60% respectively;
- For the Consolidation Project, all upfront capital expenditures are placed into service by the end of 2021. The capital expenditures for Status Quo are based on a high level assessment of the current sites, assets are placed into service when the scope of work is completed at each site;
- The timing and values associated with sustaining capital expenditures are based on the combination of the related useful lives for IFRS purposes, inflated upfront capital expenditures by category and information provided by WSP;
- Capital costs associated with the Watermark building are included in the financial analysis for the Status Quo alternative. As the Watermark property is integrated into the Rossdale site and is not available for disposition, it is not included in the Consolidation Project;
- Reduction of 30 duplicative positions through attrition; and
- Total labour expense per employee is set at $63,000, after accounting for capital labour recoveries.

4.3.2 Methodology

37. The basis of the analysis are a combination of EPCOR's actual historical data and third-party inputs from WSP and CBRE. WSP provided upfront capital expenditures, sustaining capital expenditures and operating expenditures, except where EPCOR's actual historical data was more applicable. CBRE provided estimated proceeds from property sales.

38. <u>Upfront Capital Expenditures</u> – *Land purchase, construction, furnishings, fittings and equipment, architecture, design, engineering and construction management.*

Costs related to existing properties (Status Quo) – For owned facilities WSP provided unit rates of $184/square foot for office space and $80/square for warehouse/shop based on industry standards. For leased facilities, WSP provided unit rates of $155/square foot and $65/square. WSP also provided the timing of capital expenditures, prioritizing renovations based on current building conditions.

Costs related to the Aurum Property (Consolidation Project) – WSP evaluated each individual building and provided the estimated costs required to prepare each building for its intended use. Unit rates range from $10 to $47/square foot for office space and $6 to $20/square for warehouse/shop. These rates ensure that the buildings are safe to operate out of and meet basic utility standards.

39. Sustaining Capital Expenditures – Lighting, security, land improvements, building, furniture/shuttle bus, hardware, etc.

Costs related to existing properties (Status Quo) – Based on current assets in service and replacement frequency based on related IFRS lives.

Costs related to the Aurum Property (Consolidation Project) – Based on a combination of the asset replacement frequency based on related IFRS lives, and information provided by WSP.

40. Operating Expenditures – New building operating costs, lease costs and labour efficiencies.

Costs related to existing properties (Status Quo) – For existing properties other than Watermark, based on actual historical operating costs. Beginning on January 1, 2023 ongoing operating costs associated with the Watermark facility are assumed to be 25% of current annual costs until further redeployment.

Costs related to the Aurum Property (Consolidation Project) – Based on observed historical costs.

41. Contingency – Provided by WSP and consistent with internal contingency guidelines.

- Construction contingency of 10% is applied to Status Quo, while 20% is applied to the Aurum Property option as recommended by WSP. Contingency at the Aurum Property is higher due to WSP's lower level of familiarity with the condition of the property as compared with EWSI's current properties.
- The total contingency applied to the capital expenditure forecast of $55.09 million of 6.5% is consistent with EPCOR's capital investment policy at the final design stage.

42. Internal labour, overhead and AFUDC – Estimated as percentage of total construction costs, based on similar projects completed by EWSI.

43. Sales proceeds – Provided by CBRE based on expert opinion of current market conditions.

5.0 COST FORECAST

44. Table 5.0-1 summarizes the cost estimates for the new service centre. The costs have been inflated to the year of expenditure as per the project schedule.

Table 5.0-1
Drainage Water Real Estate Project
2022-2026 Capital Expenditures Forecast
($ millions)

		A **Pre-2022**
	Direct Costs:	
1	Contractors/Initial Purchase	49.38
2	Internal Labour	0.66
3	Contingency	3.20
4	**Sub-total Direct Costs**	**53.24**
5	Capital Overhead and AFUDC	1.85
6	**Total Capital Expenditures**	**55.09**

45. The estimated cost to purchase the Aurum Property and redevelop the existing buildings on that site is $55.09 million. The total upfront capital expenditures are partially offset by $17.06 million in estimated proceeds from the sale of the existing surplus properties.

46. As discussed in Section 2.1, an expansion of the existing Water D&T facilities was included in the Water Service 2017-2021 PBR submission at a total cost of $16.00 million. The City of Edmonton Drainage model included $4.70 million for Drainage Facility Upgrading.

47. Thus, the implementation of the Consolidation Project represents $17.34 million in incremental rate base as shown in Table 5.0-2, which is anticipated to be more than offset by efficiency savings as a result of colocation.

Table 5.0-2
Incremental Rate Base
($ millions)

	Item	A **Rate Base Impact ($)**
1	Upfront Capital Expenditure	55.09
	Less:	
2	Sales Proceed on Existing Properties[1]	(17.06)
3	Water D&T Facility (2017-2021 Water PBR submission)	(16.00)
4	Drainage Facility Upgrades (City of Edmonton 10 year Capital Plan)	(4.70)
5	**Total Incremental Rate Base**	**17.34**

[1] Any gains recognized from the sale of EWSI existing properties will benefit customers as a reduction to EWSI's rate base at the time of sale.

48. As shown in Table 4.1-1, the cost of the total incremental rate base increase noted above is more than offset by lower operating costs and labour and other operational efficiencies gained by eliminating the duplication that comes with having multiple sites.

49. Through the delivery of this project, we will ensure cost minimization through the following.

- A Project sponsor and Steering committee has been implemented to ensure the project scope aligns with the requirements of the major stakeholder groups. The sponsor and the committee have the final decisions for the project scope, budget and schedule
- Cost savings are anticipated through the implementation of efficient space design considerations and the use of spaces for multiple purposes (e.g., using crew gathering areas as training spaces or meeting rooms during the day time, the development of a multi-purpose area, etc.)
- Design standards – WSP provided estimates of the cost to redevelop the Aurum Property facilities to high, medium and low standards. In order to minimize rates to customers, the low standard was selected, representing the minimum utility standard required to safely occupy the space.
- Reuse of furniture, equipment and office materials – To every extent possible, furniture, equipment and office materials will be moved from existing EPCOR facilities and reused at the new site. For example, cubicles, office furniture, chairs, PC's, monitors, TV's, phones, shop equipment from existing facilities will be disassembled, moved and reassembled at the new Aurum Property.
- Project delivery (Design and Engineering) – An RFP will be sent out for an Architectural firm. The award will be based on price, qualifications and experience working with Utility companies. The intent will be to partner with a company that has experience designing multi-purpose space.
- Project delivery (Construction) – Construction Manager at Risk (CMAR) – A RFP will be sent out for a Construction company. The award will be based on price, qualifications and experience. The CMAR delivery method has the following advantages:
    - The CMAR delivery method ensures that the CMAR firm (Construction Manager) and selected Architectural firm have the opportunity to develop an immediate and strong, collaborative working relationship.

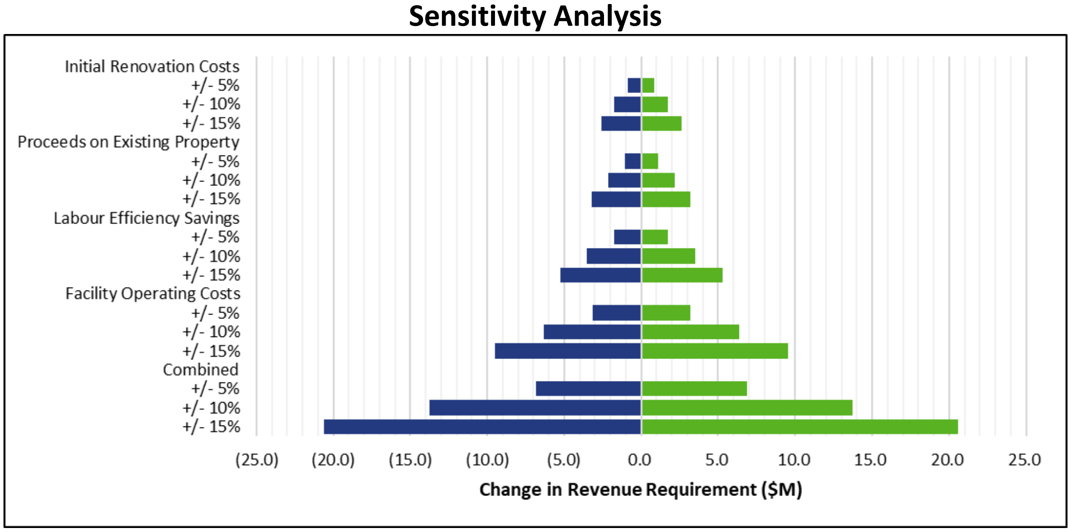
- The CMAR firm will be contracted early in the design phase, maximizing potential for cost certainty by allowing the Construction Manager to assist with value engineering, cost estimating and constructability reviews.
- Because the CMAR has begun working as part of a collaborative team with EPCOR and the Architects, there is the opportunity to overlap the traditionally distinct phases of design and construction – such as initiating acceleration of the construction schedule through early start packages – for construction activities such as excavation and site dewatering prior to final design.
- Cost certainty is provided at an early stage of the project. The CMAR will be requested to provide a Guaranteed Maximum Price ("GMP") somewhere within the 60 to 90 percent design phase of the project.

5.1.1 Sensitivity Analysis

50. This section provides the results of sensitivity analysis for the Project. The sensitivity analysis applies increases and decreases of 5%, 10%, and 15% to each major input, and then calculates the impact of each input on the revenue requirement.

51. As shown in Figure 5.1.1-1, the revenue requirement is most sensitive to changes in labour efficiency savings and facility operating costs.

Figure 5.1.1-1
Sensitivity Analysis



52. Facility Operating Costs - The risk of variance on facility operating costs is mitigated by using two independent benchmarks in deriving the forecast. As explained in Section 4.3.2, actual

facility operating costs at EPCOR's Hugh J. Bolton Business Centre form the basis for operating expenses, except property taxes. Because these costs reflect EPCOR's actual business operations, they are most applicable to this business case. However, to ensure accuracy, the costs are validated against actual costs for gas and electric utilities and property maintenance incurred by the previous Aurum Property owners.

53. Labour Efficiency Savings - EWSI is mitigating the risk of variance on labour efficiency savings by developing plans to educate and retrain employees.

54. Under the worst-case scenario, with all major costs inputs 15% higher than EWSI's current forecast, the NPV of the revenue requirement would increase by $20.59 million to $128.25 million. This is still lower than Status Quo. All major costs inputs would have to increase by approximately 25% for the Project to return the same NPV of revenue requirement as Status Quo.

6.0 RISK AND MITIGATION PLANS

55. The risks are associated with this project are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial – Land sales not being achieved in a timely fashion.	A sensitivity analysis concluded that even if the property sales were delayed by five years, the NPV to the customer is still better to proceed with the Consolidation Project.
2	Financial – Property sales realize lower than estimated value.	A sensitivity analysis concluded that even if the property sales were reduced by 30%, the NPV to the customer is still better to proceed with the Consolidation Project. Working directly with the City sub-division authority and the COE Real Estate branch on options to reduce the cost for sub-division at Poundmaker or implement other economical options.

Appendix F6

EPCOR WATER SERVICES INC.

Water Services

E. L. Smith New Power Feed Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The E. L. Smith water treatment plant provides approximately 65-70% of EWSI's treated water. A 2013 risk mitigation analysis of the plant's electrical system identified that the plant's only two power feeders, which were constructed in 1976, run through a single shaft under the North Saskatchewan River is a critical risk. This represents a single point of failure, so that a collapse in that shaft would result in a disruption in water supply for an estimated 1-2 months. This is considered a low-likelihood but extremely high consequence event. Therefore, EWSI has determined that it would be prudent to design and install a new power feeder to the plant from a substation on the South side of the North Saskatchewan River. This would provide 100% redundancy, as each feeder is sized to meet the entire electrical demand of the plant.

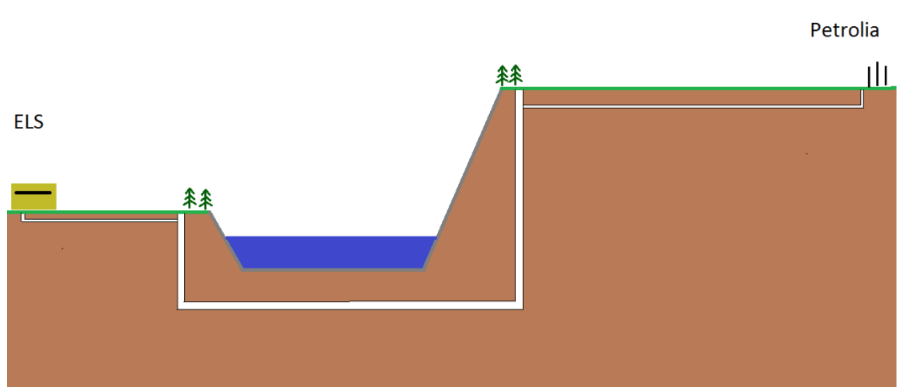
2. The E. L. Smith New Power Feed Project is included in the reliability / life cycle category and EWSI has forecast the total cost at $5.94 million, with $1.09 million forecast to be spent within the 2022-2026 PBR term. The in-service date is scheduled for 2028.

2.0 PROJECT BACKGROUND AND DESCRIPTION

2.1 Background

The E. L. Smith plant provides potable water to a large portion of the City of Edmonton as well as regional customers, representing approximately 65-70% of EWSI's water production. Both the P12 and P72 power feeders carry power from the Petrolia Substation through a common shaft under the North Saskatchewan River, as shown in Figure 2.1-1. The shaft is from the E. L. Smith plant's original construction in 1976 and its condition is unknown.

Figure 2.1-1
E. L. Smith River Crossing



3. In 2013, a risk mitigation analysis was completed on the electrical system at E. L. Smith to review options for mitigating the risk of having both power feeders running through a common ductbank. EWSI's goal is to ensure there is redundancy in the event of a major failure in the shaft itself.

Although each power feed has sufficient capacity to supply the electrical needs of E. L. Smith, two lines are required in order to provide redundancy. For example, in 2013, Feeder P72 failed catastrophically and was replaced as a result. The plant continued running exclusively on Feeder P12 for 3-4 weeks while the replacement work on Feeder P72 concluded.

4. Feeder P12 is scheduled to reach its end of useful life by 2024. If it is to be replaced, the plant will run exclusively on the Feeder P72 for 2-3 weeks until replacements works have concluded**.** Under the proposed plan, both Feeder P12 and Feeder P72 will continue to be operational during installation of the new power feed. Feeder P12 will only be decommissioned once the new power feed from the Riverview Substation is in-service. Although Feeder P12 will have passed its useful end of life beyond 2024, increasing the risk of failure, this plan reduces overall redundancy risk to the plant, as it involves the planned operation of at least two power feeds at any point in time.

5. A condition assessment of feeder P12 is planned to be completed by the end of year 2020. Depending on the results, the urgency for this project may change if the results show the condition of this feeder is terminal.

2.2 Project Description

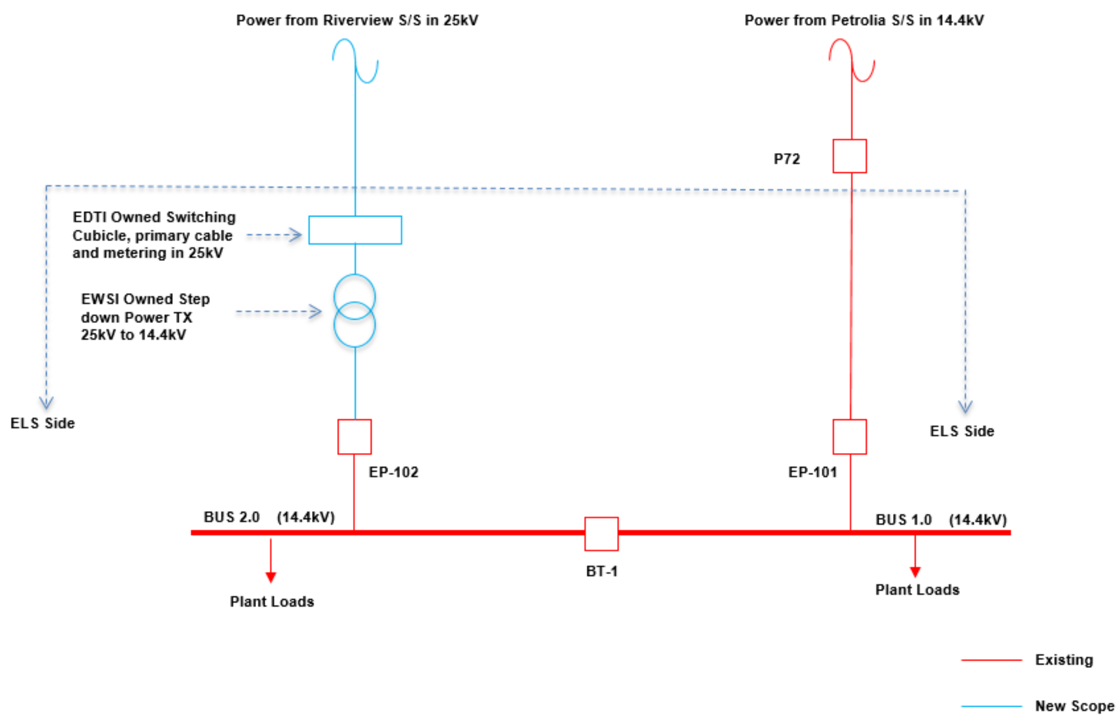
6. The scope of this project is set to include building a new electrical feeder to E. L. Smith from Riverview Substation; and abandon in place existing feeder P12 from Petrolia Substation after new feeder is fully commissioned and in service.

7. The system will be designed to include:

- Underground Power cables and ductbanks from Riverview substation to E. L. Smith
- Power transformer at E. L. Smith to reduce incoming voltage from 25 kV to 14.4 kV (operating voltage at E. L. Smith's main Switchgear)
- Metering, protection, and switching devices as required

8. As shown in Figure 2.2-1, both existing power feeders are 14.4 kV. EDTI will provide EWSI with a primary metered service at 25 kV. EWSI will install and own the necessary equipment to step down to 14.4 kV, then to 4.16 kV as per the E. L. Smith pump requirements.

Figure 2.2-1
Proposed New Feeder for E. L. Smith – Single Line Diagram



9. Any distribution feeder from the Riverview Substation must run underground, as per Alberta Utilities Commission restrictions would prevent crossing of the Transportation Utility Corridor with an aerial line.

10. This project's expected timelines are shown in Table 2.2-1.

Table 2.2-1
Program Phases

	A 2023	B 2024	C 2025	D 2026	E 2027	F 2028
1 Initiation/Approvals	X					
2 Preliminary Design		X	X	X		
3 Regulatory Approvals		X	X	X		
4 Detail Design		X	X	X		
5 Procurement		X	X	X		
6 Construction		X	X	X	X	X
7 Commissioning		X	X	X	X	X
8 Close-out		X	X	X	X	X

11. The following regulatory requirements apply to this project:

- Alberta Electric System Operator (AESO)
- Alberta Infrastructure
- Municipal Government Act – Bylaw 15100:
  - Development Permit
  - Phase I/II Environmental Site Assessment
  - Building and Trade Permits
- Alberta Environmental Protection and Enhancement Act
- Alberta Historical Resources Act (HRA)
- Alberta Wildlife Act (for tree removal)
- Migratory Birds Convention Act (for tree removal)

3.0 PROJECT JUSTIFICATION

12. This constitutes a single point of failure since it is the only path for both feeders to supply the plant. In the event of a collapse of the shaft, the electrical supply will cease and the plant will be out of power and unable to supply water to West Edmonton, Parkland County, Northwest Edmonton and St. Albert for a minimum of 1-2 months. Once the E. L. Smith Solar Farm and associated battery energy storage system (BESS) have gone into service, the Solar Farm is capable of running the plant at capacity while the sun is available. However once the sun goes down, BESS alone would be able to support the Plant at a very reduced capacity; and for about one hour or less before the batteries are discharged. Thus, on-site electrical supply and storage will be sufficient to provide power reliability for short-term power outage events (measured in minutes or hours) but is insufficient to address a long-term power outage event such as a shaft collapse.

13. In the event of a collapse, the most expedient means of restoring water treatment services would be the construction of an aerial line crossing over the North Saskatchewan River. The restoration time estimate of 1-2 months is predicated on the assumption that stakeholder engagement and permitting has been completed in advance.

14. EWSI has twelve-treated water storage facilities in Edmonton including onsite reservoirs at the water treatment plant sites and field reservoirs, which are able to readily supply up to 630 megalitres (gross storage is 810 megalitres). The water stored is only sufficient to meet average customer demands for approximately two days and will be less during high demand periods in the summer. Even assuming maximum additional support from the Rossdale water treatment plant and nearby reservoirs, service could only be provided to the affected areas for 48 hours following the failure. Whereas, the construction of an aerial line could take 1-2 months or more depending on the extent of proactive stakeholder engagement and permitting. Additionally, the affected areas in the distribution network would start to depressurize and risk of contamination from low pressures would develop. This is a risk to public health that may require issuing of an extended boil water advisory. Substantial flushing of the distribution system would be required under these circumstances to ensure any contaminated water was removed from the system. This would further complicate restoration of service to customers.

4.0 ALTERNATIVES ANALYSIS

15. EWSI considered the following alternatives:

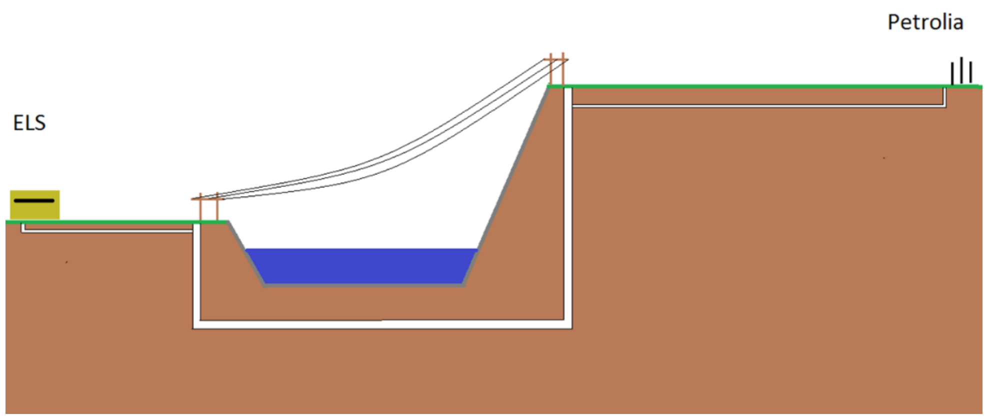
4.1 Alternative 1: Install New Power Feed from Riverview Substation (Selected)

16. See project description.

4.2 Alternative 2: Install Contingency Aerial Electrical Feed

17. As depicted in Figure 4.2-1, this option involves the installation of an aerial feed from the Petrolia Substation over the North Saskatchewan River. The cost of Alternative 2 is estimated at $2.80 million.

Figure 4.2-1
View of Proposed Aerial Crossing



4.3 Conclusions

18. In order to satisfy EWSI's reliability and redundancy requirements, the selected option must be able to supply the full electrical requirements for E. L. Smith in the event that the existing power feed is out of service.

19. Unlike the existing and planned new power feeds, an aerial feed would not provide 100% redundancy, as it would not have the ability to supply E. L. Smith's entire electrical requirements. E. L. Smith may be unable to operate at maximum capacity during the summer months.

20. Additionally, the aerial option supplies power from the same substation as the existing power feed, and thus would not provide redundancy in the event of a substation outage.

21. For these two reasons, Alternative 2 was deemed not to be a viable long term solution.

5.0 COST FORECAST

22. The costs for this project can be broken down as follows:

1. Internal EWSI costs
    - These costs are based on EWSI's prior experience with projects at E. L. Smith.
    - Contingency of 30% has been applied as these are Class 5 estimates. The project is currently in the conceptual design phase, and the preliminary design phase doesn't start until 2024.

2. Costs EWSI will be required to pay to EDTI for assets installed by EDTI
   - These cost estimates have been provided by EDTI
   - Contingency of 15% has been applied due these being Class 5 estimates.
3. Costs EDTI will cover for the EDTI-owned switching cable as displayed in Figure 2.2-1.
   - These costs are not included in the projected total cost for this project as they are not borne by EWSI.

23. Costs over the 2022-2026 period include just design and procurement, with construction beginning in 2027. The projected costs are shown in Table 5.0-1.

Table 5.0-1
E. L. Smith New Power Feed Project
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2024**	B **2025**	C **2026**	D **Total**
	Direct Costs				
1	Contractors	0.17	0.17	0.35	0.68
2	Internal Labour	0.02	0.03	0.05	0.11
3	Contingency	0.04	0.04	0.09	0.18
4	**Sub-total Direct Costs**	**0.23**	**0.24**	**0.50**	**0.97**
5	Capital Overhead & AFUDC	0.02	0.04	0.06	0.12
6	**Total Project Costs**	**0.25**	**0.28**	**0.56**	**1.09**

24. Explain EWSI's approach to minimizing these expenditures. For example:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.

- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

25. The risks are associated with this project are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Schedule Risks – Approval Delays	Coordination with different provincial and regulatory bodies such as AESO, Alberta Infrastructure, the City of Edmonton and others may take long time. Careful planning for obtaining the necessary permits and approvals to proceed with the work is key for the success of this project
2	Assessment of impacts to other plant support infrastructure and related projects.	Impacts will be evaluated as part of the conceptual design phase. Other projects being considered in relation to this one include: E. L. Smith 5 kV Gear and Electrical Room Expansion and E. L. Smith Solar Project.
3	Operational Risks - Tie-ins into existing infrastructure will be risky and will require comprehensive planning with appropriate contingencies in place in order to effectively execute.	These details will be further reviewed and assessed during the detailed design and construction phases.
4	New underground power cables will cross the Anthony Henday Highway	Proper signage, traffic control, barricades and required permits from the City of Edmonton, Alberta Infrastructure and their regulatory bodies shall be requested and planned in advance
5	A portion of the works for this project will be executed within the limits of a Transmission Utility Corridor (High Voltage Power Lines)	EDTI construction guidelines and previous experience in similar projects, review of limits of approach and the use of best industry practices shall be included during detail design to ensure compliance with AESO, Alberta Infrastructure, the City of Edmonton and other regulatory bodies

Appendix F7

EPCOR WATER SERVICES INC.

Water Services
E. L. Smith Filter Upgrades Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The E. L. Smith Filter Upgrades Project is required in order to support existing plant operation due to the deteriorating structural condition of the filter infrastructure. A structural failure would significantly increase the risk of not meeting customer demands in the northwest and south sections of Edmonton and regional customers primarily supplied by the E. L. Smith water treatment plant. Shutdowns at the Rossdale water treatment plant would also be cancelled to provide as much help from the Rossdale zone as possible, thus impacting both capital and maintenance work plans at the plant.

2. The filter upgrades are also required in order to convert the filters to deep bed filtration (DBF) to improve water treatment resiliency and increase filtration capacity, which was originally planned for the 2017-2021 period but delayed due to the urgency of this project.

3. This project is included in the reliability / life cycle category and EWSI has forecast total program capital expenditures during 2022-2026 at $15.62 million. The project will extend into the 2027-2031 PBR period, with eventual conversion to DBF in the 2032-2037 PBR period.

2.0 PROJECT BACKGROUND AND DESCRIPTION

2.1 Project Background

4. Alberta Environment and Parks (AEP) requires EWSI to make continuous improvements and reductions in residuals discharge to the river. The residuals management strategy includes both alum dosing optimization and eventual DBF conversion.

5. Through the E. L. Smith Stage 2 and Stage 3 Filter Conversion project, EWSI had planned to convert the E. L. Smith filter infrastructure to DBF in the 2017-2021 PBR. The conversions were to provide both technical and capacity benefits. The DBF will enable EWSI to switch from conventional operation mode to direct filtration mode for up to six months of the year. Under direct filtration mode, the use of chemicals is greatly reduced which further reduces the amount of chemicals and solid residuals being discharged into the North Saskatchewan River. From a capacity perspective, DBF will enable additional filtration capacity within the existing footprint.

6. In 2018, conceptual design began for the E. L. Smith Stage 2 and 3 Filter Conversion. The intent of this project was to upgrade stage 2 and 3 filters (12 of the 18 filters) to DBF by increasing the filter media depth. Stage 1 filters (filters 1-6) were to remain as regular bed filters. In

anticipation of the filter conversions, structural inspections were conducted on the stage 1 filters for the first time in 15 years. The inspections identified poor concrete condition and damaged asbestos-containing formwork within the confined space area of the filters. Stage 2 filters are of similar construction to stage 1 filters and expected to be in comparable deteriorating condition, to be confirmed by future inspections of stage 2 filters.

7. Structural upgrades to stage 1 and stage 2 filters must be completed to support existing plant operation and prior to upgrading filters to DBF. As a result, completion of DBF conversion will be delayed until the 2032-2036 PBR period.

2.2 Asset Descriptions

8. E. L. Smith Water Treatment Plant (ELS) has eighteen filters that are separated into three stages (Figure 2.2-1). Each stage consists of six filters. Stage 1 and 2 filters were built and operational with the original plant around 1976 and 1982, respectively. Figure 2.2-1 depicts the filter operation of stage 1 and 2 filters that are structurally the same, as each filter has a filter underdrain slab that supports the underdrain system and filter media. There is a filter plenum space under the slab where the filtered water and backwash filtration processes occur. Figure 2.2-2 shows the different filter underdrain panels installed in the existing filters.

Figure 2.2-1
Filter Operation and Filter Underdrain Systems

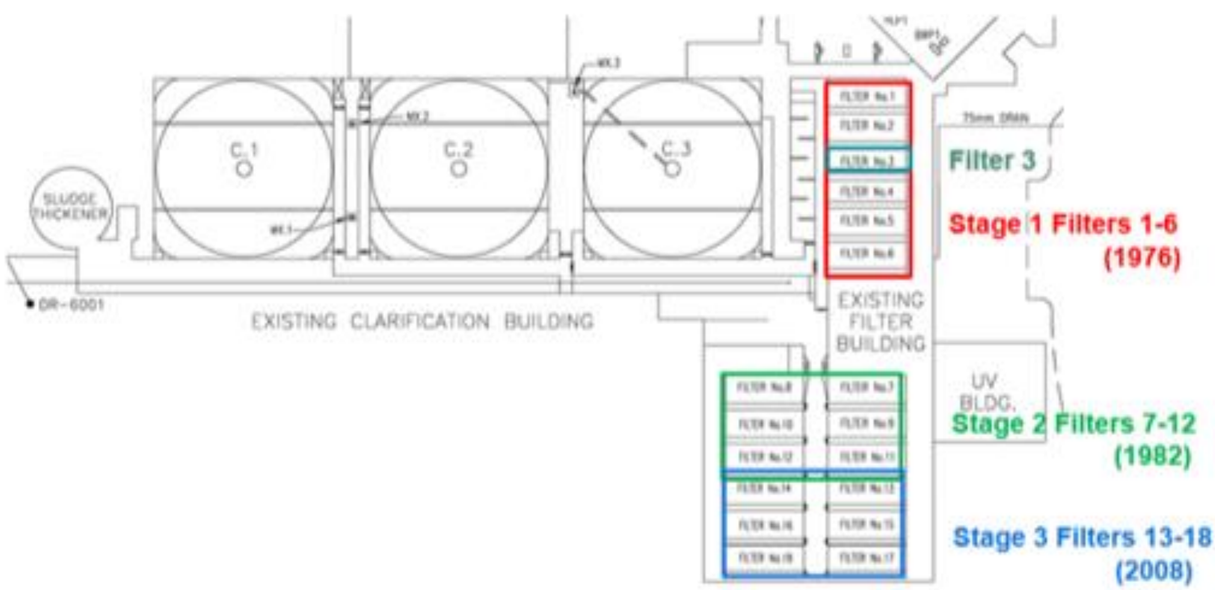
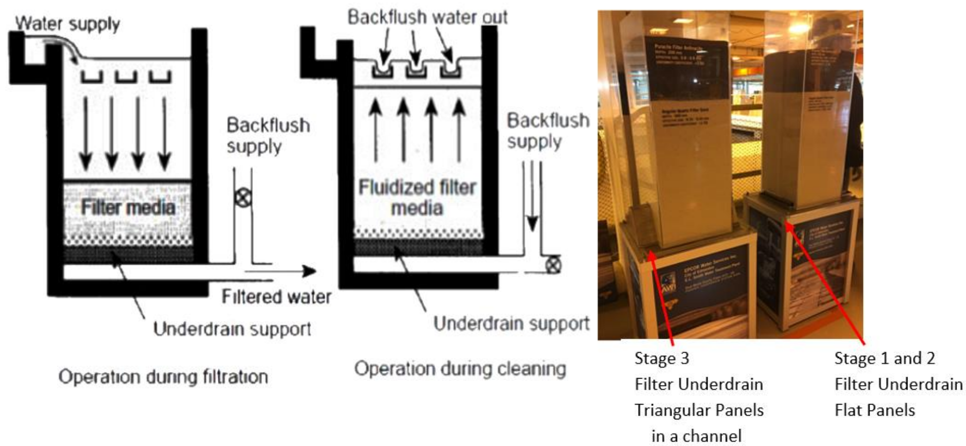


Figure 2.2-2
Filter Underdrain Flat vs. Triangular Panels



9. The stage 3 filters were constructed as part of the ELS Expansion in 2008. The stage 3 filters are structurally different, with the filter underdrain system is within a channel and there is no plenum.

2.3 Inspection Findings

10. Stage 1 filter plenum observations and inspections were completed by structural consultant Read Jones Christoffersen Ltd. (RJC) in the first quarter of 2019. RJC determined the filter underdrain slab is the limiting factor for current and future process upgrades. The filter plenum inspections also identified the following common observations that are required to be addressed:

- Filter underdrain slab underside in the plenum has exposed concrete due to damage in the formwork material;
- Numerous plenum columns, that support the filter underdrain slab, have large voids between the slab and the top of the column;
- Filter underdrain slab and columns have exposed and corroded reinforcing steel;
- Notable reduction in structural capacity of the filter underdrain slab due to existing conditions as it is a thin slab with numerous holes from the original construction; and
- The combination of observations noted above, causes the concern for punching shear at deteriorated column locations (i.e., column break through the filter underdrain slab).

11. **Error! Reference source not found.** depicts the filter areas and deterioration from the i nspections completed by RJC in March 2019.

Figure 2.3-1
Filter Operation and Filter Underdrain Systems

1. Filter Without Media

2. Filter Plenum Space

3. Spalled Piece of Transite Formwork

4. Separation of Transite Formwork

2.4 Scope and Timelines

12. Due to operational requirements only one filter can be upgraded at a time and it is estimated that each filter upgrade will take approximately 6-8 months. As shown in Table 2.4-1, the filter structural and process upgrades will be completed in order by the following projects:

1. Filter 3 (already under construction)
2. Stage 1 filters (remaining five filters 1, 2, 4, 5 and 6)
3. Stage 2 filters (six filters 7-12)

Table 2.4-1
E. L. Smith Filter Upgrades Project Timelines

	A **2021**	B **2022**	C **2023**	D **2024**	E **2025**	F **2026**	G **2027 and beyond**
1 Filter 1 Upgrade	X						X
2 Filter 2 Upgrade	X	X					
3 Filter 4 Upgrade		X	X				
4 Filter 5 Upgrade			X	X			
5 Filter 6 Upgrade				X	X	X	
6 Stage 2 filter structural rehabilitation*					X	X	
7 Stage 2 filter structural and process upgrades**							X

*based on condition and inspection recommendations.
** similar to stage 1 filter upgrades.

13. Based on the inspection findings, a project was initiated in 2019 for structural and process upgrades of filter 3 (one of the filters in stage 1) Though all six stage 1 filters were found to be in poor condition, filter 3 appeared to be in the worst condition, which rendered it an ideal candidate to be the first filter to be upgraded. The scope addressed the immediate need for structural rehabilitation while ensuring the filter can accommodate future conversion to DBF. The Filter 3 Upgrades Project scope is slated to start construction in Q3 of 2020. The lessons learned from the Filter 3 Upgrades Project will be very applicable to remaining five filters included in this project and thus will be utilized to improve safety, increase efficiency and reduce cost.

14. The stage 1 portion of the E. L. Smith Filter Upgrades Project includes the completion of the structural and process upgrades from the remaining five stage 1 filters (Filter 1, 2, 4, 5, and 6). The stage 1 portion is slated to start in 2021 and will be complete in 2025. This portion of the project includes removal and reuse of existing filter media, asbestos abatement, demolition of deteriorating filter concrete infrastructure, new filter channel, underdrain and air scour system, concrete waterproofing, lifecycle valve replacement and piping upgrades and raising the gullet wall for future DBF conversion (similar to stage 3 filters configuration).

15. Upon completion of the remaining stage 1 filters in 2025, the stage 2 portion of the E. L. Smith Filter Upgrades Project will be initiated. The stage 2 filter structural rehabilitation scope will be based on the filter inspections and recommendations to extend the filter operation until the 2027-2031 PBR period when the structural and process upgrades can be implemented to ensure the filter can accommodate future conversion to DBF.

16. A few depictions of the scope are shown below Figure 2.4-1 shows the new flume, underdrain, air scour header and gullet wall. Figure 2.4-2 shows the scope in bold lines: new production valve, process piping, and future FTW connection.

Figure 2.4-1
Typical Section of Filter 3 Modification

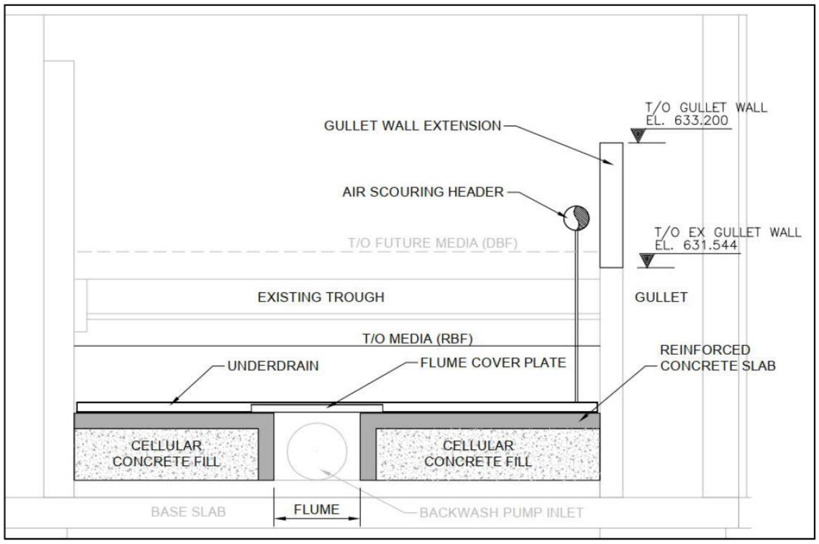
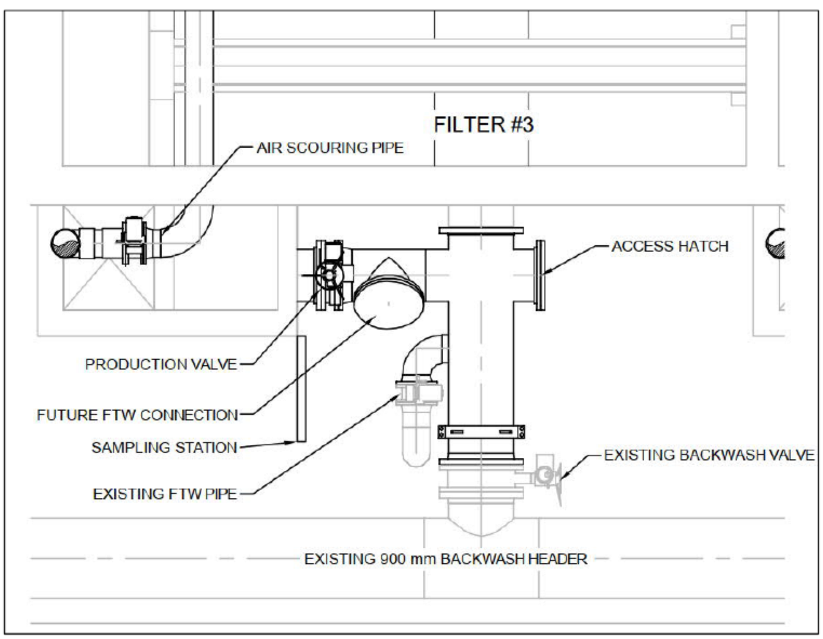


Figure 2.4-2
Filter 3 New Piping Layout



3.0 PROJECT JUSTIFICATION

17. Structural upgrades are required to avoid running existing filter process infrastructure to failure. Significant structural concrete deterioration with the filter underdrain slab and column, which is essential for the filtration and supports the filter media, needs to be addressed. Ongoing deterioration and imminent structural failure of the filter underdrain slab in stage 1 filters is a significant operational and safety concern. A structural failure resulting in the collapse of the filter underdrain slab (through puncture shear), would result in stage 1 filters being shut down for up to 1 year. This would decrease the plant's capacity by one third. E. L. Smith provides a majority (65%) of the water supply in Edmonton and surrounding region. During high demand periods and times when the raw water quality is poor, this reduction would significantly increase the risk of not meeting customer demands in the northwest and south sections of Edmonton and regional customers primarily supplied by E. L. Smith.

18. Having filters out of service would also require all shutdowns at the Rossdale plant to be cancelled to provide as much help from the Rossdale zone as possible, thus impacting both capital and maintenance work plans at the plant. From a financial perspective, the costs to repair the filters would not be included in the budget, so other work would have to be delayed to stay within the capital budget.

19. Also, EWSI's long term plan options for E. L. Smith do not include the addition of any new filters and propose to increase water treatment capacity with the conversion of existing filters to DBF. The originally planned DBF conversion has been delayed as the existing condition and deterioration of the filters will not structurally allow for upgrading the filters to improve water treatment and future capacity requirements.

4.0 ALTERNATIVES ANALYSIS

20. The following criteria are used to evaluate the alternatives:

<u>Critical Requirements:</u>

- Operational reliability and resiliency of plant production to meet customer demands (not met by status quo);
- Cost effective (not met through the construction of new filters)
- All plant shutdowns required for construction must be less than 24 hours.

<u>Added benefits:</u>

- Rehabilitation of the existing filters (18 regular bed) will not meet the forecast future 2030 demand in conventional and direct filtration operation.
- Converting filters to DBF will increase filtration capacity within the existing footprint to meet future demand capacities.

Alternative 1: Rehabilitation so the filter can be used ($30-40 million)

21. Benefits:
    - Filter rehabilitation is necessary to meet current water treatment demands and future conversion to deep bed to improve filter operation in direct filtration and increase filtration capacity
    - Achieves reliability needs at the lowest cost.
    - Allows for the cost of the work to be budgeted.
    - Allows for shutdown planning to occur at both water treatment plants to schedule work to have the least impact on operations.
    - Ensures shutdown size and duration does not affect customer supply during high demand periods and challenging raw water quality.

22. Disadvantage:
    - Extended impacts on operations, as only 1 or 2 filters can be rehabilitated simultaneously.

Alternative 2: Run to failure

23. Benefits:
    - Lowest short term cost

24. Disadvantages:
    - This option is not viable because it does not meet the short term or long term requirements:
        - Short term: Failure of this asset would result in a reduction of plant capacity by one third
        - Long term: The existing filters' underdrain slab is unable to structurally support future upgrades of additional media depth for DBF conversions.

Alternative 3: New Build ($50 million)

- Construct a brand new section of filters in a new building with a new filter backwash system and chemical feedlines. This would also require significant structural changes to the current clarifier effluent channels and the influent channels to the existing UV system.

25. Disadvantages:

- High cost
- Construction time would be longer than for Alternative 1.
- Costs are expected to be more than double because a new building would be required. The high cost would result in an increase in customer rates.
- Due to the shutdown limitations at E. L. Smith, structural alterations to the clarifier effluent and UV system influent channels could not be accommodated. The shutdown time for this work would require a very lengthy plant shutdown that would result in customers supplied primarily from the E. L. Smith zone without water.
- Impacts to the current plant hydraulics is not known. There is a risk new filters cannot be added without an adverse impact to current hydraulics eliminating this alternative completely.
- New construction involves intensive regulatory requirements for provincial and federal environmental permits, archeological, and City of Edmonton bylaws that take a considerable amount of time.

26. **Conclusion -** The rehabilitation option is proposed because it meets both the reliability and financial criteria.

27. Running the equipment to failure does not meet the reliability criteria. In conventional and direct filtration modes of water treatment, the E. L. Smith plant requires between 15-17 filters in operation and an additional filter offline as a spare. Structurally upgrading the existing stage 1 and stage 2 filters is necessary to meet current water treatment demands and to ensure ongoing reliability.

28. Construction of new filters is an option that does not meet the financial criteria, as the cost is $10-20 million higher than the rehabilitation option.

5.0 COST FORECAST

29. Construction cost estimates are based on the guaranteed maximum contractor price obtained for Filter 3, for which construction is already underway. These cost estimates are reasonable, as the filters are nearly identical.

30. The costs associated with the Filter 3 Project were significantly higher than initially anticipated due to asbestos/silica/lead abatement and monitoring, work sequencing and shutdown/isolation challenges, extent of piping of the air scour system and process piping adjustment. Those items are now able to be projected with a higher degree of accuracy based on the Filter 3 Project experience.

31. The design costs projected for this project are lower than the cost of design for the Filter 3 Project, as the design work performed for the Filter 3 Project will be applied to the remaining filters. The projected costs are shown in Table 5.0-1.

Table 5.0-1
E. L. Smith Filter Upgrades Project
2022-2026 Program Capital Expenditures
($ millions)

		A	B	C	D	E	F
		2022	**2023**	**2024**	**2025**	**2026**	**Total**
	Direct Costs:						
1	Contractors	2.83	2.9	2.97	2.93	0.77	12.4
2	Internal Labour	0.17	0.17	0.18	0.29	0.11	0.92
3	Contingency	0.25	0.26	0.27	0.28	0.08	1.14
4	**Sub-total Direct Costs**	**3.25**	**3.33**	**3.42**	**3.5**	**0.96**	**14.46**
5	Capital Overhead and AFUDC	0.23	0.24	0.25	0.34	0.1	1.16
6	**Total Capital Expenditures**	**3.48**	**3.57**	**3.67**	**3.84**	**1.06**	**15.62**

32. EWSI will take the following approach to minimize expenditures on this project:

- The execution strategy on this project will mimic the execution strategy for Filter 3 upgrade. The delivery method is planned to continue with the Construction Manager at Risk (CMAR) contracting strategy. This delivery method brings together EPCOR, the Consultant, the Contractor and, specifically for this project, the major supplier (AWI) into a collaborative and efficient team to meet project objectives and milestones during the design stage. At the end of the design stage or as otherwise determined, the Contractor will submit a guaranteed maximum price and EPCOR has the opportunity to award or to go to market. The pricing is provided in a transparent open-book process utilizing competitive pricing from subcontractors.

- The contracting strategy also allows for flexibility in scheduling and as such, the consultant will be delivering the final long lead material specifications and the final demolition package first which will enable the contractor to start on this scope.

6.0 RISKS AND MITIGATION PLANS

33. The risks are associated with this project are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Operational Risks – This project is needed to extend life of the filters for current operations and plant production and also support the ability for future expansion to meet long term water treatment objectives.	The design and construction of the filter upgrades will extend the filter service life and considers and supports future filter expansion. The filter structural deterioration associated with the filter underdrain slab will be removed and waterproofing of the remaining filter concrete will be extended by waterproofing. The new filter upgrades have also considered and can support the future filter conversion to deep bed.
2	Safety Risks – The project will eliminate the presence of asbestos and confine space in the filter plenum area that was part of original filter construction	The filter upgrades include asbestos abatement of all transite and removal of the filter underdrain slab/ and columns and construction of a new filter channel to replace the existing filter plenum space.
3	Operational risks – The project scope will impact Operations as only one filter can be placed out-of-service and upgraded at a time. The accessibility to some areas of the plant will be reduced to complete the work.	Operations has a representative on the team executing the project work and daily morning meetings are held to ensure projects are coordinated with Operations.
4	Operational risks – The project requires multiple shutdowns for the work to proceed.	Construction sequencing and shutdown planning process is in place to optimize the schedule and ensure work can be completed within shutdown period.
5	Operational risks – The project will change and upgrade the existing plant infrastructure and process operations	A commissioning standard has been developed for project management at Edmonton water treatment plants. The standard outlines commissioning requirements to ensure commissioning activities are conducted to verify equipment is working safely and as designed prior to Operations taking over care, custody and control of the new asset.

Appendix F8

EPCOR WATER SERVICES INC.

Water Services
Flood Protection Project
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. EWSI's Water Treatment Plants (WTP) supply water to nearly one-third of the population of the Province of Alberta. As such, a flood disaster in Edmonton has the potential for detrimental socioeconomic impacts in Edmonton and surrounding areas.

2. During a 1:180 year return period flood event[1], river flood water will enter the water treatment plants across overland flood plains and through underground waste stream/overflow piping systems that discharge to the river. Damage would be incurred to critical electrical infrastructure, chemical storage facilities and reservoirs. The WTPs could remain inoperable for up to 3-10 months, with severely reduced or zero capacity in the early period (3-6 months). It would be necessary for EWSI to truck water to its Edmonton and regional customers at an estimated cost of $140 million. After water services are restored, a boil water advisory would need to remain in place until the entire Edmonton distribution and transmission network, approximately 4,000 km of pipe, is flushed and sufficiently disinfected. The entire regional customer transmission network would also require flushing. Direct damages to EWSI's infrastructure are estimated at nearly $17.00 million. Lost revenue would account for an additional $210 million in losses to EWSI.

3. Thus, the direct cost and damages to EWSI of a 1:180 year return period flood event is estimated at nearly $370 million, while the potential GDP impacts to the region are estimated at between $28 billion to $45 billion.

4. EWSI has deemed it necessary to undertake the Flood Protection Project in order to improve Edmonton's WTP flood resiliency to provide protection for a 1:500 flood. Provincial recommendations for critical infrastructure protection range from 1:500 to 1:1000 year return period design criteria.

5. The two key objectives of this project 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.

6. After completion of this project, a 1:500 year flood would result in the WTPs being back into operation within days or weeks, rather than months.

[1] A 1:180 return period flood event is a flood magnitude with a 1/180 probability of occurring in any given year and was the approximate size of the 1915 flood on the North Saskatchewan River.

7. Two government initiatives have promised grant funding to complete this work: the Provincial Alberta Community Resilience Program (ACRP), and the Federal Disaster Mitigation and Adaptation Fund (DMAF). The total projected capital expenditure of this project, net of $11.37 million in grant funding, is $25.55 million. EWSI has forecast the net capital expenditures during 2022-2026 at $16.11 million, with an additional $3.07 million projected to have been placed prior to 2022 and $6.36 million projected after 2026.

8. This project is included in the Regulatory and HSE category. Construction is planned to begin in 2022 with all new assets to be in service no later than 2027.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Project Background

9. The worst flood experienced in Edmonton since official records have bene kept occurred in June 1915, as pictured in Figure 2.1-1. The 1915 flood is considered a 1:180 year event. An 1824 flood documented in the Hudson's Bay Company Archives likely exceeded the 1915 flood levels.

Figure 2.1-1
Historical Photo of the 1915 Edmonton Flood

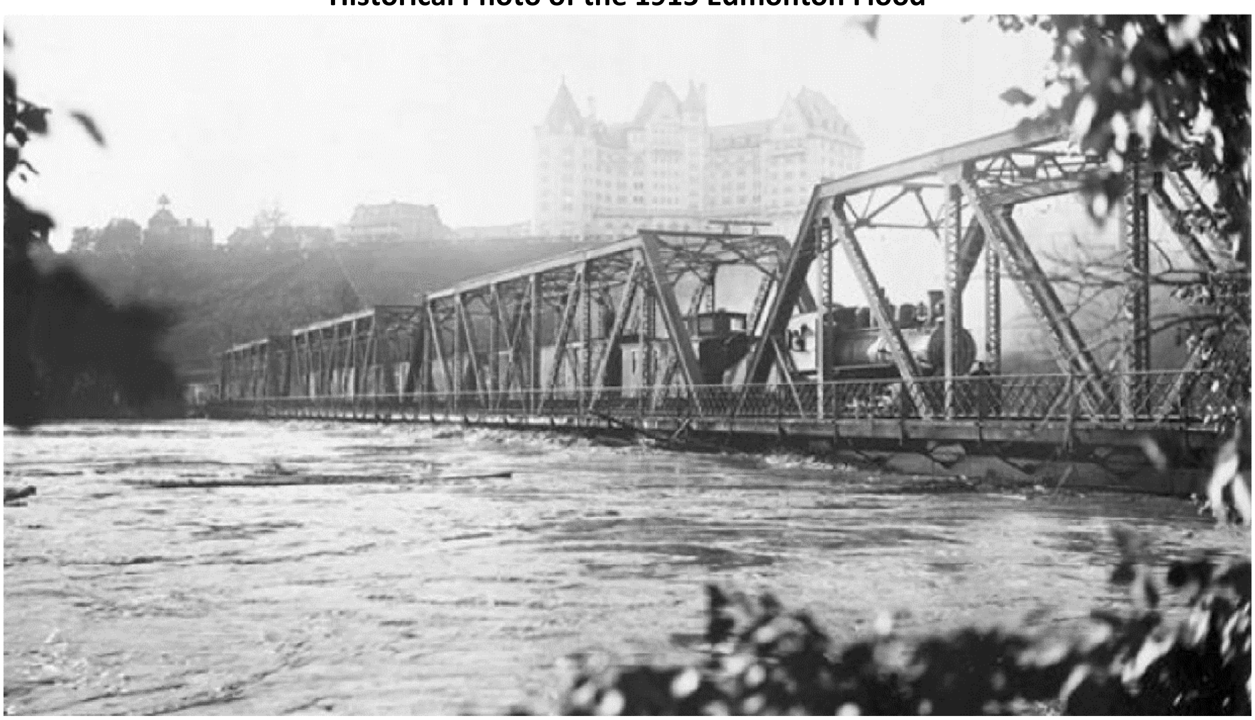


Image Credit: https://www.cbc.ca/news/canada/edmonton/flood-of-1915-the-worst-in-edmonton-history-1.3737170

10. The 2013 flooding in Calgary, Canmore, Kananaskis and High River, have prompted an assessment of the Edmonton water treatment plants' vulnerability to a North Saskatchewan River (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 and will be discussed in further detail in the section that follows. Additionally, EWSI's Stormwater Integrated Resource Plan (SIRP) has identified that the Rossdale WTP is situated in a high-risk sub-basin, and the E. L. Smith WTP is situated in a medium-high risk sub-basin (Figures 2.1-2 and 2.1-3).

Figure 2.1-2
Simulation of Unmitigated 1:180 (1915) Flood at Rossdale

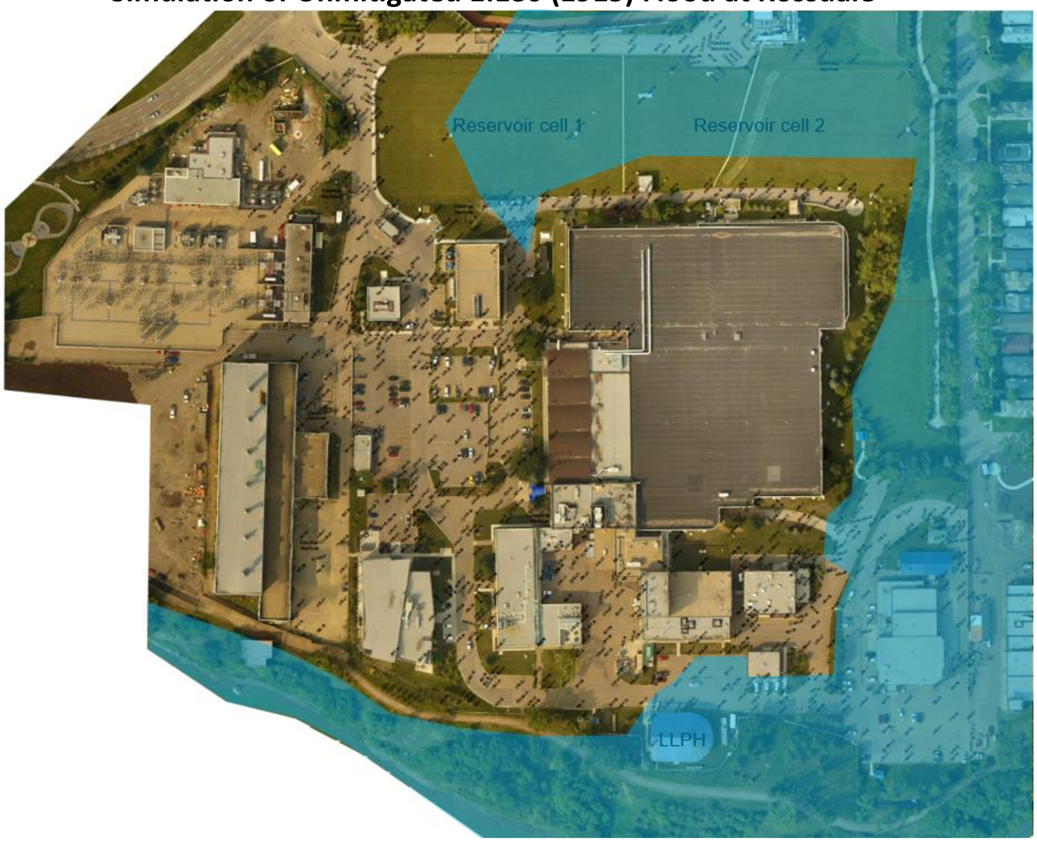
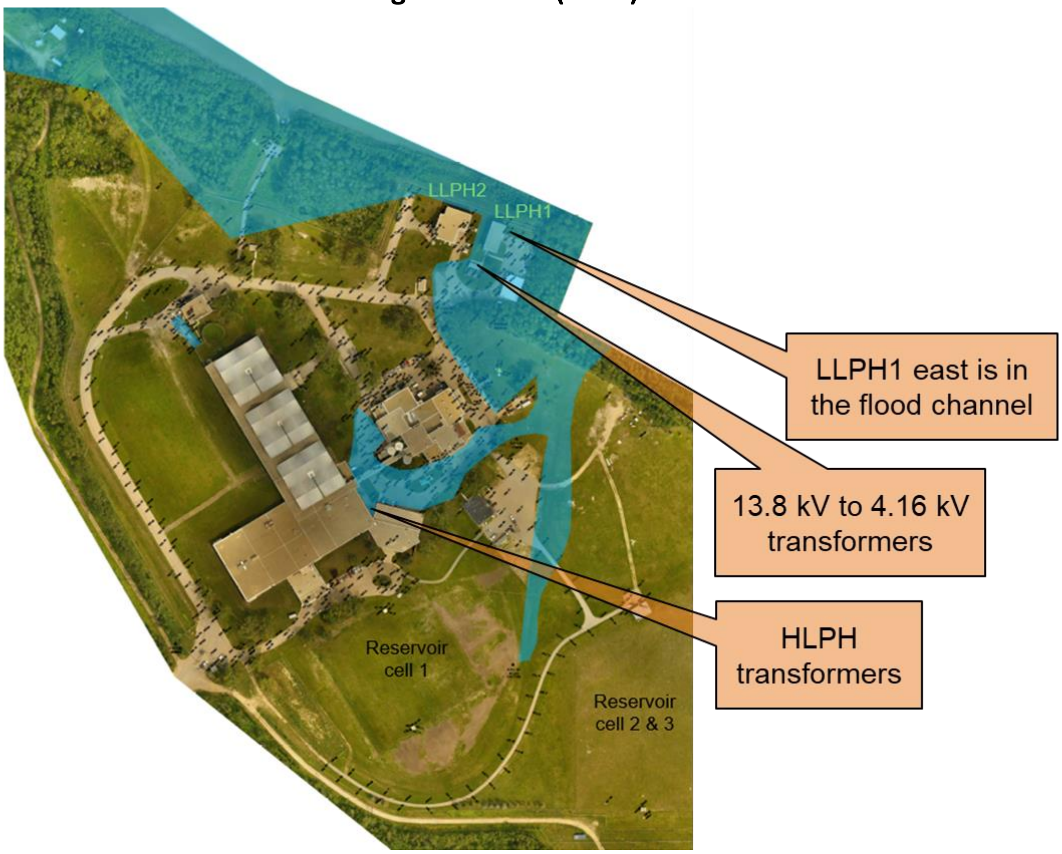


Figure 2.1-3
Simulation of Unmitigated 1:180 (1915) Flood at E. L. Smith



11. Production of potable water becomes highly challenging after a 1:50 flood level due to raw water quality. EWSI has twelve-treated water storage facilities in Edmonton including onsite reservoirs at the water treatment plant sites and field reservoirs. The water stored is only sufficient to meet average customer demands for approximately two days, but assuming strict demand management measures are put into place and there is enough warning of an oncoming flood that reservoirs can be filled prior to WTP shut-in then the supply may be extended to three or four days.

12. The sections that follow will discuss details associated with the above history, insurance assessments, impacts of WTP outages, and the proposed mitigation measures.

2.2 Project Justification

2.2.1 Summary

13. During a 1:180 year return period flood event (i.e. the 1915 Edmonton flood), river flood water enters the water treatment plants by overland flooding and backups in the underground piping systems that normally discharge water back to the river. Equipment that supplies electricity to the WTPs would be submerged and damaged beyond repair, on-site buried potable water reservoirs could be fractured and contaminated, and buried chemical holding tanks could be fractured, leaking chemicals to the surrounding soil and losing the capacity to hold a supply level necessary to make intake water safe for drinking and general use.

14. After river flooding recedes, the WTPs must be cleaned to remove contamination and sediment. Major electrical equipment like transformers would need to be replaced, and tanks and reservoirs would need to be repaired. As discussed above, the reservoirs at E. L. Smith cannot presently be bypassed in case of contamination or damage, placing the WTP out of service until both the electricity could be restored and the reservoirs could be repaired.

15. After water services are restored, a boil water advisory will need to remain in place until the entire Edmonton distribution and transmission network is flushed and disinfected.

16. Provincial recommendations for critical infrastructure protection range from 1:500 to 1:1000 year return period design criteria. Thus, although the cost estimates provided herein are based on a 1:180 year flood scenario, the scope of the project is to protect against a 1:500 year flood scenario. As a result, the cost estimates are conservative relative to the level of protection being provided.

17. Three types of costs are assessed under the 1:180 flood scenario:

- Direct costs to citizens
- Direct costs to EWSI
- Regional impacts to GDP

2.2.2 Direct Costs to Citizens

18. The added electrical cost of boiling water during the boil water advisory, assuming $0.10 per kilowatt hour of electricity and 5L per person per day, costs upwards of $13M. The time opportunity cost of having to get bottled and trucked water during the do-not-use and boil water advisories is estimated at $9 per person per day, totaling close to $3B.

2.2.3 Direct Costs to EWSI

19. Without safe drinking water available, to provide Edmonton and its surrounding populations with a minimum of 4 L of water per day it has been determined that more than 5.0 ML/d of emergency water would be needed. The water demand far exceeds the internal response capacity of EPCOR. Water would need to be hauled in from other regions by truck and train. The cost of providing water to regional customers assumes a minimum acceptable supply of 5100 m^3/day to the general public and 4700 m^3/day to hospitals/correctional facilities at a rate of $4.00/$m^3$ for bulk water (2021 EPCOR rate) and $1.25 for every four litres of bottled water. The hospital water usage rates are based on past billing rates. Once reservoir depletion occurs, it is expected that the first four days would incur a cost of $1.8 million per day which will then decrease to $0.49 per day as it is assumed that emergency water demand can then be completely satisfied by bulk truck shipments as opposed to bottled water. It is assumed that bulk shipments of water will be required for two weeks for residents to cover the “do not use period” and 12 months for hospitals/correctional facilities during the “boil water” advisory. The total cost for trucking and freight is estimated at $140 million.

20. In addition to costs in Edmonton and the surrounding communities, EPCOR will incur expenses and experience revenue loss from the following:

- Damage to critical electrical infrastructure, chemical storage facilities and reservoirs
- Cleaning / disinfection of the reservoirs and regional drinking water treatment network
- Loss of revenue from reduced water sales

21. Direct damage to the drinking water treatment plants accounts for $16.63 million of direct costs.

22. During a 1:180 year flood event, river flood water enters the water treatment plants through overland flows and the underground waste stream/overflow piping systems that discharge to the river. After river flooding recedes, many parts of the WTPs must be cleaned to remove contamination and added sediment.

23. After water services are restored, a boil water advisory will need to remain in place until the entire Edmonton distribution and transmission network, approximately 4,000 km of pipe, is flushed and sufficiently disinfected. The entire regional customer transmission network will also

require flushing. This transmission piping connects over 70 communities from Wabamun to Vermillion.

24. The large, low lift pump house electrical transformers and the high lift pump electrical transformer at E. L. Smith will be exposed to flood waters during a 1:180 year flood event and will need to be replaced due to their expected catastrophic failure. Due to the criticality of the electrical infrastructure each treatment plant has pre-existing redundant pairs of electrical transformers; however as currently built, they still remain within the 1:180 year flood fringe. Transformers of this size are estimated to take up to 9 months for successful reinstallation.

25. There are two 50 ML potable water reservoirs at the Rossdale water treatment plant and three similar sized potable water reservoirs at E. L. Smith water treatment plant. A 1:180 year flood event is likely to cause significant structural damage.

26. The reservoirs were constructed with underdrain systems to eliminate piezometric pressures under the concrete floor slabs. However, the reservoirs will be unable to drain during a 1:180 year flood due to the elevated river levels and ground water levels. This is expected to cause extensive structural damage that takes weeks to months to adequately repair.

27. There is also an additional impact to the utility based on lost revenue from the loss of water services during this time period. It is expected that the total loss of revenue is approximately $210 million over the timeframe of the disruption. This is based on an existing internal audit of drinking water plant vulnerability to disruption from oil spills.

2.2.4 Regional Impacts to GDP

28. Social and economic impacts are approximated by estimating the overall GDP impacts based on experiences at other municipalities that have undergone similar lifeline service loss events. These estimates are derived from a federal study on the economic impacts of Walkerton and other estimates from academia.

29. The analysis provided a range of potential GDP impacts between $28B and $45B for the Edmonton region. The most conservative impact resulted from the application of the Walkerton Ontario case study at $27.9 billion dollars of potential economic and social impact, or approximately 25% of the regional GDP.

2.2.5 Insurance Savings

30. Annual insurance savings are anticipated after completion of this project. Project Description

2.3 Sub Projects

31. This project is a collection of smaller sub-projects related to three major flood mitigation categories:

- Critical asset protection or relocation
  - Hardens underground reservoirs and chemical storage tanks against flood related structural damage
  - Raises key electrical infrastructure above flood water heights
- Backflow prevention from waste stream outfalls
  - Stops backflow of flood water through process drains to prevent building indoor flooding and treatment process equipment contamination
- Prevention of overland flood inundation

32. 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.

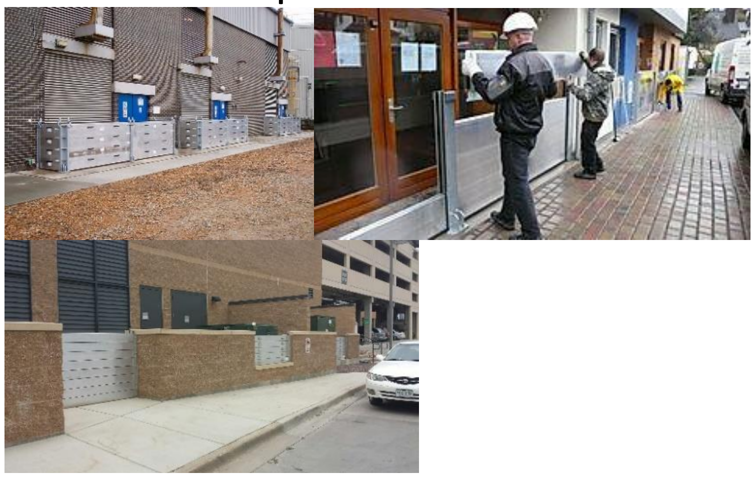
33. Each project's contribution toward mitigating the city-wide flood risk has been evaluated by integrating them with EPCOR's SIRP, which consists of a dynamic multi-dimensional city-wide risk assessment modelling platform. The proposed project selection is optimized to reduce the social, financial, environmental and health related flood risks that were prioritized by the public during initial engagement.

34. The execution strategy will prioritize assets at highest risk, considering equipment life-cycle needs, procurement timelines, availability of contributions, and the impact to customer rates and PBR budgets.

2.3.1 Project Details

35. EWSI has begun to procure mitigative equipment for emergency response planning. Figure 2.3.1-1 shows examples of removable flood barriers to be installed at the low lift pumphouses at both water treatment plants.

Figure 2.3.1-1
Example Removable Flood Barriers



36. Conceptual design work is currently underway. This phase of the project will include a groundwater and geotechnical assessment, the results of which will be used to identify necessary at-risk equipment requiring structural assessments and will inform embankment designs. A stakeholder risk assessment quantifying the vulnerability of the WTPs pre- and post-mitigation will also be included during this phase of the project.

37. The next phase of work will be detailed engineering design. There are a number of initiatives that are currently underway that will be taken into account during the detailed design phase, including reservoir roof rehabilitations at Rossdale, stormwater management plans at both WTPs and the Solar project at E. L. Smith. Additionally, Alberta Environment and Parks (AEP) has commissioned a NSR Flood hazard study, the results of which will also be considered. During this phase, it will be determined whether a treated water reservoir bypass pipeline is required at E. L. Smith. At Rossdale, the reservoirs can be bypassed but at E. L. Smith, there is no way to pump water around a damaged reservoir. As such, the highest-producing WTP (supplying nearly 2/3 of the water demand to nearly 1/3 of the Province) would be out of service until the reservoirs could be repaired. The location and depth requirements of the flood water inundation protection (i.e., embankments) will also be determined. During this phase, at-risk transformers at both WTPs will be relocated and waste stream backflow prevention equipment will be installed. The requirements for improving resiliency of the buried alum tanks will also be determined.

38. An Environmental Impact Assessment will be developed based on the results of a public consultation plan and an Indigenous consultation plan.

39. Construction and commissioning of the assets funded by both the Federal Disaster Adaptation and Mitigation Funding Program (DMAF) and Provincial Alberta Community Resilience Program (ACRP) is scheduled for completion by September 2023. Construction and commissioning of the assets funded by DMAF only is scheduled for completion December 2027.

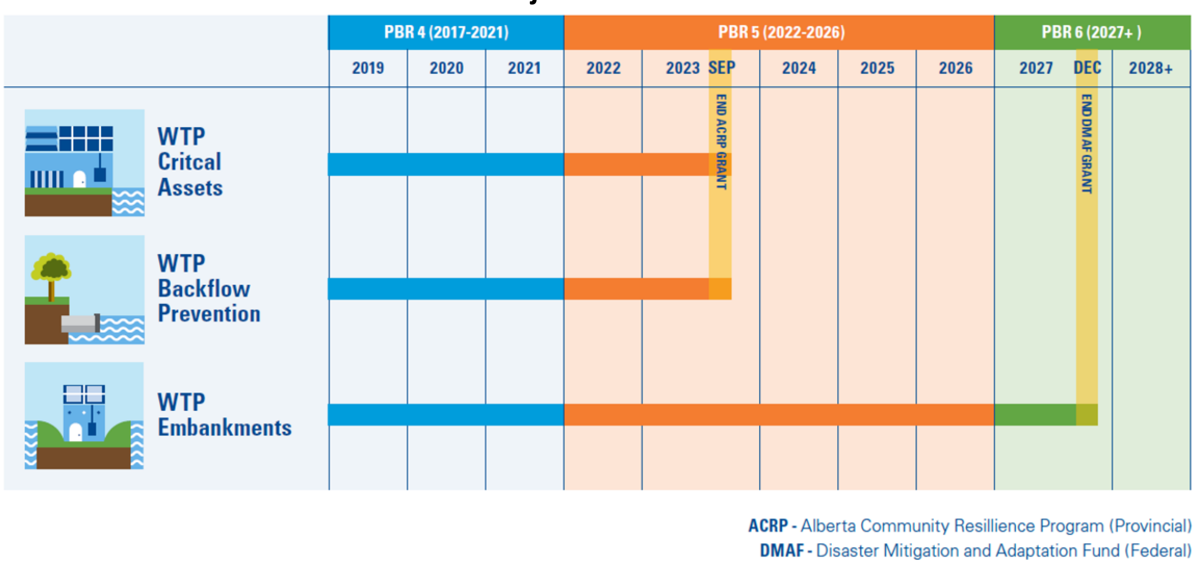
2.3.2 Exclusions

40. The following scope exclusions currently apply:

- Watermark building & ROS sanitary lift station
  - These buildings would need a flood wall ≥ 2.5m to be protected.
- ROS electrical power substation
  - Under evaluation by EDTI.
- Scope impact of a heavy rainfall event
  - Considerations incorporated; full assessment to follow.
- Bank stability adjacent to river intakes.

41. This project will be completed in alignment with DMAF and ACRP granting timelines. Figure 2.3.2-1 below outlines a high-level schedule.

Figure 2.3.2-1
Schedule of Project Phases and Durations



2.3.3 Permitting and Environmental Considerations

42. A Regulatory Road Map (i.e., an expected pathway through the approvals process) has been completed. EWSI will need to comply with up to 22 different federal, provincial and municipal acts, bylaws, etc., including environmental and zoning policies.

3.0 ALTERNATIVE ANALYSIS

43. Alternative 1: Protect up to and including a 1:500 Flood Event (Selected) - Protection from overland flooding and groundwater migration in the case of a 1:500 return-period probability high water event in the North Saskatchewan River is achieved. This is the highest-cost option (~$37M), with the lowest impact to society and the Provincial economy in the event of a major flood in the North Saskatchewan River. Rather than taking out operations for months in the event of a major (1:500) flood, the WTPs would likely be operable within days or weeks.

44. Alternative 2: Status Quo - The cost and damages to EWSI of a 1:180 year flood is estimated at $296 million, while the potential GDP impacts to the region are estimated at between $28 billion to $45 billion.

45. Alternative 3: Protect up to and including a 1:100 Flood Event - Protection from overland flooding and groundwater migration in the case of a 1:100 return-period probability high water event in the North Saskatchewan River is achieved. No protection past 1:100 high water levels; for example, the 1915 Edmonton flood was equivalent to a 1:180 return period flood. This option is of moderate cost (~$20M), but comes with the loss of some Federal grant funding. Rather than taking out operations at both water treatment plants for months in the event of a major (1:500) flood, E. L. Smith would likely remain inoperable for months and Rossdale would continue at reduced operation for months.

46. Alternative 4: Protect up to and including a 1:50 Flood Event - Protection from overland flooding and groundwater migration in the case of a 1:50 return-period probability high water event in the North Saskatchewan River. No protection past 1:50 high water levels; for example, the 1986 Edmonton flood was equivalent to just under a 1:50 return period flood. This option carries the lowest cost (~$6M), but comes with the loss of some Provincial and most Federal grant funding. Rather than taking out operations at both water treatment plants for months in the event of a major (1:500) flood, both E. L. Smith would likely remain inoperable for months and Rossdale would continue at greatly reduced operation for months.

47. Conclusion - The above assessments were completed to weigh the cost to EWSI's customer base to complete this project versus the socioeconomic impact of a flood disaster that would result in the inability to supply nearly 1/3 of the Province of Alberta with clean, safe water. Alternatives 2, 3 and 4 are rejected because they fail to improve flood resiliency in a significant way. Under all three alternatives, both WTPs would remain seriously impacted. Edmonton has previously seen a flood at a 1:180 level. The cost differential to protect to 1:180 vs. 1:500 is not consequential in comparison to the benefit gained, and the 1:500 level has been recommended by FM Global, a worldwide insurance provider and standards agency specializing in flood disaster mitigation. Additionally, the full DMAF and ACRP funding is only available under Alternative 1. Thus, Alternative 1 is recommended.

4.0 COST FORECAST

48. Cost Breakdown estimates were developed as follows:

- Consulting costs – estimated as 15% of the construction costs. Most detailed work is expected to be completed through engineering contracts.
- Contractor costs – estimated based on internal engineering estimates, supplier budgetary estimates, and comparisons with previous similar work.
- In-house hours – estimated based on full-time equivalent hours expenditures expected to be required throughout the lifecycle of the project.

49. Two government initiatives have promised grant funding to complete this work: the Provincial Alberta Community Resilience Program (ACRP), and the Federal Disaster mitigation and Adaptation Fund (DMAF). The total value of secured grant funding for the 2022-2026 term is $6.74 million. The projected costs are shown in Table 4.0-1.

Table 4.0-1
Flood Protection Program
2022-2026 Program Capital Expenditures
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **2022-2026 Total**	G **2027+**
	Direct Costs:							
1	Contractors	3.97	6.13	0.34	2.35	3.10	15.89	5.75
2	Internal Labour	0.39	0.33	0.11	0.12	0.12	1.07	0.12
3	Contingency	0.87	1.60	0.05	0.36	0.64	3.52	1.76
4	**Sub-total Direct Costs**	**5.24**	**8.05**	**0.50**	**2.83**	**3.86**	**20.48**	**7.64**
5	Capital Overhead & AFUDC	0.63	0.76	0.18	0.30	0.51	2.37	0.84
6	Grant Funding	(2.35)	(2.73)	(0.10)	(0.47)	(1.09)	(6.74)	(2.12)
7	**Net Capital Expenditures**	**3.51**	**6.08**	**0.58**	**2.66**	**3.27**	**16.11**	**6.36**

50. An overall project contingency of approximately 25% has been included in the estimate, as the project is currently in the conceptual design phase and this is a class 4 estimate.

51. All work except the WTP embankments and E. L. Smith reservoir bypass is to be in service no later than 2023, with the remainder to be in service no later than 2027

52. EWSI will take the following steps to ensure capital expenditures are minimized:

- Access to the provincial and federal grants ensure maximum value to rate payers for this project.
- Contracted services are performed by pre-qualified external contractors and done on a competitive basis.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.

5.0 RISKS AND MITIGATION PLANS

53. The risks are associated with this project are shown in Table 5.0-1.

Table 5.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Environmental Risk – The embankments scope involves construction in some potentially sensitive areas.	An Environmental Impact Assessment (EIA) will be executed.
2	Multi Impact - Construction will be required outside the water treatment plants fence lines, and in potentially environmentally or historically sensitive areas.	Stakeholder – Community and indigenous stakeholders will be engaged early to manage relationships throughout the project. Regulatory – Impact assessments and approvals requirements will be investigated and mitigated as required by regulator inputs.
3	Regulatory Risk - Numerous regulatory bodies may become involved due to the environmental sensitivity of some aspects of this project.	Regulators will be engaged early to manage regulatory requirements in the planning phases

Appendix F9

EPCOR WATER SERVICES INC.

Water Services
Franchise Agreement Relocates Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Franchise Agreement Relocates Program provides capital funds to relocate or modify existing water mains and appurtenances in order to eliminate conflicts between existing water facilities and proposed City of Edmonton projects.

2. These modifications must be completed at the sole cost of EWSI in accordance with Section 9.1 of EWSI's Franchise Agreement with the City of Edmonton, which states:

> *Upon receipt of thirty (30) days written notice from the City, EWSI shall, at its sole cost and expense, arrange to relocate or cause to be relocated any Equipment operated on the City Lands, or perform any other work in connection with any Equipment and Attachments as may be required by the City to comply with safety standards or accommodate any relocation, installation, modification, repair, construction, upgrading or removal of City facilities.*

3. This program falls under the growth category and EWSI has forecast total program capital expenditures during 2022-2026 of $11.00 million. Because the scope of this program is driven by requests from the City of Edmonton, it is not within the control of EWSI. The scope of this program for the 2022-2026 PBR term is to relocate an average of 28 hydrants and 264 meters of water mains annually. The base volume of work and total expenditures for this program are forecast at a level similar to the 2017-2021 term, with an additional $5.00 million projected for the Yellowhead Trail relocates. Forecast spend over the 2017-2021 period was $6.02 million and actual spend was $7.04 million.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

4. The relocate clause in EWSI's Franchise Agreement applies to all EWSI facilities located within City road right-of-ways, on City bridges, or within City owned land such as parks and school sites. It also applies to any City-driven facility installation or modification including road and sidewalk realignments, bridge construction/rehabilitation, LRT track extensions or building modifications.

5. Included in the scope of the Franchise Agreement Relocates Program are water distribution facility modification projects that are within the City road right-of-ways. The water

infrastructure modifications required by most City projects are generally small in nature and involve hydrant or valve relocates based on road curb alignment changes and new sidewalk installation projects. However, on occasion, water facility conflicts with City projects can be quite significant and costly (LRT extensions, construction of bridges and highway overpasses) and may require extensive distribution and transmission main relocates and/or modifications.

6. Since the Drainage Department has transitioned from the City of Edmonton to EPCOR Drainage in September 2017, water system modifications for EPCOR Drainage Projects no longer fall within franchise agreement relocate requests. Similar to any water system modifications required for EPCOR Power or other franchised utilities, any water system modifications required for EPCOR Drainage Projects must be funded by the project proponent. These water system modification projects will therefore fall within the scope of the Customer Infrastructure Request Program (formerly the New Water Distribution Main Program).

7. Since the Franchise Agreement Relocates Program is driven solely by external requests from various City departments, EWSI does not have direct control over the annual scope for this program. However, every water facility relocate request is reviewed internally by EWSI to ensure the relocate is truly required and the most cost effective solution is implemented.

2.2 Program Justification

8. This program is justified on the basis of EWSI's obligation to provide service under its Franchise Agreement with the City of Edmonton. In addition, every water facility relocate request is reviewed internally by EWSI to ensure the relocate is required and the most cost effective solution is implemented. For each City request, a comprehensive request form has to be signed by the City project manager and EWSI to ensure that the City manager is aware of the requested water facility modification implications and impacts on the water system and associated costs.

3.0 PROGRAM DESCRIPTION

9. The franchise agreements projects requested by the City can be divided into two groups, described below.

i) Water facility modification and relocate/abandonments requests for special projects; construction of new bridges and overpasses:

Major projects undertaken by the City often have large impacts upon a number of utilities, including the water distribution system. Previous examples of such projects include the new Walterdale Bridge with the associated abandonment of the existing bridge and the new overpass over Highway 2 at 41 Avenue South. The necessary modifications to the water distribution system to eliminate conflict with the City's project during construction and enable ongoing maintenance of the water infrastructure with minimal impact on other improvements in the area can result in significant projects. Due to the scope and scale of some of these projects, water main relocate costs are often in excess of $200,000 and have been as high as $500,000.

ii) Hydrant Relocates based on Road\Curb Realignments and Sidewalk Installations:

Most hydrants in conflict with City of Edmonton road and sidewalk improvement/realignment projects are identified and requested for relocate throughout the fall and winter before the construction season. Approximately 40 to 60 hydrants are requested annually for relocate by the City. Of these, approximately 30 to 45 are generally relocated through the Franchise Agreement Relocates Program; about five to ten hydrants are typically rejected as the hydrants are found not to be in direct conflict with the road project or the new sidewalk/curb alignment can be modified to prevent a conflict and eliminate the cost of the relocate; and about two to five hydrants will be relocated as part of scheduled water main renewal projects with the costs of these relocate included in those projects.

10. EWSI forecasts 28 hydrants and 264 meters of water mains to be relocated annually under the Franchise Agreement Relocates Program. This is higher than the historical amount of work due to the inclusion of the Yellowhead Trail relocates, which comprise approximately half of the costs projected for the 2022-2026 period.

11. Upgrades to Yellowhead Trail between St. Albert Trail and 156 St have been identified for construction in 2021-2023, with water main relocates required in 2022. Approximately 400 m of 250 mm AC will need to be relocated east of 156 St to prevent conflicts with the changing 156 St. off ramp and the proposed new service road to the north of Yellowhead Trail. The existing main is in conflict with changing curb lines and needs to be relocated. Further east between 149 St. and 142 St, approximately 450 m of 250 mm AC and 325 m of 300 mm AC will need to be

relocated to remove conflicts with the addition of new traffic lanes and changing curb lines. These three segments have already been reduced in scope by EWSI from the initial 500 m, 850 m, and 800 m lengths proposed through discussions with the City.

12. In 2024-2026, 66 Street at Yellowhead Trail will be converted into an overpass and the existing transmission main along Yellowhead Trail near 66 Street will be abandoned. A relocated transmission main will be built through the PDTM program prior to the abandonment. All the required additional tie ins, connections, and smaller relocates at 66 Street to maintain a functioning water system for the surrounding communities, and to remove conflicts with the overpass design and construction, are included in the YHT Program.

13. Yellowhead Trail roadwork east of St. Albert Trail up to Fort Road is also expected, and additional water main relocates may be required. Preliminary work to close the service road north of Yellowhead between 82 St. and 97 St. has already been completed by the City, but roadwork on Yellowhead at this location has not begun.

14. Not included in the scope of the Franchise Agreement Relocates Program:

- Certain larger water facility modification projects that cannot be finished within one year; such as water facility modification requests for LRT expansions, or transmission main relocates/modifications to accommodate the construction of large Road/Highway overpasses, will be considered as individual separate projects with their own business case and budget.
- Any water facilities installed outside the road right-of-way.
- Water facility modification requests not in conflict with City projects.
- EWSI is only responsible for the first water facility modification. If the facility has to be relocated again based on changes in City design, the City will pay for the second relocate.

4.0 ALTERNATIVE ANALYSIS

15. Due to EWSI's commitment under Section 9.1 of the Franchise Agreement, there is no alternative to the Franchise Relocates Program.

5.0 COST FORECAST

16. The types of franchise agreement projects constructed under this program are similar from year to year. Although the costs of individual projects can vary based on site-specific scope, conditions and conflicts, most projects are fairly routine in nature and estimates for each project are based on EWSI's past experience.

The cost of performing the work has been estimated based on actual costs incurred from similar work other including the Water Distribution Modification Program. The average cost of a hydrant relocate is estimated at $31,236. The projected costs are shown in Table 5.0-1.

Table 5.0-1
Franchise Agreement Relocates Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	2.09	1.59	1.35	1.38	1.72	8.13
2	Internal Labour	0.28	0.29	0.29	0.31	0.31	1.48
3	Vehicles and Equipment	0	0	0	0	0	0.02
4	Contingency	0.08	0.09	0.09	0.09	0.09	0.44
5	**Sub-total Direct Costs**	2.47	1.97	1.74	1.78	2.13	10.08
6	Capital Overhead and AFUDC	0.18	0.18	0.18	0.19	0.19	0.92
7	**Total Capital Expenditures**	2.64	2.15	1.92	1.97	2.32	11.00

17. EWSI takes a number of steps to minimize the level of these capital expenditures including the following.

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. In addition, the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's three long term construction contractors.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.
- All franchise agreement projects are coordinated with the City to minimize road reconstruction costs.

6.0 RISKS AND MITIGATION PLANS

18. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial - Deeper than expected water mains, excavation cave-ins due to poor soil conditions, additional hydrovac costs to identify other utilities, field design changes based on incorrect or un-marked utilities, and traffic accommodation of busy roadways	Involving and integrating the field and design experience of internal staff, City project managers, consultants, and other utilities, and working with EWSI's approved contractors during the project design phase.
2	Customer Service – Water outages could result from work to relocate water mains.	Proactive communication to customers, such as delivering presentations to business associations in affected areas.

Appendix F10

EPCOR WATER SERVICES INC.

Water Services
High Lift Pump House Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The E. L. Smith water treatment plant was built in 1976 (with major additions and upgrades in 1984 and 2007) and currently provides 65 – 70% of the treated water production for Edmonton and surrounding region (with the remaining 30 – 35% from the Rossdale Water Treatment Plant). As the plant is a major contributor to the total treatment capacity for the Edmonton region, it is a vital asset for EPCOR to continue meeting customer water demands. The High Lift Pump house (HLPH) is original to the 1976 construction and incorporates four high lift pumps and two filter backwash pumps.

2. The current configuration of the HLPH results in three main risks to Edmonton's water supply. First, reliability and redundancy weaknesses exist due to a single point of failure. Second, there is currently unmitigated risk of flooding (both from the North Saskatchewan River (NSR) and from an internal pipe or equipment failure). Both of these risks have the potential to significantly disrupt Edmonton's water supply. Third, ability to expand the HLPH to support future capacity increases is limited.

3. The High Lift Pumphouse Expansion Project will include the construction of a new pumphouse, the addition of two vertical turbine pumps (VTPs) and associated electrical gear. In order to mitigate the potential for flood damage, VTPs are configured with the motor above ground level. The current configuration has pumps and motors approximately 9m below ground level.

4. This Project is categorized as reliability / life cycle replacement. The total capital expenditure of this project is estimated at $31.40 million, with $4.98 million within the 2021-2026 PBR term. The new HLPH will be placed into service in 2029.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Project Background

5. The HLPH is fed from one common pipe and flume from the 3 onsite reservoir cells and then discharges it through a common header to four transmission feeders. The pump house has two primary purposes:

- High Lift Pumping - Pumping of potable water through the City's large transmission mains to offsite reservoirs and booster stations throughout the City. From there, water is distributed to residential, commercial and industrial customers within the

City of Edmonton. As well, potable water is pumped to regional customers within EWSI's service area.

- Filter Backwash Pumping - Pumping of potable water backwards through the filters to flush out debris captured in the media bed which is then discharged back to the river. There is one common filter backwash supply pipe which feeds all 18 filters.

6. In 2015, a criticality analysis was completed for the HLPH discharge header which was installed in 1976. The intent of the study was to understand the risk possibility of a failure on a critical pipe system with no redundancy (single point of failure pipe). The analysis identified 8 separate failure mode effects on the HLPH discharge header which all have a 1:50 probability of occurrence. Although there are some mitigation techniques available, there is no option available to completely replace this pipe in the event of catastrophic failure, other than to install a redundant pipe. And, this can only be achieved by constructing a completely separate facility. It should be noted this analysis can be directly applied to all steel single point of failure pipe headers in the HLPH as they are all of the same vintage.

7. A secondary and less critical reliability issue relates to the two original pumps installed in 1976 as they have exceeded their life cycle replacement and EWSI is concerned with their reliability. Taking either of these pumps out of service for a prolonged period for a replacement or a rebuild is not possible during high demand periods or until redundant pumping capacity is built into the system via a second pump house.

2.2 Project Justification

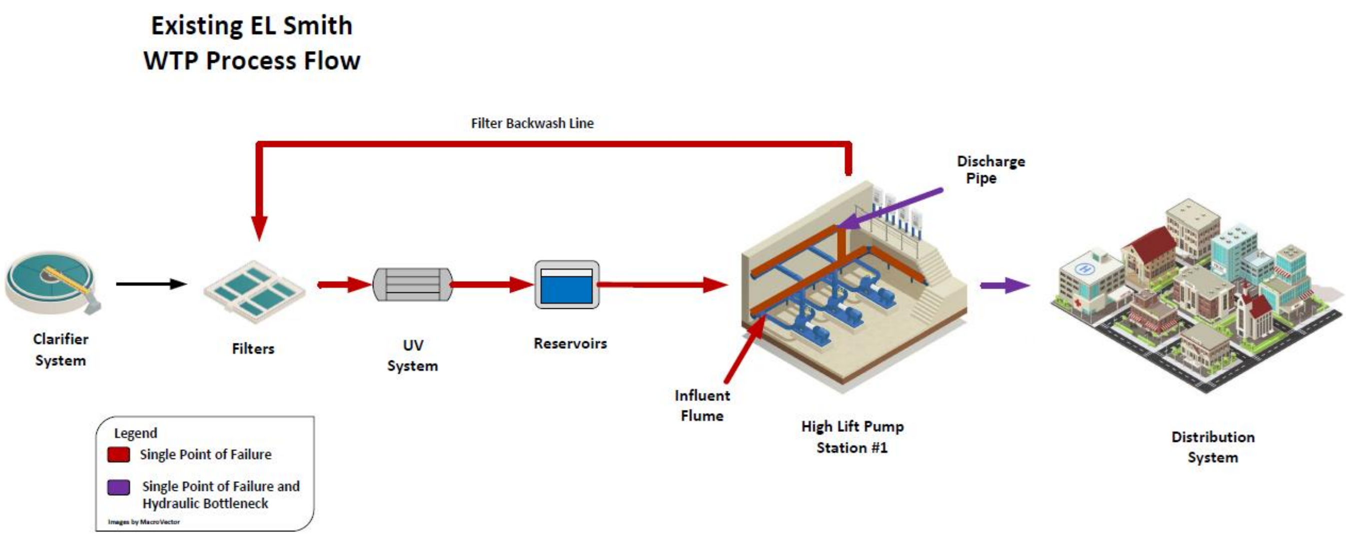
8. This project addresses three main risks at the E. L. Smith water treatment plant.

2.2.1 Reliability and Redundancy Risk (High Urgency)

9. In consideration of the HLPH as a single process unit, there is no redundancy available when it needs to be taken out of service for maintenance, inspection, refurbishment or upgrade of specific assets. Many of the individual components within the asset have not been inspected since it was brought into service in 1976. The high lift pump suction flume and discharge header, and the filter backwash discharge header shown in Figure 2.2.1-1 constitute a single points failure risk (i.e. if a header or flume were to fail the whole plant will need to be shut down.) If this were to occur, the repair will take longer than the shutdown time available before customers are impacted. Recently, the Plant had to complete an expensive specialized in-service repair to the discharge header as taking it out of service to patch weld it would take longer than can be

afforded by Operations. This leak identifies the need to properly inspect the entire header for failure potential and, possibly full replacement. This cannot be accomplished until a second (redundant) HLPH discharge pipe is in place.

Figure 2.2.1-1
Single Point of Failure Risk



2.2.2 Flood Risk (High Urgency)

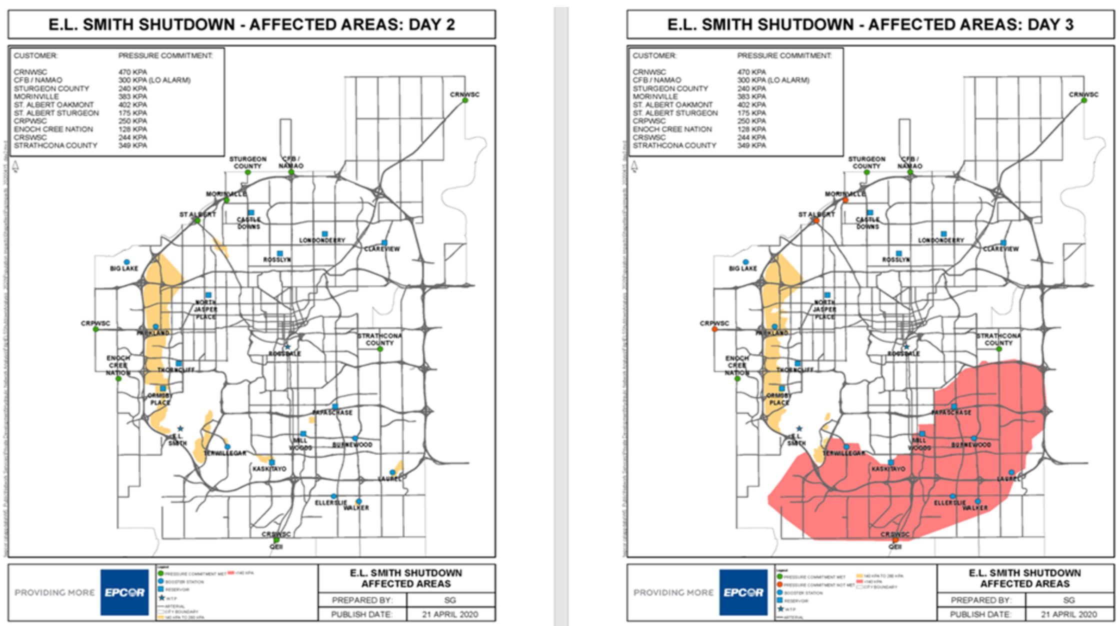
10. Due to the configuration of the existing HLPH, equipment is susceptible to damage from flooding as it is all 9 meters below grade in a dry pump pit. If there was a failure of the flume feeding the pumps or, of the discharge pipe downstream of the pumps, the volume of water would quickly inundate pumps, drive motors, electric valve actuators and control equipment. Affecting all of this equipment concurrently would make it difficult to stop the leak quickly and major damage would occur.

11. A secondary risk to the HLPH exists as the NSR is at an increased risk of flooding due to the affects of climate change. Depending on the flood return frequency, the building could see infiltration from river water which could also affect the equipment in the pump pit. For the new HLPH, the pumps are of a different style and the motors would not be in a pump pit, nor would the valve actuators and control equipment. They would all be above the ground elevation and would not be at risk from flood water.

12. The 2020 Water Integrated Resource Plan (IRP) completed a shutdown analysis of the E. L. Smith Plant based on a number of different scenarios, to determine how supply interruptions

would affect customer service. For a full E. L. Smith outage with no high lift pumping available, it was determined that customer water pressures will be impacted as early as day 2 of the shutdown with significant impacts in South Edmonton by day 3. Refer to Figure 2.2.2-1 for areas affected by a prolonged E. L. Smith plant outage.

Figure 2.2.2-1
Day 2 and Day 3 E. L. Smith Shut Down Impacts



Water Pressure at Critical Levels (140 – 280 kPa)   Water Pressure at Unacceptable Levels (< 140 kPa)

2.2.3 Capacity Risk (Moderate Urgency)

13. Although plant capacity and meeting customer demands is not presently an issue, the ability to expand the HLPH for future growth and demand increases is not possible for the following reasons:

- All the pump flow is pushed through a common discharge header. The discharge header forms a hydraulic bottleneck for future capacity requirements. As noted earlier, increasing the size of this pipe through replacement is not possible.
- This also restricts the discharge capacity of the pumphouse and the ability to install a larger pump in the pump 5 designated spot.

14. The 2020 Integrated Resource Plan (IRP) also analyzes the overall plant capacity based on forecast future customer demands. Taking into consideration the future high 5 day demand in the Edmonton region, both water treatment plants are showing vulnerabilities during the

summer and during fall transition to the direct filtration treatment mode. The bottleneck in the E. L. Smith HLPH will restrict the ability to manage these vulnerabilities.

15. For these reasons, EWSI recommends the additional high lift pumping capacity to:

- Improve pumping reliability, including maintaining sufficient backup pumping capacity,
- Remove single point of failure risk and,
- Prepare base infrastructure for expandability when there is a significant increase in customer water demand.

3.0 PROJECT DESCRIPTION

16. New Building - The High Lift Pumphouse Expansion Project includes the construction of a new HLPH building to the east of the existing HLPH, which will house the new high lift pumps and associated building mechanical and other support infrastructure. The building will also include a redundant filter backwash pump and piping as there is a single point of failure within the existing system.

17. Vertical Pumps - To avoid the potential flooding risk, vertical turbine pumps will be installed as they will allow for the motor and pump discharge header to be located at an elevation above the high river water level.

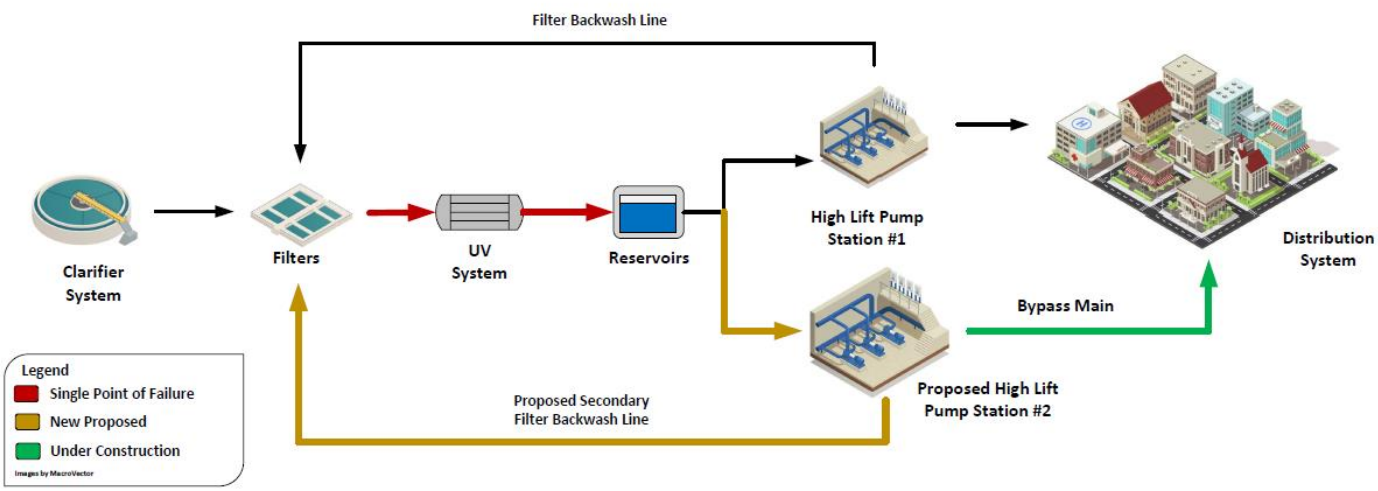
18. New Pumps - New high lift pumps (likely two) with a capacity of 150 ML/d will be installed initially to meet redundancy requirements. The pumphouse will also include a new backwash pump to feed the proposed redundant filter backwash pipe that enters the Filter Building on the southwest side. Interconnections between the two backwash systems will ensure full redundancy and operational flexibility for filter backwash on any of the 18 filters. It will also provide Operations with the ability to backwash two filters simultaneously which currently, is not possible. Backwashing of two filters simultaneously allows the Plant to recover more quickly during periods of low water quality in the North Saskatchewan River. Although this is a secondary issue now, it will become an Operational necessity, once the Plant upgrades to deep bed filtration.

19. Electrical Gear - The new HLPH building will be designed to house electrical gear and adjustable speed drives for the pump motors. The electrical equipment will be located on a mezzanine level, to further protect it from flood potential.

20. The new pumphouse will remove the single points of failure that currently exist within the high lift pumping system to the City's transmission system from E. L. Smith. It will also provide Operations with sufficient flexibility to pump water to from either pumphouse to all of E. L. Smith's service areas (North or South). As well, with the addition of a redundant filter backwash pump and second supply pipe, it also removes the single point of failure and operational needs within the existing filtration system.

21. Figure 3.0-1 shows a conceptual location plan for the new high lift pump house (HLPH in the diagram).

Figure 3.0-1
New HLPH Location Concept



22. The following regulatory requirements apply to this project:

- North Saskatchewan River Valley Area Redevelopment Plan (ARP) – Bylaw 7188
- EIA
- Site Location Study
- *Municipal Government Act* – Bylaw 15100:
- Development Permit
- Phase I/II Environmental Site Assessment
- Building and Trade Permits
- Alberta Environmental Protection and Enhancement Act

- *Alberta Historical Resources Act* (HRA)
- *Alberta Wildlife Act* (for tree removal)
- *Migratory Birds Convention Act* (for tree removal)

23. Alberta Culture, Multiculturalism and Status of Women has been made aware of this project and, EWSI has gained extensive experience with the Solar Farm and the Bypass Main projects to effectively negotiate the requirements of the NSR ARP and the HRA. Cultural testing has been completed in the proposed location for the new HLPH as part of the Bypass Main project and no materials were discovered that would require further mitigation.

24. The timelines anticipated for this project are shown in Table 3.0-1.

Table 3.0-1
Program Phases

	A **2018**	B **2019**	C **2020**	D **2021**	E **2022**	F **2023**	G **2024**	H **2025**	I **2026**	J **2027**	K **2028**	L **2029**
1 Initiation/Approvals	X						X					
2 Feasibility Study and Risk Analysis	X											
3 Conceptual Design			X									
4 Preliminary/Detail Design				X				X				
5 Procurement								X				
6 Construction									X	X	X	X
7 Commissioning												X
8 Close-out												X

4.0 ALTERNATIVE ANALYSIS

25. In 2018, EWSI completed a Capital Upgrades Strategy for the E. L. Smith water treatment plant to review several planned upgrades to increase capacity and resiliency, as well as to provide redundancy in assets threatened by a single point failure. One of the projects evaluated was upgrades to the HLPH. The strategy evaluated alternatives developed in consultation with key Plant stakeholders.

26. In order to evaluate the alternatives in the most comprehensive manner, a Triple Bottom Line (TBL) + Risk assessment was conducted. The TBL is a framework that recommends that companies commit to focus on social, environmental, and economic concerns when evaluating risks associated with decision making. Attributes and risk factors were developed for each TBL category by Plant staff which were then used to complete a comparative analysis of the alternatives.

4.1 Alternative 1: Install High Lift Pump 5 (HLP 5)

27. This involves installing a fifth pump in a spare location already designated within the existing pumphouse. The estimated capital expenditure of this option is $4.35 million.

28. Benefits of this option include:

- Improve overall system reliability by adding a backup pump,
- Some increased capacity, provided the electrical restriction noted earlier is removed, and
- Is the lowest cost option.

29. Disadvantages of the option include:

- The single point failure at suction flume and discharge header pipe remains.
- Only limited capacity gain can be expected due to the remaining discharge header bottleneck.
- Flood risk remains.
- Construction of a second HLPH will eventually be required to accommodate growth. At that point, this option will be made redundant.
- No backup backwash pump is available, following the implementation of simultaneous backwashing required for future deep bed filtration. The double filter backwashing capacity will be disabled, if one of the backwash pumps is out of service for Maintenance or repairs ultimately limiting the overall filter capacity.

4.2 Alternative 2: Install HLP 5 with a Separate Suction Line

30. This is similar to Alternative 1 in that a fifth pump is installed in the existing pump house however, two of the pumps swap locations due to size variation to gain some operational flexibility. Also, a separate dedicated suction line is installed to this pump only, in order to keep it separate from the existing suction flume. The estimated capital expenditure of this option is $6.53 million.

31. This option addresses eliminates the single point of failure risk at the pump section flume and suction pipe from the reservoir and improves system reliability by adding a backup pump to the two aged pumps. However, only limited capacity gain can be expected due to a hydraulic bottleneck at the existing discharge header. The flood risk remains and the redundancy of this work once a second HLPH is built in the future remains.

32. This option creates the following new disadvantages:

- The significance of the suction pipe buried outside of the building (for single point failure risk removal) will disappear when the new HLPH is in place. As well, this dedicated suction line will interfere with the new HLPH construction, if the new HLPH is to be located next to the existing HLPH, as originally planned.
- The suction pipe running above the operation floor will cause conflicts for plant personnel to effectively complete maintenance work in the area.

4.3 Alternative 3: Install HLP 5 with a Separate Suction Line to the New Pump and to One of the Filter Backwash Pumps

33. This is a variation of Alternative 2 by including a separate suction to one of the existing filter backwash pumps, so it is fed from a separate line instead of the existing flume. This option allows the plant to maintain up to 150 ML/d of capacity, when the flume needs to be shutdown. This option replaces one of the filter backwash pumps to a different style, due to space restrictions within the existing pump house and all of the additional suction piping required. The estimated capital expenditure of this option is $9.75 million.

34. This option has all of the additional benefits of Alternative 2. Additionally, due to the proposed separated suction line for both HLP 5 and the backwash pump, a minimum production can be maintained when the existing flume requires a shutdown for maintenance.

35. In addition to the disadvantages listed for Alternative 2, this option comes with significant costs to modify the existing structure to fit in the vertical turbine can pump and the construction risk will be high. This option does not provide additional capacity or flood protection benefits relative to Alternatives 1 and 2.

4.4 Alternative 4: Install a Second HLPH (Selected)

36. See Project Description section for an overview of this alternative.

37. Benefits of this option include addressing all three of the risks identified in the Project Justification section (reliability & redundancy, flood and capacity):

- The single point failure risks at both the discharge and suction headers and the backwash header are eliminated.

- The flow of the new high lift pump will not be restricted by the existing discharge header. A high capacity gain can be achieved and this will remove the plant's overall primary bottleneck.
- Flood risk is removed.

38. Alternative 4 also comes with the following added benefits:

- Expandable HLP base infrastructure to address growth requirements in the future (i.e. Not all pumps are required now and can be staged, depending on population growth and future water demand).
- HLPH redundancy for EWSI's goal of developing two independent treatment trains at E. L. Smith.
- A backup backwash pump will be available and will improve backwash's reliability.
- Other infrastructure needs can be addressed within the new building including electrical upgrades and other support systems.

39. Disadvantages of the option include:

- High initial cost.

4.5 Conclusions

40. Alternative 1 is not able to eliminate the single point of failure risks, growth constraints or flood risks. Although Alternatives 2 and 3 are able to eliminate one single point of failure risk, they are not able to address the discharge header single point of failure, growth constraints, and flood risk. Although Alternatives 2 and 3 are lower cost in the near term, they are only temporary solutions, as a second high lift pumphouse will be required in the future to accommodate growth.

41. Alternative 4 was selected by taking into account social, environmental and economic factors along with current risks associated with only one HLPH in operation. It addresses risks associated with the lack of redundancy, reliability, resiliency, and flooding. As a further benefit, it sets up base infrastructure for future growth in the City as water demand increases with population gain. This project also aligns with EWSI's need to construct two independent treatment trains at E. L. Smith to address the extreme shutdown limitation of 24 hours, before customers are impacted.

5.0 COST FORECAST

42. The projected costs associated with this project are shown in Table 5.0-1 and are based on the following:

- Construction estimates are based on a third-party 2018 Capital Upgrade Strategy. This Project is still in the conceptual design stage and is built based on an analogous approach as limited information is known at this time.
- The cost of the conceptual design, currently underway, is estimated based on a quotation for fees. The cost of the detailed design is estimated based on a percentage (15%) of the construction estimate for a project with a higher complexity level.
- Internal costs are based on previous projects of similar sized complexity and scope.

Table 5.0-1
High Lift Pumphouse Expansion Project
2022-2026 Program Capital Expenditures
($ million)

		A **2025**	B **2026**	C **Total**
	Direct Costs:			
1	Contractors	0.69	2.83	3.52
2	Internal Labour	0.03	0.05	0.08
3	Contingency	0.17	0.71	0.88
4	**Sub-total Direct Costs**	**0.89**	**3.59**	**4.48**
5	Capital Overhead and AFUDC	0.17	0.33	0.50
6	**Total Capital Expenditures**	**1.06**	**3.92**	**4.98**

43. EWSI will take the following steps to minimize expenditures:

- During the conceptual design study, EWSI is evaluating options to reduce the filter backwash scope, as it may be able to be moved out of the new HLPH and installed in a location closer to the filters.
- EWSI is evaluating the future growth needs of the City, so as not to over-build the new pumphouse with infrastructure that is not needed at this time.
- The pumphouse conceptual design is being evaluated alongside other projects including the 5 kV Gear and Electrical Room and the Two Train Upgrade projects, to look for efficiencies and synergies between all three projects.
- Contracted services will be performed by pre-qualified external consultants and contractors who will be retained through a competitive bidding process.

- The project will follow the Construction Manager at Risk (CMAR) project delivery process to streamline delivery efficiency and to have a contractor on-board during the design phase to assist with constructability aspects of the projects.
- Where possible, work will be coordinated with other site projects within a comprehensive capital upgrade plan.

6.0 RISK AND MITIGATION PLANS

44. The risks associated with this project are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Operational Risk - Potential impacts to other plant support infrastructure and related projects. Other projects being considered in relation to this one include: ELS 5 kV Gear and Electrical Room Expansion and the ELS Two Train Upgrade.	These impacts will be evaluated as part of the conceptual design phase which is being completed in 2020/21.
2	Operational Risk - Tie-ins into existing infrastructure will be risky, due to limitations with Plant shutdown durations.	Comprehensive planning with appropriate contingencies in place in order to effectively execute this function will be paramount. Currently, other projects that require lengthy plant outages are being operationally tested, to ensure these shutdown impacts are understood and mitigated.
3	Regulatory Risk - The site location forms one of the risks of this project, as site conditions may present construction challenges. Depending on where the new building is located, there could be cultural mitigation requirements mandated through the Historic Resource Act.	In 2018, EWSI included this project as part of their Historic Resource Impact Assessment for the Bypass Main project (currently under construction) and presented the findings in their application to Alberta Culture, Multiculturalism and Status of Women. Therefore, some preliminary work has been completed, in order to mitigate this risk.

Appendix F11

EPCOR WATER SERVICES INC.

Water Services
Infill Fire Protection Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The proposed Infill Fire Protection Program provides a methodology to fairly share the costs of upgrading fire protection infrastructure in older neighbourhoods to current standard amongst infill developers, EWSI water ratepayers and the City's Fire Rescue Services department. Prior to initiation of a pilot project for this program in 2020, infill developers paid for 100% of water infrastructure required to serve a new development or upgrade an existing area including costs related to fire protection upgrades to current standards set out in Volume 4 of the City of Edmonton Design and Construction standards.

2. The proposed cost share approach recognizes that some fire protection upgrades to the water system that improve fire protection in established areas benefit the entire neighbourhood. The cost sharing approach will allow some infill projects to proceed that otherwise may have been deemed unviable by the infill developer. The cost share approach is not a subsidy for infill developers. EWSI has worked closely with the infill development industry and City of Edmonton to develop this program.

3. This program is categorized as a growth/customer driven program. This is a new program which replaces the Accelerated Fire Protection Program previously approved at $16 million over the 2017-2021 PBR term and which was directed at fire protection upgrades in neighbourhoods targeted for neighbourhood renewal. EWSI has forecast total program capital expenditures during 2022-2024 at $20.00 million for this new program. The forecast cost was determined based on applications that EWSI received from developers for the 2020-2021 Infill Cost Share Pilot Program. The pilot project has indicated that $20 million is a reasonable forecast of the future costs of anticipated fire protection upgrades associated with qualifying infill developments during the 2022-2026 PBR term.

2.0 BACKGROUND/JUSTIFICATION

4. Historically, infill developers have provided all of the water infrastructure required to serve a new development or upgrade an existing area. The proposed cost share approach recognizes that some upgrades that improve fire protection in established areas benefit the entire neighbourhood. The agreed-to approach will provide a methodology to share costs between infill developers, ratepayers, and the City's Fire Rescue Services department.

5. During Q4 2018 through Q2 2019, EWSI participated in workshops with the City of Edmonton and representatives from the development community to discuss options for a cost

share approach. Based on feedback from the workshops, the Infill Working Committee formed by the City, EWSI, and IDEA worked together to develop an approach that would:

- Be fair, easy to understand, transparent, and predictable
- Provide incentives for targeted infill development in older neighbourhoods
- Be relatively easy to administer
- Recognize that limited public funding is available

6. With the proposed cost sharing approach, developers would continue to pay for upgrades and installations that would primarily benefit a new development, including:

- Extensions – the provisioning of a net-new water main as well as additional hydrants to bring water servicing and fire protection to an area that did not previously have water service.
- Relocations – moving existing water infrastructure to meet a developer's site-specific needs.
- Service installations – new service lines to new infill properties.

7. For developments selected for inclusion in the cost share pilot project, upgrades that benefit all users will be funded by water ratepayers and Edmonton Fire Rescue Services, including:

- Expansions – replacing an existing water main with a larger one, or adding hydrants to improve fire protection in an area.
- Realignments – moving of water mains and hydrants from an alley to a road.

8. Neighbouring customers will also benefit from the new water mains and fire hydrants funded by this program, as the required infrastructure will be in place to allow for further redevelopment of those neighbouring properties. EPCOR and ratepayers also see a benefit, as this new infrastructure is constructed to the current design standard, resulting in lower operating costs compared to the existing infrastructure.

Eligibility and Ranking Criteria

9. Only applicants / developers who have received responses for zoning applications, pre-application submissions, or development permit applications from the City of Edmonton are eligible to apply for funding consideration by the Infill Fire Protection Program. These applications must have obtained advisements or conditions of approval (that entail the construction of a

public water distribution system, which involves water mains and associated appurtenances) from the City of Edmonton.

10. To determine which projects will receive this public funding, EWSI ranks submissions based on the following six criteria:

- System Capabilities – the current capability of the water system to provide the required fire flows into the area in which the proposed development will be located.
- Neighbourhood Renewals and Arterial Program - the coordination with proposed, ongoing, or completed water main renewal projects.
- Location and Use – projects selected for consideration are to comply with the current City Plan and therefore will only consider funding for residential and mixed use developments with three or more units in established mature and downtown neighbourhoods. Developments that meet the definition of "missing middle" (triplex/fourplex homes, row-houses, stacked row-houses, low rise and mid-rise (up to six stories) apartment buildings) will be ranked higher than high rise apartments.
- Transit Network – the distance of the development to public transit nodes and corridors including LRT corridors, major transit corridors (frequent and rapid service routes) and transit centres as defined in the City's Bus Network Redesign.
- Readiness – how far along the project is in the development process. For example, a project that is in the development permit phase is further along than a project that still requires rezoning. As fire protection upgrades are required to be in place prior to construction, developments that have started construction will not be considered.
- Coordination – the extent to which the project is aligned with other new infill development projects on the same street so that efficiencies in project coordination can be realized.

11. The cost sharing approach will allow some projects to proceed that otherwise may have been deemed unviable by the infill developer. The cost sharing approach reflects a fair allocation of costs between infill developers, Edmonton water ratepayers, and City of Edmonton Fire Rescue Services based on the benefits received from each of these parties from the fire protection infrastructure. The cost share approach is not a subsidy for infill developers. The approach was presented to City Council's Urban Planning Committee on June 25, 2019 (report CR_6170).

The Infill Cost Share Pilot Program

12. Following this presentation to Urban Planning Committee, EWSI determined it could allocate $2.4 million from an existing approved capital program – the Accelerated Fire Protection capital program – to fund a pilot of the Infill Fire Protection Program (the Infill Cost Share Pilot) for the last two years of the current PBR term, 2020 and 2021. Since EWSI was able to allocate $1.2 million per year from this existing capital program to accommodate the Infill Cost Share Pilot, this ensured there would be no water rate increases during the 2020-2021 period. This pilot program was devised in conjunction with City Administration to lower the barriers posed to 'missing middle' infill development by water infrastructure upgrade requirements faced by these projects to address gaps in fire protection in infill neighbourhoods. The Infill Cost Share Pilot program provided EWSI with two years of data on the number and cost of infill developments that would benefit from a cost sharing of fire protection upgrades.

13. Thirty-four development projects were submitted during 2019-2020 for funding from the Infill Cost Share Pilot. The pilot was able to provide the $2.4 million available funding to the five highest ranked projects – including four low rise apartment buildings and one row house development. The pilot project worked as expected, providing funding to projects that best met the six criteria. Costs of fire protection upgrades eligible for pilot project funding ranged from $50,000 to $722,000 per development project.

14. The data gathered through the Infill Cost Share Pilot Project is used to inform EPCOR's funding request for an Infill Fire Protection Program in the 2022 to 2026 Performance Based Regulation Term. The Infill Fire Protection Program will extend the infill cost share process beyond the pilot phase and provide funding for the next five-year period. Based on the applications received for the Infill Cost Share pilot, EWSI is proposing the Infill Fire Protection Program at a cost of $20 million for the 2022-2026 PBR term, which will fund 'missing middle' developments (including mixed use developments) that need the support of this funding to remain financially viable. This funding over a five year timeframe may allow for some neighbourhood commercial infill projects to be included in the program. The funding over five years will also allow for entry into the cost share at the zoning stage of development as the project would likely progress to construction within the five year funding term.

Infill Fire Protection Assessment

15. Complementing the Infill Fire Protection Program, the City and EWSI have implemented a new review process to determine whether water infrastructure for on-street fire protection is

needed for rezoning, subdivision and development permit applications. During the review of a development permit application, EWSI conditions water infrastructure upgrades based on the requirements of the City of Edmonton Construction and Design Standards which look at the highest use permitted under the Zoning Bylaw. Fire Rescue Services can complete a site-specific review to assess existing hydrant spacing and fire flows, using the methodology outlined in the Fire Underwriters Survey.

16. This assessment process provides a technical basis to relax the upgrades conditioned by EWSI should the existing fire flows and hydrant spacing be found to be sufficient as a result of the site-specific assessment for the subject site, and can potentially eliminate or reduce the large financial barriers for projects posed by those upgrades. Since this new review process started in July 2019, the Fire Rescue Services review team at the City of Edmonton has reviewed approximately 210 files to-date and adjusted the water infrastructure upgrades requirements for 168 (80 per cent) of these files resulting in an average cost savings of $249,000 per project and a total avoided cost of $41.8 million. This cost avoidance review process reduced the number of projects that required the assistance of the cost share pilot project funding.

3.0 PROGRAM DESCRIPTION

17. The Infill Fire Protection Program replaces a previous capital program for fire protection upgrades in older neighbourhoods. The Accelerated Fire Protection Program, was intended to provide fire protection upgrades in targeted mature neighbourhoods which were identified for neighbourhoood renewal. This new program adjusts the criteria for fire protection upgrades to focus on neighbourhoods targeted for infill development rather than neighbourhood renewal.

18. The Infill Fire Protection Program will operate on the same basis as the Infill Cost Share Pilot Project. Developers of infill projects would apply to the program to enter for consideration for funding of their required water infrastructure upgrades. At the closing of an application period, all applicant projects will be processed through the program ranking criteria, which will result in a ranking score for each development. The top ranking projects (up to the annual program funding budget) will be selected to receive funding for their water infrastructure upgrades. These upgrades will be designed and constructed by EWSI in the following construction season.

19. Developers will be able to apply for funding under this program for EWSI to complete required water infrastructure upgrades in the 2022 to 2026 construction seasons. Application intake deadlines will be set for the year prior to the construction work occurring. This is consistent

with the original intent of the Accelerated Fire Protection Program, which was to improve fire protection deficiencies in the water infrastructure network, both to meet Fire Rescue Services' requirements and to support and promote infill and re-development within the City of Edmonton.

4.0 ALTERNATIVES ANALYSIS

Alternative 1: Do Nothing

20. This alternative was not selected as it would run counter to the stated goals of City Council in supporting infill development within the City of Edmonton and would not provide funding to support fire protection upgrades in mature neighbourhoods. This alternative would also not align with the information gathered during the two-year Infill Cost Share Pilot Project, which demonstrated that there was a significant interest and need for this type of program to support 'missing middle' development within mature neighbourhoods in the City of Edmonton. Without a program to fairly allocate fire protection costs, EWSI expects that many infill developments will not proceed.

Alternative 2: Alternative Funding Models

21. City Administration, in collaboration with EPCOR have investigated the suitability of other established infrastructure funding methods for use in addressing the water infrastructure gap that is hampering infill development in the City of Edmonton. Funding methods considered included reserve funds and/or off-site levies, Local Improvement Financing, boundary recoveries and increases in water utility rates and/or property taxes (similar to neighbourhood renewals). The only options which would make a significant difference in facilitating infill development would be those that involve the injection of considerable public funds.

22. Based on its understanding of these alternatives, EWSI considers that Infill Fire Protection Program as the best option to meet the principles set out above: fair, easy to understand, transparent, and predictable; provides incentives for targeted infill development in older neighbourhoods; relatively easy to administer and recognizes that limited public funding is available. EWSI understands that City Administration and IDEA also support the proposed Infill Fire Protection program, as the most appropriate and fair method of funding the fire protection upgrades associated with infill development.

5.0 COST FORECAST

23. An overall contingency of 5% has been included in the estimate compared to the guideline range of Class 1 (5 – 15%). The contingency amount will be used to cover additional construction costs that could be incurred due to:

- Delays during construction due to unfavourable weather conditions.
- Delays caused by poor or unexpected ground conditions during construction.
- Complex utility alignment conflicts, or conflicts caused by third party utilities outside of their prescribed alignments.

24. An overall contingency amount at the lower end of the proscribed range is justified due to the following factors:

- All the planning, design, drafting, construction coordination for this program is completed by EWSI internal staff.
- All the construction work is performed by EWSI approved long-term contractors.
- The majority of the work done by our contractors is based on agreed unit rates.
- Although this is a new program for the 2022-2026 PBR, the type of water main construction projects designed and constructed under this program are similar to those completed in the past from year to year. Although, the costs of individual projects can vary based on site-specific scope, conditions and conflicts, overall most projects are routine in nature.
- For each project an individual cost estimate and PO is issued based on actual construction quantities.

25. In addition, the scope of this program can be adjusted to remain within the budget targets, if required. If the final cost of the program is expected to exceed the targeted budget, the EWSI Capital Steering Committee will be informed in a timely manner about the need for approval of extra funding.

26. Cost estimates were developed based on the following assumptions:

- EWSI internal staff time requirements will be similar to previous years.
- All proposed water main renewal and valve repair projects will go ahead.
- No major changes in the City’s pavement restoration specifications.

- No additional safety requirements, other than those currently identified under EWSI's Contractor Management Program will be imposed on the contractors.

27. Cost Breakdown estimates were developed as follows:

- Consulting costs - There are usually no consulting costs associated with this program since all engineering, design, drafting, inspection, and as-built recording works are completed by EWSI internal staff.
- Contractor costs - Contractor costs are estimated based on an average per metre installation cost based on historical project actual costs. These costs are composed primarily of unit rate items as determined in EPCOR's long term construction contracts (current master agreement contract signed in 2018) with some costs incurred on a force account basis. Contractor unit rate prices are reviewed and adjusted each year. Based on the current economic conditions in Alberta and current contracts, it is assumed that contractor prices and per metre water main renewal costs for the 2020 construction season will remain at about the same level as 2020. The per metre water main renewal cost for installing distribution pipes is expected to be about $1900.
- In-house hours - In-house hours are based on historical in-house hours for the Accelerated Fire Protection Program.

28. The capital cost forecast for the Infill Fire Protection Program for the 2022-2026 PBR term is presented in Table 5.0-1.

Table 5.0-1
Infill Fire Protection Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs						
1	Contractors	3.18	3.18	3.26	3.34	3.34	16.30
2	Internal Labour	0.35	0.36	0.37	0.37	0.38	1.83
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.01	0.05
4	Contingency	0.18	0.18	0.18	0.19	0.19	0.91
5	**Sub-total Direct Costs**	**3.71**	**3.72**	**3.82**	**3.91**	**3.92**	**19.09**
6	Capital Overhead & AFUDC	0.21	0.22	0.22	0.23	0.23	1.11
7	**Total Project Costs**	**3.92**	**3.94**	**4.04**	**4.14**	**4.15**	**20.20**

29. EWSI takes a number of steps to manage the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with EWSI's and the City's standards. Master contractor agreements are in place.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and completed on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to leverage cost efficiencies.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

30. Table 6.0-1 below provides the key risks and mitigations plans associated with executing this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Risk of Stranded Assets – Fire protection upgrades are constructed for a development that subsequently does not proceed. This could be exacerbated due to expanding the program to allow developments in the rezoning application stage to qualify for funding consideration.	EWSI will maintain regular (monthly) contact with developers of projects selected for funding to confirm that development is proceeding. EWSI will set milestone requirements for when a project's upgrades can be released to construction (i.e. approved development permit required)
2	Financial Risks - Demand for the program, and therefore our ability to spend the allocated funds, is dependent on expected infill development levels within the City of Edmonton.	Program funding level was determined based on the pilot project which was undertaken during a time of lower economic activity in Alberta. The COVID-19 Pandemic has had a negative impact on economic activity and land development activities within the City of Edmonton economic activity, but may be offset by federal and provincial stimulus funding. If demand for this program is lower than forecast, EWSI will consider the option of redeploying funds from this program towards a targeted infill commercial pilot project.
3	Financial Risk – Due to limited space and other utility conflicts, it can be difficult to secure the optimum water main alignments.	EWSI will work with City designers and other utilities and construction coordinators to ensure all water main alignments are identified and secured as early as possible. EWSI will obtain information on other utility relocation project status' and as-built locations.
4	Construction Resources – This is a significant increase in capital expenditures from the pilot project, and will require additional construction resources to execute.	EWSI's long-term contractors have demonstrated the ability to staff up and deploy additional resources to meet EWSI's construction needs. In addition, capital expenditures on EWSI's water main renewal programs are expected to be optimized for the 2022-2026 PBR term, which will free up contractor resources to take on the additional scope under the Infill Fire Protection Program.

Appendix F12

EPCOR WATER SERVICES INC.

Water Services
LRT Relocates Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Light Rail Transit ("LRT") Relocates Program moves water infrastructure that falls within the LRT conflict zone. The LRT conflict zone is an approximate 12 meter right-of-way in which all parallel water infrastructures must be relocated and all perpendicular water main crossings must be lowered and installed inside a casing.

2. EWSI has received formal notification from the City of Edmonton to continue to advance utility relocates for the West Valley Line LRT beginning in 2019, prior to LRT construction beginning as early as 2021. Utility relocates are expected to continue for the next three to four years. To meet this accelerated timeline for this section of the LRT, utility relocates for the West Valley Line LRT are required to be completed in 2022 and 2023.

3. These modifications must be completed at the sole cost of EWSI in accordance with Section 9.1 of EWSI's Franchise Agreement with the City of Edmonton, which states:

> *Upon receipt of thirty (30) days written notice from the City, EWSI shall, at its sole cost and expense, arrange to relocate or cause to be relocated any Equipment operated on the City Lands, or perform any other work in connection with any Equipment and Attachments as may be required by the City to comply with safety standards or accommodate any relocate, installation, modification, repair, construction, upgrading or removal of City facilities.*

4. This project is categorized in the growth/customer requirements PBR category. EWSI has forecast total project capital expenditures during 2022-2026 at $10.25 million to complete the remaining 35% of the West Valley Line LRT. Construction is scheduled to begin in 2022 with an in-service date of 2023.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

5. As part of the Franchise Agreement, referenced above, EWSI must relocate any water infrastructure in conflict with the proposed LRT with no cost recovery from the City of Edmonton. The relocate clause in EWSI's Franchise Agreement applies to all EWSI facilities located within City road right-of-ways, on City bridges, or within City owned land such as parks and school sites. It also applies to any City-driven facility installation or modification including road and sidewalk

realignments, bridge construction/rehabilitation, LRT track extensions, building modifications or new sewer and drainage main installations or modifications.

6. When EWSI's 2017-2021 PBR Application was prepared, EWSI did not have specific information on the timing and scheduling of the next phase of the LRT. The City had not yet determined if the West leg of the Valley Line would be the next phase of LRT construction, nor was any specific timing or scope available. Accordingly, EWSI included a forecast of capital expenditures as a placeholder in the 2017-2021 PBR, with incremental capital additions approved through a Non Routine Adjustment (NRA). EWSI's current projection is that the actual expenditure over the 2017-2021 term will be $16.01 million, which is $1.50 million higher than the approved NRA amount.

7. EWSI has completed 100% of relocates for the South Valley Line and 65% of relocates for the West Valley Line. This program will see through the completion of the remaining 35% of relocates for the West Valley Line.

2.2 Program Justification

8. This program is a requirement under the Franchise Agreement with the City of Edmonton. Relocating water infrastructure that is in conflict with the proposed LRT tracks also protects the existing water infrastructure from potential damage during the LRT construction, ensures EWSI's ability to operate and maintain the water network in the future, and protects the LRT from potential damage of future main breaks underneath the tracks.

3.0 PROGRAM DESCRIPTION

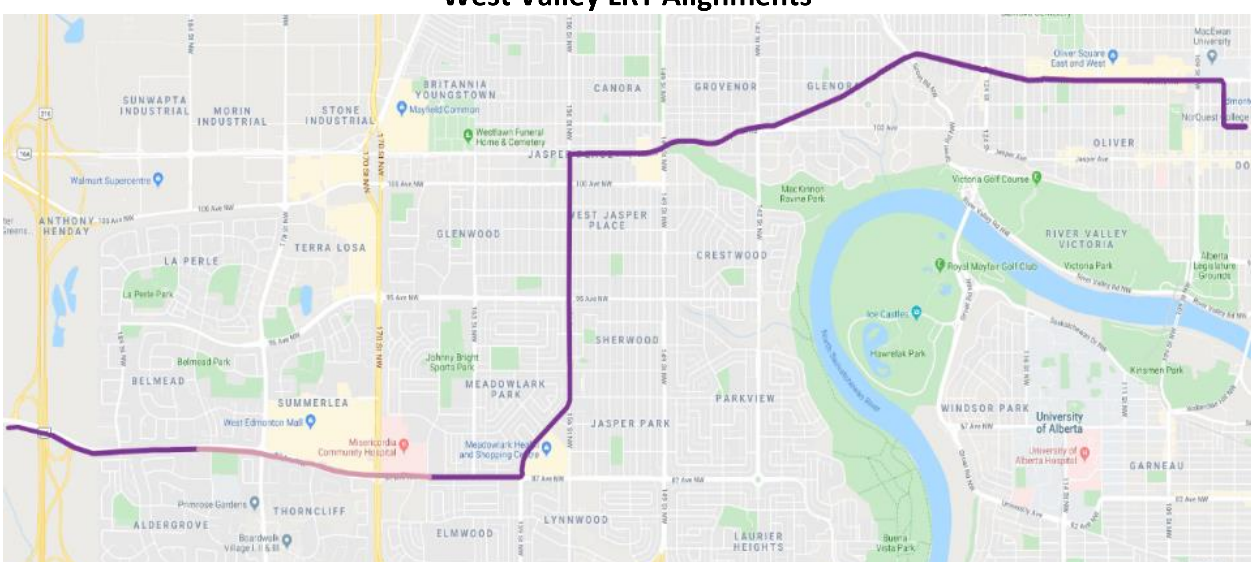
9. The purpose of this program is to enable EWSI to meet its commitments under the Franchise Agreement within the 2022-2026 PBR period by relocating existing water infrastructure as required for LRT construction. Water relocates are completed based on EWSI's commitments under the Franchise Agreement and the City of Edmonton LRT Design Guidelines. Water mains crossing the LRT tracks must be installed inside a casing, a minimum 2.0 meters from top of rail to top of casing (except small diameter services, which do not have to be constructed in a casing). Water mains parallel to the LRT tracks must be more than 4 meters from the outside of the track, with an extra meter separation required at a station.

10. The LRT conflict zone includes a right of way 4 meters from the center of each track in addition to 1 meter around each proposed station. In most cases, this results in an approximate 12 meters right-of-way in which all parallel water infrastructure must be relocated and all

perpendicular water main crossings must be lowered and installed inside a casing. Hydrants and other facilities may have to be relocated due to road widening or other changes in the road profile related to the LRT construction. Hydraulic analysis is used to determine the impact to the overall water network and to evaluate design alternatives and look for efficiencies. For example, in some cases multiple crossings of the LRT tracks can be replaced with one larger water main crossing. In other cases, an off-corridor upgrade may be required prior to abandoning a water main in conflict with the LRT. Each water infrastructure conflict is evaluated to determine if it should be abandoned or relocated.

11. As shown in Figure 3.0-1, the current focus of this program is completing the water main relocates for the West extension of the Valley Line LRT (Downtown to Lewis Farms), with construction of a large portion of relocates having begun in 2019. After an initial review of the preliminary alignment, a similar number and complexity of relocates (per km) is expected compared to the Southeast Valley Line LRT, and construction is anticipated to be spread out over the same number of years. This program will cover the completion of these relocates in 2022 and 2023.

Figure 3.0-1
West Valley LRT Alignments



*Pink section represents above ground LRT infrastructure.

12. All activities related to project selection, design, drafting, construction coordination and inspection, and as-built recording will be undertaken by internal staff within the Water D&T group. Construction and restoration activities will be completed by EPCOR’s long-term contractors and their sub-contractors. The City of Edmonton’s Construction Services Branch will

be used to complete materials testing. EPCOR Power will provide lay-out and as-built survey. Utility relocate alignments and construction schedules are subject to approval of the ConnectEd Transit Partnership, and also through the ULA process.

13. Permits required on every project include approval from the ConnectEd Transit Partnership, a ULA permit, and an OSCAM (applied for by the contractor). Certain projects may require River Valley Bylaw Approval (e.g., construction in a ravine), *Historical Resource Act* (e.g., construction near a historical site), contaminated soil awareness (e.g., construction near an abandoned gas station), or land administration items (e.g., utility right of way, crossing agreements, etc.). These items are checked for as part of the project review process and applied for as needed

4.0 ALTERNATIVES ANALYSIS

14. Each LRT conflict or crossing is evaluated to determine the impacts to the water network if it is abandoned, and if it needs to be relocated. The proposed changes to the water network are evaluated for hydraulic requirements, customer servicing, future operability and maintenance, and hydrant spacing. If a water main needs to be removed/relocated, hydraulic analysis is conducted to determine the necessary upgrades required to return the area to its existing condition (pressures, flows), and to maintain service to customers and fire protection. Each design considers the pipe size crossing the LRT Tracks, to ensure it will provide adequate flow for the interim and the ultimate water network. Hydrant locations have been evaluated to maintain existing fire protection wherever possible, or reviewed and approved by the Fire Department prior to construction. The method for constructing each crossing (open cut vs. directional drill) will also be evaluated with the lead designer and contractor. All attempts will be made to minimize construction costs by coordinating project schedules and working with other utilities.

15. If EWSI does not complete the required LRT relocates, the existing water mains would likely be damaged during the LRT construction. The water mains would also not be accessible once the tracks were built and could cause significant damage to the tracks if a break were to occur. The relationship between EWSI and the City would be also be negatively impacted, as EWSI would not be adhering to the requirements of the Franchise Agreement.

5.0 COST FORECAST

16. The volume and type of work is entirely driven by the number and type of requests for relocate made by the City, Because the scope of this program is driven by requests from the City of Edmonton Transportation and Drainage departments, it is not within the control of EWSI.

17. The total forecast for water relocates for the West Valley Line is higher than the Southeast Valley Line due a few different factors, namely: an extra km of track, total amount of transmission main relocates, and the size/scope of the arterial roadways that EPCOR is required to be working on (major commuters).

18. A similar number and complexity of relocates (per km) is expected compared to the Southeast Valley Line LRT, and construction is anticipated to be spread out over the same number of years. A comparison of the two LRT extensions is summarized in Table 5.0-1 below:

Table 5.0-1
Southeast Valley vs. West Valley Line LRT

	Southeast Valley Line LRT (Mill Woods to Downtown)	A **West Valley Line LRT (Downtown to Lewis Farms)**
	LRT Design & Construction:	**LRT Design & Construction:**
1	- 13 km LRT extension	- 14 km LRT extension
2	- Planned 5 years total construction	- Planned 5 years total construction
3	- Contract awarded & construction started in 2016	- LRT Construction could start as early as 2021
4	- Planned to be operational 2020	- Earliest operational date is 2023
	Water Infrastructure Relocates:	**Water Infrastructure Relocates:**
5	- Water relocates completed over 5 years	- Plan for relocates to be completed over 5 years
6	- Total cost for water relocates: $22.1M	- Total forecast for water relocates: $28.5M

19. Contractor costs – are based on the preliminary or conceptual project designs for 2022/2023 with a similar scope or location of work, the actual costs of LRT relocate projects from 2019-2020 with a similar scope or location of work, and further evaluation to increase or decrease the amount based on unique aspects or challenges with the 2022/2023 project scope. Unique scopes of work for the West line include the large diameter transmission main crossings and relocates and some of the work on arterial roads/downtown.

20. The following assumptions have been made when estimating costs for this program:

- The proposed water infrastructure relocates will be approved by the ConnectEd Transit Partnership, the City, LRT Integrated Infrastructure Services (IIS), and other utilities within a reasonable timeframe.

- There are no significant changes to the LRT design including track alignments, proposed property lines, curbs, sidewalks, elevations, drainage, and streetlights.
- The ConnectEd Transit Partnership will provide the necessary information about the final LRT designs to allow adequate time for approvals & construction of EPCOR Water's relocate projects.
- EPCOR's contractor will have unencumbered access to the project sites, and will have enough resources to complete all the projects within specified timeframes, despite restrictions with regard to road closures, transmission main shutdowns and coordination with other utilities' construction.
- There will be no major changes in the City's pavement restoration specifications, traffic accommodation requirements or costs for services (ex. materials testing).
- Additional water mains, services, and hydrants required for new LRT stations or facilities will be constructed at the cost of the City / ConnectEd Transit Partnership as they do not fall under the Franchise Agreement.

21. The projected costs are shown in Table 5.0-2.

Table 5.0-2
LRT Relocates Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **Total**
	Direct Costs:			
1	Contractors	4.20	4.43	8.63
2	Internal Labour	0.36	0.37	0.72
3	Vehicles and Equipment	0.01	0.01	0.02
4	Contingency	0.23	0.24	0.47
5	**Sub-total Direct Costs**	**4.79**	**5.05**	**9.84**
6	Capital Overhead and AFUDC	0.20	0.21	0.41
7	**Total Capital Expenditures**	**5.00**	**5.25**	**10.25**

22. EWSI will ensure the minimization of capital expenditures through the following:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by

EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

23. The risks associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial - Changes to the LRT alignment and future curb/roadway design will affect the number and location of the water infrastructure conflicts.	Work with the City designers, LRT Design & Construction and other utilities and construction coordinators to identify potential conflicts and minimize the design changes that result in increased costs for EWSI. Address all conflicts / concerns and obtain all appropriate approvals in writing prior to construction.
2	Financial - Due to limited space and other utility conflicts, it can be difficult to secure the optimum water main alignments.	Work with City designers and other utilities and construction coordinators to ensure all water main alignments are identified and secured as early as possible. Obtain information on other utility relocate project status' and as-built locations.
3	Financial - Unforeseen construction costs and force accounts will impact the overall costs of projects.	Work with designers, coordinators, and contractors to identify potential problems, provide accurate design and quantity estimates to minimize the need for extra work. Defer portions of the construction as necessary to remain within the approved budget.
4	Customer Service – Water outages could result from work to relocate water mains.	Proactive communication to customers, such as delivering presentations to business associations in affected areas.

Appendix F13

EPCOR WATER SERVICES INC.

Water Services
Meter Change Outs Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. The Meter Change Outs program includes the costs associated with meters that must be replaced for a variety of reasons such as meters scheduled for retirement and broken meters. Starting in 2022, meters will be equipped with AMI devices that transmit readings to EDTI's AMI mesh network. From 2022-2024, all meter change outs and associated costs will be captured under the AMI Device Deployment program, as the AMI devices will be installed in the same home visit during which meters are replaced.

2. This program is required for EWSI to meet its obligations for service under Section 8.1, Schedule 2 of the *EPCOR Water Services Bylaw #19626* ("the Bylaw") which requires that EWSI meter the water consumption for all of its customers. Metering also provides important operational information on water consumption for EWSI, and valuable water consumption feedback to customers.

3. This program falls under the PBR category Reliability/Life-Cycle. Total project capital expenditure is projected at $5.78 million. The $7.98 million reduction from the actual cost of the program over the 2017-2021 term is primarily the result of transferring $8.06 million in 2022-2024 costs that are captured instead in the AMI Deployment Project cost forecast and an overall decrease in program costs by 25% on an annual basis. There is an opportunity to better optimize EPCOR's meter replacement strategy once AMI consumption data is available which may lead to future savings not yet reflected above.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

4. EWSI meters the water consumption of all its customers in accordance with Section 8.1, Schedule 2 of the Bylaw. Water meters not only provide EWSI with accurate consumption data required for billing, they also encourage EWSI customers to use water in an efficient manner. Water meters promote good utility management practices by enabling EWSI to track its distribution system water losses.

5. Metering consumption is also an important element of EWSI's water conservation programs. Informing consumers of usage increases awareness and therefore reduces maintenance and operational costs in the treatment of water. Decreasing the demand for water also decreases energy infrastructure costs to pump and move the water.

6. Every year, capital funds are allocated for the replacement of existing meters. EWSI currently installs Automatic Meter Reading ("AMR") meters with a device called an Encoder Receiving Transmitter ("ERT") attached to the water meter. The ERT allows the water meter reading to be transmitted via radio frequency to the meter reader's hand held device, eliminating the need to enter the premise. Beginning in 2022, the AMR technology will be replaced with Advanced Metering Infrastructure ("AMI") technology. The AMI technology equipment is separate from the meter and the ERT device is no longer required as part of the meter installation. As a result, once AMI is fully deployed in 2024, the long-term cost of the Meter Change Out program will be reduced by 25%.

2.2 Program Justification

7. This program is necessary to comply with the requirement for EWSI to meter all of its water customers in accordance with the Bylaw.

3.0 PROGRAM DESCRIPTION

8. The scope for the 2022-2026 Meter Change Out Program is to continue to support and follow EWSI's plan to annually test meters, and remove and replace stopped, damaged or burst meters. The plan also includes retiring meters based on the meter replacement schedule.

9. Meter replacements have increased annually as a result of the mass installations that began in the late 1970's and into the 1980's when the City of Edmonton was growing at a faster rate. In one year during this period, over 17,000 new meters were added to the system. Rusting bolts and bottom plates and stopped registers have been the cause of some increases in meters dying vs. reaching retirement. In the case of pulse meters, outside displays have broken down due to the weather and aging. This program will address these meters as they are identified through ongoing monitoring.

10. Meters are replaced under this program for a variety of reasons including:

- meters that have reached the end of useful life that need to be replaced;
- meters removed for testing as part of EWSI's quality assurance program; and
- replacement of burst, damaged, or defective meters.

11. Prior to the deployment of AMI meter reading technology, meter replacements were prioritized due to the following reasons:

- replacement of First Generation ERT modules due to end of battery life;

- older technology meters changed out and replaced with AMR-enabled meters for efficiency; and
- safety of EWSI employees (dangerous dog and customer sites).

12. Although meters will not need to be replaced for the aforementioned three reasons, this will not change the cost of the Meter Change-Out Program. The redundancy of these reasons affects only the prioritization of meter locations within the program, but not the overall meter replacement schedule.

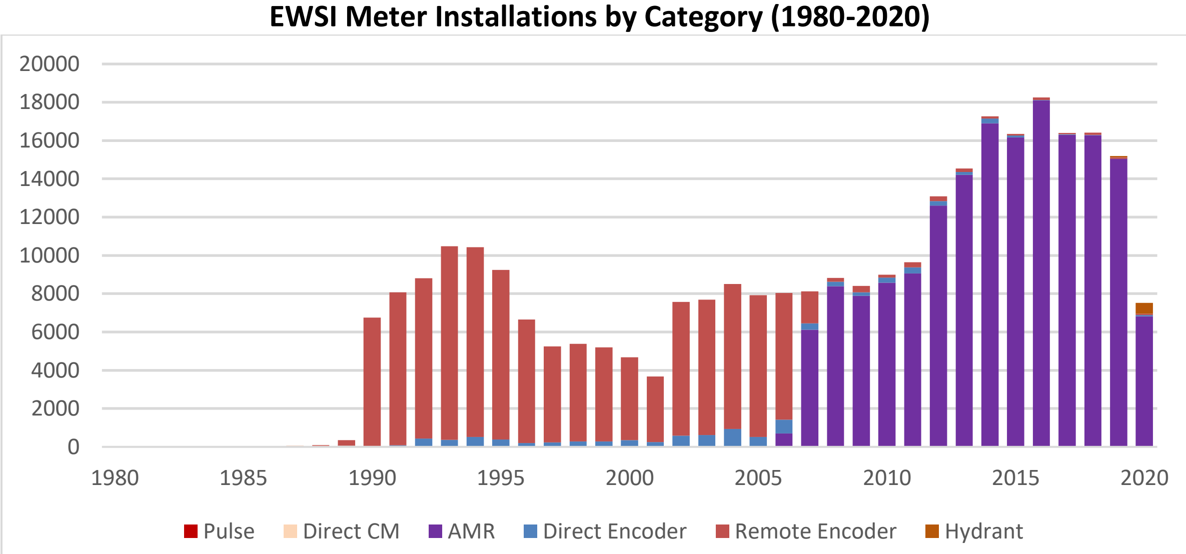
13. There are five categories of meter replacements described below.

3.1.1 Meters for Retirement Including Defective Meters

14. It is forecast that an average of 9745 meters per year will require retirement based on the number of meters installed per year 30 years ago. In 2022-2024, these meters will be retired and replaced under the AMI Deployment Project. These meters will be replaced with new meters that are equipped with AMI devices.

15. Figure 3.1.1-1 shows the age distribution of meters installed in the water system as of mid-2020. Some of the meters in use today are older than 30 years. This is primarily due to customers not granting access to have their meter replaced. EWSI continues to encourage these customers to allow their meter to be replaced to reduce the risk of flooding due to structural meter failure after 30 years.

Figure 3.1.1-1
EWSI Meter Installations by Category (1980-2020)



16. This category also covers the meters expected to be replaced due to stopped meters or meters that break down for various reasons. This may include meters that burst due to exposure to temperature fluctuations despite being inside the home or meters that are found to be slowing for various reasons. Once the AMI Deployment Program is complete, EWSI will be able to better target its meter replacement program due to regular data points allowing for quicker recognition of stopped, slowing or defective meters.

17. EWSI's water meter retirement and testing schedule is provided in Table 3.1.1-1 below:

Table 3.1.1-1
EWSI Water Meter Replacement/Testing Schedule by Meter Size

		A	B
	Meter Size	**Replacement \Testing Target**	**Testing Validation**
1	16mm	30 years	Statistical Sampling
2	20mm	30 years	Statistical Sampling
3	25mm	25 years	Statistical Sampling
4	40mm	25 years	Statistical Sampling
5	50mm	20 years	Statistical Sampling
6	80mm	5 years	100 % Performance Testing
7	100mm	4 years	100 % Performance Testing
8	150mm	Annual Test	100 % Performance Testing
9	200mm	Annual Test	100 % Performance Testing
10	250mm	Annual Test	100 % Performance Testing
11	300mm	Annual Test	100 % Performance Testing
12	400mm	Annual Test	100 % Performance Testing
13	600mm	Annual Test	100 % Performance Testing

3.1.2 Quality Assurance Program

18. During the 2022 to 2026 PBR period, EWSI will continue to sample and test meters for monitoring metering accuracy and meter life cycle. Implementation of the Meter Quality Assurance program has generated meter performance data from 2000 to 2015. This program confirms that, other than for a few select identified series, EWSI's inventory of meters is operating with a high degree of accuracy. As a result of this high degree of meter accuracy, it was decided in 2004 to extend 16 mm to 50 mm service meter life for an additional five years. Annual sampling of meters will continue to ensure that meter accuracy remains within acceptable limits and also serves to gather additional data to monitor the optimal life cycle of the meter inventory. Once AMI is fully deployed, EWSI will evaluate the optimal life cycle of the meter inventory based on AMI data.

3.1.3 Burst Meters

19. EWSI expects to replace approximately 400 burst meters per year during the 2022-2026 PBR term based on historical averages. EWSI must prioritize the demand for burst meters as these customers are without water until the defective meter is changed. The average over the last few years has ranged from 200 to over 400 per year depending on the weather conditions. Burst meters occur when the customer does not maintain adequate heat in their property, this results in the meter chamber becoming frozen and the meter failing due to the expansion of ice inside the meter. EWSI responds to all customers with burst meters to control flooding and to install a new meter to ensure the customer's water consumption is measured. The number of burst meters in any one year will vary depending on the severity of the winter.

4.0 ALTERNATIVES ANALYSIS

20. Due to EWSI's requirement under Section 8.1, Schedule 2 of the Bylaw, there is no alternative to this program. EWSI must replace meters as they age in order to ensure accurate water consumption data.

5.0 COST FORECAST

21. Table 5.0-1 summarizes the costs of this project. Cost estimates were based on actual product price quotes, actual meter retirement date requirements and management judgment.

22. There will be no costs coded to this program during the 2022-2024 period. Rather, the cost of replacing meters during the 2022-2024 period have been captured under the AMI Deployment project. For project management purposes, it would be challenging to break out the work performed to replace meters and the work performed to install the AMI devices, as these will occur during the same home visit. As a result, EWSI made the decision to include the 2022-2024 costs that normally would have been captured under the Meter Change Out program under the AMI Deployment project instead.

23. The long term cost of the Meter Change Out program reduces by 25% as a result of AMI deployment. The current meter reading devices are pre-fabricated on to the meters, so that the old meter reading device must be retired at the same time that a meter is retired. The meter reading device required for AMI easily detaches from the meter being retired, and attaches to the new meter, so that the AMI meter reading devices do not need to be retired at the same time as the meter. This reduces the overall cost of the meter change out, and therefore reduces the program's cost.

Table 5.0-1
Meter Change Outs Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2025**	B **2026**	C **Total**
	Direct Costs:	1.23	1.26	2.49
1	Contractors	0.90	0.91	1.81
2	Internal Labour	0.16	0.16	0.31
3	Vehicles and Equipment	0.11	0.12	0.23
4	Contingency	0.11	0.12	0.23
5	**Sub-total Direct Costs**	2.40	2.45	4.84
6	Capital Overhead and AFUDC	0.46	0.48	0.94
7	**Total Capital Expenditures**	2.86	2.92	5.78

24. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI typically engages in longer-term agreements with suppliers to effectively manage the supply, quality and cost of required equipment.
- EWSI uses industry standard materials and only stocks limited numbers of variations of materials. As such, EWSI has minimized the need to stock much of the required equipment, reducing the overall costs of all installations and upgrades.
- Continuous efforts to maximize resources through various scheduling opportunities, such as:
  - improved route planning to reduce travel time between scheduled appointments; and
  - “blitzing” meter change outs for specific areas of the City for evening and weekend appointments when customers are home.
- Working with the homebuilders to minimize call times and scheduling efforts by installing meters prior to home owner possession.
- Working to reduce the number of second site visits through various process improvements including:
  - improved confirmation processes with the customer just prior to the scheduled appointment;
  - providing flexibility in appointment times for the customer; and
  - reducing appointment windows to provide more definitive arrival times to the appointment and improve overall customer experience.

- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.

6.0 RISKS AND MITIGATION PLANS

25. The risks associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial Risk - Costs of meter materials change drastically from current costs resulting in budgetary impacts	EWSI engages in long term contracts with suppliers to ensure agreed upon rates. As needed, EWSI can engage EPCOR's supply chain team to source vendors, including an RFP/RFQ process to validate best market price for meters. Careful project management will be applied and should any rate changes take place these impacts will be analyzed and communicated prior to.
2	Financial Risk - Meters fail at a much faster rate than anticipated resulting in a higher number of replacements	EWSI completes meter quality assurance and testing program in accordance with AWWA M9 standards. This testing program has historically provided data which supports that EWSI's meters perform well, allowing for confidence in our chosen lifetimes. However, once AMI is implemented, EWSI will be able to closely monitor meters and better solution any defective meters earlier. At that time, the meter testing program and life cycles can be reviewed and updated as needed.

Appendix F14

EPCOR WATER SERVICES INC.

Water Services
Network PD Transmission Mains Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Network Private Development Transmission Mains Program is an annual program in which EWSI works with key stakeholders – property developers, the City of Edmonton, and other utility agencies – to ensure an orderly development of EWSI's water transmission system. Through this program, developers fund expansions to the transmission system and are subsequently reimbursed by EWSI after the commissioning of the infrastructure to place it in service and the receipt, review, and acceptance of the required supporting documentation.

2. This program is required to: (i) provide funding for expansion of the transmission system which is needed to provide water services to all of EWSI's customers; and (ii) ensure that all expansion or extension of the transmission system will be properly sized for the development being constructed, future development that will branch off of it, and so that all fire protection requirements and system reliability requirements will be met at the different stages of development. Without this program, water standards would not be met in new subdivisions during early construction stages.

3. The cost of this program covers the reimbursement by EWSI to developers of the costs that they incur to complete water transmission system expansions after the infrastructure has been commissioned. It also includes the costs directly incurred by EWSI for engineering and inspection services to ensure that all facilities are constructed in accordance with City of Edmonton Design and Construction standards. This program includes reimbursement to developers for transmission mains that are 450 mm and larger.

4. This program falls under the growth/customer requirements category. EWSI has forecast total program capital expenditures during 2022-2026 at $15.00 million. The increase in cost of $0.62 million over the 2017-2021 PBR Application forecast is mainly attributable to inflation. EWSI forecasts to expand the transmission main system by an average of approximately 2000 meters annually through this program.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

5. Under the current land development process in the City of Edmonton, EWSI is responsible for reimbursing developers for the cost of the design and construction of all water mains 450mm in diameter and larger through the Private Development Transmission Mains Program. The cost

of distribution water mains (sizes 400mm and smaller) is incurred by the land developer who then recovers these costs through lot sales as well as through EWSI's Water Main Cost Sharing Program. Upon final inspection of these assets by EWSI, ownership of the mains are subsequently transferred from the developer to EWSI.

6. Transmission mains sized 450mm and larger are required to transmit adequate water supply over large distances to many neighbourhoods and reservoirs. It is not justified for developers to partially or fully fund these large transmission mains for two reasons: (i) they will not be able to directly service off of them; and (ii) these large transmission mains are the backbone of EWSI's system and support customers beyond the developer's proposed subdivisions. As such, EWSI funds these large transmission mains through the Private Development Transmission Mains Program.

7. This Private Development Transmission Mains program was expanded in EWSI's 2017-2021 PBR Application to include and fully fund water mains with an internal diameter of 450mm. The program now encompasses the full costs of transmission mains sized 450mm and larger. In addition to including reimbursement to developers for cost of transmission mains, this program includes the costs incurred by EWSI to complete a range of engineering activities to effectively interface between the land development industry, the City of Edmonton, and other utility agencies. EWSI's strategy is to work in close alignment with the stakeholders to extend and enhance the water transmission and distribution network to meet the needs for water supply and fire protection in new development areas. An effective planning process by the City of Edmonton, supported by EWSI, will facilitate an orderly progression of development growing outwards from existing serviced areas. EWSI will ensure responsible management of capital expenditures and risks by conducting a careful review of the need for each water transmission project. Water transmission facilities will be constructed in step with orderly development progress, not in advance of development, and in conjunction with road construction where necessary.

2.2 Program Justification

8. This program is required to pay for the expansion of EWSI's growing transmission system as the City of Edmonton grows and to ensure that all expansion to the transmission system will be properly sized for the development being constructed, future development that will branch off of it, and so that all fire protection requirements are met. Without this program, water

standards for serviceability, pressures, and fire protection would not be met in new subdivisions during early stages of development.

9. This program also supports the orderly contiguous development of new subdivisions in the City of Edmonton. It allows EWSI to provide potable water for consumption and firefighting at the level of service expected by the residents and the City. This program supports effective water supply to rapidly developing areas and is responsive to changes in the direction of development progress.

10. This program also supports the City of Edmonton's Planning and Development Process. Developers and the City's consultants are encouraged to propose new methods and materials for the construction of the transmission mains. Furthermore, it ensures contiguous development and expansion of the water network that maintains and supports quality potable water.

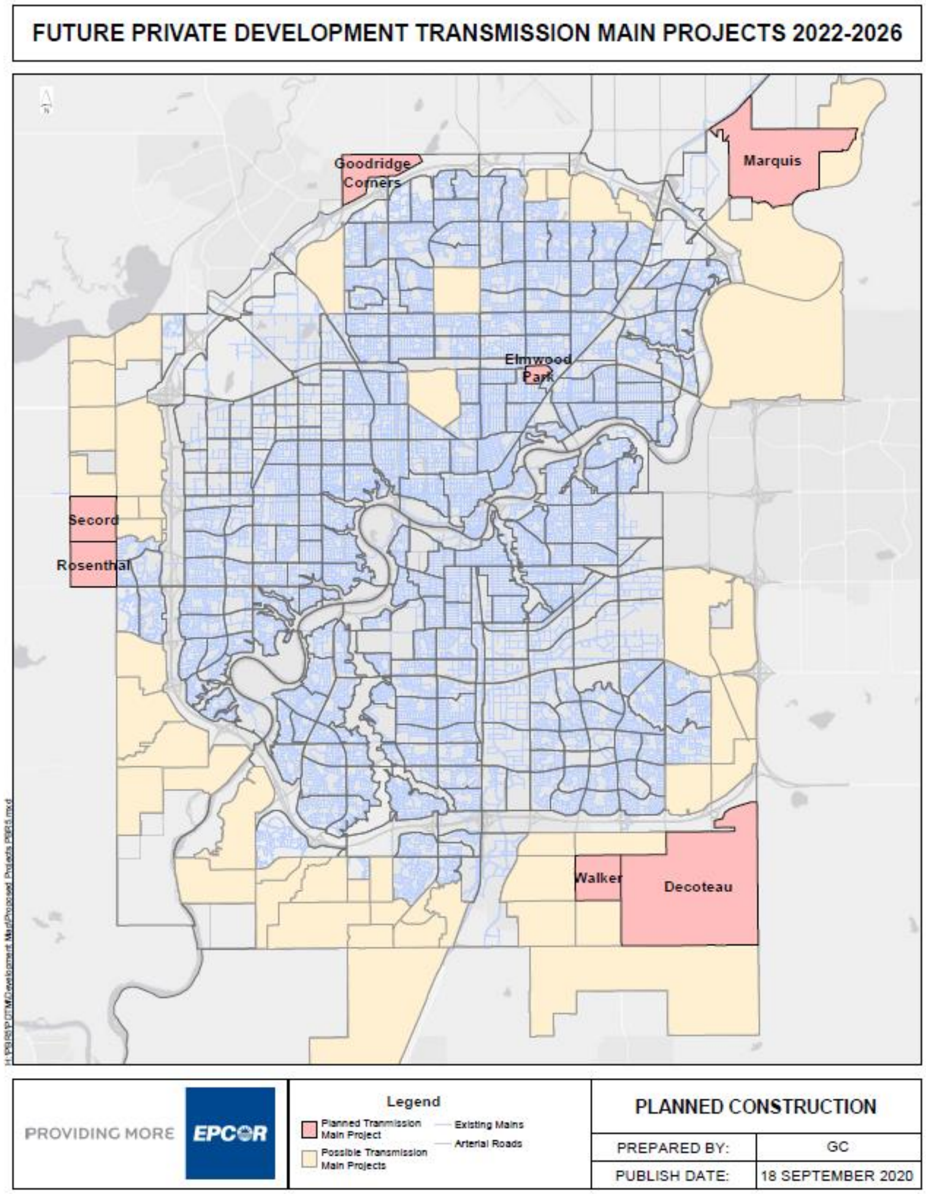
3.0 PROGRAM DESCRIPTION

11. The transmission mains will be designed and constructed by the land developer and their consultants. Engineering drawings for the transmission mains will be submitted to the City through the normal private development process and will be reviewed and approved by EWSI. The developers' consultants will provide all resident engineering services during the design and construction of the water main, but EWSI's inspectors will provide audit inspections of the construction.

12. Developers will initially pay for the entire cost of the design and construction of the mains. Once the infrastructure has passed inspection and is in service, EWSI will then reimburse the developer for the costs of infrastructure equal to and larger than 450mm in diameter. A purchase and sales agreement is required prior to commencing construction and is prepared during the engineering drawing review phase. This agreement contains EWSI's terms and conditions for the purchase of the transmission main.

13. EWSI has prepared a forecast of new water mains based on where development is expected to occur throughout the City of Edmonton over the next five years. Figure 3.0-1 below provides a map of areas within the City of Edmonton where EWSI plans to complete projects under the Private Development Transmission Main Program during 2022-2026. As shown in Figure 3.0-1, there is development expected in all areas of Edmonton. The direction and amount of development will impact the amount of transmission main built, and thus impact the future costs of the Private Development Transmission Main Program.

Figure 3.0-1
Future Development



4.0 ALTERNATIVES ANALYSIS

14. The only alternative to this program is to delay installing transmission mains until they are necessary based on reservoir construction or full build-out requirements; that is when the neighbourhood water demand becomes high enough to justify a transmission main or when supply or discharge lines are needed for a new reservoir. The advantage of this alternative is that the costs will be deferred. However, the primary disadvantage to this is that the costs associated with installation of transmission mains in fully built-up areas is two to three times higher than greenfield installation costs found in the proposed solution, which are the costs of construction

in an undeveloped area. In addition, there is no guarantee of an alignment being available when an area is fully built-out which would result in less optimal installation locations. Lastly, without orderly development of transmission infrastructure on a timely basis, the distribution mains built to service certain neighbourhoods may have to be over-sized to meet the interim servicing requirements.

15. For these reasons, the recommended solution is to continue the Private Development Transmission Mains program because it has the lowest risks.

5.0 COST FORECAST

16. EWSI estimated the per-meter cost of transmission expansion based on historical costs of transmission expansions. EWSI's forecast of transmission development over the next 5 years is based on known projects identified by developers and EWSI, combined with a forecast of projects not yet identified based on growth expectations, as listed in Table 5.0-1. From 2017-2019, 7,992 meters of 450 mm transmission main and 4,765 meters of 600 mm transmission main were constructed. EWSI is projecting a slower pace of growth over the 2022-2026 PBR term.

Table 5.0-1
Forecast Build-Up

		A **Meters**	B **$/Meter**
1	Decoteau - Ellerslie Road - 600mm - 2023	850	1000
2	Marquis Offsite Watermain - 600mm -2022	3000	1425
3	Rosenthal Loop - 450mm - 2025	900	1000
4	Goodridge Corners - 450mm - 2025	300	1000
5	Projects not yet identified - 2022	371	1500
6	Projects not yet identified - 2023	1200	1500
7	Projects not yet identified - 2024	1200	1500
8	Projects not yet identified - 2025	1020	1500
9	Projects not yet identified - 2026	1025	1500

17. The average cost per lineal meter of $1,500/m includes the transmission main itself, contractor and consultant costs, and any works related to the transmission main such as connections to existing system, site restorations, road detours, etc.

18. Table 5.0-2 summarizes the costs of this project.

Table 5.0-2
Network Private Development Transmission Mains Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	3.83	2.49	1.91	2.50	1.60	12.33
2	Internal Labour	0.02	0.02	0.02	0.02	0.02	0.11
3	Contingency	0.77	0.50	0.39	0.50	0.33	2.49
4	**Sub-total Direct Costs**	**4.62**	**3.02**	**2.31**	**3.03**	**1.95**	**14.93**
5	Capital Overhead and AFUDC	0.01	0.01	0.01	0.01	0.02	0.07
6	**Total Capital Expenditures**	**4.63**	**3.03**	**2.32**	**3.04**	**1.97**	**15.00**

19. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will work closely with consultants early in the planning and design phase to ensure the transmission mains will meet our standards and to eliminate unnecessary redundancies.
- Alternative routings, downsizing of mains, and the elimination of mains are considered as part of the planning stages of private development. The routings and sizes are determined based on supplying sufficient fire flows, servicing pressures, and the ability to fill reservoirs.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Contracted services, hired by the consultants in charge of the project, are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.

6.0 RISKS AND MITIGATION PLANS

20. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk – EWSI has no control over the level of construction projects initiated by developers	EWSI has developed a reasonable forecast based on the best available information and will continue to ensure close communication with developers.

Appendix F15

EPCOR WATER SERVICES INC.

Water Services
New Meter Installations Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The New Meter Purchases and Installations Program includes the costs associated with the purchase and installation of meters for new customers expected to connect to EWSI's system during the 2022-2026 PBR period. The new meters are equipped with AMI devices that transmit readings to EDTI's AMI mesh network. These readings are used for billing and other purposes. This program falls under the PBR category of Growth/Customer Requirements.

2. This program is required for EWSI to meet its obligations for service under the *EPCOR Water Services Bylaw #19626* ("the Bylaw") which requires that EWSI meter the water consumption for all its customers. Metering also provides important operational information on water consumption for EWSI, and valuable water consumption feedback to customers. Since AMI devices provide water consumption data at regular (hourly) intervals, rather than a single monthly reading, this data may be used for a variety of purposes. This program is categorized as growth/customer requirements. EWSI has forecast total program capital expenditures during 2022-2026 at $13.88 million, a slight increase from the $13.22 million forecast in the 2017-2021 PBR application.

2.0 BACKGROUND AND JUSTIFICATION

3. Apart from the requirement for EWSI to meter all its water customers in accordance the Bylaw, water metering provides two very specific benefits.

4. First, it provides accurate information to EWSI regarding water consumption. This data is used to create customer bills, forecast future consumption, and analyze water losses. Without this critical data, it would be very difficult for EWSI to operate the water utility in an effective manner.

5. Second, because EWSI's water rates are primarily based on consumption charges, metering provides customers with accurate and timely feedback on their consumption, thereby encouraging responsible water usage.

3.0 PROGRAM DESCRIPTION

6. Prior to 2022, new water meters installed by EWSI since 2007 have been Automatic Meter Reading (AMR) meters with a device called an Encoder Receiving Transmitter (ERT) attached to the water meter. The ERT allows the water meter reading to be transmitted via radio frequency

to the meter reader's hand held device, eliminating the need to enter the premise. Beginning in 2022, the AMR technology will be replaced with Advanced Metering Infrastructure (AMI) technology. The AMI technology equipment is separate from the meter and the ERT device is no longer required as part of the meter installation. This is beneficial as the AMI device and the water meter can be treated as separate components and changed out individually. While there are no direct cost reductions to the New Meter Installation Program, there are overall cost benefits to the Meter Change Out Program to which this program is linked. The following was considered as part of the development of EWSI's forecast of the number of new meters to be installed during the upcoming PBR period:

- 2017-2019 meter installations by meter size (Table 3.0-1)
- Current economic outlook.

Table 3.0-1
2013-2019 Number of Installations

	A **2013**	B **2014**	C **2015**	D **2016**	E **2017**	F **2018**	G **2019**
1 New Installs	6,630	7,610	8,635	7,472	6,359	6,618	6,088

7. Based on this information, EWSI forecasts an average of 5,679 new water meter installations per year under this program.

4.0 ALTERNATIVES ANALYSIS

8. Due to EWSI's requirement under Section 8.1, Schedule 2 of the Bylaw, there is no alternative to this program.

5.0 COST FORECAST

9. Cost forecasts were based on the 2017-2019 actual costs for the New Meter Purchases and Installations program. The basis for the contingency estimate was the current cost of meters and projections based on previous years.

10. The information from 2014-2015 was used to determine the average number of new meter installations in PBR4, creating a forecast of 7,153 new meters annually. Since that time, it is clear that Edmonton was seeing unusual growth from 2014-2016 and that in a typical year, new meter installations are much lower.

11. Using the data from 2017-2019, we can see an average of 6,355 new meters installed annually. However, due to current economic conditions, including the COVID-19 pandemic, EWSI is predicting a decrease in new housing starts over the 2022-2026 term. Current information from CMHC indicates a sharp decrease in the number of new housing starts for Edmonton, with expected recovery starting in 2022. This recovery is expected to be gradual.

12. Accordingly, EWSI has applied an 11% reduction in the number of new housing starts expected annually over 2022-2026, to create a forecast of 5,759 new meters per year.

13. Table 5.0-1 summarizes the costs of this project. Cost estimates were based on actual product price quotes, historical meter requirements, projected growth and management judgment.

Table 5.0-1
New Meter Installations Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	1.46	1.50	1.53	1.57	1.61	7.67
2	Internal Labour	0.63	0.65	0.67	0.68	0.70	3.32
3	Vehicles and Equipment	0.11	0.12	0.12	0.12	0.12	0.60
4	Contingency	0.11	0.11	0.12	0.12	0.12	0.58
5	**Sub-total Direct Costs**	**2.31**	**2.38**	**2.44**	**2.50**	**2.55**	**12.17**
6	Capital Overhead and AFUDC	0.33	0.33	0.34	0.35	0.36	1.71
7	**Total Capital Expenditures**	**2.64**	**2.71**	**2.78**	**2.85**	**2.91**	**13.88**

14. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI typically engages in longer-term agreements with suppliers to effectively manage the supply, quality and cost of required equipment.
- EWSI uses industry standard materials and only stocks limited numbers of variations of materials. As such, EWSI has minimized the need to stock much of the required equipment, reducing the overall costs of all installations and upgrades.
- Continuous efforts to maximize resources through various scheduling opportunities, such as:
  - improved route planning to reduce travel time between scheduled appointments.

- Working with the homebuilders to minimize call times and scheduling efforts by installing meters prior to home owner possession.
- Working to reduce the number of second site visits through various process improvements including:
  - improved confirmation processes with the customer just prior to the scheduled appointment;
  - providing flexibility in appointment times for the customer; and
  - reducing appointment windows to provide more definitive arrival times to the appointment and improve overall customer experience.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.

6.0 RISKS AND MITIGATION PLANS

15. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial Risk – Costs of meter materials change drastically from current costs resulting in budgetary impacts	EWSI engages in long term contracts with suppliers to ensure agreed upon rates. Careful project management will be applied and should any rate changes take place these impacts will be analyzed and communicated prior to.
2	Financial Risk – Housing market fluctuates dramatically resulting in budgetary impacts	EWSI has found based on experience that although the housing market may fluctuate and impact a specific budget year, it does not typically have a great budgetary impact when considering the budget on a five year cycle.

Appendix F16

EPCOR WATER SERVICES INC.

Water Services
Obsolete Hydrant Replacements Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EWSI provides the City of Edmonton Fire Rescue Services with fire protection service that is essentially a standby service and available on demand. EWSI must be ready to provide adequate water quantities and pressures at all times throughout its distribution system for firefighting purposes. Fire hydrants and the associated waterworks infrastructure are owned by EPCOR.

2. The Obsolete Hydrant Replacements Program covers the replacement of inoperable hydrants, only after an evaluation has concluded that the hydrant cannot be repaired. Failure to complete these repairs within 30 days would place EWSI in violation of the terms of the agreement with Fire Rescue Services (FRS).

3. This project is included in the reliability / life cycle category and EWSI has forecast total program capital expenditures during 2022-2026 at $8.44 million. EWSI has no control over the number of hydrant replacements performed each year. The projected cost of the program in the 2017-2021 PBR Application was $4.38 million to replace a projected 50 hydrants per year and the actual spend over 2017-2021 is projected at $9.69 million. The increase in projected costs between the 2017-2021 PBR Application and the 2022-2026 PBR Application is the result of an increase in the amount of hydrants needing to be replaced. EWSI is forecasting to replace 75 hydrants annually under this program in the 2022-2026 PBR. Actuals hydrants replaced for 2017 was 69, 2018 was 76, 2019 was 83, and as of October 29, 2020 76 hydrants have been replaced in 2020.

2.0 PROJECT DESCRIPTION

2.1 Background

4. The EPCOR water distribution system in Edmonton currently has 21,512 fire hydrants. 400 are considered obsolete, which means these specific types of hydrants have no replacement parts. Further, 160 of these 400 hydrants are slide gate hydrants which require excessive force to operate. All slide gate hydrants will have been replaced by the end of the 2022-2026 term. A recent infrastructure report shows the average age of all the fire hydrants in EWSI's system is 25.2 years of age. The average age of fire hydrants in the system is an indicator of the overall system condition and informs replacement planning. EPCOR has a FRS target of not exceeding more than 30 days out of service for hydrants within the City of Edmonton. EWSI has replaced 230 hydrants between 2017 and 2019. As shown in Table 2.1-1, an average of 77 hydrants have

been replaced annually compared to a PBR projection of 50 per year. All hydrant replacements are completed on a reactive basis, after it is verified that an above ground repair cannot be completed with the hydrant being out of service.

Table 2.1-1
2017-2020 Number of Hydrant Replacements

	A **2017**	B **2018**	C **2019**	D **2020**[1]	E **2017-2019 average**
1 Hydrant Replacements	69	76	83	76	77

2.2 Project Justification

5. Leaving inoperable fire hydrants in the water network for longer periods of time would create a backlog and could have a negative impact on fire protection in an area, increasing the risk of damage in the event of a fire. Hydrants are only replaced on a reactive basis, and prioritized in order to meet the targets in the FRS contract. If these replacements were not completed within 30 days, EPCOR would be in violation of the terms of the agreement with FRS and potentially putting properties at risk in the event of a fire.

3.0 PROJECT DESCRIPTION

6. When a hydrant is determined to be inoperable, through an inspection or damage report, it is taken out of service and the deficiency is evaluated. If the hydrant cannot be repaired through regular maintenance or repairs, it will be flagged for full replacement. If an obsolete hydrant is identified as inoperable, it will be identified for replacement right away due to the lack of replacement parts available.

7. If a hydrant is deemed to be inoperable as a result of damage by a third party (e.g., hit by traffic), attempts will be made to recoup the costs from the responsible party.

4.0 ALTERNATIVE ANALYSIS

8. Failure to replace inoperable hydrants is not an option, as per EWSI's contract with the City of Edmonton, Fire Rescue Services.

5.0 COST FORECAST

9. The proposed budget is required in order to replace 375 hydrants over the 5 year PBR period. The projected average of 75 hydrants per year is very close to the historical observed average of 2017-2019 of 77 hydrants per year, shown in Table 2.1-1. The cost of obsolete hydrant

replacement for 2022-2026 has been calculated based on the actual average cost observed in 2020 of approximately $18,000-$20,000 per hydrant replacement. The projected costs are shown in Table 5.0-1.

Table 5.0-1
Obsolete Hydrant Replacements Program
2022-2026 Program Capital Expenditures
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	0.17	0.17	0.18	0.18	0.19	0.90
2	Internal Labour	0.74	0.76	0.78	0.80	0.81	3.90
3	Vehicles and Equipment	0.28	0.30	0.30	0.31	0.31	1.51
4	Contingency	0.12	0.12	0.13	0.13	0.13	0.63
5	**Sub-total Direct Costs**	**1.31**	**1.36**	**1.39**	**1.43**	**1.45**	**6.93**
6	Capital Overhead and AFUDC	0.29	0.29	0.30	0.31	0.32	1.50
7	**Total Capital Expenditures**	**1.60**	**1.65**	**1.69**	**1.74**	**1.76**	**8.44**

10. EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISK AND MITIGATION PLANS

11. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Customer Service Risk – service disruptions. Replacement of a hydrant requires a 3-6 hour temp shutdown to replace a hydrant safely	Notification to customers
2	Environmental Risk – Hydrants can leak which can cause chlorinated water onto the roadways.	A quick response to isolate the hydrant by closing the hydrant control valve to isolate the leak

Appendix F17

EPCOR WATER SERVICES INC.

Water Services
Obsolete Valve Replacements Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. Water distribution systems are comprised of a number of components, including pipe and control valves. Control valves on these water distribution systems sometimes deteriorate at a quicker rate than the piping system.

2. All valves replaced under the Obsolete Valve Replacements Program will have a deficiency that renders them inoperable. Each deficient valve in the system is first evaluated to determine if it can be returned to an operable condition through regular maintenance and surface repairs.

3. Without a valve replacement program, the number of inoperable and deficient valves in the system would continue to increase, creating a backlog of work. If valves are left inoperable, crew response times are adversely affected, the number of customers affected by an emergency outage increase significantly and a larger volume of water is released during a failure event.

4. This project is included in the reliability / life cycle category and EWSI has forecast total program capital expenditures during 2022-2026 at $11.60 million. EWSI is forecasting to replace 60 valves and 50 valve casings annually under this program.

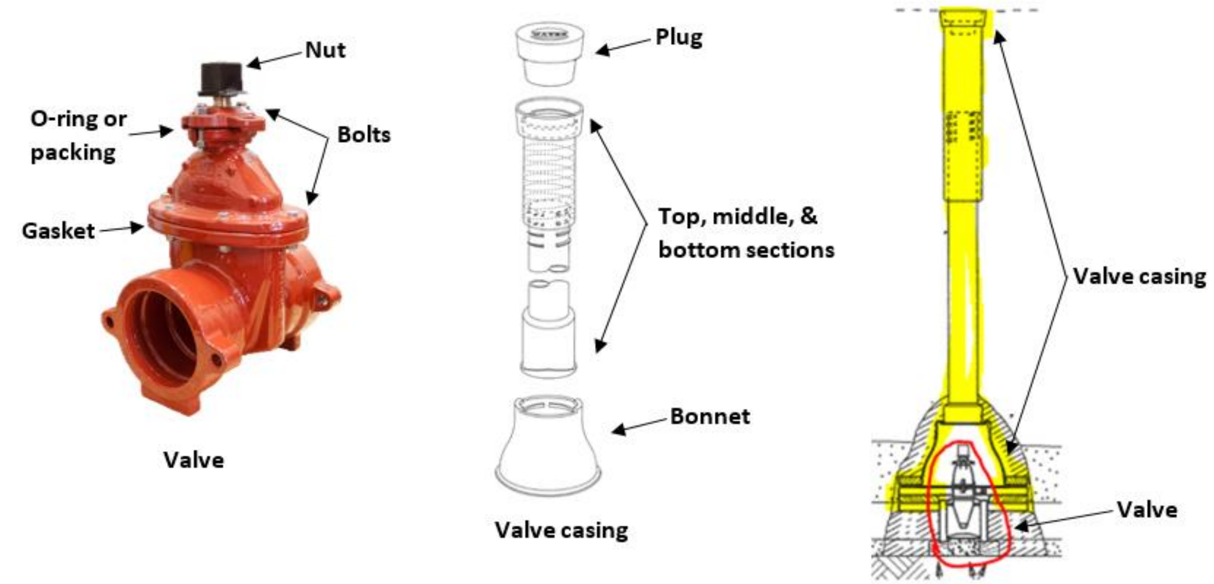
5. The increase of $7.48 million over the cost forecast for the 2017-2021 PBR Application is the result of three factors: (1) actual per-valve costs higher than previously forecast (2) number of valve replacements higher than previously forecast and (3) broadened program scope to include replacement of just the valve casing, which previously was recorded as an operational cost.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Background

6. Water distribution systems are comprised of a number of components, including pipe and control valves (Figure 2.1-1). Control valves on these water distribution systems sometimes deteriorate at a quicker rate than the piping system. Deterioration of valves occurs on water distribution systems, regardless of the pipe material to which the valves are connected.

Figure 2.1-1
Valve Components



7. Current programs such as unidirectional flushing (UDF) and hydrant purging identify defective valves on an ongoing basis. Over a five year period, nearly every valve is exercised at least once to determine whether it is functioning. When a valve is found to be broken, the operations group will first determine whether a surface repair can be executed. Otherwise, the excavation group must dig the valve and/or valve casing up. In some cases, only the valve casing requires replacement. In other cases, both the valve and valve casing must be replaced. In 2019 EWSI created a critical valve list which outlines non-operable valves in the distribution system that has a major effect on the water network. This program will be used to replace valves that are on the critical valves list.

8. In 2019 EWSI created a critical valve list which outlines deficient valves in the distribution system that has a major effect on the water network. This program will be used to make risk based decisions to replace/repair valves that are on the critical valves list.

9. With a valve casing replacement comes the refurbishment of the actual valve as well to extend the life of it. Refurbishing the valve means changing the bolts, packing, and gaskets on the valve.

10. In addition, EWSI continues to provide, at no charge, casings and plugs to the City of Edmonton and their contractors when they complete road repairs. This is done for several reasons:

- It allows the road repairs to be finished within their timeframe; and
- It ensures we have good quality casings and plugs, as existing ones are often damaged by the road repairs and paving. In many instances, we do not have the resources to respond on short notice to replace these throughout the city just before paving takes place. It is more cost effective to provide materials to paving contractors.

11. The 2017-2022 PBR forecast was based on an estimate of 45 valve replacements per year. As shown in Table 2.1-1, the actual number of valve replacements averaged 65 per year over the 2017-2019 period.

Table 2.1-1
2017-2020 Number of Valve Repairs and Replacements

		A **2017**	B **2018**	C **2019**	D **2020**[1]	E **2017-2019**
1	Valve Repairs	124	91	109	63	108
2	Valve Replacements	71	50	74	77	65

[1] 2020 numbers year to date as of September 24, 2020 – not included in the 2017-2019 average as pro-ration is not simple due to seasonality of program activity.

12. Valve casing replacements were formerly recorded as an operating cost after a comprehensive review of the activity has been completed but has been transferred over into this capital program.

13. This program is justified based on financial, environmental and safety risks.

14. Without a valve replacement program, the number of inoperable and deficient valves in the system would continue to increase creating a backlog of work. A major concern with leaving inoperable valves in the system is that it can significantly impact the ability of emergency crews to respond quickly to isolate a water main in the event of a failure. Inoperable valves will result in an extended shutdown area, which can significantly increase the number of customers affected by an emergency outage. It may also result in a longer isolation response time and larger volume of water released during a failure event, which can increase damage due to flooding and increased environmental concerns related to the release of chlorinated water to the environment or storm collection system.

15. Depending on the type of deficiency, inoperable valves in the system can also create other problems. For example:

- If EWSI does not repair a valve that has broken in the closed position, this creates a dead end in the system which decreases the flows in the area, resulting in reduced fire protection and potential for stagnant water to cause water quality concerns; and
- If EWSI does not replace a valve that is actively leaking, it can result in environmental concerns due to the discharge of chlorinated water onto the roadway, as well as public safety concerns due to pooling/flooding in warm conditions and ice build-up in freezing conditions.

16. Excavation of these valves under emergency conditions has historically proven to be approximately 30% higher in cost, adversely affecting customer satisfaction metrics and impacting operations due to extended repair times. Without ongoing upgrading of these valves, system operations would be seriously and negatively impacted.

3.0 PROGRAM DESCRIPTION

17. All of the valves replaced under this program will have a deficiency that renders them inoperable. Each deficient valve in the system is first evaluated to determine if it can be returned to an operable condition through regular maintenance and surface repairs. If not, it is identified for a full replacement.

18. Typically, around 50% of the valves EWSI replaces are due to emergent issues (leaking, broken in the closed position, non-operable and required for a system isolation). The remaining valves will be prioritized for replacement based on overall risk to the water network, considering the overall impact of a delayed response to a leak or failure of the water network in a given area (customer impact, environmental impact, traffic impact, potential for property damage, etc.).

19. The scope of the program includes distribution capital valve replacements, including:

- Full valve replacements (replace valve & casing, install anode, tie-into existing pipe with couplings).
- Valve casing replacements (plug, top/middle/bottom sections, bonnet and valve box) along with other necessary valve repairs (replace body bolts/O-ring/gasket, fix packing leak).
- Necessary replacements of check valves or PRVs.

20. The scope of this program does not include:

- Routine inspection, operation and repairs of the valves in the water network.

- The replacement of small diameter service valves (CC valves or ball valves), 50mm and smaller.
- The replacement or refurbishment of large diameter transmission valves, chambers and other appurtenances.
- New valve installations.

4.0 ALTERNATIVES ANALYSIS

21. There are no alternatives to this project as inoperable valves must be replaced in order for the water distribution system to continue functioning.

22. Inoperable valves are risk ranked based on a number of considerations including environmental, customer impact, financial and the operational ability to manage the transmission main. EWSI repairs the highest risk valves first, and aims to maintain a consistent level of deficient valves in the system in order to ensure maximum customer benefit for the cost of the program.

23. Delaying this project would result in decreased system reliability and safety as well as increase costs due to:

- Reactive emergency repairs;
- Inability to effectively isolate system for project/maintenance work;
- Higher risks of public safety and environment due to inability to effectively isolate system leaks; and
- High risks of poor water quality due to valves that are broken in the closed position.

24. Deficient valves could be fixed on a reactive basis, however this would increase costs due to emergency response.

5.0 COST FORECAST

25. This program was forecast to cost $4.12 million in the 2017-2021 PBR, however EWSI is projecting to have actually spent $8.32 million. The actual costs are higher than forecast because both the cost per valve and the number of valves were higher than anticipated.

- <u>Cost per Valve</u>: The construction cost of valve replacements for the 2022-2026 PBR has been projected at approximately $15,000-20,000/valve, based on the actual average costs observed in 2020. These projections incorporate the higher contractor costs for hydrovac, paving and concrete restorations that led to higher than expected costs in the 2017-2021 PBR term.

- Number of Valves: For the 2022-2026 PBR term, EWSI is forecasting 60 valve replacements and 50 valve casing replacements per year.

26. Casing and Plugs Provided to the City of Edmonton: The exact quantities and locations required for casings and plugs provided to the City of Edmonton is dependent on the City's paving program, however, an estimate can be made on the basis of historical usage and projected city-wide paving activity. Based on these factors, annual requirements are projected at approximately $150,000 (approximately 500 top sections).

27. EWSI is forecasting a cost of $11.60 million over the 2022-2026 PBR term for this program. This is $3.28 million higher than the projected $8.32 million 2017-2021 PBR term spend because the scope of the program has been expanded to include valve repairs. Valve repairs have previously been recorded as an operational expense.

28. The projected costs are shown in Table 5.0-1.

Table 5.0-1
Obsolete Valve Replacements Program
2022-2026 Program Capital Expenditures
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	0.25	0.26	0.26	0.27	0.28	1.31
2	Internal Labour	1.08	1.12	1.15	1.18	1.20	5.73
3	Vehicles and Equipment	0.42	0.44	0.45	0.46	0.46	2.23
4	Contingency	0.02	0.03	0.03	0.03	0.03	0.13
5	**Sub-total Direct Costs**	**1.78**	**1.84**	**1.89**	**1.93**	**1.96**	**9.40**
6	Capital Overhead and AFUDC	0.42	0.43	0.44	0.45	0.46	2.20
7	**Total Capital Expenditures**	**2.19**	**2.27**	**2.33**	**2.39**	**2.42**	**11.60**

29. Contingency of 1.3% is based on a high risk approach to fix valves that could be in higher traffic area’s which can increase costs.

30. EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

31. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk – Leaking valves must be repaired as soon as possible to avoid customers being without water. A higher than projected proportion of repairs being completed on overtime is a key financial risk.	Responding to these leaking valves as soon as they are reported
2	Safety Risk – Excavating a valve is a hazardous activity due to the depths of a valve	Proper shoring and following SOP's (Standard Operating Procedures) mitigates these risks

Appendix F18

EPCOR WATER SERVICES INC.

Water Services
Private Development Construction Coordination
Program Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Private Development Construction Coordination Program is an annual Program which includes the costs associated with EWSI's activities to coordinate private water main development. In this process, private developers plan, design, and construct new water assets. EWSI reviews these plans and inspects the new water assets during construction. Finally, once these assets have gone into service and final inspection has been completed, EWSI takes over these new assets. This program falls under the PBR category of Growth/Customer Requirements.

2. This Program is essential to the orderly development of the water system, ensuring not only that the City of Edmonton Design and Construction Standards are met, but also that water mains will be constructed with consideration for future development requirements. As EWSI will assume ownership of these assets upon completion, it is essential that EWSI be involved throughout the planning, design, and construction process to ensure proper asset information is available for future operation and maintenance activities.

3. EWSI forecasts gross capital expenditures of $9.73 million for this project. This covers the internal labour costs associated with construction coordination activities undertaken by EWSI from the planning phase to the point at which EWSI takes ownership of the new water infrastructure. This cost is partially offset by contributions from the City of Edmonton in the form of inspection fees collected from developers. These contributions are intended to cover a portion of the costs associated with the program, specifically engineering drawing review, inspection, and crew time and are provided by the City of Edmonton at the time of servicing agreement signing. The capital expenditures net of contributions have decreased by $5.71 million from the 2017-2021 PBR forecast due to inspections staffing changes and lower than expected crew support requirements.

4. This Program does not include the cost of constructing the water infrastructure. Water infrastructure construction is funded by private developers as part of the costs of their development.

5. The work contained within the program scope includes land planning, engineering, and inspection/certification tasks. The mix of the tasks varies year-over-year based on the focus of the development industry, with increases in inspection/certification being offset by decreases in planning and engineering. As the mix of work types of this Program is not within the control of EWSI, as development decisions are made external to EWSI, there is some uncertainty as to the

rates of recovery as inspection fees are coupled to construction proceeding; however, EWSI has used the previous work load and fee receipt data as a basis for the cost forecast. This is a reasonable approach because although economic conditions are difficult to predict from year to year, this is a long term program with many years of data that can be utilized to estimate future costs, and the nature of the work results in consistent workload over a PBR period.

2.0 BACKGROUND AND JUSTIFICATION

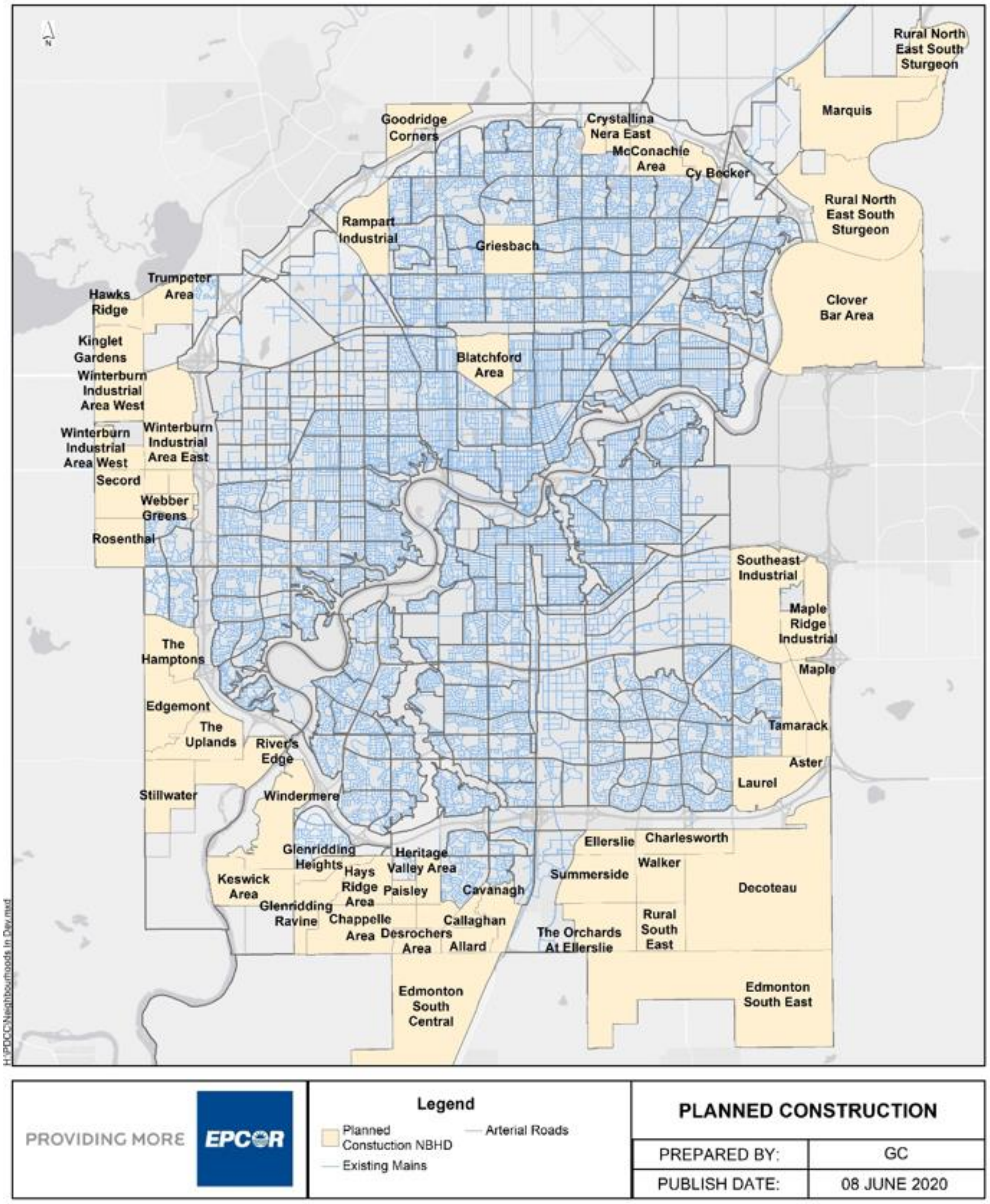
2.1 Program Background

6. As part of the City of Edmonton's Area Planning and Subdivision approval process, EWSI is responsible for the orderly, functional, and efficient expansion of the water supply system in Edmonton through private development. This is achieved by EWSI's ongoing activities such as drawing reviews and approvals, land development responses, construction inspections and recording of constructed water infrastructure. These activities are required to eliminate conflict between water and other utilities and to ensure design and construction of new developments complies with EWSI's standards as defined in the City of Edmonton Design and Construction Standards. The workload for this Program depends on the level of private development which is subject to changes in the economy and housing market, and therefore can fluctuate from year to year.

7. Recent market information (2020) provided by the Urban Development Institute illustrates a decrease in residential construction (single family) and number of sales for this year. To date, although there have been fewer new Program projects (based on engineering drawing submissions) proposed than last year, significant carry-over has resulted in a shift to finalizing project reviews, construction, inspections, and turning over the infrastructure to various City departments.

8. Although, it is expected that a slow-down in residential construction (especially single family homes) will be observed during the current period of economic uncertainty, there is also potential for different types of growth, along with a certainty of development upon economic rebound. Edmonton has diversified as a city over the last 5 years, with expanding development within a number of regions within the city boundary as shown in Figure 2.1-1. Furthermore, re-development in mature neighbourhoods, the growth of the downtown core, and the annexation of a portion of Leduc County may provide additional opportunities for future growth.

Figure 2.1-1
Private Development Planned Construction 2022–2026



9. Additionally, the City of Edmonton and its stakeholders have renewed their focus on finding efficiencies and enhancing the development process. This has resulted in a number of process redesign initiatives and commitments from the various City departments to provide reasonable review timelines, inspection processes, and accelerated final acceptance for private development projects. Recent progress in this area includes:

- Weekly meetings between all departments prior to the circulation of engineering drawings, development permits, and land development applications;
- Movement to a digital process for development permits and a new digital process for land development applications;
- Requirement to meet review, inspection, and acceptance timelines as determined by the City of Edmonton;
- Review of current City of Edmonton Design and Construction Standards; and
- Review of current City of Edmonton Inspection Fees.

10. Furthermore, EWSI has implemented a number of internal processes and procedures over the last few years in response to the concerns with processes, timelines, and expectations raised by the development industry and the City of Edmonton. These updates include:

- Increased communication with consultants and developers.
- Synergies implementation between water and drainage inspections team, with the target to become a single, cohesive team inspecting all deep utility installations.
- Updates to the drawing review process and LDA process.
- Increased collaboration with consultants and developers on design, construction, and inspection items earlier in the process, thereby streamlining review and inspection times.
- Focus on approving drawing submissions earlier in the process with conditions, thereby eliminating duplicate reviews and streamlining the process.
- Focus on hazardous energy isolation (HEI), including the requirements around the operation of boundary valves.
- Improvements to the commissioning process for new water mains

11. To summarize, there are a number of factors that contribute to the expectations for the private development process. These include:

- The standard City of Edmonton process which facilitates the development of new infrastructure by private developers.
- A general trend in an increase in the number of private development projects.
- The types of projects, which comprise more complex developments, including commercial and infill.
- Increased attention from the City of Edmonton to update and review development processes and procedures, to improve the development process.

- Increased focus by EWSI to improve its own internal processes and procedures for development in response to requests made by industry and the City of Edmonton.

12. All of these expectations point to the requirement for a robust Program to provide support for private development within the City of Edmonton. This Program provides an opportunity for EPCOR Water to complete various review activities in order to eliminate potential utility conflicts and to ensure the design and construction of new developments complies with EWSI's standards as defined in the City of Edmonton Design and Construction Standards. This Program also provides EWSI the opportunity to collaborate with private development stakeholders through committees, meetings, and other communication avenues, in order to promote and protect our interests as Edmonton develops into a world class city.

2.2 Program Justification

13. Due to the changing nature of the type and complexity of private development projects, and concerns raised by the development industry, the City of Edmonton has placed increased priority on the commitments from the various City departments to provide reasonable timeframes in which to complete review, inspection, and final acceptance for private development projects.

14. A robust Private Development Coordination Program is required to provide support for private development within the City of Edmonton. This Program provides an opportunity for EWSI to complete various review activities in order to eliminate potential utility conflicts and to ensure the design and construction of new developments complies with EWSI's standards as defined in the City of Edmonton Design and Construction Standards. If these standards are not met, EWSI (and therefore its customers) could be exposed to significant risks as the future owner and operator of these water distribution assets. These risks to EWSI include public health risk, environmental risk and regulatory risk associated with water quality violations. For example, improper construction and commissioning of water infrastructure may result in future large scale water quality concerns (i.e. more than 150 customers impacted) due to failures on turbidity, chlorine, or bacteriological testing. These failures can be attributed to inadequate disinfection procedures, insufficient water flushing of the infrastructure, or unsuitable boundary valve management. Furthermore, improper construction and failure to follow EWSI standards may lead to future water main breaks with the potential for customer complaint/claims and environmental issues associated with potential release of chlorinated water. There is also a risk

that potential future operation and maintenance would be compromised because of a lack of readily available information on assets for which EWSI had no direct input into constructing.

3.0 PROGRAM DESCRIPTION

15. EWSI plays a significant coordination role to support a private development project from the beginning of the life-cycle of the project (planning phase) until the final acceptance of infrastructure as EWSI's. This Program includes EWSI's costs associated with providing the following activities required as part of the private development process:

- Reviewing and approving proposed plans and designs for areas, neighborhoods, and subdivisions;
- Inspecting construction to ensure compliance with regulations and standards;
- Recording new water infrastructure to maintain accurate records for operation and maintenance activities;
- Operating valves and hydrants during FAC inspections to ensure there are no deficiencies; and
- Reviewing and approving proposed plans and designs for infill projects.

16. The following items are not included in this program:

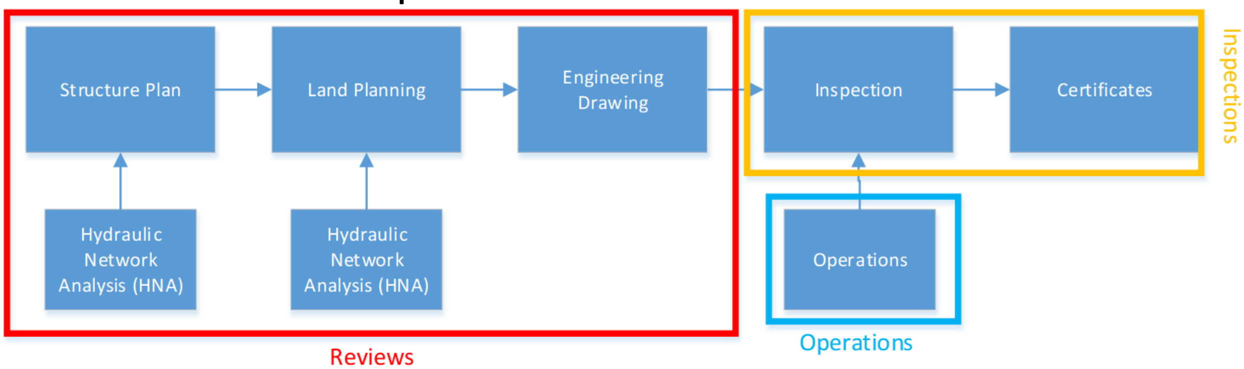
- Providing any consulting or contracting services for a project including the completion of planning, design, and construction, and all other items associated with a development to the satisfaction of the City of Edmonton and its various departments.
- Providing any project management services for a development including: scheduling, budgeting, cost estimation, safety management, and cost recovery.
- Providing initial funds for the financing of a project beyond EWSI's two programs that allow developers to re-coup some of the funds associated with the installation of new water mains for private development projects. These programs are the Water Main Cost Sharing program and the Private Development Construction Coordination Program described in Appendix H-11.

17. As the proponent of the project, private developers are responsible for the majority of planning, design, and construction activities. EWSI is responsible for completing review and inspection throughout this process; ensuring water system infrastructure is protected and that public health and safety is maintained.

18. The tasks contributing to the private development reviews are structure plan review, land planning reviews, and engineering drawing reviews (Figure 3.0-1). Tasks like hydraulic network

analysis review and land administration reviews that support the review processes will need to be housed within other operational areas as operating expenses, rather than as part of the capital program.

Figure 3.0-1
Development Workflow and Work Classification



19. Certification is one of the last stages in a project and workload early in the year is dependent on the previous year's construction. During busy periods, carry over from prior years can be expected. Inspection activities involve private development inspectors, and will involve Operations teams as needed only for isolation activities rather than the historical involvement in final acceptance inspections.

20. In-house activities are required to support a private development project from the beginning of the life-cycle of the project (planning phase) until the final acceptance of infrastructure as EWSI's. Review, inspection, and recording activities are required as part of this process. All of these activities are funded through the Private Development Construction Coordination Program.

21. This Program also records contributions from the City of Edmonton. These contributions are expected to cover a portion of the inspection, engineering drawing review, and crew costs. Typically, a minimum of approximately $300,000 in contributions has been received each year, however there has been a downward trend in inspection fee collection due to a smaller number of development stages proceeding. It is important to understand however that contributions are provided to EWSI each time a servicing agreement is signed and therefore contributions will fluctuate, depending on the time of year or the current economic conditions. Higher recoveries are seen in later winter/early spring as developers prepare for the year's construction, and again in late fall as some developer's prepare for the next year's construction and final fees for projects

initiated during the summer are collected. In years where there is a focus on planning and engineering, fees tend to be lower as the fees are collected as construction is initiated.

22. Furthermore, there is an anticipated contribution of approximately $25 to $30 million in new assets (mains, hydrants, and services) that will become part of the Water Distribution and Transmission network as part of the Program. This valuation is net of the Water Main Cost Sharing rebates and Private Development Transmission Main fully funded infrastructure.

4.0 PROGRAM ALTERNATIVES ANALYSIS

23. The following alternatives are available for consideration.

Alternative 1: Status Quo

24. Complete an annual Private Development Construction Coordination Program to provide funds for reviews, inspection, and recording activities.

- Major Benefit: EWSI can be involved in all aspects of the development process, thereby allowing the optimization of system expansion and ensuring the most cost-effective system is constructed accounting for future growth outside of development boundaries, including asset protection, operational concerns are addressed, and ensuring the City of Edmonton Design and Construction Standards are met.
- Potential risk event: As this Program is dependent on the economy, there is a risk that project hours will change based on annual private development.

Alternative 2: Recommended Option

25. Complete a reduction in an annual Private Development Construction Coordination Program that provides funds for reviews, inspection, and recording activities.

- Major Benefit: EWSI can be involved in most aspects of the development process, meeting the requirement to protect EWSI interests, and ensuring the city of Edmonton Design and Construction Standards are maintained.
- Potential Risk Event: Potential for the City of Edmonton Design and Construction Standards to not be followed, due to inspector capacity, resulting in future operational and maintenance concerns. Additional concerns regarding drawing review timelines as reviewer capacity is insufficient to have a timely turn around. Further concerns regarding the degree to which operations crews can supply maintenance on projects for final certification inspections.

Alternative 3: Third-Party Solution

26. A third party completes private development activities such as reviews, inspections, and recording activities.

- Major Benefit: EWSI is not responsible for the completion of any review, inspection, or recording activities.
- Potential Risk Events: Potential for City of Edmonton Design and Construction Standards are not followed resulting in future operational and maintenance concerns. Additional concerns regarding lack of readily available future asset information.
- This option exposes EWSI to risk as we are the future owners of private development water assets and would be responsible to operate and maintain these assets.
- Lastly, this option poses a high risk of water quality violations as according to the approvals and various certifications with the Province of Alberta, only EWSI is certified to complete various commissioning activities without provincial review.

Alternative 4: Do Nothing

27. Do not complete any type of review, inspection, or recording activities for private development projects.

- Potential Risk Events: Potential for City of Edmonton Design and Construction Standards to not be met, potential future operation and maintenance concerns, lack of readily available information on assets that would eventually become EPCOR's.
- This option would expose EWSI to a lot of risk including public health, environmental, and regulatory risk associated with water quality violations as we would be supplying the product that would flow through these developments once commissioning had taken place. Furthermore, EPCOR would be the future owner of these assets and would be responsible to operate and maintain these assets.

Conclusion

28. Alternative 2 was selected because it allows for the prudent balancing / allocation of limited resources without an immediate increase in rates for the customer.

5.0 COST FORECAST

29. The costs of this Program are almost exclusively made up of labour charges. As such, in order to estimate the future Program expenditures a detailed analysis of historical charges was

undertaken. This analysis included analysis of total Program project hours (annual basis), the project hours type (e.g., administration, inspection, etc.) and analysis of historical trends (e.g., increasing crew costs). From this information, a prediction of future project hours was developed and then used to forecast the future Program cost, based on employee hourly salaries. Management judgement was used as part of the forecasting process, particularly when considering the impacts of future economic conditions and current EWSI initiatives that could affect this program (e.g., the hiring of additional private development staff in order to keep up with levels of development or expectations of the development industry, etc.).

30. Historical Program data was used to forecast the internal resource costs. Vehicle costs for the inspection vehicles were based on the EWSI standard mileage rate of $0.5/km. Internal vehicle costs were developed based on recorded crew costs from historical data.

31. Costs for the Program are determined using historical hours. There have been staffing changes through the past PBR term, with the reduction in head count of 2 individuals. There is also a fluctuation year-over-year in the inspection fees, which directly affects the direct recoveries of the Program. These too were based on the trends of the 2018-2019 financial period as discussions with various developers is indicating a similar level of development within the 2022-2026 period.

32. Due to the current economic condition there is an anticipated reduction in the level of service provided as part of the Private Development Construction Coordination Program. The projected costs are shown in Table 5.0-1.

Table 5.0-1
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	0.03	0.03	0.03	0.03	0.03	0.16
2	Internal Labour	1.11	1.15	1.18	1.21	1.24	5.87
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.01	0.03
4	**Sub-total Direct Costs**	**1.15**	**1.18**	**1.21**	**1.24**	**1.27**	**6.06**
5	Capital Overhead & AFUDC	0.70	0.72	0.73	0.75	0.77	3.67
6	Contributions	(0.19)	(0.20)	(0.20)	(0.21)	(0.21)	(1.00)
7	**Total Net Capital Expenditures**	**1.66**	**1.70**	**1.74**	**1.78**	**1.83**	**8.73**

33. EWSI's approach to minimizing these expenditures involves the following:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- Streamlined scope with more ownership on the development to ensure compliance with Standards and EWSI requirements.
- Rely heavier on third party consultants to provide on-site supervision during construction; reduce site presence of EPCOR staff.
- Remove operations support from capital program.
- Remove support for City-driven initiatives such as Building Great Neighbourhoods or Industrial Servicing Strategy from program scope.
- Move to full-cost recovery for special projects led by the City of Edmonton under Memorandums of Understanding and Government of Alberta under Construction Agreements.

6.0 RISKS AND MITIGATION PLANS

34. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Public Health and Environment Risk – increased risk of contamination events and release of chlorinated water to water bodies.	Providing increased ownership and expectations on third party engineering consultants. Prevent work from occurring without inspector on site (risk of contraventions and reputational impacts).
2	Reputation Risk – decreased responsiveness and inability to meet industry expectations and City of Edmonton review/response timelines.	Provide overtime as required or renegotiate timelines with stakeholders.
3	System Reliability Risk – decreased understanding of system configuration and increased likelihood of asset failure.	Accept risk and resolve through increased operations/maintenance activities.

Appendix F19

EPCOR WATER SERVICES INC.

Water Services
QEII Highway 41 Ave Crossing Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The primary purpose of the QE II and 41 Avenue Crossing Project is to implement the most optimal and effective way to increase pumping capacity to the tertiary zone to improve fire flows and meet peak hour demands.

2. Moreover, the Capital Region Southwest Water Service Commission (CRSWSC) is set to transfer existing infrastructure to EWSI in 2020 as a result of the City of Edmonton annexation of portions of Leduc County. Redundancy is lacking within the transferred infrastructure. As a result, any impact to Blackmud Creek Booster Station will impact EPCOR’s ability to serve ~55,000 customers in Discovery Park and CRSWSC. A secondary purpose of this project is to provide improve fire flows and pumping capacity to customers in the tertiary zone.

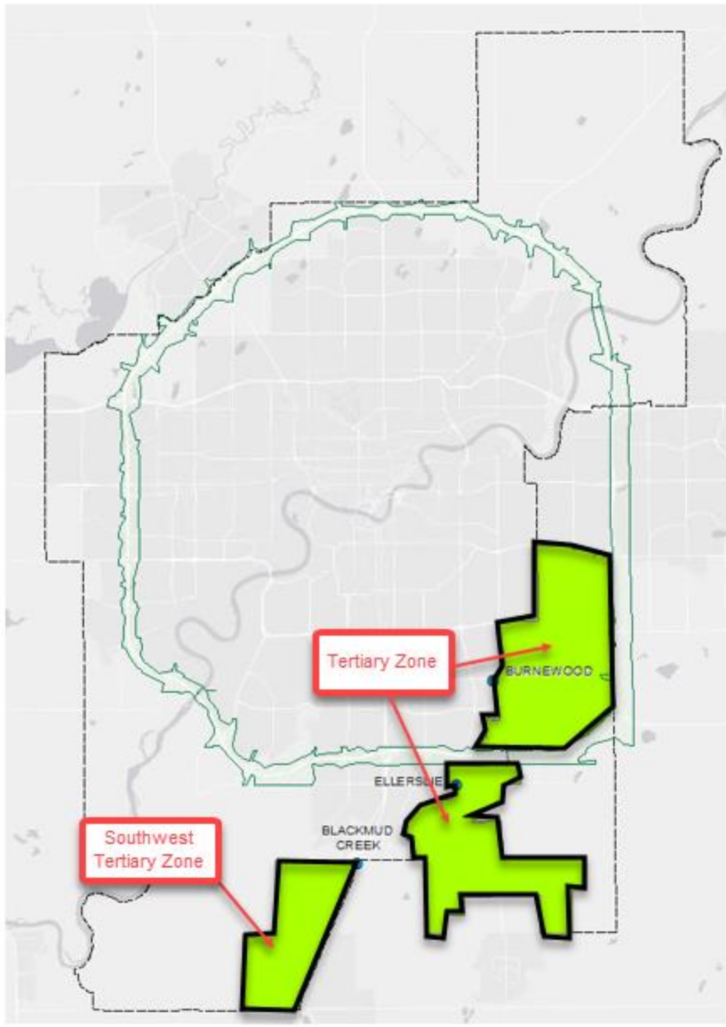
3. The recommended option of installing a 900 mm transmission main from the Blackmud Booster Station to Ellerslie Industrial has an estimated total project capital expenditures during 2022-2026 at $14.14 million. Construction will begin in 2024 and the assets will be placed into service the same year.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Project Background

4. On January 1, 2019 the City of Edmonton annexed portions of Leduc County south of 41st Ave. SW. In 2018, EWSI began discussions with the CRSWSC to transfer existing Commission infrastructure, located within the City of Edmonton annexation lands, to EWSI. This includes the Boundary Pump Station located adjacent to HWY 2, south of 41st Ave., which is hereby referred to as Blackmud Creek Booster Station, and the 750 mm transmission main in the area. The acquisition of this infrastructure provides a backbone for future growth in the annexation land west of Highway 2. Blackmud Creek station is shown on Figure 2.1-1.

Figure 2.1-1
Tertiary Zone and Southwest Tertiary Zone Booster Stations



5. As of June 2020, transfer of infrastructure to EWSI is planned to occur within the calendar year. As only a single line services the booster station, any impact to Blackmud Creek Booster Station resulting in reduction of pumping capacity impacts customer servicing south of 41st Avenue Southwest (i.e., CRSWSC and Discovery Park). The lack of redundancy makes both the acquired booster station and the 750mm transmission main critical pieces of infrastructure.

6. The tertiary zone also lacks redundancy during high demand times. Tertiary Zone is currently supplied by Burnewood Booster Station and Ellerslie Booster Station (shown on Figure 2.1-1); however, there are pumping capacity issues in the area. Ellerslie Booster Station was originally intended to be a temporary station and is therefore not intended to meet ultimate development water requirements. In other words, during annual peaks, when all pumps in both

stations are running at full capacity, losing one pump would significantly impact customer servicing pressures. As the tertiary zone grows, this issue will only exacerbate if not addressed.

7. Finally, a large fire requiring maximum fire flows in the tertiary zone has potential to greatly impact Edmonton customers in high value areas of the tertiary zone if the system is unable to provide the required fire flows. Hydrant flow tests in some newly developed areas of the tertiary zone have shown that the system is unable to achieve the required 300 L/s fire flows required for high value zoning. These high value areas are typically industrial, commercial, and institutional areas as well as high density residential buildings (such as apartment buildings).

2.2 Project Justification

8. The proposed project will increase pumping capacity to improve fire flows to the tertiary zone via connection to existing transmission mains north of 41st Ave. SW and improve pumping redundancy for peak hour.

9. 55,000 customers are serviced by CRSWSC in the area circled in Figure 2.2-1. Any impact to Blackmud Creek Booster Station will also impact EWSI's ability to serve these customers.

10. Hydraulic modeling analysis shows improved fire flows in the tertiary zone, south of the Transportation Utility Corridor (TUC), where fire flows are currently deficient (see fire flow map below). The construction of this alternative will increase fire flows in over 115 hydrants within the tertiary zone. This means that the project could potentially increase fire flows to high demand sites where 300 L/s is required. The modeling analysis also shows increased pumping capacity in peak demand times, and subsequently improved servicing pressures. Without the 900 mm transmission from Blackmud Creek Booster Station, south of the Anthony Henday Drive in the tertiary zone has a large area experiencing unacceptable servicing pressures. Addition of the 900 mm main reduces this area significantly, as can be seen in Figure 2.2-2 due to the lack of orange nodes. This means that this alternative can successfully improve servicing pressures during annual peaks.

Figure 2.2-1
Edmonton Region Water Service Area

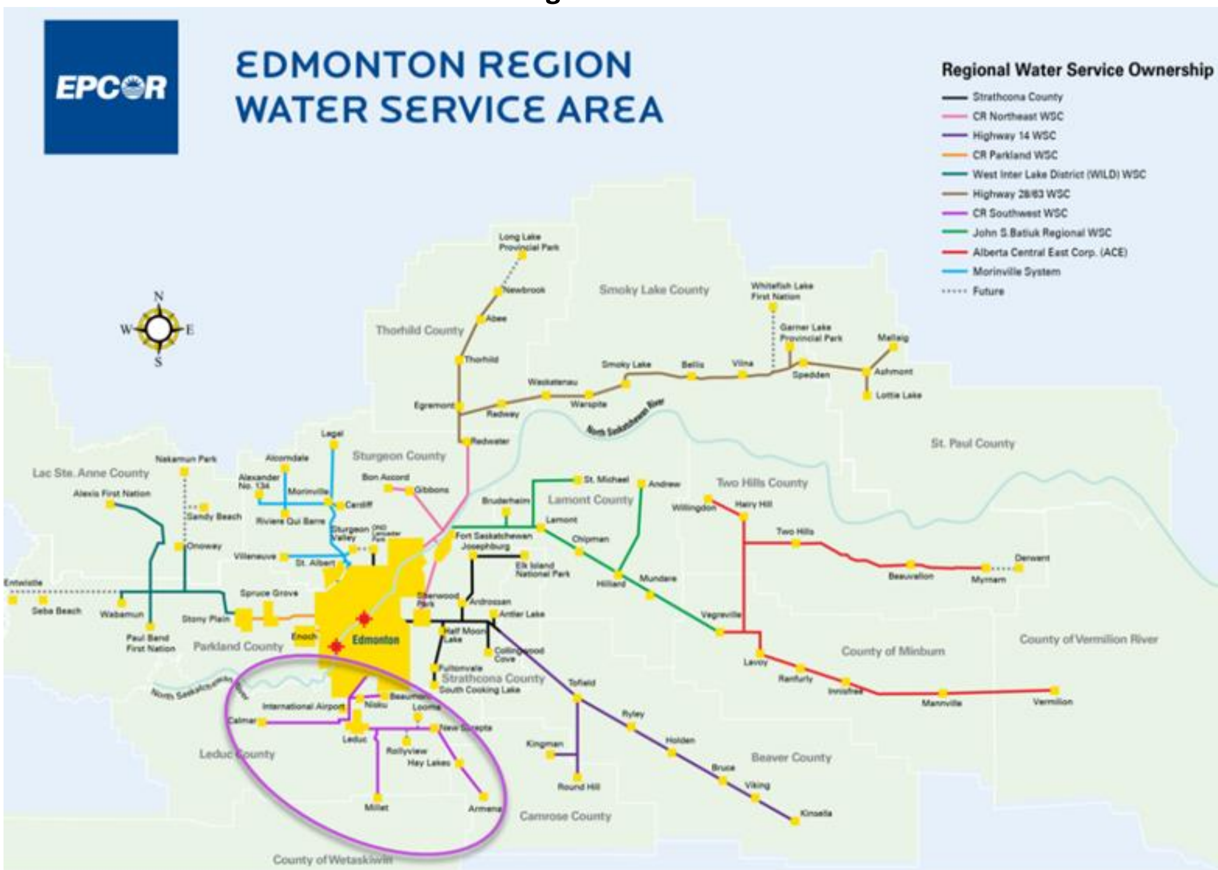
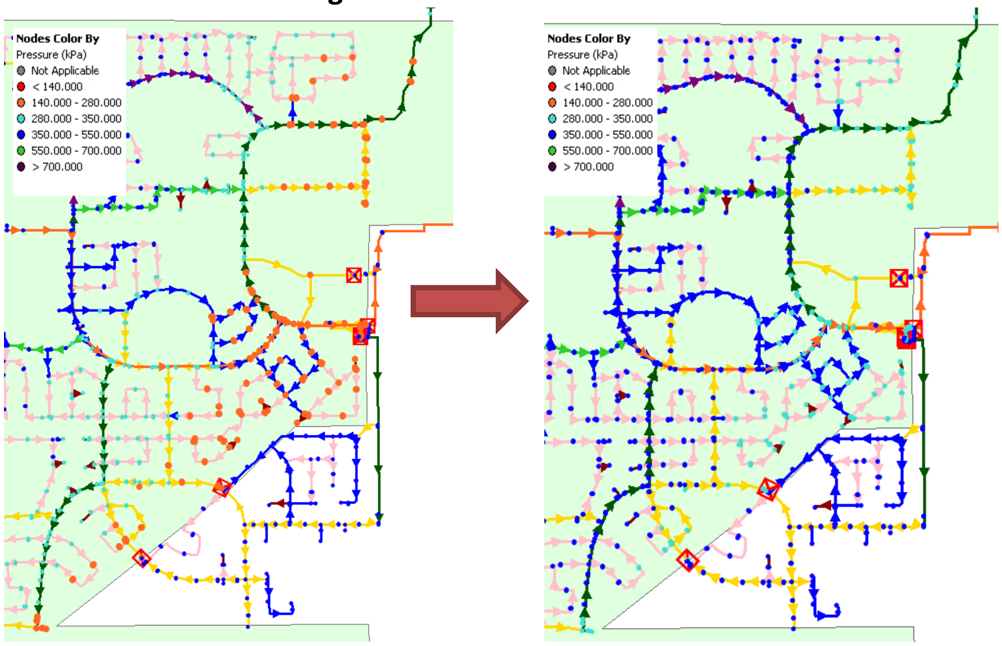


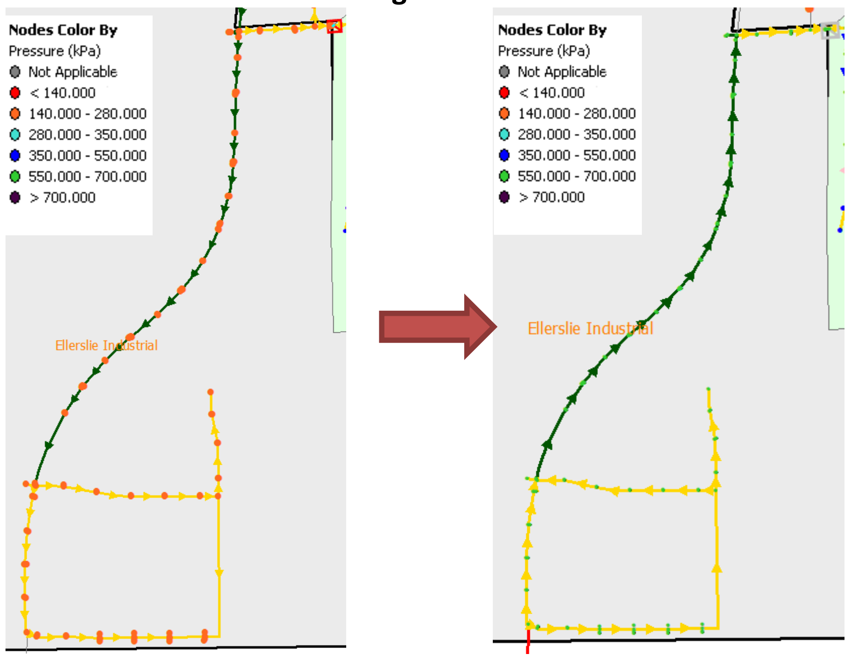
Figure 2.2-2
Increase in Servicing Pressures due to Addition of 900 mm Main



Without 900 mm Transmission *With 900 mm Transmission*

11. Ellerslie Industrial area will also experience increased servicing pressures as several mains in the area will be converted to tertiary zone pipes from secondary zone pipes as a result of this project. The comparison of servicing pressures in Ellerslie Industrial with and without the 900 mm main can be seen in Figure 2.2-3.

Figure 2.2-3
Increase in Ellerslie Industrial Servicing Pressures due to Addition of 900 mm Main

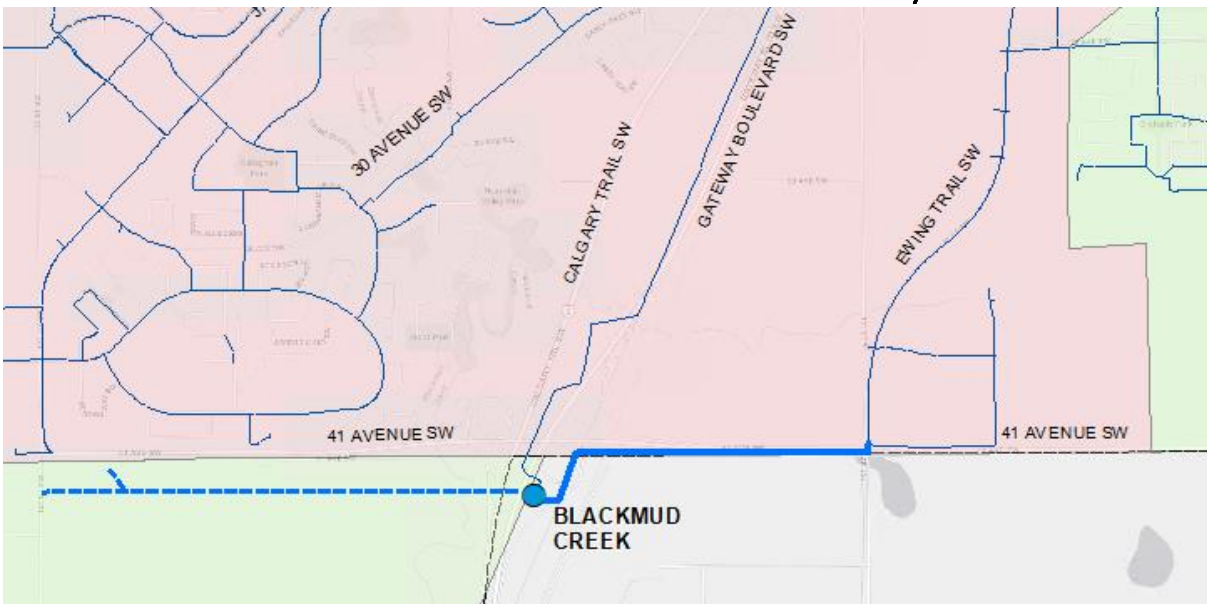


Without 900 mm Transmission *With 900 mm Transmission*

12. Another modeling analysis looked at how much pumping capacity Burnewood and Ellerslie could provide to CRSWSC. With Blackmud Creek Booster station offline, the analysis showed Burnewood and Ellerslie booster stations can provide some servicing to CRSWSC, while still supplying the tertiary zone during annual peaks, but it will be below average daily demand requirements. This redundancy reduces the criticality of Blackmud Creek station.

Additionally, this construction provides opportunity for redundancy south of 41st Avenue Southwest, in the Southwest Tertiary Zone. The option exists to connect the 750 mm transmission main along Highway 2 to mains in this area. Doing so would allow all tertiary stations (Burnewood, Ellerslie, and Blackmud Creek) to pump into Southwest Tertiary Zone. The ability to have future interconnection of all tertiary pressure zones is advantageous for this reason. Figure 2.2-4 shows the approximate location and potential alignment into the southwest tertiary zone (blue dashed line).

Figure 2.2-4
Connection from 750 mm Main to Southwest Tertiary Zone



3.0 PROJECT DESCRIPTION

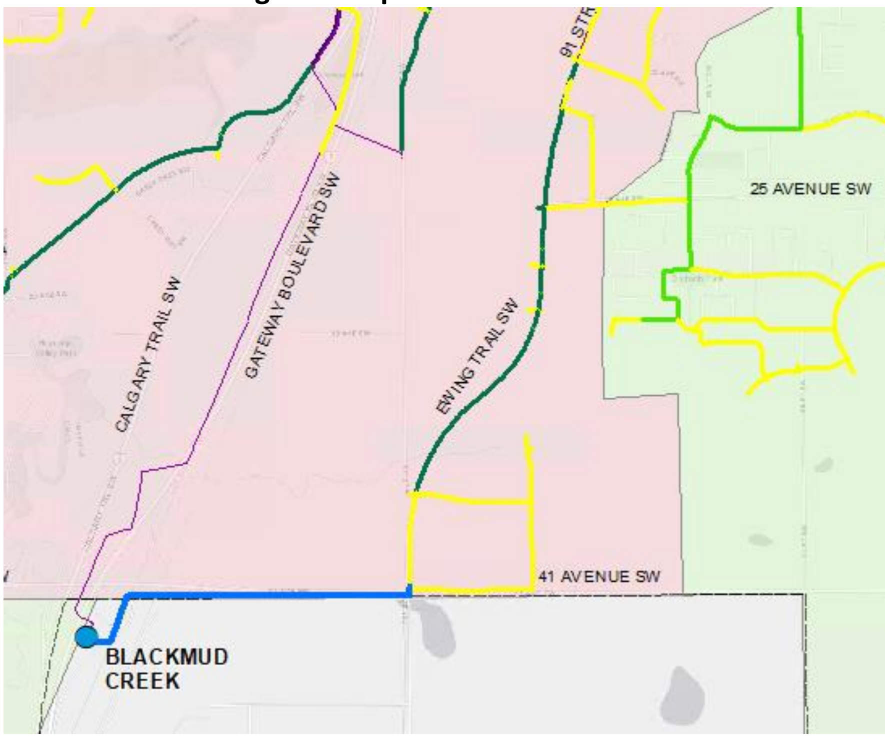
13. The scope of the project is to construct a 900 mm main, approximately 1.2 km in length, to connect Blackmud Creek Booster Station to a 300 mm PVC main, near-to the intersection of 41st Avenue Southwest and Ewing Trail Southwest.

14. The assumed alignment for the project is on the east side of Highway 2, in the ditch line east of the service road, alongside the existing oil and gas pipeline corridor. The project is then assumed to be completed alongside 41st Ave. SW.

15. Several crossings are included in the scope of the project – Highway 2, 41st Avenue Southwest, a pipeline corridor, and a railroad. The Highway 2 and pipeline corridor crossings are expected to be horizontal directional drillings (HDDs). The Railway crossing is also expected to be completed by HDD, and the 41st Ave crossing will either be and HD Bore or open cut and will be determined after evaluations of the traffic impacts are completed.

16. New pumps will be required in the Blackmud Creek Booster Station, to adequately support the tertiary zone. The area where the proposed transmission main connects to the existing Tertiary Zone will be undersized in the interim, as well. This is shown below in Figure 3.0-1 the proposed blue 900 mm main connects to existing 300 mm mains.

Figure 3.0-1
Existing and Proposed Transmission Mains



17. The project will require two significant horizontal directional drilling's (HDD's) – one across HWY 2, and one across the pipeline corridor that parallels the east side of HWY 2, heading east along 41st Ave. SW. ATCO Gas and ALTA Gas both do not allow PVC within their right-of-way, meaning the pipe will have to be HDPE installed within a steel casing, or steel, to cross the pipeline corridor. It is likely that utilizing steel pipe will be lesser or equal in cost to the larger steel casing required if utilizing HDPE.

18. Planning and design is scheduled for 2023 and construction is scheduled to start and finish in 2024, with the assets going into service in 2024.

4.0 PROJECT ALTERNATIVES ANALYSIS

19. The primary purpose of this project is to identify the most optimal and effective way to increase pumping capacity to the tertiary zone to improve fire flows and meet peak hour demands. A secondary consideration is the redundancy for the CRSWSC customers, serviced by the Blackmud Creek Booster Station. Four alternatives were considered to achieve these:

Alternative 1: Status Quo

20. Doing nothing to address these issues is the most cost effective solution. The disadvantages are that (1) fire flows in the tertiary zone will remain inadequate and (2) there is no redundancy provided for CRSWSC, as the acquired booster station and transmission main would remain critical. Any impact to Blackmud Creek Booster Station will impact EWSI's ability to serve Discovery Park and CRSWSC, and potentially the reputation of EWSI in these areas.

Alternative 2: Upgrade the existing Ellerslie Booster Station

21. This option would increase the pumping capacity out of Ellerslie Booster Station to improve peak hour demands and fire flows in the tertiary zone; however, to allow for Ellerslie to be taken offline for upgrades, significant transmission main upgrades are required in Decoteau neighbourhood. High costs would be associated with construction of these mains, as brownfield transmission mains cost between $2,500-5,000 per meter.

22. This option explored expanding Ellerslie Booster Station to accommodate additional pumps, larger piping, and improved intake/discharge piping along Ellerslie Road. While the expansion would allow for an increase in flow out of Ellerslie, offsite transmission mains are required east of Ellerslie Booster Station for the tertiary zone to experience these flow benefits. Expansion of the existing Ellerslie Booster Station is challenged also by a nearby stormwater management facility and 1:100 year return high water level, along with the need for City of Edmonton permitting to upgrade. Additionally, this option does not provide any redundancy for the CRSWSC. Since significant transmission system upgrades are required to take Ellerslie Booster Station offline for upgrades, this alternative was rejected due to the high cost.

Alternative 3: Construct a new Ellerslie Booster Station

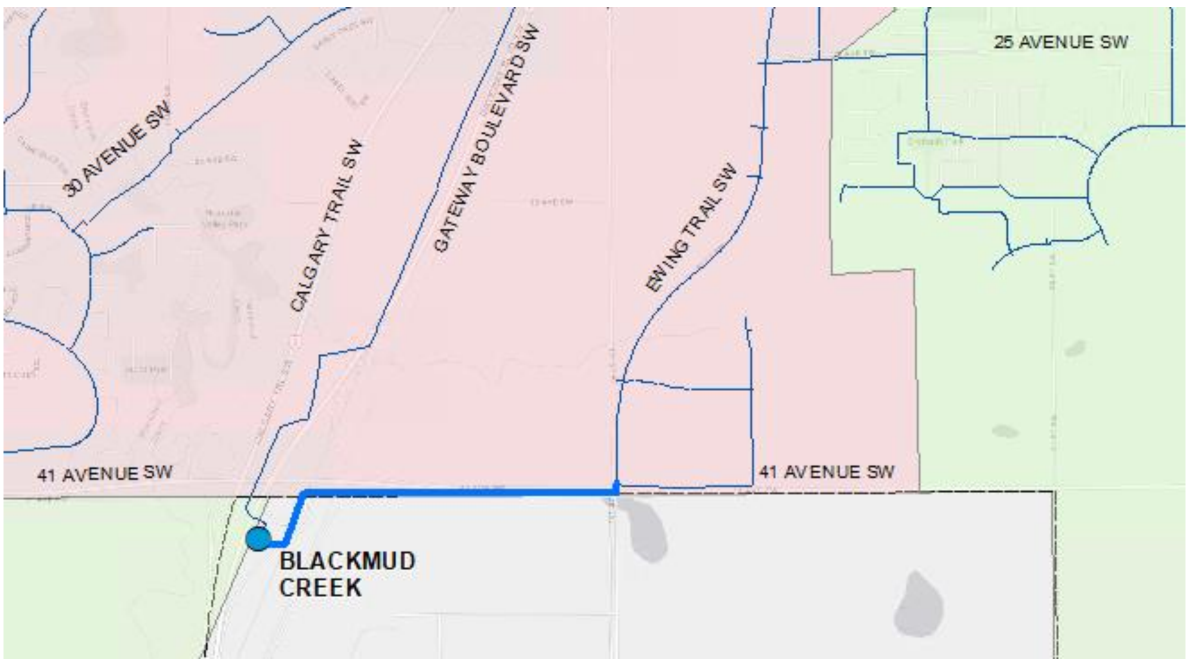
23. In this option, there is the ability to stage flow upgrades as demand in the tertiary zone increases, and there are no building constraints limiting the sizing of infrastructure. This option also increases pumping capacity to improve peak hour demands and fire flows.

24. If this alternative was pursued, EWSI would be decommissioning Ellerslie Booster Station prior to it being fully depreciated. As well, there is the risk of land not being available for construction of a new booster station, and unknowns surrounding the cost of available land. Since development has occurred in the area, it is likely land costs will be quite high. Construction of a new Ellerslie Booster Station would also not provide any redundancy for the CRSWSC.

Alternative 4: Queen Elizabeth II Highway and 41 Avenue Crossing (Selected)

25. Installation of a 900 mm transmission main from the Blackmud Creek Booster Station to Ellerslie Industrial, across 41st Avenue Southwest. The potential alignment and approximate location of this main is shown in blue in Figure 4.0-1. This requires approximately 2.1 km of 900 mm transmission main and crossing both HWY 2 and a pipeline corridor. Rather than construct a new booster station, as suggested in the third alternative, EPCOR would be able to leverage their newly acquired asset to support existing City of Edmonton customers in the tertiary zone. The station would pump to tertiary elevations and improve peak hour demands and fire flows in some areas. In addition, this option provides redundancy for CRSWSC.

Figure 4.0-1
900 mm Transmission from Blackmud Creek Booster Station



Conclusions

26. Alternative 1 is rejected due to its inability to increase redundancy and pumping capacity for the tertiary zone. While Alternative 2 would increase pumping capacity, it is less than what Alternative 3 can provide, and would require significant transmission system upgrades. For this reason, Alternative 2 is rejected. Alternative 3 would provide additional pumping capacity to the tertiary zone, but no redundancy for CRSWSC. Alternative 4 provides both additional pumping capacity to the tertiary zone and redundancy for CRSWSC, but pump upgrades in Blackmud Creek Booster Station and a few major crossings.

27. The benefit of achieving redundancy for CRSWSC, while also improving fire flows and pumping capacity in the tertiary zone, results in the selection of Alternative 4.

5.0 COST FORCAST

28. EWSI's cost forecast is based on a projection of 2.1 kilometers of transmission line, at a rate of $5400/mm*km. This rate aligns with estimations used for pipeline projects in the Edmonton TUC that utilized HDD.

29. 20% contingency is applied because of uncertainty with respect to precise location and whether HDD will be required. On the west side of Ewing Trail, there is a 323 mm ATCO pipeline and a 406 mm Plains Midstream pipeline. If the project must be executed on the west side, then the project may have an additional high-pressure pipeline crossing. It is expected crossings of these pipelines are open-cut which would have a minimal impact on the project cost, but there is the possibility that EPCOR is required to HDD across these pipelines.

30. The projected capital expenditures for this project are displayed in Table 5.0-1.

Table 5.0-1
QE II Highway and 41 Avenue Crossing Project
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2023**	B **2024**	C **Total**
	Direct Costs:			
1	Contractors	0.00	11.26	11.26
2	Internal Labour	0.04	0.06	0.11
3	Contingency	0.00	2.26	2.26
4	**Sub-total Direct Costs**	**0.05**	**13.59**	**13.63**
5	Capital Overhead and AFUDC	0.03	0.48	0.51
6	**Total Capital Expenditures**	**0.08**	**14.07**	**14.14**

31. Explain EWSI's approach to minimizing these expenditures. For example:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.

- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

32. The risks are associated with this project are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk – pipeline alignment risks. Failure to perform a require HDD drill would require work to be redone at double the overall cost. Bad soils could lead to larger excavations than budgeted.	Either (a) a proper soils management plan, or (b) utilize HDD for the entire install alignment along HWY 2
2	Schedule Risk – delay in permits for construction	Develop permit packages early, maintain constant communication with permit grantors
3	Schedule Risk – availability of materials may delay construction	Start procurement early and engage contractors early in the project

Appendix F20

EPCOR WATER SERVICES INC.

Water Services
Risk Based Renewals Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EPCOR Water's distribution system contains over 3,600km of pipe with varying materials, sizes, manufacturers and vintages. A main is classified as distribution size when its diameter is 300mm or less, although there are some 350mm mains used for distribution purposes. The distribution system is used to move water from larger transmission mains directly to customers.

2. Over the 120+ year lifespan of the water network, these pipes have been installed throughout Edmonton and have historically been replaced through capital programs that target mains that have experienced either repeated mainbreaks (Reactive Programs), water quality/reliability issues (Proactive Program), or through cost sharing initiatives with 3rd party work (Accelerated Renewals). These programs, while having different individual selection criteria, all contribute toward a common goal; to reduce the potential risk in the water distribution system. The purpose of this program is to replace the Reactive, Proactive and Accelerated Renewal programs with a single risk-based program that targets the highest consequence of failure (COF) and probability of failure (POF) mains within the distribution system. This will ensure optimal return for the investment.

3. This program is categorized as reliability / life cycle replacement. EWSI has forecast total program capital expenditures during 2022-2026 at $28.95 million. This funding allows for the renewal of approximately 2.75 km of distribution mains per year.

4. Funding for distribution main renewals has been reduced in the 2022-2026 PBR term, compared to projected capital expenditures of $116.90 million in the 2017-2021 PBR term. The reasons for funding reductions are set out in Section 4.4.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

5. In 2019, a desktop condition assessment of the entire pipe network was completed using deterioration models based on historical break data. Each pipe was given a condition rating between A and F, which each letter corresponding to an expected probability of having at least 1 break at the pipe's current age (break probability). Table 2.1-1 summarizes the condition grade definitions.

Table 2.1-1
Condition Grade Definition

Condition	Score	A Break Probability
1	A	<1%
2	B	1% to 5%
3	C	5% to 10%
4	D	10% to 15%
5	E	15% to 20%
6	F	>20%

6. Based on the model results, approximately 400km (11%) of all distribution mains are considered to be in Poor (~20% chance of having at least 1 main break) or Very Poor (>20% chance of having at least 1 main break) condition (Figure 2.1-1), with the vast majority of those being cast iron mains (Table 2.1-2).

7. Using this information, a POF value was assigned for each pipe segment in the Geographic Information System (GIS) database based on its calculated condition score.

Figure 2.1-1
Overall Condition Grade for Distribution Mains

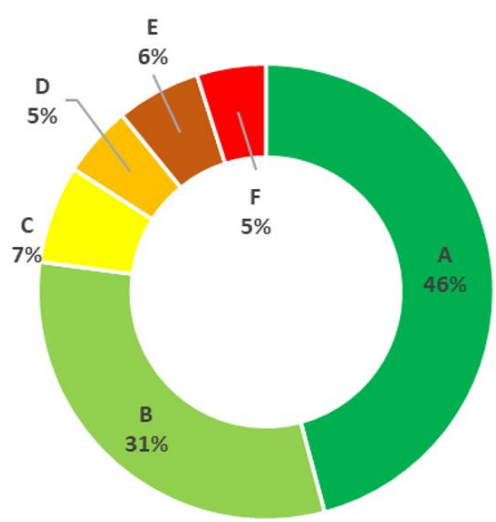


Table 2.1-2
Condition Grade by Material for Distribution System

		A	B	C	D	E	F	G	H
	Condition	**Pipe Length by Material (km)**							
	Score	**PVC**	**AC**	**CI**	**STL**	**COP**	**COMPOSITE**	**OTHER**	**Total**
1	A	1,576	1	0	1	16	25	7	1,626
2	B	337	754	1	2	6	0	9	1,108
3	C	8	196	16	2	21	1	2	246
4	D	0	2	173	2	2	0	0	179
5	E	0	0	210	0	2	0	0	212
6	F	0	0	166	6	1	0	0	174

8. A COF score was also developed for each pipe segment by comparing the impact of a pipe failure on six risk categories (Health and Safety, Environment, Reputation, Regulatory, Financial, and Operational). This was completed by using working groups consisting of subject matter experts across EPCOR Water and by utilizing GIS spatial analysis on the watermain dataset. The results of this analysis indicate that, other than a few exceptions, the vast majority of the distribution system has low COF. However, these scores will require updates when outside factors arise that were excluded from the original analysis. This includes items such as whether or not a specific pipe can be repaired (based on field analysis), future changes to the water network, or additional recommendations from regulatory bodies. Table 2.1-3 summarizes the COF score for the distribution network.

Table 2.1-3
COF Score by Material for Distribution System

		A	B	C	D	E	F	G	H
	Consequence of	**Pipe Length by Material (km)**							
	Failure Scores	**PVC**	**AC**	**CI**	**STL**	**COP**	**COMPOSITE**	**OTHER**	**Total**
1	0 - 1	218	9	5	0	26	26	20	277
2	1 - 2	1,639	911	514	4	26	10	18	3,110
3	2 - 3	83	72	45	1	1	0	3	206
4	3 - 4	5	5	2	0	0	0	1	13
5	4 - 5	0	0	0	0	0	0	0	0
6	5 - 6	0	0	0	0	0	0	0	0

9. Section 3.0 explains how this information will be used to determine prioritization of work within the program over the 2022-2026 term.

2.2 Program Justification

10. Once a pipe has had numerous breaks and its overall reliability is compromised, it becomes necessary to replace the pipe as opposed to continually repair the individual breaks. Residents depend on a reliable distribution network to meet their daily needs and many

businesses rely on the network to support their processes and source of income. If the Risk Based Program is delayed or cancelled, it will lead to increased levels of customer dissatisfaction as the frequent main breaks or high consequence main break will result in ongoing service disruptions and other customer impacts. These frequent or high consequence breaks will also cause an increase in maintenance and operating costs.

11. Over past PBR terms, the number of main breaks has steadily declined, and the mains that have the highest consequence of failure have been replaced. The current state of the distribution system is such that the pace of distribution main replacement can be slowed temporarily over the 2022-2026 PBR term, without an expected corresponding increase in main breaks back to historical levels. However, the program must continue to address removal of deteriorating assets, and preventative renewal of assets that will deteriorate in the PBR term, otherwise significant increased capital investment will be required in future terms. If the Risk Based Program is delayed or cancelled, existing neighborhoods will continue to fall further behind the current design and construction standards. The system will continue to experience ongoing water quality issues in neighborhoods, causing increased costs and labor required for maintenance and operations to perform flushing requirements and main break repairs, and deal with ongoing customer complaints.

3.0 PROGRAM DESCRIPTION

12. The results from the analysis presented in Section 2.1 will be continually updated as more of the pipes are investigated and analyzed, their respective condition will be updated and reflected in the overall POF and COF scores.

13. A risk score is calculated for each main using the below matrix (Figure 3.0-2) by combining the POF and COF scores. The resulting list of distribution mains with risk scores will be the main source for selecting candidates for this program. Summaries showing the total length of main and the material type can be seen in Figures 3.0-1 and 3.0-2.

Figure 3.0-1
Risk Matrix and Summary of Results for Distribution Mains

COF Score								
6	COF - HIGH	3 - Medium	3 - Medium	4 - High	5 - Extreme	5 - Extreme	5 - Extreme	5 - Extreme
5	COF - HIGH	3 - Medium	3 - Medium	4 - High	5 - Extreme	5 - Extreme	5 - Extreme	5 - Extreme
4	COF - HIGH	3 - Medium	3 - Medium	4 - High	5 - Extreme	5 - Extreme	5 - Extreme	5 - Extreme
3	COF - MED. HIGH	3 - Medium	3 - Medium	3 - Medium	4 - High	5 - Extreme	5 - Extreme	5 - Extreme
2	COF - MEDIUM	2 - Low	3 - Medium	3 - Medium	3 - Medium	4 - High	4 - High	4 - High
1	COF - MED. LOW	1 -Negligible	2 - Low	3 - Medium	3 - Medium	3 - Medium	3 - Medium	3 - Medium
0	COF - LOW	1 -Negligible	1 -Negligible	2 - Low	3 - Medium	3 - Medium	3 - Medium	3 - Medium
		POF - LOW	POF - MED. LOW	POF - MEDIUM	POF - MED. HIGH	POF - HIGH	POF - HIGH	POF - HIGH
		0	1	2	3	4	5	6
		POF Score						

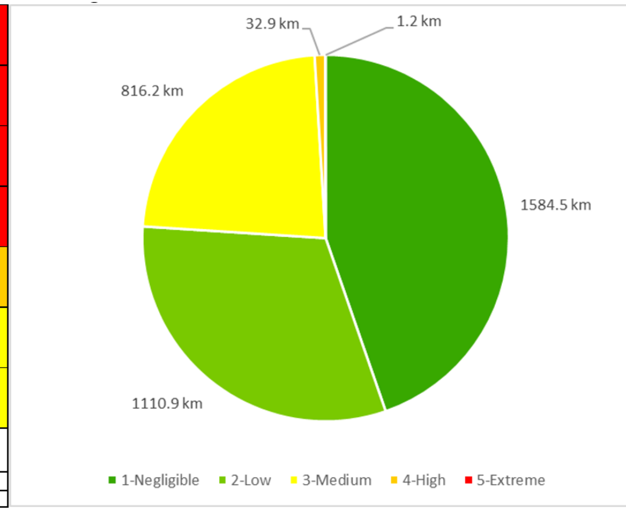
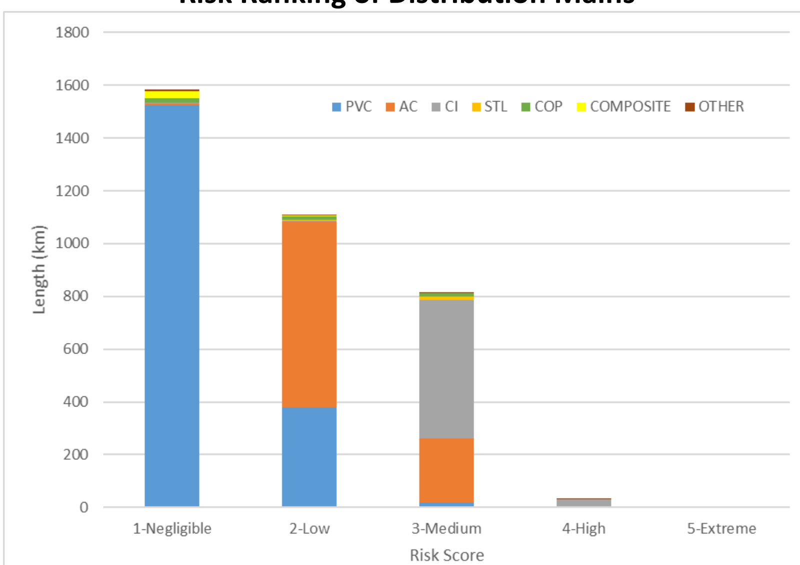


Figure 3.0-2
Risk Ranking of Distribution Mains



14. The Risk Based Renewals Program will target the highest risk mains first. Every year, the risk scores will be re-evaluated as part of the selection process for this program.

15. Candidates will no longer be prioritized for accelerated replacement in coordination with City of Edmonton neighborhood work. The former Accelerated Water Main Renewal Program supported the City's request for EWSI to replace water mains in alignment with the City's neighborhood renewal and paving programs. The purpose of the program was to coordinate on-street construction to minimize customer disruption. Coordination benefits are not critical to the

performance of the system, are not a factor in the candidate selection process for the Risk Based Renewals Program in the 2022-2026 PBR.

16. Each identified risk based candidate is evaluated to determine the impacts to the water network if it is abandoned, modified or if it needs to be relocated. The proposed changes to the water network are evaluated for hydraulic requirements, customer servicing, future operability and maintenance, and hydrant spacing. If a water main needs to be removed/relocated, hydraulic analysis is conducted to determine the necessary upgrades required to return the area to its existing condition (pressures, flows), and to maintain service to customers and fire protection. Each design considers the pipe size to ensure it will provide adequate flow for the interim and the ultimate water network. Hydrant locations have been evaluated to maintain existing fire protection wherever possible, or reviewed and approved by the Fire Department prior to construction. The method for constructing each crossing (open cut vs. directional drill) will also be evaluated with the lead designer and contractor. All attempts will be made to minimize construction costs by coordinating project schedules and working with other utilities.

3.1 Program Scope

17. Candidates' risk scores will be the replacement criteria used as the basis to build the program each year, and each candidate is evaluated individually to ensure the most value is received for dollars spent and the highest risk mains are replaced. The highest risk candidates will be selected each year up to the annual spending limit of the program. Risk scores and their inputs will be updated, calibrated and calculated annually. If a request comes in mid annual cycle, the candidate will be evaluated based on the same desktop study methods and measured against the existing candidates for the annual program.

18. Table 3.1-1 displays the criteria, measures of success and goals of the program.

Table 3.1-1
Measures of Success

	Criteria	A **What is measured (a.k.a. the metric)**	B **Goal**
1	Breaks experienced on replaced sections of pipe reduced to zero for 20 years	Number of breaks over 20 years	Zero
2	Improved system hydraulics and reliability	Minimum % of required fire flow available from system	100%
3	Water quality in the system is not disrupted by the construction or commissioning activities	# of water quality events caused by construction	0
4	Compliance with PBR measures for planned construction	Five days advance notice for service interruption requiring temporary hoses and underground construction completed within specified timeframe.	95.8%
5	The environment is protected during construction	# of environmental incidents including the release of chlorinated water to the storm system	0
6	Improvement of water quality from water main lining.	Adenosine Triphosphate (ATP) count for water as a measure of biological activity.	0
7	Reduce risk in the distribution system	Length of pipe in the system with a risk score of Extreme or High is reduced	2.75km per year of High or Extreme Risk Mains

19. The current funding for this program will allow the renewal of approximately 2.75km per annum. For context, EWSI replaced approximately 11 km annually between 2017 and 2020. The reduction is primarily the result of candidates no longer being prioritized based on coordination with the City of Edmonton's neighborhood work. By combining reactive and proactive renewals into a single program, EWSI is able to prioritize across renewal work to ensure that the reduced level of investment targets the highest risk candidates.

3.2 Program Execution

20. All activities related to project selection, design, drafting, construction coordination and inspection, and as-built recording will be undertaken by internal staff within the EPCOR Water Distribution & Transmission group.

21. The actual construction, including surface restoration, will be completed by EPCOR's three construction contractors. The construction projects will be divided between the three contractors when the full scope and the locations are known.

22. The City of Edmonton's Integrated Infrastructure, Engineering Service Section will be used to complete all required road surface QA and materials testing and back alley layout survey. EPCOR Power will provide water main renewal project layout and as-built survey services.

23. All projects will be scheduled and coordinated in conjunction with the City of Edmonton's Transportation Department. This includes the Building Great Neighbourhoods (Neighbourhood Rehabilitation) Group and Integrated Infrastructure Services – Transportation (Arterial Roads/Special Projects) Group.

3.3 Permitting and Environmental Considerations

24. While the specific distribution mains to be replaced in the 2022-2026 Risk Based Renewal Program is not yet known, the following are permits that are more commonly required based on previous experience:

- Crossing/Proximity Agreements with other Utilities or Industries
- River Valley Bylaw Approval
- Construction within a Historical Resource Area
- Utility Right of Ways
- Right of Entry

25. If projects are identified to require the above, the developed processes with EPCOR's land administration, the City's River Valley Bylaw Group, and the Historical Resource Consultant will be followed.

4.0 PROJECT /PROGRAM ALTERNATIVES ANALYSIS

4.1 Alternative 1: Replace highest risk water mains (recommended)

26. The intent of this program is to replace the highest risk water mains in the system to reduce overall water main breaks, reduce future maintenance costs and free up internal resources, maintain service reliability to customers, and minimize the negative impacts of water main breaks such as flooding, property damage, and release of chlorinated water.

27. Each candidate that qualifies for water main replacement is evaluated to determine if it should be replaced or abandoned, the appropriate pipe material & method of construction (open cut or trenchless) and any other modifications required to improve the network or meet current standards (pipe sizes, hydrant spacing & locations, eliminating dead ends, etc.).

4.2 Alternative 2: Repair main breaks but do not replace any water mains

28. The alternative to doing a full scale replacement program for mains that continue to break would be to let them keep breaking and just doing spot repairs. Each main break would have potential to cause disruption to customers, flood damage, traffic interruptions, unplanned service outages, releases of chlorinated water. An increasing rate of water main breaks would place strains on EWSI's resources and would increase operating costs as the increasing workload to fix water main breaks increases EWSI's overtime.

4.3 Alternative 3: Maintain historic levels of spending on renewals

29. This option would maintain historic levels of spending on water main renewals. An additional $87.95 million in capital expenditures would be required to bring spending to the approved 2017-2021 PBR level. Approximately $50 million in spending was historically allocated to accelerated renewals, which prioritizes lower-risk sections of main in order to provide coordination benefits. The remaining $37.95 million capital expenditure investment would be allocated toward remaining renewal candidates with the highest risk scores, as per the risk scoring criteria applied to this program.

4.4 Conclusion

30. The recommended solution is Alternative 1. The risks to the system associated with Alternative 2 are too high. Alternative 3 has been rejected for the 2022-2026 PBR term in order to manage rate increases. Although it will be necessary to increase spending on this program back in line with historic levels in future PBR periods, EWSI has determined that it is able to temporarily slow investment in this program, while continuing to meet EWSI's performance metrics and without a material impact on system reliability.

5.0 COST FORECAST

31. Contractor costs – are based on a per metre installation cost as determined in EPCOR's long term construction contracts and are reviewed and adjusted each year. For water main renewal projects the actual per metre water main renewal costs can vary significantly based on project location (downtown vs. neighbourhoods), project scope (transmission main vs. distribution main renewal), soil condition (wet and loose vs. dry and firm), and the amount of fillcrete required for trench backfill and road restoration requirements (concrete base vs. gravel base), therefore cost estimate is also based on the preliminary or conceptual project designs for 2022-2026 with a similar scope of work to distribution renewals in 2020.

32. In-house hours – are based on historical data from 2019-2020, plus an estimate of projected costs for 2022-2026.

33. A contingency of 5% for both internal and external costs was chosen as there is a potential of extra costs for each project based on: weather conditions during construction, unexpected ground conditions, other utilities not at the recorded alignments and problems encountered during construction with potential to increase the estimated cost.

34. The following assumptions underlie the cost forecast:

- EPCOR internal staff time requirements will be similar to previous years.
- No major changes in the City's pavement restoration specifications.
- Grind and overlay will only be required on a minimum number of projects.
- Sidewalks and curbs can be replaced with asphalt in all neighborhood rehabilitation areas as they will be re-build by the City contractor in the future.
- No additional safety requirements, other than those currently identified under EPCOR's Contractor Management Program will be imposed on the contractors.

35. The projected costs are shown in Table 5.0-1.

Table 5.0-1
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	4.67	4.78	4.90	5.03	5.15	24.53
2	Internal Labour	0.37	0.38	0.39	0.40	0.41	1.97
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.01	0.04
4	Contingency	0.25	0.26	0.27	0.27	0.28	1.33
5	**Sub-total Direct Costs**	**5.30**	**5.43**	**5.57**	**5.71**	**5.85**	**27.86**
6	Capital Overhead and AFUDC	0.21	0.21	0.22	0.22	0.23	1.09
7	**Total Capital Expenditures**	**5.51**	**5.65**	**5.79**	**5.93**	**6.08**	**28.95**

36. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

37. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial Risk – Due to limited space and other utility conflicts, it can be difficult to secure the optimum water main alignments.	Work with City designers and other utilities and construction coordinators to ensure all water main alignments are identified and secured as early as possible. Obtain information on other utility relocation project status' and as-built locations.
2	Financial Risk – Unforeseen construction costs will impact the overall costs of the project.	Work with designers, coordinators, and contractors to identify potential problems, provide accurate design and quantity estimates to minimize the need for extra work. Defer portions of the construction as necessary to remain within the approved budget.
3	Operational Risk – increased number of watermain breaks than forecast. Need to accelerate the rate of cast iron pipe replacement.	Focus on replacing the mains that are highest risk to the water system first, which will include the mains with the highest likelihood of failure. Operational staff will repair pipe with lower risk levels as breaks occur.

Appendix F21

EPCOR WATER SERVICES INC.

Water Services
Structural Rehab and Roof Replacement
Upgrades Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. This program includes monitoring and upgrading reservoir cell roofs and structural components within EWSI's Edmonton operations. The reservoirs are used to store water throughout the city to manage high water demand. The program is necessary to ensure that EWSI maintains high quality water and ensures reliability of critical water distribution infrastructure. The reservoir roofing system is required to prevent leakage of contaminants into the reservoir which could potentially lead to loss of water service to a large number of customers, cause water quality violations, or, in severe cases, result in a drinking water advisory.

2. The Structural Rehabilitation and Roof Replacement Upgrade Program cost is included under the reliability / life cycle category and the cost is estimated at $9.64 million for the 2022-2026 PBR term.

3. All reservoir cell and structural work is grouped together within the Structural Rehabilitation and Roof Replacement Program for the 2022-2026 PBR Application, in order to enable improved coordination of shut downs. Overall spending on this work is similar to that included in the 2017-2021 PBR Application although the work itself is split out differently between programs.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

4. This program is for the monitoring, renewal and upgrading of reservoir roofs and reservoir structural components at various sites throughout the Edmonton area. There are 21 reservoirs currently within the EPCOR Water Distribution System that services Edmonton and surrounding areas. A reservoir is a tank where treated water is stored prior to distribution to customers. The purpose of storing water within the distribution system is to ensure that supply can be maintained as demand changes and also provide some capacity in case of an emergency situation such as a fire or a leak which may require additional water. Reservoirs are typically large underground or above ground concrete tanks which require numerous columns for structural support, specialized joints to prevent infiltration and exfiltration as well as an impermeable roof membrane which prevents contamination from entering the water system. This infrastructure degrades overtime and require regular rehabilitation to ensure structural integrity and protect water quality. The purpose of the Structural Rehabilitation and Roof Replacement Upgrades Program is to maintain operable assets and protect the water quality in reservoir. The roofing

system on the reservoir is used to prevent water infiltration into the reservoir to eliminate the risk of contamination.

5. Typical goals for this project include refurbishing or upgrading deteriorated structures and structural systems to prevent loss of water from and contamination into the reservoir, to replace or upgrade existing structures that protect people and processes, or to simply extend the asset life of reservoir structures. Periodic inspections are conducted to monitor the condition of these roofing systems and plan their replacement at the end of life or when concerns are identified. The Major Inspections program will fund these inspections over the 2022-2026 term. Concerns which may trigger further inspection are not limited to but can include: changes in water quality, changes in flow characteristics or identified as a result of adjacent construction activities or observations from Operational personnel.

6. Reservoir inspections have been in place informally since the mid 1980's, and a formalized program of inspections was begun in 2000. At each 10 year cleaning of the reservoir, Engineering personnel document the condition inside the reservoir. A formal structural inspection was added to the scope of these inspections circa 2018 starting with E. L. Smith Cell 3. Starting in 2020, additional elements were added to the inspection as outlined below.

- A pre-cleaning inspection to document sources of ingress, and the nature of ingress.
- Additional structural and building integrity elements for the pump house, and further investigation of the roof membranes to establish current condition.

7. During the 2022-2026 PBR planning period, a multi-disciplinary stakeholder team was assembled to assess the risks associated with delaying capital work on the Edmonton Reservoirs. After consulting with the team, it was determined that there is a high risk of contamination entering the reservoirs through reservoir roofs if the integrity is compromised. While EWSI tests for the parameters required by the Canadian Drinking Water guidelines, some types of contamination cannot be identified though the standard testing. It was noted by EWSI's microbiologist that this type of contamination may be difficult to detect in the community as people do not always report mild symptoms, and there is currently no system that correlates various health complaints with location.

8. EWSI conducted an audit of the Reservoir Roof Cell's, to confirm (in select locations on each cell), the type of reservoir roof membrane (if any), and the overall condition. From this report, a rehabilitation plan was developed to provide recommendations, based on a limited data set on, on which reservoirs were highest priority for the upcoming PBR.

9. The scope of work proposed for the 2022-2026 PBR term is based on priorities outlined in the Reservoir Structural Asset Management Plan. Over time, as additional inspections are completed, or more updated information such as changes in water quality become available, the priorities will change and the sequence of construction will be updated to reflect the most current information.

2.2 Program Justification

10. The purpose of this program is to prevent the leakage of contaminants from penetrating through the roof of the reservoir resulting in a potential contamination of the potable water supply that could lead to loss of water service to a large area of Edmonton or cause water quality violations. This work will improve the integrity and life of the reservoirs.

11. The consequences of delaying or abandonment of this project would be increased risk levels of contamination of the water storage facility. This could result in the loss of water service to a large area of Edmonton and potential violation of the Approval to Operate. Excessive emergency repair costs would be incurred in order to waste the remaining storage volume, complete the repair and to disinfect the entire storage facility.

12. Scheduling shutdowns continued to be a challenge during the 2017-2021 term. Shutdowns need to be carefully considered in relation to all other shutdowns occurring in the water system to ensure that adequate water supply is maintained. In the upcoming 2022-2026 term, all reservoir cell and structural work was grouped together to assist with coordination of this work.

3.0 PROGRAM DESCRIPTION

13. This program is both preventative and reactive in nature. Work is completed preventatively to ensure continued reliability of the asset. Additionally, if a failure or quality issue is identified, priorities will be re-evaluated to respond appropriately to issues. The scope of work for this program typically includes, roofing membrane rehabilitation and replacements, rehabilitation of the concrete tank and structural components and safety related upgrades.

14. The scope items in this program have been identified based on the above criteria and are categorized using recommendations from the engineering assessments.

15. Table 3.0-1 shows the initial items which are included in the scope for this program for 2022-2026. Not all scope or alternatives has been identified in advance as needs at the reservoirs are dynamic and will change over the 5-year PBR period.

Table 3.0-1
Scope Items

		A	B
	Scope Item	**Anticipated Year in Service**	**Cost ($ millions)**
1	2022 Londonderry Cell 2 Structural and Roof	2022	2.23
2	2023 E. L. Smith Cell 2 Roof and Structural	2023	2.23
3	2024 E. L. Smith Cell 3 Roof and Structural	2024	2.38
4	2025 Kaskitayo Cell 1 Roof	2025	0.98
5	2026 Rossdale Cell 2 Roof	2022	2.23
6	Total	2023	2.23

16. The scope of work for each reservoir may vary. Typical scope is outlined below:

- Prepare the site and restore once completed;
- Expose existing membrane on the roof, clean and repair;
- Rehabilitation of reservoir structural components; and
- Improve safety as required.

17. Specifically excluded from this program is building envelope (i.e., booster station structural and roof rehab) upgrades and replacements. There are separate programs (Reservoir Site Facilities) to accommodate this asset type. There is also a separate roofing program for Rossdale and E. L. Smith roofs so no plant roofing projects from these areas are included in this program. Additionally major inspections will be completed under a dedicated Major Inspection Program.

4.0 PROGRAM ALTERNATIVES ANALYSIS

18. Evaluation criteria for alternatives reviewed including status quo will consist of the following activities:

- Criteria for evaluation will be defined. Examples include safety, adequacy to solve the identified problem, cost, schedule, regulatory requirements, etc.
- Residual risk assessment.
- Reasons for retaining /discarding each option, including reference to technical analysis or studies if applicable.

- Criteria may include:
  - Roof and Concrete Condition;
  - Known Intrusion/Leak Testing;
  - Chlorine Level;
  - Water Age; and
  - Microbial Activity (Measured through ATP).

19. Once the reservoirs have been assessed based on the criteria above, a multi-disciplinary team will further review based on the attributes specific to the each reservoir to determine if all relevant criteria have been included in the analysis.

5.0 COST FORECAST

20. The estimated capital expenditures for this project are based on the list of five scope items shown in Table 3.0-1. The cost for each of these items has been determined based on per-unit costs from two historical construction projects (Castledowns and Rosslyn 1), which have been pro-rated based on the size of assets to be upgraded. The data from these projects was used to calculate the unit rates and to estimate fixed costs. An additional $0.5 million was included for engineering design and 15% external contingency has been applied. The projected costs are shown in Table 5.0-1.

Table 5.0-1
Structural Rehabilitation and Roof Replacement Upgrades Program
2022-2026 Program Capital Expenditures
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	1.64	1.68	1.87	0.77	1.49	7.45
2	Internal Labour	0.08	0.14	0.09	0.07	0.09	0.48
3	Contingency	0.25	0.25	0.28	0.12	0.22	1.12
4	**Sub-total Direct Costs**	**1.97**	**2.07**	**2.24**	**0.96**	**1.81**	**9.04**
5	Capital Overhead and AFUDC	0.12	0.16	0.13	0.08	0.12	0.60
6	**Total Capital Expenditures**	**2.08**	**2.23**	**2.37**	**1.04**	**1.93**	**9.64**

21. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI procures contractor services on a competitive bid basis and has taken advantage of longer-term contracts with suppliers to effectively manage the supply, quality and construction of required equipment.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- The installations will be consistent with roofing construction standards which will minimize stock requirements and speed up design and construction.

6.0 RISKS AND MITIGATION PLANS

22. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk – Visual inspection does not adequately show the extent of "poor" concrete and therefore additional rehabilitation areas are typically found through destructive testing and removal of "poor" concrete.	The volume of work within the program may need to decrease if this increases the costs associated with each scope item.
2	Operational Risk – Impacts to Operations are expected during construction as reservoirs will be placed out-of-service.	Close coordination with plant personnel.
3	Health and Safety Risk – Reservoir work is high risk due to the enclosed nature of the reservoirs as well conditions often present within the reservoir during the work (potential exposure to silica during demolition, high humidity within the cell, lack of lighting, presence of baffle walls making rescue and material insertion or extraction more difficult)	Ensure workers are away of hazards and Job Hazards Assessments are completed to mitigate risks.
4	Regulatory Risk – potential for shutdowns duration to be extended due to construction difficulties	This will need to be assessed on a case by case basis as each reservoir is unique. A shutdown plan with contingencies will need to be developed prior to start of the work.

Appendix F22

EPCOR WATER SERVICES INC.

Water Services
Transmission Mains and Appurtenances Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Transmission Mains and Appurtenances Program proactively identifies 350mm and larger sized transmission main pipes that are at risk of failure and require rehabilitation or replacement. This Program also includes the replacement and refurbishment of transmission main appurtenances and facilities including: transmission main valves, air vents, blow offs, pressure-reducing valves and check valves.

2. The focus of this program on improving the reliability of the water transmission network, and to ensure that transmission pipes can be quickly and safely isolated and drained as required to complete future maintenance or emergency repair work.

3. Without this program, there is an increased risk of catastrophic transmission main breaks. Unlike distribution main breaks, transmission main breaks represent much higher risks due to releases of large volumes of water, longer repair times, location of transmission mains (typically on arterial roads, crossing waterways and rail/LRT tracks), and taking a water transmission main out of service to facilitate an unplanned repair can result in significantly lower water pressure to customers located within the supply zone associated with that transmission main when other planned activities are also in progress.

4. Transmission main breaks also increase the potential for releases of large volumes of chlorinated drinking water to the environment and environmental damage cause by erosion. Environment Canada considers a release of chlorinated drinking water to a natural water body that contains fish to be a violation of the *Federal Fisheries Act*.

5. By proactively replacing and refurbishing transmission mains that are at risk of failure, much of the property damage that could result from such breaks is avoided. Functional transmission main valves are required to minimize the required transmission main shut down length, shut down time, flooding and water system impact of transmission main breaks.

6. EWSI moved to a proactive approach based on risk assessment for this work in the 2017-2021 PBR. Under this new approach, transmission main facilities with the highest risk factor will be prioritized for replacement or refurbishment.

7. This program is categorized as reliability / life cycle replacement. EWSI has forecast total program capital expenditures during 2022-2026 at $10.68 million. This program combines two programs described in the 2017-2021 PBR Application: the Transmission Mains Replacements

and Refurbishment and Network Valve Chamber Replacements Programs. Combined, those two programs had an approved capital expenditures of $18.89 million in the 2017-2021 PBR and the actual projected capital expenditures for the 2017-2021 period is $20.20 million.

8. The reduction in applied-for capital expenditure of $8.21 million is due to focusing of scope solely on deficiencies identified through the Critical Pipeline Inspection Program presented in Appendix F4.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

9. The function of the transmission main system is to transport large volumes of water from the treatment plants to the reservoirs, the pressure zones, the Edmonton distribution system and to regional customers. The water transmission system in Edmonton consists of more than 510 km of water mains, which range in size from 350mm to 1350mm in diameter. The majority of transmission mains in Edmonton were installed after 1950, and based on an estimated service life of 80 to 90 years, less than 5% of transmission mains have reached the end of their useful life to date.

10. To effectively and efficiently operate the transmission main system a number of different functional appurtenances and facilities including: transmission main valves, air vents, blow offs, pressure-reducing valves and check valves are required.

11. If a critical number of the transmission main facilities are broken or deficient, it can be quite difficult to operate the transmission main system, and subsequently, the distribution system safely and effectively.

12. Over time, there has been an increasing trend and number of main breaks on transmission mains from a low of nine in 1999 to a high of 30 in 2008, 2009 and 2012. Since 2009, the annual numbers of breaks have remained around 20 to 30 breaks per year. Transmission main breaks, which accounted for less than 1% of all breaks in 1999, now account for 5% to 8% of the total breaks in Edmonton. As this infrastructure continues to age, more transmission mains will reach the end of service life and transmission main failures will continue to rise.

13. Presently most of the transmission main facilities are installed in underground chambers. To enter the chambers, confined space entry permits are required. Most chambers are partially filled with corrosive road run off water which causes the facilities in the chambers to deteriorate

much faster. In winter, the water in the chambers freezes and makes it difficult to access/operate the facilities in the chamber and can also cause damage to the facilities in the chambers. As part of this program, facilities in chambers will be replaced with direct buried facilities. Direct buried facilities are valves that can be operated from the surface without the need for a chamber vault that must be entered very time a valve is operated. These types of valves require less maintenance as there is not a concrete chamber to maintain and it is safer for the employee to operate direct buried valves when there is no need to enter any confined spaces. Direct buried valves have only recently been an option due to improvements in valve reliability leading to lower maintenance requirements as well as advancements in actuator technology that allows reliable operation of the valve from the surface. The risk of road subsidence due to chamber collapse is also eliminated by moving to a direct bury configuration because the elimination of the chamber means that facility is not present to deteriorate and cause roadway subsidence.

14. To identify and prioritize the refurbishment/replacement of inoperable transmission main facilities an Asset Management Tool and a Transmission Main Risk-Based Asset Management Plan has been developed by EWSI. Under a proactive approach, the condition of the facility is assessed prior to failure and often a relatively inexpensive refurbishment (e.g., changing the gearbox of a valve) can significantly extend the useful life of the existing asset without requiring a full replacement.

2.2 Program Justification

15. A transmission main break could have the following risks: chlorinated water released directly into a waterbody; service outages to large customer groups; service outages longer than 24 hours; low pressures to large customer groups; or reduced ability to provide adequate fire flows to large areas for the duration of the repair

16. For emergency repair and maintenance work on the transmission main system, the extension of a routine shutdown and the commissioning of a transmission main due to a non-functioning transmission main valve can take a long time and can be costly as crews require extra time to identify and operate functional isolation points.

17. The shutdown of larger than necessary portions of the transmission main system may also result in low pressures across a wide area of the water distribution system, and/or reduced fire flows for an extended period. In addition, extreme flooding can result from transmission main breaks, due to the continual release of water until the line can be isolated.

3.0 PROGRAM DESCRIPTION

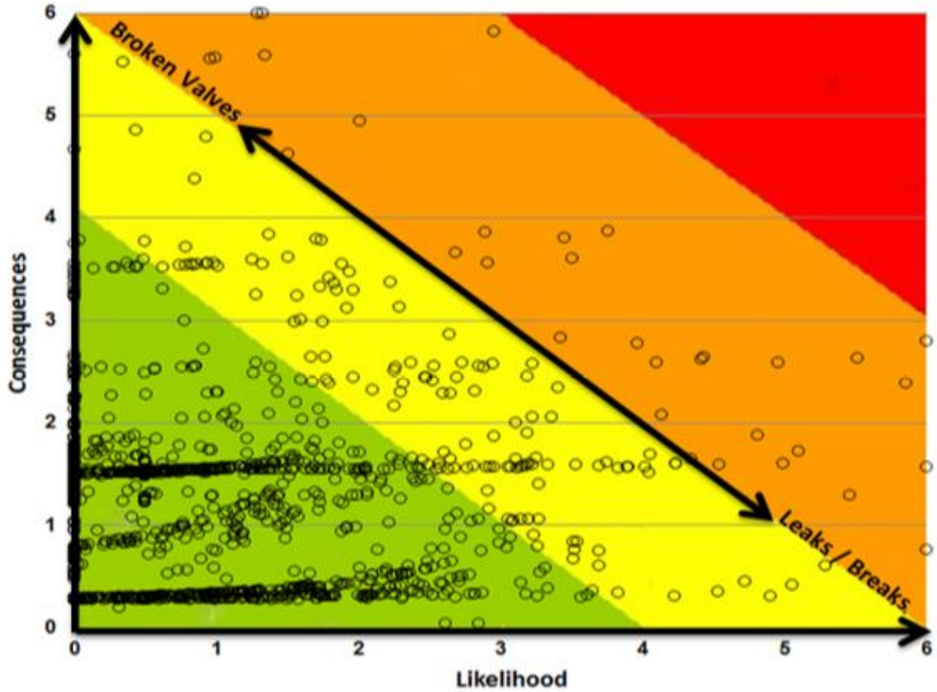
18. The Scope of this program includes the rehabilitation of high risk Transmission mains, 350mm in diameter or greater, that show signs of deterioration, are made of a highly susceptible material (certain vintages of cast iron), or have a history of breaks but do not yet qualify for the reactive renewal program. The program will also do targeted repairs or replacement of valves to facilitate shutdowns, or to reduce shutdown lengths to reduce out of water customers. Also included in the program is the execution of any spot repairs that are indicated as required based on the results of the Critical Pipeline Inspection Program.

19. In 2014 EWSI developed a prioritization tool to quantify the risk of a transmission main failure in the network (based on the likelihood and consequence of a break) and enhance decision making and prioritization of capital improvements.

20. For the 2022-2026 PBR Application, in to better realize the goals of this program, all transmission replacement and rehabilitation work will take place under this single program including valves and appurtenances. Formerly this work was separated into two programs. This program takes into consideration opportunities to combine transmission mains and valves needing replacement as priorities. It will also utilize results from the inspection program to execute targeted repairs on transmission mains to extend their useful life without executing a full replacement.

21. To evaluate potential candidates for future replacement, EWSI assessed each transmission main and pipe segment for likelihood and consequences of a potential failure, and plotted on a risk matrix as shown in Figure 3.0-1 below.

Figure 3.0-1
Transmission System Cumulative Risk Matrix



22. Each transmission main facility identified will be evaluated individually and will be prioritized for refurbishment/replacement. Priorities for the program and individual projects will be re-evaluated on an annual basis as water facility inspection information is updated and roadway paving plans are revised. The prioritization is based on a number of factors including how the specific method of refurbishment can achieve construction synergies with other planned capital construction projects as project coordination can often result in overall cost savings.

23. This program will include replacement or rehabilitation of transmission size water mains, 350 mm or larger. Any pipe material may qualify for the program based on cumulative risk ranking, although most candidates will be cast iron or steel.

24. Candidates will be prioritized each year based on overall risk of failure and construction coordination opportunities, and each one will be evaluated to determine the appropriate project scope and the method of replacement or rehabilitation. This program will also be used in emergency situations to fund replacements in response to main break events when a typical repair is not possible and it is determined a section of pipe must be replaced.

25. The following is considered out of scope for this project:

- Installation of new transmission mains that doesn't involve retiring, replacing or rehabilitating an existing main.
- Large scopes of work on distribution mains (300mm and smaller in diameter).
- Mains that have recently been identified as cathodic protection candidates and have had cathodic protection installed.

4.0 PROGRAM ALTERNATIVES ANALYSIS

Alternative 1: Repair Only

26. One alternative to this program is to repair transmission mains and valve facilities as they break, but not replace or rehabilitate them. Although it is possible that the option to continue to repair the pipe could be a lower cost alternative than replacement or rehabilitation, due to the catastrophic nature of a transmission main break, as explained above, EWSI does not consider this to be either prudent or responsible. The environmental impact and property damage that can result from the failure of a water transmission main, when considered in light of the increasing failure rate of transmission main pipes due to their age-related deterioration, highlights the need to increase the level of investment in this activity.

Alternative 2 Increase Scope

27. A second alternative would be to include all transmission mains and valves in the med-low (yellow) cumulative risk category, but such an undertaking would increase the program cost to a much higher level and would be including additional infrastructure with a much lower risk profile. Although this alternative would reduce the operational risk for the transmission main network, EWSI believes this alternative would not be an appropriate choice.

Alternative 3 Abandonment

28. This option eliminates the most risk. The disadvantage is that a significant portion of the transmission main along the same stretch is still good or can be cathodically protected to extend its life and therefore still serve the purpose of alleviating the transmission main system during high demand period, especially when the adjoining water transmission main is down for break repairs. This will help to avoid higher pumping cost, which has environmental benefits.

Alternative 4 New Construction

29. The benefit to constructing a new main is that new system and risks of breaks are eliminated. However, the cost for total new construction of the water transmission main is high – not affordable. Thus, new construction of only the high risk portions is included in the scope of this program.

Conclusion

30. The scope of this program was selected because it the lowest cost option that achieves the required objectives of maintaining the transmission system integrity and service to customers.

5.0 COST FORCAST

31. Valves: The following outlines assumptions that used made in preparing this cost estimate:

- The costs are based on replacing five valves on transmission mains of 350mm to 500mm at a cost of $100,000 each and 10 valves on transmission mains of 500mm or greater at a cost of $250,000 each. Also included is 22 valve gear replacements at $10,000 each.

32. Transmission Mains: Cost forecasts are based on replacing 500 meters of transmission main at a cost of $1,795 per meter and ten targeted section replacements at a cost of $400,000 each.

33. External contingency of 10% and internal contingency of 5% were applied based on the unknowns that may be encountered during construction and the potential for additional high priority replacements that may be encountered during the 5 year program. The projected costs of this project are shown in Table 5.0-1.

Table 5.0-1
Transmission Mains and Appurtenances Program
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	1.71	1.75	1.79	1.84	1.88	8.97
2	Internal Labour	0.09	0.10	0.10	0.10	0.10	0.49
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.01	0.04
4	Contingency	0.18	0.18	0.18	0.19	0.19	0.92
5	**Sub-total Direct Costs**	**1.98**	**2.03**	**2.08**	**2.13**	**2.19**	**10.41**
6	Capital Overhead and AFUDC	0.05	0.05	0.05	0.06	0.06	0.27
7	**Total Capital Expenditures**	**2.03**	**2.08**	**2.14**	**2.19**	**2.24**	**10.68**

34. Explain EWSI's approach to minimizing these expenditures. For example:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

35. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Customer Disruption Risk - Utility conflicts, in-operable valves, bad soil conditions, new road restoration requirements, changes to the City's planned project scope, and conflicts with other construction projects in the area may increase construction timeframes, resulting in disruption to customers	Circulate all projects through the ULA system and check all boundary valves prior to construction. EWSI works closely with the City of Edmonton to identify and clarify new requirements to restoration specifications and changes to project scope. Construction is coordinated with other utilities and the City of Edmonton. EWSI also works closely with our long term contractors to proactively de-escalate customer concerns.
2	Financial Risk – Minimization of traffic impacts from construction, especially in downtown or arterial roads, may impact ability to obtain permits or restrict work to off-peak hours, impacting construction prices	Advise the City of Edmonton's Traffic Operations Group of all projects where arterial/collector roads are affected well in advance of construction. Coordinate work closely with planned paving projects whenever possible to reduce disruption.

Appendix F23

EPCOR WATER SERVICES INC.

Water Services
Fleet and Vehicle Additions Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EWSI operates vehicles and mobile equipment to support personnel involved in the construction, maintenance, and operation of water facilities in the greater Edmonton area. This request is part of an annual recurring program to replace existing vehicles and equipment.

2. Criteria for replacement under the Vehicle and Fleet Additions Program is based on annual review of life cycle, maintenance history, as well as mileage and/or hour meter readings to evaluate deferrals and accelerated unit replacements. During the 2022-2026 PBR term, this program is projected to replace a total of 46 units.

3. This program is categorized as reliability / life cycle replacement. EWSI has forecast total program capital expenditures during 2022-2026 at $6.98 million. This is a reduction in capital expenditures of $4.96M from the 2017-2021 PBR term. The decrease in spending is a result of replacing fewer units and extending the life cycle of existing units. EWSI will use rental units to offset decreased availability for units that are not replaced, given the anticipated higher maintenance time required.

4. Rental costs are operating, and not capital, expenditures and are thus not captured in the total capital spend for this program. EWSI has not included an increase in operating expenses associated with this scope change, and instead will seek to realize operational efficiencies to offset any increase in operating costs.

2.0 BACKGROUND AND JUSTIFICATION

5. EWSI requires reliable fleet assets to ensure the ability to maintain Water systems and provide reliable service to customers. Failure to maintain an appropriate and functioning Fleet would result in EWSI staff taking longer periods of time to respond to emergency situations, replacement of aging infrastructure, and installation of new infrastructure throughout Edmonton. Additionally, EWSI staff would have to use existing vehicles and equipment for extended use, further diminishing the reliability of those existing vehicles and equipment.

6. EWSI Fleet assets approaching end of life cycle require additional repair and maintenance work, leading to higher maintenance and repair costs and extended periods of downtime. A high level analysis of EWSI Fleet's active units showed that 41% of total lifetime maintenance costs were incurred when the units remained in service past their useful life. Downtime impacts the

operational efficiency of work crews and requires increased use of rental units that are not normally equipped to meet our operational requirements.

7. In order to both extend the useful lives of some fleet assets, and eliminate the risk of critical failure or an unsafe working condition, EWSI will supplement our fleet with rental assets so that owned assets can be taken out of service more often to receive maintenance and repairs. This increases our operating costs for fleet overall, but reduces the amount of capital investment required during this PBR term.

8. The scope of this program has been reduced due to financial constraints. Over the 2017-2021 period a total of 89 units are projected to have been replaced. The projected number of replacements over the 2022-2026 period is just 46 units. In order to minimize capital expenditures within the program, a temporary change of scope will be implemented under which units will be rented rather than purchased, where possible. The 46 projected units represent units that must be custom built and thus are not readily available for rental.

3.0 PROGRAM DESCRIPTION

9. There are 46 units designated to be replaced from 2022 to 2025, representing 18% of the entire EWSI fleet. The 46 units in question have been selected for replacement based on their service lives ending between 2022 and 2025 and are shown in Table 3.0-1.

Table 3.0-1
Number of Units Projected for Replacement 2022-2026

		A	B	C	D	E	F
		2022	**2023**	**2024**	**2025**	**2026**	**Total**
1	1 Ton		1				1
2	1/2 Ton	2					2
3	Backhoe	1	2	3			6
4	Caboose	2	2		2		6
5	Crew Truck	2	2		3		7
6	Forklift	1	1				2
7	Hydrant Van				1		1
8	Leak Detection			1			1
9	Meter Cargo Van	1		2			3
10	Meter Reading SUV	2	2				4
11	SUV			1			1
12	Tandem Dump	1					1
13	Trouble Truck	2	1		1		4
14	UDF Truck		1				1
15	Valve Turner	1					1
16	Water Tank		2	3			5
17	**Grand Total**	**15**	**14**	**10**	**7**		**46**

10. Replacements will be reviewed on a yearly basis based on life cycle, maintenance history, as well as mileage and/or hour meter readings to evaluate deferrals and accelerated unit replacements. The 2022-2026 PBR term strategy for this project takes a prudent approach to vehicle replacement to manage rate increases within the term, while achieving the overall objectives of the program.

11. There is a possibility that an additional 38 existing units will be replaced with rental units on an interim basis where feasible (when maintenance costs become excessive and unit availability is impacted). Only units which are easily available and require minimal retrofitting will be rented. Additional vehicles will also be rented when appropriate for seasonal work or when unit availability is low and impacting EWSI's obligations to operate and maintain the Edmonton Water facilities in a safe and reliable manner.

12. Similarly, replacement of vehicles reaching end of life in 2026 will be deferred to the 2027-2031 PBR term. Additionally, purchase replacement of vehicles that are not custom built will be extended into the 2027-2031 PBR term.

13. EWSI Fleet will replace 46 existing units. This includes the procurement of the chassis, building the utility body, installing all-weather tires (winter rated), installing safety features (arrow board, beacon lights, strobes, etc.), decals, and telematics devices.

14. Rental costs, operational costs, fuel, and regular maintenance of these units is not included in the scope of this project.

4.0 PROGRAM ALTERNATIVES ANALYSIS

Alternative 1: Do Nothing

15. Failure to replace units, either through purchase or rental, will result in the following:

- Increase in maintenance and repair costs resulting in increase in operating expenses;
- Reduced availability due to more frequent running repairs and longer scheduled preventative maintenance and inspections;
- Reduced fuel economy therefore further increasing operating costs; and
- Reduced equipment reliability impacting ability to complete and delivery of capital work.

Alternative 2: Full Purchase Strategy

16. This is the standard approach typically applied to the Vehicle and Fleet Additions program, wherein all units are purchased, rather than certain units being rented. The full purchase strategy is the long term strategy that leads to the lowest cost to the customer. However, this strategy is being paused over the 2022-2026 PBR term in order to reduce spending on this program by $5 million to manage rate increases.

Alternative 3: Mixed Purchase/Rental Strategy

17. This is the recommended option. For this PBR term, EWSI has sought to balance its overall capital spending program and reduce capital investment on a temporary basis in favour of more pressing programs and projects. Fleet availability and safety can be maintained by replacing owned units with rental units for a period of time. If implemented indefinitely however, this approach would result in an overall increase cost to customers.

5.0 COST FORECAST

18. Pricing for the new units being purchased from 2022 to 2025 reflects 2020 unit replacement pricing. There have been some adjustments to the historical costs for the units that will be replaced from 2022 to 2025, in order to account for factors such as safety feature improvements, vendor increases, part cost increases, steel tariff increases, and import fee increases. The projected costs are shown in Table 5.0-1.

Table 5.0-1
Vehicle and Fleet Additions Program
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	1.91	1.76	1.31	1.52	0.00	6.50
2	Internal Labour	0.07	0.07	0.08	0.08	0.00	0.30
3	**Sub-total Direct Costs**	**1.98**	**1.83**	**1.39**	**1.59**	**0.00**	**6.80**
4	Capital Overhead and AFUDC	0.05	0.05	0.05	0.05	0.00	0.19
5	**Total Capital Expenditures**	**2.03**	**1.88**	**1.44**	**1.64**	**0.00**	**6.98**

19. EWSI will take the following steps to minimize expenditures within this program:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, upfitting of required units, and ensure quality vehicle builds. As such, EWSI has minimized the need to stock much of the required materials reducing the overall costs of vehicle upfitting.

- EWSI Fleet will engage the City of Edmonton Fleet Engineering Services to develop specifications on units that require new standards to be developed.
- External vendors will be engaged to supply Chassis and outfit the units with all required equipment as specified in their Management Service Agreements.
- Contracted services are performed by pre-qualified external vendors and done on a competitive unit price basis.
- The upfitting will be consistent with EWSI's fleet and industry standards and unit specifications.
- Every vehicle replacement is evaluated to improve economy of scale where possible.
- The City of Edmonton Fleet Services Procurement team will be engaged to inspect and place the units in service, as well as identify and correct any deficiencies or warranty claims.

6.0 RISKS AND MITIGATION PLANS

20. The risks are associated with this program are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk – Risk associated with committing costs for chassis by ordering units prior to the year they are to be replaced.	This risk is offset by the earlier delivery of the chassis ordered allowing for up fitting to be completed prior to the specified deadline.
2	Health & Safety Risk – Risk associated with worker injury while up fitting units.	Third party vendors are used to upfit the units at their facilities.

Appendix F24

EPCOR WATER SERVICES INC.

Water Services
Water Main Cathodic Protection Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. Cathodic protection extends the service life of cast iron water mains by adding sacrificial metal (anodes), which will corrode before the cast iron pipe thus protecting the pipe. Cathodic protection can extend the life of cast iron water mains by up to 15 years.

2. EWSI has utilized cathodic protection of the cast iron pipe portion of the water distribution system since 1997, and it has proven to be highly effective. In 2007, EWSI conducted a review of the effectiveness of this cathodic protection program. When break frequencies before and after the introduction of cathodic protection were compared, cathodically protected pipe sections experienced an approximate 50% reduction in break frequency. This program reduces the number of water main breaks and therefore extends the service life of the infrastructure, deferring the need for pipe replacement.

3. This program is categorized as performance improvement. EWSI has forecast total program capital expenditures during 2022-2026 at $15.08 million. The reduction of $5.93 million relative to the approved amount of $21.01 million in the 2017-2021 PBR is the result of a reduction in scope from 150 km to 75 km of cathodic protection over the five year term, and an increase in cost per km due to reduced spacing of anodes. EWSI projects to have spent $17.76 million over the 2017-2021 term. The lower actual spend than forecast over the 2017-2021 term is a result of redeployment of funds for the Capital Region Northeast Water Services Commission (CRNWSC) project which was approved in 2017, as well as weather delays from abnormal rainfall in the 2019 construction season.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

4. Buried metallic water mains deteriorate by corrosion due to exposure to corrosive soil conditions, stray electric current in the ground, and/or from the use of dissimilar metal pipe materials. Cathodic protection (CP) of metallic water mains is a proven and effective method of reducing break frequency and extending the useful life of those pipes. In cathodic protection, a more readily corroded metal (the anode) is attached in an electric circuit to the metallic pipe, and instead of the pipe corroding, the anode does. In this way, the anodes are sacrificed to prevent the corrosion of the pipe. When installed properly, cathodic protection can extend the useful lifetime of metallic water mains by up to 15 years. These anodes can then be replaced, further extending the life of the main.

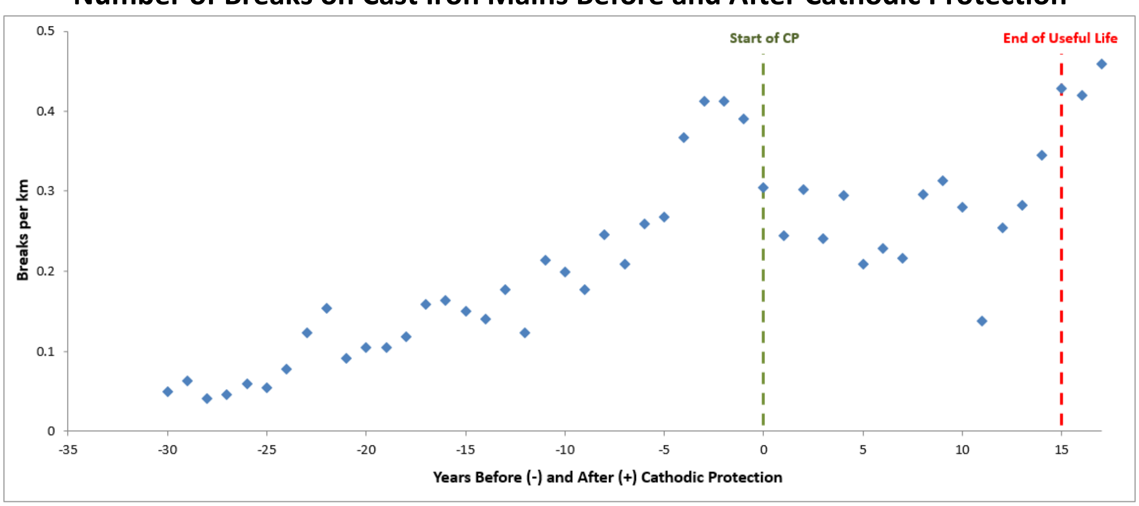
5. In 1997, EWSI commenced the CP program for cast iron water mains in an effort to extend their useful life. The sacrificial anodes are installed from the surface utilizing a minimally-invasive hydrovac excavation methodology (augernode) that does not require extensive open cut – therefore pavement is not extensively disturbed.

2.2 Program Justification

6. Between 1997 and 2019, EWSI has cathodically protected approximately 265 km of cast iron water mains. During this time, as anodes have expired, sections of these protected cast iron mains have been replaced through renewal programs. EWSI has conducted two reviews of the effectiveness of the cathodic protection of distribution water mains. The first review was conducted in 2004 and the second in 2007. Both reviews concluded that EWSI's application of cathodic protection had been effective in reducing the number of water main breaks on protected pipe.

7. In 2010, further reviews, along with studies available from the National Research Council, identified a common trend among metallic water mains: as metallic pipes begin to show deterioration from corrosion and start to experience breaks, there is only a short period of time before the deterioration starts to exponentially increase. This means an accelerated breaking phase for the pipe is expected to start once a single break occurs. Figure 2.2-1, which consists of actual main break data on protected pipe in EPCOR Water's system, illustrates this concept. It can also be shown that after cathodic protection is implemented, there is a significant decrease in breaks during the useful lifetime of the anodes.

Figure 2.2-1
Number of Breaks on Cast Iron Mains Before and After Cathodic Protection



8. A field investigation was conducted in 2019 to determine the anticipated useful lives of anodes within the Edmonton environment. Anodes installed in prior years were tested and visual assessed within 7 different neighbourhoods across the city. The results indicate that anodes can provide CP for up to 15 years. After this point, the anodes need to be replaced. As the first set of anodes were installed in 1997, there will be an increasing need to replace these depleted anodes in the 2022-2026 PBR period. Once mains are no longer protected, their break frequency will increase to rates seen before the pipe was protected. Table 2.2-1 summarizes the amount of cast iron protected as of the end of 2019:

Table 2.2-1
Current Progress of Cathodic Protection on Distribution Cast Iron Mains

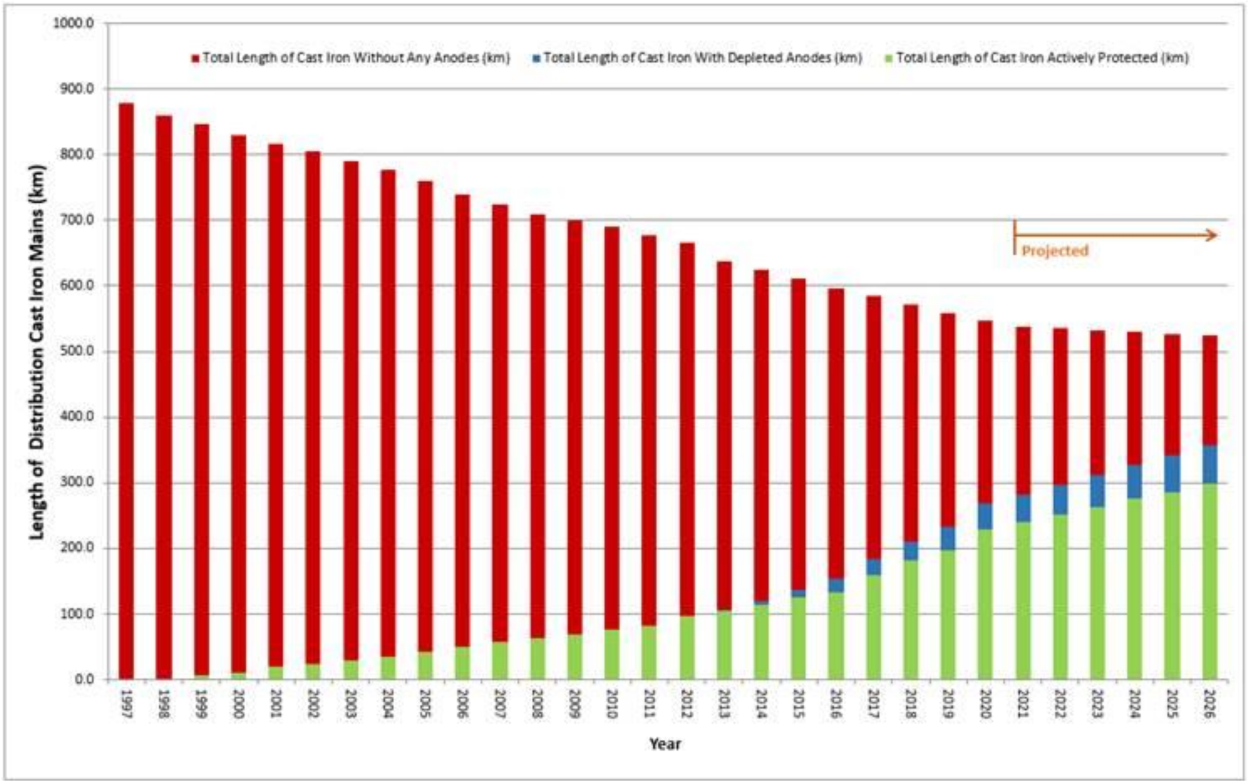
		A
1	Total Length of Pipe With Anodes [Active or Depleted] (km)	232.7
2	Total Length of Pipe Without Anodes (km)	325.3
3	Total Length of Pipe with Depleted Anodes (km)	35.8
4	% With Anodes	42%
5	% Actively Protected	35%

9. Figure 2.2-2 shows the effect that replacing anodes will have on the anticipated timeframe to fully cathodically protect the cast iron distribution network, assuming 2.75 km of cast iron are replaced annually through the Risk Based Renewal Program.

10. By the end of the 2022-2026 PBR cycle, there will be approximately 200km of cast iron mains without any active CP that will need to be protected in future PBRs. The total length of cast iron mains in the system will continue to decrease as they are replaced under other capital programs, which will reduce the future financial requirements of CP. However, even after all cast iron has been protected, a continual budget will still be required in order to replace depleted anodes after their 15 year lifespan.

11. EWSI is currently reviewing the CP program with an industry consultant (CorrPro) in order to update its CP design standards and processes. The revised design standard will likely recommend placing the anodes closer together on cast iron mains in order to ensure minimum protection currents are met. As a result, it is anticipated that the average cost to provide CP to a pipe on a per kilometer basis will increase.

Figure 2.2-2
Protected and Unprotected Distribution Mains in Service



3.0 PROGRAM DESCRIPTION

12. EWSI projects to install 1,500 augernodes annually over the course of the 2022-2026 term, protecting approximately 75km of cast iron main for 15 years. Installation and procurement of the anodes is completed by EPCOR Technologies. The installation of 1,500 augernodes annually represents a reduction in scope relative to the 2017-2021 PBR period, as shown in Table 3.0-1.

Table 3.0-1
Historical Program Activity

	A **2017**	B **2018**	C **2019**	D **2020**	E **2021**
1 Actual or Expected # of Anodes	2,498	2,196	1,831	2,400	2,400
2 Actual or Expected Capital Spend	$3,793	$3,213	$3,123	$3,800	$3,888

3.1 Prioritization

13. In order to ensure that the program is focused on the cast iron water mains that can most benefit from cathodic protection, EWIS prioritizes installation to those mains that have experienced some corrosion-related deterioration, but not to the extent that the overall structural integrity has been compromised.

14. In 2010, the criteria for cathodic protection shifted to cast iron mains that have had one break or less in its life time and no breaks within the last 5 years. In 2019, the selection list expanded to include all cast iron mains in the surrounding area, as soil corrosivity levels should be consistent within a neighbourhood. This also helped reduce the mobilization costs of construction crews.

15. while CP demonstrates significant benefits, overall when combined with our risk based renewal program, we have reduced the amount of CP installed over this period in favour of other capital projects and programs in Water to manage our overall rate increase

16. Along with break frequency, other factors that may affect the priority of selected mains include:

- Visual condition index (VCI) rating of roadway. Roads with a VCI greater than 6 will have a moratorium and candidates under these roads are considered lower priority due to limited access.
- Planned roadway projects for pavement reconstruction. Candidates under these roads are considered higher priority if anodes can be installed prior to construction.
- Above or below grade 3rd party infrastructure that may affect the ability to access water mains. Candidates in these conditions are considered lower priority due to limited access.
- Length and diameter of selected mains. Longer sections of mains and larger diameter mains are considered higher priority due to construction efficiencies impact on service reliability.
- Coordination with other cast iron renewal/replacement programs. For example, a cast iron main with several breaks on one portion of the pipe: if a capital replacement program were to renew the portion of a main with all the breaks, the remaining cast iron would become a high priority CP candidate.

3.2 Scope

17. The proposed scope for the 2022 to 2026 term includes 15 km of cathodic protection annually, including 1500 augernodes installed each year. As this program focuses on distribution sized mains, only cast iron pipe with diameters ranging from 150mm to 350mm are included in this scope. Mains will be grouped together in neighbourhoods as much as possible in order to obtain higher construction efficiencies, and as a result, a lower install cost per anode. In addition,

checks will be performed at test location sites with anodes that were installed more than 15 years ago and marked for future replacement, as necessary.

18. Cathodic protection of transmission mains is out of scope for the Water Main Cathodic Protection Program.

4.0 PROGRAM ALTERNATIVES ANALYSIS

Alternative 1 – No action

19. If no action is taken to protect or replace aging cast iron mains, then there is expected to be an acceleration of growth in the amount of cast iron main breaks in the system. Cast iron water mains would be repaired or replaced when the break frequency justifies the replacement.

Alternative 2 – Increase the Rate of Replacing Cast Iron and Steel Mains

20. While this alternative would have the highest impact on eliminating main breaks, it is not financially feasible to replace all cast iron mains in the EPCOR system in a short period of time. Current cast iron renewal programs are already targeting high break frequency mains using approved budgets. However, it is ~ 15 times more expensive to replace cast iron than it is to cathodically protect it. The financial benefits of cathodically protecting pipe can be seen in the NPV results discussed in Section 4.1.

Alternative 3 – Cathodic Protection (recommended)

21. Explained in Section 3.0. The program does not require an extensive open cut to pavement, and therefore has environmental benefits in that it requires fewer resources to implement than alternative repair or replacement programs. It also results in less disruption to traffic than break repair or pipe replacement. When combined with pipe replacement programs, the general benefits associated with overall reduction in water main breaks are realized by a greater number of customers. Those benefits include improved service reliability, reduced potential for property and environmental damages, and reduced travel disruptions. The financial, customer service, and operating risks are lowest under this option.

Alternative 4 – Maintain Historic Levels of Program Activity

22. Under this option, EWSI would continue to protect 30 km of distribution main annually. Although it will be necessary to increase activity on this program back to historic levels in future PBR periods, EWSI has determined that it is able to temporarily show investment in this program,

while continuing to meet EWSI's performance metrics and without a material impact on system reliability.

4.1 Financial Analysis

23. A financial analysis was completed on a scenario in which the same amount of capital expenditure is invested in both Alternative 2 – Increase the Rate of Replacing Cast Iron and Steel Mains and Alternative 3 – Cathodic Protection. Table 4.1-1 summarize the forecast capital expenditures of the two alternatives over the 2022-2026 PBR. These forecasts include construction costs, internal labour, contingency, and inflation.

Table 4.1-1
2022-2026 Forecast Capital Expenditure
($ millions)

		A **Alternative #2 Increase Replacement***	B **Alternative #3 Cathodic Protection**
1	Cost to replace Cast Iron mains with PVC	15.08	-
2	Cost to install anodes	-	15.08
3	**Total Costs**	**15.08**	**15.08**

* 2022-2026 Capital expenditures are assumed to be the same as the Cathodic Protection Program forecast, which results in replacement of 7.7 km of cast iron mains over the PBR term. It would cost approximately $142.50 million (in 2020 dollars) to fully replace the 75 km of cast iron mains protect by the 2022-2026 Cathodic Protection Program.

24. In order to determine the long term impacts on EWSI's customers an NPV analysis of the three alternative's revenue requirement was completed. As shown in Table 4.1-2 over a 25 year period Alternative 3 results in a lower long-term revenue requirement than Alternative 2.

Table 4.1-2
NPV of Revenue Requirement – 25 Year Period
($ millions)

		A **Alternative #2** **Increase** **Replacement**	B **Alternative #3** **Cathodic** **Protection**
1	Operations and Maintenance	9.54	7.60
2	Depreciation Expense	2.24	11.92
3	Return on Rate Base Financed by Debt	4.25	2.40
4	Return on Rate Base Financed by Equity	7.43	4.20
5	Franchise Fees	2.04	2.27
6	Terminal Value of Rate Base	7.37	2.60
7	**Revenue Requirement**	**32.87**	**30.99**

25. The following assumption were used in the NPV analysis:

- 25 year period used for analysis;
- Unprotected cast iron main have a main break frequency of 0.39 main breaks per km per year;
- Cathodic protection decreases the cast iron main break frequency to approximately 0.26 main breaks per km per year;
- In Alternative 2 the number of main breaks per year decrease as cast iron mains are replaced with PVC mains;
- Each main break costs $13,000 plus inflation in repair costs, and $10,000 plus inflation in potential customer damage claims/investigation;
- Anodes have a 15 year lifespan, after which they need to be replaced in order to maintain protection of the mains;
- Alternative 2 – 7.7 km of cast iron mains are replaced with PVC mains over the 2022-2026 period, at a cost of $1,900 per meter plus inflation; and
- Alternative 3 – 75 km of cast iron mains are cathodically protected.

4.2 Conclusion

26. Alternative 1 is not a viable alternative as the risks to both the utility and customers are too high. Accelerating cast iron main replacement (Alternative 2) has a significant cost to customers; under this alternative only 7.7 km of cast iron mains can be replaced for the same capital costs as cathodically protecting 75 km of main. As a result, Alternative 3 – Cathodic Protection is the preferred alternative. Not only is the long term cost to customers lower than that of Alternative 2, but cathodic protection also provides the following benefits:

- Reduced environmental impacts, as less main breaks would reduce the amount of chlorinated water entering the ecosystem;
- Reduced impact on traffic and roadways;
- Fewer customer outages and impact; and
- Delays the eventual replacement of aging cast iron main.

5.0 COST FORECAST

27. External cost estimates are based on unit rate contractor estimates. Internal costs are based on historical unit cost for installing anodes using the augernode process.

28. Cost to install are estimated at $1,586 per augernode based on fixed cost provided by EPCOR Technologies. These estimates were developed based on historical costs. EWSI is forecasting to install 7,500 augernodes over 2022-2026. The projected costs are shown in Table 5.0-1.

Table 5.0-1
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	2.50	2.56	2.63	2.69	2.76	13.14
2	Internal Labour	0.14	0.15	0.15	0.15	0.16	0.75
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.01	0.06
4	Contingency	0.13	0.14	0.14	0.14	0.15	0.70
5	**Sub-total Direct Costs**	2.79	2.86	2.93	3.00	3.08	14.64
6	Capital Overhead and AFUDC	0.08	0.08	0.09	0.09	0.09	0.43
7	**Total Capital Expenditures**	2.87	2.94	3.01	3.09	3.17	15.08

29. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

30. The construction-related risks are identified in Table 6.0-1 along with necessary mitigation efforts:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial Risk - Interference from existing utilities during construction.	Ensure all utilities are located prior to construction. Confirm alignments of other utilities on first-calls. Since construction takes place on our current alignment, conflict should not pose a problem.
2	Financial Risk - Construction site is within a roadway moratorium, causing higher remediation costs.	Ensure candidates are not within 3 year asphalt no-cut locations prior to design and use tools such as GeoFit to check VCI.
3	Financial Risk - Likelihood that geotechnical conditions will present problems during construction (for underground work).	Remove candidate from program.
4	Environmental and Customer Service Risk - Noise from hydrovac activity may impact wildlife and people (including public and employees) in the area.	Ensure hydrovac operator and EPCOR Technologies PM & front line staff are familiar with Edmonton Noise Bylaw and OH&S Regulations. Ensure all workers within site are wearing proper PPE including hearing protection. Ensure proper signage is in place to warn public of hazards.
5	Environmental Risk - Hydrovac slurry is considered a waste material and may be contaminated.	Perform a visual and smell check on site to examine soil conditions. Ensure contaminated hydrovac slurry is disposed of at a proper hazardous waste disposal facility. Ensure non-contaminated hydrovac slurry is disposed of at an Alberta Environment approved facility.

Appendix F25

EPCOR WATER SERVICES INC.

Water Services
Water Service Replacement
and Refurbishment Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Water Service Replacement and Refurbishment Program is required to fund the replacement and refurbishment of water service lines that:

- do not meet current servicing standards (non-compliant servicing alignment); or
- consist of obsolete water service line material (non-approved material such as lead or asbestos cement).

2. Water service lines include the water pipelines owned by EWSI which provide a connection between a water main and the customer's service connection point which is typically at or near a customer's property line.

3. Water service lines that do not meet current standards or are comprised of non-approved material pose a potential health risk to EWSI's customers. In particular, this program is necessary to address the associated health risk posed by obsolete service material (e.g. lead). This program not only supports EWSI's Envirovista Stewardship commitment to replace lead services; it also helps customers to reduce their health risk associated with obsolete material. As such, this program is critical for the safe and reliable delivery of drinking water. This program also includes the issues with installations that do not meet current standards for other reasons, discussed later.

4. This program falls under the category of health, safety and environment. EWSI has forecast total program capital expenditures during 2022-2026 at $24.67 million.

5. Historically, EWSI completed some water service line replacement and refurbishments as part of the Water Service Connections program. During the 2012-2016 PBR term, EWSI embarked on a public health initiative to expedite lead service line replacement, increasing the scope of this work. The Water Services Replacement and Refurbishment Program was first introduced in the EWSI's 2017-2021 PBR Application, with a forecast capital spend of $10.15 million and actual projected spend of $12.09 million.

6. A Non Routine Adjustment (NRA) of $5.92 million was approved over the course of the 2017-2021 term for the accelerated replacement of high priority lead service lines. The actual NRA spend over the 2017-2021 PBR term is projected at $5.95 million.

7. The increase in forecast capital expenditure for this program from $10.15 million to $24.67 million is mainly attributable to:

- EWSI has included Curb Cock (CC) replacement and full service box replacements to the program. These costs were historically captured as operating costs and now can be justified as capital costs because the replacement results in the service life of the asset being extended by at least one year after replacement. The costs over the 5 year term will be $9.43 million.
- The additional $4.94 million is required to complete High Priority lead service line replacements, defined as residences that exceed the maximum acceptable concentration of lead after the addition of orthophosphate.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

8. This program covers capital construction investment in non-contributed water service line assets. It had previously been included as part of the Water Service Connections program. The Water Service Connections program is for new water service construction driven by new home construction and infill development within the inner city neighbourhoods and is fully contributed by developers. The Water Services Replacements and Refurbishments includes relocation of water service lines that do not meet current servicing standards, reactive replacements of service box and components, and replacement of service lines composed of asbestos cement, lead, camaloy and/or galvanized iron.

2.1.1 Non –Compliant Relocations Portion of the Program

9. This portion of the program covers relocation of water service lines that do not meet current servicing standards (non-compliant servicing alignment). Examples would include relocations of cross lot servicing or servicing from a transmission main where servicing from a proximal distribution main is possible.

2.1.2 Service Box and Curb Cock (CC) Replacement Portion of the Program

10. The service box replacement part of the program is entirely reactive. The service box replacements can be classified in two types of replacements; Replace Full Service Box, and Replace CC valve & Full Service Box.

2.1.3 Lead Service Line Replacement Portion of the Program

11. On March 8, 2019, Health Canada released a new Guideline for Canadian Drinking Water Quality (“guidelines”) proposing to reduce the maximum acceptable concentration (“MAC”) for lead in drinking water from the current 10 µg/L (micrograms per Litre) to 5 µg/L. The guidelines

shift the point of compliance to be water samples collected at the customer's tap within the home or building (as opposed to points in the municipal water distribution system). EWSI has determined that although the change will not immediately impact compliance with provincial drinking water regulation, EWSI will not be able to comply with the intent of the proposed lead guideline in the Edmonton water system if the program is not implemented.

12. In response to the change in guidelines, EWSI carried out a pilot project in 2018 that involved full lead service line replacements at eight homes within the city. Based on the experience gained in this pilot, EWSI prepared a Lead Mitigation Strategy Business Case, submitted to Utility Committee March 2019, which outlined different options to reduce lead levels at the tap, including the addition of a corrosion inhibitor (orthophosphate) at the water treatment plants, as well as accelerated replacement of lead service lines (LSLs) from the water main to the meter inside the customer's building.

13. This program has the following focus on lead service replacements:

- Accelerating the replacement of High Priority lead services, defined as homes that test over the MAC of 5 ug/L. after the addition of orthophosphate. This will require full replacement of the lead service line from the water main to the meter inside the customer's home. EWSI estimates there will be 360 total buildings in this category after the addition of orthophosphate.
- Replacing private side lead services in conjunction with the public side during construction of other renewal work i.e. water main replacement.
- Replacing public and/or private lead services in conjunction with repair work associated with leaking, frozen, broken services.

2.2 Program Justification

2.2.1 Non- Compliant Relocations Portion of the Program

14. Cross lot services are replaced because it does not meet the Canadian plumbing code. Cross lot servicing results in pressure and other supply issues. Water services directly connected to a transmission main are replaced because they limit EWSI's ability to provide service to our customers during periods where isolations are required.

2.2.2 Service Box and Curb Cock (CC) Replacements Portion of the Program

15. Service box replacements are required when the asset has failed. These are customer driven replacements due to leaking, frozen, damaged services. Failure to replace these assets

would result in an increase in non-revenue water and could have a negative affect on water quality.

2.2.3 Lead Service Line Replacements Portion of the Program

16. The Water Services Replacement and Refurbishment Program is required to replace certain water service lines which are non-compliant with current servicing standards and which limit EWSI's ability to provide service to our customers during periods where isolations are required. Not addressing these issues when they arise would result in unacceptable risks to public health through drinking water that contains lead. In addition, there would be risks to EWSI's reputation both with customers and provincial regulatory authorities (Alberta Environment and Parks, Alberta Health Services).

17. This program also provides renewal of water service lines that are obsolete because the material is not accepted under existing City of Edmonton design and construction standards Replacement of these obsolete service lines is prioritized on the basis of the associated health risk posed by obsolete service material (e.g., lead). This program helps customers to reduce their health risk.

3.0 PROGRAM DESCRIPTION

3.1 Non-Compliant Relocations Portion of the Program

18. The replacement or relocation of water services found to not be in compliance with current servicing standards will occur both on a proactive and reactive basis. Proactive replacement/relocations will occur when they are identified in non-emergent conditions (i.e., cross lot servicing). Reactive replacements/relocations will be undertaken when presented in an emergent basis (i.e., leaking service off a transmission main that can be relocated to a proximal distribution main). Historically an average of 2 service relocations are completed each year.

3.2 Service Box and CC Replacement Portion of the Program

19. The service box replacement part of the program is entirely reactive. These are customer driven replacements due to leaking, frozen, or damaged services.

20. The service box replacements can be classified in two types of replacements; Replace Full Service Box, and Replace CC valve & Full Service Box. The scope for each is detailed below;

21. Replacement Type 1: Replace full service box – The scope consists of replacing CC cap, casing and rod only. The work is carried out from ground surface with a hydrovac crew. As these are customer driven, the volume each year will vary based on customer requests.

22. Replacement Type 2: Replace CC valve & full service box – The scope consists of replacing CC cap, casing, rod and CC valve. The work is carried with an excavation crew due to the size of the pit required to access the CC valve. As these are customer driven, the volume each year will vary based on customer requests.

23. As shown in Table 3.2-1, EWSI has completed an average of 489 service box replacements and 117 CC valve + service box replacements annually between 2017 and 2019. EWSI is forecasting completing 500 service box and 120 CC valve + service box replacements annually 2022-2026.

Table 3.2-1
2016-2019 Number of Replacements

	A	B	C	D	E	F
	2016	**2017**	**2018**	**2019**	**2017-2019 Average**	**2021-2026 Annual Forecast**
1 Service Box	394	498	495	568	489	500
2 CC Valve + Service Box	124	109	127	106	117	120

3.3 Lead Service Line Replacement Portion of the Program

24. As presented in the March 2019 Lead Mitigation Strategy Business Case, EWSI's Lead Mitigation Strategy to reduce lead at the tap includes:

- Implementing the addition of lead corrosion inhibitor (orthophosphate) at each WTP.
- Eliminating the creation of partial lead services (i.e., private side LSLs discovered during a replacement for any reason on a public side LSL).
- Accelerating the completion of high priority LSL replacements over a five-year period, and
- Continuing to provide point of use filters as an interim measure of protection.

25. The Lead Mitigation Strategy will not change in scope, but will be herein referred to as the lead service line replacement portion of the Water Services Replacement and Refurbishment Program.

26. A "care list" identifying priority customers with high lead samples provides the sequence in which customers are contacted to arrange a home visit. At the home visit, a visual confirmation

of service material pre-meter is completed. Customers sign an agreement enabling EWSI to complete construction of the replacement on the private side. Hydrovac is utilized to determine whether full or partial replacement is required. Full replacement is required when lead is present on both the private and public side, whereas partial replacement is required when lead is only present on the private side.

27. Table 3.3-1 provides the forecast level of activity anticipated on all three portions of the program over 2022-2026.

Table 3.3-1
LSL Replacements Scheduled for 2022-2026

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**
1	High Priority - public and private side	100	100	0	0	0
2	Customer Initiated - public side only	80	80	80	80	80
3	Water Main Repair and Renewal	20	20	20	20	20

3.4 Program Schedule

28. The 2022-2026 Water Services Refurbishment and Replacement Program will be completed every year. High level planning and coordination with future City projects for any given year will begin in the previous year to prepare for the upcoming design season. Spending will not begin on upcoming projects until the project year begins and the project opens.

29. EWSI anticipates approximately 360 homes will still have a MAC greater than 5 ug/L after the addition of orthophosphate (assuming 80% efficacy). EWSI is currently replacing High Priority lead services lines in 2020 and 2021 with a goal of 80 lead service replacements per year. The remaining 200 High Priority lead service replacements will be carried out in 2022 and 2023, 100 replacements per year respectively.

30. Not included in the scope of this program is the addition of Orthophosphate.

4.0 ALTERNATIVES ANALYSIS

31. Alternatives for relocations and the service box and CC replacement were not considered as these are critical parts of the water distribution infrastructure. If damaged or leaking, then replacement is required to maintain service to the customer, not replacing is not an option.

32. The March 2019 Lead Mitigation Strategy Business Case contains a detailed assessment of five alternative lead mitigation strategies, including: (i) continuing with the current program

alone, (ii) adding orthophosphate, (iii) adding orthophosphate and eliminating partial LSL replacements (iv) adding orthophosphate, eliminating partial LSL replacements and accelerating replacement of High Priority LSLs and (v) adding orthophosphate and full replacement of all LSLs over 15 years. Alternative (vi) is the option that has been selected and approved by the City for implementation.

33. Alternative D was selected because this alternative will ensure compliance with the intent of the Health Canada lead guideline for all homes with LSLs by 2025 and will reduce the risk of lead exposure in all other homes across Edmonton and the region in a cost effective manner. Specifically:

- The proposed alternative will eliminate the number of LSL homes exceeding the proposed MAC of 5 µg/L and will reduce the number of all homes across the city testing greater than the proposed MAC from 23,000 (8.5%) to 5,500 (2%) due to lead-containing plumbing.
- Implementing both a lead corrosion inhibitor (orthophosphate), eliminating the practice of partial LSL replacements, and accelerating the replacement of high priority LSLs is in alignment with Health Canada's direction to make every effort to "maintain lead levels in drinking water as low as reasonably achievable".

5.0 COST FORECAST

5.1 Relocations Portion of the Program

34. Both the number of relocations and the cost per relocation are consistent with the cost forecast in the 2017-2021 PBR Application.

5.2 Replacements Portion of the Program

35. Both the level of activity and the cost per replacements have been projected based on historical averages. EWSI is forecasting 500 service box and 120 CC valve + service box replacements annually over 2022-2026. This aligns with the historical averages displayed in Table 3.2-1.

36. The average cost over 2016-2019 of replacing a service box was $1,616. The average cost of replacing the CC valve along with the service box was much higher, at $8,908. The forecast is based on the number of crew hours, based on historical timesheets.

5.3 Lead Portion of the Program

37. The external costs estimate was based on average replacement costs considering full service replacements from rates provided by two external contractors secured for the work. $18,000 per full service replacement was used as an estimated replacement cost. The projected costs are shown in Table 5.3-1.

Table 5.3-1
Water Services Replacement and Refurbishment Program
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs						
1	Contractors	1.80	1.83	0.10	0.11	0.11	3.95
2	Internal Labour	1.74	1.81	1.85	1.90	1.95	9.24
3	Vehicles and Equipment	0.86	0.90	0.92	0.95	0.95	4.58
4	Contingency	0.31	0.32	0.15	0.15	0.16	1.09
5	**Sub-total Direct Costs**	**4.70**	**4.86**	**3.03**	**3.11**	**3.16**	**18.86**
6	Capital Overhead & AFUDC	1.10	1.13	1.16	1.19	1.22	5.80
7	**Total Project Costs**	**5.80**	**6.00**	**4.19**	**4.30**	**4.38**	**24.67**

38. EWSI will ensure that expenditures within this program are minimized through the following:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by EWSI's internal staff.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down). Construction method will be used to meet requirements at the lowest cost.

- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

39. The risks are associated with this program are shown in Table 6.0-1:

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial – Project capital costs increase beyond the forecast due to a lower effectiveness of orthophosphate that anticipated, leading to an increase in the number of High Priority LSL replacements required.	EWSI calculated High Priority LSLs assuming 80% orthophosphate efficacy. Based on experience in other jurisdictions, EWSI considers the likelihood of reductions in lead levels of less than 70% to be unlikely.
2	Financial – Higher than expected costs for replacement of privately-owned portion and/or utility-owned portion of LSLs.	EWSI has relied on its records, field reconnaissance notes and industry data to estimate the number of LSLs with lead on the privately-owned portions, though not all records were complete. EWSI records private-side service materials when lead is observed at the water meter during meter installation and maintenance. EWSI will initiate a hydrovac program to confirm records prior to LSL replacement and will encourage customers to confirm the construction of their service lines.
3	Regulatory – Risk of future changes to regulatory requirements mandating the removal of all lead service lines, including private-side LSL.	The proposed LSL replacement program includes full LSL replacements and the removal of High Priority private-side only LSLs. Any changes to regulations requiring the removal of remaining private-only LSLs, not exceeding the Health Canada MAC, will be addressed at that time.
4	Customer Risk – customers and property owners are resistant to replace the private section of the LSLs during full LSL replacements, are not aware of the program, or are not available for access into the home. This includes vacant and rental properties.	Communication and education of customers will occur through direct conversations, open houses, and advance notifications.
5	Customer Risk – reputational damage to EPCOR if customers are unhappy with the portion of work undertaken on their property.	Work completed within a customer's home will be completed by a third party contractor with a goal to limit vibratory compaction and use a sand/fillcrete backfill to prevent damage. Any damages identified by customers will be covered by the contractor scope of work. Use of preconstruction photos to maintain record of weak points/cracking in the walls and foundation.

Appendix F26

EPCOR WATER SERVICES INC.

Water Services
Winterburn Booster Station Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Winterburn Booster Station Project involves the construction of a new booster station in the Winterburn area and the decommissioning of the existing Parkland Booster Station. This project has been deemed the most cost effective approach to addressing short term and long term concerns. In the short term, significant investment would have been required to upgrade the Parkland Booster Station's electrical equipment. This is urgent work that was originally planned for the 2017-2021 PBR term, but delayed due to the plan to transfer of assets from the Capital Region Parkland Water Services Commission (CRPWSC) to EPCOR.

2. The scope of work for this project entails design and construction of a booster station, which includes site development, construction, installation of all booster station components, and connection to the 610 mm diameter steel transmission line, which currently transports water from the station to the regional customer's network. Also included in the project is stakeholder consultation and decommissioning of the Parkland booster station.

3. This project is included in the reliability / life cycle category and EWSI has forecast total program capital expenditures during 2022-2026 at $6.70 million. Design is scheduled to begin in 2023. Construction is scheduled to begin in 2024 with the new booster station going into service in 2025.

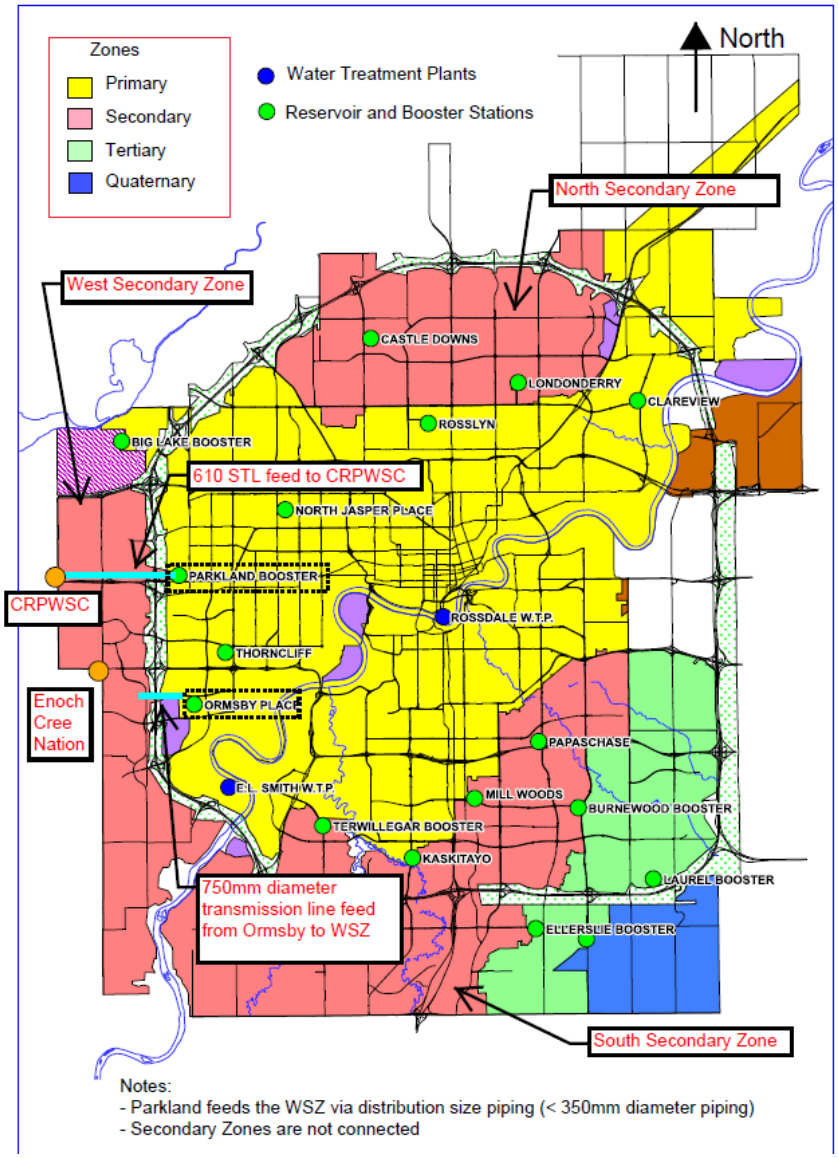
2.0 BACKGROUND AND JUSTIFICATION

2.1 Project Background

4. The Parkland Booster Station is one of two stations that services the West Secondary Zone (WSZ). The station pumps up pressures as water passes from the Primary Zone to the WSZ. The WSZ, which is also serviced by the Ormsby Reservoir Pump Station, includes more than 35,000 residents, 330 commercial customers, four critical customers and the Enoch Cree Nation.

5. As shown in Figure 2.1-1, Parkland booster station currently acts as a boundary station between EPCOR and the CRPWSC. About half of the assets in the Parkland station and the entire 610 steel line are currently owned and operated by the CRPWSC. The other half of the Parkland station is currently owned and operated by EWSI.

Figure 2.1-1
EPCOR service zones



6. In January 2021, the CRPWSC transferred the entire Parkland Booster Station assets and the portion of the 610 steel line that is within the City of Edmonton boundaries to EWSI, as part of their plan to install a new boundary station. As per historical policy, annexation of land by the City of Edmonton did not see the transfer of assets from the original owners. This is the final transfer of assets required in order for EWSI to own all water system assets within City of Edmonton boundaries.

7. The transfer of the Parkland assets triggered the following changes to the system:

- The 610 steel line transferred to EWSI.

- EWSI owns all assets of the Parkland Booster station, including electrical equipment, all 6 pumps, and site infrastructure.
- The new boundary station for CRPWSC, and thus the entire customer service area of this regional customer, will be fed by the WSZ network.

8. The 610 steel line is an important piece of infrastructure, as it will be converted to service the WSZ and can be used for tie-ins to the service area. The booster station assets are being transferred at net book value and require significant upgrades to convert the remainder of the infrastructure to EPCOR's service needs:

- Electrical equipment such as wiring, switch gears, and breakers are required. These were installed in 1972 and are deteriorating. If left unattended, these could lead to a fire event or an unplanned shutdown of the station.
- The Motor Control Centres (MCCs), need to be replaced due to their age (1982) and so that the pumps can be converted to soft start. Soft starts help to minimize pressure swings when a pump is started or stopped.
- Life cycle upgrades for the pumps being transferred to EPCOR (pump 6, 7 and 8) are be required. Pumps 6, 7, and 8 will be utilized on a more frequent basis to service the WSZ zone, which is expected to grow over the next few years.
- The programmable logic controller (PLC) system used to control pumps 6,7 and 8 uses obsolete equipment and will require upgrades to ensure compatibility with EPCOR's system

9. As an alternative to completing these upgrades, the option of decommissioning the Parkland Booster Station and replacing it with a new station west of the Anthony Henday Drive (AHD), and closer to the WSZ, was reviewed. This is the option EWSI has selected due to operational benefits and anticipated lower long term cost.

2.2 Project Justification

10. The risks of status quo (continuing to operate the Parkland Booster Station with no upgrades), are high. The WSZ services 35,000 residents, 330 commercial customers, 4 critical customers, the Enoch Cree Nation and since January 2021, it also includes the CRPWSC, which currently contains around 60,000 customers. Parkland is one of just two stations that feed this zone making it an important station to maintain reliability in this area. If Parkland is out of service due to electrical or mechanical failures with no funding to complete capital upgrades, then the

entire area will be fed by the Ormsby station and its 750 mm feed. In this scenario, the area will experience low pressures when demand reaches very high levels.

11. Furthermore, EWSI operations relies on Ormsby's reservoir to provide reliability to both the Primary and West Secondary Zones. In situations, where the Primary Zone requires support, such as during E. L. Smith shutdowns, EWSI operations rely on Parkland's boosting capability to maintain pressures in the WSZ. The upgrades or new booster station will thus facilitate operational flexibility.

12. Electrical equipment at Parkland has exceeded its life cycle replacement. In its current state, it has been deemed a fire hazard and requires extensive upgrading to ensure it meets the electrical code. Failure of these assets could mean a long station shutdown, or even a fire.

Pump and SCADA systems need to be upgraded as they do not meet EPCOR standards. Under status quo (continuing to operate the Parkland Booster Station with no upgrades), the station will not have the ability to provide the required support in the WSZ.

13. Either of the alternatives – (1) upgrading the Parkland Booster Station and (2) construction of a new booster station in the Winterburn area, is able to resolve the issues identified above. The new Winterburn Booster Station provides additional operational benefits at a lower anticipated long term cost to customers.

3.0 PROJECT DESCRIPTION

14. The scope of work entails design and construction of a booster station, including:

- Site development which includes utility servicing, grading, and road structure
- Construction of building and foundation
- Installation of all components of a booster station – electrical, mechanical, HVAC, and controls
- Connection to existing 610 steel line
- Design to include the following
  - Conceptual design
  - Detailed Design
- Stakeholder consultation and obtaining permits
  - Developers

   - Neighbourhood
   - City of Edmonton
   - Utilities
- Decommissioning the existing Parkland station
- Commissioning

15. The following items are out of scope for this project, however these costs have been included in the NPV analysis in Section 4.3:

- The land is being purchased under a separate project and is planned to be secured by 2022.
- Decommissioning of the Parkland Booster Station is not included in this project.

16. The proposed project phases and target years are shown in Table 3.0-1.

Table 3.0-1
Program Phases

	A **2022**	B **2023**	C **2024**	D **2025**	E **2026**
1 Initiation/Approvals	x	x			
2 Conceptual Design		x			
3 Permit Applications		x			
4 Detail Design		x	x		
5 Procurement		x	x		
6 Construction			x	x	
7 Commissioning				x	
8 Close-out					x

17. The following permitting requirements are expected for this project:

- *Municipal Government Act* – Bylaw 15100:
   - Development Permit
   - Phase I/II Environmental Site Assessment
   - Building and Trade Permits
- Regulation of Work and Equipment Installation on City Lands Bylaw- Bylaw 12846:
   - Utility Line Assignment
   - On Street Construction and Maintenance Permit

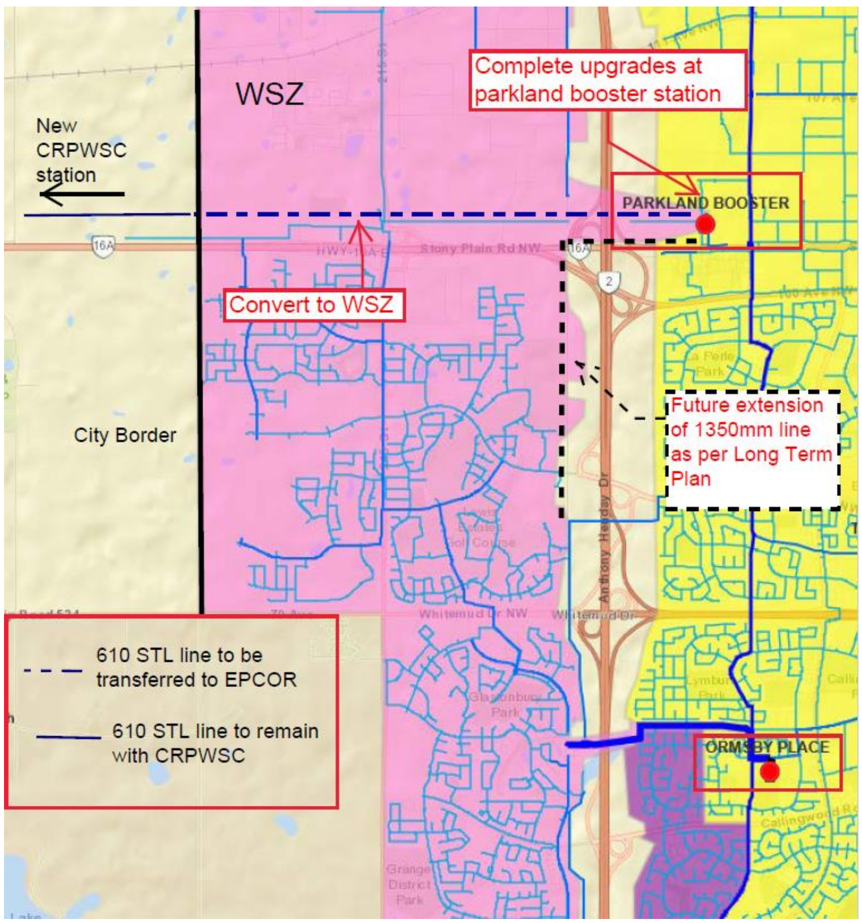
4.0 ALTERNATIVES ANALYSIS

18. EWSI considered the following alternatives:

4.1 Alternative 1: Complete upgrades at the Parkland Booster Station

19. Figure 4.1-1 below illustrates this option in the red squares. The figure also shows a future planned 1350 mm diameter main extension.

Figure 4.1-1
Alternative 1 Overview



20. Benefits: This option has lower short-term capital expenditures at $2.45 million, over the 2022-2026 PBR term. ;

21. Disadvantages:

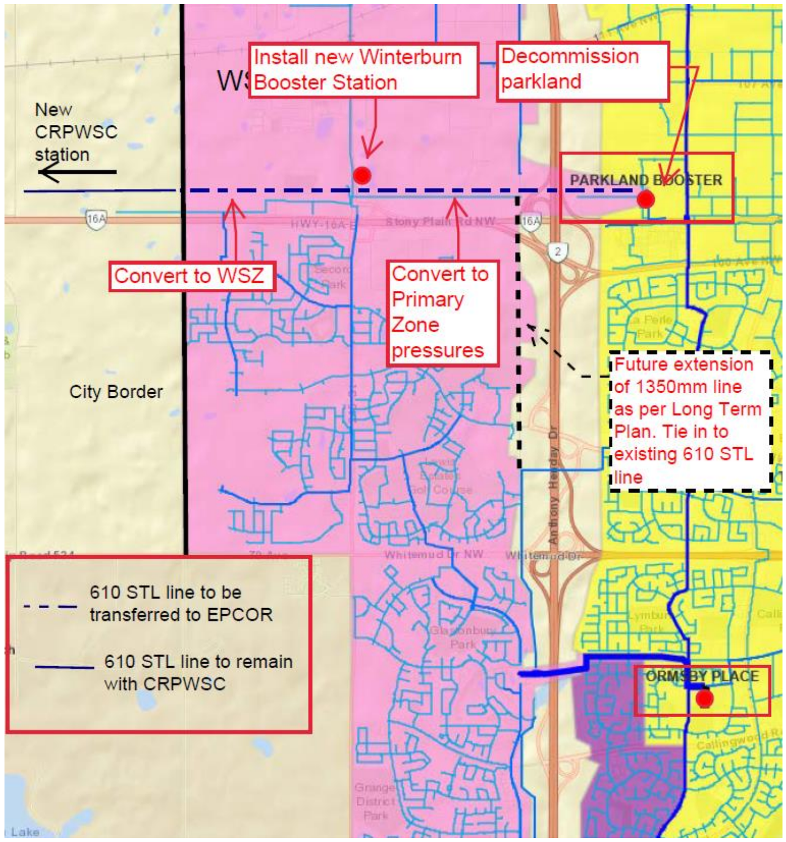
- This option is anticipated to be the most expensive over the long term, as it will require an additional estimated $6.77 million in construction costs for the 1350 mm transmission main to cross the Anthony Henday Drive when it is extended on 199 Street.

- This option comes with more unknowns and thus higher risk. There are limitations working around a station built to lower standards. It is possible that the upgrades considered in the current cost estimates will not be feasible with the older equipment. Additionally, shut down planning will be required to minimize the impact to existing operations in the WSZ.
- In the short to medium-term, the 610 steel line will experience head loss because there is a long stretch of pipe between the existing Parkland Station and the WSZ service area. However, this disadvantage is not critical to the selection of the final option.

4.2 Alternative 2: Construction of a new station west of the Anthony Henday Drive

22. As an alternative to completing the upgrades required for Alternative 1, this alternative involves decommissioning the Parkland Booster Station and replacing it with a new station west of the Anthony Henday Drive (AHD), and closer to the WSZ. Figure 4.2-1 below illustrates this option in the red squares text boxes. The figure also shows a future planned 1350 mm diameter main extension.

Figure 4.2-1
Alternative 2 Overview



23. Benefits:

- The station would be placed at a more advantageous location for future capital projects. The planned 1350 mm diameter transmission main extension can connect to the 610 steel line on the west side of the Anthony Henday Drive because the transmission main at that location will be part of the primary zone. This reduces the amount of main required and removes the need to cross the Anthony Henday Drive which will reduce future capital expenditures by an estimated $6.76 million.
- A supplementary benefit is that this is hydraulically more efficient as the pressure is boosted closer to the service areas. At a result, pumps require less power to meet service requirements for the zone, leading to environmental benefits as well as operational cost savings.

24. Disadvantages:

- This option has higher short-term capital expenditures at $7.21 million, including $0.50 million in land purchase costs, in the 2022-2026 PBR term.

- This option requires $0.25 million in operating expenses to decommission the Parkland Booster station, in the 2022-2026 PBR term.

4.3 Financial Analysis

25. Tables 4.3-1 and 4.3-2 summarize the forecast capital expenditures of the two alternatives, by PBR. These forecasts include construction costs, internal labour, contingency, inflation, and AFUDC. The Parkland Booster Station alternative has lower capital expenditures in the 2022-2026 PBR term but results in higher capital expenditures in the 2027-2032 PBR term, and overall.

Table 4.3-1
Alternative 1: Parkland Booster Station Upgrades
Capital Expenditure Forecast by PBR
($ millions)

		A **2022-2026[1]**	B **2027-2032[1]**	C **Total**
1	Electrical Upgrades	1.99	-	1.99
2	Pump Upgrades	0.15	-	0.15
3	PLC Upgrades	0.31	-	0.31
4	1350 mm Main Extension	-	24.72	24.72
5	Pump Replacement	-	0.27	0.27
6	**Total Costs**	**2.45**	**24.99**	

[1] Includes Contingency of 20%.

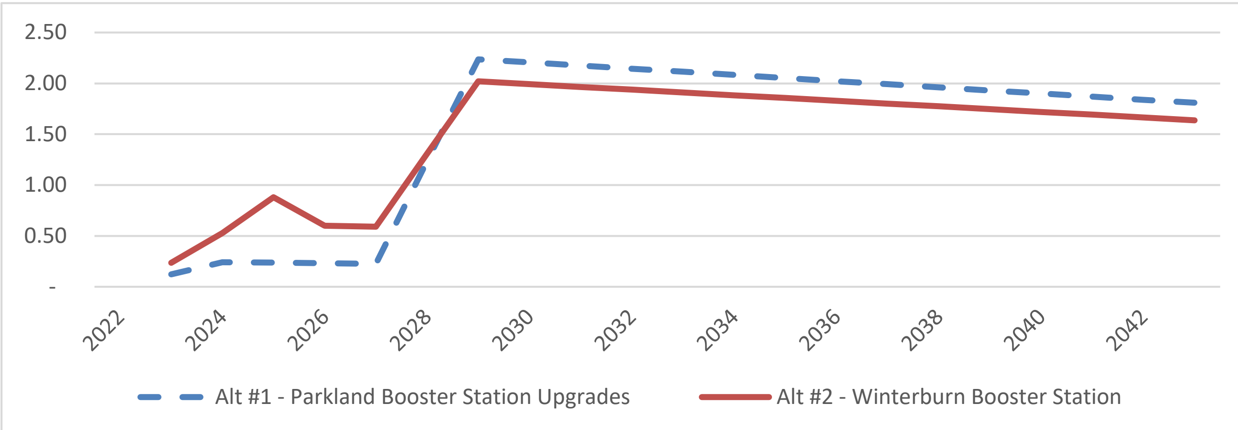
Table 4.3-2
Alternative 2: Winterburn Booster Station
Capital Expenditure Forecast by PBR
($ millions)

		A **2022-2026[1]**	B **2027-2032[2]**	C **Total**
1	Winterburn Booster Station	6.70	-	6.70
2	Land Purchase	0.50	-	0.50
3	1350 mm Main Extension	-	17.96	17.96
4	**Total Costs**	**7.21**	**17.96**	**25.16**

[1] Includes Contingency of 15%.
[2] Includes Contingency of 20%.

26. In order to determine the long term impacts on EWSI's customers an NPV analysis of each alternative's revenue requirement was completed. As shown in Figure 4.3-1 Alternative 1, the Parkland Booster Station Upgrades, results in a lower short term annual revenue requirement. Once the 1350 mm main extension project is complete in 2027-2032 PBR term, the long term annual revenue requirement increases to a level higher than Alternative 2.

Figure 4.3-1
Annual Revenue Requirement



27. Table 4.3-3 provides the NPV of the revenue requirement for each alternative. Over a 25 year period Alternative 2, the Winterburn Booster Station, returns a slightly lower long-term revenue requirement.

Table 4.3-3
NPV of Revenue Requirement – 25 Year Period
($ millions)

		A **Alternative #1 Parkland Booster Station Upgrades**	B **Alternative #2 Winterburn Booster Station**
1	Operations and Maintenance Expenses	-	0.20
2	Depreciation Expense	3.77	3.61
3	Return on Rate Base Financed by Debt	3.94	3.97
4	Return on Rate Base Financed by Equity	6.90	6.95
5	Franchise Fees	1.27	1.28
6	Terminal Value of Rate Base	4.73	4.30
7	**NPV of Revenue Requirement**	**20.61**	**20.31**

28. The following assumptions were used in the NPV analysis:

- 25 year period used for analysis;
- Alternative #2 includes $0.25M in operating and maintenance costs for decommissioning of the Parkland Booster Station;
- Both alternatives require the same annual operating and maintenance expenses. Preliminary engineering studies show the Winterburn Booster Station may be hydraulically more efficient (lower power costs). These cost savings have not been considered in the NPV analysis, any costs savings would decrease the revenue

requirement of Alternative 2 and would be passed on to customers during the 2027-2032 PBR term; and

- The 1350 mm Main Extension and Pump Replacement are placed into service in 2029.

4.45 Conclusions and Proposed Alternative

29. As the difference in long term NPV cost is negligible, the decision to proceed with the Winterburn Booster Station was made based on qualitative considerations. Alternative 2 has operational benefits, such as lower risk associated with installing new equipment as opposed to working around existing equipment and lower long term power consumption due to hydraulic efficiency. As a result, Alternative 2 has been selected as the preferred solution.

5.0 COST FORECAST

30. The project was estimated using recent historical costs. The average design and construction costs of the Big Lake and Walker Booster Station projects formed the basis of the forecast. Internal time was also based on the historical averages.

31. The projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Winterburn Booster Station Project
2022-2026 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
	Direct Costs:						
1	Contractors	0.00	0.51	3.11	1.33	0.27	5.22
2	Internal Labour	0.04	0.09	0.12	0.03	0.00	0.27
3	Contingency	0.00	0.08	0.47	0.20	0.04	0.78
4	**Sub-total Direct Costs**	**0.04**	**0.67**	**3.69**	**1.55**	**0.32**	**6.27**
5	Capital Overhead and AFUDC	0.02	0.08	0.25	0.07	0.01	0.43
6	**Total Capital Expenditures**	**0.06**	**0.75**	**3.94**	**1.63**	**0.33**	**6.70**

6.0 RISKS AND MITIGATION PLANS

32. The risks are associated with this project are shown in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Stakeholder Engagement Risk – The final product does not meet stakeholder expectations or stakeholders having a negative impact on project.	Prior to sourcing consultant for conceptual design, the last two booster station projects, Big Lake and Walker, will be reviewed for lessons learned and a criteria for the new station will be developed. Stakeholders will continue to be involved throughout the entire design and construction process.
2	Safety Risk – Inherent Health, Safety, and Environment risks associated with construction of the project. Furthermore, risk that final product does not meet HSE requirements.	EPCOR has a comprehensive health, safety and environment program and training requirements to ensure project work meets or exceeds safety and environmental legislation. The health and safety of all workers and the public is the first priority to EPCOR, so this is an important focus during project planning and execution.
3	Impacts to Operations Risk – The final product disrupts ongoing Operations and or does not meet operational requirements	A commissioning standard has been developed for project management at Edmonton water treatment plants and reservoirs and booster stations. The standard outlines commissioning requirements to ensure commissioning activities are conducted to verify equipment is working safely and as designed prior to Operations taking over care, custody and control of the new asset.

Appendix G1

EPCOR WATER SERVICES INC.

List of Wastewater Treatment Programs and Projects in the 2022-2024 PBR

February 16, 2021

Capital Expenditures for EWSI's Wastewater Treatment Programs and Projects (2022-2024 PBR) ($ millions)

	Category	A Reliability/Life Cycle Sub-Category	B 2022-2024 PBR Plan
	Regulatory		
1	Odour Control Improvements Project		5.58
2	**Sub-total: Regulatory**		**5.58**
	Growth/Customer Requirements		
3	Secondary inDense™ Upgrade Project		4.50
4	Install Secondary Baffles		1.00
5	**Sub-total: Growth/Customer Requirements**		**5.50**
	Health, Safety and Environment		
6	Code Compliance Upgrades		0.82
7	**Sub-total: Health, Safety and Environment**		**0.82**
	Reliability and Life Cycle Improvements		
8	Buildings and Site Rehabilitation (2022-2024)	Buildings and Site	2.00
9	Furniture Replacement (2022 - 2024)	Buildings and Site	0.15
10	Operations Center at Mid-Point Entrance	Buildings and Site	1.33
11	Electrical Rehabilitation Program (2022 - 2024)	Electrical	2.50
12	600V Electrical Building Project (EB-2)	Electrical	11.85
13	Aux Control Room Electrical Upgrade Project (EB-1)	Electrical	11.25
14	Loop 5 Rehab and Upgrade	HVAC	0.31
15	HVAC Rehabilitation (2022-2024)	HVAC	1.50
16	Tunnel Ventilation Upgrades	HVAC	3.50
17	Electrical Room HVAC Upgrades	HVAC	1.25
18	Maintenance Shop Ventilation	HVAC	1.50
19	Scum House 1 Ventilation	HVAC	0.50
20	Screen Building 1 Ventilation Upgrades	HVAC	0.50
21	Instrumentation Rehabilitation Program (2022-2024)	Instruments / Other Equipment	3.00
22	Laboratory Equipment (2022-2024)	Instruments / Other Equipment	0.45
23	Fleet Replacements (2022-2024)	Instruments / Other Equipment	0.55
24	Plant Equipment Upgrades (2022-2024)	Instruments / Other Equipment	0.60
25	Digester 4 Upgrades Project	Mechanical	13.40
26	Mechanical Rehabilitation Program (2022-2024)	Mechanical	1.50
27	Clarifier Chain Replacement (2022-2024)	Mechanical	1.00
28	Sludge Pipelines Rehabilitation (2022-2024)	Mechanical	3.50
29	Utilities Rehabilitation (2022-2024)	Mechanical	1.30
30	Rotating Equipment Rehabilitation (2022-2024)	Mechanical	4.20
31	Process Piping Rehabilitation (2022-2024)	Mechanical	3.20
32	Control System Rehabilitation (2022-2024)	Process Projects / IT	1.31
33	Gold Bar Microcomputers	Process Projects / IT	0.24
34	Microstation Replacement	Process Projects / IT	0.34
35	ProjectWise Upgrade	Process Projects / IT	0.06
36	Gold Bar LIMS Upgrades	Process Projects / IT	0.36
37	Gold Bar IVARA Upgrade	Process Projects / IT	0.40
38	Expand Flare Capacity Project	Process Projects / IT	8.00
39	Structural Rehabilitation (2022-2024)	Structural	4.00
40	Diversion Structure Structural Rehabilitation Project	Structural	0.50
41	PE Channel Upgrades - Bypass Chamber Project	Structural	16.96
42	Dewatering Facility Project	Clover Bar	38.36
43	**Sub-total: Reliability and Life Cycle Improvements**		**141.36**

	Category	A **Reliability/Life Cycle Sub-Category**	B **2022-2024 PBR Plan**
	Performance Efficiency and Improvement		
44	NSR Flood Protection		1.00
45	Plant Improvements (2022-2024)		3.50
46	Laboratory Facility Consolidation Project		5.93
47	Secondary Aeration Blower Upgrades Project		8.00
48	**Sub-total: Performance Efficiency and Improvement**		**18.43**
49	**Total Capital Expenditures**		**171.68**

Appendix G2

EPCOR WATER SERVICES INC.

Wastewater Treatment
600V Electrical Building Project (EB-2)
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. The 600V Electrical Building Project (EB-2) will relocate and replace the 600V electrical distribution equipment and control system interface from existing locations to a new dedicated electrical building at the Gold Bar Wastewater Treatment Plant (WWTP).

2. The project will address asset lifecycle issues since many of the associated assets are at or near end of expected life.

3. In addition, the project will address safety issues with electrical equipment that is located in areas that are classified as hazardous and or corrosive, are exposed to moisture, and/or are in tunnels that are at risk of unexpected inundation from process upsets.

4. This will reduce the risk of failure of the electrical equipment, resulting in operations that are more reliable.

5. Failure of equipment in this area would affect many of the primary treatment facilities, as they would lose power and capability, thus resulting in partially treated wastewater flowing into the North Saskatchewan River.

6. This project falls into the Reliability/Life Cycle category.

7. The project will be initiated in early 2022 and the project will be completed in 2026.

2.0 BACKGROUND AND JUSTIFICATION

8. In 2018 an electrical code compliance review of the Gold Bar WWTP was completed.

9. In 2019 the Gold Bar WWTP Electrical Long-Range Plan (ELRP) was completed. This was prepared to support EWSI in planning major upgrades and expansions required in the Gold Bar WWTP's electrical distribution system in order to address capacity, asset lifecycle, code compliance, and technology modernization challenges that will be encountered through the year 2056.

10. At Gold Bar WWTP, major electrical distribution equipment is installed in locations that pose a significant risk to safety and plant operations. For example, 600-volt motor control centres (MCC's) are installed in areas which are classified as hazardous and/or corrosive, are exposed to moisture, and/or are in tunnels that are at risk of unexpected inundation from process upsets.

11. It was noted that electrical equipment installed in these locations has been prematurely failing, primarily due to corrosion, putting at risk both property and personnel.

12. In addition, both reports identified numerous instances where existing equipment is approaching (or has already exceeded) the end of its expected life.

13. Failure of equipment in this area would affect many of the primary treatment facilities, as they would lose power and capability, resulting in partially treated wastewater flowing into the North Saskatchewan River. If this situation was to arise, repair and/or replacement of failed gear would likely take months and this is not an acceptable operational approach for the Gold Bar WWTP.

14. This 600V Electrical Building project will relocate existing major 600V distribution equipment servicing the solids treatment portion of the plant from high risk areas into a new dedicated electrical building, Electrical Building 2 (EB-2). This will address existing code compliance issues while improving the reliability and longevity of the replacement equipment.

15. As part of this project, a new 600V substation will be constructed to simplify and optimize the architecture of the plant's 600V distribution system and provide a location from which to supply future plant expansions.

16. EB-2, as referenced in Figure 2.0-1, was identified as the second highest priority behind the Auxiliary Control Room 600V Electrical Building 1 (EB-1) for replacement and relocation of 600V electrical equipment in the ELRP. A total of 453 MCC sections were ranked based on area classification, flood risk, corrosive locations, asset age, future plant development and space constraints. Once ranked, the work was consolidated into three phases to balance the spending and effort over future PBR periods.

17. In conjunction with this project, the Auxiliary Control Room Electrical Building Project (EB-1) will also be delivered. While there will be challenges with switching multiple gear and loads, running the projects concurrently provides the opportunity to benefit from synergies between the projects.

18. The proposed location for the new building is immediately to the north of existing Digester 7, as shown in Figure 2.0-1.

Figure 2.0-1
Electrical Building Project Site Location Overview

3.0 PROJECT DESCRIPTION

19. The scope of the EB-2 project includes a new 2-storey building to house new 600V switchgear, two new 13.8kV-600V power transformers, and an entire floor dedicated to replacement 600V MCC's. The building will be used to house replacement equipment as follows:

- Blend Tank Gallery: Classified as Zone 2 (Hazardous) and Category 2 (corrosive) and at risk from flooding. The 600V distribution equipment in this room currently sub-feeds the electrical distribution equipment that services the fermenters and digester square #1. The design of this space, and various significant openings, make it infeasible to declassify. Replacement and relocation of this equipment is a high priority due to the high risk of an accident and prolonged power interruption due to the equipment location.
- Fermenter Gallery: Classified as Zone 2 (Hazardous) and Category 2 (corrosive) and at risk from flooding. The design of this space, and various significant openings, make it infeasible to declassify. Replacement and relocation of this equipment is a high priority due to the high risk of an accident and prolonged power interruption due to the equipment location.

- Control System Interface: Automated operation of equipment supplied power from the MCC's are controlled by the plant control system. A new cabinet and cabling between the MCC and control devices will be installed to meet this requirement.

20. The following table (Table 3.0-1) summarizes the existing 600V MCC's to be replaced and relocated to EB-2, future projects to be fed, estimated total supplied load, and estimated MCC space requirements (number of vertical sections that will need to be accommodated).

Table 3.0-1
600V Electrical Building Project MCC Analysis

	Equipment	A **Existing Location**	B **Vertical Sections**	C **Estimated Load (Amps)**
1	726-MCC-28892		12	
2	726-MCC-28893	Fermenter 1-3 Gallery	15	
3	726-MCC-28890E		11	
4	725-MCC-14009 Fermenter 4	Fermenter 4 Gallery	8	1499
5	725-MCC-14011		8	
6	725-MCC-14012	Blend Tank Gallery	10	
7	725-MCC-14013E		10	
8	Thermophilic Digestion (Future)	Digester Area		150
9	Digester Square 2 TRF-46013	Digester Square 2	n/a – Feeders Only	596
10	Digester Square 2 TRF-46014	Digester Square 2		1082
11		**Sub-Total:**	**74**	**3327**

21. The project will be started in early 2022, with preliminary design and procurement. Ordering of long-lead delivery equipment will be required so that construction and commissioning can be completed by the end of 2026. This project will extend beyond 2024 due to the complex nature of the plant shutdowns required to transfer electrical loads for this and the Auxiliary Control Room Electrical Upgrades Project (EB-1). That project will also extend to 2026.

22. The project will be executed in a traditional design bid build delivery method. A consulting engineering company will complete the design. Equipment supply and construction will be completed by a supplier selected through a competitive process.

23. Development and building permits will be required.

24. Construction of this project will be sequenced to avoid negative impacts to ongoing operations as much as possible. To do so, the following general sequence is anticipated:

- Construct new building;

- Install new distribution equipment;
- Install new cable trays, power feeders and field control cabling; leave protected and coiled for future termination to existing loads;
- Test new distribution equipment. This includes, but is not limited to, manufacturer's testing and Contractor's operational testing of protective devices, starters and associated control systems. Detailed quality control and testing requirements will be included in the tender package; and
- Sequentially transfer loads from existing equipment using the Shutdown Process and abandon old switchgear as loads are transferred.

4.0 PROJECT ALTERNATIVE ANALYSIS

25. Three alternatives were considered for this project: Do Nothing, Upgrade the Electrical Equipment in Place, and Construct a New Building and Relocate Electrical Equipment.

26. Doing nothing would result in failure of electrical switchgear in the near future due to the risks faced today. This would affect many of the primary treatment facilities, as they would lose power and capability, thus resulting in partially treated wastewater flowing in to the North Saskatchewan River, which is a violation of Gold Bar's Approval to Operate. If this situation was to arise, repair and/or replacement of failed gear would likely take months and this was not considered an acceptable operational approach for the Gold Bar WWTP. As such, this alternative was rejected.

27. Upgrading the existing electrical equipment in place holds significant risks. Under this alternative, temporary switchgear would be purchased and installed in a location close to the existing switchgear. Electrical loads would be transferred to the temporary gear and then the existing gear would be demolished and replaced with new. Once the new switchgear was commissioned, the loads would be transferred to new and the temporary gear would be disposed of. While the benefit of not building new is large, this is outweighed by significant abandonment costs associated with demolishing the temporary gear in addition to the extensive internal costs for safely transferring all electrical loads twice which together are estimated to be about $1.5 million. The new equipment would also remain in hazard exposed locations, which is not considered operationally appropriate and which could reduce the life of those assets. For these reasons, this alternative was rejected.

28. The third alternative was to construct a new building and equip it with new switchgear. Once the new switchgear is commissioned, the loads would be transferred and the existing switchgear would be demolished. Given that most of the existing equipment is end of life there would be little or no early financial write offs associated with this alternative. Capital costs were estimated to be the same for this option however there were significantly lower risks both to implement, due to fewer load transfers, and ongoing because equipment was located in a safer location.

29. The construction estimates for alternatives two and three were nearly identical while alternative three avoids the retirement cost of the temporary equipment and relocates electrical gear to a more appropriate location, hence achieving a preferred long term solution. As such, the third alternative was selected.

5.0 COST FORECAST

30. The project cost forecast is derived from the construction and engineering estimates from the ELRP.

31. A contingency of 21% of external costs is included in the cost forecast. This is based on the current level of project development. Project scope was defined by way of a long-range plan, which is considered conceptual level design.

32. Projected costs for this project are shown in Table 5.0-1

Table 5.0-1
600V Electrical Building Project
($ millions)

		A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **Total**
1	**Direct Costs**						
2	Contractors	1.21	6.20	2.17	0.72	0.79	11.08
3	Internal Labour	0.07	0.10	0.09	0.09	0.09	0.44
4	Vehicles and Equipment	-	-	-			-
5	Abandonments	-	-	-			-
6	Contingency	0.20	0.10	0.99	0.71	0.33	2.33
7	Risk Allowance	-	-	-			-
8	**Sub-total Direct Costs**	**1.48**	**6.40**	**3.25**	**1.52**	**1.21**	**13.86**
9	Capital Overhead & AFUDC	0.06	0.29	0.52	0.08	0.19	1.14
10	**Total Capital Expenditures**	**1.54**	**6.69**	**3.77**	**1.60**	**1.40**	**15.00**

33. This project is expected to go into service in 2024 through 2026.

34. EWSI takes a number of steps to minimize the capital expenditures. These include:

- EWSI intends to deliver this project in coordination with the Auxiliary Control Room Electrical Upgrade (EB-1) project, which is expected to result in cost efficiencies by having one group execute both projects (e.g., more fluid communication, coordinated procurement, contractor effectiveness, etc.).
- EWSI has worked with external consultants to evaluate the current condition, expected life and future demands of the entire electrical system at Gold Bar WWTP and developed a long-range plan that creates efficiencies for consolidating efforts and minimizing duplicate effort.
- EWSI will take advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project safely stays on time and to specifications.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down).
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- EWSI is considering use of an existing building design that has become a standard within EPCOR Electricity Services for substations. This could help reduce design fees and, because it has been standardized for construction, should result in efficiency gains as well.

6.0 RISKS AND MITIGATION PLANS

35. Table 6.0-1 provides key risks and mitigation plans associated with this project.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Key Health and Safety (H&S) Risks – There are H&S risks associated with working on high voltage switchgear.	EPCOR employs hazardous energy isolation procedures to eliminate the risk of injury from conducting this type of work.
2	Key Process Safety Risks – process safety risks arise during complex plant shutdowns.	Process shutdowns are planned using a planning process and multiple work packages are incorporated as needed. EPCOR also has Process Hazard Analysis procedures to identify specific mitigations required for each outage.
3	Fluctuating global economy – cost for equipment may be impacted by COVID-19.	No specific mitigation available at this time. May need to adjust procurement timing depending on market conditions.

Appendix G3

EPCOR WATER SERVICES INC.

Wastewater Treatment
Aux Control Room Electrical Upgrade Project (EB-1)
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Auxiliary Control Room Electrical Upgrade Project (EB-1) will relocate and replace the 600V electrical distribution and control system interface equipment from existing locations to a new dedicated electrical building at the Gold Bar Wastewater Treatment Plant (WWTP).

2. The project will address asset lifecycle issues since many of the associated assets are at or near end of expected life.

3. In addition, the project will address issues with electrical equipment that is located in areas that are classified as hazardous and/or corrosive, are exposed to moisture, and/or are in tunnels that are at risk of unexpected inundation from process upsets.

4. This will reduce the risk of failure of the electrical equipment, resulting in operations that are more reliable.

5. Failure of equipment in this area would affect many of the primary treatment facilities, as they would lose power and capability, thus resulting in partially treated wastewater flowing into the North Saskatchewan River.

6. This project falls into the Reliability/Life Cycle category.

7. The project will be initiated in early 2022 and the project will be completed in 2026.

2.0 BACKGROUND AND JUSTIFICATION

8. In 2018, an electrical code compliance review of the Gold Bar WWTP was completed.

9. In 2019, the Gold Bar WWTP Electrical Long-Range Plan (ELRP) was completed. This was prepared to support EWSI in planning a series of major upgrade projects and expansions required in the Gold Bar WWTP's electrical distribution system in order to address capacity, asset lifecycle, code compliance, and technology modernization challenges that will be encountered through the year 2056.

10. At Gold Bar WWTP, major electrical distribution equipment is installed in locations that pose a significant risk to safety and plant operations. For example, 600-volt motor control centres (MCPc's) are installed in areas which are classified as hazardous and/or corrosive, are exposed to moisture, and/or are in tunnels that are at risk of unexpected inundation from process upsets.

11. It was noted that electrical equipment installed in these locations has been prematurely failing due to corrosion or flooding, putting at risk both property and personnel.

12. In addition, both reports identified numerous instances where existing equipment is approaching (or has already exceeded) the end of its expected life.

13. The Auxiliary Control Room is a stand-alone building containing electrical switchgear distributing power to various equipment on the southwest portion of the Gold Bar WWTP for primary treatment. More specifically this switchgear provides power to the grit tanks, screens and primary clarifiers.

14. Failure of this equipment would result in significant disruption to the wastewater treatment process potentially resulting in partially treated wastewater flowing into the North Saskatchewan River.

15. If this situation was to arise, repair and/or replacement of failed equipment would likely take months and this was not considered an acceptable operational approach for the Gold Bar WWTP.

16. This Auxiliary Control Room Electrical Upgrade project will relocate existing major 600V distribution equipment from the high risk areas into a new dedicated electrical building, EB-1. This will address existing code compliance issues while improving the reliability and longevity of the relocated replacement equipment.

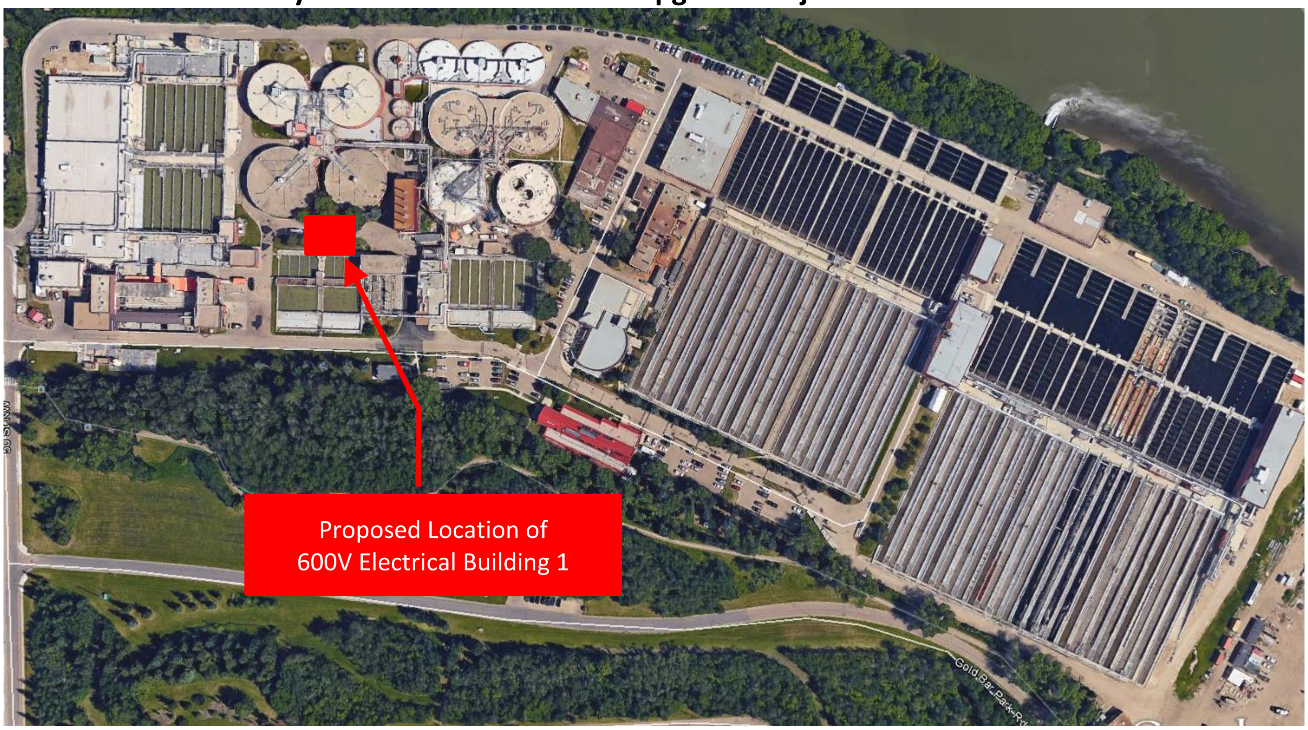
17. As part of this project, a new 600V substation will be constructed to simplify and optimize the architecture of the plant's 600V distribution system and provide a location from which to supply future plant expansions.

18. EB-1, as referenced in Figure 2.0-1, was identified as the highest priority for replacement and relocation of 600V electrical equipment in the ELRP. A total of 453 MCC sections were ranked based on area classification, flood risk, corrosive locations, asset age, future plant development and space constraints. Once ranked, the work was consolidated into three phases to balance the spending and effort over future PBR periods.

19. In conjunction with this project, the 600V Electrical Building Project (EB-2) will also be delivered. While there will be challenges with switching multiple gear and loads, running the projects concurrently provides the opportunity to benefit from synergies between the projects.

20. The proposed location for the new building is southwest of Digester 6 as shown in Figure 2.0-1.

Figure 2.0-1
Auxiliary Control Room Electrical Upgrade Project Site Location Overview



3.0 PROJECT DESCRIPTION

21. The scope of the EB-1 project includes a new 2-storey building to house new 600V switchgear, two new 13.8kV-600V transformers, and an entire floor dedicated to replacement 600V motor control centers. The building will be used to house replacement electrical equipment as follows:

- Tunnel B: Classified as Zone 2 (Hazardous) and Category 2 (corrosive); flood risk; equipment near end-of-life (estimated 2026). Some equipment in this area has had to be prematurely replaced due to recurring failures caused by corrosion. Replacement of this equipment is high priority due to risk of accidental flooding, failure or explosion and associated consequences, including but not limited to injury or death and prolonged power interruption.
- Tunnel C: Classified as Category 2 (corrosive); flood risk; most equipment is near end-of-life. Per information from EWSI maintenance personnel, some equipment has had to be prematurely replaced due to recurring failures caused by corrosion.

Replacement of this equipment is considered a medium priority due to risk of accidental flooding or failure and associated consequences, including but not limited to prolonged power interruption.

- Auxiliary Control Room: Classified as Zone 2 (Hazardous) and Category 2 (corrosive), and the equipment is near end-of-life. The 600V distribution equipment in this room currently sub-feeds numerous other facilities in the primary treatment areas of the plant. Per information from EWSI maintenance personnel, some equipment has had to be replaced due to recurring failures caused by corrosion. Replacement of this equipment is high priority due to risk of accidental flooding, failure or explosion and associated consequences, including but not limited to injury and prolonged power interruption. The arrangement of the auxiliary control room makes it challenging to declassify this area and the space is very cramped with less than ideal working conditions.
- Control System Interface: Automated operation of equipment supplied power from the MCC's are controlled by the plant control system. A new cabinet and cabling between the MCC and control devices will be installed to meet this requirement.
- Future Projects: Transformer capacity and spare 600V breakers (or space for future breaker additions) in the new EB-1 switchgear will be made available to accommodate future projects.

22. The project excludes upgrading of any downstream electrical equipment such as motors, etc.

23. The following table (Table 3.0-1) summarizes the existing 600V MCC's to be replaced and relocated to EB-1, future projects to be fed, estimated total supplied load, and estimated MCC space requirements (number of vertical sections that will need to be accommodated).

Table 3.0-1
600V Electrical Building Project MCC Analysis

<table>
<tr><th colspan="2">Equipment</th><th>A
Existing Location</th><th>B
Vertical Sections</th><th>C
Estimated Load (Amps)</th></tr>
<tr><td>1</td><td>706-MCC-14016</td><td>Tunnel B</td><td>6</td><td rowspan="7">1950</td></tr>
<tr><td>2</td><td>738-MCC-14033</td><td rowspan="2">Tunnel C</td><td>12</td></tr>
<tr><td>3</td><td>738-MCC-14034E</td><td>4</td></tr>
<tr><td>4</td><td>738-MCC-14020</td><td rowspan="4">Aux. Control Rm.</td><td>11</td></tr>
<tr><td>5</td><td>738-MCC-14021</td><td>11</td></tr>
<tr><td>6</td><td>738-MCC-14019E</td><td>7</td></tr>
<tr><td>7</td><td>738-MCC-14021E</td><td>7</td></tr>
<tr><td>8</td><td>High Rate Clarifiers
(Convert Primary Clarifiers 5-8)</td><td>EPT Building Area</td><td>n/a – Feeder only</td><td>400</td></tr>
<tr><td>9</td><td colspan="2">Sub-Total:</td><td></td><td>2350</td></tr>
</table>

24. The project will be started in early 2022, with detailed design and equipment selection. Ordering of long-lead delivery equipment will be required so that construction and commissioning can be completed by the end of 2026. This project will extend beyond 2024 due to the complex nature of the plant shutdowns required to transfer electrical loads for this and the 600V Electrical Building No.2 (EB-2) project. The EB-2 project will also extend to 2026.

25. The project will be executed in a traditional design bid build delivery method. Design will be completed by a consulting engineering company, and construction will be completed by a contractor selected through a competitive process.

26. Development and building permits will be required.

27. Construction of this project will be sequenced to avoid negative impacts to ongoing operations as much as possible. To do so, the following general sequence is anticipated:

- Construct new building;
- Install new distribution equipment;
- Install new cable trays, power feeders and field control cabling; leave protected and coiled for future termination to existing loads;
- Test new distribution equipment. This includes, but is not limited to, manufacturer's testing and Contractor's operational testing of protective devices, starters and associated control systems. Detailed quality control and testing requirements will be included in the tender package; and
- Transfer loads from existing equipment using the Shutdown Process and abandon old switchgear as loads are transferred.

4.0 PROJECT ALTERNATIVE ANALYSIS

28. Three alternatives were considered for this project: Do Nothing, Upgrade the Electrical Equipment in Place, and Construct a New Building and Relocate Electrical Equipment.

29. Doing nothing would result in failure of electrical switchgear in the near future due to the risks faced today. This would affect many of the primary treatment facilities, as they would lose power and capability, resulting in partially treated wastewater flowing in to the North Saskatchewan River, which is a violation of Gold Bar's Approval to Operate. If this situation was to arise, repair and/or replacement of failed gear would likely take months and this was not considered an acceptable operational approach for the Gold Bar WWTP. As such, this alternative was rejected.

30. Upgrading the existing electrical equipment in place holds significant risks. Under this alternative, temporary switchgear would be purchased and installed in a location close to the existing switchgear. Electrical loads would be transferred to the temporary gear and then the existing gear would be demolished and replaced with new. Once the new switchgear was commissioned, the loads would be transferred to new and the temporary gear would be disposed of. While the benefit of not building new is large, this is outweighed by significant abandonment costs associated with demolishing the temporary gear in addition to the extensive internal costs for safely transferring all electrical loads twice which together are estimated to be about $1.5 million. The new equipment would also remain in hazard exposed locations, which is not considered operationally appropriate and which could reduce the life of those assets. For these reasons, this alternative was rejected.

31. The third alternative was to construct a new building and equip it with new switchgear. Once the new switchgear is commissioned, the loads would be transferred and the existing switchgear would be demolished. Given that most of the existing equipment is end of life there would be little or no early financial write offs associated with this alternative. Capital costs were estimated to be the same however there were significantly lower risks both to implement, due to fewer load transfers, and ongoing because equipment was located in a safer location.

32. The construction estimates for alternatives two and three were nearly identical while alternative three avoids the retirement cost of the temporary equipment and relocates electrical gear to a more appropriate location, hence achieving a preferred long term solution. As such, the third alternative was selected.

5.0 COST FORECAST

33. The project cost forecast is derived from the construction and engineering estimates from the ELRP.

34. A contingency of 21% of external costs is included in the cost forecast. This is based on the current level of project development. Project scope was defined by way of a long-range plan, which is considered conceptual level design.

35. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
600V Electrical Building Project
($ millions)

		A	B	C	D	E	F
		Pre-2022	**2022**	**2023**	**2024**	**2025 and later**	**Total**
1	**Direct Costs**						
2	Contractors	-	1.53	5.38	1.81	0.11	8.83
3	Internal Labour	-	0.04	0.04	0.04	0.08	0.20
4	Vehicles and Equipment	-	-	-	-		-
5	Abandonments	-	-	-	-		-
6	Contingency	-	0.24	0.42	0.69	0.69	2.04
7	Risk Allowance	-	-	-	-		-
8	**Sub-total Direct Costs**	**-**	**1.81**	**5.84**	**2.54**	**0.88**	**11.07**
9	Capital Overhead & AFUDC	-	0.08	0.34	0.63	1.63	2.68
10	**Total Capital Expenditures**	**-**	**1.89**	**6.18**	**3.17**	**2.51**	**13.75**

36. This project is expected to go into service in 2024 through 2026.

37. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI intends to deliver this project in coordination with the 600V Electrical Building (EB-2) project, which is expected to result in cost efficiencies by having one group execute both projects (e.g., more fluid communication, coordinated procurement, contractor effectiveness, etc.).
- EWSI has worked with external consultants to evaluate the current condition, expected life and future demands of the entire electrical system at Gold Bar WWTP and developed a long-range plan that creates efficiencies for consolidating efforts and minimizing duplicate effort.

- EWSI will take advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project safely stays on time and to specifications.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (using a common shut down).
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- EWSI is considering use of an existing building design that has become a standard within EPCOR Electricity Services for substations. This could help reduce design fees and, because it has been standardized for construction, should result in efficiency gains as well.

6.0 RISKS AND MITIGATION PLANS

38. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Key Health and Safety (H&S) Risks – There are H&S risks associated with working on high voltage switchgear.	EPCOR employs hazardous energy isolation procedures to eliminate the risk of injury from conducting this type of work.
2	Key Process Safety Risks – process safety risks arise during complex plant shutdowns.	Process shutdowns are planned using a planning process and multiple work packages are incorporated as needed. EPCOR also has Process Hazard Analysis procedures to identify specific mitigations required for each outage.
3	Fluctuating global economy – cost for equipment may be impacted by COVID-19.	No specific mitigation available at this time. May need to adjust procurement timing depending on market conditions.

Appendix G4

EPCOR WATER SERVICES INC.

Wastewater Treatment
Dewatering Facility Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Dewatering Facility Project will construct a new dewatering facility at the Clover Bar Biosolids Recycling Facility (CBBRF).

2. The facility will process biosolids produced in the wastewater treatment process. These biosolids are piped from the Gold Bar Wastewater Treatment Plant (WWTP) and sent on truck from the Alberta Capital Region Wastewater Treatment Plant (ACRWWTP) to the lagoons to be thickened and then onto the dewatering facility. Dewatering is an essential requirement for the management and disposal of biosolids.

3. The new dewatering facility is necessary because the existing City of Edmonton dewatering facility is being demolished in the near future along with the City of Edmonton composter facility. This closure has expedited EPCOR's Biosolids Management Program and planning for a new dewatering facility in order to manage biosolids in the City of Edmonton.

4. The City of Edmonton has requested that EPCOR finance and operate their own dewatering facility for future operational needs at the CBBRF.

5. This project falls in to the Reliability/Lifecycle category.

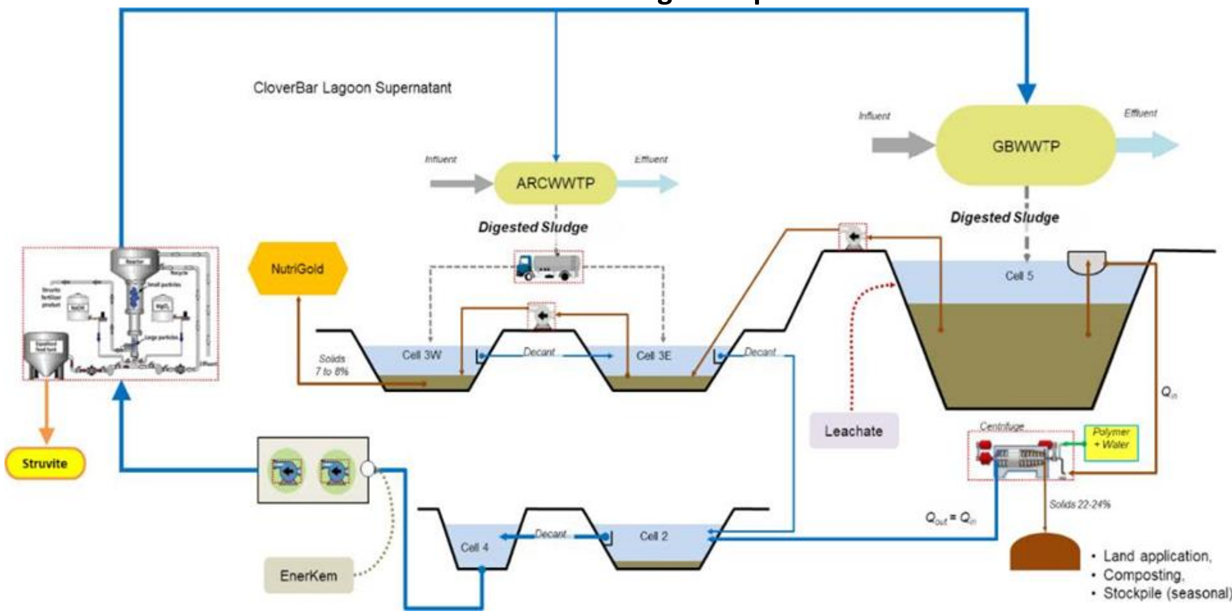
6. The project was initiated in 2020 and the project will be completed in 2024.

2.0 BACKGROUND AND JUSTIFICATION

7. Treatment of wastewater at the Gold Bar WWTP produces digested sludge that must be disposed of or land applied. At present, Gold Bar WWTP produces approximately 20,000 dry metric tonnes (DMT) of sludge per year on average, with an additional 8,000 DMT contributed by ACRWWTP. Wet weather events can result in additional sludge being produced.

8. The digested sludge, commonly referred to as biosolids, is pumped to a holding pond (Cell #5) located at the CBBRF. A number of pipelines between Gold Bar WWTP and CBBRF are used to transport digested sludge from Gold Bar WWTP to CBBRF. By agreement, sludge is also trucked from the ACRWWTP to the CBBRF. After treatment at CBBRF, the supernatant (a liquid separated from the thickened sludge) is pumped back to Gold Bar WWTP and ACRWWTP. See Figure 2.0-1.

Figure 2.0-1
Normal Clover Bar Lagoon Operations



9. In Cell #5, the biosolids are gravity-separated into the settled (or thickened) sludge and the supernatant (the remaining liquid). The thickened sludge is pumped to the existing City of Edmonton dewatering facility located in the northwest corner of the Edmonton Waste Management Centre.

10. In the existing dewatering facility, more liquid is separated from the biosolids (dewatered) in centrifuges with polymer added to achieve a solids concentration in the range of 22-24% solids. Three centrifuges are available for dewatering with a combined output of approximately 40,000 dry tonnes per year.

11. The dewatered solids from CBBRF were used for either composting at the Edmonton Composting Facility (ECF) or hauled by trucks to various sites for land application, either agricultural or non-agricultural (mine reclamation).

12. There are two limiting factors in this process, primarily driven by weather conditions. The season for land application is limited by favourable weather, and during inclement conditions, especially below -30°C, the dewatered biosolids cannot be hauled away and used for land application. It is therefore necessary to have temporary storage of biosolids, currently in Cell #5 at the CBBRF.

13. In 2017, the City of Edmonton Composting Facility (ECF) was shut down temporarily due to structural issues.

14. By 2024, it is expected that the current City of Edmonton Dewatering Facility will cease operations as a result of the ECF closure. EWSI was verbally informed of the permanent ECF closure in May 2019, and the closure publicly announced at the end of May 2019.

15. In 2019, in response to the uncertain future of the City of Edmonton compost facility, EWSI developed a Biosolids Management Program and investigated conceptually the development of a separate dewatering facility.

16. The Biosolids Management Program determined that a replacement dewatering facility was required to be in operation in early 2024.

17. This project focuses on constructing a new biosolids dewatering facility to replace the City of Edmonton facility. EWSI plans to own and operate the new biosolids dewatering facility.

18. It is anticipated that by 2024, the cost to operate the existing dewatering facility will have risen to $450/DMT. In contrast, the direct operating cost of dewatering at the proposed new dewatering facility is currently estimated to be less than $300/DMT in the first year of operation. These costs are based on consideration of staff or contractor labour to operate a 20,000 DMT facility, utilities costs, chemical consumption costs, and average annual costs to maintain the facility (e.g. snow clearing, road maintenance, etc.).

3.0 PROJECT DESCRIPTION

19. The scope for the Dewatering Facility project is to build a new dewatering facility, located at the Clover Bar site.

20. The conceptual design provides the basis for current estimates.

21. A more detailed design for the facility is being prepared in order to develop a capital and operating and maintenance (O&M) expenditure opinion of probable cost that will provide EWSI with further certainty of the level of effort to construct this facility.

22. The key is to keep the facility design as simple as possible to maximize its utility, cost-effectiveness and reliable operations.

23. The new dewatering facility will be located at the CBBRF. The exact location will be finalized through detailed design and consider total costs including capital, operating and financing and other logistical requirements.

24. The current method for removing dewatered biosolids and feeding the silos to load the product on to hauling trucks for land application is challenging. The new facility will provide a better method and configuration to load the dewatered biosolids onto truck for land application.

25. The conceptual design report provided recommendations that will be reviewed and incorporated in the next design stage of this project, including:

- The facility will be designed to enable expansion in the future if needed.
- Project costs include design and construction to dewater 20,000 DMT per year.
- A sludge-holding tank will be designed to buffer peaks or fluctuations of incoming biosolids and load, for better performance of centrifuge dewatering. The exact location and configuration of the sludge holding tank is to be determined during the design phase.
- Final technology selections for the dewatering facility components will be developed as part of the design phase.

26. The project will be initiated in 2020, with detailed design through 2021. Construction will be performed through the 2021 to 2023 period, and the dewatering facility will go in to service in 2024.

4.0 PROJECT ALTERNATIVE ANALYSIS

27. There are three main alternatives:

1. Do Nothing (Status Quo).
2. EWSI Construct a new Dewatering Facility.
3. Temporary Skid Mounted Dewatering Facility.

28. Status Quo is not feasible since the City of Edmonton is expected to cease operations in 2024, resulting in removal of the current dewatering facility. Therefore, this alternative is rejected.

29. Alternative two would mean that EWSI is responsible for constructing (and operating) a new dewatering facility, similar to the existing City of Edmonton facility, based on a 20,000 DMT annual capacity.

30. The engineering design considered several dewatering technologies. These technologies were assessed during the preliminary design, considering operational impacts, energy consumption, odour and costs. Centrifuge dewatering was selected as the optimal solution.

31. This alternative involves a capital investment of $42 million, and associated operating and maintenance costs.

32. This alternative can be delivered on site at the CBBRF, in close proximity to the lagoons.

33. Alternative three means that EWSI sets up a temporary, likely skid mounted, dewatering facility. This arrangement would be akin to a turnkey contract operation.

34. The operating window for this alternative is six months, from May to October each year, as this type of facility operates open to the elements (i.e., is not housed in a building or insulated from cold temperatures). The temporary facility would be removed by the contractor each winter, resulting in mobilization and demobilization effort and costs.

35. The shorter, six month operating window means that the facility needs to process 20,000 DMT in six months to achieve the same annual output as the permanent facility alternative. EPCOR would handle biosolids transport and application. An all-weather haul and stockpile location is required, preferably directly off the highway, to match dewatered material production. A typical agricultural site can be forced to shut down because of wet fields and soft gravel roads, so the dewatered biosolids cannot be applied in these conditions.

36. The space requirement for the temporary facility is significant since it requires space for the dewatering equipment, temporary storage and the truck-turning radius. There is some doubt as to whether a sufficient space currently exists at the CBBRF, and civil work to prepare the ground may be necessary for the required footprint.

37. There are other concerns with proceeding with a temporary facility, including the requirement for available water capacity. There is a potential for additional costs to be incurred to upsize the existing water supply. The shortened dewatering season places more pressure on the biosolids program to move material. Since the program can be highly weather dependent with wet fields preventing agricultural land application, there is a greater need for space for stockpiling during the growing season, which is a challenge. With a permanent constructed facility, excess dewatered material can be stored over-winter on the fields without adverse impacts to the farmers' ability to work their fields, and the material can be immediately applied in the spring, resulting in efficiencies for the farmer. A temporary facility's operating window

overlaps with the agricultural season, and this same space would not be available for stockpiling material, so alternatives would need to be found, likely at additional cost.

38. Based on a review of the advantages and disadvantages of the alternatives, the decision was made to proceed with constructing a dewatering facility (alternative two). The drawbacks of the temporary facility, coupled with the space issues at CBBRF, were too significant to proceed with alternative three.

5.0 COST FORECAST

39. The project cost forecast is based on estimates developed in the conceptual validation stage, plus an assessment of EWSI overheads, internal costs and risk allowances.

40. A contingency of 17% is included in the cost forecast. This is to cover the cost of unknowns that cannot be identified or anticipated during the current preliminary design phase. These challenges may include for example:

- Changes in the scope of the project;
- Delay in the delivery of long-lead equipment;
- Completing construction work in a live plant (CBBRF) can interrupt day-to-day activities or cause constraints for construction;
- Unexpected site conditions; and
- COVID-related constraints and complications.

41. Projected costs for this project are shown in Table 5.0-1

Table 5.0-1
Dewatering Facility Project
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Total**
	Direct Costs					
1	Contractors	2.97	12.26	12.88	0.28	28.39
2	Internal Labour	0.67	0.43	0.63	0.18	1.91
3	Contingency	0.00	1.00	4.00	1.00	6.00
4	**Sub-total Direct Costs**	**3.64**	**13.69**	**17.51**	**1.46**	**36.30**
5	Indirect Costs	0.00	0.94	2.14	2.62	5.70
6	**Total Capital Expenditures**	**3.64**	**14.63**	**19.65**	**4.08**	**42.00**

42. The project is expected to go in to service in 2024.

43. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term relationships with consultants, contractors and suppliers to effectively manage the quality of design, supply, and construction of required upgrades.
- All activities related to project management, construction coordination and inspection will be undertaken internally by EWSI, eliminating the need for external project management services. The delivery of major equipment is procured with direct contract with suppliers thus eliminating additional cost of contractors' premium.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project safely stays on time and to specifications.
- Contracted services are performed by qualified external contractors and done on a competitive unit price basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk and synergies with other projects (e.g. using a common shut down). Construction methods will be used to meet requirements at the lowest cost.

- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

44. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Completing construction work in a live plant (CBBRF) can interrupt regular day to day activities or cause constraints on construction.	This risk will be managed with appropriate planning and communication between all parties involved.
2	Changes in the scope of the project.	Detailed discussions with project stakeholders to optimize project solutions.
3	Delay in the delivery of long-lead equipment.	Signing direct contracts with manufacturers of major equipment, scheduling participation in Factory Acceptance Tests. Timing ordering of equipment so delivery is not the critical path in the construction, and applying contingencies in the construction schedule.
4	Unexpected site conditions.	Detailed site investigations were completed as part of Preliminary design and will be completed later at the Detailed design stage. A risk allowance will also be maintained in the project cost estimate.

Appendix G5

EPCOR WATER SERVICES INC.

Wastewater Treatment
Digester 4 Upgrades Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Digester 4 Upgrades Project will provide major rehabilitation and upgrades to Digester 4, along with replacement of systems and components that are end of life or have failed. Originally built in 1956, Digester 4 is one of the oldest digesters at the Gold Bar Wastewater Treatment Plant (WWTP), and much of the infrastructure associated with this digester is due for rehabilitation.

2. The Digester 4 Upgrades project is part of a larger set of digester upgrade projects, initiated to ensure that the digesters are upgraded at the appropriate rate and are capable of handling increased solids loading in a continuous, safe and stable operation.

3. Existing process risks, such as foaming and ineffective solids processing, will be reduced by updating the current gas mixing system to a linear motion mixing system. Improved mixing allows use of the full digester capacity, essentially creating more space in the digesters to keep pace with the City of Edmonton's growth.

4. The Digester 4 Upgrades project was planned for the current PBR period, however due to additional scope on the Digester 3 project, and the plan as described below to perform one digester upgrade at a time, this project was put on hold until the Digester 3 Upgrades Project is completed.

5. Digester 3 went into service in 2020. There are a number of reasons why the plan is to upgrade one digester at a time, including limited space on site, competent contractor availability and the costly nature of the upgrades. Further, it is important to ensure that there is always available capacity within the plant to treat peak flows.

6. This project falls under the PBR category of Reliability/Life Cycle.

7. The project forecast cost is $14.58 million. This includes $1.18 million spent prior to 2022, and the remaining $13.40 million of the cost planned in the 2022-2024 PBR period.

8. The project will be initiated in 2021 and is expected to go in to service in 2024.

2.0 BACKGROUND AND JUSTIFICATION

9. Gold Bar WWTP treats wastewater by removing contaminants using a series of treatment stages. The contaminants that are removed (“solids”) in each stage require additional treatment. Therefore, wastewater treatment plants also contain equipment for treating the solids of which digesters are a major component. The solids treatment facilities at Gold Bar WWTP include eight anaerobic digesters. The digesters treat and stabilize the solids, generating biogas in the process, prior to the solids being pumped to the Clover Bar Lagoons for re-use.

10. Digester 4 is one of the oldest digesters at the Gold Bar WWTP. The digester has operated since 1956 with no major rehabilitation or upgrades. Much of the infrastructure associated with the digester is overdue for major rehabilitation and/or upgrades to ensure reliable and safe operation, and achievement of complete mixing of sludge for optimal performance.

11. EWSI completed similar rehabilitation and upgrades during 2012-2016 on Digesters 1 and 2, and during 2017-2021 on Digester 3. Experience gained during the rehabilitation and upgrading of these digesters, that are of similar age and operational history, suggests that the components of Digester 4 will be in fair to poor condition and will require replacement.

12. The mixing system is obsolete and frequently plugs with debris, rendering it ineffective. Biogas piping, internal concrete protection (gas proofing), external roof membrane, safety equipment, sludge piping and other ancillary systems have exceeded their life cycle replacement and in many cases have been found to have failed.

13. The Gold Bar WWTP experienced significant digester foaming in the summer and fall of 2009. Foaming is an abnormal operational condition that traps hazardous gases and reduces the available volume of the digester to treat sludge. This has the potential to over-pressurize the digester and creates a situation where gases need to be released directly to the atmosphere, which is unsafe and would result in an Environmental Protection and Enhancement Act (EPEA) violation.

14. EPCOR conducted a root cause analysis of the digester foaming and a preliminary risk assessment of the contributing factors. The root cause analysis identified large swings in digester loading and or significant changes in digester feed composition resulting from the start-up of the Enhanced Primary Treatment facility. The team concluded that it was imperative that measures are put in place to minimize foam propagation that could compromise of the biogas and pressure

relief safety systems. Mitigation alternatives for the existing digesters were discussed and evaluated at workshops in 2016 and 2017.

15. In 2016, a review of digester mixing systems was initiated to screen options for mixing. This work resulted in a recommendation for mechanical linear motion mixing technology to be implemented as the mixing system for Digester 3. The intent upon proof of performance was to expand this technology to remaining digesters as each was rehabilitated. Digester 3 is due to go in to service in 2020 and the technology will continue to be monitored for its effectiveness.

16. Mechanical mixing eliminates risks associated with gas mixing, such as safety risks from gas compression and piping of biogas and financial risks because gas compression requires more electricity. Mechanical mixing systems are also safer for operations and maintenance staff as these are easier isolations, there are no protocols required for working around biogas, and no need to buy specialty valves and instruments for gas handling.

17. The Solids Loading to Gold Bar WWTP and Digester Capacity Analysis Report (2019) identified loading conditions and capacity for the digesters. The report recommended completing the rehabilitation of Digesters 4-6 to maximize available digester capacity. The Gold Bar WWTP Integrated Resource Plan (IRP) identifies the lack of ability to expand the footprint of the plant as a confining factor and as such, the existing footprint must be used as effectively as possible. Even if there was room to expand, a new digester is cost prohibitive. As the population served by Gold Bar WWTP grows, the plant will receive more wastewater to process. The linear motion mixing technology allows the digester to be full to the roof instead of needing headspace of 10%-15% required with gas mixing. Across the eight digesters, a capacity gain of 10% is equivalent to 80% of a new digester. Therefore implementing this technology is key to the continued servicing of wastewater within the Gold Bar WWTP footprint.

18. The project team will leverage lessons learned from the Digester 3 upgrades, which is due to go into service in 2020.

19. Based on some leakage experienced on Digester 3, and work to determine solutions and compare alternatives, the interior of Digester 4 will be lined with a cementitious, epoxy liner on the walls, from the base of the HDPE liner to the junction with the floor, and the entire floor and cone surface. This will prevent sludge from leaking into the ground and into the North Saskatchewan River, which is less than 50 metres away from Digester 4. Installing the liner while the scaffolding is in place for the rehabilitation work will also realize construction efficiencies.

20. Once digester upgrades are completed for Digesters 1-4, and the associated conversion to Linear Motion Mixing is fully implemented, the gas compression and handling systems for these digesters will be decommissioned, which will result in improved safety for plant personnel and approximately $27 thousand in annual savings of electricity per digester.

21. The current plan upgrades one digester at a time. There are a number of reasons why this approach is taken, including limited space on site (each upgrade requires two overhead cranes), competent contractor availability and the costly nature of the upgrades. Further, it is important to ensure that there is available capacity within the plant to treat peak flows.

3.0 PROJECT DESCRIPTION

22. The scope for the Digester 4 Upgrades project includes removing the old roof and old gas pumping system and replacing with the new linear motion mixing system, lining the inside of the digester, installing a new roof, and any other rehabilitation identified during the project.

23. The project will be initiated in Q4 of 2021, with detailed design and procurement through Q1 of 2022. The construction period will be from Q1 2022 through to Q3 2024, with commissioning throughout the final 2 quarters of the construction period. Digester 4 will go into service in Q4 of 2024.

24. Phases of the project are per Table 3.0-1

Table 3.0-1
Digester 4 Upgrades Project Timelines

Project Phases	A **Q4 2021**	B **2022 Q1**	C **2022 Q2**	D **2022 Q3**	E **2022 Q4**	F **2023 Q1**	G **2023 Q2**	H **2023 Q3**	I **2023 Q4**	J **2024 Q1**	K **2024 Q2**	L **2024 Q3**	M **2024 Q4**
1 Initiation / Approvals	X												
2 Requirement Review and Scope Approval	X	X											
3 Detail Design	X	X											
4 Procurement	X	X											
5 Construction		X	X	X	X	X	X	X	X	X	X	X	
6 Commissioning											X	X	
7 Close-out													X

4.0 PROJECT ALTERNATIVE ANALYSIS

25. Three alternatives were considered: Run Digester 4 to failure, Demolish Digester 4 and build a new digester, and Rehabilitate and upgrade Digester 4.

26. Running Digester 4 to failure was rejected due to safety risks such as a biogas release and operability risks, which would result in high costs to operate unreliable equipment.

27. Demolishing Digester 4 and building a new digester in place was rejected because it was a more expensive alternative. Early estimates indicate that the cost of replacing Digester 4 would be between $25 and $30 million in current dollars.

28. The favoured alternative is to rehabilitate and upgrade Digester 4, in line with the Gold Bar WWTP IRP and with previous digester projects.

29. The decision to move from gas mixing to mechanical mixing was made in previous PBR's and EWSI continues to favor this approach.

5.0 COST FORECAST

30. The project cost forecast is based on the cost for completing the same upgrade on Digester 3. Digester 3 forecast costs at completion are $14.07 million compared to forecast cost for Digester 4 of $14.58 million. The increased cost is related to inflation, offset by some efficiencies in applying the liner during construction rather than retrospectively.

31. A contingency of 6% is included in the cost forecast. This is to cover the cost of unknowns that cannot be identified or anticipated during the design or inspection phase, and typically arise during demolition.

32. Projected costs for this project are shown in Table 5.0-1

Table 5.0-1
Digester 4 Upgrades Project
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Total**
	Direct Costs					
1	Contractors	1.04	3.29	2.24	4.14	10.71
2	Internal Labour	0.15	0.33	0.33	0.33	1.14
3	Vehicles and Equipment	0.00	0.00	0.00	0.00	0.00
4	Abandonments	0.00	0.00	0.00	0.00	0.00
5	Contingency	0.00	0.00	0.00	0.80	0.80
6	Risk Allowance	0.00	0.00	0.00	0.00	0.00
7	**Sub-total Direct Costs**	**1.19**	**3.62**	**2.57**	**5.27**	**12.65**
8	Indirect Costs	0.00	0.39	0.62	0.92	1.93
9	**Total Capital Expenditures**	**1.19**	**4.01**	**3.19**	**6.19**	**14.58**

33. This project is expected to go into service in 2024.

34. EWSI takes a number of steps to minimize the level of capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment, and ensure more favorable pricing.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and provide site level oversight, to ensure the project stays on schedule and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and the project is likely to be bid on a fixed price basis. The bid process will be detailed and thorough, including site visits, interviews, safety history and references as part of the contractor selection. In addition, detailed costs and schedules will be required as part of the submission requirements.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk and based on synergies with other projects (e.g. using a common shut down).

6.0 RISKS AND MITIGATION PLANS

35. Table 6.0-1 provides key risks and mitigation plans associated with this project.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Key Health and Safety (H&S) Risks – There are a number of potential H&S Risks including Hazardous Energy Isolation and confined space entry.	EPCOR follows standard processes to reduce or eliminate H&S risks, including but not limited to: • Ensuring site specific safe work plans and procedures are developed that are compliant with regulatory requirements, at minimum • Procuring qualified contractors with experience working in these conditions • Including safety systems and safety performance in evaluation criteria for the selection of contractors • Completing process hazard analysis, constructability reviews and risk assessments as part of the design and construction stages • Developing a hazard registry specific to the required tasks, and implementing best practices like job-site hazard assessments and daily toolbox meetings to ensure workers are aware of these hazards • Conducting regular site visits and formal, documented inspections during construction….
2	Key Environmental Risks – Silica dust during construction, and removal and disposal of construction debris	Risks are mitigated by following the EPCOR Life Saving Rules utilizing the tools as described above, with periodic review of work conditions and any changes thereof. Where risks exist, the aim is to engineer them out where possible, apply engineering or administrative controls, and ensure use of Personal Protective Equipment (PPE).
3	Key Financial Risks – further change orders or unknown conditions that cannot be seen until demolition is complete	If a deficiency is identified, an engineering analysis is completed to determine the most cost and constructability efficient solution that maintains EPCOR's health and safety standards.
4	Key Quality Risks – this is the risk that construction is not performed to a sufficiently high standard, in which case for example, leaks could develop or the mixer may not function appropriately.	Examples of how quality risks are managed are: • Rigorous contractor selection process that considers experience, safety performance, and past performance on similar projects. • Comprehensive and clear technical specifications for the work and equipment/materials • Applying lessons learned from the Digester 3 Upgrades project • Inspection and testing plan to ensure only quality products and workmanship are accepted • Contractor, strong specs, using lessons learned from Digester 3 Upgrade.

Appendix G6

EPCOR WATER SERVICES INC.

Wastewater Treatment
Diversion Structure Structural Rehabilitation Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Diversion Structure Structural Rehabilitation Project provides major rehabilitation to the Diversion Structure at the Gold Bar Wastewater Treatment Plant (WWTP).

2. This primarily includes rehabilitation and upgrade of the concrete structural components of the Diversion Structure.

3. Inspections conducted in 2017 determined that the Diversion Structure was in poor structural condition, with moderate to severe concrete deterioration noted throughout the structure walls, beams, ceilings, aluminum handrails, and access ladders.

4. The severe nature of the deterioration meant that the risk of structural failure was high, with the potential to result in an environmental release and severe impacts on the treatment process.

5. Allowing the structure to continue deteriorating and run to failure would result in a more costly subsequent emergency repair.

6. In addition, since the structure had to be taken down in stages to manage around seasonal flows, it needed a longer period of time to complete this work. Waiting until the 2022-2024 PBR would have resulted in continued deteriorating conditions and a high risk of failure.

7. Because of the emergent nature of the work, rehabilitation of the structure began in 2018. The project is being delivered in three phases in order to manage plant flows and capacity requirements, and is scheduled for completion in 2022.

8. This project falls into the Reliability/Life Cycle category.

2.0 BACKGROUND AND JUSTIFICATION

9. Gold Bar WWTP has multiple concrete structures that are key components of the wastewater treatment process.

10. The Diversion Structure transports raw wastewater from the EPCOR Drainage Services collection system into the Gold Bar WWTP Influent Channels.

11. In the case of high flow events, when influent coming in to the Gold Bar WWTP exceeds treatment capacity, the Diversion Structure routes excess flows through initial treatment (screening) into the North Saskatchewan River (NSR).

12. The structure also distributes the flows between the various influent channels.

13. Inspections conducted in the spring of 2017 determined that the Diversion Structure was in poor structural condition (Figures 2.0-1 and 2.0-2). Moderate to severe concrete deterioration was noted throughout the structure walls, beams, ceilings, aluminum handrails, and access ladders.

Figure 2.0-1
Concrete Deterioration

Figure 2.0-2
Soffit Deterioration

14. The issues were due to extensive hydrogen sulphide (H_2S) attacks on the structure. H_2S is an odorous and corrosive gas, which is emitted from the wastewater stream due to

microbiological activities. By nature it is very corrosive to bare concrete surfaces. In wastewater treatment infrastructure, concrete deterioration and corrosion is typically most severe above the surface of the wastewater stream.

15. Based on previous experience and research literature, a protective coating or barrier is recommended, intended to minimize exposure of concrete surfaces to H_2S attack. For this structure, the recommendation was to use a cast-in-place High Density Polyethylene (HDPE) liner to protect the concrete. Also recommended was the upgrade of various safety components associated with this structure. This included replacement of existing aluminum handrails and access ladders with stainless steel installation. Existing safety components were severely deteriorated and required replacement both for safety and longevity considerations.

16. Additional safety components proposed for the structure included access hatches and a fall protection system (stainless steel horizontal lifeline), to better support future maintenance activities and inspections of the structure.

17. The severe nature of the deterioration meant that the risk of structural failure was high. Such failure could result in an environmental release and have severe impacts on the treatment process.

18. Allowing the structure to continue deteriorating and run to failure would result in a more costly subsequent emergency repair, as opposed to addressing the issue immediately.

19. In addition, since the structure had to be taken down in stages to manage around seasonal flows, the project needed a longer period of time to complete this work. Waiting until the next PBR would have resulted in a high risk of failure and continued deteriorating conditions.

20. Therefore, because of the emergent nature of the work, rehabilitation of the structure began in 2018 and is scheduled for completion in 2022.

21. It is not possible to take the entire Diversion Structure out of service at once because there is no bypass for the structure. The only way to make any modification is to isolate one channel (either North or South) at any given moment. Hence the project is phased over a period of four years with construction during low flow (dry season) to mitigate the risk of having one channel out of operation.

3.0 PROJECT DESCRIPTION

22. The scope of the project includes rehabilitation and upgrade of the concrete structural components of the Diversion Structure.

23. Since the entire Diversion Structure cannot be taken out of service at once, the project is delivered in three phases, over a four-year period. The phases are shown in Figures 3.0-1 and 3.0-2.

Figure 3.0-1
Diversion Structure Project Phases

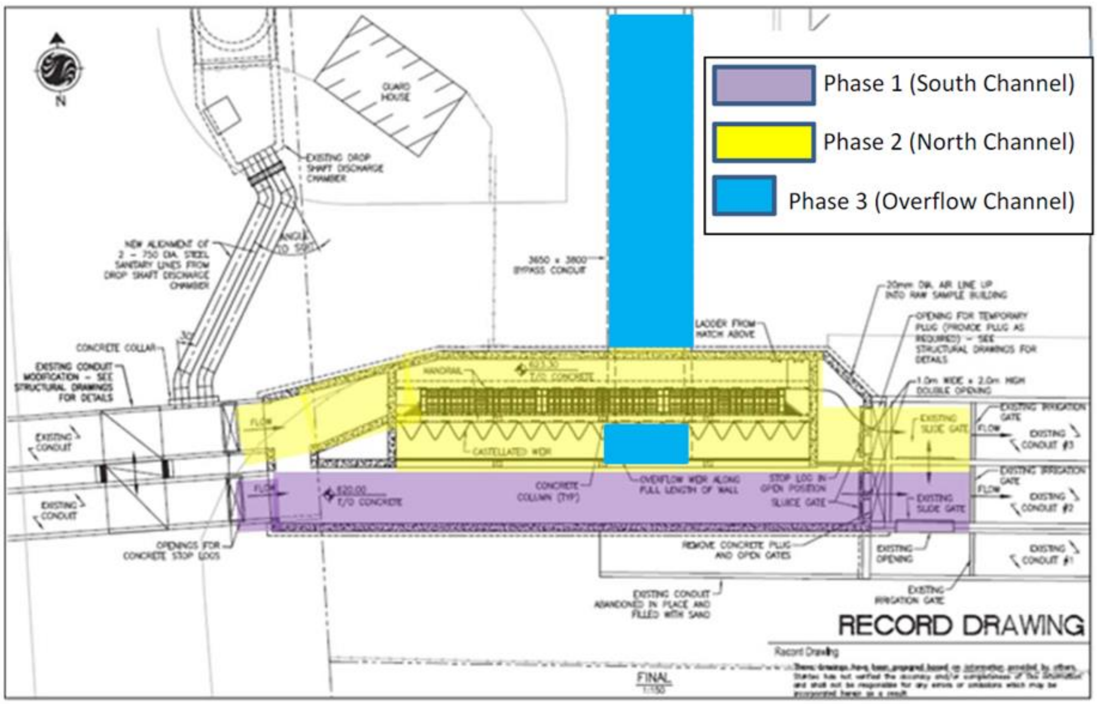
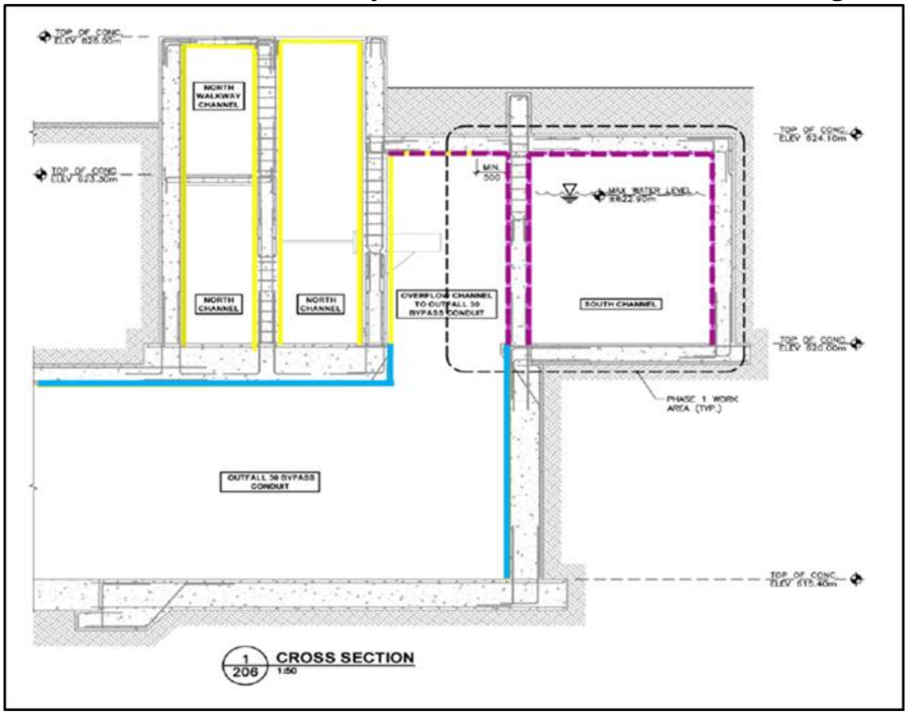


Figure 3.0-2
Diversion Structure Project Phases – Cross Section Drawing



24. The first phase of the project (South Channel) was planned for winter 2018-2019, however could not be completed in that timeframe due to unforeseen early snow melt in March 2019. Snowmelt brought higher than expected inflow to Gold Bar WWTP, and the North Channel alone could not keep up with the increased flow. Construction resumed in October 2019 and phase one was completed by the end of February 2020. The scope of work for phase one included:

- Installation of a HDPE liner to protect concrete surface on the walls and ceiling.
- Purchase of stop logs and installation of stop log frame for future Hazardous Energy Isolation (HEI) of the South Channel.
- Installation of access hatches.

25. Phase two (North Channel) started in January 2020 and will be completed by the end of February 2022. The scope of work for the Second Phase is similar to the first phase and includes:

- Installation of a HDPE liner.
- Supply and installation of stop logs for future Hazardous Energy Isolation (HEI) isolation of the North Channel.
- Inspection and some modifications to the overflow screen.

- Replacement of existing and installation of new safety components.

26. The project team completed an inspection of the Bypass Channel (Phase three) in February 2020 and initiated its design. It includes the following:

- Installation of spray liner to protect concrete on the walls and ceilings.
- Repair of expansion joints and cracks on walls.

27. The project was initiated in 2018 and will go fully in to service in 2022.

4.0 PROJECT ALTERNATIVE ANALYSIS

28. The project alternatives were limited to doing nothing, or rehabilitating the Diversion Structure.

29. Doing Nothing was rejected because of the consequences of the structure failing. If the structure failed it would not be able to support flows in to the Gold Bar WWTP, and EWSI could not meet its operating permits and commitments to its customers.

30. If the Diversion Structure was permitted to run to failure, and was instead managed on an emergency basis, it would be a far more costly repair. The ability to manage and adequately treat flows would also constrain the ability to complete the repairs if the failure were to occur during the wet weather season.

31. Therefore, the decision was taken to rehabilitate the Diversion Structure as soon as practically possible.

32. Since the decision was based on qualitative factors, no quantitative analysis is provided.

5.0 COST FORECAST

33. The project cost forecast is derived from the cost of engineering and construction contracts.

34. A minimal level of contingency is included in the project budget because all major contracts have been signed, and the contractor is very familiar with the site and structure conditions.

35. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Diversion Structure Structural Rehabilitation Project
($ millions)

		A **Pre-2022**	B **2022**	C **Total**
	Direct Costs			
1	Contractors	7.17	0.33	7.50
2	Internal Labour	1.33	0.04	1.37
3	**Sub-total Direct Costs**	**8.50**	**0.37**	**8.87**
4	Indirect Costs	-	0.13	0.13
5	**Total Capital Expenditures**	**8.50**	**0.50**	**9.00**

36. This project is expected to go in to service in 2022.

37. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term relationships with consultants, contractors and suppliers to effectively manage the quality of design, supply, and construction of required upgrades.
- All activities related to project management, construction coordination and inspection will be undertaken internally by EWSI, eliminating the need for external project management services. The delivery of major equipment is procured with direct contract with suppliers thus eliminating additional cost of contractors' premium.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project safely stays on time and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit price basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk and based on synergies with other projects (e.g. using a common shut down). Construction methods will be used to meet requirements at the lowest cost.

- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

38. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A Risk Mitigation Plan
1	Completing construction in a live plant can interrupt regular day to day activities and/or cause constraints on construction.	This risk will be managed with appropriate planning and communication between all involved parties.
2	Key Health and Safety Risks include: • HEI – it is difficult to stop the flow into the North Channel. This is because there is no current provision to isolate the channels of the Diversion Structure. • Confined space entry and construction close to live channel with wastewater flow stream.	• Contractor will utilize previous experience to establish HEI with installation of a temporary stop log. This will remain sealed for the duration of the construction. • Confined space entry and related hazards will be managed through well-developed safety practices.
3	Flooding of the work site if high flow conditions are experienced at Gold Bar.	Work is currently scheduled for completion during low flow conditions, however if the influent flow to the Gold Bar WWTP exceeds a specified level, warnings will be in place, staff will be safely exited from the worksite, and a portion of the construction site will be flooded.
4	Possibility of high H_2S in the workspace.	Air monitoring and ventilation will be in place to manage and minimize the risk of high H_2S levels.

Appendix G7

EPCOR WATER SERVICES INC.

Wastewater Treatment
Expand Flare Capacity Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Expand Flare Capacity Project is to construct a new building to house new flares and associated equipment.

2. This will provide the Gold Bar Wastewater Treatment Plant (WWTP) with redundancy capability since under the current setup, one flare alone cannot safely process all potential biogases produced in the wastewater treatment process.

3. A failure in the flare system could result in biogas being released to the environment. This is a hazard to people, the environment, the process, and is a prohibited practice (per Alberta Environment Approval 639-03-06 and Digester Gas Code CSA B149.6).

4. This project falls in to the Reliability/Life Cycle category.

5. The project will be initiated in 2022 and will be completed in 2024.

2.0 BACKGROUND AND JUSTIFICATION

6. Gold Bar WWTP currently has two flares, as shown in Figure 2.0-1.

Figure 2.0-1
Flares at Gold Bar WWTP

7. These two flares are shown in more detail in Figure 2.0-2.

Figure 2.0-2
Candle Stick Flare (left) and Enclosed Burner Flare (right)

8. The flares are primarily used to control biogas pressures and volumes within the anaerobic digesters headspace.

9. Biogas is a by-product of the wastewater treatment process, and is a blend of gases: methane, carbon dioxide, hydrogen sulfide, water vapour, and traces of others. The biogas is generated in the anaerobic digesters and then either utilized to provide heat and energy on site through boilers, or flared.

10. A failure in the biogas pressure control system, including the flares, could result in biogas being released to the environment. This is hazardous to people, the environment, the process, and is prohibited, per Alberta Environment and the Digester Gas Code (per Alberta Environment Approval 639-03-06 and Digester Gas Code CSA B149.6). As such, Gold Bar WWTP is required to have sufficient flaring capabilities within its direct control.

11. The existing flares were installed circa 2004-2008, as part of a flare facility upgrade. Since then there have been concerns regarding existing capacity, operation and maintenance.

12. A recent study was completed in 2019 to review the capacity of existing infrastructure. The study confirmed that the current installation does not provide full redundancy. This means that one of the flares alone cannot handle the full biogas loading for a significant amount of time.

13. The flares require regular preventative maintenance, which involves shutting them down for a period of time. Preventative maintenance work typically involves disassembly, inspection,

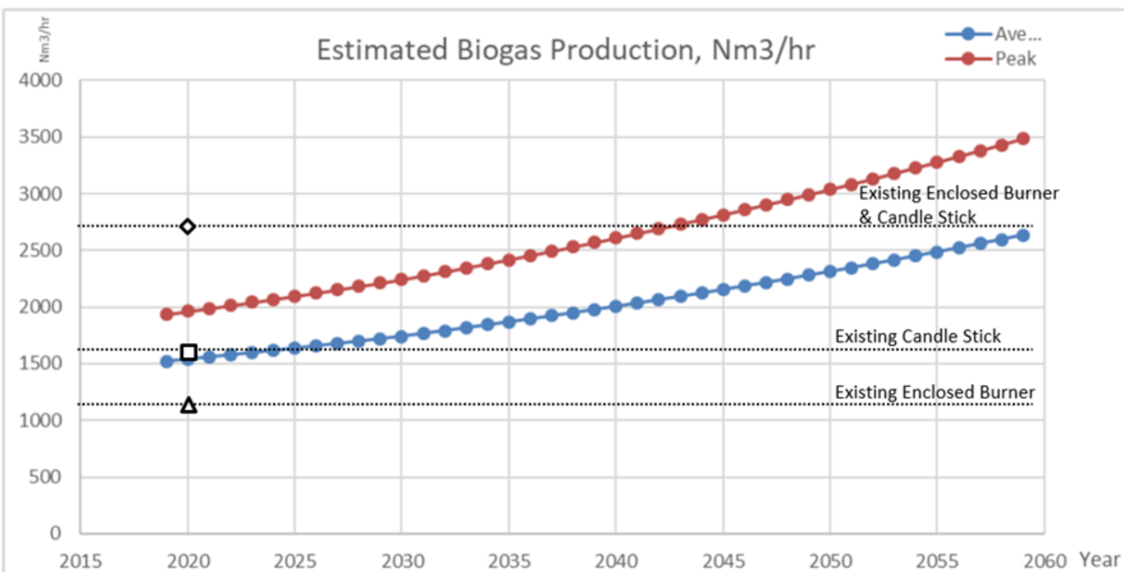
and replacement or reconditioning of parts (e.g., flame arrestors, thermal safety valves, thermocouples, burner nozzles).

14. While one flare is shut down for maintenance, the plant is dependant on the other for full service. While this is possible for short periods of time, it takes careful coordination to ensure this is done safely, and with consideration of the risk to the facility, particularly with the lack of full redundancy.

15. With only one flare in operation, there is therefore a risk of a biogas release. This results in the potentially hazardous situation, as described above.

16. A study was completed to review future biogas projections and capacity requirements up to 2060. Refer to Figure 2.0-3.

Figure 2.0-3
Estimated Hourly Biogas Production and Observed Capacities of Existing Flares



17. In Figure 2.0-3, the red and blue dots are based on modelling and predicted data, whereas the black and white shapes display actual measured data.

18. As seen in Figure 2.0-3, the study identified the lack of capacity in the current installation to provide adequate redundancy in the near term. In addition, it demonstrated the future shortfall in capacity in existing flares, and that around 2042 this would become an issue even on a combined flare basis.

19. The goal of the study was to provide guidance on expanding flare capacity in preparation for future demands. A conceptual design was produced to demonstrate how to expand the current flare capacity, which involved building a new flare facility.

20. The recommendation, to expand for additional capacity, achieved two outcomes. The new flare facility would establish adequate redundancy now, and would support continued expected future demands.

3.0 PROJECT DESCRIPTION

21. The scope for the Expand Flare Capacity project includes construction of a new building to house the new flare and associated equipment. Due to existing site conditions and current code requirements on spacing and location, a new building is required for the new equipment to address minimum clearances from digesters, other flares and other combustible gases.

22. It is expected that one new flare will be constructed now to supplement the existing plant flaring capacity, and establish the necessary redundancy completely within the control of regular Gold Bar WWTP operations. Future flares would be added as capacity, redundancy or replacement is required.

23. In the longer term there will be space for additional flares to be constructed, in order to provide capacity for future expansion and growth (i.e. blind flanges for future tie-in).

24. The current concept is to build the facility on a concrete pad, adjacent to the proposed Renewable Natural Gas (RNG) facility. Biogas piping will already need to be routed to this area, so it is advantageous from the perspective of construction team mobilization and set up of similar equipment to use similar infrastructure (pipe racks). These practical efficiencies will result in cost savings to the project. This flare project will continue to look for other opportunities to minimize cost through collaboration with the proposed RNG facility.

25. Regardless of the operational time of the proposed RNG facility (e.g. operational 90% of the time), Gold Bar WWTP requires sufficient and redundant flaring capacity to handle all of the site's biogas production. Building RNG does not eliminate the need for this project.

26. The new building would contain all the biogas handling equipment (e.g. flame arrestors, thermal safety valves, pressure control valves). Since this equipment would handle biogas saturated with water vapour, sheltering it from the cold climate conditions is required to mitigate the risk of freezing.

27. The flares themselves would be placed on the roof.

28. The building would also be designed to meet the plant's hazardous area classification standards.

29. The project will be initiated in 2022, with detailed design and procurement through 2022 and 2023. The construction period will be 2023 to 2024, with commissioning toward the end of the construction period. The new facility is expected to go in to service in 2024.

30. Phases of the project are per Table 3.0-1

Table 3.0-1
Digester 4 Upgrade Project Timelines

	Project Phases	A 2022 Q1	B 2022 Q2	C 2022 Q3	D 2022 Q4	E 2023 Q1	F 2023 Q2	G 2023 Q3	H 2023 Q4	I 2024 Q1	J 2024 Q2	K 2024 Q3	L 2024 Q4
1	Initiation/Approvals	X											
2	Preliminary Design		X										
3	Detail Design			X	X								
4	Procurement				X	X							
5	Construction					X	X	X	X	X	X		
6	Commissioning								X	X	X	X	
7	Close-out												X

4.0 PROJECT ALTERNATIVE ANALYSIS

31. There are four project alternatives: Defer Upgrade, Install a Temporary Flare, Upgrade the Existing Flare(s), or Build a New Flare Facility.

32. Deferring the upgrade does not resolve redundancy issues or address safety concerns and, on this basis, was rejected as a feasible alternative.

33. Installation of a temporary flare would increase the plant's capacity to process biogas, and has previously been considered to support flare maintenance work, i.e. a temporary install to create capacity while a flare is taken out of service. This would involve a temporary tie-in to the biogas piping system, and a temporary control set-up to integrate the flare into the regular plant operations. This arrangement was not considered practical during the flare maintenance work, as it involves a great deal of coordination over a short period of time. The existing biogas pressure control system does not have established provisions for a temporary system. The work steps required to implement this (including modifications to biogas piping, installation of temporary bypass piping, and bypassing automated safety system controls) are high risk. Other

risks are introduced when trying to integrate a temporary system in to the plant's control system for the biogas, which could detrimentally affect other areas of the operating plant. Any errors in that integration could result in a biogas release or explosion. In addition, this alternative requires EPCOR to rent equipment thus increasing operating expenses. This alternative was evaluated and confirmed to be high risk and therefore, this alternative was rejected.

34. Consideration was given to upgrading or modifying the existing flares in place to increase capacity. The candle stick flare is already the largest size available from the manufacturer (Varec Biogas) and is therefore not capable of providing additional capacity. The enclosed burner flare is available in one size larger, and the existing nozzles could be bored out to slightly increase its capacity. However, this involves taking the flare out of service for an extended period of time, and relying only on one flare to handle all of the biogas produced on-site. This presents the same challenges and risks experienced during maintenance work. While it is possible to do this, it involves a great amount of coordination and may result in only a slight increase in capacity. This option was rejected, as it did not provide sufficient additional capacity to warrant the risks involved with forgoing redundancy during construction and installation.

35. The construction of a new flare facility would allow for an increased biogas handling capacity while the existing flares are still in operation. This would mitigate the risk of a potential biogas release from a flare failure, as additional spare capacity would be available. This also provides space to install the necessary equipment to address the expected increase in biogas production in the years to come. Since there are code requirements that control the location details, and a new facility is required to align with these, the new building will also consider the location details of the future expansions.

36. The fourth alternative, to build a new flare facility, was considered the best option based on its ability to provide redundancy now and additional capacity in the future to meet growth needs. In addition, there would not be any decrease in flare capacity during construction as the two existing flares could continue to operate.

5.0 COST FORECAST

37. The project cost forecast is based on a conceptual design and engineering cost estimates.

38. A contingency of 30% is included in the cost forecast. This is based on the current level of project development, which is currently at conceptual design.

39. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Expand Flare Capacity Project
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Total**
	Direct Costs					
1	Contractors	0.28	0.80	2.50	1.65	5.23
2	Internal Labour	0.07	0.08	0.09	0.09	0.33
3	Contingency	0.00	0.11	1.14	0.68	1.93
4	**Sub-total Direct Costs**	**0.35**	**0.99**	**3.73**	**2.42**	**7.49**
5	Indirect Costs	0.00	0.11	0.27	0.48	0.86
6	**Total Capital Expenditures**	**0.35**	**1.10**	**4.00**	**2.90**	**8.35**

40. This project is expected to go in to service in 2024.

41. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will take advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and provide site level oversight, to ensure the project stays on schedule and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and done on a competitive price basis.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, based on synergies with other projects (e.g. using a common shut down). The construction execution plans will be selected and reviewed to ensure project requirements are met at the lowest cost.
- Project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

42. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A Risk Mitigation Plan
1	Key Health and Safety (H&S) Risks – There are a number of potential H&S Risks including Hazardous Energy Isolation for the duration of the project, and working around biogas and hydrogen sulfide (H_2S) gases.	EPCOR follows standard processes to reduce or eliminate H&S risks, including but not limited to: • Ensuring site specific safe work plans and procedures are developed that are compliant with regulatory requirements, at minimum. • Procuring qualified contractors with experience working in these conditions. • Including safety systems and safety performance in evaluation criteria for the selection of contractors. • Completing process hazard analysis, constructability reviews and risk assessments as part of the design and construction stages. • Developing a hazard registry specific to the required tasks, and implementing best practices like job-site hazard assessments and daily toolbox meetings to ensure workers are aware of these hazards. • Conducting regular site visits and formal, documented inspections during construction.
2	Key Environmental Risks – Process safety risks arise during complex plant shutdowns, construction, or commissioning, resulting in the release of biogas to the environment	Process shutdowns are planned using a planning process and multiple work packages are incorporated as needed. EPCOR has Process Hazard Analysis procedures to identify specific mitigations required for each significant activity.
3	Key Financial Risks – further change orders or unknown conditions that cannot be seen until demolition is complete	If a deficiency is identified, an engineering analysis is completed to determine the most cost efficient and constructible solution that maintains EPCOR's health and safety standards.
4	Key Quality Risks – this is the risk that construction is not performed to a sufficiently high standard, in which case for example, leaks could develop or the flare may not function appropriately.	Examples of how quality risks are managed are: • Rigorous contractor selection process that considers experience, safety performance, and past performance on similar projects. • Comprehensive and clear technical specifications for the work and equipment/materials. • Applying lessons learned from previous biogas related projects. • Inspection and testing plan to ensure only quality products and workmanship are accepted.

Appendix G8

EPCOR WATER SERVICES INC.

Wastewater Treatment
Laboratory Facility Consolidation Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Laboratory Facility Consolidation Project will co-locate Quality Assurance and Environment wastewater and water laboratory functions into the Rossdale Water Treatment Plant (WTP) Water Excellence Lab Building.

2. This will provide a platform for synergistic processes and savings across the two teams and effectively create one laboratory team.

3. Once the Gold Bar lab team has moved to the WTP, the existing Gold Bar lab building will be available for alternative use to the Plant.

4. This project falls into the Performance / Efficiency Improvement category.

5. The project was initiated in 2020 and the project will be completed in 2023.

2.0 BACKGROUND AND JUSTIFICATION

6. The Gold Bar Wastewater Treatment Plant (WWTP) lab building was built in 1991, and transferred from the City of Edmonton to EPCOR with Wastewater operations in 2009.

7. The building houses the wastewater laboratory function, which incorporates employees from the Quality Assurance and Environment (QAE) team.

8. The building has experienced a number of issues over the years, primarily related to its building envelope, and mechanical and electrical systems.

9. In 2019, EWSI commissioned a study (the study) of alternatives for the future of the Gold Bar lab building including continuing to maintain the existing building, significantly upgrading the existing building, demolishing and replacing the existing building at the Gold Bar site or renovating the water laboratory in the Water Excellence Laboratory at the Rossdale site to accommodate the wastewater laboratory function.

10. The study completed a general condition assessment of the existing Gold Bar lab building, using Functional Statements of the National Building Code – 2019 Alberta Edition (Building Code) and requirements of the National Energy Code of Canada for Buildings 2017 (Energy Code) to assess how the building complied with minimum requirements of each code. Laboratories fall under Part 3 of the Building Code and requires compliance to the Energy Code.

11. The study also evaluated alternatives for addressing concerns raised relating to the lab building, including poor environmental control and inability to maintain an adequate thermal environment.

12. The study performed workshops with the Rossdale and Gold Bar lab teams to explore issues that would arise from consolidation of different lab functions, including assessment of advantages and disadvantages of the alternatives.

13. The condition assessment outlined various challenges with the building.

14. The building fails to satisfy almost half of its safety, health, accessibility, fire, structural protection and environmental functions outlined in today's building code standards. These issues must be addressed to meet the requirements of a major renovation Building Permit.

15. The building envelope fails to meet any of the minimum energy performance criteria for the seven major building envelope components. It also does not satisfy another six critical performance measures, essential to meet Energy Code minimum requirements. These issues must be addressed to meet the requirements of a major renovation Building Permit.

16. The difficulty the building systems have to maintain a comfortable thermal environment has a direct and negative impact on employee wellness and productivity.

17. Without a major upgrade to building systems for environmental conditions (building envelope, mechanical and electrical), the building does not meet current building standards. It would also be highly unlikely to meet future, more stringent performance standards.

18. These issues must be addressed to meet the objectives of the City's Sustainable Building Policy.

19. The report recommends that the building requires a life-cycle refit of its major services, if the lab team is to remain in the existing building. The risks associated with not completing any upgrades to address these concerns are high.

20. There are two key drivers for the proposed change.

21. First, the existing lab building contains a number of issues, primarily around the heating system and building envelope that has led to less than reasonable working conditions and testing conditions.

- The lab building does not have an independent heating system and is instead connected to the Gold Bar WWTP hot water system. This means that when there is a plant shutdown or maintenance work on the plant heating, the lab loses heating capability.
- The building's HVAC system is not suited for a lab function. Fumehoods in the lab draw significant volume of air to limit exposure to hazardous fumes, which adds a high ventilation demand and a high demand to the heating system. During winter, the heating system is not able to warm the building to sufficient temperatures. On occasion, temperatures in the lab building drop to around 10 degrees Celsius. Cooler temperatures mean that testing is sometimes not performed within the guidelines of the quality management system.
- The study has confirmed that the lab is in poor physical condition. Any improvements would require substantial upgrades to meet the current iteration of building and energy codes.

22. Second, the other driver is to generate synergies across EWSI's business processes.

- In September 2017, Drainage operations transferred from the City of Edmonton to EPCOR. EWSI has since investigated opportunities to generate synergistic processes and savings across the organization in order to deliver on commitments made during transition.
- As part of the study, the co-location of two existing lab teams from Gold Bar WWTP and the WTP was investigated, since both teams exist under the QAE team using similar expertise and equipment to perform their functions. The study concluded that this is a feasible option.
- A review confirmed that work was capable of flowing differently and more efficiently if the two teams were housed in the same lab building.

23. In order to achieve the goal of co-locating the lab teams and to address the deteriorating conditions of the Gold Bar lab building, this project proposes to consolidate the wastewater laboratory functions currently located at the Gold Bar WWTP with the water laboratory functions in the Water Excellence Lab at Rossdale WTP.

3.0 PROJECT DESCRIPTION

24. The scope for this project includes:

- Preliminary design.
- Detailed Design.
- Procurement of consultant, contractor, and long lead items.
- Stakeholder engagement workshops and review meetings.
- Mechanical, electrical and other utility upgrades at the Rossdale WTP Water Excellence Building to accommodate integration of the wastewater lab function.
- Demolition and renovation of the first floor of the Water Excellence Building to accommodate the integration of the wastewater lab function.
- Providing an alternative space during construction and temporary operational plan to ensure water lab functions can remain ongoing during construction.
- Development of a Lab Move Plan.
- All associated permit requirements and procurement requirements to achieve the project.
- All project management and contractor management activities to achieve the project.

25. The project will be initiated in 2020 and will be available for complete transition of wastewater operations in Q4 of 2023.

4.0 PROJECT ALTERNATIVE ANALYSIS

26. Five alternatives were considered for this project:

- Do Nothing (Status Quo).
- Refurbish the existing Gold Bar WWTP lab.
- Demolish and rebuild the Gold Bar WWTP lab.
- Integrate lab operations at the Rossdale WTP – recommended alternative.
- Contract out lab services to a third party.

27. Only one of the options considers consolidation of functions. The other alternatives were developed to provide context to the relative cost and the logic of integrating lab operations at the Rossdale WTP.

28. Status Quo was rejected due to the inadequate heating system and the ongoing capital upgrades required to the building. The impact of the inadequate heating on employee working conditions and engagement during cold periods, and on the quality of the testing environment were considered critical flaws of this alternative. The NPV of this alternative was modelled for baseline purposes in Table 4.0-1.

29. Refurbishing the existing lab building involved spending capital dollars to ensure it meets Building and Energy Codes. While this alternative would avoid the need to move lab employees to a different site, it would be difficult to achieve without significant disruption to lab employees and operations throughout the refurbishment. In addition, it would not remove issues such as the connection of the heating system to the plant. This alternative was assessed in the NPV analysis, detailed in Table 4.0-1. Based on the higher NPV, a significant capital outlay, and the qualitative risks associated with this alternative, it was rejected.

30. The third alternative to demolish the existing lab building and rebuild new in place was rejected. While the new build would ensure that Building and Energy Codes were met, and more modern systems would reduce maintenance and operational costs, there is a significant capital cost associated with constructing a new building. In addition, it would be challenging to continue lab operations throughout the project because practically there would be nowhere for lab operations to be performed. This alternative was considered cost and practically prohibitive.

31. The fourth alternative was to integrate lab teams at Rossdale WTP lab. This alternative brings the lab expertise together in one location, which creates a platform to generate synergistic processes and savings. Some renovation is required to the first floor of the Rossdale WTP Excellence Building, to create additional space for the wastewater lab testing facilities. This would displace administrative employees, who would be moved to the second floor of the building. The NPV of this alternative was modelled and is shown in Table 4.0-1. This proved to be a cost effective alternative with many qualitative benefits. For these reasons, this was selected as the preferred alternative.

32. Outsourcing Gold Bar lab operations was considered due to its potential to reduce operating expenses through staffing, materials and equipment savings. Practically however there are many qualitative disadvantages to this approach, including but not limited to:

- loss of in-house technical wastewater knowledge and experience (this is particularly important during plant upsets);

- reduction to high quality and speedy support service (this is also especially important during emergencies and or plant upsets);
- potential loss of internal operational and regulatory oversight; and
- a negative impact on employee engagement across various associated teams.

33. To achieve this fifth alternative would require significant longer term planning and organization, particularly in consideration of repurposing specialized employees to alternative roles. In addition, there would need to be a robust strategy to ensure that the benefits of real-time laboratory analytics and skills could continue to be realized. Given its shorter term challenges and significant disadvantages, this alternative was rejected.

34. An NPV was performed in order to provide quantitative feedback on the three feasible alternatives: Status Quo, Refurbish existing lab, and Relocate to Rossdale WTP.

35. The results of this analysis are shown in Table 4.0-1.

Table 4.0-1
NPV and Capital Outlay Analysis of Alternatives
($ millions)

		A	B
	25 Year Summary	**NPV Revenue Requirement**	**Capital Outlay**
1	Status Quo*	81.99	4.00
2	Refurbish existing Gold Bar lab	93.22	18.54
3	Integrate lab teams at Rossdale WTP Lab	89.13	6.48

* Does not resolve current inadequate heating issues in the existing building.

36. The Status Quo revenue requirement is lowest, however because the alternative does not resolve issues with the existing building envelope, this alternative was rejected.

37. Second to this alternative is the co-location at Rossdale WTP and this is supported by a capital outlay and NPV close to the Status Quo, and the added benefit of offering synergistic opportunities within QAE. This supports the decision to proceed with alternative three, Integrate lab teams at the Rossdale WTP lab.

5.0 COST FORECAST

38. The project cost forecast is based on estimates provided in the study, plus internal labour and overheads associated with delivering a project of this size and scope. The estimation class for this estimate is Level 4.

- Construction costs were estimated based on square footage of renovated floor space at Rossdale. The quantities were derived based on a possible new layout of the floorplan provided in the study.
- Design costs were estimated as a percentage of construction costs.
- Internal time was estimated assuming project management will be completed internally.

39. A contingency of 30% is included in the cost forecast, which is consistent with EWSI's contingency guidelines range for this level of project definition. The higher end of the range was used to reflect the following uncertainties related to the project:

- The level of utility upgrades required. The Water Excellence Laboratory may require some upgrades, the extent of which will be determined during detailed design. There are some chemical lines running through the building. It is uncertain at this time how this will affect the addition of a new lab function in the same space and the extent of upgrades that will be required.
- The level of impact of stakeholders on the scope and schedule.
- The level of impact to Rossdale lab operations during construction.

40. The contingency is to cover the cost of unknowns that cannot be identified or anticipated during the design or inspection phase, and typically arise during demolition.

41. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Gold Bar Laboratory Consolidation Project
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Total**
	Direct Costs					
1	Contractors	0.50	1.99	1.95	0.00	4.44
2	Internal Labour	0.10	0.10	0.11	0.01	0.32
3	Contingency	0.00	0.60	0.59	0.00	1.19
4	**Sub-total Direct Costs**	0.60	2.69	2.65	0.01	**6.95**
5	Indirect Costs	0.00	0.19	0.38	0.01	0.58
6	**Total Capital Expenditures**	0.60	2.88	3.03	0.02	**6.53**

42. The project is expected to go in to service in 2023.

43. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- Construction coordinators will be on-site at Rossdale to manage the day to day activities of contractors and ensure the project stays on time and to specifications.
- All activities related to project management, construction coordination and inspection will be undertaken internally by EWSI, eliminating the need for external consultants.
- Consultants and contractors will be procured via competitive bidding.
- The project will go through a phased process whereby the forecast of the project will be reviewed by senior leadership as the project is more defined. This will ensure that the project is evaluated for its costs and benefits at each stage.
- The design will go through multiple iterations of a risk review process to ensure assumptions are valid. This will help minimize the number of changes required during construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

44. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A **Risk Mitigation Plan**
1	Key Health and Safety Risks – There are a number of potential H&S Risks that are related to construction and renovation of an existing space.	EWSI has a comprehensive health, safety and environment program, and associated training requirements to ensure project work meets or exceeds safety and environmental legislation. The health and safety of all workers and the public is the first priority to EWSI, and this is an important focus during project planning and execution. Contractor experience in managing and coordinating trades as well as experience working at EWSI's sites will be evaluated during the procurement phases. EWSI also has a contractor management procedure to provide a detailed framework to manage contractors and outline expectations.
2	Key Operational Risks – current lab operations could be impacted during the construction phase.	A Lab Move Plan will be developed with stakeholders to ensure smooth transitions and continued operations through periods of change and disruption.
3	Key Financial Risks- Risks unknown at this time could arise during the design and construction phases that could put the project objectives at risk. This includes the risk that not all requirements are adequately captured at the design phase.	A requirements and assumptions log will be developed and managed throughout the project. The lessons learned for the Water Excellence Lab Building project will be reviewed, occupants will be consulted, and maintenance personnel will be consulted at the start of the project to understand some of the risks associated with the building. Furthermore, Hazard and Operability studies (HAZOP) will be completed prior to completion of design and once again, when contractor is selected. Project drawings will be Issued For Construction after contractor is selected and construction HAZOP is completed. This will ensure that the design does not result in any unintended consequences for maintenance and operation of the asset, and that risks are identified and mitigated before construction begins.

Appendix G9

EPCOR WATER SERVICES INC.

Wastewater Treatment
Odour Control Improvements Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EWSI has made a commitment to all of its stakeholders to continuously improve odour control by actively managing odour sources within the Gold Bar Wastewater Treatment Plant (WWTP).

2. This is a shared outcome as per the current Integrated Resource Plan (IRP) submitted to the Utility Committee.

3. The Odour Control Improvements Project will address odourous emissions from sources emitting the highest odour based on an odour assessment completed in 2019.

4. The Project will consider construction of a dedicated capture and treatment facility (scrubber) in either the diversion structure or the primary clarifiers.

5. The decision to choose either the diversion structure or the primary clarifiers for project execution will be made based on the cost and complexity of the required upgrades for each area, as well as, benefits and level of odour mitigation for each.

6. The remaining odour sources will undergo detailed design and construction in future periods.

7. This project falls in to the Regulatory/HSE category.

8. The project was initiated in 2020 and will be completed in 2024.

2.0 BACKGROUND AND JUSTIFICATION

9. The Gold Bar WWTP provides sanitary and combined sewer wastewater treatment services for the residents of the City of Edmonton.

10. Its prime objective is to safely and reliably treat wastewater in compliance with environmental regulations.

11. Gold Bar WWTP is an operational site that, by its nature, has little direct interaction with the public. The interaction that does occur is typically with the immediate surrounding communities. The majority of these customer service interactions involve concerns regarding odours.

12. The main contributor to odour generation at Gold Bar WWTP is Hydrogen Sulfide (H_2S), which is produced by normal biological activity in wastewater (sewage). The long travel time in the collection system to the plant (which is even longer during dry weather) can cause the wastewater to be extremely odourous on arrival at the plant.

13. With millions of litres of wastewater treated at Gold Bar WWTP every day, ensuring proper odour control is a key and ongoing concern for EPCOR as well as the residents of the communities surrounding the plant.

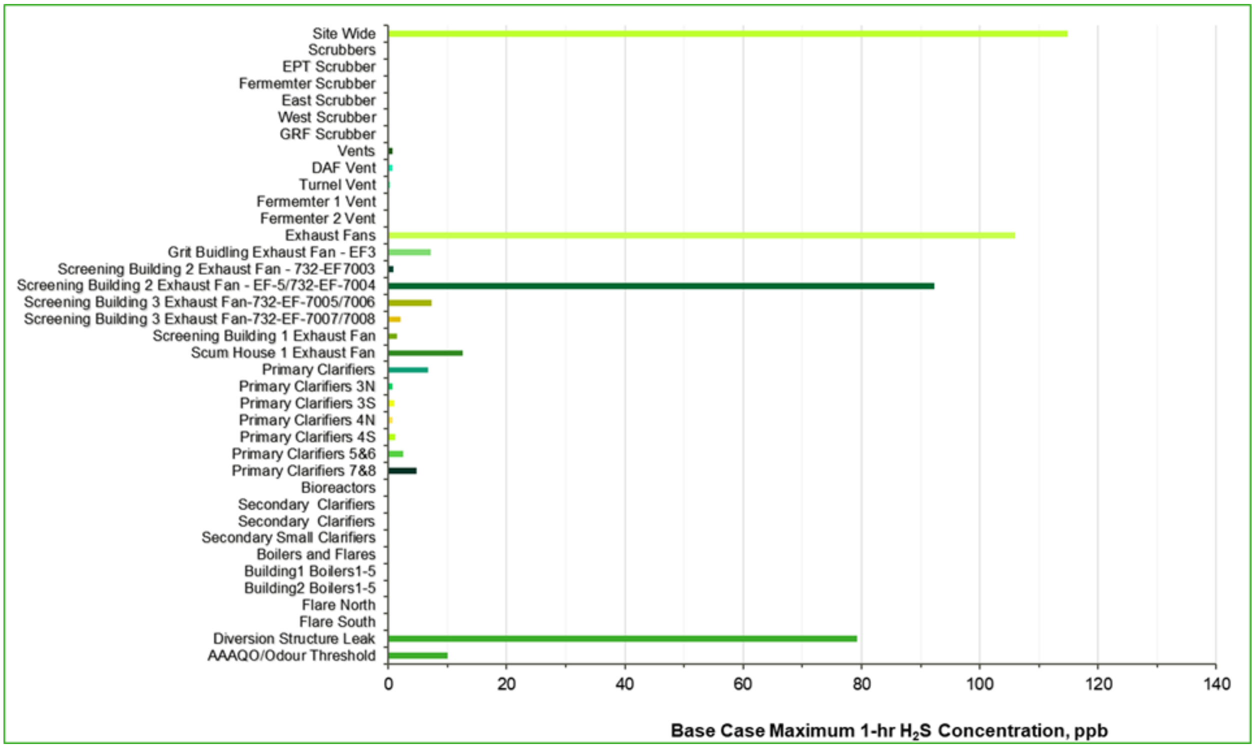
14. An initial odour assessment was performed in 2016 at the Gold Bar WWTP, which informed a number of improvements that have been implemented during the current PBR. In 2019, the odour assessment was repeated in order to guide future improvements. Two cases of dispersion modelling were performed, the base case and the future case.

15. The base case modelled odour and H_2S emissions as currently measured at the plant.

16. The future case was modelled assuming there were no diversion structure leaks, no exhaust fan emissions and that the Grit and Screening Building scrubber had been installed. These items were identified as the top sources of odour in the 2019 study. The Grit and Screening Building sources have been addressed through upgrade projects completed subsequent to the 2019 study, but the diversion structure leaks have not. The primary clarifiers were not suppressed in the future case but they are the next most significant odour source after these sources are addressed.

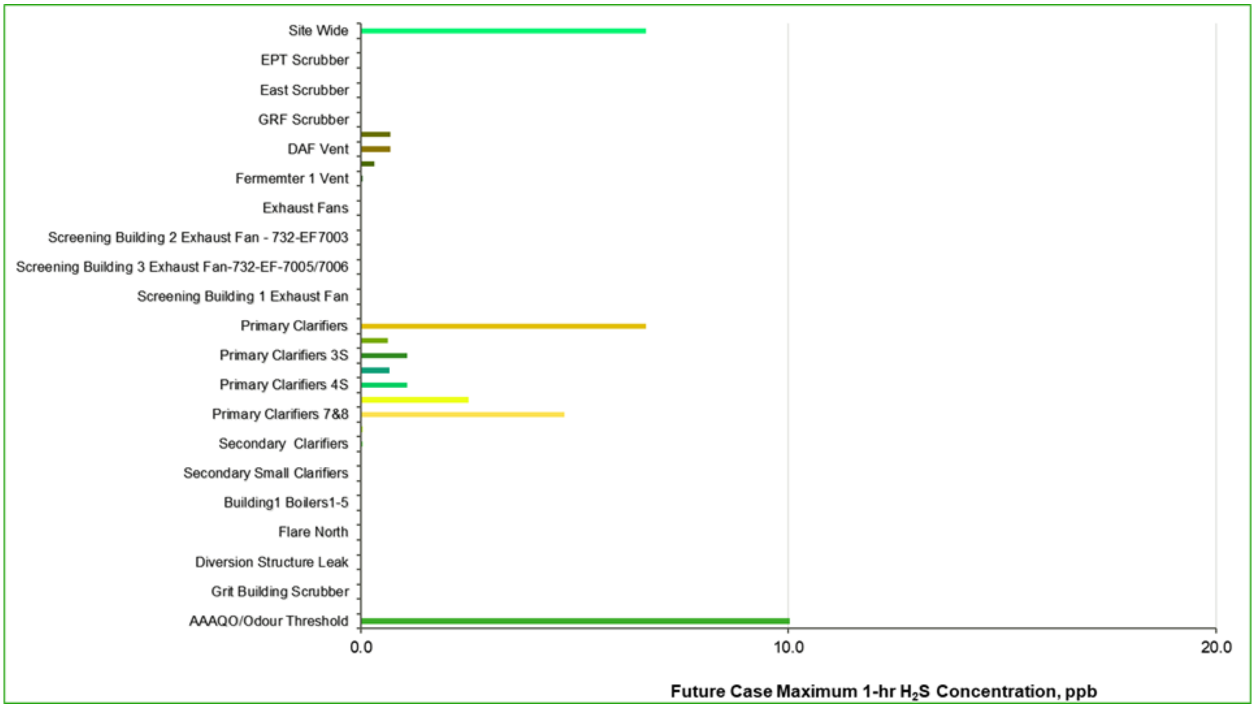
17. The 2019 Odour Assessment and modelling results are shown in Figures 2.0-1 and 2.0-2 below.

Figure 2.0-1
Odour Assessment – Base Case



18. Figure 2.0-1 shows that the key contributors to odour in and around the plant in the base case are generally found site wide, and are mainly because of the exhaust fans, the Screening building and diversion structure leaks. The concentration of the top four causes of odour are at and above 80 parts per billion or ppb, which is higher than the ambient threshold levels established within the Alberta Ambient Air Quality Objectives (AAAQO) by Alberta Environment and Parks (AEP).

Figure 2.0-2
Odour Assessment – Future Case



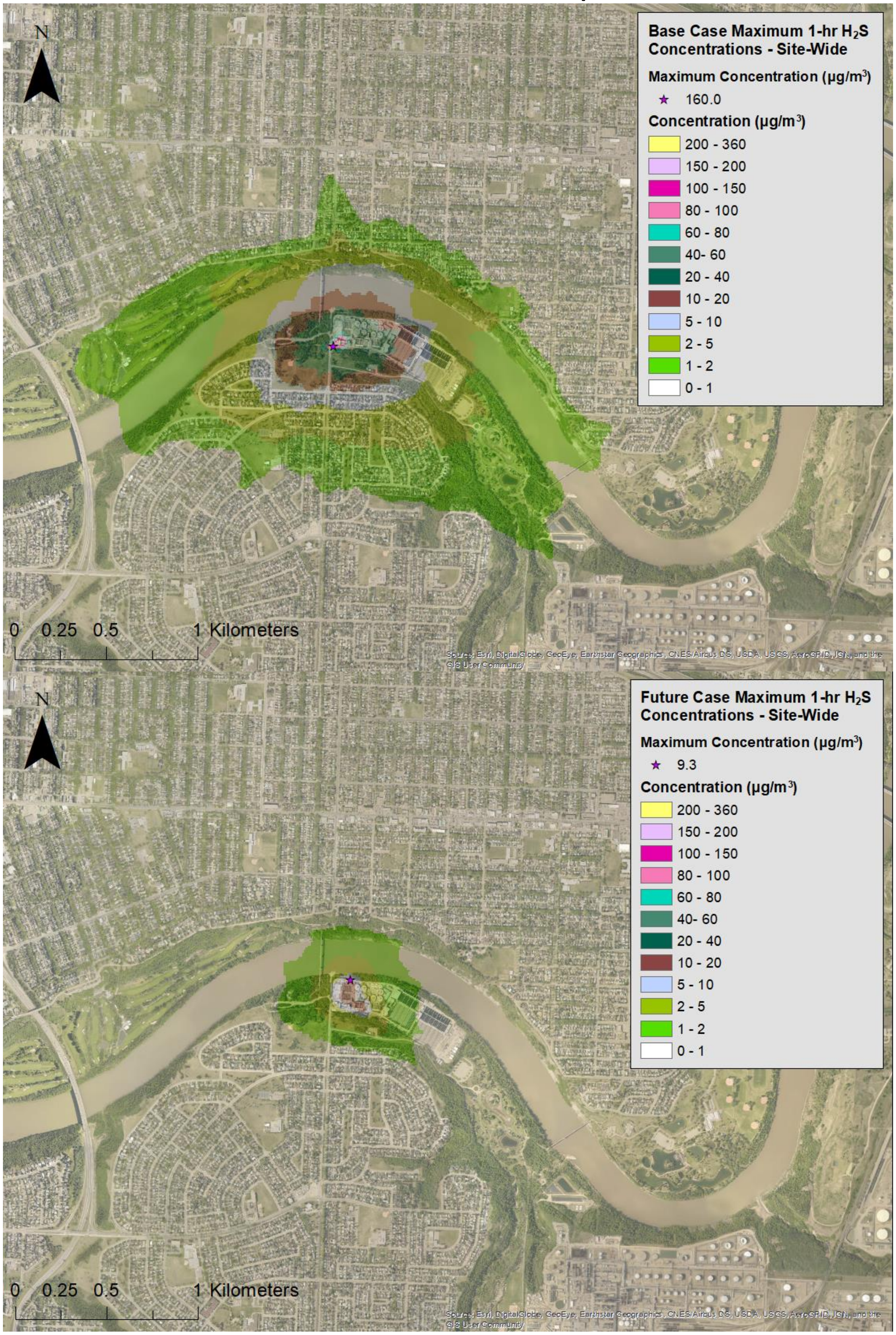
19. Figure 2.0-2 shows that once the upgrades have been completed to resolve the identified issues resulting in odour around the plant today, the expected odour reading will be 10 ppb or less, which is the 1-hour average threshold concentration as per AAAQO.

20. EPCOR has made a commitment to all of its stakeholders to continuously improve odour control by actively managing sources within the Gold Bar WWTP. This is a shared outcome as per the current Integrated Resource Plan (IRP) submitted to the Utility Committee.

21. To postpone the project would mean not addressing known major sources of emission. Fugitive or uncontrolled emissions from the diversion structure can also cause exceedance of the AAAQO and will remain a major source of odour until resolved.

22. Additional model results demonstrate the reduction to odour expected because of this project, as seen below in Figure 2.0-3. The figures demonstrate contours of 1 hour average H_2S concentrations under the current scenario and after the major odour sources are mitigated in the future. The figures show that after project completion, the impacted area reduces significantly, as does the level of odour and the resulting concentration levels outside of the plant boundary are within the prescribed limits of the AAAQO.

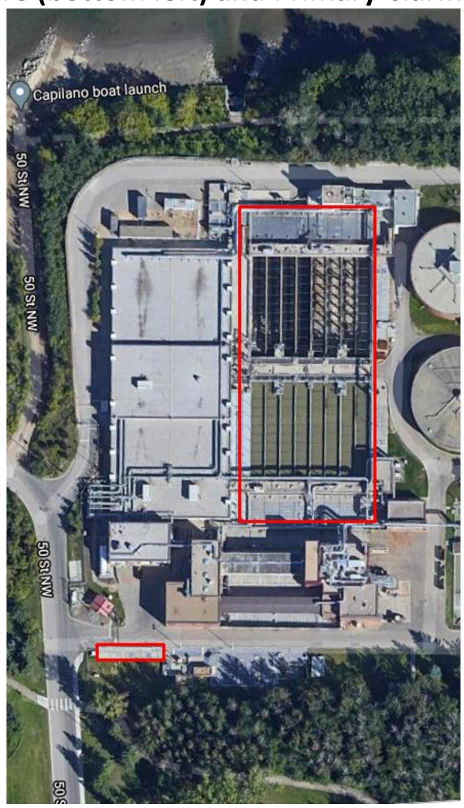
Figure 2.0-3
Base and Future Case – Odour Impact Area



3.0 PROJECT DESCRIPTION

23. This project considers addressing odourous emissions from the diversion structure and the primary clarifiers. Figure 3.0-1 shows these two odour sources within the red outlines.

Figure 3.0-1
Diversion Structure (bottom left) and Primary Clarifiers 5-8 (top right)



24. The proposed solution is the capture and treatment of the foul air in new and/or existing odour treatment facilities (scrubbers) from one of the two odour sources.

25. The complex nature of the diversion structure and its connection to the collection system, bypass channel and outfall makes it extremely challenging for effective isolation, seal and capture.

26. The conceptual design will address both sources (diversion structure and primary clarifiers) and identify practical solutions and conceptual level cost estimates for mitigating both sources.

27. Further stages of the project (detailed design and execution) will focus on one of the two sources for mitigation during the 2022-2024 PBR period. The remaining odour source will be addressed in the future.

28. The project was initiated in 2020, with detailed design and procurement through 2022 and 2023. The construction period is 2023 through to 2024. The project will go into service in Q4 of 2024.

29. Phases of the project are shown in Table 3.0-1

Table 3.0-1
Digester 4 Upgrade Project Timelines

Project Phases	A **2020 & 2021**	B **2022 Q1**	C **2022 Q2**	D **2022 Q3**	E **2022 Q4**	F **2023 Q1**	G **2023 Q2**	H **2023 Q3**	I **2023 Q4**	J **2024 Q1**	K **2024 Q2**	L **2024 Q3**	M **2024 Q4**
1 Initiation/Approvals	X												
2 Preliminary Design	X												
3 Detail Design		X	X	X	X	X							
4 Procurement					X	X	X						
5 Construction							X	X	X	X	X	X	
6 Commissioning												X	X
7 Close-out													X

4.0 PROJECT ALTERNATIVE ANALYSIS

30. EWSI considered four alternatives: do nothing, construct a liquid phase chemical dosing facility, have an in-situ gas phase ionization treatment unit, and have a dedicated capture and treatment facility (scrubber).

31. The first alternative, to do nothing, was rejected as unacceptable. EPCOR has made a commitment to the local community to continuously improve odour control by actively managing sources within the Gold Bar WWTP, and doing nothing would not meet this commitment.

32. Alternative two, having a liquid phase chemical dosing facility has been trialed and proven unsuccessful. In addition, odourous compounds are already released in gas phase before flows enter the facility, so the treatment would have limited effectiveness. This alternative was rejected.

33. An in-situ gas phase ionization treatment unit collects air from the atmosphere, induces ionization and injects the pressurized reactive air into the headspace. This creates positive pressure and makes it very difficult to achieve a seal, resulting in fugitive emissions. The complex nature of the structure however makes it impossible to achieve appropriate contact of the foul air with the injected ionized air. This has been trialed and proven to be unsuccessful. This alternative was rejected.

34. Alternative four, having a dedicated capture and treatment facility (scrubber) in the diversion structure and primary clarifiers is the current proposed solution. It offers the greatest chance of success for on-site treatment.

35. Since the decision was based on qualitative factors, no quantitative analysis is provided.

5.0 COST FORECAST

36. The project cost forecast is largely based on prior experience of executing similar projects on site.

37. A contingency of 13% is included in the cost forecast. This is to cover the cost of unknowns that cannot be identified or anticipated during the design or inspection phase, and typically arise during demolition and construction. These challenges may include for example, extra provisions to allow effective capture and treatment of foul air, or provisions to resolve interference with aboveground or buried infrastructure during construction, etc.

38. Projected costs for this project are shown in Table 5.0-1

Table 5.0-1
Odour Control Improvements Project
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Total**
	Direct Costs					
1	Contractors	0.30	0.58	2.02	1.50	4.40
2	Internal Labour	0.12	0.06	0.06	0.06	0.30
3	Vehicles and Equipment					
4	Abandonments					
5	Contingency	0.00	0.08	0.15	0.44	0.67
6	Risk Allowance					
7	**Sub-total Direct Costs**	0.42	0.72	2.23	2.00	**5.37**
8	Indirect Costs	0.00	0.09	0.19	0.35	0.63
9	**Total Capital Expenditures**	0.42	0.81	2.42	2.35	**6.00**

39. The project is expected to go in to service in 2024.

40. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will stock only the required equipment to reduce the overall costs of all installations and upgrades.

- A number of activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, minimizing the need for external consultants.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project stays on time and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit price basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Project scope and design will be validated by stakeholders to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

41. Table 6.0-1 provides key risks and mitigation plans associated with this project.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A Risk Mitigation Plan
1	Key Health and Safety (H&S) Risks – There are a number of potential H&S Risks including Hazardous Energy Isolation for the duration of the project, confined space entry, etc.	EPCOR follows standard processes to reduce or eliminate H&S risks by conducting Process Hazard Analysis and by implementing appropriate engineered and administrative controls.
2	Key Environmental Risks – Silica dust during construction, and removal and disposal of construction debris	EPCOR conducts Process Hazard Analysis to identify risks and implement appropriate mitigation measures for Environmental risks. Appropriate delineation of construction area, including necessary dust control and debris management measures will be employed to mitigate relevant risks.
3	Key Financial Risks – further change orders or unknown conditions that cannot be seen until demolition is complete	EPCOR manages financial risks by conducting preliminary design and allocation of contingency funds appropriate for the design level. The financial risks will become more evident as further design is completed.

Appendix G10

EPCOR WATER SERVICES INC.

Wastewater Treatment
PE Channel Upgrades – Bypass Chamber Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The PE Channel Upgrade – Bypass Chamber Project will provide major rehabilitation and upgrades to the Bypass Chamber part of the primary effluent (PE) Channel system.

2. This project will include rehabilitation of degraded concrete within the bypass chamber, the installation of a gate system in order to isolate channels (by stopping flows) within the PE system, and connectivity for a potential additional downstream PE Channel.

3. Creating the ability to isolate flows means that Gold Bar Wastewater Treatment Plant (WWTP) operations will be able to safely complete necessary upgrades and maintenance work to the rest of the PE Channel system.

4. Regular inspections and maintenance should also prolong the expected life of associated assets and reduce the risk of failure.

5. The upgrade to the Bypass Chamber is part of a group of projects that will upgrade the entire PE Channel system in future PBR periods. The channels downstream of the Bypass Chamber cannot be upgraded until the gate system is installed, as there is no existing mechanism to safely alternate flows between the downstream PE channels.

6. This project falls in to the Reliability/Life Cycle category.

7. The project was initiated in 2019 and will be completed in Q4 of 2024.

2.0 BACKGROUND AND JUSTIFICATION

8. The Gold Bar WWTP consists of a number of channels and chambers that convey wastewater from the entrance of the plant, through various treatment processes, to the outfalls back into the North Saskatchewan River (NSR).

9. Within the plant, PE channels move effluent from the primary clarifiers to the bioreactors, as shown in Figure 2.0-1.

Figure 2.0-1
Primary Effluent Channel Path

10. The red line shows the flow of the primary effluent, moving from the primary clarifiers on the west side of the plant (left hand side of the figure) along the south side of the plant, through the bypass chamber (just north-west of the red building), and on to the bioreactors in the east side of the plant (right hand side of the figure) for secondary treatment.

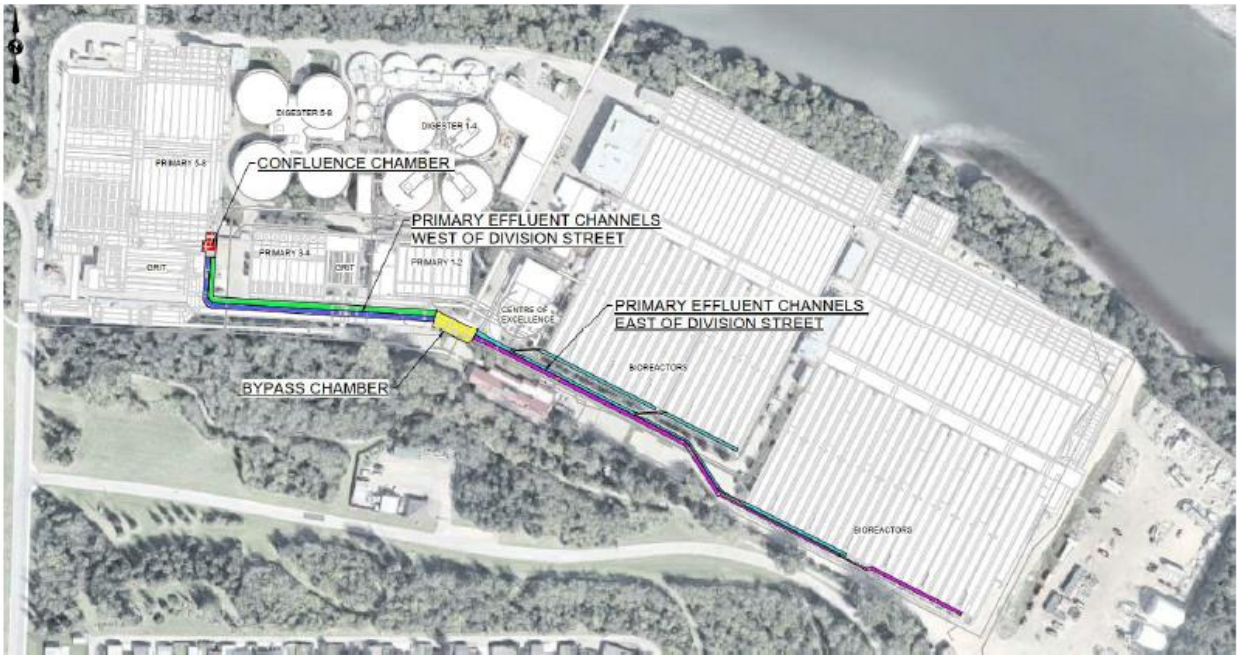
11. The central sections of channels and chambers were constructed in the 1950's and are beyond their expected life.

12. Inspection of the majority of PE channels was completed in 2016, and they were found to be deteriorated and in need of rehabilitation.

13. The current PE Channel configuration does not allow for isolation of any structures: Bypass Chamber, Confluence Chamber, or channel sections (see Figure 2.0-2). An additional channel downstream of the Bypass Chamber may also be considered in the future for increased hydraulic capacity.

14. Because isolation is not possible, the channel inspections were completed through available ports and openings with the channel running live, i.e. with constant flows, which is less safe and risky.

Figure 2.0-2
PE Channel System including Chambers



15. The bypass chamber, highlighted in yellow, in Figure 2.0-2 is a key component of the PE Channel system. The purple and green lines represent the PE channels west (upstream) of the bypass chamber and the blue and pink lines represent the PE channels east (downstream) of the bypass chamber.

16. In order to perform thorough channel inspections and associated upgrades it is necessary to stop flows into portions of the chambers and channel sections. This is achieved by using a gate system within the chamber in other areas of the plant.

17. The gates in the Bypass and Confluence Chambers will be designed to drop down through the chamber and stop flows to one or more chamber or channel sections so that employees can perform detailed inspections, maintenance and upgrades.

18. The Bypass Chamber and Confluence Chamber represent single points of failure in the PE Channel system. In order to facilitate channel upgrades it is necessary to install gates within the chamber structures to manage flows.

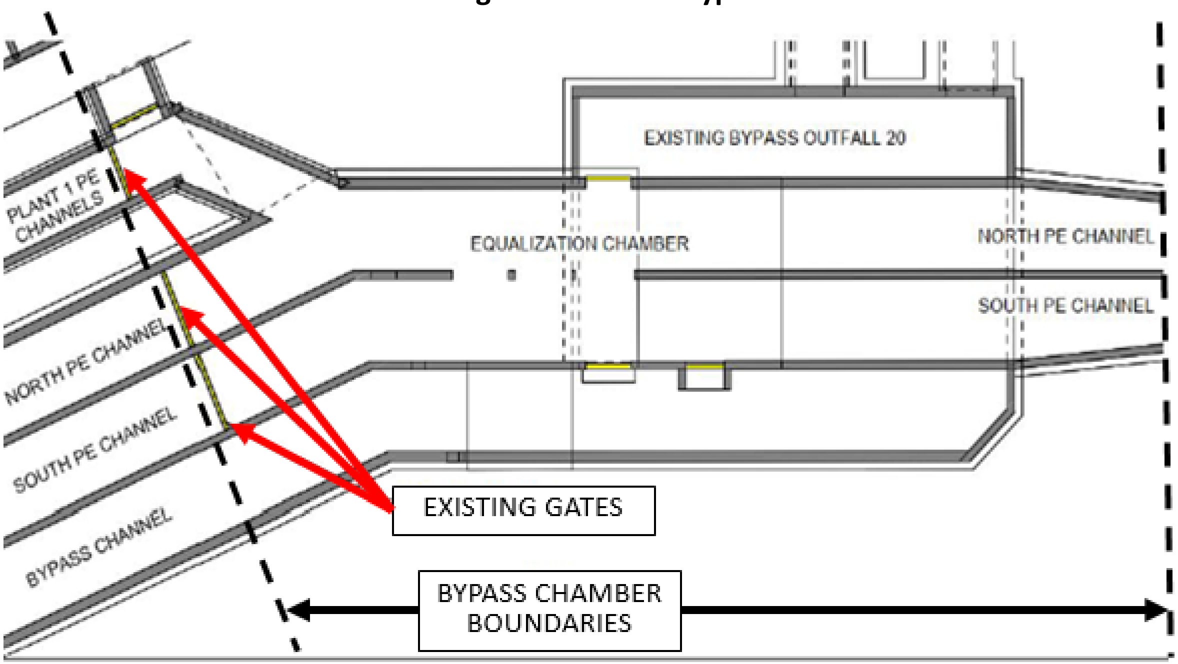
19. The existing isolation gate systems in the PE channels require all flow to be stopped or diverted, and, as such, there has not been any maintenance or upgrades performed on the channels or chambers since they were constructed.

20. This presents a significant risk at the Gold Bar WWTP. As evidenced by inspection, the channels have significantly degraded over time due to lack of maintenance. Potentially if there is a failure, leak or collapse in the PE Channel system, plant employees would not be able to inspect or resolve the issue without having to run temporary piping to divert flows around the area of concern.

21. While temporary piping is a short term workable solution, it is not an appropriate long term solution due to space constraints in this congested area of the site and is not quick or easy to erect on an emergency basis.

22. Inspection of the confluence chamber found it to be in better condition than the bypass chamber, due primarily to the age and the configuration of the Bypass Chamber. Hence it was determined that the first phase of rehabilitating the PE Channel system would be to upgrade the Bypass Chamber. This would eliminate this single point of failure and resolve issues with the most degraded part of the system.

Figure 2.0-3
Current Configuration of the Bypass Chamber



23. In considering the Bypass Chamber in more detail (Figure 2.0-3), it is possible to see that there are a number of channels congregating at the bypass chamber.

24. The North PE and South PE channels, as well as primary effluent from Clarifiers 1 to 4 (shown as Plant 1 in Figure 2.0-3) feeding the chamber can be isolated using existing isolation gates in the current configuration.

25. A fourth channel carries emergency plant bypass flows from the headworks area of the plant, which is then directed underneath the North and South PE Channel to the NSR via Outfall 20. This is used when incoming flows are in excess of plant capacity during high flow events.

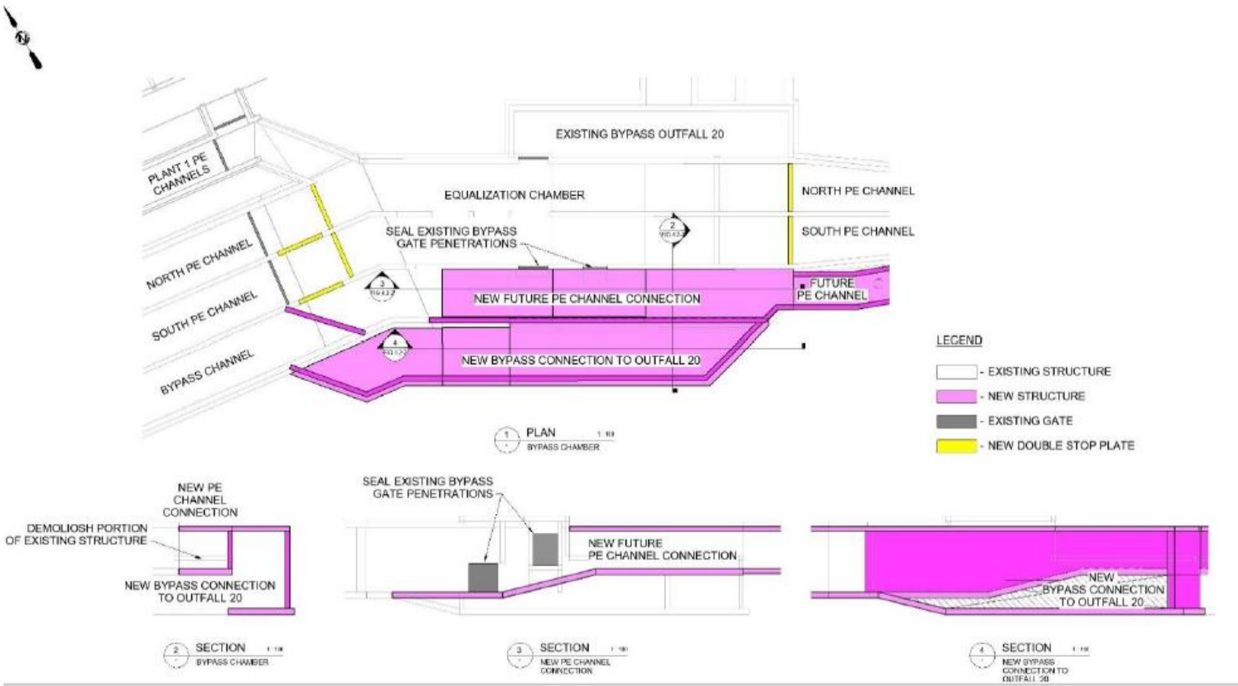
26. However, once the flows enter the chamber there is no means to isolate the north or the south streams leaving the chamber.

27. Various options for upgrading the Bypass Chamber were considered with a goal to achieve the following functionalities:

- Ability to isolate parts of the chamber from incoming flows to allow future inspection and maintenance work without disrupting distribution of flow to the secondary treatment process.
- Ability to independently isolate the North and South PE channels downstream of the chamber.
- Making above modifications and still allow functionality to bypass to Outfall-20.
- Modification to the Bypass Chamber to allow for future PE channel connection in consideration of future additional expected flows. It is more cost effective to perform a short channel construction with a gate while the chamber is under construction than retrospectively in the future.

28. Figure 2.0-4 shows the proposed modifications to the existing Bypass Chamber.

Figure 2.0-4
Proposed Upgrades to the Bypass Chamber



29. Modifications to the existing Bypass Chamber are as follows:

- Install two additional isolation gates on the North and South PE channels feeding the chamber.
- Install a gate on the south wall of the North PE Channel to allow flow diversion to the South PE Channel.
- Install a gate on the south wall of the South PE Channel to allow flow diversion to the new future PE channel connection once constructed.
- Use a section of the existing Bypass channel for future PE Channel connections and seal the existing bypass gate penetrations.
- Construct a new bypass connection to Outfall-20 located to the south of the existing chamber.
- Construct a new structural wall upstream of the bypass channel to allow flow diversion to the new bypass connection to Outfall-20.

30. The Bypass Chamber will be isolated from the PE Channel system and remain out of service throughout construction.

31. During this period, the flow of primary effluent from the channels feeding the Bypass Chamber will be pumped to the channels downstream of the chamber using a temporary bypass pumping system capable of handling the required flows to the downstream secondary treatment.

32. The flow from Plant 1 will be stopped by closing the existing gates that feed into the Bypass Chamber. Similarly, flow from Plant 2 will be stopped by closing the existing gates on the North and South PE channels feeding the chamber.

33. The existing bypass channel, which carries the plant influent overflow to the chamber, can be isolated by closing the two slide gates that open into the chamber as shown in Figure 2.0-4.

34. The existing gates will be inspected and tested prior to implementing the shutdown. Consideration will be given to install a second temporary gate (bulkhead) upstream of the North and South PE channel isolation gate to provide double block isolation.

35. The temporary bypass system will be designed and installed to handle and distribute the maximum flow, per current plant requirements, to the downstream bioreactors.

36. The temporary bypass system will be complete with a control system to allow continuous flows as PE flow rates fluctuate.

37. The cost of using a temporary bypass system to pump flows around the Bypass Chamber accounts for about 24% of the overall cost of the upgrade. The detailed design phase of the project will verify the flows to determine the size of the pumping system required and undertake a cost-benefit analysis of renting the pumping system versus purchasing the pumping system. The analysis will consider the temporary pumping requirement over future upgrades to the PE Channel system, considering that the confluence chamber and PE channels will require rehabilitation in the future.

3.0 PROJECT DESCRIPTION

38. The scope for the PE Channel Upgrade project in this PBR includes design, rehabilitation, construction and commissioning of upgrades to the Bypass Chamber of the PE Channel system.

39. The following forms the basis of the current scope of work:

- Install two additional isolation gates on the North and South PE channel feeding the chamber.

- Install a gate on the south wall of the North PE Channel to allow flow diversion to the South PE Channel.
- Install a gate on the south wall of the North PE Channel to allow flow diversion to the new future PE channel connection once constructed.
- Use the section of the existing Bypass channel for future PE Channel connections and seal the existing bypass gate penetrations.
- Construct a new bypass connection to Outfall-20 located to the south of the existing chamber.
- Construct a new structural wall upstream of the bypass channel to allow flow diversion to the new bypass connection to Outfall-20.

40. This will include detailed design and constructions of all required electrical and controls, and commissioning of the completed system.

41. The project was initiated in 2020, with detailed design and procurement through 2022 and early 2023. Construction will follow through 2023 and 2024. Commissioning will be performed in 2024 with the upgraded Bypass Chamber going into service in 2024.

42. Phases of the project are per Table 3.0-1

Table 3.0-1
PE Channel Upgrades Project Timelines

Project Phases	A **2021 and Prior**	B **2022 Q1**	C **2022 Q2**	D **2022 Q3**	E **2022 Q4**	F **2023 Q1**	G **2023 Q2**	H **2023 Q3**	I **2023 Q4**	J **2024 Q1**	K **2024 Q2**	L **2024 Q3**	M **2024 Q4**
1 Initiation/Approvals	X												
2 Preliminary Design	X												
3 Detail Design		X	X	X	X	X							
4 Procurement				X	X	X							
5 Construction						X	X	X	X	X	X	X	
6 Commissioning										X	X	X	X
7 Close-out													X

4.0 PROJECT ALTERNATIVE ANALYSIS

43. There are three alternatives for this project: Do Nothing (i.e. run to failure), Upgrade the Bypass Chamber and divert primary effluent to the NSR, and Upgrade the Bypass Chamber and establish a temporary pumping system.

44. Doing nothing accepts the Bypass Chamber as a single point of failure within the PE Channel system. This means that operations teams are not able to isolate flows to perform any future upgrades or maintenance on the PE Channel system. This was considered a critical flaw since inspections have shown that significant upgrade work is required throughout the PE Channel system, and hence this alternative was rejected.

45. It is possible to divert PE flows to the NSR through Outfall 30 avoiding the Bypass Chamber. That, however, would eliminate secondary treatment and disinfection from the wastewater, which would contravene Gold Bar's approval to operate and have significant environmental impacts. Hence this alternative was rejected.

46. Upgrading the Bypass Chamber to include the gate system on the upstream and downstream sections provides the ability to shut down various parts of the PE Channel system to enable required rehabilitation of channels. Without upgrading the Bypass Chamber, no future channel upgrades are possible, which leaves a critical flaw in the PE Channel system. This was considered the most appropriate and immediate requirement and as such this alternative was selected.

47. Since the decision is based on qualitative factors discussed above, no quantitative analysis is provided.

5.0 COST FORECAST

48. The project cost forecast is prepared using contractor pricing estimates based on preliminary design and using information provided by the designers. The contractor evaluated the means, methods, and quantities involved to construct the preliminary design and assumed poor condition of the Bypass Chamber. Additional estimates for internal activities such as engineering, construction coordination etc. are also included.

49. A contingency of 22% is included in the project cost forecast. This is based on the current level of design and the unknown condition of the uninspected portion of the chamber.

50. Projected costs for this project are shown in Table 5.0-1

Table 5.0-1
PE Channel Upgrades Project
($ millions)

		A Pre-2022	B 2022	C 2023	D 2024	E Total
	Direct Costs					
1	Contractors	0.23	2.59	5.08	4.20	12.10
2	Internal Labour	0.05	0.06	0.13	0.12	0.36
3	Contingency	0.00	0.47	1.47	1.22	3.16
4	**Sub-total Direct Costs**	0.28	3.12	6.68	5.54	**15.62**
5	Indirect Costs	0.00	0.16	0.52	0.95	1.63
6	**Total Capital Expenditures**	0.28	3.28	7.20	6.49	**17.25**

51. This project is expected to go in to service in 2024.

52. EWSI takes a number of steps to minimize the level of capital expenditures. These include:

- Work with other EPCOR business units to determine equipment and resource availability to help offset cost.
- A detailed cost-benefit analysis will be completed to determine whether purchasing a temporary pumping system or renting will be more cost effective for this project and future PE Channel Upgrade projects.
- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required upgrades.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project stays on time and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit price basis.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every requested project is evaluated individually to prioritize projects; based on the highest risk, and based on synergies with other projects (using a common shut down).
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

53. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A Risk Mitigation Plan
1	Key Health and Safety (H&S) Risks – The key H&S safety risk for this project is properly isolating the Bypass Chamber for construction to protect workers in the chamber and channels.	EWSI has developed isolation design for many of the channel rehabilitation projects completed in past years. This design employs a double-block and bleed arrangement providing robust protection to workers.
2	Key Environmental Risks – The key environmental risk during construction is the potential release of PE flow to the plant site and eventually the NSR.	The design of the temporary bypass pumping will include redundant backup for pumping and power supply as necessary for maximum flows. EWSI will also work closely with regulators to provide adequate awareness and any potential approvals that may be required.
3	Key Financial Risks – The key financial risk is the cost to establish temporary pumping and the unknown condition of the currently submerged portions of the Bypass Chamber.	A Contractor partner currently engaged in large-scale projects at Gold Bar WWTP, provided construction estimates. Conservative estimates were provided for means and methods.
5	Key Reputational Risks – The key reputation risk is noise pollution from the temporary bypass pumping system.	Noise levels will be taken into consideration during design and minimized to acceptable levels. Community engagement will also be conducted to address stakeholder concerns.

Appendix G11

EPCOR WATER SERVICES INC.

Wastewater Treatment
Secondary Aeration Blower Upgrades Project
Business Case

February 16, 2021

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1.0 OVERVIEW

1. Aeration is a critical component of the Biological Nutrient Removal (BNR) process. Without the appropriate level of aeration, there may be a loss of biology in the BNR process, resulting in a failure to remove nutrients from the wastewater and ultimately violation of environmental regulations.

2. The Gold Bar Wastewater Treatment Plant (WWTP) currently has four aeration blowers to supply process air to the BNR system and the tertiary membrane plant.

3. The existing blowers are of different sizes and were installed at several stages of plant upgrades since 1969. These systems have reached end of useful service life, have limited range for operational control and have significant reliability issues.

4. The process air demand is highly variable due to daily and seasonal variation in wastewater flows and loading coming to the plant. This variability in demand results in the differently sized blowers being operated at sub optimal conditions.

5. All existing blowers currently have only one method of control by throttling the inlet flow, using inlet guide vanes (IGV). At lower IGV positions, the blowers are quite inefficient and start to demonstrate significant mechanical vibration issues, increasing the risk of potential failures.

6. The Secondary Aeration Blower Upgrades Project will install an additional blower into Blower Building 2 on site, and replace the motor operating Blower 6 to increase efficiency.

7. Due to the low reliability of the existing blower systems, addition of a new blower with improved control range is recommended to ensure the continued stable operation of the plant. Replacement of an oversized motor on Blower 6 is recommended to significantly improve the efficiency and reduce the power consumption of the overall operation.

8. None of the existing blowers are recommended to be upgraded or demolished at this time. They can be used in combination with the new blower or as backup units and eventually run to failure and replaced in phases as future upgrades to the aeration system are implemented.

9. This project falls in to the Reliability/Life Cycle category.

10. The project will be initiated in 2022 and completed by 2024.

2.0 BACKGROUND AND JUSTIFICATION

11. The Gold Bar WWTP has four aeration blowers, which supply process air to the BNR system and the tertiary membrane plant.

12. For the BNR system, the supplied air is used to create conditions necessary for the biological treatment process to break down nutrients and organic matter. For the tertiary treatment, the supplied air is used to scour the membrane filter modules in order to prevent build up. Both of these processes would cease to function without the required volume of supplied air, resulting in complete breakdown of the secondary and tertiary treatment and subsequent violation of environmental and regulatory targets, and contractual obligations.

13. Blowers 1 and 4 are located in Blower Building 1 and Blowers 5 and 6 are located in Blower Building 2. Blowers 2 and 3 had significantly smaller capacity and were decommissioned after Blower 5 was installed.

14. There are five blower foundations currently installed at the plant, two in Blower Building 1, which are occupied by Blowers 1 and 4 and three in Blower Building 2, two of which are occupied by Blowers 5 and 6, leaving one spare foundation.

15. The design configuration and capacity of existing blowers is shown in Table 2.0-1.

Table 2.0-1
Secondary and Tertiary Process Aeration Blowers at Gold Bar WWTP

	Item	A **Blower 1**	B **Blower 4**	C **Blower 5**	D **Blower 6**
1	Install Year	1969	1969	1977	1996
2	Motor, HP	1,500	1,500	3,500	3,500
3	Rated Capacity (SCFM*)	39,400	39,400	77,000	88,000 De-rated to 50,000 in 2002

* SCFM – Standard Cubic Feet per Minute.

16. The total installed capacity of all blowers based on nameplate data is 205,800 standard cubic feet per minute (SCFM). Considering the largest blower out of service, the maximum available capacity is 128,800 SCFM.

17. At Gold Bar WWTP, Inlet Guide Vanes (IGVs) are used to adjust the aeration volume. This enables the blower motors to operate at constant speed while the inlet air volume is regulated or throttled. However, the efficiency is typically reduced when the inlet is throttled. Also, if the

inlet is throttled below 30%, the blowers start to experience mechanical vibration issues increasing the risk of potential failure.

18. The biological treatment process experiences significant daily and seasonal variation because of changes in weather pattern, incoming flows and loads. The unevenly sized blowers are operated in combination to address daily and seasonal variation in demand, often resulting in throttled inlet conditions that are much lower than recommended by the manufacturer.

19. Blowers 1 and 4 are typically used stand alone at low demands or as top-up blowers during peak demand conditions with one of the larger blowers. They experience frequent starts and stops when operated to match demand conditions, which can result in electricity surging, increasing the risk of failure.

20. Blowers 5 and 6 are never operated together because they are very large and their combined capacity exceeds the process demand. However, having one of these two blowers out of service significantly reduces the overall capacity and the plant is unable to operate if both of these blowers are non-functional. Also, because of their size, these units are the most energy intensive to operate.

21. There are significant concerns with the electrical system for Blowers 1 and 4. The power system shows signs of corrosion and advanced aging. In addition, the blowers use 2300 V motors that are older and no longer widely available. These issues with the electrical system further reduce the overall reliability of these Blowers.

22. Blower 5 historically caused the most reliability issues but it has recently been overhauled and is less likely to cause major issues in the immediate future. Blower 6 has not been overhauled for more than a decade and is more likely to cause reliability issues in the current operation.

23. A 2016 energy audit indicated that the secondary aeration blowers are the source of the largest individual energy demand at the plant (approximately 30% of the total electricity consumption). Thus, there is also significant potential to improve energy efficiency by making appropriate upgrades to the existing blower systems.

24. The current blower systems have significantly lower efficiency compared to modern industry standards. Historically, Blower 5 has been the most maintenance intensive unit but it is the most efficient of the existing blowers, when operated with the inlet air throttled by not more than 55%.

25. The original Blower 6 impeller was downsized in 2002 to provide a lower capacity, as it was too large for the demand at the time, but the associated motor size was never downsized to match the change. Thus, Blower 6 has the lowest efficiency out of all current blowers. There is substantial opportunity for power cost savings with the operation of Blower 6 by installing an appropriately sized motor. These modifications can potentially generate an estimated maximum power cost savings of approximately $80,000 annually.

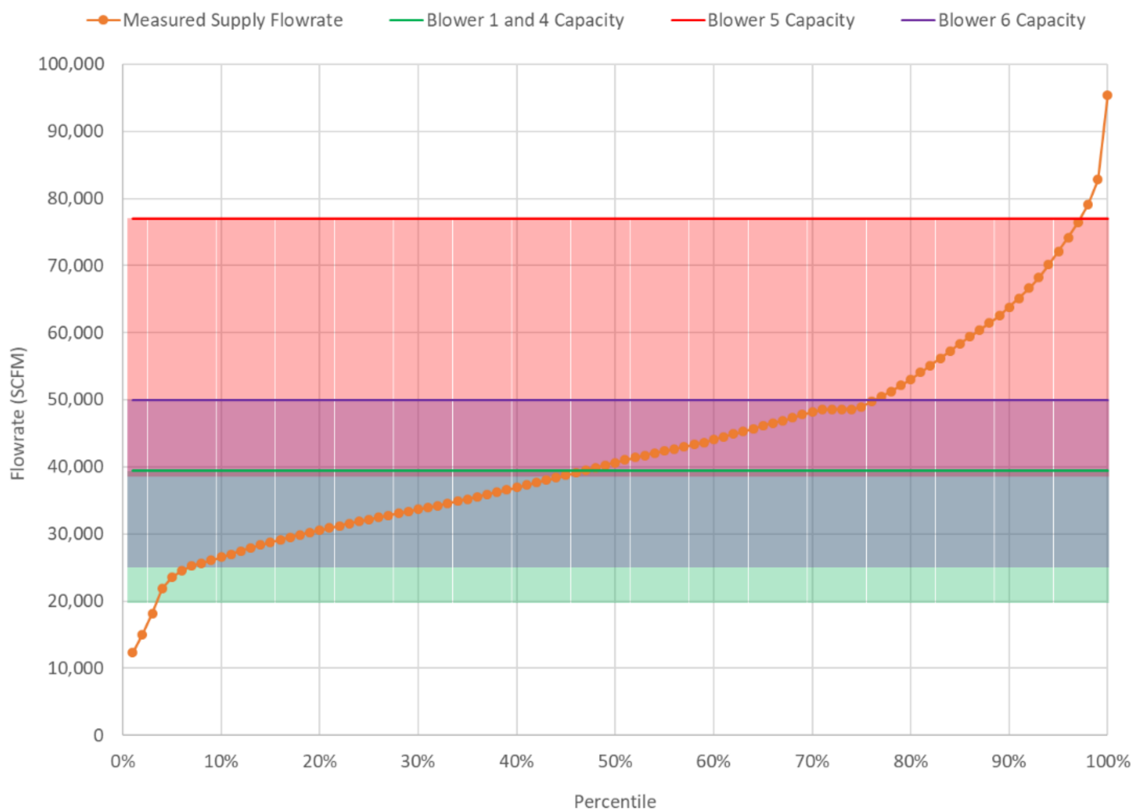
26. Figure 2.0-1 shows the percentile distribution of total measured blower flowrates with the capacities of the available blowers. The shaded region shows effective operational range for each blower.

- Blowers 1 and 4 are each sized to supply the required demand approximately 5%-50% of the time.
- Blower 5 can supply the required demand approximately 50%-97% of the time.
- Blower 6 can supply the required demand approximately 10%-75% of the time, at very low efficiency due to the oversized motor.
- When Blower 5 is out of service, Blowers 1 or 4 is used to fulfill demands beyond the 75th percentile.
- When Blower 5 is available, Blowers 1 or 4 is used to fulfill demands beyond the 97th percentile.

27. Overall, it is currently very difficult for Operations to maintain process air supply reliably and efficiently with the existing blower system. Although the combined capacity is sufficient to meet demand, improvements are recommended to ensure continued reliability of this critical process.

28. It is however not recommended to upgrade any of the existing blowers with Variable Frequency Drives (VFDs), due to very limited improvement potential as per the manufacturer. Also demolition is not recommended, as it is more cost effective to use the existing blowers in combination with a new blower or as backup units and eventually run to failure or replaced strategically.

Figure 2.0-1
Percentile Distribution of Measured Flowrates and Blower Capacities



29. It should be noted that a sharp increase in required flowrate is observed after the 75th percentile demand. Hence, it is recommended to consider sizing a future blower to meet the 75% demand at a minimum.

30. Blower sizing will be reviewed and finalized during design, in conjunction with considering forecast demand and a long term secondary aeration strategy that is consistent with the future capacity and technology used for secondary treatment.

3.0 PROJECT DESCRIPTION

31. The scope of work includes installation of a new single stage blower and installation of associated power supply and controls in Blower Building 2. This option was compared to an option of a new blower equipped with a VFD, and was determined to have a better NPV based on the plant's operating characteristics.

32. Reuse of existing foundations is recommended because constructing new foundations would require significant structural modifications and result in considerable construction costs.

Blower Building 2 has an existing spare foundation, which is suitable and can be used for the installation of the new blower.

33. Further design will confirm the selection and sizing of the new blower. The design will consider the short and long term strategy for secondary aeration based on the current plan for secondary treatment upgrades, per the Gold Bar WWTP IRP. New controls will be fully integrated with the existing plant controls and automation system.

34. The project also includes an overhaul of Blower 6 and replacement of the existing motor with an appropriately sized motor that will improve the operating efficiency.

35. The project will be initiated in 2022, with detailed design and procurement through 2022/2023 and construction during 2023/2024. Commissioning will be performed through 2024. The project will go in to service in Q4 of 2024.

36. Phases of the project are per Table 3.0-1

Table 3.0-1
Secondary Aerations Blowers Upgrade Project Timelines

	Project Phases	A **2022 Q1**	B **2022 Q2**	C **2022 Q3**	D **2022 Q4**	E **2023 Q1**	F **2023 Q2**	G **2023 Q3**	H **2023 Q4**	I **2024 Q1**	J **2024 Q2**	K **2024 Q3**	L **2024 Q4**
1	Initiation/Approvals	X											
2	Detail Design	X	X										
3	Procurement			X	X	X	X						
4	Construction							X	X	X	X	X	
5	Commissioning											X	X
6	Close-out												X

4.0 PROJECT ALTERNATIVE ANALYSIS

37. A number of alternatives were considered:

- Do nothing.
- Improve existing blowers.
- Install new turbo blower.
- Add a new blower to Blower Building 2 and downsize the Blower 6 motor – recommended alternative.

38. Alternative one, to do nothing, was the least costly from a capital perspective; however, the system would continue to be unreliable and inefficient. Since the existing blower systems

have reached the end of their useful life and have major reliability issues, this alternative was rejected.

39. Upon consultation with the manufacturer, it was determined that under alternative two, improving existing blowers, it is not possible to increase flow by a sufficient amount with the installation of VFD's. In addition, the age of the existing blowers and the style of the associated motors makes the addition of VFDs costly without any major benefit. Thus this alternative was also rejected.

40. Alternative three involved installing new turbo blowers. This would increase operational flexibility and reduce power costs, however there were a number of other steps required to make this alternative feasible. Step-down transformers would be required to supply power for turbo blowers, more units would be required due to the maximum possible size of these blowers and there would be more stops and starts on the machines. Construction costs would be higher given the greater number of units. As such, this alternative was rejected.

41. Alternative four, adding a new single stage blower and downsizing Blower 6 motor, gains operational flexibility and reduces power costs. There would be redundancy to enable maintenance activity, and to provide additional flexibility during high and low demand periods, which would reduce the likelihood of any interruption in process air supply and resulting failure of secondary treatment system, and contravention of regulatory effluent quality limits. Incremental operation and maintenance costs for the additional blower are offset with power savings resulting from having a more efficient blower and the improvements to Blower 6. Considering this offset, this project is expected to achieve a net savings of between $0.20 million to $0.25 million per year.

5.0 COST FORECAST

42. The project cost forecast is based on consultation with equipment manufacturers and from previous conceptual work completed by the internal engineering team and a consultant in 2016.

43. A contingency of 6% is included in the cost forecast. This is to cover the cost of unknowns that cannot be identified or anticipated during the design or construction phase, and typically arise during demolition. The majority of the project cost is related to the cost of the new equipment and there is very little construction or demolition scope involved. This is why the

construction contingency is a lower percentage of the total cost than is typical for this level of design.

44. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Secondary Aeration Blower Upgrades Project
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	0.48	5.21	0.60	6.29
2	Internal Labour	0.14	0.09	0.16	0.39
3	Contingency	0.05	0.14	0.25	0.44
4	**Sub-total Direct Costs**	**0.67**	**5.44**	**1.01**	**7.12**
5	Indirect Costs	0.10	0.23	0.55	0.88
6	**Total Capital Expenditures**	**0.77**	**5.67**	**1.56**	**8.00**

45. The project is expected to go into service in 2024.

46. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will try to minimize the need to stock spare equipment reducing the overall costs of all installations and upgrades.
- A number of activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, minimizing the need for external consultants.
- Construction coordinators will be on-site at Gold Bar WWTP to manage the day to day activities of contractors and ensure the project stays on time and is constructed to specifications.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit price basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Project scope and design will be validated by stakeholders to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

46. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk Statement	A Risk Mitigation Plan
1	Key Health and Safety Risks – There are a number of potential H&S Risks including Hazardous Energy Isolation for the duration of the project.	EPCOR follows standard processes to reduce or eliminate H&S risks by conducting Process Hazard Analysis and by implementing appropriate engineered and administrative controls.
2	Key Environmental Risks – Silica dust during construction, and removal and disposal of construction debris	EPCOR conducts Process Hazard Analysis to identify risks and implement appropriate mitigation measures for Environmental risks. Appropriate delineation of construction area, including necessary dust control, ventilation and debris management measures will be employed to mitigate relevant risks.
3	Key Financial Risks – further change orders or unknown conditions that cannot be seen until demolition is complete. Engineering and construction costs similar to historical trends	EPCOR manages financial risks by conducting preliminary design and obtaining manufacturer's quotes for establishing the project budget. The financial risks will become more evident as further design is completed. A competitive procurement strategy will also be implemented to ensure the best value is achieved.
4	Equipment sourcing, project timing/ completion date, shutdowns to accommodate construction.	The proposed new blower and motor are very large pieces of equipment and will have very long lead times. Sufficient time in the project schedule has been allocated for procurement and installation of the equipment. It is recommended to proceed with the next stage of design as soon as feasible.

Appendix G12

EPCOR WATER SERVICES INC.

Wastewater Treatment
Secondary inDENSE™ Upgrade Project
Business Case

February 16, 2021

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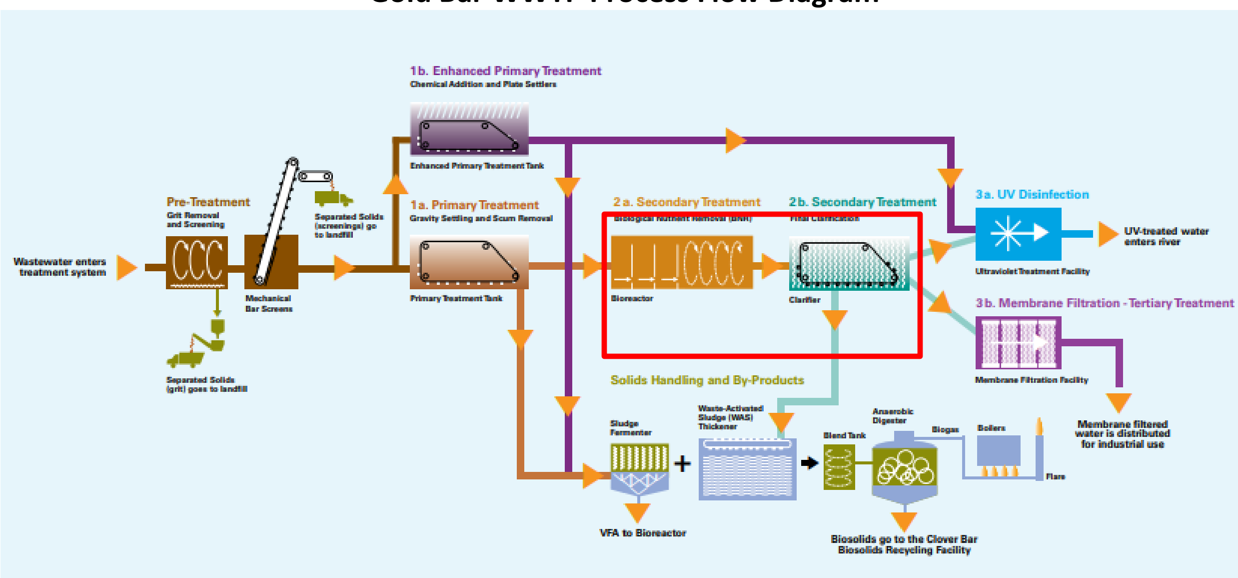
1.0 OVERVIEW

1. The Gold Bar Wastewater Treatment Plant (WWTP) employs a Biological Nutrient Removal (BNR) process for its secondary treatment. BNR is an advanced biological treatment process, which improves final effluent quality by removing nutrients like phosphorus and ammonia-nitrogen from wastewater. Excessive nutrients discharging into surface waters can cause unwanted growth of algae and depletion of dissolved oxygen thereby causing potentially severe issues with the ecosystem.

2. The Secondary inDENSE™ Upgrade Project is to design and install an inDENSE™ system in one of the eleven BNR process trains at Gold Bar WWTP. Each BNR train consists of a bioreactor followed by a clarifier as shown by the red box in the process flow diagram below.

Figure 1.0-1
Gold Bar WWTP Process Flow Diagram



3. This will increase treatment capacity and allow for deferment of the more costly implementation of Membrane Biological Reactors (MBR), which would otherwise have to be in place in at least one train by 2028 or earlier in order to remain compliant with regulated discharge limits.

4. If the Gold Bar WWTP treatment capacity is not increased, it is unlikely that environmental discharge limits will be met, when considering both forecast population growth and an anticipated decrease to future effluent compliance limits.

5. This project falls in to the Growth/Customer Requirements category.

6. The total project spend is $5 million, with $4.5 million of the spend in the 2022-2024 PBR period.

7. The project was initiated in 2020 and will be completed in 2024.

2.0 BACKGROUND AND JUSTIFICATION

8. The Gold Bar WWTP provides full secondary treatment to sanitary wastewater from the City of Edmonton, some regional areas and a portion of the stormwater generated within the older central core area of Edmonton. The secondary treatment process has a total of eleven BNR trains.

9. Each BNR train consists of a bioreactor followed by a clarifier. The purpose of the bioreactors is to grow and maintain the microbiology responsible for the removal of the nutrients. The purpose of the clarifiers is to remove the biomass or activated sludge from the water to meet the effluent limits and return the biomass to the bioreactors. Currently the overall capacity of each train is limited by the nutrient removal capacity of the secondary clarifiers.

10. Current population projections published in the Gold Bar WWTP Integrated Resource Plan (IRP) suggest that after 2028, forecast population growth may cause nutrient removal capacity for BNR to be exceeded.

11. EPCOR anticipates that future environmental discharge limits for nutrient compounds may change based on Total Loadings from all discharge sources to the North Saskatchewan River. Similar to other jurisdictions, some of the effluent compliance limits may be lowered for the upcoming permitting cycle and new limits could be applied by 2035.

12. For the purposes of long range planning in the IRP, EPCOR assumed that load based limits for nutrients and organics will come into effect in 2035 and will mandate total loadings not to exceed 2015 levels. It is also assumed that a total nitrogen removal requirement (rather than the current ammonia removal requirement) may be implemented to align with many other North American jurisdictions.

13. With more stringent effluent criteria, there will be a need to intensify treatment in the current system, because more nutrients will have to be removed from the wastewater to meet the discharge limits.

14. EPCOR has committed to maintain Gold Bar WWTP operations within the existing site footprint and as such, space for expansion on site is constrained.

15. Expanding plant treatment capacity using existing conventional technology while staying within the existing site footprint is not possible. Therefore, technologies that intensify treatment capacity within the existing footprint have been evaluated as a solution.

16. The current IRP recommends the retrofit of existing BNR systems to MBR by installing membranes in the secondary clarifiers to expand capacity, with the first MBR train in operation by 2028 or earlier. EPCOR developed a conceptual design for the conversion of BNR train No.11 to an MBR, with the concept of converting up to seven trains to MBR over the next 40 years as recommended in the IRP. Train No.11 was primarily identified due to its ease of conversion and future integration.

17. While conversion to MBR solves capacity issues at the plant, this conversion is expected to have a very significant installed cost of approximately $70 million per train and substantially increase operating costs by approximately $2 million annually per train.

18. Due to the high costs associated with this option, EPCOR investigated alternative technologies that could be implemented to delay the conversion of the BNR trains to MBR.

19. EPCOR recommends the technology known as inDENSE™.

20. inDENSE™ reduces capacity requirements as compared to other technologies through a densification process (improving the settleability of sludge), and may allow up to a 20% increase in capacity, or 6 million litres per day (MLD) increase in sustained average flowrate, through one BNR train.

21. inDENSE™ is the lowest cost option, with a capital cost of $5 million and incremental annual operating costs of $120 thousand.

22. Implementation of inDENSE™ means that the high cost MBR option can be delayed for a number of years (dependent on inDENSE™ performance, but is estimated to be 16 years), as shown in section 4. In addition, feasibility of new and alternative technologies are continually being evaluated. This provides customers with continued operational excellence within the goal of prudent capital investment.

23. The overall purpose of installing the inDENSE™ technology is to increase capacity of BNR treatment using existing tanks and allow the deferment of MBR implementation, which otherwise would have to be in place in at least one train by 2028. Figure 2.0-1 shows the nutrient removal capacity of the secondary treatment system at Gold Bar WWTP and the projected timeline for MBR retrofits as presented in the current IRP. Figure 2.0-2 shows the recommended approach of installing the inDENSE™ system earlier and more frequently, which allows for deferment of the more costly MBR retrofits.

Figure 2.0-1
Projected Timelines for MBR retrofits as presented in current IRP

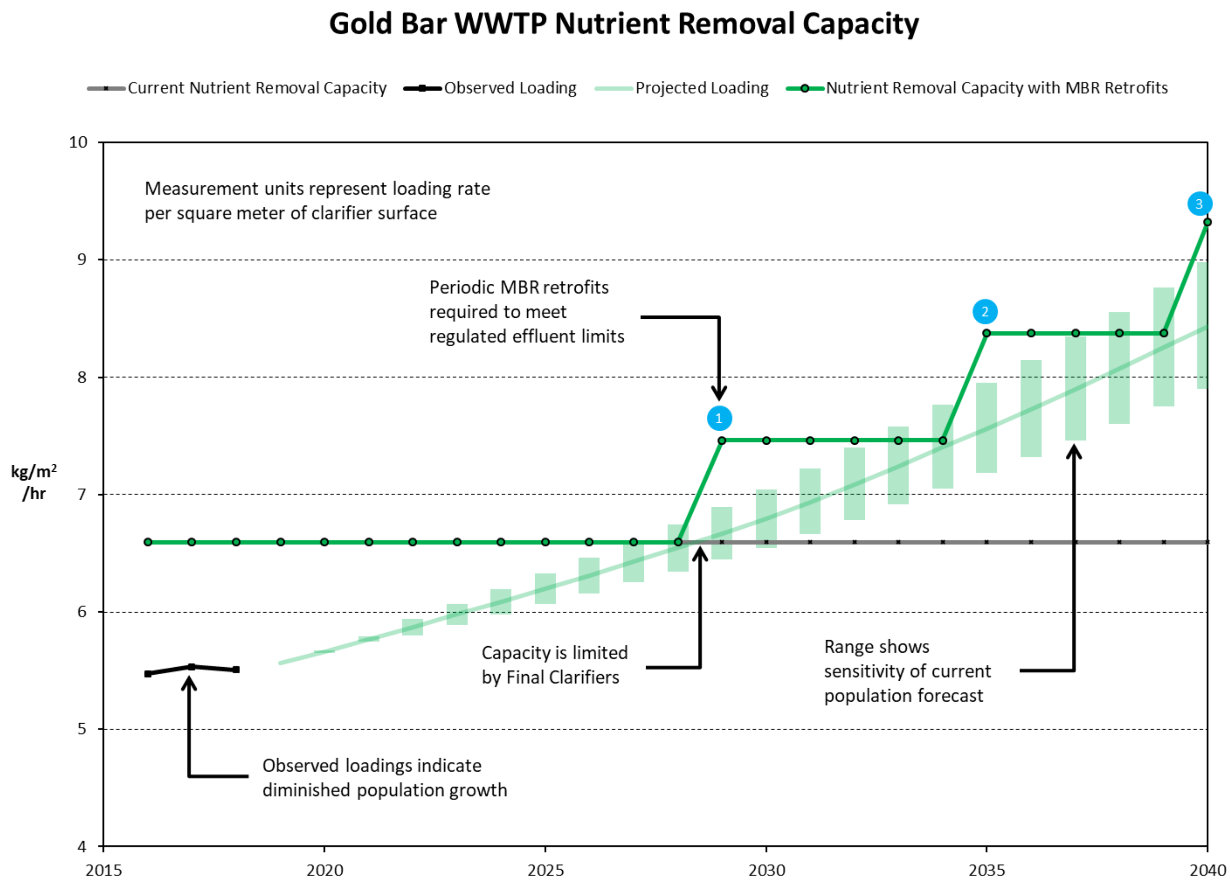
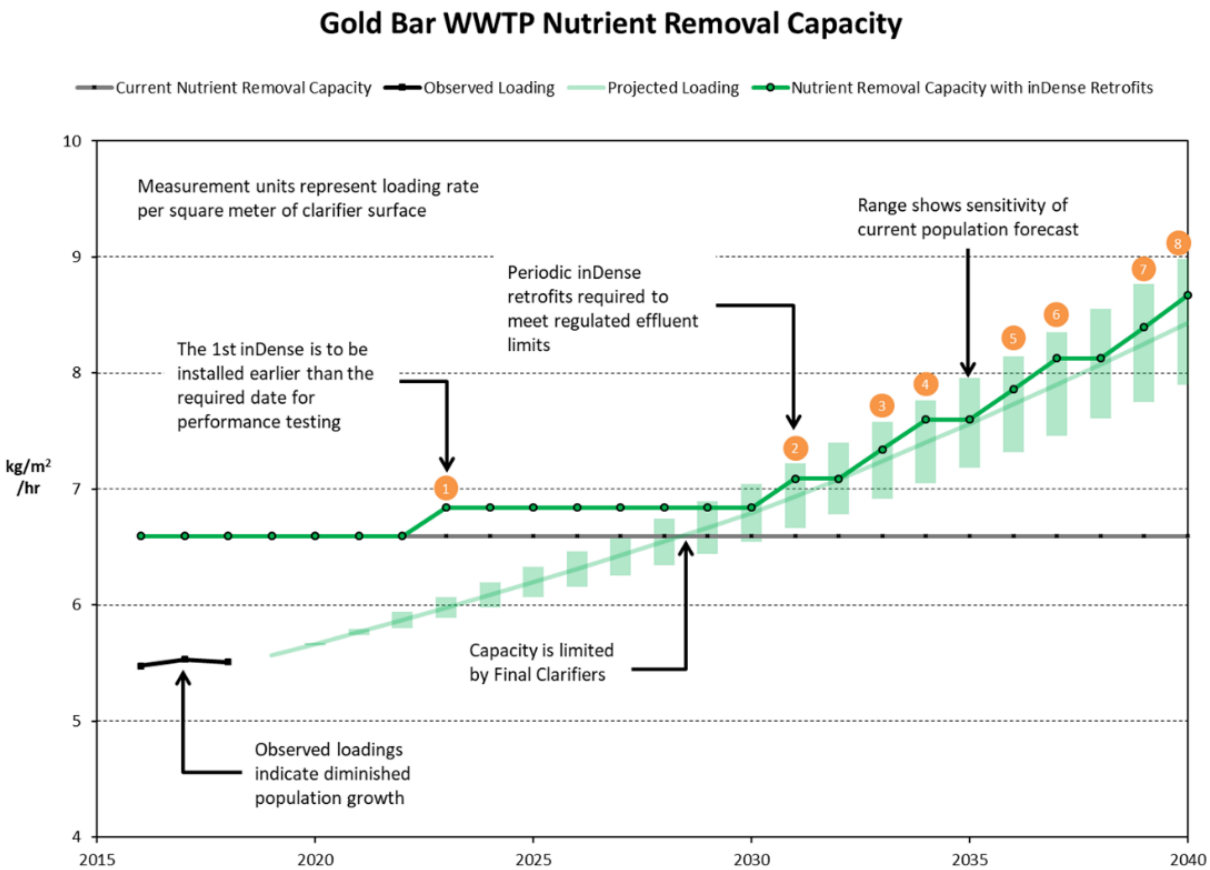


Figure 2.0-2
Recommended inDENSE™ installation timeline



24. Providing performance is satisfactory, three inDENSE™ systems will be added in the 2030-2034 PBR and four more will be installed in the 2035-2039 PBR, based on the capacity requirement. If inDENSE™ performance does not meet expectation, detailed design of the first MBR conversion will be initiated by 2024 with construction completing by 2028.

3.0 PROJECT DESCRIPTION

25. This project will complete the design and implementation of an inDENSE™ system in one of the eleven BNR process trains at Gold Bar WWTP.

26. The inDENSE™ system will be installed as soon as possible to allow appropriate time for performance evaluation, which could take 1-2 years because of the seasonality of biological treatment performance.

27. The project was initiated in 2020 and will be completed by Q4 of 2024.

28. Based on currently available information, a traditional design bid build approach is recommended for the project delivery.

29. Anticipated phases of the project are per Table 3.0-1

Table 3.0-1
Secondary inDENSE™ Upgrades Project Timelines

Project Phases	A **2020**	B **2021**	C **2022**	D **2023**	E **2024**
1 Design	X	X			
2 Procurement/Construction		X	X	X	
3 Operational Readiness				X	
4 Ready for Hand Over				X	X
5 Project Close Out					X

4.0 PROJECT ALTERNATIVES ANALYSIS

30. A comprehensive list of technology alternatives was considered. A shortlist was created based on their ability to increase plant capacity and allow deferment of MBR conversion by a significant period. The extent of deferment was based on process modelling and contained various assumptions related to performance of each alternative.

31. Lower cost options that could be implemented in stages and not cause negative side-effects or process impacts were preferred.

32. The shortlist of alternatives focused on emerging technologies that would be implemented at the Gold Bar WWTP only after establishing reasonable design parameters. Emerging technologies could offer a substantial benefit to the facility should they prove to achieve their early promise. Due to the emerging nature of technologies, implementation would be on a single, pilot basis and only implemented in additional clarifiers after a proven performance period.

33. A net present value (NPV) calculation was undertaken to determine the most cost effective alternative. This was based on a 25-year test period and requirements for timing of future installations under each alternative. The NPV excluded non-construction or soft costs such as land acquisition, permitting, legal and owner administration costs.

34. Table 4.0-1 shows the shortlisted alternatives implemented on all trains, considered along with their 25-year calculated NPV.

Table 4.0-1
Project Alternatives Analysis

	Alternative	A **Description**	B **NPV ($ millions) (25 years)**	C **Potential MBR deferment (years)**
1	Status Quo	Unacceptable as projected demand will exceed current treatment capacity after 2028		
2	Base Case	Install first MBR system by end of 2028 and subsequent conversions every five years	$ 192.98	0
3	Alternative 1	Install inDENSE™	$ 70.05	16
4	Alternative 2	Convert to Aerobic Granular Sludge (AGS) system	$ 117.26	25
5	Alternative 3	Convert to Micro-Carrier Activated Sludge (MCAS) system	$ 195.24	20
6	Alternative 4	Convert to Membrane Aerated Biofilm Reactors (MABR) system with inDENSE™	$ 557.11	30

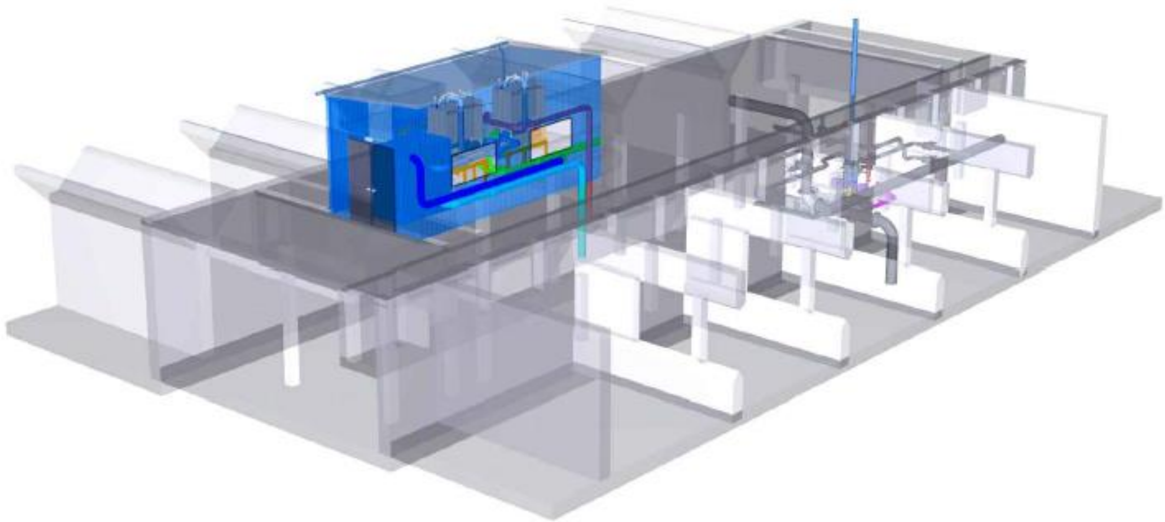
35. Immediate implementation of inDENSE™ was recommended (Alternative 1) based on lowest NPV and minimal operational impact. All technology strategies considered in the NPV assessment are fully compatible with future MBR conversions.

5.0 COST FORECAST

36. The preliminary project cost forecast is based on conceptual design for the implementation of inDENSE™ technology in one secondary clarifier.

37. Upgrades to a single treatment train will include; inDENSE™ hydrocyclone skids housed in a single enclosure above the mixed liquor channel, transfer pumps situated in the tunnel between the bioreactor and secondary clarifier, as shown in Figure 5.0-1 below.

Figure 5.0-1
Conceptual Rendering of an inDENSE™ Installation



38. It is expected that the current Gold Bar WWTP resources will be able to manage the small operating and maintenance activity increase and therefore no additional labour will be required. Additional power costs will be incurred due to the addition of one sludge transfer pump always in operation.

39. A contingency of 23% is included in the cost estimate, as estimates are based on a conceptual study. More accurate estimates for construction and overall project cost will be available upon completion of detailed design, through 2020 and 2021.

40. Projected costs for this project are shown in Table 5.0-1.

Table 5.0-1
Secondary inDENSE™ Upgrade Project
($ millions)

		A Pre-2022	B 2022	C 2023	D 2024	E Total
	Direct Costs					
1	Contractors	0.30	1.53	1.06	0.07	2.96
2	Internal Labour	0.20	0.08	0.08	0.08	0.44
3	Vehicles and Equipment					
4	Abandonments					
5	Contingency	0.00	0.62	0.20	0.01	0.83
6	Risk Allowance					
7	**Sub-total Direct Costs**	**0.50**	**2.23**	**1.34**	**0.16**	**4.23**
8	Indirect Costs	0.00	0.15	0.28	0.34	0.77
9	**Total Capital Expenditures**	**0.50**	**2.38**	**1.62**	**0.50**	**5.00**

41. This project is expected to go in to service in 2024.

42. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will try to minimize the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- A number of activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, minimizing the need for external consultants.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit price basis.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Project scope and design will be validated by stakeholders to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

43. There are no significant health and safety, or environmental risks associated with the execution of this project.

44. Any financial risk is limited to a scenario where the inDENSE™ system fails to work completely. Based on the experience from a similar installation in Denver, it is extremely unlikely that the system will fail completely. However, performance expectations will be discussed during contract negotiations with the vendor in order to reduce the financial risk resulting from a complete failure to perform.

45. The key financial risk would be realized only if the Gold Bar WWTP needs to move to the more expensive MBR alternative sooner than hoped. The deferment period for MBR will be shortened if the inDENSE™ system is unable to perform as expected.

46. Conversely, the magnitude of financial gain will be determined by the performance of the inDENSE™ technology and the actual duration of the MBR deferment.

Appendix G13

EPCOR WATER SERVICES INC.

Wastewater Treatment
Digester 3 Upgrade Project
Post Implementation Review

February 16, 2021

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1.0 PROJECT DESCRIPTION

1. The Digester 3 Upgrade project was initiated to rehabilitate and upgrade Digester 3 at the Gold Bar Wastewater Treatment Plant (WWTP) to “as new” condition and convert it to a submerged roof design.

2. This program fell under the PBR category of Reliability/Life Cycle.

3. Originally built in 1956, Digester 3 is one of the oldest digesters at Gold Bar. Much of the infrastructure associated with the digester was due for rehabilitation. This project would upgrade Digester 3 to ensure it was fully compliant with requirements of Canadian Standards Association 149.6-11 Digester Gas and Landfill Installations (Digester Gas Code). This standard is intended to ensure that these kinds of installations are designed, operated and maintained in such a way that workers and the general public are safe. Failure to meet these standards could also lead to enforcement actions by Alberta Environment and Parks, which may include warnings, fines or an order.

4. This project was also to implement upgrades to minimize the risk of digester venting and allow Digester 3 to operate reliably and safely at its maximum capacity. These upgrades support EPCOR’s Combined Sewer Overflow (CSO) initiative by increasing digester capacity, which allows Gold Bar to treat additional CSO flows.

5. The project forecast cost was $11.3 million and was forecast to be in service in 2018.

2.0 PROJECT COST VARIANCE

6. Table 2.0-1 summarizes the variance of this project compared to the original 2017-2021 PBR term capital plan and compared to the final approved EPCOR budget established in 2020.

Table 2.0-1
Digester 3 Upgrade Project Capital Expenditures
($ millions)

	A **2017-2021 PBR Forecast**	B **Final EPCOR Approved Budget**	C **Actual / Forecast Total**	D **Variance from 2017-2021 PBR**	E **Variance from Final EPCOR Budget**
1 Total Capital Expenditures	11.32	14.50	14.50	3.18	0.00

3.0 VARIANCE ANALYSIS

7. Original cost estimates for this project were developed based on early conceptual design. Column A in Table 3.0-1 provides the project cost estimates at the time of the PBR application in 2016. The projects actual/forecast costs are shown in column B of Table 3.0-1.

Table 3.0-1
Capital Expenditure Variances
($ millions)

		A **2017-2021** **PBR**	B **2017-2021** **Actual / Forecast**	C **Variance**
	Direct Costs			
1	Design/Engineering	0.28	1.19	(0.91)
2	Construction/Commission	8.59	10.29	(1.70)
3	Controls	0.07	0.07	0.00
4	Winter Conditions *	0.08	0.08	0.00
5	Sub-Total Direct Costs	9.02	11.63	(2.61)
6	**Indirect Costs**	**2.27**	**2.84**	**(0.57)**
7	Risks	0.04	0.02	0.02
8	**Total Project Costs**	**11.33**	**14.50**	**(3.17)**

* Winter conditions include the cost of auxiliary activities required during the winter construction season (i.e. hoarding, installation of unit heaters, cost of natural gas, etc.)

8. The cost variances in the project relate to the identification of unanticipated hydraulic leaks in the digester floor and walls in 2019, during commissioning of the digester following the original planned rehabilitation work. The flange connection between the linear motion mixer and the digester was also identified as having leakage concerns. Commissioning was halted and an investigation (root cause analysis team (RCAT)) and structural assessment were completed to determine the sources of the leaks.

9. The investigation identified surface defects on the floor slab and the digester walls. The mixer flange was found to have surface irregularities suspected to have been caused by welding during site assembly of the flanges.

10. As a result, the floor and wall surfaces were sandblasted and prepared for the installation of a high-density polyethylene (HDPE) liner. The HDPE liner was installed in 2020. The flange leak issue was addressed through a re-design of the flange connection and a new machined flange connection installed. The digester was then re-commissioned and successfully passed subsequent leak tests.

11. The RCAT, structural assessment, HDPE liner design and installation, re-design and installation of a new mixer flange connection and re-commissioning of the digester represented changes to the original project scope, and consequently increased project costs compared to the costs anticipated in the PBR plan. Several learnings were derived from this project as a result:

- Structural integrity should be assessed in developing the scope of future digester projects, as their age and harsh operating conditions create a high potential for structural rehabilitation requirements. Hydrostatic leak testing after digester cleaning will assist in defining the structural scope.
- Lining the entire vessel with an epoxy liner, when leaks are identified, is more cost effective and may produce a better quality product than using different products for different sections of the digester. Additional investigation into this application would be required to confirm the suitability of this approach.
- Documentation is limited for structures constructed in the 1950s. Field verification of construction details will provide better project definition and improve the accuracy of cost estimates. The design of rehabilitation for this age of structure cannot assume concrete uniformity.

Appendix G14

EPCOR WATER SERVICES INC.

Wastewater Treatment
Headworks and Primary Aeration Upgrades Project
Post Implementation Review

February 16, 2021

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1.0 PROJECT DESCRIPTION

1. The Pre-treatment Facilities at the Gold Bar Wastewater Treatment Plant (WWTP) consist of raw influent channels, grit tanks and primary influent channels. These facilities remove heavy solid materials (e.g. sand, gravel – collectively termed "grit"), which adversely impact treatment and cause mechanical wear on equipment, from the incoming wastewater. Organic materials adhering to the grit are beneficial to the treatment process, and are separated from the grit in the Pre-treatment Facilities using air. Aeration in the channels were originally designed to keep the grit in suspension until it could be removed in the grit tanks and the Primary Treatment system. The aeration system included 3 blowers, a network of piping and air injection infrastructure.

2. The existing aeration system was unable to supply sufficient air to the Pre-Treatment Facilities, resulting in solids accumulation in the channels, hydrogen sulphide (H2S) attacks on the concrete structure, odours and ineffective operation of the Pre-Treatment Facilities. These impacts resulted in significant maintenance effort to frequently remove the accumulated solids.

3. At that time, much of the aeration piping in the raw influent channels was also not functioning or not in service due to long and complex piping runs with several critical valves being inaccessible.

4. At the time of project initiation, the project scope included:
   - provision for aeration of the raw influent channels (Channels 2 and 3) upstream of the grit tanks including new piping, diffusers and two new blowers;
   - upgrades to the aeration piping in the East and West Primary Influent Channels downstream of the grit tanks including an additional two new blowers; and
   - odour control facilities including a new scrubber system near the grit facilities.

5. Several major primary influent channels and treatment tanks at Gold Bar WWTP have undergone extensive upgrades and rehabilitation to improve efficacy of solids removal and restore structural integrity since that time. Channels have been cleaned routinely to facilitate construction and access to the channels has been improved during recent structural rehabilitation projects facilitating easier future maintenance. In addition, aeration piping was opportunistically upgraded during structural rehabilitation of these channels. As a result, the accumulation of solids in the channels is less of an operational issue than observed previously.

6. As such, the scope of the project was reduced to eliminate the addition of aeration to the raw influent channel, and to utilize blower capacity originally intended for aeration of the raw influent channel to satisfy the air requirement for Grit Tanks 4 to 7. Upgrades to the existing primary influent channel aeration piping also became unnecessary. With improved access implemented in other projects, a regular maintenance program was also instituted for the primary influent channels to reduce solids build up. This also had the potential benefit of reducing odour generation, resulting in a recommendation to remove the odour scrubber from this project's scope and re-evaluate the need for odour management in this system considering the implemented changes.

7. The project is in the Reliability/Life Cycle category.

8. The project forecast cost was $6.72 million during the 2017-2021 period.

2.0 PROJECT COST VARIANCE

9. Table 2.0-1 summarizes the variance of this project compared to the original 2017-2021 PBR term capital plan and compared to the final approved EPCOR budget established in 2019.

Table 2.0-1
Headworks and Primary Aeration Upgrades Project Capital Expenditures
($ millions)

	A **2017-2021 PBR Forecast**	B **Final EPCOR Approved Budget**	C **Actual / Forecast Total**	D **Variance from 2017-2021 PBR**	E **Variance from Final EPCOR Budget**
1 Total Capital Expenditures	6.72	1.37	1.37	5.35	0.00

3.0 VARIANCE ANALYSIS

10. Original cost estimates for this project were developed based on an initial scoping and preliminary design report prepared in 2012. Column A in Table 3.0-1 provides the projects work breakdown structure and cost estimates at the time of the PBR application in 2016. The projects actual costs are shown in column B of Table 3.0-1 broken down in accordance with the projects work breakdown structure.

Table 3.0-1
Capital Expenditure Variances
($ millions)

		A **2017-2021 PBR**	B **2017-2021 Actual**	C **Variance**
	Direct Costs			
1	Downstream Aeration – All Components	0.77	0.00	0.77
2	Upstream Aeration – All Components	0.94	0.00	0.94
3	Odour Control – facility and ancillary equipment	1.70	0.00	1.70
4	Additional aeration to Grit tanks	0.00	0.64	(0.64)
5	New aeration controls and control valves	0.00	0.30	(0.30)
6	**Sub-Total Direct Costs**	3.41	0.94	2.47
7	Indirect Costs – Internal Time and Overheads	2.80	0.43	2.37
8	Risks	0.51	0.00	0.51
9	**Total Project Costs**	6.72	1.37	5.35

11. The project was completed for $5.35 million less than the original budget.

12. This was due to a change in scope, primarily the elimination of aeration in channels upstream of the grit tanks, and elimination of additional aeration in the downstream channels. An odour scrubber was also not implemented at this time to allow for an assessment of odour generation impacts resulting from the changes made to date. This meant that additional piping, blowers, odour capture and associated supporting infrastructure was not required.

13. Aeration around the grit tanks was removed from the project scope to focus debris removal on the grit tanks, which have sufficient solids removal capacity to accomplish this task.

14. The project was due to go in to service in 2019, but the schedule was delayed to early 2020 primarily due to issues with readiness for commissioning activities for new blowers and variable frequency drives (VFD's) on the supplier side. In addition, the commissioning methods needed further refinement, which caused minor delays.

15. Adding VFD's to the new and existing blowers will provide an economic benefit because the large blowers do not need to be continually run at full speed. The ability to fine-tune the aeration rate for the grit tanks will also improve inorganic solids removal, which is expected to have a positive impact on the mechanical equipment downstream.

16. The revised distribution piping layout, redundant blower availability and the ability to monitor and control aeration rates for the grit tanks has allowed Operations to better control the performance of the grit tanks for inorganics removal. Inorganics removal plays a large role in mitigating unexpected wear and failure of downstream solids handling equipment.

17. The ability to better control the performance of the grit tanks, resulting in fewer unexpected failures of solids handling equipment, is expected to avoid unexpected process upsets.

18. In addition, the ability to provide the same benefit of the original project scope through more detailed analysis and design while avoiding the need for additional large, energy intensive facilities will improve Gold Bar WWTP's relationship with stakeholders, shareholders and the community.

19. The primary risk mitigated by the project is process upset due to unexpected failure of grit tank blowers, leading to the passing of inorganics downstream into process equipment not capable of handling the material. Operations and Maintenance now have the necessary redundancy to respond quickly to an emergent situation. These risks have been successfully mitigated.

20. The project reinforced the demonstrated benefit of comprehensive stakeholder involvement during the design phase of the project. This approach enabled a less costly alternative to be developed from a holistic operational perspective, with ancillary benefits realized from channel structural upgrades and adjustments to maintenance activities that still achieved the desired outcomes of the project.

Appendix G15

EPCOR WATER SERVICES INC.

Wastewater Treatment
Hydrovac Sanitary Grit Facility Project
Post Implementation Review

February 16, 2021

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1.0 PROJECT DESCRIPTION

1. The City of Edmonton Drainage Services Branch removed sanitary grit material using hydrovac trucks during sanitary lift station and combined sewer sand trap cleaning activities. The highly odourous residual waste removed was disposed at Clover Bar lagoons where biosolids (digested sludge) were stored. Although this practice was not contrary to any environmental regulation, Drainage Services deemed this disposal method unsustainable and undesirable as it: impacted the quality of the biosolids potentially limiting future land application; may have resulted in an enforcement order in the future, and disturbed the water cap on the lagoons increasing the likelihood of odour releases. It was also not aligned with the City of Edmonton's Biosolids Management Strategy, which formed a part of Drainages *Environmental Protection & Enhancement Act* operating approval. Drainage Services required an alternative option for disposal and treatment of this material, and in 2013 recommended that EWSI construct a hydrovac sanitary grit treatment facility at Gold Bar.

2. EWSI agreed to design, construct, commission, operate, and maintain the new facility provided that the City of Edmonton either: (i) approved the project as part of the 2017-2021 PBR term capital budget; or (ii) pay EWSI all reasonable costs to construct and operate the facility.

3. Drainage Services presented a Business Case for this project to the City of Edmonton Utility Committee on Aug. 27, 2015 and the terms of an agreement with EWSI on Oct. 29, 2015. The Utility Committee approved the agreement on Oct. 29, 2015 and Edmonton City Council approval was granted on Nov. 17, 2015.

4. Upon approval of this agreement to include the project as part of the 2017-2021 PBR term capital budget, EWSI proceeded to design and construct the facility.

5. The project included the design, construction and commissioning of the new facility located in the south-east corner of the Gold Bar site, and the required utility connections. The facility consists of a receiving hopper and a drum screen followed by two grit washers. The drum screen removes material larger than 10 mm and the grit washers separate the grit from the liquid fraction. The washed grit is then collected in a bin. Final effluent is used as the wash water supply for the treatment process and the contaminated reject water (separated liquid fraction) is pumped to the Gold Bar headworks for treatment. The screenings and washed grit are disposed of at landfill, but possible reuse options for the washed grit may be investigated in the future.

6. A building encloses one truck bay, one receiving hopper and all processing equipment resulting in the mitigation of odour and noise concerns. HVAC facilities have been designed to collect the odourous air from within the facility and direct it through an odour scrubber prior to release to atmosphere.

7. The Hydrovac Sanitary Grit Facility project expenditures were estimated to total $21.5 million and the facility was placed in to service in 2017.

8. This project fell under the PBR category of Growth/Customer Requirements.

2.0 PROJECT COST VARIANCE

9. Table 2.0-1 summarizes the variance of this project compared to the original 2017-2021 PBR term capital plan and compared to the final approved EPCOR budget established in 2017.

Table 2.0-1
Digester 3 Upgrade Project Capital Expenditures
($ millions)

	A **PBR Forecast**	B **Final EPCOR Approved Budget**	C **Actual / Forecast Total**	D **Variance from 2017-2021 PBR**	E **Variance from Final EPCOR Budget**
1 Total Capital Expenditures	21.50	19.20	17.90	3.60	1.30

3.0 VARIANCE ANALYSIS

10. Original cost estimates for this project were developed based on conceptual design. Column A in Table 3.0-1 provides the project cost estimates at the time of the PBR application in 2016. The project’s actual/forecast costs are shown in column B of Table 3.0-1.

Table 3.0-1
Capital Expenditure Variances
($ millions)

		A **2017-2021** **PBR**	B **2017-2021** **Actual / Forecast**	C **Variance**
	Direct Costs			
1	Design/Engineering	2.55	2.55	0.00
2	Construction/Commission	14.91	13.23	1.68
3	Internal Costs	0.67	0.81	(0.14)
4	**Sub-Total Direct Costs**	**18.13**	**16.59**	**1.54**
	Indirect Costs			
5	Contingency	1.68	0.00	1.68
6	IDC	1.27	0.76	0.51
7	Capital Overhead	0.42	0.55	(0.13)
8	**Sub-Total Indirect Costs**	**3.37**	**1.31**	**2.06**
9	**Total Project Costs**	**21.50**	**17.90**	**3.60**

11. The cost variances (under-spend when compared to original budget) in this project are primarily as a result of the chosen delivery method for this project.

12. The chosen delivery method was Construction Management at Risk (CMAR). The benefit of this delivery method is the creation of a team early in the design phase between owner, engineer and construction manager (CM). During the pre-construction phase, the CM assisted with cost estimates and provided constructability feedback during preliminary and detailed design.

13. Another benefit of CMAR is the option to accept a Guaranteed Maximum Price (GMP) from the CM. For this project, the GMP set the upper cost limit corresponding to the quantified scope of work expressed in the design documents provided for the GMP estimate. Setting a GMP reduces the risk of cost exceedances for the defined scope of work.

14. In addition, regular progress meetings were held with this team so that issues could be resolved as quickly as possible, which supported project cost control throughout the project period.

15. There were a limited number of significant changes to the original project plan, which meant that the cost estimates did not need to be materially adjusted during the project period.

16. While the project was delivered close to schedule (commissioned in Oct 2017), hand-over of the facility to day-to-day operations was delayed due to the failure of the coarse auger to

function suitably. Redesign and replacement of the auger was completed and the facility fully turned over to operations in April 2018.

17. The original project estimate included sufficient contingency to cover potential unknown events or changes to the project plan.

18. In 2018, the project won two engineering awards at the Consulting Engineers of Alberta (CEA) Showcase Gala, one for Environmental – Award of Excellence and the other for Sustainable Design – Award of Merit.

19. The facility operation continues to be optimized to improve flow pathways and grit settlement, to enable ease of maintenance of system components prone to grit accumulation, and to accept and process a wider range of characteristics of the sanitary grit hauled to the facility. The optimization process is expected to be completed at the end of 2021.

Report to Utility Committee

December 6th, 2019

EPCOR WATER SERVICES INC.

Sludge Line Upgrades

TABLE OF CONTENTS

1.0 OVERVIEW

1. The Gold Bar Waste Water Treatment Plant ("Gold Bar WWTP") produces digested sludge as a by-product of treating wastewater. The digested sludge is transferred by pipeline to the Clover Bar Lagoons ("Lagoons") at the Edmonton Waste Management Center ("EWMC") where the sludge receives further treatment prior to land application. Supernatant (a liquid waste stream generated during the treatment process at the Lagoons) is transferred by pipeline from the Lagoons back to the Gold Bar WWTP for further treatment.

2. The Gold Bar 2017-2021 PBR Application, filed with the City of Edmonton in 2016, included forecast capital expenditures of $3.4 million for the Sludge Line Upgrade Project. This project included continued inspection of sludge pipelines and minor improvements required to facilitate inspections. No sludge line replacement or repairs were included in the scope.

3. During 2016 and 2017, cleaning and inspection of a majority of the older sections of pipelines indicated that significant deterioration had occurred. In May 2017, shortly after completion of the inspections, there was a release of digested sludge in Hermitage Park from a failed pipeline. As a result of the leak, combined with the deteriorated condition, three pipeline segments were removed from service leaving the Gold Bar WWTP with reduced operational flexibility and no redundancy.

4. In early 2017, EWSI conducted a risk analysis based on results of the inspections completed to date and determined that the following rehabilitation and replacement of defective sections of pipeline were required:

- rehabilitation of nine localized defect locations at the EWMC Clover Bar Site (three excavations);
- rehabilitation of nine localized defect locations in Rundle Park (three excavations);
- rehabilitation of nine localized defect locations in Hermitage Park (six excavations) including replacement of a 200 m section in close proximity to Pembina pipelines; and
- replacement of approximately 2.5 km of pipeline from the North Saskatchewan River Park to Clover Bar.

5. Following the inspections and the release event in 2017, EWSI determined that additional work is necessary to clean, inspect and rehabilitate these pipelines to allow the Gold Bar WWTP sufficient redundancy for reliable operations and to mitigate the risk of releases to the environment. In the fall of 2017, EWSI expanded the scope of the Sludge Line Upgrades Project to include rehabilitation of localized defects. Rehabilitation was completed on the 27

defects by spring of 2018 with those segments returning to service and reducing the risk to Gold Bar WWTP operations and restoring some available redundancy. A separate project was also created for replacement of the 2.5 km section of pipelines between the Clover Bar lagoons and the North Saskatchewan River (the “Replace 2.5 km Sludge Line Project”). The new sections of pipeline at Clover Bar will be complete by the end of 2019.

6. As a result of the expanded scope of the original Sludge Lines Project and the additional Replace 2.5 km Sludge Line Project, EWSI’s current capital cost estimates for sludge lines upgrades for the 2017-2021 PBR term is $14.6 million. This cost estimate includes the a forecast of $7.1 million for the original Sludge Line Upgrade Project and an additional $7.5 million for the Replace 2.5 km Sludge Lines Project.

7. This business case is being brought to the attention of the City of Edmonton Utility Committee for information purposes, and to serve as an update of investments made by EPCOR Water Services Inc. (“EWSI”) on the sludge and supernatant pipelines to date as established under these two capital projects.

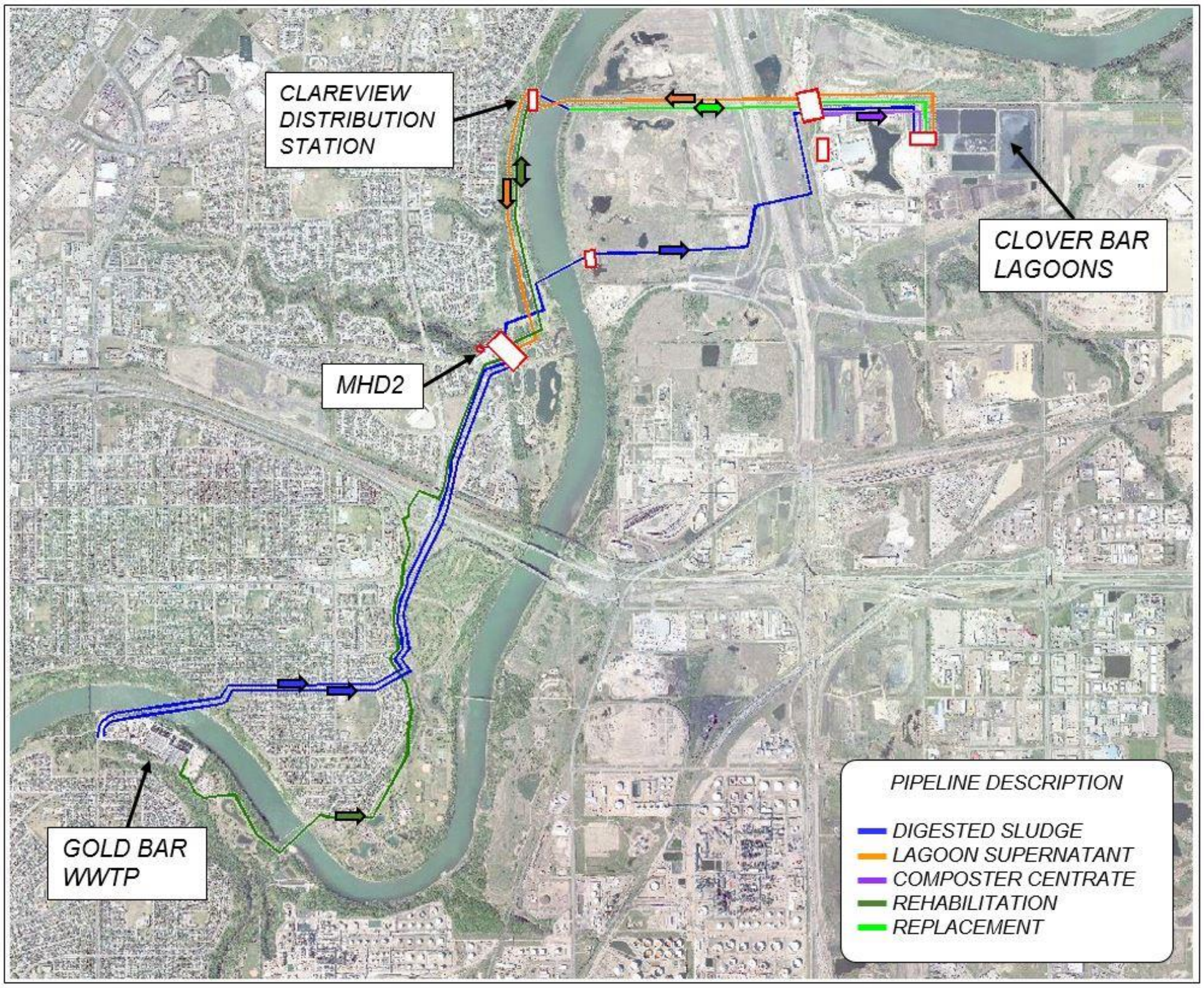
2.0 PROJECT DESCRIPTION

2.1 Background

8. The first sections of the Sludge/Supernatant Pipelines were built in 1972 and have expanded continually since then to a total of approximately 33 km of pipeline. Figure 2.1-1 below illustrates the basic configuration and use of these pipelines.

Figure 2.1-1

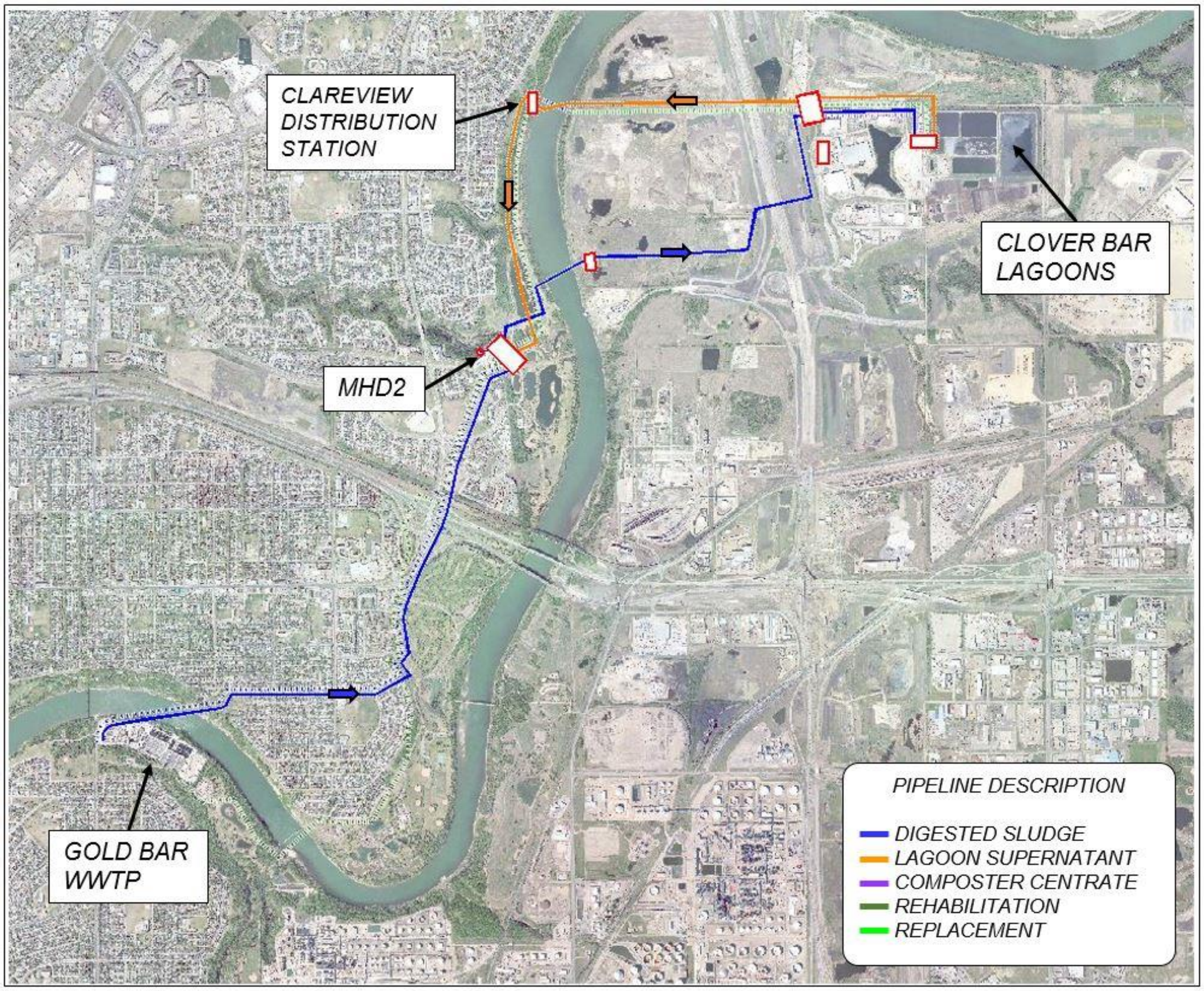
Sludge and Supernatant Pipeline Overview



9. Typical operation of this system of pipelines is for digested sludge to be pumped from Gold Bar WWTP through one series of the pipeline segments to the Lagoons. Supernatant is pumped from the Lagoons using a separate series of the pipeline segments to Manhole D2 (“MHD2”). Note that the supernatant flows through the drainage collection system from MHD2 to Gold Bar WWTP and/or from Clareview Distribution Chamber to the Alberta Capital Region Wastewater Treatment Plant. Figure 2.1-2 demonstrates a typical flow paths for these pipelines during regular operations.

Figure 2.1-2

Sludge and Supernatant Pipeline Typical Flow Paths



Notes:
a. Multiple flow paths are available between Gold Bar and Clover Bar Lagoons. For clarity, only one path for each Digested Sludge and Lagoon Supernatant is illustrated.
b. Lagoon Supernatant travels from MHD2 to Gold Bar using the Drainage collection system (not illustrated).

10. There are several line segments between Gold Bar WWTP and the Clover Bar Lagoons, which generally allows for three series of pipelines to be used for pumping. Since there are two commodities (digested sludge and supernatant) that are pumped, this allows one series of segments for standby in the event of an issue with a pipeline path. There are also some valve chambers along the routes, which also give some interconnection flexibility.

11. In 2015, the Gold Bar WWTP developed a Sludge/Supernatant Pipeline Inspection Program. This program specified a phased approach for cleaning and inspection of the pipelines

to assess their condition and identify any needed repairs, rehabilitation or upgrades to ensure the integrity of the pipelines.

12. Prior to that time, cleaning of these pipelines was typically completed when required to alleviate operational issues. That is, flow rate reductions would occur due to fouling (i.e. internal struvite build up). Routine cleaning and inspection activities were not established, and pipeline conditions were unknown. Cleaning and removal of pipeline fouling is required to properly inspect and assess the condition.

2.2 **Project Description**

13. In the 2017-2021 PBR, EWSI initiated the Sludge Line Upgrade project to support implementation of the Sludge/Supernatant Pipeline Inspection Program. Results of inspections conducted in 2017 required the scope of this project to be expanded to also include rehabilitation. More specifically, the Sludge Line Upgrade project scope currently includes the following:

- implementation of necessary upgrades to allow completion of cleaning and inspection of all pipeline segments;
- cleaning and the inspection of all pipeline segments;
- completion of any high priority rehabilitation work required to restore the system to reasonable operating condition; and
- Development of Pipeline Master Plans and finalize Pipeline Asset Management Plans for future planning.

14. The Sludge Line Upgrade Project scope was based on a review of the existing system, which included age, materials of construction, previous failures, previous inspections, potential risks, and proposed inspection methodologies. Consideration was also made to prioritize rehabilitation work for areas with higher risk of failures.

15. The Replace 2.5 km Sludge Line Project was also initiated following the inspections and risk analysis. This project includes full replacement of two pipeline segments based on EWSI determination that replacement was immediately necessary due to the high risk of failure of these segments.

3.0 PROJECT JUSTIFICATION

16. The primary risk events that these two projects are intended to mitigate include: (i) operational failures to the Gold Bar WWTP and (ii) releases of digested sludge or supernatant to the environment.

Operational Failures

17. A pipeline failure would limit pumping from Gold Bar WWTP and impact plant capacity until rehabilitation or major replacement work is completed. While there is sufficient volume in the Clover Bar Lagoons to endure a longer outage in supernatant return, interruptions in the pumping of digested sludge impact the operation of the plant immediately. Gold Bar WWTP pumps approximately 2.0 million litres of digested sludge to the lagoons per day with no facilities for sludge storage on-site. An interruption in sludge pumping would lead to solids build up in throughout the WWTP, resulting in mechanical damage and/or a reduction of the overall liquid treatment process.

18. Due to the complexity of the entire wastewater treatment system, operational requirements, design, permitting and construction requirements for cleaning, inspection and rehabilitation need to be carefully staged. It is necessary to ensure that digested sludge can be pumped from the Gold Bar WWTP and supernatant can be pumped from the Lagoons in sufficient quantities at all times. Implementing upgrades and improving the design of these systems allows for enhanced flexibility to operations, ease of future inspections, and enhanced emergency response.

Releases to the Environment

19. A majority of the pipeline system is located within the North Saskatchewan River ("NSR") valley with several river crossings occurring along the way. An unplanned rupture of these pipelines could result a release of sludge/supernatant into the NSR which pose an environmental risk with regulatory and reputation consequences.

4.0 EVALUATION OF ALTERNATIVES

20. Following pipeline inspections and the release event in 2017, EWSI considered the following alternative responses to the situation:

4.1 **Alternative 1: Do Nothing – Run to Failure**

21. One alternative is to run the pipes to failure but this creates operational and environmental risks that are unacceptable. Pumping digested sludge to the Clover Bar Lagoons is critical to the safe operation of the Gold Bar WWTP as there is no storage at the site of the Gold Bar WWTP. There are also regulatory, reputational, environmental and financial impacts associated with the spill and cleanup of a rupture of pipe and release of supernatant or digested sludge to private land or the North Saskatchewan River. This alternative does not mitigate any risk and therefore is not recommended.

4.2 **Alternative 2: Spot Repair and Rehabilitation**

22. Under this alternative the regular cleaning and inspection of the pipeline segments provides detailed condition information which is used for decision making. A review of the overall condition of the pipeline (e.g., age, material, location) and the number of found defects is conducted. Defects are typically locations where a certain amount of either internal or external pipeline wall loss has occurred.

23. Spot repairs and rehabilitation on defects are most often conducted by excavation and replacement of a segment of pipe (about 2-5 m) and when the number of found defects are not excessive in quantity along the full line length. These excavations can be challenging and costly, especially when pipeline locations are close to the North Saskatchewan River or in busy parkland areas (e.g. Hermitage Park).

4.3 **Alternative 3: Replacement of Full Pipeline Segments**

24. A full replacement of a pipeline segment is likely if the frequency and severity of defects identified along that length are significant, and spot repair is not practical or cost effective. Full replacement also provides an opportunity for: (i) improved alignment of pipeline segments for future maintenance; (ii) efficiencies in construction methods such as horizontal directional drilling, and; (iii) using newer pipeline material not susceptible to corrosion such as HDPE versus conventional steel pipe.

25. The following table summarizes the advantages and disadvantages of each alternative

Table 4.3-1

Summary of Alternatives for Rehabilitation

Alternative 1: Run to Failure	Alternative 2: Spot Repair/Rehab	Alternative 3: Full Replacement
	Advantages	
• no capital expenditures	• Most practical rehabilitation strategy for a small defect in long pipeline segment • Lower capital investments per location compared with full replacement • Shorter time for regulatory approvals (considered as maintenance work) • Ability to deal with multiple defects in close proximity • Relatively shorter time frame to complete work compared to full replacement (e.g. days or weeks)	• Lowest risk to Gold Bar WWTP Operations with new pipelines • Lowest risk of release to Environment • Most practical rehabilitation strategy for pipeline segments in very poor condition with significant number of defects • Enables for efficient construction strategies to be utilized (e.g. HDD) • Allows more options for improvements in the overall design (e.g. alignment, materials) • Investment in pipeline segment gives a longer overall expected life
	Disadvantages	
• Highest risk to Gold Bar WWTP operations • Highest risk of release to environment	• Encounter challenges is some locations (e.g. ground water, public, environment) • Limited options for further improvements (e.g. alignment, material) • May not be practical for pipeline segments in very poor condition	• Highest capital investment • Longer time for regulatory approvals • Longer time frame to complete work (e.g. months or years) • Having a segment isolated for construction reduces available redundancy which creates a small operational risk

4.4 Conclusions and Selected Alternative

26. Based on this analysis and risk assessment, EWSI elected to proceed with a combination of spot repairs and rehabilitation (under the Sludge Line Upgrades Project) at locations where failure had already occurred or was likely in the possible in the near future and full replacement of two segments of pipeline (under the Replace 2.5 km Sludge Line Project) at locations where replacement was immediately necessary due to the high risk of failure. This strategy supports the need for redundancy in the WWTP operations and mitigates the risks of potential operational failures or releases to the environment in the poor condition pipeline segments.

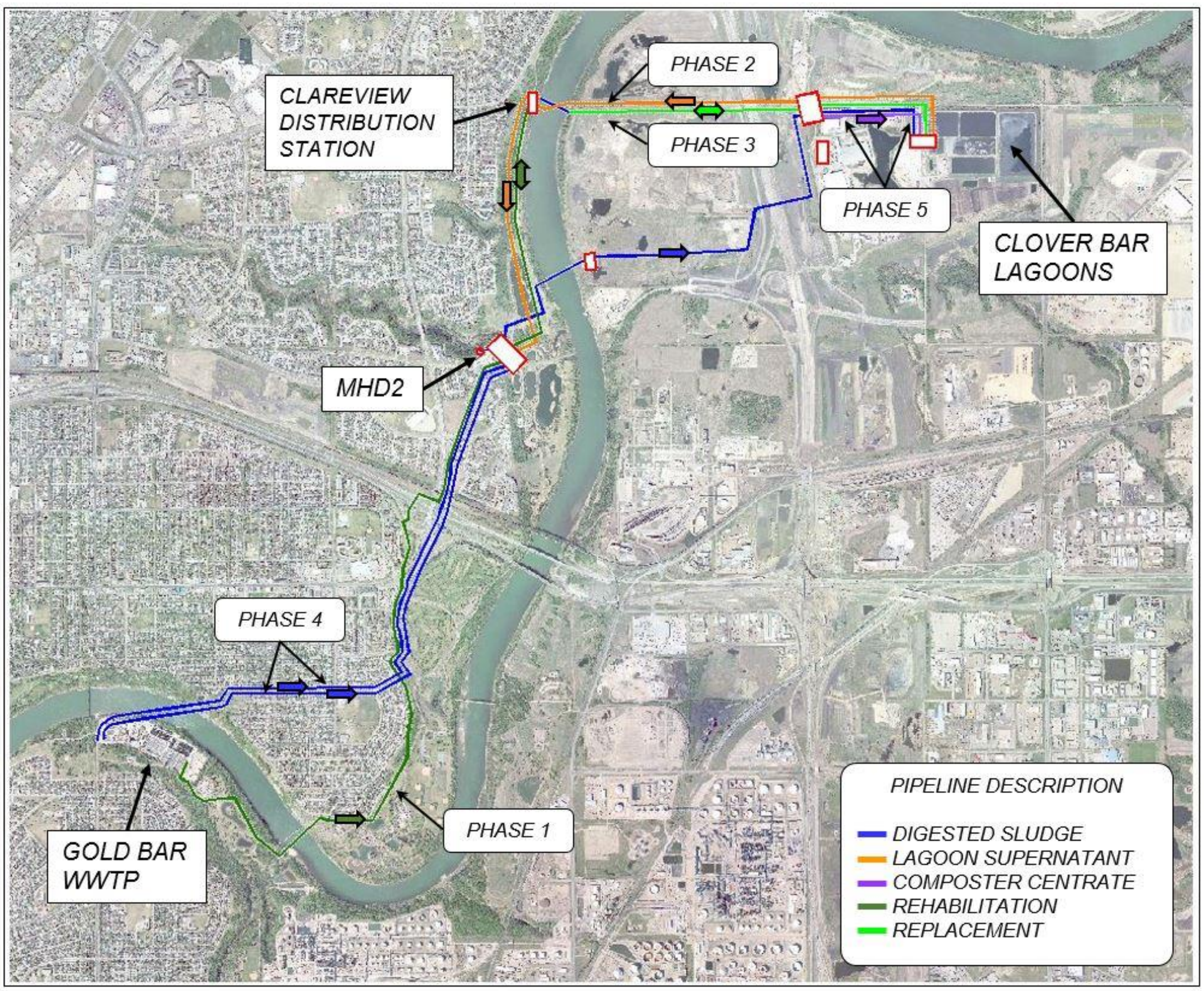
27. Future pipeline considerations were reviewed as a part of this project, including future capacity, materials of construction, and alignment. The objective is that this work would be appropriate for the present and future.

5.0 PROJECT PROGRESS

28. The cleaning and inspection scope of the Sludge Line Upgrade Project was divided into phases to minimize impact on normal operation of the sludge/supernatant system. Figure 5.0-1 shows which pipeline series were inspected for each phase.

Figure 5.0-1

Sludge and Supernatant Pipeline Phases of Work



29. Table 5.0-1 provides the timeframe for each phase of work including the cleaning and inspection work and rehabilitation/replacement work.

Table 5.0-1
Summary of Work by Phase

Phase	Cleaning and Inspection Timeframe	Rehabilitation / Replacement Work	Rehabilitation / Replacement Completion
1 - Gold Bar to MHD2	Spring/Summer 2016	Rehab high risk defects (Rundle Park)	2017
2 - Clover Bar to MHD2	Winter 2016/2017	Rehab high risk defects (Clover Bar, Hermitage Park)	2018
3 - Clover Bar to MHD2	Winter 2016/2017	Replace 2.5km (Clover Bar to NSR)	2019
4 - Gold Bar to MHD2	Fall/Winter 2018	No high risk defects identified	2019
5 - Clover Bar	Fall/Winter 2018	Replace one segment as part of 2.5km (Clover Bar)	2019

30. In the spring and summer of 2016 (after PBR submissions were completed) phase 1 of the pipeline inspection program was executed. Phase 1 included the cleaning, modification of lines for inspection tools and inspection of the oldest pipeline segment from Gold Bar WWTP to Chamber MHD2. The inspection identified the segment had deteriorated significantly and numerous corrective actions were required for the segment to safely remain in service. One rehab was completed in 2016 but the segment was removed from service until further rehabilitation could be completed.

31. During the winter of 2016/2017 phases 2 and 3 of the pipeline inspection program were completed. These phases included cleaning and inspection of six pipeline segments between the Clover Bar Pump Station and Manhole D2. Inspection results for three of the segments indicated significant deterioration had occurred. Shortly after completion of the inspections there was a release of digested sludge in Hermitage Park from a failed pipeline. The sludge release was immediately cleaned with vacuum trucks and that area of the park fenced off until repair could be completed. Subsequent soil sampling showed no adverse environmental impact. As a result of the leak and the deteriorated condition those three pipeline segments were also removed from service leaving the Gold Bar WWTP with reduced operational flexibility and no redundancy.

32. In 2017, EWSI completed a comprehensive risk analysis on the inspection results completed to this point (Phases 1-3) and the following conclusions for rehab and replacement of defective sections were made:

- rehabilitation of nine localized defect locations at the EWMC Clover Bar Site (three excavations);
- rehabilitation of nine localized defect locations in Rundle Park (three excavations);
- rehabilitation of nine localized defect locations in Hermitage Park (six excavations) including replacement of a 200 m section in close proximity to Pembina pipelines; and
- replacement of approximately 2.5 km of pipeline from the North Saskatchewan River Park to Clover Bar.

33. In that fall of 2017, EWSI commenced the work to complete rehabilitation of the localized defects under the Sludge Line Upgrades Project and a initiated a separate project, the Replace 2.5 km Sludge Line, to complete replacement of the 2.5 km section of pipelines. Rehabilitation was completed on the 27 defects by Spring of 2018 with those segments returned to service reducing the risk to the Gold Bar WWTP and restoring available redundancy.

34. In the fall of 2018, Phase 4 of the inspections was completed on the remaining two sections of pipelines between Gold Bar WWTP and Chamber D2. Results showed these two segments to be in acceptable condition with no defects requiring immediate attention.

35. Phase 5 of inspections was completed on two sections of pipeline at Clover Bar. This work was executed under the Replace 2.5 km Sludge Line project to develop scope during detailed design. Based on the results of that inspection the decision was made to replace one of these lines considering the savings of the contractor already installing pipelines in that area. Construction at Clover Bar is expected be complete in November of 2019.

36. Several samples of the defects were analyzed in closer detail, to identify any common characteristics or failure mechanisms. The analysis considered physical properties and material chemistry. While mechanisms were identified for internal and external corrosion, the review determined that the materials installed were consistent with ones typically used. The recommendations made also support the development and implementation of the Pipeline Integrity Program, which is already underway.

6.0 PROJECT COST VARIANCE

37. The 2017-2021 PBR submission for this project was $3.4 million which was based primarily on expected costs for continued inspection of pipelines and minor improvements required to facilitate inspections; replacement and/or rehab was not in scope.

38. 2017-2021 PBR Forecast compared to actuals/forecast capital expenditures for both inspection and rehabilitation work completed under the Sludge Line Upgrades and Replace 2.5 km Sludge Line Project are provided in Table 6.0-1 below.

Table 6.0-1
Sludge and Supernatant Pipeline Capital Expenditures
2017-2021 PBR Term
($000s)

		A	B	C	D	E	F	G
		2016	2017	2018	2019	2020	2021	Total Costs
1	**PBR Forecast**		1.1	1.1	1.1			3.4
	Actual/Forecast							
	Sludge Line Upgrades Project							
2	Inspections	0.4	0.6	1.3	0.2			2.5
3	Rehabilitation		2.4	2.0	0.2			4.6
4	Subtotal	0.4	3.0	3.3	0.4			7.1
	Replace 2.5 km Sludge Line Project							
5	Inspections				0.7	0.6		7.5
6	Rehab		0.2	1.0	5.1			
7	Subtotal		0.2	1.0	0.	0.6		7.5
8	**Total Capital Expenditures**	**0.4**	**3.1**	**4.4**	**6.1**	**0.6**		**14.6**

6.1 Sludge Line Upgrades Project

39. Final project costs for the Sludge Line Upgrades Project are forecasted to be $7.1 million or $3.7 million (111%) greater than the original PBR forecast of $3.4 million. The PBR forecast cost of the project only included the costs of cleaning and inspecting the sludge lines between

Gold Bar WWTP and the Clover Bar Lagoons. Inspections on the older sections of pipelines showed that the sludge lines were in poor condition and required significant additional capital expenditure under this project for rehabilitation / replacement to ensure that these pipelines can continue to operate with minimal risk of leakage.

6.2 **Replace 2.5 km Sludge Line**

40. The Replace 2.5 km Sludge Line Project was not included in the 2017-2021 PBR forecast as the forecast was prepared prior to the inspection work. Costs for this project are forecasted to be $7.5 million. This project provides for replacement of a 2.5 km section of sludge lines located between the Clover Bar Lagoons and the North Saskatchewan River. This section of the sludge lines were found to be in such poor condition that repairs or rehabilitation was not financially viable.

7.0 FUTURE PLANNING / PATH FORWARD

41. Entering into the 2017-2021 PBR period, EWSI's goal was to complete inspections on all of EPCOR's sludge line assets while developing both a Pipeline Master Plan and a Pipeline Asset Management Plan for planning of future work. These inspections and a failure of one section of pipeline, however, drove the need for immediate repair, rehabilitation and replacement of significant portions of these pipelines.

42. The system is currently in an operationally stable state with a low risk of failure in the near term and further inspections are not required in this PBR period. EWSI now has the ability to better plan for future inspections (e.g., means, methods, costs, frequency) based on the information obtained during these inspections. This experience and information also aids in determining what improvements are required.

43. EWSI is currently developing a Pipeline Master Plan for sludge/supernatant piping system. This Master Plan will focus on capacity requirements and the best pipeline practices to identify the current and future needs for the system upgrades. The plan will also serve as a basis for considering future projects in future PBR applications. The Master Plan will be completed by the end of 2019 and will consider the following:

- the overall layout to determine the upgrades required to meet the Gold Bar Integrated Resource Plan (IRP) design horizon of 2060 and the forecast volumes to be pumped to the Clover Bar Lagoons from Gold Bar WWTP;

- the number and size of pipelines required to meet these volume requirements and to provide necessary redundancy for regular maintenance and emergency situations;
- pipeline material selection to provide the longest life, while being strong enough to withstand pressure fluctuations and other environmental aspects; and
- monitoring options to allow for enhanced condition and operational state awareness.

44. EWSI is also developing a Pipeline Asset Management Plan in conjunction with the Master Plan. The Pipeline Asset Management Plan serves two key functions:

i) To develop and document an integrated investment and management plan for the sludge/supernatant system to address all asset needs that will:
   - maintain existing levels of service (base maintenance);
   - accommodate future operational capacity requirements due to population growth and demand changes;
   - adapt to environmental pressures and/or regulator changes; and
   - provide basis for the development of routine cleaning and inspection program, improved monitoring and other system improvements.

ii) To act as a communication document to inform key stakeholders of the required investment required and expected outcomes.

45. Integrated resource planning is the long term planning process used by EWSI for Gold Bar. The Pipeline Asset Management Plan and Pipeline Master Plan are two critical documents that together support the development of the Gold Bar IRP, which will provide details regarding the near, medium, and long term plans, vision, and investment needs, specifically related to pipelines.

46. Planning and costing for future PBR periods is currently underway based on the documents currently in preparation. The goal is to establish a realistic and sustainable forecast per PBR that reduces the likelihood of encountering unforeseen issues that cause significant variance to occur. This information will be included in EWSI's next PBR application. EWSI expects regular future capital investment will be required to support cleaning, inspection, and rehabilitation in the range of $3 to $5 million per PBR term. Replacement of segments as they are identified through inspections are expected to cost approximately $5 million and would be presented separately.

Appendix H1

EPCOR WATER SERVICES INC.

List of Drainage Programs and Projects in the 2022-2024 PBR

February 16, 2021

	Program	A Regulatory Category	B **2022-2024 PBR Plan**
	Drainage Neighbourhood Renewal		
1	Neighbourhood Renewal Program	Growth / Customer	76.5
2	**Sub-total: Drainage Neighbourhood Renewal**		**76.5**
	Drainage System Expansion		
3	Private Development Construction Coordination Program	Growth / Customer	11.3
4	Yellowhead Trail Freeway	Growth / Customer	9.2
5	Operations Equipment Progam	Growth / Customer	4.5
6	Drainage Facility Upgrades Program	Reliability or Life Cycle	2.3
7	Business Systems Upgrades Program	Reliability or Life Cycle	2.2
8	IT Hardware Program	Reliability or Life Cycle	2.0
9	Servicing for Downtown Intensification (105 Ave)	Growth / Customer	1.3
10	Transportation Construction Coordination Program	Growth / Customer	1.3
11	Construction Equipment Program	Reliability or Life Cycle	1.1
12	Microstation Upgrade/Replacement	Reliability or Life Cycle	1.0
13	Mobile Applications	Reliability or Life Cycle	1.0
14	AssetWise(Ivara) Upgrade	Reliability or Life Cycle	0.6
15	Office Furniture and Equipment Program	Reliability or Life Cycle	0.6
16	Safety Program	Regulatory and HSE	0.3
17	ProjectWise Upgrade	Reliability or Life Cycle	0.1
18	Service Connections Program	Growth / Customer	-
19	**Sub-total: Drainage System Expansion**		**38.8**
	Drainage System Rehabilitation		
20	High Priority Replacement Program	Reliability or Life Cycle	52.1
21	Small Trunk Rehabiliation Program	Reliability or Life Cycle	18.8
22	Pump Station Rehabilitation Program	Reliability or Life Cycle	15.5
23	Fleet and Vehicles Program	Reliability or Life Cycle	13.2
24	Drill Drop Manholes Program	Reliability or Life Cycle	13.1
25	Proactive Service Renewal Program	Reliability or Life Cycle	10.3
26	Manhole Catch Basin Replacement Program	Reliability or Life Cycle	8.7
27	Arterial Roadway Coordination Program	Reliability or Life Cycle	8.7
28	Outfall Rehabilitation Program	Reliability or Life Cycle	8.2
29	New Buena Vista Pump Station Rehabiliation	Reliability or Life Cycle	7.4
30	Electrical Upgrades - Pump Stations Program	Reliability or Life Cycle	2.6
31	Local Sewer Rehabilitation Program	Reliability or Life Cycle	5.4
32	Mechanical Upgrades Pump Stations Program	Reliability or Life Cycle	1.6
33	SCADA Upgrading	Reliability or Life Cycle	0.4
34	**Sub-total: Drainage System Rehabilitation**		**166.0**
	LRT		
35	LRT Relocates Program	Growth / Customer	48.5
36	**Sub-total: LRT**		**48.5**
	SSSF		
37	Sanitary Servicing Strategy Fund Contribution	Growth / Customer	4.5
38	**Sub-total: SSSF**		**4.5**

	Program	A Regulatory Category	B 2022-2024 PBR Plan
	Flood Mitigation		
39	Dry Pond Program - Malcolm Tweddle	Growth / Customer	32.7
40	Rideau Park Empire Park	Growth / Customer	1.1
41	Tweddle Place	Growth / Customer	0.3
42	**Sub-total: Flood Mitigation**		**34.1**
	SIRP		
43	SIRP Dry Pond Program	Growth / Customer	60.4
44	SIRP LID Program	Growth / Customer	53.1
45	SIRP Proactive Pipe Relining Program	Reliability or Life Cycle	22.9
46	SIRP Proactive Manhole Relining Program	Reliability or Life Cycle	18.7
47	SIRP Outfall Gates Program	Growth / Customer	9.6
48	SIRP Emergency Response Equipment Program	Growth / Customer	7.4
49	SIRP Home Flood Proofing Program	Growth / Customer	7.2
50	SIRP Monitoring Program	Efficiency, profit, or	6.5
51	SIRP Imagine Jasper Ave Streetscape	Growth / Customer	4.8
52	SIRP Kinnaird Sewer Separation	Regulatory and HSE	4.1
53	SIRP Storm Water Management Facilities (SWMF) Safety Review	Regulatory and HSE	3.3
54	SIRP Environmental Enhancement Program	Growth / Customer	1.7
55	SIRP Overland Drainage Program	Growth / Customer	1.7
56	SIRP Ermineskin/Steinhauer	Growth / Customer	1.5
57	SIRP Environmental Monitoring Program	Regulatory and HSE	1.3
58	SIRP LID Site and Training Facility	Growth / Customer	0.7
59	SIRP Total Load Reduction Program	Regulatory and HSE	0.5
60	SIRP Automate Multi-Residential Storm Water Entries	Efficiency, profit, or	0.2
61	**Sub-total: SIRP**		**205.6**
	CORE		
62	CORe Large Trunk Rehabilitation Program	Reliability or Life Cycle	79.0
63	CORe Duggan Tunnel Project	Regulatory and HSE	56.3
64	CORe Drop Structure Modification Program	Growth / Customer	22.0
65	CORe Access Manhole Program	Growth / Customer	17.9
66	CORE Pump Station Enhancements Program	Regulatory and HSE	2.7
67	CORE Ventilation Control Program	Growth / Customer	2.2
68	CORe Odour Monitoring Program	Regulatory and HSE	0.3
69	**Sub-total: CORE**		**180.4**
70	**Grand Total**		**754.4**

Appendix H2

EPCOR WATER SERVICES INC.

Drainage Services
CORe Access Manhole Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The CORe Access Manhole Program was initiated in 2019 as a critical component of EWSI's Corrosion and Odour Reduction Strategy (CORe) to understand, mitigate and prevent sewer odour issues. The CORe Access Manhole program will include construction of access manholes throughout 80 km of major trunk lines which require safe access for inspections and cleaning. Safe access for inspections and cleaning is critical to identify sources of hydrogen sulfide, concrete corrosion, and sags or deposits of sediment/fat that require cleaning. The CORe Access Manhole Program targets trunk lines with poor existing access availability, where odour causing sediment accumulations are expected and where there is a risk of moderate to severe deterioration of the sewer structure from hydrogen sulfide corrosion.

2. The continuation of the CORe Access Manhole Program is critical for providing safe access to the sanitary system to support EWSI's CORe Strategy. Without safe access to the sanitary system, EWSI cannot inspect or remediate areas where there is an accumulation of odour causing sediments. The odours can impact quality of life for nearby residents and lead to reduced asset service life or unexpected asset failures because the accumulation of hydrogen sulphide causes concrete corrosion. Premature asset failure can result in significant customer service disruptions and will require costly emergency repairs.

3. Without appropriate access there is also a very real risk to human life during human entry inspection, financial and customer service risks for repairs and by-passes and risk to equipment operation due to long distance between access points. Human entry into sewers is often needed to carry out or support inspections, cleaning and repairs. Long stretches of trunk without access reduces communication capacity and complicates rescues by forcing operators to work further away from escape points. Because the risk of a fatality is real and conceivable in such an environment, entry requirements for operators remains very strict. It is only by improving the safety of the existing infrastructure that human entry availability can be extended.

4. The long distance between access points will also make any rehabilitation work difficult. Without sufficient access, inspections may not be feasible and structural deficiencies are only detected when they become major failure events. Additionally, a lack of access requires larger sewerage by-passes in order to complete rehabilitation work on the trunk lines. Bypassing sewage flow over long distances is very complex and can create lots of disturbance to the surrounding area. More access manholes will reduce the size of these bypasses.

5. While the technology supporting robotic sewer inspections has improved dramatically, losing a robot in the sewers is still a very real risk in sewers with limited access and has happened as recently as 2020. Poor access reduces tether control, increases the risk of snares, particularly at bends and the mass of the tether line begins to affect maneuverability at longer deployment lengths. The loss of a robotic inspection platform in a sewer is costly due to the loss of highly specialized equipment but more concerning is the potential for the platform to create a debris pile that blocks or damages the sewer. Access manholes are needed to support robotic deployment, retrieval and tether control.

6. The CORe Access Manhole Program is a new program which was initiated in 2019 as a key CORe deliverable. To date, 6 access manholes have been completed and a further 13 access manhole projects have been initiated and are proceeding towards or undergoing construction at an estimated capital cost of $13.7 million. The scope of this program for the 2022-2024 PBR term is to construct a total of 24 additional access locations on major trunk lines. This program is categorized as an environmental quality enhancement program. EWSI has forecast total program capital expenditures during 2022-2024 at $17.9 million.

2.0 BACKGROUND AND JUSTIFICATION

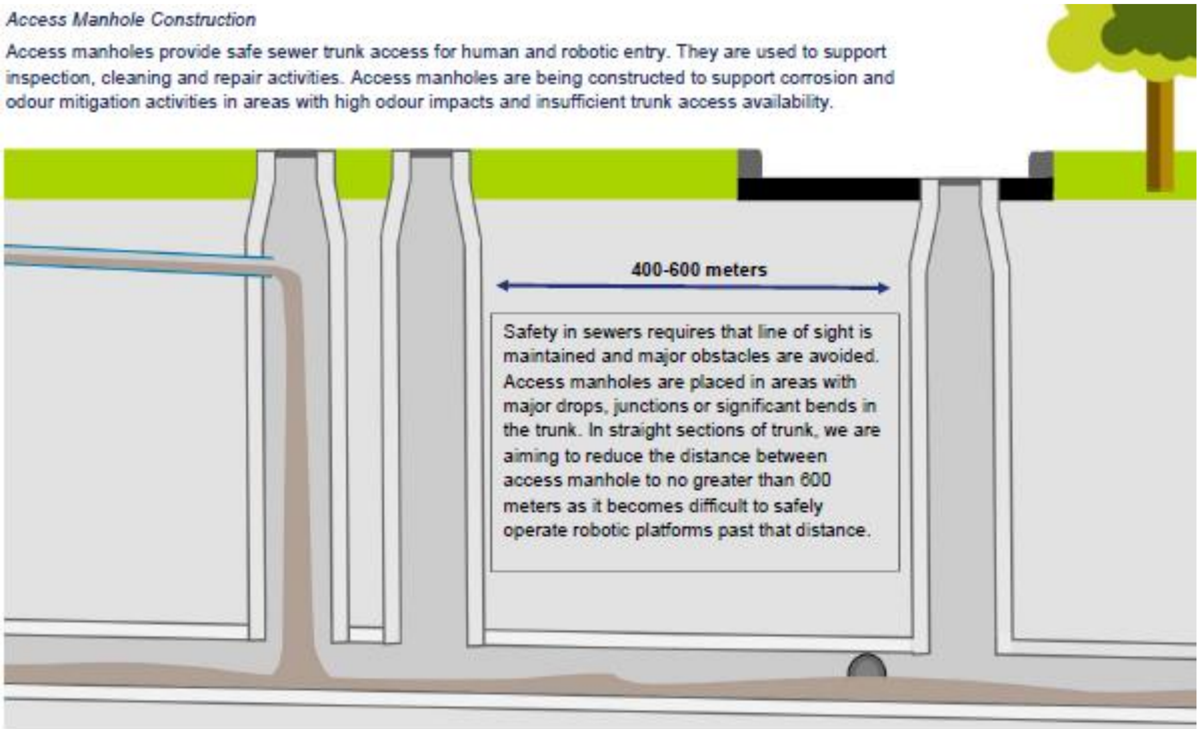
7. EWSI initiated the Corrosion and Odour Reduction (CORe) Strategy in 2019 to understand, mitigate and prevent sewer odour issues across the city of Edmonton using a combination of capital and operational interventions. The CORe Strategy focuses on preventing the formation of H_2S gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Under CORe, EWSI segregates the City into regions with consistent odour issues, those with dynamic odour issues, and those with emerging odour issues. Different approaches have been proposed for each region to ensure that causes of the odour are fully understood and to ensure that capital projects will provide sustainable relief. The capital projects and operating activities in CORe can be classified into four themes of investment: PREVENT, OPTIMIZE, MONITOR and CONTROL.

8. The Access Manhole Program is a critical component of the CORe Strategy under the PREVENT theme. The Access Manhole Program is an annual program that initiates projects to construct access manholes in major trunk lines. The access manholes are used to mitigate health and safety risks, financial risks, environmental risks and risks of customer service disruptions by providing safe access for inspections and cleaning.

9. There are approximately 170 km of sanitary and combined large trunk sewers (1,200 mm diameter and larger) constructed over the past 100 years to varying standards and specifications. Approximately 80 km of the large trunk lines in the City of Edmonton have insufficient access provisions to safely permit either manned or robotic inspections. Safe access for inspections is critical to identify sources of hydrogen sulfide, concrete corrosion, structural failures, and whether the line contains sags or deposits of sediment/fat that requires cleaning. EWSI estimates that fully addressing access needs across Edmonton's combined and sanitary trunk system could require as many as 150 new access manholes. The CORe Access Manhole Program is prioritizing the construction of 24 new access manholes at trunk lines with poor existing access availability, where odour causing sediment accumulations are expected and where there is a risk of moderate to severe deterioration of the sewer structure from hydrogen sulfide corrosion. This program is a critical pre-requisite for completing trunk line inspections and sediment cleaning projects planned under CORe by providing access along trunk lines where there is currently no viable and safe methods of entry either for human or robotic platforms. Additional benefits include the use of the new access for asset management inspections and for future rehabilitation efforts.

10. Figure 2.0-1 shows a graphical image of access manholes, which provide safe sewer trunk access for human and robotic entry and support inspection, cleaning and repairs.

Figure 2.0-1
Access Manhole Construction



11. The CORe Access Manhole Program was initiated in 2019 as a key CORe deliverable. Since 2019, 6 access manholes have been completed and a further 8 access manhole projects have been initiated and are proceeding towards or undergoing construction. The Access Manhole Program has currently enabled the inspection of 400 meters of trunk line in Empire Park and has assisted the completion of 1,000 meters of trunk inspection in Brookside. Trunk cleaning is planned for these locations especially when there are debris in the trunk line.

12. The new access manholes constructed under the CORe program have also been beneficial for trunk rehabilitation and emergency repair activities. The construction of two access manholes in Empire Park not only allowed inspectors to identify structural failures in the connected trunk line prior to trunk line collapse, but are also being used to support the on-going rehabilitation and repair activities. Two access manholes recently completed in Brookside under the CORe program are being used to support emergency repairs to the Whitemud Creek trestle by providing safe access points to the trunk line immediately upstream of the trestle bridge.

13. Significant synergies are expected across EWSI's Drainage Services from the CORe Access Manhole Program beyond the benefits of odour mitigation. Additional access manholes in strategic locations will not only be used to address requirements of EWSI's CORe Strategy, but

can also be used to support inspections and rehabilitation planning activities. EWSI will consider planned inspection and rehabilitation program requirements when selecting locations and timing for each access manhole project in order to maximize potential synergies wherever possible. Some examples of planned synergies for 2021 include:

- Using 4 access manholes in Meadowlark and Jasper Park to support the inspection of the 87th Avenue, 1,200 mm diameter trunk line which is needed prior to Edmonton Valley Line West LRT Expansion.
- Assisting with the re-inspection and repair of multiple non-emergency structural deficiencies on a 1,200 mm diameter trunk line near Jasper Park.
- Supporting rehabilitation planning in Mill Creek by providing access to the 1,500 mm diameter 88th Street trunk line.
- Supporting rehabilitation planning and sewer separation activities for the 1,650 mm double barrel trunk line in Oliver on 116th Street by providing access near its discharge location on 108th Avenue.

14. The continuation of the CORe Access Manhole Program is critical for managing several identified risk factors including the potential for health and safety, financial and customer service disruptions. Without access to the sanitary system, the accumulation of odour causing sediments cannot be safely identified through inspection or remediated using cleaning technologies due to unsafe access. To safely access the major trunk lines, technicians and robotic inspectors require manholes that provide direct line of sight to the trunk, at distance intervals approaching 600 meters and which allow for the safe navigation around major bends, weirs and drops. The CORe Access Manhole Program is designed to provide those conditions at trunks with known odour issues across the city. The odours can impact quality of life for nearby residents and lead to reduced asset service life or unexpected asset failures by causing concrete corrosion. The premature aging of the sewer assets can result in customer service disruptions and require costly emergency repairs. Without appropriate access there is a very real risk of injury and damage/loss of inspection platforms in the sewers.

3.0 PROGRAM DESCRIPTION

15. The scope of the CORe Access Manhole Program includes construction of twenty-four new access manholes across the City of Edmonton in 2022, 2023 and 2024, with 10 completed in 2022 and 7 scheduled for 2023 and 7 scheduled for 2024.

16. The scope of the project is to install access manholes along major trunk lines with poor existing access and are expected to be contributing to downstream sewer odour problems due to excessive sedimentation and debris accumulation. Candidate locations are chosen which satisfy the following criteria:

- The sewer asset has been determined to not having sufficient access for inspections to be completed in a safe manner.
- The asset is a sanitary or combined sewer trunk line of a diameter greater than 650 mm.
- Downstream hydrogen sulfide concentrations exceed an average of 2 ppm over 24 hours or reach a peak concentration above 10 ppm at least once a day or are suspected of reaching such concentrations if access is not available for monitoring. Note that 10 ppm indicates that 0.001% of the sewer air volume is hydrogen sulfide.

17. In addition to the above criteria, the location choice will consider safety of access during construction, ground conditions, potential impacts to traffic and possible conflicts with nearby buried utilities. Additionally, sections of trunk lines with sharp bends, drill drops or flat to negative slopes are given precedence when assigning access manhole locations as the presence of those specific asset features drastically increase access difficulty and are high risk areas for asset deterioration and odour nuisance.

18. Under CORe, the current selection and prioritization process for access manhole construction is driven primarily through public odour reporting and system wide sewer behaviour analysis with additional consideration provided to on-going asset management needs in order to complement rehabilitation and replacement programs.

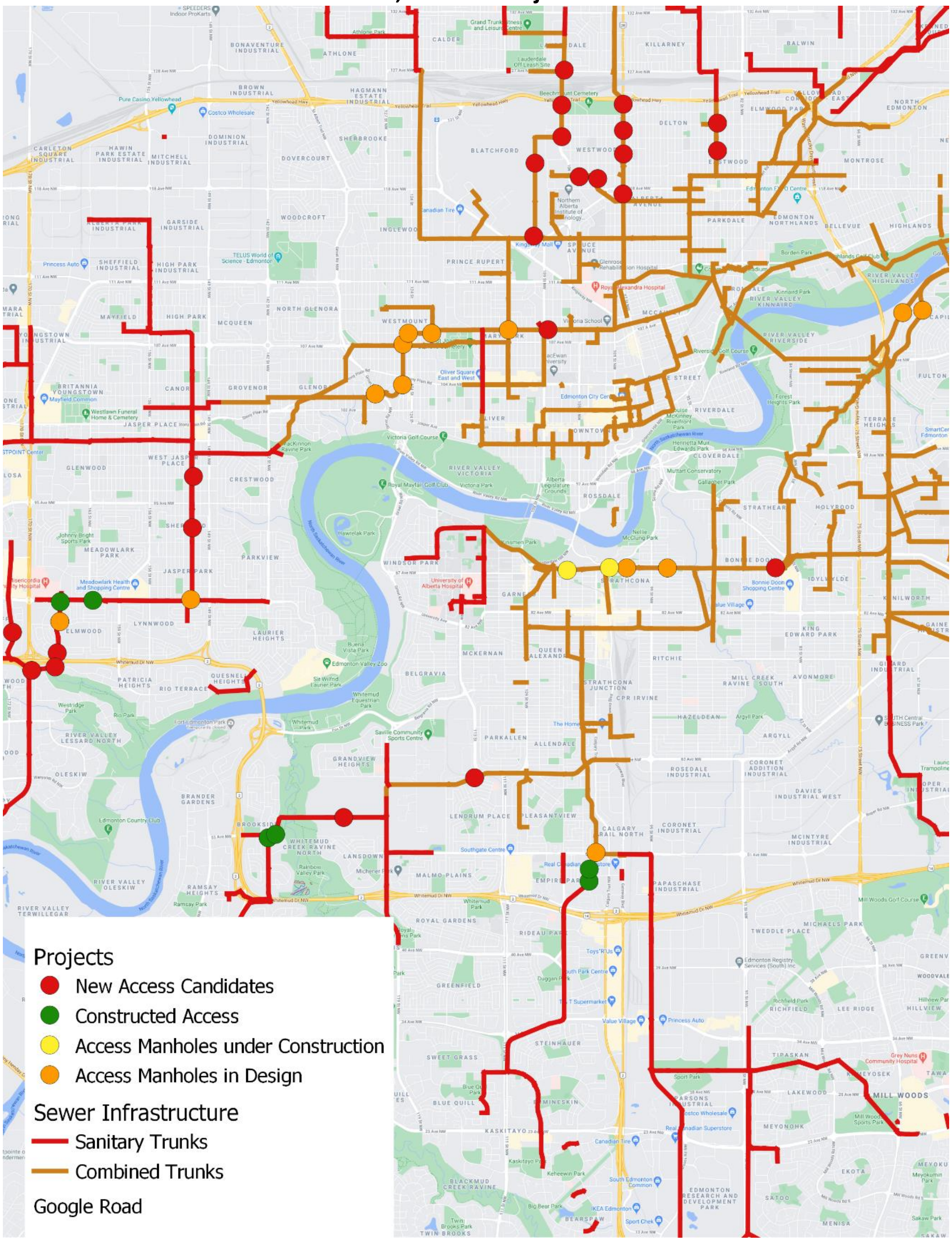
19. While the program has a goal to construct a total of 24 additional access locations during the 2022-2024 PBR term, the timing and location of candidates for access manhole may change as understanding develops but such changes will be subject to the selection criteria. Factors that alter candidate viability include surface access limitations, conflicting construction schedules (LRT, neighborhood renewal) and the presence of nearby buried utilities.

20. Maintenance and repair of the trunk line beyond the tie in location, abandonment of other assets and inspection/cleaning are outside the scope of this program and will be managed and prioritized through appropriate asset programs such as the Large Trunk Rehabilitation Program. Preliminary locations for 20 access manholes have been identified and are shown in the Figure 3.0-1 below. The locations for the remaining 4 access manholes has not been finalized

as we re-evaluate access needs along several major trunks in Capilano, Oliver, Downtown, 151st Street near West Jasper and 61st Avenue near Pleasantview. The final selection is striving to have manholes placed in locations that are beneficial for both odour control and future rehabilitation needs in order to maximize the value of each manhole.

21. The tentative locations of the access manhole projects are identified by the blue circles in Figure 3.0-1 below. The yellow, orange and green circles identify locations that have been or are being completed by 2021.

Figure 3.0-1
Access Manhole Locations, Current Projects and Future Candidates



22. Based on past projects, engineering is expected to take between 2 to 3 months while construction also takes approximately 2 to 3 months. Construction scheduling proceeds based on the utilization of EWSI's construction crews and allowable road detours.

23. Table 3.0-1 provides a schedule for this program over the 2022-2024 PBR term.

Table 3.0-1
CORe Access Manhole Program Schedule
(2022-2024)

Project Phases	A **2021 Q4**	B **2022 Q1**	C **2022 Q2**	D **2022 Q3**	E **2022 Q4**	F **2023 Q1**	G **2023 Q2**	H **2023 Q3**	I **2023 Q4**	J **2024 Q1**	K **2024 Q2**	L **2024 Q3**	M **2024 Q4**
1 Initiation and Approvals	α			β				μ					
2 CCTV & Design	α	α	α	α	β	β	β	β	μ	μ	μ	μ	
3 Procurement		α	α	α	α	β	β	β	β	μ	μ	μ	
4 Construction		α	α	α	α	β	β	β	β	μ	μ	μ	μ
5 Commissioning			α	α	α	β	β	β	β	μ	μ	μ	μ
6 Close-out			α	α	α	β	β	β	β	μ	μ	μ	μ

α: Projects initiated for 2022.
β: Projects initiated for 2023.
μ: Projects initiated for 2024.

4.0 ALTERNATIVES ANALYSIS

24. Current inspection and trunk cleaning technologies cannot effectively address the existing sewer system where long stretches of trunk sewer exist without proper access. Therefore, there are no viable "structural" alternatives for access manholes. Alternative options are limited to:

- No Action (status quo).
- Alternative project locations.
- Project deferral.

25. From the perspective of the overall program, maintaining status quo does not meet the program objectives and is not an acceptable alternative because of the inherent risks that inaccessibility poses to the existing system. The limited access conditions across the city prohibit safe inspection and cleaning activities and severely limits our understanding of the state of the sanitary sewer network. Because of the limited access proper planning to address sewer odour and corrosion issues is difficult especially in areas without easily identifiable point sources for odour, such as pump stations. For example, in communities such as Bonnie Doon, the limited access has made it difficult to identify all of the sources of odour affecting the area. Providing reliable, safe and regular access is a critical requirement for managing our existing system.

5.0 COST FORECAST

26. Costs are estimated based on the reported costing for the most recently completed access manhole projects in 2019 and 2020. Costing is not expected to vary significantly between projects and is mostly determined by shaft depth which is expected to be between 25 to 30 meters for most projects and is not expected to exceed 35 meters.

27. The following assumptions were made to forecast capital expenditures for the CORe Access Manhole Program for the 2022-2024 PBR term:

- 24 access manholes will be constructed with costs per manhole at $0.76 million based on historical costs estimates;
- Construction shaft depths are between 25 to 35 meters;
- Sufficient space is available for construction equipment;
- The roads have moderate to heavy traffic requiring active traffic control provisions;
- The target trunk line requires only standard structural strengthening to support the access manhole; and
- Geotechnical investigations will be completed by external resources.

28. In the CORe strategy that EWSI presented to the City in 2019, access manhole projects were estimated to have a project cost of approximately $1.8 million each. However, due to efficiencies realized by utilizing internal resources, actual project costs have been much lower. For constructing sewer shafts to similar depths as the candidate locations in the 2022-2024 access manhole program, the anticipated cost per location is approximately $0.8 million each. The yearly budgeted forecast has been decreased to reflect the lower costs realized by pivoting from external construction.

29. In 2019, two access manholes were completed at a per manhole cost of approximately $660,000 per manhole. The 2020-2021 access manhole construction program is still on-going and does not have a finalized project cost but was also used to guide the cost estimate for this PBR. During 2020 and 2021, the cost per manhole constructed have ranged from between $600,000 to $850,000, largely depending on shaft depth but also depending on the site conditions (road disturbances, tree interactions, condition of the trunk line).

30. The costing forecasting for access manhole is further reduced from costing presented in the 2019 CORe Strategy by having a lower project contingency of approximately $10,000 per manhole and having reducing external expenses by approximately $5,000 per manhole. The

reductions to contingency and external expenditures are based on experience and feedback from the past and on-going projects.

31. Table 5.0-1 provides the capital expenditure forecast for this program for the 2022-2024 PBR term.

Table 5.0-1
CORe Access Manhole Program
Capital Expenditure Forecast
(2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs:				
1	Contractors	1.79	1.40	1.77	4.96
2	Internal Labour	3.24	2.34	3.23	8.81
3	Vehicles and Equipment	0.58	0.38	0.53	1.48
4	Contingency	0.00	0.46	0.62	1.08
5	**Sub-total Direct Costs**	**5.61**	**4.59**	**6.14**	**16.34**
6	Capital Overhead and AFUDC	0.56	0.41	0.56	1.53
7	**Total Capital Expenditures**	**6.17**	**4.99**	**6.70**	**17.87**

32. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by using in house construction resources who are skilled and experienced in the construction of these asset types.
- Where necessary, contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control. Contracted services will only be used if internal resources are not available due to unforeseen emergency repairs or interventions external to this project.
- The longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.

- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- EWSI will use standard designs to expedite the design phase. Pre-planning of shaft locations minimizes the cost by avoiding utilities (above and below ground), assessing ground conditions to optimize construction methods and ensuring adequate space for materials, equipment and safe operation. Every project scope is evaluated to improve economy of scale.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

33. Table 6.0-1 provides key risks and mitigation plans associated with executing this program.

Table 6.0-1
Key Risks and Risk Mitigations

		A
	Risk	**Mitigation Plan**
1	**Health and Safety Risk** - This project requires heavy construction activities that include, excavations, crane use, confined space entry and working in high traffic areas.	EWSI's construction team will follow EPCORs best practices for ground disturbances and follow all safety procedures and plans. EWSI will ensure that external contractors submit safety plans the meet or exceed EPCOR health, safety and environment (HSE) requirements prior to commencing any work.
2	**Risk of Customer Disruptions** - During construction, the projects can have an impact on the neighborhood by causing disruptions to traffic, releasing sewer gasses and making noise.	EWSI will schedule activities to minimize all impacts and work may need to be adapted if unexpected conditions occur that can worsen impacts on neighbours and residents. EWSI will ensure manholes are designed to not act as egress points for odour, and the project must monitor upstream and downstream impacts.
3	**Financial Risk** – Unknown geotechnical conditions, utility conflicts and poor trunk condition can increase the project cost.	EWSI's design team will conduct desktop geotechnical studies during the design stage and commit to appropriate redesigns in advance when adverse geotechnical condition are anticipated. In the event of poor structural integrity of the trunk, additional project funding has been assigned to allow for moderate structural rehabilitation and support for the interface between the trunk and the new manhole. The project will obtain information on all underground utilities during design stage and conduct hydrovac exposure to confirm utility locations.

Appendix H3

EPCOR WATER SERVICES INC.

Drainage Services
CORe Drop Structure Modification Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The CORe Drop Structure Modification Program is a critical component of EWSI's Corrosion and Odour Reduction (CORe) Strategy to understand, mitigate and prevent sewer odour issues. This program initiates projects to construct structures that reduce the downstream air pressurization of a sewer headspace that results from the normal operation of the drop structure. This helps prevent sewer air from exiting the sewer at catch basins and manholes in neighbourhoods.

2. The odours can impact quality of life for nearby residents and lead to reduced asset service life or unexpected asset failures because the accumulation of hydrogen sulphide causes concrete corrosion. Premature asset failure can result in significant customer service disruptions and will require costly emergency repairs.

3. This program is categorized as environmental quality enhancement program. This program started in 2019 as part of the CORe strategy. Since then, EWSI has initiated six drop structure modification projects which are currently under design and construction. During the 2022-2024 PBR term, this program will complete construction of 21 drop shaft air recirculation structures. EWSI has forecast total program capital expenditures during 2022-2024 at $22.0 million.

2.0 BACKGROUND/JUSTIFICATION

4. EWSI initiated the Corrosion and Odour Reduction (CORe) Strategy in 2019 to understand, mitigate and prevent sewer odour issues across the city of Edmonton using a combination of capital and operational interventions. The CORe Strategy focuses on preventing the formation of H2S gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Under CORe, EWSI segregates the City into regions with consistent odour issues, those with dynamic odour issues, and those with emerging odour issues. Different approaches have been proposed for each region to ensure that causes of the odour are fully understood and to ensure that capital projects will provide sustainable relief. The capital projects and operating activities in CORe can be classified into four themes of investment: PREVENT, OPTIMIZE, MONITOR and CONTROL.

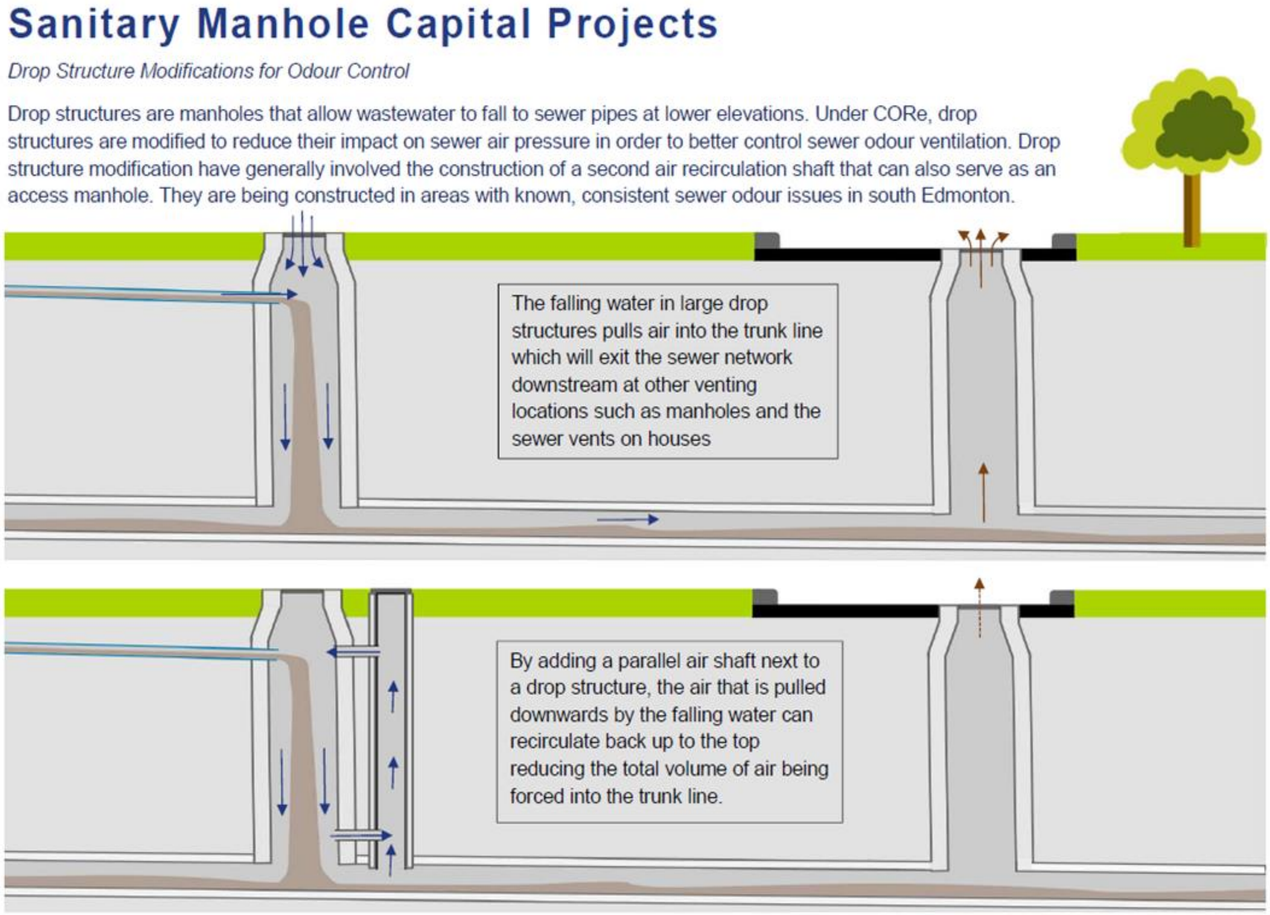
5. The Drop Structure Modification Program is a critical component of the Corrosion and Odour Reduction Strategy (CORe) under the CONTROL theme. A drop structure is a location where wastewater is allowed to fall from a more elevated sewer into a deeper trunk line.

However as the water falls in the drop structure it drags air along with it, acting like an air pump and pressurizing the receiving trunk line. If left unabated, the resulting high air pressure in the trunk lines will force air out of the sewer at other locations often creating odour and/or corrosion problems far away from the sources of sewer odour. High air pressure in trunk lines is one of the main factors for the perception of sewer odours around catch basins and manholes.

6. The CORe Drop Structure Modification program is an annual program that constructs structures that reduce the downstream air pressurization of a sewer headspace that results from the normal operation of the drop structure. This helps prevent sewer air from exiting the sewer at catch basins and manholes in neighbourhoods.

7. The approach being employed by the CORe program to reduce air pressurization involves modification of drop structures through installation of several horizontal pipes between the drop structure and a newly constructed air re-circulation shaft (refer to Figure 2.0-1). The principle is that the air entrained due to the falling effect of the wastewater is recirculated through the connection pipes between the drop shaft and the air re-circulation shaft. This re-circulation configuration prevents the entrained air from pressurizing the downstream trunk system and escaping into the environment. The modified drop shaft can also be adapted to incorporate accessibility improvements for the trunk line.

Figure 2.0-1
Drop Structure Modifications – Air Re-Circulation Shaft Method



8. During the 2022-2024 PBR term, the Drop Structure Modification Program will include the construction of 21 additional drop structure modifications

9. Approximately 80 of 170 kilometers of deep trunk lines lack appropriate access provisions for safe entry. 17 of the candidate project locations in this program lie along trunks with poor accessibility and where there is value in incorporating accessibility improvements into the drop modification shafts. A decision to incorporate accessibility improvements into the drop structure modification design will be based on the requirements of the location. Additional access will not be added if there is already access available at alternative locations within the same area.

3.0 PROGRAM DESCRIPTION

10. The scope of this program is to modify drop structures to reduce downstream headspace pressure in major trunk lines. A secondary goal of this project is to provide additional trunk access. Candidate locations should satisfy the following conditions:

- The asset must serve an upstream area with an average dry weather flow greater than 300 m^3/day;
- The asset must result in a height drop greater than 8 meters for a trunk line or 10 meters for a sewer lateral;
- Downstream hydrogen sulfide concentrations exceed an average of 2 ppm over 24 hours or reach a peak concentration above 10 ppm at least once a day. (Note that 10 ppm indicates that 0.001% of the sewer air volume is hydrogen sulfide.);
- The asset is demonstrated to increase downstream air pressure by 20 Pascal or more; and
- The location choice consider access safety during construction, potential impacts to traffic and not conflict with nearby buried utilities.

11. With the above criteria in place, the current selection and prioritization process for the construction of drop shaft modifications is driven primarily through public odour reporting and system wide sewer behaviour analysis.

12. Maintenance and repair of the trunk line beyond the tie in location, abandonment of other assets and inspection/cleaning are beyond the scope of this program and will be prioritized and managed in the CORe Large Trunk Rehabilitation Program.

13. Based on past projects, engineering is expected to take between 2 to 3 months while construction also takes approximately 2 to 3 months. Construction scheduling proceeds based on the utilization of in-house construction crews. As shown in Table 3.0-1, the schedule for this program for 2022-2024 will include 5 to 10 drop structure modification projects completed per year, for a total of 21 projects completed in the PBR term.

Table 3.0-1
CORe Drop Structure Modifications Schedule
(2022-2024)

		A **2022**	B **2023**	C **2024**	D **Total**
1	# Drop Structure Modifications With Access	4	8	5	17
2	# Drop Structure Modifications Without Access	1	2	1	4
3	**Total**	**5**	**10**	**6**	**21**

14. Table 3.0-2 provides the annual schedule for the Drop Structure Modification Program for the 2022-2024 PBR term.

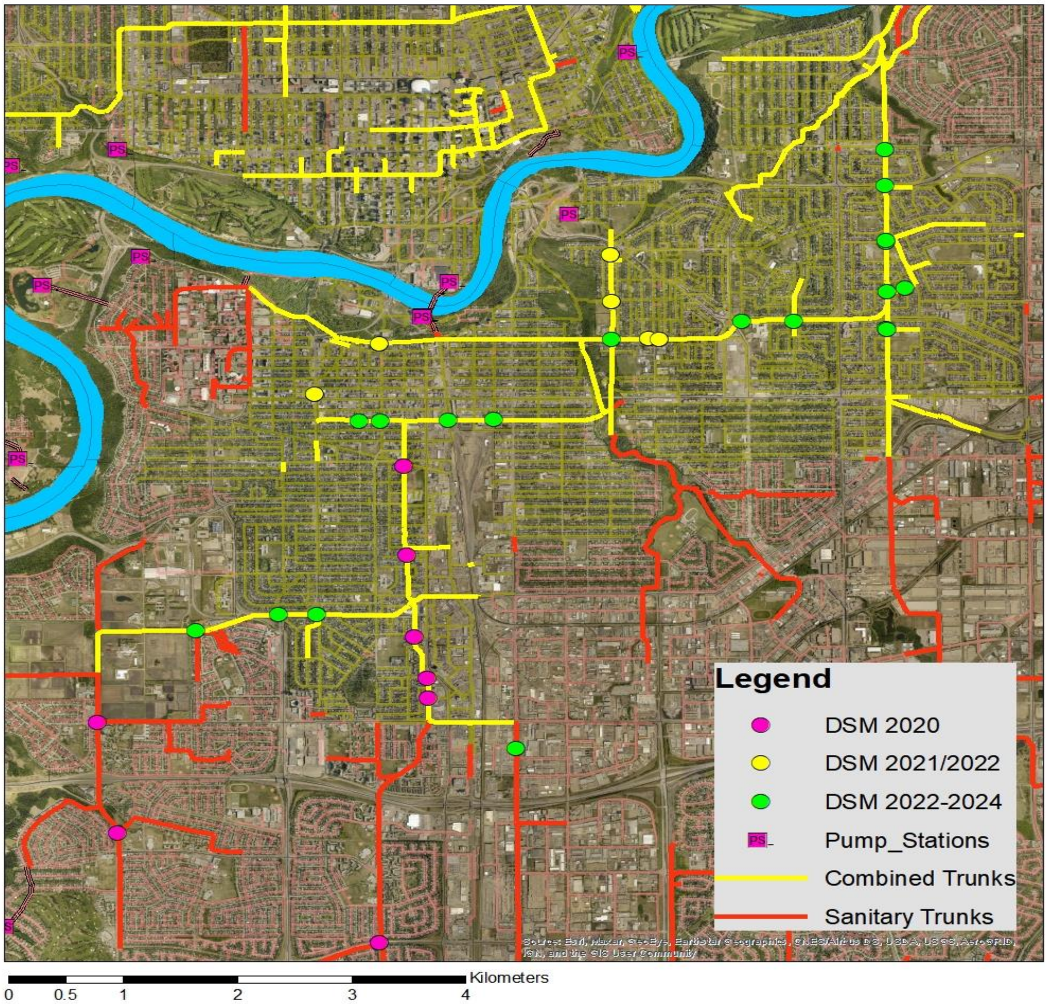
Table 3.0-2
Drop Structure Modification Program Schedule
(2022-2024)

Project Phases	A **2021** **Q4**	B **2022** **Q1**	C **2022** **Q2**	D **2022** **Q3**	E **2022** **Q4**	F **2023** **Q1**	G **2023** **Q2**	H **2023** **Q3**	I **2023** **Q4**	J **2024** **Q1**	K **2024** **Q2**	L **2024** **Q3**	M **2024** **Q4**
1 Initiation and Approvals	α			β				μ					
2 CCTV & Design	α	α	α	α	β	β	β	β	μ	μ	μ	μ	
3 Procurement		α	α	α	α	β	β	β	β	μ	μ	μ	
4 Construction		α	α	α	α	β	β	β	β	μ	μ	μ	μ
5 Commissioning			α	α	α	β	β	β	β	μ	μ	μ	μ
6 Close-out			α	α	α	β	β	β	β	μ	μ	μ	μ

α: Projects initiated for 2022.
β: Projects initiated for 2023.
μ: Projects initiated for 2024.

15. The tentative locations of the drop structure modification projects are identified by the green circles in Figure 3.0-1 below. The yellow and pink circles identify locations that are being completed by 2021.

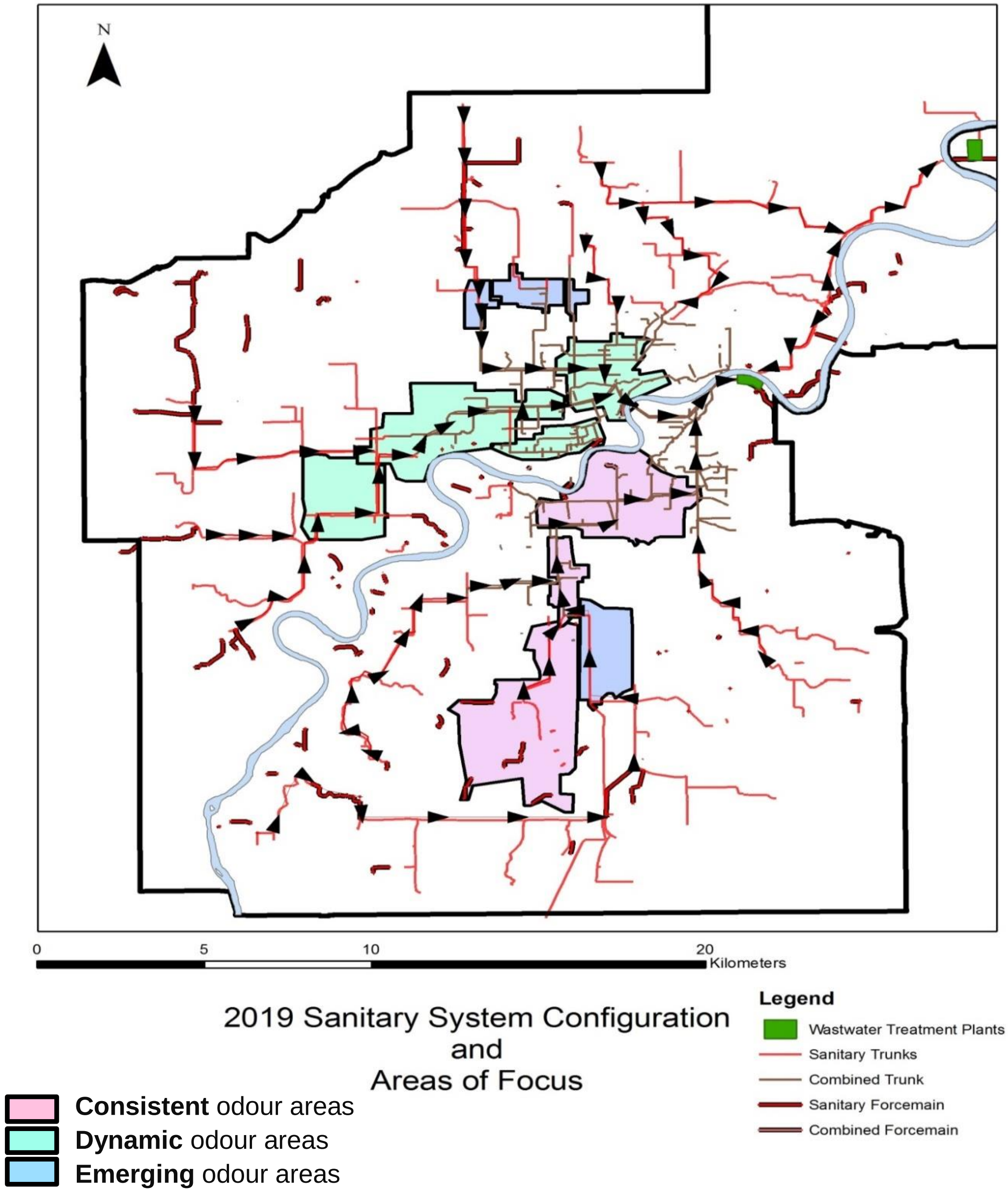
Figure 3.0-1
Drop Structure Modification Program Current Projects and Future Candidates (2022-2024)



Candidate
Drop Shaft Modification Projects

16. The selected locations will target the consistent odour area in the City as shown in Figure 3.0-2 and will benefit neighbourhoods such as Boonie Doon and Strathcona.

Figure 3.0-2
Edmonton Sanitary System
Odour Areas of Focus



4.0 ALTERNATIVES ANALYSIS

17. A number of alternative approaches have been considered in lieu of modifying drop structures. The purpose of modifying drop structures is to reduce odours from leaving the sewer

system by decreasing trunk line air pressure in the sewer headspace. However, reducing odour emissions can also be accomplished through: i) containment; ii) forced removal; or iii) source treatment.

18. Containment has proven to be a viable and versatile mitigation approach for small local applications but does not scale up effectively and may increase corrosion risks. It becomes prohibitively expensive if used as a primary odour control approach. Using containment structures, such as one-way flaps, air curtains and manhole seals has a much smaller benefit area and often still requires accompanying drop structure modifications in order to mitigate sewer odours without increasing the risk of transferring the odour and corrosion issues to another area in the sewer network. Therefore this method is not a viable alternative for drop structure modifications on its own and several air containment structures are being deployed selectively across the sewer system, often in close proximity to proposed drop structure modification locations.

19. The forced air removal alternative uses vent stacks or odour control facilities. Under this approach, the benefits generally do not extend beyond their immediate locality even when large volumes of air are extracted. These type of facilities require high initial investment for construction, high cost of operation and maintenance and have had larger spatial foot-prints in the past. These facilities also have poor performance in combined sewer systems like those in Bonnie Doon and Strathcona. Therefore this method is not a viable alternative for drop structure modifications.

20. Source treatment is a very effective alternative and one that is being pursued heavily in CORe using the pump station treatment/optimization and trunk line cleaning programs. However, in several communities fully treating odour at every odour generating point source has been determined to be cost prohibitive. While the main point sources of sewer odors are being targeted for treatment across the city, drop structure modifications and other forms of ventilation control remain cost competitive in sections of the sewer network with many small, distributed, point sources of sewer odour as well as in areas where the volume of waste water carried by the sewer infrastructure makes treatment by chemical injection cost prohibitive or technically untenable.

21. On a project by project basis, drop structure modifications are deemed non-viable when there are too many utility conflicts near original drop structure or when construction cannot be completed in a manner that is not too disruptive to local traffic.

5.0 COST FORECAST

22. Costs are estimated based on on-going projects of a similar type and scope. Currently 6 drop shaft modifications are at various stages of design and construction across the city as part of the 2019 and 2020 CORe Drop Shaft Modification Program. Of those, 4 are drop shaft modifications with access provisions and two are being constructed without access provisions. All of the projects are being constructed using internal resources. The construction costs of two drop shaft modification structures in the Jasper Place community in 2014/2015 were also considered when developing costing.

23. The following assumptions were made in this cost estimate:

- Construction shaft depths are between 25 to 35 meters.
- Sufficient space is available for construction equipment.
- Shafts are constructed using in house resources.
- The roads have moderate to heavy traffic requiring active traffic control provisions.
- The target trunk line requires only standard structural strengthening to support a re-circulation shaft.
- Geotechnical investigations will be completed by external resources.
- Contingency.

24. In the CORe strategy, drop structure modification projects were estimated to have a project cost of approximately $2.2 million each. However, due to efficiencies realized by utilizing internal resources, actual project costs have been much lower. For constructing sewer shafts to similar depths as the candidate locations in the 2022-2024 drop structure program, the anticipated cost per location is approximately $1.3 million each. The yearly budgeted forecast has been decreased to reflect the lower costs realized by pivoting from external construction.

25. The program cost estimates for the 2022-2024 PBR term are shown in Table 5.0-1.

Table 5.0-1
CORe Drop Structure Modifications Program
Capital Expenditure Forecast
(2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs:				
1	Contractors	2.65	3.19	2.04	7.88
2	Internal Labour	2.54	2.92	2.70	8.16
3	Vehicles and Equipment	0.48	0.55	0.56	1.58
4	Contingency	0.00	1.61	1.08	2.69
5	**Sub-total Direct Costs**	**5.66**	**8.26**	**6.38**	**20.31**
6	Capital Overhead and AFUDC	0.44	0.66	0.59	1.68
7	**Total Capital Expenditures**	**6.10**	**8.92**	**6.97**	**21.99**

26. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed using in house construction resources who are skilled and experienced in the construction of these asset types
- EWSI uses standard designs to expedite the design phase. Pre-planning of shaft locations minimizes the cost by avoiding utilities (above and below ground), assessing ground conditions to optimize construction methods and ensuring adequate space for materials, equipment and safe operation.
- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place. The use of external contractors is being limited to geotechnical assessments and in scenarios where internal resources are not available due to emergency interventions.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.

- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

27. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	**Health and Safety Risk** - This project requires heavy construction activities that include, excavations, crane use, confined space entry and working in high traffic areas.	The construction team will follow EPCORs best practices for ground disturbances and follow all safety procedures and plans. External contractors will be expected to submit safety plans the meet or exceed EPCOR health, safety and environment (HSE) requirements prior to commencing any work.
2	**Risk of Customer Disruptions** - During construction, the projects can have an impact on the neighbourhood by causing disruptions to traffic, releasing sewer gasses and making noise.	Activities should be scheduled to minimize all impacts and work may need to be adapted if unexpected conditions occur that can worsen impacts on neighbours and residents. Design must ensure manhole are designed to not act as egress points for odour, and the project must monitor upstream and downstream impacts.
3	**Financial Risk** - Unknown geotechnical conditions, utility conflicts and poor trunk condition can increase the project cost.	The design team will conduct desktop geotechnical studies during design stage and commit to appropriate redesigns in advance when adverse geotechnical condition are anticipated. In the event of poor structural integrity of the trunk, additional project funding has been assigned to allow for moderate structural rehabilitation and support for the interface between the trunk and the new manhole. The project will obtain information on all utilities during design stage and conduct hydrovac exposure to confirm the location of utilities.

Appendix H4

EPCOR WATER SERVICES INC.

Drainage Services
CORe Duggan Tunnel Project
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. The Duggan Tunnel is a key project proposed under EWSI’s Corrosion and Odour Mitigation (CORe) Strategy. The CORe Strategy proposes to reduce the odour impact both in Duggan and the downstream communities through operational changes and active odour treatment of the wastewater. One of the key strategies is to limit the release of hydrogen sulfide gas (H_2S gas) and reduce the pressurization within the Duggan Tunnel through structural upgrades to the sewer.

2. The Duggan Tunnel Project is essential for addressing sewer corrosion and odour issues in the Steinhauer-Duggan area. The Steinhauer-Duggan sewer corridor is an area that suffers from chronic, intense sewer odours and rapid asset corrosion. The area has accounted for one out of every ten sewer odour complaints received in the City of Edmonton over the past 20 years. The issues are attributed to the premature corrosion of downstream sewers. The odour complaints center on a single common sewer asset, the Duggan deep sanitary/combined sewer trunk (the “Duggan Tunnel”). The sewer’s design and operation create ideal conditions for both, the creation of gases causing odours, and for allowing the release of sewer air into the Duggan Tunnel surrounding communities.

3. The creation of sewer odour within the Steinhauer-Duggan sewer corridor also has severe impacts on downstream communities as the corridor discharges septic and odour laden wastewater into the communities of Allendale and Bonnie Doon. The H_2S gas produced in the Duggan Tunnel has significantly contributed to the observed concrete corrosion of sewer crowns and manholes shafts in the downstream drainage network. The corrosion has been sufficiently advanced in many locations to necessitate a number of planned and emergency rehabilitation projects. The proposed upgrades will address the sewer odour in this area and greatly reduce downstream sewer corrosion.

4. The Duggan Tunnel Project includes the abandonment of the existing Duggan Tunnel and Duggan Pump Station and the construction of a new, shallower sewer trunk. The proposed new sewer will create a gravity-flow system that eliminates the need to operate the existing Duggan pump station. The Duggan Tunnel Project was initiated in 2019 to provide timely odour mitigation in the community. Construction start is planned for late 2021, and the project is expected to be completed and placed in service in mid-2025. Total capital expenditures for this project are forecast at $85.89 million.

5. The CORe Duggan Tunnel Project will address health and safety risks associated with H_2S gas along the Steinhauer-Duggan sanitary service area. It will also mitigate the risks of customer service disruptions from the existing tunnel failure that could affect residents in multiple neighbourhoods for months. Financial risks associated with costly emergency repairs or replacement from tunnel or pump station failures, as well as potential environmental risks associated with sewer and pump station deterioration, will also be addressed.

6. EWSI conducted an alternative analysis comparing this project with other odour containment options. Following the financial and risk analysis of the alternatives, this tunnel bypass solution is recommended. Although this project is not included in EWSI's revenue requirement for sanitary utility until the project goes into service in 2025, this business case is provided in the Application because of the significant capital expenditures that will be incurred in the 2022-2024 period.

2.0 BACKGROUND AND JUSTIFICATION

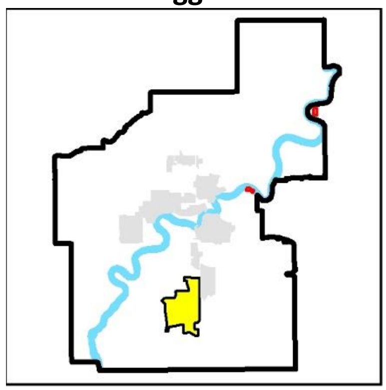
7. EWSI initiated the Corrosion and Odour Reduction (CORe) Strategy in 2019 to understand, mitigate and prevent sewer odour issues across the city of Edmonton using a combination of capital and operational interventions. The CORe Strategy focuses on preventing the formation of H_2S gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Under CORe, EWSI segregates the City into regions with consistent odour issues, those with dynamic odour issues, and those with emerging odour issues. Different approaches have been proposed for each region to ensure that causes of the odour are fully understood and to ensure that capital projects will provide sustainable relief. The capital projects and operating activities in CORe can be classified into four themes of investment: PREVENT, OPTIMIZE, MONITOR and CONTROL. The CORe Duggan Tunnel Project is a critical component of the CORe Strategy under the PREVENT theme.

8. The CORe Strategy places significant emphasis on consistent odour areas due to the impact on customers and communities to provide rapid relief within these service areas. Since significant research and analysis has already been completed in these areas, the capital projects and operating activities required to address corrosion and odour issues are well understood. The CORe strategy identified Steinhauer–Duggan Sanitary Service area as a consistent odour area. Steinhauer-Duggan is the first sanitary service area to be targeted under the CORe Strategy.

9. The Steinhauer–Duggan sanitary service area (shown in Figure 2.0-1) is located in south-west Edmonton, has a 14.5 hectare service area and serves more than 7,500 customers.

Communities within the Steinhauer-Duggan sewer corridor include Bearspaw, Blackburne, Blue Quill, Calgary Trail South, Duggan, Ermineskin, Keheewin, Rideau Park, Skyrattler, Steinhauer, Sweet Grass and Twin Brooks.

Figure 2.0-1
Steinhaurer – Duggan Sewer Corridor



10. The Steinhauer-Duggan sanitary service area suffers from chronic and intense sewer odours. The area has accounted for 1 out of every 10 of the sewer odour complaints received in the City of Edmonton over the past 20 years. The odour complaints center on a single common sewer asset, the Duggan Tunnel. The design and operation of the Duggan Tunnel creates conditions that are ideal for both the creation of sewer odours as well promoting their release into the communities surrounding the tunnel. The sewer odours within the Steinhauer-Duggan sanitary service area also has severe impacts in downstream communities as the corridor discharges septic and odour laden wastewater into the communities of Allendale and Bonnie Doon.

11. The CORe Strategy determined that odour issues along the length of the tunnel are caused by multiple compounding structural and operational issues:

- The presence of three major upstream pump stations which contribute septic wastewater into the system.
- A major 35 meter vertical drop structure on Saddleback Road and 111 Street NW that agitates the wastewater significantly, causing the localized release of H_2S gas.
- The Duggan Pump Station at the terminus of the Duggan Tunnel which causes wastewater to stagnate and limits air flow in the sanitary system causing odorous air discharges to occur upstream of the pump station and contributes septic wastewater downstream of the Duggan Pump Station.

12. The CORe Duggan Tunnel Project will address a number of risks:

- **Health & Safety Risks** – The odours can impact quality of life for nearby residents. The Duggan Tunnel Project will eliminate the main source of H_2S gas creation along the Steinhauer Duggan area.
- **Risk of Customer Service Disruptions** - High concentrations of H_2S gas causes concrete corrosion and can lead to reduced asset service life or unexpected asset failures. There is a high risk of structural failure in the tunnel that could result in service interruption affecting a significant part of Edmonton for a few weeks or multiple neighbourhoods for a few months. The proposed Duggan Tunnel project will lower the risks of sewer tunnel and pump station failures and service interruptions.
- **Financial Risks** – The potential of Duggan Tunnel and Duggan Pump Station failure could result in more costly emergency replacement. The proposed bypass tunnel and Duggan Pump Station abandonment will lower the risks of sewer tunnel and pump station failure and, therefore, reduce the emergency replacement costs.
- **Environmental Risks** - Risk of sewage leakage and spills associated with Duggan Tunnel and pump station failure can result in violation of environmental compliance and potential fines. Replacing the Duggan Tunnel and Duggan Pump Station will lower the risks of Duggan Tunnel and pump station failure.

The Duggan Tunnel Line

13. The Duggan Tunnel begins at Saddleback Road and 111 Street NW with a 35 meter vertical drop structure where wastewater falls from three incoming community sewers into the deeper Duggan Tunnel. The wastewater then travels through a 1,500 mm diameter sewer tunnel for 1,620 meters and then enters a smaller 1,200 mm diameter sewer for the remaining 1,390 meters. The entire tunnel is 3,212 meters long. There are five locations along the Duggan Tunnel line with service tie-ins, all of them are along 106th Street between 34th Avenue and 43rd Avenue.

14. The Duggan Tunnel then continues northward without any further sanitary tie-ins. Before reaching its terminus, the tunnel passes beneath multiple multi-unit residential buildings. The Duggan Tunnel terminates at the Duggan Pump Station at 45th Avenue and 105th Street. The pump station lifts the wastewater from 39 meters below grade to 21 meters below grade (18 meters). The wastewater is immediately discharged into a 1,650 mm diameter sewer main that continues into the community of Allendale. The pump station is located on 45th Avenue and 105th Street in the front drop off area for the L.Y. Cairns Public School. The pump station has

traditionally used the upstream Duggan Tunnel for wet weather storage and for wastewater storage in the winter. However, in the past 10 years, due to aging of the pump station and inadequate flow capacity, the Duggan tunnel has had to store wastewater in the Duggan Tunnel continuously. The wastewater is held in storage for so long that it becomes extremely septic and accumulates considerable volumes of solids and sediments creating sewer odours. Additionally, with the tunnel fully filled with wastewater, air that has been driven into the Dugan Tunnel by the upstream drop structures is forced to exit through the connected community sewers ultimately driving sewer odours directly into the residential neighborhoods.

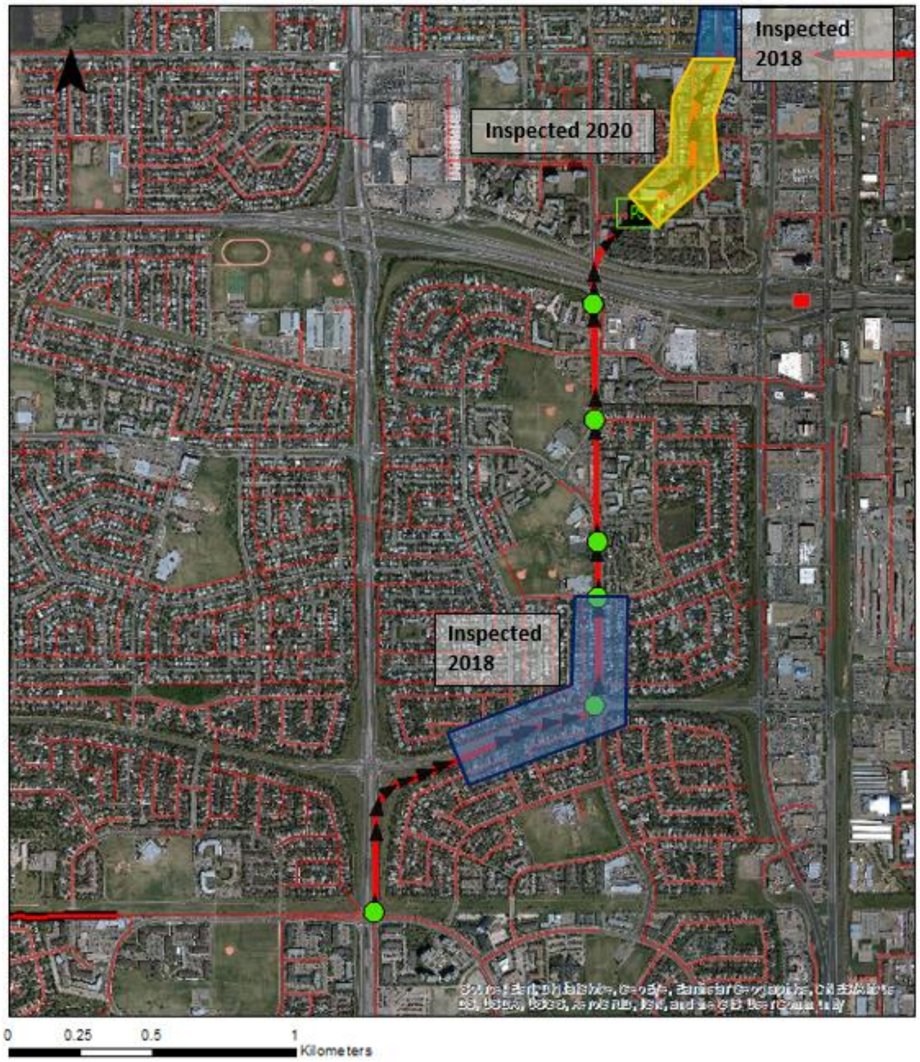
15. The specific design of the existing Duggan Tunnel is not ideal from the perspective of wastewater conveyance. At the commencement of its construction in 1970, the technology available was not sufficiently advanced to provide the tunneling capabilities required to pass through sections of sand and glacial deposits located closer to the surface. As a result, to avoid a large section of sand near Whitemud drive, the tunnel depth was increased substantially. This required the construction of the existing Duggan Pump Station to lift wastewater. Today, technology exists to tunnel through the varied geotechnical conditions present along the current tunnel alignment. The modern tunneling technology allows for a shallower tunnel depth through the sand layer to create a gravity flow system. The proposed gravity flow system would eliminate the need for large drop structures and the need of a pump station in front of L.Y. Cairns school.

16. The Duggan Tunnel has been a source of odour throughout most of its length. Odour complaints primarily center around the first drop structure and then further downstream along 106th street where there are multiple sanitary tie-ins. H_2S gas monitoring along the length of tunnel measured high concentrations H_2S gas in the air of the sewers and in manholes at multiple locations, corresponding closely with the locations with higher numbers of public odour complaints. In several locations peak H_2S gas concentrations were measured at levels that can be expected to cause major odour nuisance and cause severe sewer corrosion.

17. In 2018, EWSI inspected an 800 meter stretch of the trunk line between manholes along 34th Avenue (Figure 2.0-2). Measurements of H_2S gas were similar to those previously recording for that location and did not at any time exceed 4 ppm. The section that was inspected showed only minor corrosion and limited asset damage. Further inspection of the Duggan Tunnel, particularly in the areas with high H_2S gas, could not be completed due to insufficient access and the presence of large amounts of sediment accumulation near the north most section where the inspection was occurring. EWSI completed additional inspections in late 2018 north of 51st Avenue and in 2020 immediately north of the Duggan Pump Station and found significant

concrete corrosion that required immediate corrective action. Measured H_2S gas concentrations were in the same range as observed in manholes connected to sections of the Duggan Tunnel that were not successfully inspected indicating that there is a credible risk of severe concrete corrosion along the northern stretch of that trunk line.

Figure 2.0-2
Duggan Tunnel Configuration and Inspection Areas



The Duggan Pump Station

18. The Duggan Pump Station is recognized as one of the largest odour contributors in the sanitary network and is designated as a high risk asset by EWSI asset management system. The building of the Duggan Pump Station as seen on the surface is shown in Figure 2.0-3. The current Duggan Pump Station is required because the existing Duggan Tunnel is more than 20 meters

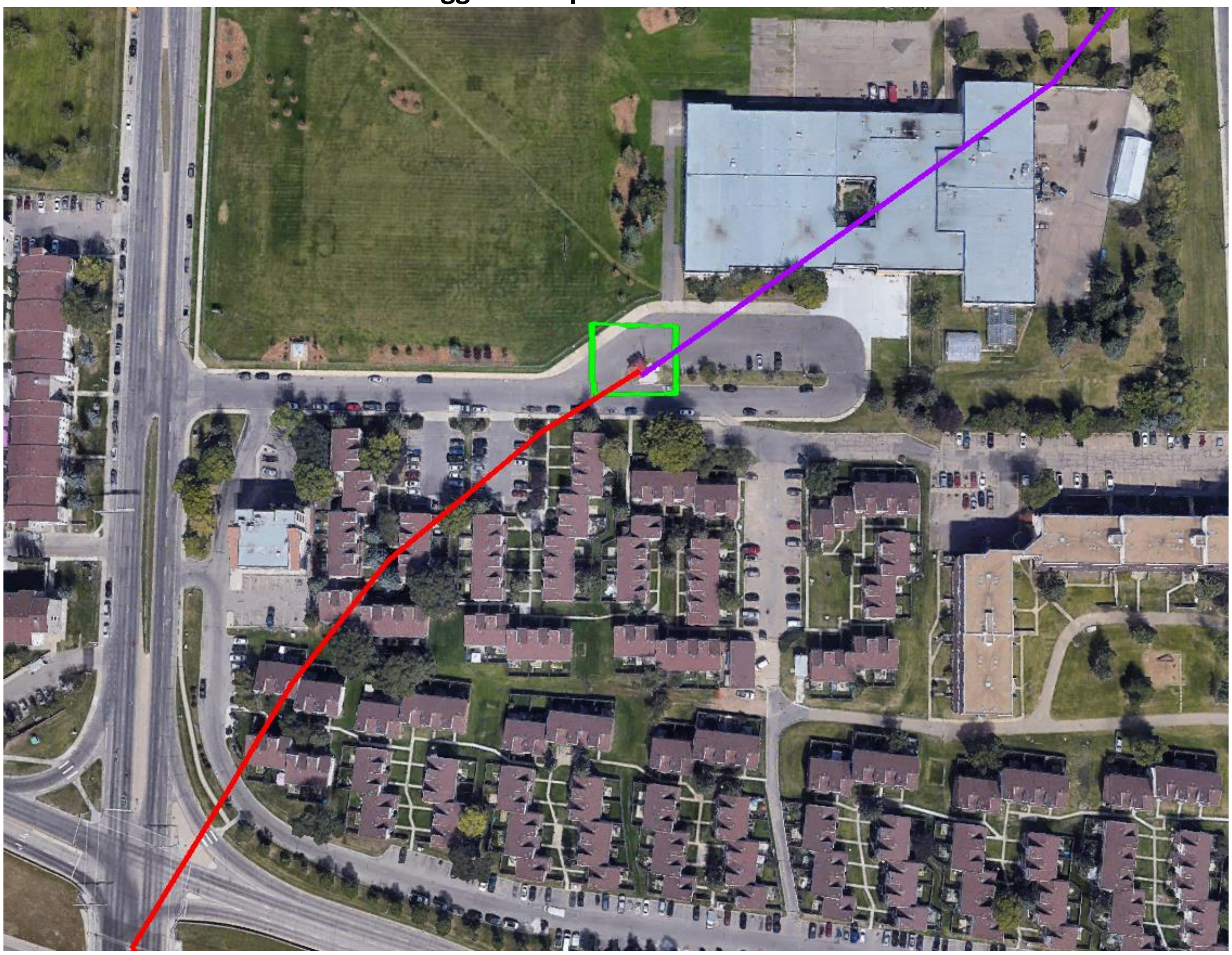
lower than the downstream sewers that receives its wastewater. The pump station's main purpose is to lift the wastewater to the higher elevation so that it can then continue to flow, naturally, towards the Gold Bar Wastewater Treatment Plant.

19. The proposed Duggan bypass tunnel will create a gravity system and eliminate the need for a pump station at this location.

Figure 2.0-3
Duggan Pump Station

20. As shown in Figure 2.0-4, the Duggan Pump Station is located in the main drop-off area south of the L.Y. Cairns School. The red and purple lines in the photo indicate the tunnel alignment.

Figure 2.0-4
Duggan Pump Station Ariel View



21. The existing Duggan Pump Station suffers from a combination of capacity limitations and aged assets that limits its ability to effectively pump wastewater. Wastewater now primarily enters the downstream tunnel by overflowing through the pump station wet well. As a result, wastewater is continuously stored in the Duggan Tunnel for a longer duration (upwards of 18 days). With such long storage times time, the amount of H_2S gas generated is significant. Based on the past dry weather flows and previous H_2S gas monitoring in that area, the pump station is likely discharging more than 2 tons of H_2S gas into the downstream sanitary network each day.

22. The immediate effect on concrete sewer infrastructure is substantial. Inspections of the Duggan Tunnel have been limited due to a lack of access along both the upper and lower sanitary reaches, however a photo taken in 2016 (refer to Figure 2.0-5) from the pump station wet well at its point of discharge showed substantial corrosion to the point of exposing rebar in the 1,650 mm tunnel roof. Further inspection in 2020 was completed after the construction of two

new access manholes. The inspection revealed that several sections of the sewer tunnel downstream of the Duggan pump station had deteriorated sufficiently to require immediate repairs.

Figure 2.0-5
Duggan Pump Station Wet Well Point of Discharge

3.0 PROJECT DESCRIPTION

23. The Duggan Tunnel project proposes to reduce the creation and release of H_2S gas along the Duggan Tunnel by eliminating the need for the sewer assets responsible for odour creation. To mitigate odours in the Steinhauer-Duggan service area, the Duggan Tunnel Project will construct a new sanitary tunnel bypass that follows the same path as the original tunnel but will be placed 20 meters higher. Raising the sewer tunnel to this higher elevation eliminates several large drops encountered by the wastewater and removes the need for a lift station permitting the permanent abandonment of the Duggan Pump Station. The removal of the pump station, in particular, will greatly reduce sewer odours by eliminating wastewater storage, wastewater stagnation and the accumulation of sediments and debris. With the elevated tunnel bypass, wastewater will flow freely and without obstruction. The proposed tunnel bypass and abandonment activities are expected to significantly reduce odour issues locally and as far downstream as Bonnie Doon. Several major structural, mechanical and capacity deficiencies are present at the Duggan Pump Station that severely limit its capacity to operate.

24. EWSI's other CORe capital programs are providing additional reductions to sewer odour nuisance in the Steinhauer Duggan area. The CORe Ventilation Program is installing air flaps and

manhole seals at locations where odours are known to escape from the sewer system in the Duggan Area. The flaps prevent sewer air from entering into community level sewers while the manhole seals prevent odours from leaving street level manholes. The devices are being installed along the length of 111th Street, 34th Avenue and 106 Street at assets that have been inspected and verified to be contributing to localized odour issues. Most of the installations were completed in early 2020 with only a few locations remaining to be addressed. The CORe Pump Station Treatment Program is investing in odour control and treatment systems at pump stations upstream of the Duggan Tunnel. These stations have been confirmed to be operating in a manner that creates sufficient H_2S gas to contribute to the odour issues experienced along the Duggan Tunnel. Through the application of operational design changes or the addition of chemical odour treatment units, the creation of H_2S gas at those locations will be significantly reduced. Odour benefits from these improvements will extend to the area served by the Duggan Tunnel. The pump station treatment projects are currently in the detailed design phase and will begin construction early 2021.

25. Replacing the Duggan Tunnel will involve the construction of the 3,400 meter long 1,500 mm pipe bypass tunnel completed by micro-tunneling. The bypass tunnel will approximately follow the same alignment as the existing Duggan tunnel. It will discharge into an existing 1,650 mm sewer at 105A Street and 45th Avenue NW just south of the L.Y. Cairns School. At its tie-in, the sewer will be 21 meters below grade. The pipe will have a steep enough slope that is more than sufficient to provide self-cleaning of the sewer tunnel and meet design standards for 1,500 mm sanitary pipe. This will ensure that sediment and debris does not accumulate in the tunnel, minimizing the need for operational intervention and cleaning in the future. The proposed bypass tunnel alignment is shown in Figure 3.0-1.

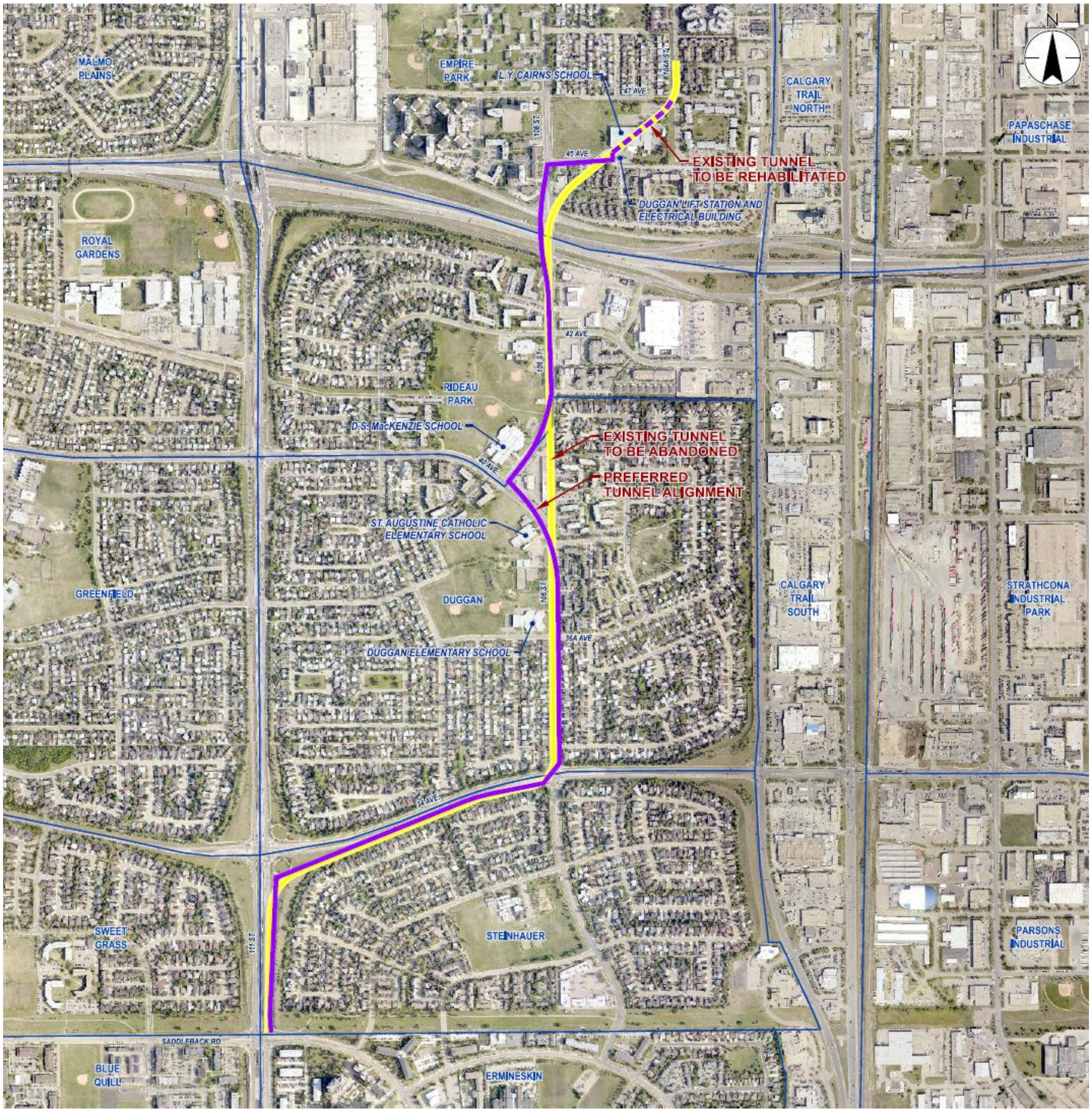
26. As part of the tunnel costing the following assets and activities were added and accounted for:

- 3,400 meter long 1,500 mm pipe bypass tunnel completed by micro-tunneling
- five 20 meter deep working shafts to permit boring machine access and alignment changes;
- eight 20 meter deep access shafts for future inspection and cleaning activities;
- installation of a corrosion resistant liner over the entire 3,212 meters of the tunnel; and
- installation of one sewer air vent to provide pressurization relief along the tunnel bypass.

27. Additionally this project includes a total of 6 tie-ins with existing sanitary assets at:

- A manhole at 106th Street and 34th Avenue
- A drill drop manhole at 106th Street and 36A Avenue
- A manhole at 106th Street and 38th Avenue
- A drill drop manhole at 106th Street and 40A Avenue
- A manhole at 106th Street just south of Whitemud Drive
- A drill drop manhole on 106th Street and 45th Avenue

Figure 3.0-1
Proposed Tunnel Alignment



28. Preliminary design and detailed geotechnical assessment began in 2019 and was completed in mid-2020. Detailed design will be completed in late 2020 to early 2021, followed by procurement with an anticipated construction start in fall 2021. The remainder of the project timeline will depend on tunneling speed and the contractor’s chosen methodology of shaft construction and tunnel construction sequence. For costing, a tunneling speed of 2 meters per day was assumed, requiring a total of 1,715 tunneling days to complete the full 3,400 meters of

proposed tunnel. Based on the assumed tunneling rate and no more than 350 tunneling days per year, EWSI anticipates that the tunnel component will be completed mid to late 2025.

29. The bypass tunnel will be constructed with a corrosion resistant material or a corrosion resistant liner. The ventilation unit can be installed prior to the completion of the tunnel, particularly if its installation can be used to depressurize the existing Duggan tunnel until construction of the new tunnel is completed. Access shafts and working shaft placement will depend on the contractor's construction technology and sequencing strategy.

30. Table 3.0-1 provides the Duggan Tunnel Project Schedule.

Table 3.0-1
Duggan Tunnel
Project Schedule

	Activity	A **2020**	B **2021**	C **2022**	D **2023**	E **2024**	F **2025**	G **2026**
1	Preliminary Design and Geotechnical Investigation	X						
2	Detailed Design	X	X					
3	Procurement		X					
4	Construction		X	X	X	X	X	X
5	Commissioning							X

4.0 ALTERNATIVES ANALYSIS

31. EWSI investigated three solution pathways to mitigate sewer odour at the Duggan Tunnel for both local and downstream benefits.

- **Alternative 1, the Tunnel Bypass Solution:** involves completely replacing the Duggan Tunnel with a new, elevated tunnel, and abandoning the existing pump station.
- **Alternative 2, the Active Treatment Solution:** involves installing odour containment, control and treatment infrastructure along the existing tunnel along with odour control through long-term operational management (Air extraction and treatment facilities, modifying drop structures, sewer vents, manhole seals, a new higher capacity pump station).
- **Alterative 3 New Pump Station and Bypass:** Involves constructing a new pump station at 111 Street and 29A Avenue and bypassing the existing deep tunnel with a shallow force main. Alternative 3 was rejected prior to proceeding to a detailed financial analysis due to early indications that it will substantially increase project capital costs

and annual operating costs while not providing the same level of service as the other two solutions.

32. Alternative 1 -Tunnel Bypass Solution and Alternative 2- The Active Treatment Solution provide similar reductions to odour intensity surrounding the Duggan Tunnel. Additionally, both of the proposed alternatives are expected to significantly decrease the prevalence of sewer odours in Allendale and are expected to have beneficial impacts as far away as Bonnie Doon, however the tunnel bypass solution is expected to result in greater reductions to downstream odour and corrosion overall.

Alternative 2 - Active Treatment Solution

33. This solution proposes the addition of several assets to decrease H_2S gas creation and control the release of sewer air in the community. It consists of the following:

- Modifications to the drop structures to reduce air circulation. These asset modifications have been deployed in the City previously. The modifications to the drop structure reduce the amount of air that is pumped into the lower tunnel as water falls through the drop. Without the modifications to the drops, the air is often released in large quantities from downstream manholes and household sewer vents and can cause odour problems across the entire community.
- The construction of an odour control unit (OCU) directly attached to the Duggan Tunnel at 34th Avenue and 111th street. The OCU uses high capacity air extraction fans to withdraw sewer air from the tunnel and then passes the air through an air treatment system before discharging the air into the atmosphere. The OCU will further reduce the sewer headspace pressure as well as remove H_2S gas and other sewer odours from the tunnel.
- The abandonment of Duggan Pump Station and construction of a new higher capacity pump station. The station will not include a chemical treatment system for odour control as it has been determined to be cost prohibitive. Instead the new pump station will reduce odour by greatly decreasing wastewater retention time as a result of its increased capacity. Unlike the tunnel bypass solution, the need for a pump station will remain necessary in this alternative because the wastewater will still need to be lifted up 20 meters in order to enter the higher, downstream sewer network. Identified structural, mechanical and capacity limitations require that a new pump station will need to be constructed if the need to lift the wastewater remains.

- The rehabilitation of at least 1.5 Km of the Duggan Tunnel upstream of the Duggan pump station. This will include repairs to the structure of the sewer, construction of additional access manholes and lining the tunnel with a corrosion resistant liner or sealant.
- The sealing of several manholes and isolation of all incoming sewer pipes from the air in the deep tunnel using sealing caps and one-way flaps.

4.1 Performance Analysis of Alternatives

34. EWSI has evaluated the expected performance of the two alternatives and have determined that in most cases both alternatives perform similarly in terms of odour reductions locally and downstream (both options decrease odour at locations where wastewater is dropped into the main Duggan tunnel). However, there are a few additional benefits realized from the tunnel bypass solution:

- Because the Tunnel Bypass Solution greatly reduces the size of the drops or removes them entirely, less H_2S gas is expected to be present in the headspace of the sewer immediately adjacent to the drops. This is expected to reduce localized sewer corrosion even further.
- While the Active Treatment Solution alternative will significantly reduce wastewater storage times in the Duggan Tunnel by building a larger capacity pump station, some storage will still be necessary and this will ultimately produce some septic conditions.
- The Tunnel Bypass Solution removes the need for any impediments to flow and so is very unlikely to develop septic wastewater. It is likely that the fresher wastewater will be less likely to contribute to odour issues further downstream as a result.
- The Tunnel Bypass Solution is significantly less likely to accumulate sediment and debris accumulations. If a pump station is maintained, sediment will accumulate in the storage areas and require regular cleaning in order to not become an odour and corrosion issue.

4.2 Financial Analysis of Alternatives

35. EWSI evaluated the cost of Alternative 1 and 2 on a net present value (NPV) basis. EWSI calculated the NPV of the revenue requirement associated with these two alternatives for the expected tunnel bypass service life of 75 years. EWSI assumed a discount rate of 6.17% and annual inflation rate of 2%. Tables 4.2-1 and 4.2-2 summarize the results of this analysis. The

net present value of the cost to ratepayers (total revenue requirement) is $67.7 million for the Tunnel Bypass alternative compared to $81.1 million for the Active Treatment Solution. Although the Tunnel Bypass Solution has a higher initial capital expenditure, the Active Treatment Solution has higher ongoing operational costs which offset the benefit of lower capital expenditures. Based on both the financial and qualitative considerations, EWSI selected the Tunnel Bypass as the proposed alternative.

Table 4.2-1
NPV of Revenue Requirement
Alternative 1 - Tunnel Bypass Solution
($ millions)

		A	B	C	D	E	F	G	H	I	J
		NPV	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	**Terminal Value**
1	Operating Expenses	$0.91	$0.13	$0.01	$0.02	$0.02	$0.03	$0.03	$0.04	$0.05	
2	Depreciation	$13.20	$0.00	$1.15	$1.15	$1.15	$1.15	$1.15	$1.15	$1.15	
3	Cost of Debt	$16.96	$0.00	$1.74	$1.49	$1.24	$0.99	$0.75	$0.50	$0.25	
4	Return on Equity	$31.24	$0.00	$3.21	$2.75	$2.29	$1.83	$1.37	$0.92	$0.46	
5	Franchise Fees	$5.42	$0.01	$0.53	$0.47	$0.41	$0.35	$0.29	$0.23	$0.17	
6	Terminal Value	$0.01	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$1.15
7	**Revenue Requirement**	**$67.73**	**$0.14**	**$6.64**	**$5.87**	**$5.11**	**$4.35**	**$3.59**	**$2.82**	**$2.07**	

Table 4.2-2
NPV of Revenue Requirement
Alternative 2 - Active Treatment Solution
($ millions)

		A	B	C	D	E	F	G	H	I	J
		NPV	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	**Terminal Value**
1	Operating Expenses	$8.91	$0.13	$0.35	$0.42	$0.51	$0.63	$0.76	$0.93	$1.13	
2	Depreciation	$19.98	$0.00	$1.42	$1.42	$1.78	$1.78	$2.05	$2.64	$2.64	
3	Cost of Debt	$15.92	$0.00	$1.36	$1.05	$1.23	$0.84	$0.90	$1.18	$0.61	
4	Return on Equity	$29.31	$0.00	$2.51	$1.94	$2.26	$1.55	$1.66	$2.18	$1.13	
5	Franchise Fees	$6.45	$0.01	$0.49	$0.42	$0.50	$0.42	$0.47	$0.60	$0.48	
6	Terminal Value	$0.53	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$64.12
7	**Revenue Requirement**	**$81.10**	**$0.14**	**$6.12**	**$5.25**	**$6.28**	**$5.21**	**$5.85**	**$7.54**	**$5.99**	

4.3 Tunnel Bypass Solution Financial Assumptions

36. The Tunnel Bypass Solution included at total of $85.9 million in capital additions being completed by 2025. A yearly operational expense of $116,200 (uninflated) is incurred until the abandonment of the Duggan Pump Station in 2026 with subsequent yearly operational expense of $12,000 (uninflated) being incurred there after. Costing for the tunnel bypass solution was first estimated through internal costing unit rates and was subsequently updated as part of the

preliminary design process completed by an external consultant. Costing for the tunnel bypass option is expanded upon in Section 5.0.

4.4 Active Treatment Solution Financial Assumptions

37. The Active Treatment Solution included a forecast of $70.6 million in capital additions. This includes: (i) rehabilitation of approximately 1.5 km of the existing deep tunnel ($18.3 million); abandonment of the Duggan pump station ($2.0 million); (iii) construction of a new pump station ($12.5 million); (iv) two drop structure modifications ($4.4 million); (v) one odour control/air extraction facility ($0.95 million); and (vi) relining of 3.1 km of the existing tunnel ($9.7 million).

38. The assumed capital costs were based on recent experience with similar projects in Edmonton. Pump station costing was updated based on the detailed costing analysis completed for the SA6 pump station and recent costing for a Buena Vista pump station replacement alternative. Drop structure modification and access manhole costing was updated based on recent costing for completed projects in the CORe strategy. Slip lining costs were updated based on experiences with the recent relining project on the South Edmonton Sanitary System Storage Tunnel. The rehabilitation costs were estimated assuming that only 50% (or 1.5 kilometers) of the existing Duggan tunnel requires rehabilitation. Costing for rehabilitation was reduced partially based on updated condition information and recent experience within CORe for costs associated with providing access provisions.

39. The cost analysis for the Active Treatment Solution excluded the potential costs of trunk replacement or rehabilitation at the current end of service date for the existing deep tunnel (2040), as the full scope of such activities could not be easily defined at this time. The costing also does not include provisions for future cleaning and removing of sediments in the Duggan Tunnel beyond 2022 as the frequency and scope of future cleaning operations has not been established. Even with these conservative assumptions, this is still the higher cost solution on a NPV basis.

40. Operating cost assumptions include $3.0 million in cleaning and inspection costs in 2022 and annual operating expenses of $278 thousand being incurred thereafter. Operating expenditures for the present and future operation of a pump station were based on the current yearly operational expense of the existing Duggan Pump Station. Operational costs for an OCU were estimated by an external consultant but based on past experience with the Kenilworth and King Edward Park OCUs. Inspection and cleaning costs were based on recent experience with tunnel cleaning operations at two locations along the North Edmonton Sanitary Storage Tunnel

where sediment accumulation is expected to be equivalent to the conditions in the Duggan Tunnel immediately upstream of the Duggan Pump Station.

4.5 Risks and Qualitative Considerations

41. For the Tunnel Bypass Alternative, risks and qualitative considerations include:

- while the wet weather storage capacity remains constant, there is an identified loss of wet weather storage control resulting from the abandonment of the Duggan Pump Station; and
- preliminary modelling indicates that the downstream impact remains manageable but there remains the risk that additional infiltration and inflow control measures, such as manhole sealing, may need to be implemented in the upstream sanitary catchment.

42. For the Active Treatment Alterative, risks and qualitative considerations include:

- risks associated with potential failure of the Duggan Tunnel or Duggan Pump Station;
- the potential for regular tunnel cleaning and sediment removal in the storage portions of the Duggan Tunnel;
- increased tunnel entry requirements;
- uncertainty in the long term viability of a new Odour Control Unit based on the historical performance of the Kenilworth and King Edward Park stations; and
- technical viability remains uncertain for rehabilitating and relining the tunnel when flow bypassing is required.

5.0 COST FORECAST

43. Total project costs are calculated based on the assumption of a bid-design-build project rollout for tunneling, tie-ins and the installation of the single odour ventilation unit. Costs for access manholes and working shaft construction were estimated assuming that in-house resource allocation is used. Table 5.0-1 provides the total forecast capital expenditures for this project.

Table 5.0-1
Duggan Tunnel Project
Capital Expenditure Forecast
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **2024**	E **Post 2024**	F **Total**
	Direct Costs						
1	Contractors	4.59	10.88	14.80	16.63	12.89	59.80
2	Internal Labour	0.29	0.14	0.14	0.14	0.12	0.83
3	Vehicles and Equipment	0.01	0.01	0.01	0.01	0.00	0.03
4	Abandonments	0.00	0.00	0.00	0.00	5.01	5.01
5	Contingency	0.07	0.00	2.72	5.83	2.26	10.89
6	Risk Allowance	0.00	0.00	0.00	0.00	0.00	0.00
7	**Sub-total Direct Costs**	4.96	11.03	17.67	22.62	20.28	**76.56**
8	Indirect Costs	0.15	0.65	1.52	2.80	4.21	9.33
9	**Total Capital Expenditures**	5.11	11.67	19.19	25.41	24.49	**85.89**

44. The capital cost estimates are based on unit rates provided by internal estimators and are as follows:

- $9,000 / meter of installed 1,500 mm tunnel installed via micro-tunneling
- $2,200 / meter of installed corrosion liner over the 3,202 meters of tunnel
- $24,000 / meter of depth for the five 20 meter deep working shafts
- $18,000 / meter of depth for the eight 20 meter deep access shafts
- $440,000 for one sewer air vent to provide pressurization relief
- $60,500 for the installation of one-way flaps and manhole sealing

45. Cost estimate unit rates are based on cost information from the City-Wide Flood Mitigation Strategy (pipes and tunnels) and the City-wide Odour Strategy. A further $400,000 has been allocated as an expenditure to support a detailed geotechnical study. The shaft installation unit costs assume labour and capital burden costs of 45% and 80% respectively. The ventilation unit cost is provided by an external estimator. The unit costs for the tunnel and liner are an estimate based on the internal expertise in the cost estimation group based on past projects. A 45% contingency has been applied. The unit rates together with the contingency costs also account for the miscellaneous works such as the tie-ins required for the new tunnel construction. It should be noted that construction costs associated with tunneling are highly volatile due the relatively small pool of contractor availability in this area, as well subject to market fluctuations influenced by the general construction activity in Alberta oil sands.

46. The project also incurs several operational expenses including tunnel and abandonment costs ($5 million), temporary pump station repairs ($0.9 million) and other costs for public consultations and odour venting. Estimated total operation expenditures by project completion are $6 million with an annual expenditure of $20,000 per year thereafter.

47. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- constructability and risk assessment to understand risks associated with tunnel construction and carry out additional due diligence such as a detailed geotechnical assessment;
- part of the tendering strategy, identify a risk allocation strategy that provides more visibility to bidders to provide competitive pricing;
- a two stage tendering process to screen and identify competent tunneling contactors;
- project management during construction to include dedicated schedule and cost control personnel; and
- a rigorous scope change process.

6.0 RISKS AND MITIGATION PLANS

48. Key risks associated with executing this project along with EWSI's mitigation plans are summarized in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	**Health & Safety Risks** - Covid 19 risks to project team and construction crews.	EWSI will develop pandemic response plan and contingency measures to minimize transmission of Covid 19 in line with ongoing Provincial /City recommendations.
2	**Customer Service Disruptions -** Traffic impacts resulting in customer complaints; the proposed tunnel pass through several schools in neighborhood with a potential to impact on school operations; and construction noise and vibration complaints along the tunnel alignment.	EWSI will design access shaft in location where traffic impact is minimized and will work with the City traffic operations and the contractor to develop traffic accommodation plans. Where possible, EWSI will avoid locating access/retrieval shafts near schools. Work with schools to identify access requirements and develop strategy to minimize disruption to school. EWSI will include noise and vibration monitoring at key locations in the contract.
3	**Financial Risks -** There is limited availability of tunneling contractors in Alberta resulting in cost escalation due to market conditions.	EWSI will ensure early engagement with potential contractors and will utilize a two stage tendering strategy to prequalify contractors.
4	**Environmental Risks** – There could be unexpected environment issues are encountered during construction at the shafts (e.g., contaminated soils). Potential sewage spill during construction and tie in.	EWSI will carry out Environmental Site Assessment and soil testing to identify potential contamination along the trunk line, design shaft locations accordingly and develop contingency plan for removal and remediation. EWSI will develop environmental management plan and commissioning plan to include spill contingency measures and bypass pumping plan as required.
5	**Execution Risks -** Changing geotechnical condition could add uncertainty to the proposed construction method. Utility conflicts resulting in construction delays and cost escalations	ESWI will conduct geotechnical investigations to confirm ground condition and engage experienced contractors for constructability review in advance. EWSI will identify utilities and carry out hydrovac excavations to confirm utility locations, design shaft structures to minimize utility conflicts and work with utility companies in advance of construction to relocate utility where required.

Appendix H5

EPCOR WATER SERVICES INC.

Drainage Services
CORe Large Trunk Rehabilitation Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. EWSI has initiated a Corrosion and Odour Reduction (CORe) Strategy that focuses on preventing the formation of hydrogen sulphide (H_2S) gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Starting with the 2022-2024 PBR, the CORe strategy also includes the rehabilitation projects required due to H_2S induced corrosion are categorized as part of CORe PREVENT programs. These rehabilitation projects are included in the CORe strategy as the large trunk rehabilitation which are required primarily to prevent further corrosion to the system and lengthen the life of the assets damaged due to the corrosive gases in the drainage system.

2. The CORe Large Trunk Rehabilitation Program focuses on the rehabilitation of large trunk sewers greater than or equal to 1,200 mm in diameter. There are approximately 630 km of sanitary, storm, and combined large trunk sewers constructed over the past 100 years to varying standards and specifications. Currently, approximately 60 km large trunk sewers are rated in poor and very poor condition.

3. There are several risks associated with the deterioration and failure of large trunks including health and safety risks to the public associated with potential subsidence on high traffic roadways (e.g., the subsidence at 109 Street and 61 Avenue found in October 2020) or structural stability issues; environmental risks associated with failures of large trunks causing sewage spills to the environment; risk of significant customer service disruptions and traffic disruptions associated with large trunk failures; and financial risks associated with costly emergency repairs. Deterioration and failure of large trunks is largely due to corrosion and, as such, this program should be a key component of EWSI's CORe Strategy. The high number of odour reports and direct measurements of sewer gas surrounding certain assets is an indicator that sewer corrosion is a major risk factor in many trunk lines.

4. Rehabilitating these trunk lines can reduce the number of odour reports from the area because the same solids build-up in the area which promoted the formation of H_2S and corroded the trunk lines is being addressed while the trunk lines are fixed. Another example is the rehabilitation work in West Jasper Place where odour concerns led to an inspection that revealed an asset failure. In fixing the corroded assets in West Jasper Place, many components of the CORe Strategy such as cleaning out the debris, adding access points, and modifying the drop structures were implemented. Therefore, adding this rehabilitation program to CORe Strategy is consistent with the objectives of the strategy.

5. The CORe Large Trunk Rehabilitation Program will focus on the rehabilitation either through relining or spot repairs of trunk lines and/or replacement of longer lengths of large trunks rated as poor and very poor. The program will contribute to an improvement in the asset conditions and a reduction in risk. For the 2022-2024 PBR term approximately 4.9 km of large trunk rehabilitation is planned. The most cost effective solution will be developed and they could include relining, lining, spot repair, full replacement or bypass tunnel. For the 2022-2024 PBR, EWSI has forecast 2.4 km of rehabilitation in place (lining, relining, spot repairs) with costs in the range of $5,000/m to $10,000/meter and 2.5 km of full replacement (or bypass tunnel) with construction costs ranging form $10,000/m to $20,000/m. Based on recent inspections, EWSI has identified trunk sewers that are prioritized for rehabilitation or replacement during 2022-2024. These trunk sewers are described in detail below. The scope of work under this program includes inspection, rehabilitation or replacement of large trunk sewers.

6. The CORe Large Trunk Rehabilitation Program is a new program which will be initiated in 2022 which is categorized as reliability / life cycle replacement and is a key component of CORe Strategy. Prior to initiating this program, the large trunk rehabilitation works were conducted as discrete projects as needed. The total spending on the discrete large trunk rehabilitation projects from 2018 to 2020 was approximately $69.8 million which includes approximately $12 million in unplanned large trunk failures.

7. As EWSI continues to install access manholes as another component of the CORe strategy (through the CORe Access Manholes Program), it expects to be able to identify additional large trunks requiring immediate rehabilitation work at critical locations. EWSI has forecast total program capital expenditures during 2022-2024 at $79.0 million. This includes both new projects in the program and completion of some discrete large trunk rehabilitation projects which extend to the 2022-2024 PBR term. This reflects an increase in average annual spending on the large trunk rehabilitation works from $23.3 million per year to $26.3 million per year. The increase is required to mitigate the increased risk of failure of large trunks due to corrosion and deterioration.

2.0 BACKGROUND/JUSTIFICATION

8. EWSI initiated the CORe Strategy in 2019 to understand, mitigate and prevent sewer corrosion and odour issues across the City of Edmonton using a combination of capital and operational interventions. The CORe Strategy focuses on preventing the formation of H_2S gas, which will reduce community odour impacts and lengthen the life of sewer network assets. Under CORe, EWSI segregates the City into regions with consistent odour issues, those with dynamic odour issues, and those with emerging odour issues. Different approaches have been proposed for each region to ensure that causes of the odour are fully understood and to ensure that capital projects will provide sustainable relief. The capital projects and operating activities in CORe can be classified into four themes of investment: PREVENT, OPTIMIZE, MONITOR and CONTROL.

9. The Large Trunk Rehabilitation Program is a critical component of the CORe Strategy under the PREVENT theme. The CORe Large Trunk Rehabilitation Program focuses on the rehabilitation of large trunk sewers greater than or equal to 1,200 mm in diameter. There are approximately 630 km of sanitary, storm, and combined large trunk sewers constructed over the past 100 years to varying standards and specifications. The average ages for sanitary, storm and combined trunk sewers are 35, 38 and 62 years, respectively. Some of the trunk sewers are close to or beyond their design life of 75 years. H_2S induced corrosion has also caused trunk premature deterioration. Currently, approximately 60 km large trunk sewers are rated in poor and very poor condition. The definition of poor and very poor condition is as follows:

- **Poor condition** – major deterioration evident, extensive ongoing maintenance and/or operational "prop up" actions are required to keep the element operational.
- **Very poor condition** – element deteriorated to such an extent that it is generally inoperable or unsafe, history of failures, immediate need to replace most or all of the element.

10. According to the current system wide deterioration model, the large trunk sewers in poor and very poor conditions have an estimated replacement cost of $520 million. With the aging and deterioration of large trunk sewers, the risk of failure and collapse of these sewers will continue to increase. The subsidence at 109 Street and 61 Avenue and the subsidence at Whitemud Drive and 170 Street found recently are the result of the large trunk failure due to H_2S corrosion deterioration. Not completing the rehabilitation for the large trunks in poor or very poor condition could result in unexpected large trunk failures that have potential to affect large

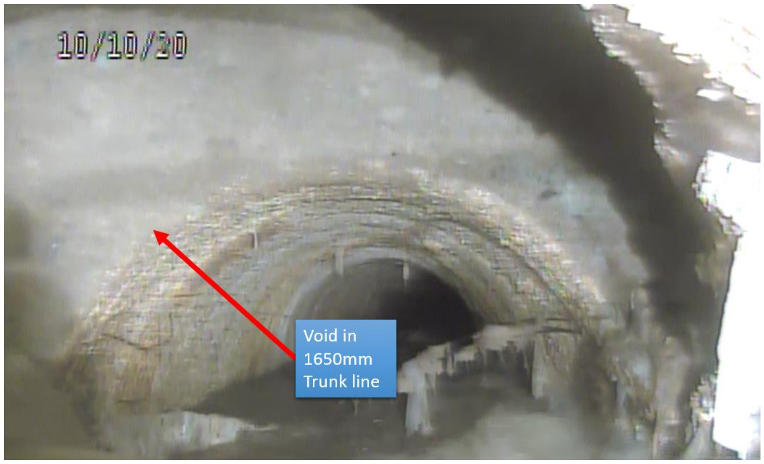
service areas and population. There are several risks associated with the deterioration and failure of large trunks:

- **Health and Safety Risk** – Failure of a large trunk could cause a subsidence on high traffic roadways or structural stability issues for infrastructures which poses a safety risk to the public. Figures 2.0-1, 2.0-2 and 2.0-3 show examples of severe deterioration and voids inside the 61 avenue trunk line which caused roadway subsidence. Replacing or rehabilitating pipe, manhole and chamber will extend the life of the trunk and lower the risks of trunk failure.

Figure 2.0-1
Severe Deterioration of 61 Avenue Trunk

Figure 2.0-2
Severe Deterioration of 61 Avenue Trunk

Figure 2.0-3
Void Inside 61 Avenue Trunk



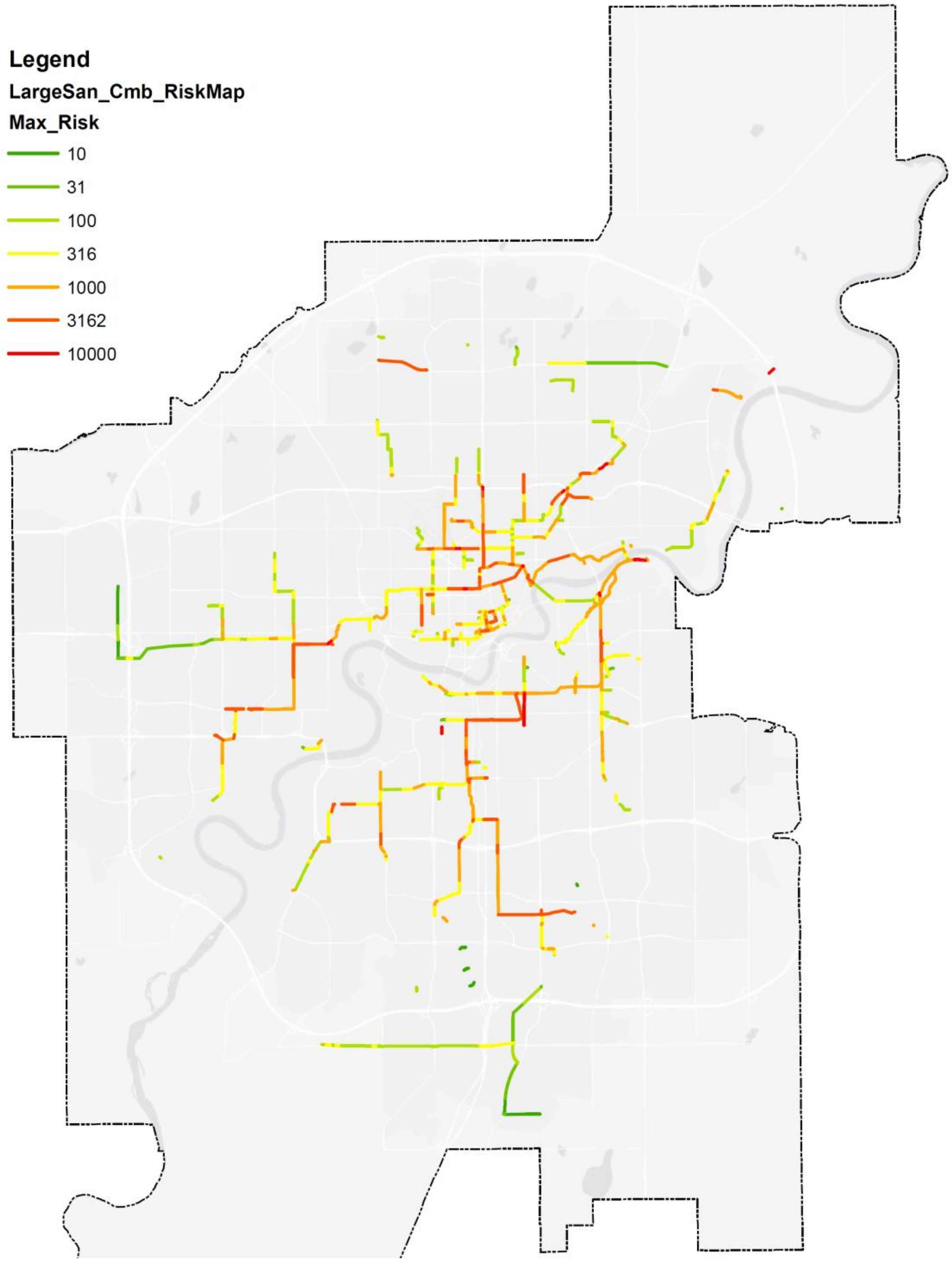
- **Environmental Risk** – Failure of a sanitary or combined large trunk could cause a sewage spill to environment or water bodies (river, creeks, storm water management facilities, etc.) and potential fines. Replacing or rehabilitating pipe, manhole and chamber will extend the life of the trunk and lower the risks of failure.
- **Customer Disruption Risk** – Failure of large trunks can cause disruption to large service areas impacting many customers and businesses for a few weeks or months and can cause sewer backups into customer's basements. Failed trunks also lead to emergency repairs which are more disruptive to high traffic roadways and therefore to the public. The odour reports and direct measurements of sewer gas surrounding certain assets is an indicator that sewer corrosion is a major risk factor in many trunk lines. Finding the affected trunk lines and implementing appropriate trunk rehabilitation will lower the risks of trunk failure and service interruption.
- **Financial Risk –** Emergency repairs of failed large trunks are more costly. Depending on the location and consequence of the failure, it could cost $1 million more to repair a failed trunk than repairing the trunk through more proactive rehabilitation. The proposed large trunk rehabilitation will lower the risks of trunk failure and, therefore, reduce the emergency replacement costs.

11. As the large trunk's conditions deteriorate it is important to prioritize inspections and rehabilitation works to deal with structural condition issues of large trunks and to mitigate the risks identified above. The CORe Large Trunk Rehabilitation Program aims to improve the conditions of the asset, which will therefore reduce the risk of failure for these assets. This program supports EWSI's asset management objectives by identifying emerging asset risks,

managing them appropriately, and reducing risk exposure. Risk prioritization will be used to prioritize trunk lines for inspection and for completion of the required rehabilitation work based on different perspectives including health and safety, environment, social impacts and financial.

12. EWSI has recently developed risk ranking for large trunk sewers based on their likelihood and consequence of failure. Figure 2.0-4 shows the risk ranking of the sanitary and combined trunks. The risk of each trunk was ranked based on the impacts on Health and Safety, Environmental, Regulatory, Customer Servicing, and Financial aspects in addition to the risk of trunk line failures.

Figure 2.0-4
Large Trunk Risk Ranking



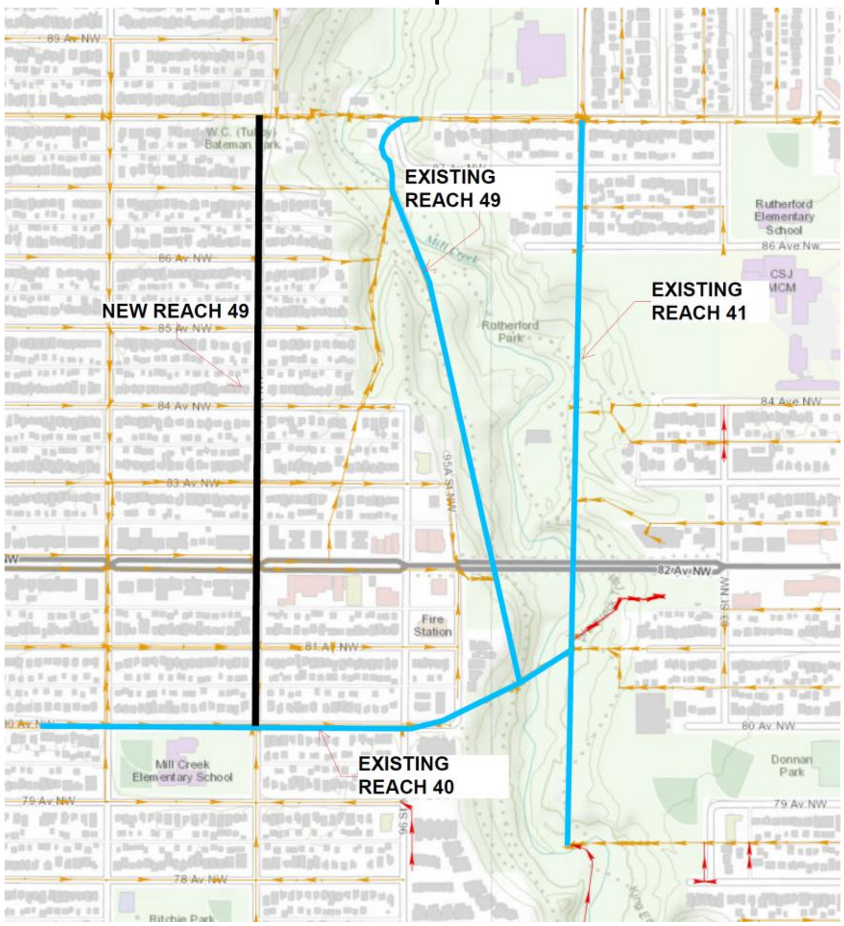
13. Through this program the following large trunk rehabilitation projects have been identified as the priority projects during the 2022-2024 PBR term. The CORe Duggan Tunnel Project is submitted as a separate business case as it was identified in the original CORe business

case focused on the priority odour area and is a new bypass tunnel project as opposed to rehabilitation of the existing deep trunk tunnel.

2.1 Mill Creek Combined Trunk Reach 49 Replacement

14. Reach 49 (built in 1960) provides drainage service to an area of Edmonton over 8,000 Ha in South Edmonton affecting a population of 300,000. The trunk reach is 800 m long 1,200 mm diameter combined bypass trunk in Mill Creek Ravine running from 80 Avenue to 88 Avenue. The trunk is in an environmentally sensitive area and contributes to the odour issues seen in this region due to its configuration with the adjacent trunk lines. Due to location there are limitations in the ability to complete full rehabilitation in its current alignment. It is proposed to build a new trunk along 97 Street and convert the existing Reach 49 to a local sewer trunk for the neighbourhood immediately to the west of the pipe. The portion of trunk line between this new location and Reach 41 will be abandoned. This reconfiguration will also increase the trunk line capacity available in Reach 41 to provide additional sewer capacity for the growth node east of Mill Creek identified through City Plan and the Transportation Orientated Development in this region. Figure 2.1-1 shows the trunk alignments.

Figure 2.1-1
Reach 49 Replacement



15. A large hole was found in Reach 49. Multi-sensor inspections (MSI) completed provided more information on the trunk condition including identification of another large hole in Reach 41. To reduce the risk of imminent trunk failure, local repair of the two large hole locations (at Reaches 41 and 49) was completed in early 2020 to avoid trunk failure Figures 2.1-2 and 2.1-3 show the poor to very poor conditions at the junction of Reaches 40 and 49.

Figure 2.1-2
Large Void Upstream of Reach 49

Figure 2.1-3
Severe Corrosion in Manhole 246631 and Junction of Reach 40 and 49

16. While no immediate work is required for the remaining segment of Reach 49, rehabilitation is required within the next few years to avoid trunk failure that would result in:

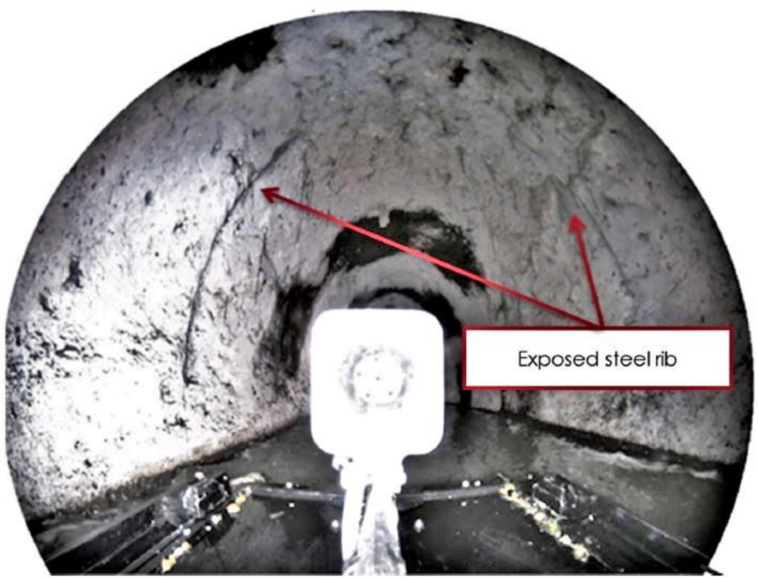
- danger to the public due to trunk failure that could result in settlement and/or collapse on trails and roads;
- loss of service for an area of 8,000 ha in south Edmonton affecting a population of 300,000 for months;

- possible raw sewage spill into the Mill Creek and downstream water courses, impacting the public health and with serious environmental regulatory implications; and
- more costly emergency replacement.

2.2 99 Avenue and 151 Street Trunk Sewer Rehabilitation

17. The 99 Avenue and 151 St Trunk Sewer Rehabilitation Project is one of the ongoing discrete large trunk rehabilitation projects which will extend into the 2022-2024 PBR term. The existing 99 Avenue sanitary trunk was constructed in 1972. This trunk system is part of the West Edmonton Sanitary Sewer (WESS) system which services over 117,000 customers in west Edmonton. The existing 99 Avenue sanitary trunk has been identified as having sections in very poor condition as shown in Figure 2.2-1 below.

Figure 2.2-1
Photo Condition of 99 Avenue Trunk



18. The deterioration was caused by hydrogen sulphide gas, which if present, reduces the thickness and strength of the concrete wall and increases the risk of collapses. As a result, approximately 1,080 m of the trunk is currently in poor to very poor conditions and in need of rehabilitation.

2.3 Other Large Trunk Rehabilitation

19. There are some known issues in some other large trunk sewers where rehabilitation is required within the 2022-2024 PBR term to avoid trunk failure.

20. One identified location has significant evidence of corrosion and other structural defects were found in in Area C-2 which is located adjacent to downtown in the McCauley, Parkdale, and Alberta Avenue neighbourhoods. Based on the findings from MSI conducted in 2019, portions of trunk sewers are in poor or very poor condition. In addition, a chamber in Combined Trunk Sewer No. 94 (Cmb_94) is located in a men's washroom at Commonwealth Stadium. It is extremely difficult to perform any operation and maintenance activities and it poses high risk for public safety as well. Therefore, Cmb_94 is recommended to be rehabilitated with a high priority.

21. Another location is the 151 Street south trunk, which is running beneath 151 Street from 93 Avenue to 99 Avenue. It is a 1,676 mm deep and 1,200 mm wide arch-shaped sanitary trunk and was constructed in the late 1960s. This tunnel section is approximately 1,035 m long and is located approximately 30 m beneath the ground surface. Inspection of this trunk was completed. The results of the inspection indicate that the trunk is in fair-to-poor to poor condition, with the furthest downstream section rated as very poor. There are numerous instances of material loss throughout the tunnel, and four holes identified in the crown region of the tunnel. Therefore, local area rehabilitation is required within the PBR term to prevent trunk failure at the worst sections.

22. Sanitary Trunk Sewer No 11 (SAN-11) Double Barrel (DB) pipe along east side of 116 Street from 102 Avenue to 108 Avenue is another identified location for this upcoming PBR. The total length of the DB pipe is about 1.12 km. According to the preliminary inspection results, portions of the divider wall (membrane) in the 1,650 mm diameter DB pipe were missing or deteriorated. The membrane was designed to separate storm and sanitary flows in the DB pipe. The compromised membrane has allowed untreated wastewater from the sanitary collection system to flow into the storm system which discharges to the North Saskatchewan River. This could result in serious environmental regulatory issues. The inspection also found voids around the sanitary drop pipe connection located at 116 Street and 108 Avenue. Further deterioration could result in trunk failure. Therefore, it is planned to complete the SAN-11 DB pipe rehabilitation by 2024.

23. In addition to the trunk sewers with known issues due to aging and deterioration of large trunk infrastructure, unexpected large trunk failures may also occur. The unexpected failures can

cause sink holes on high traffic roadways or structural stability issues for the infrastructure. In the past two years several unexpected large trunk failures have caused subsidence at 109 Street and 61 Avenue, Whitemud Drive and 170 Street, and Allendale. For the 2022-2024 PBR term, EWSI will accommodate trunk repairs after inspections identify an imminent risk of failure of the trunk line by prioritizing the projects based on the risks.

3.0 PROGRAM DESCRIPTION

24. The Large Trunk Rehabilitation Program will focus on the rehabilitation and/or replacement of large combined and sanitary trunks rated as poor and very poor. Rehabilitation to respond to the large trunk sewer failures or imminent failures are part of this program as well. For the 2022-2024 PBR term, EWSI plans to complete approximately 4.9 km of rehabilitation or replacement over the three years.

25. The scope of work for this program will include inspection, rehabilitation, or replacement of large trunk sewers. In some cases it may also include construction of new small trunks when required to accommodate growth. Trunk condition inspection, including MSI and physical invasive inspections may be required depending on the location, access, depth, and flow. Inspection results will be reviewed and rated based on the Pipe Assessment Certification Program (PACP) Ranking System as shown in Table 3.0-1 and the Large Trunk Condition Rating Scales as shown in Table 3.0-2 to determine the rehabilitation priority.

Table 3.0-1
PACP Condition Grading

	Grade	A **Definition**
1	5	Most significant defects
2	4	Significant defects
3	3	Moderate defects
4	2	Minor to moderate defects
5	1	Minor defects

Table 3.0-2
Large Trunk Condition Rating Scales

Rating		A Category	B Descriptions
1	I	Good	– Concrete wall loss greater than and equal to 5% of the design thickness. – No evidence of active surface corrosion/leaching or areas of exposed aggregates – Surface pH > 6. – Re-inspection within 10 years.
2	II	Fair	– Concrete wall loss greater than 5% to less than and equal to 15% of the design thickness at multiple locations. – Scattered areas of active surface corrosion/leaching and / or areas of exposed aggregates. – Surface pH > 5 and less than or equal to 6. – Re-inspection within 10 years.
3	III	Fair to Poor	– Concrete wall loss greater than 15% to less than and equal to 30% of the design thickness at multiple locations. – Scattered areas of active infiltration. – Continuous exposed aggregates throughout. – Surface pH > 3 and less than or equal to 5. – Re-inspection within 5 years.
4	IV	Poor	– Scattered exposed reinforcement steel. – Concrete wall loss greater than 30% to less than and equal to 50% of the design thickness at multiple locations. – Intermittent sections of surface corrosion above water level. – Continuous infiltration throughout the joints and wall. – Surface pH > 2 and less than or equal to 3. – Mitigation action is needed.
5	V	Very Poor	– Exposed ribs. – Concrete wall loss greater than or equal to 50% of the design thickness at multiple locations. – Exposed wood lagging. – Continuous sections of surface corrosion above water surface. – Surface pH < 2. – Immediate mitigation action is needed.

26. The selection criteria for large trunk rehabilitation are shown in Table 3.0-3.

Table 3.0-3
Selection Criteria for Large Trunk Rehabilitation

Selection Criteria for Rehabilitation	A Definition
1 Pipe Sizes	Equal or greater than 1,200 mm in diameter
2 Non-linear Assets	Manholes, Chamber Structures
3 Drainage Asset Condition	Pipes and manholes/chambers having defects of Grade 4 or 5 as per PACP, or
	Rating IV and V (Poor and Very Poor) as per Large Trunk Condition Rating Scales, or
	Other known issues
4 Operational Issues	Sags, excessive inflow/infiltration, excessive sediment, encrustation
5 Risk Level	High, Medium-High
6 Synergy with Other Projects	Coordination potential with other EPCOR projects
7 Implementation Priority	High operational impacts and high environmental risks.

27. Due to the complexity of the large trunk rehabilitation work, it can take multiple years from inspection to design and completion of construction for each trunk rehabilitation project depending on the scope and site-specific constraints. As such, there are multiple large trunk rehabilitation projects underway within the 2022 to 2024 PBR term and some projects may carry over from the previous years or span beyond 2024 into the next PBR term. The 2022-2024 PBR term projects are in different stages from inspection and concept development to construction. Based on the selection criteria for Large Trunk Rehabilitation Program and the known issues, it is estimated that rehabilitation of 4.9 km large trunks and associated manholes/chambers would be completed between 2022 and 2024. The most cost effective solution will be developed and they could include relining, lining, spot repair, full replacement or bypass tunnel. The scope of some of the identified large trunk rehabilitation projects are described below:

3.1 Mill Creek Combined Trunk Reach 49 Replacement

28. Mill Creek Combined Trunk Reach 49 provides drainage services to an area of over 8,000 ha in south Edmonton. After completing detailed trunk condition assessments, Reach 49 was determined to require high priority attention. After completing a thorough evaluation on the potential rehabilitation and replacement options, a new trunk is proposed along 97 Street to replace the existing Reach 49.

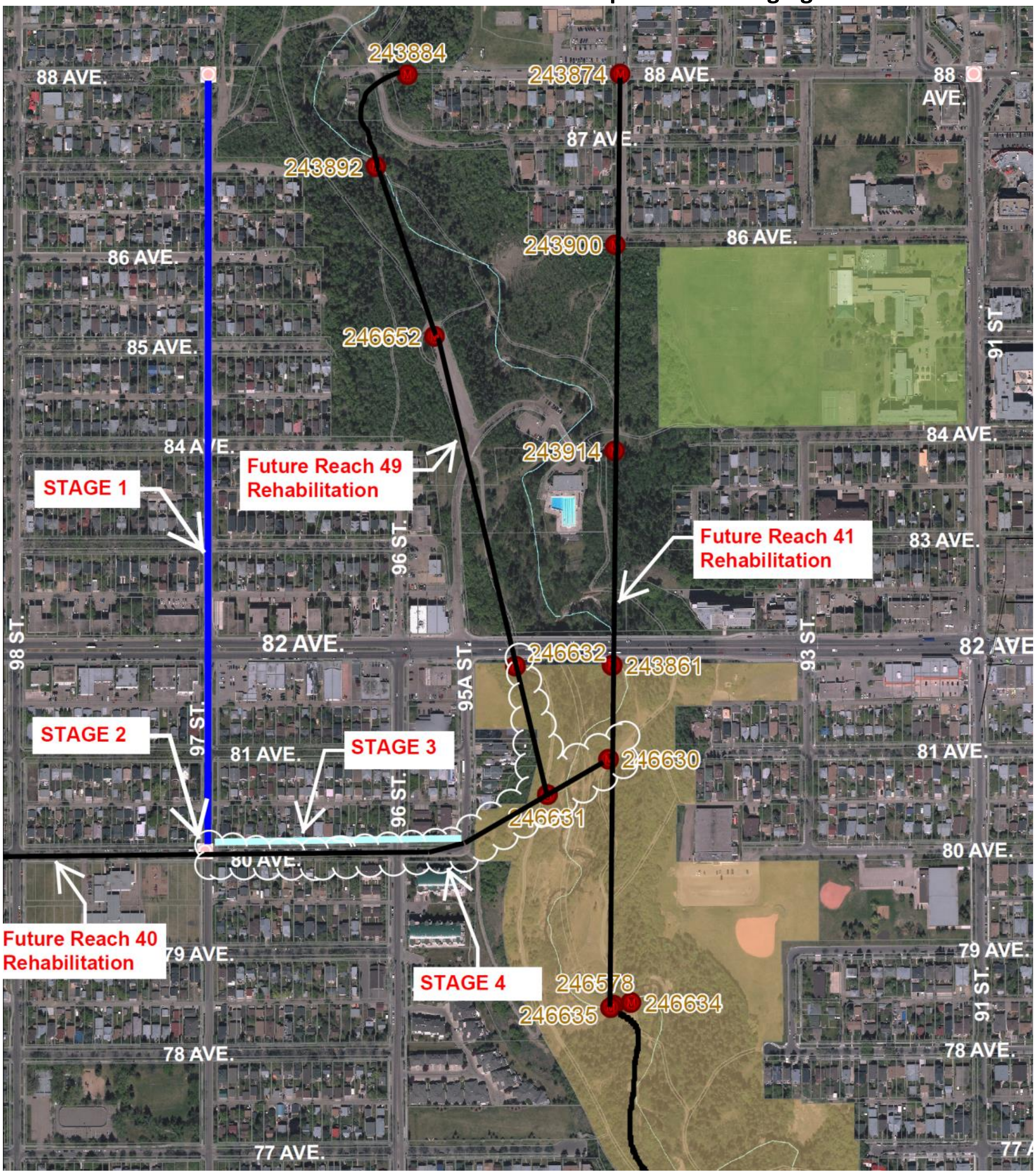
29. The project will be completed in several stages. See Figure 3.0-1.

- Stage 1: Construct a new 2100 mm trunk along 97 Street (approximately 820 meter long), and connect it to the 1500 mm combined trunk at 88 Avenue.

- Stage 2: Connect the new trunk to Reach 40 at 80 Avenue to intercept the flow from Reach 40.
- Stage 3: Relocate the local sewer at 80 Avenue which currently drains to Reach 40 at 96 Street to direct the local flow to the new trunk.
- Stage 4: Abandon Reach 40 east of 97 Street and upstream of Reach 49 with the very poor segments.

30. The cost from 2022 to 2024 for the Mill Creek Combined Trunk Reach 49 Replacement is estimated to be $27.6 million which includes the costs of 820 m replacement trunk, approximately 200 m local sewer relocation and 500 m abandonment of existing trunk which is in very poor condition. The existing Reach 49 will be converted to a local sewer to convey existing local flows.

Figure 3.0-1
Mill Creek Combined Trunk Reach 49 Replacement Staging Plan



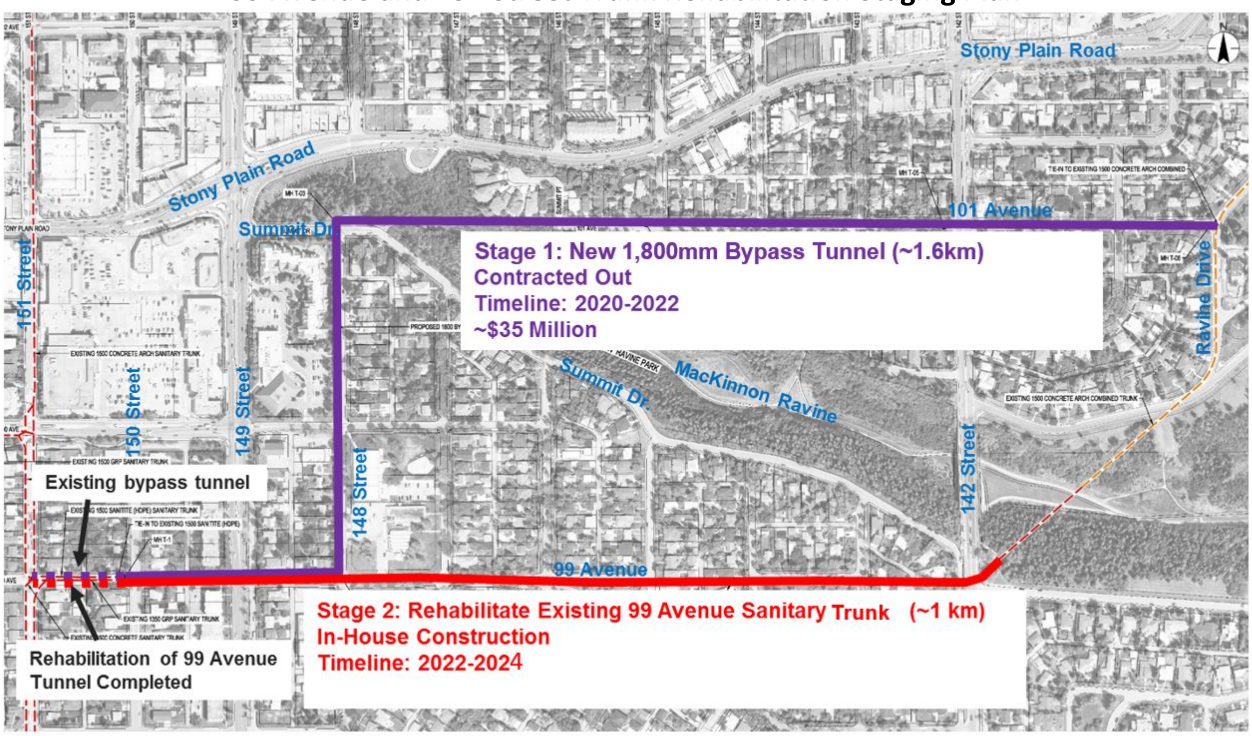
3.2 99 Avenue and 151 St Trunk Sewer Rehabilitation

31. As one of the ongoing discrete large trunk rehabilitation projects, this project is being completed in two stages. The first stage started in 2020 and is expected to be completed in

mid-2022. This stage aims to construct a new tunnel (approximately 1,636 m of 1800 mm diameter bypass tunnel) which will allow for the flows in the existing trunk to be diverted into the new tunnel to facilitate the rehabilitation of the existing trunk. The bypass tunnel will also provide benefit to protect the downstream sanitary and combined trunks from surcharging during wet weather flow conditions. The second stage of the project is planned to start in 2022 and to be complete in 2024. The aim of the second phase is to rehabilitation of 1,080 m of existing trunk along 99 avenue.

32. In addition to meeting the requirements to rehabilitate the existing tunnel, the construction of the proposed bypass tunnel, will provide additional storage capacity upstream of the W3, W4 and W5 section to protect the sanitary and combined trunks from excessive surcharging during wet weather flow conditions. Figure 3.0-2 shows the 99 avenue and 151 street Trunk Rehabilitation Staging Plan.

Figure 3.0-2
99 Avenue and 151 Street Trunk Rehabilitation Staging Plan



33. The project cost from 2022 to 2024 is estimated to be $29.7 million which include the costs of the remaining construction for the 1,636 m bypass tunnel and 1,080 m of existing trunk rehabilitation.

3.3 Other Large Trunk Rehabilitations

34. Due to aging and deterioration of the existing large trunk sewers, there are some known and emerging issues in some large trunk sewers. Based on the selection criteria for the CORe Large Trunk Rehabilitation Program, it is estimated that $21.75 million is required during the 2022-2024 PBR term to complete approximately 1.3 km of required large trunk rehabilitation works in addition to the Mill Creek Combined Trunk Reach 49 Replacement and the 99 Avenue and 151 Avenue Trunk Rehabilitation. The priority of the other large trunk rehabilitations will be determined based on the trunk conditions after the inspections are completed. Due to aging and deterioration of large trunk infrastructure, unexpected large trunk failures may occur. The unexpected failures would need to be addressed as a high priority. EWSI will prioritize the projects in the CORe Large Trunk Rehabilitation Program based on the urgency and overall risk.

4.0 ALTERNATIVES ANALYSIS

35. An alternative to the large trunks program is to do nothing and not rehabilitate any large trunks. Risks associated with leaving the trunks as status quo include:

- Health and Safety risks - leaving large trunks in poor or very poor condition in the drainage system could result in settlement and collapse on roads causing potential risks to public safety.
- Environmental and Regulatory risks - trunk failures could result in raw sewage spilling into watercourses which could impact public health, environmental compliance, and may result in potential fines to EWSI.
- Services Disruption risks - trunk failures could result in service interruptions affecting a significant part of Edmonton for a few weeks to a few months.
- Financial risks - trunk failures could result in more costly emergency replacement.

36. The status quo option does not align with EWSI's objectives and commitments to the City to mitigate these risks and is therefore not an acceptable option. Due to the complexity of the large trunk rehabilitation projects, a variety of alternatives on the trunk rehabilitation and replacement for each project is explored to determine the optimal solution. The alternatives will be developed with the consideration of the project specific conditions, criteria and constraints. The potential alternatives include trunk line replacement, trunk rehabilitation in place, (e.g., relining or spot repair), and combination of replacement and rehabilitation. These alternatives have been included in this program to achieve the most cost efficient option

wherever possible. Alternatives considered for the two identified large trunk rehabilitation projects are described below:

4.1 Mill Creek Combined Trunk Reach 49 Replacement

Alternative 1: Replace Trunk Reach 41 and 49 with New Tunnels

37. This option requires both existing Trunk Reach 41 and 49 to be abandoned and replaced with new trunks adjacent to Mill Creek Ravine. The new trunk Reach 49 consists of a 2100 mm tunnel to connect Trunk Reach 40 at 80 Avenue and the downstream trunk line at 88 Avenue. The new Trunk Reach 41 is proposed to consist of a 900 mm pipe to connect the existing 600 mm sewer south of 76 Avenue to the 88 Avenue trunk line. This option was eliminated due to the requirement of significant local sewer reconstruction which would cause surface disturbance, drainage service interruption, and significant adverse traffic impacts in multiple neighbourhoods for multiple years.

Alternative 2: Rehabilitate all Three Trunk Reaches in Place

38. This option proposes all three existing trunks to be rehabilitated in place. Several challenges have been identified associated with the trunk rehabilitation, including limited construction access, significant adverse environmental impacts, geotechnical conditions within the ravine, and a high cost for temporary flow bypass during trunk rehabilitation. It could result in a project cost of $48 million which would be approximately $20 million higher than the recommended alternative.

Alternative 3 (proposed): Rehabilitation and Replacement in Staging

39. Rehabilitation and replacement in staging was considered in this option. This option was refined and recommended as the preferred option to proceed.

4.2 99 Avenue 151 St Trunk Sewer Rehabilitation

40. A series of workshops were conducted in 2016 and 2017 to develop a concept design to address the deterioration in the pipe. The workshops explored various potential solutions and assessed their feasibility and suitability. The following nine options were initially developed for consideration:

Alternative 1: New Tunnel Parallel Alignment

41. This alternative was considered to align a new trunk underneath four residential properties. Attempts to secure additional strata easements was not successful and therefore it was eliminated.

Alternative 2: New Tunnel South Alignment

42. This alternative was not deemed technically viable as the length of this alignment, combined with minimum pipe slope, would result in tying into the existing trunk below its existing elevation which is not acceptable.

Alternative 3: New Tunnel North Alignment

43. This alignment would take the trunk along Stony Plain Road, which was not technically viable due to conflicts with other planned projects.

Alternative 4 (proposed): Rehabilitation in Dry Conditions with Bypass Tunnel Parallel Alignment

44. This alternative involves completing the project in two stages. The first stage is the construction to construct a new tunnel which will allow for the flows in the existing trunk to be diverted into the new tunnel to facilitate the rehabilitation of the existing trunk. The second stage of the project is planned to rehabilitate the existing trunk. At the end of the project, both tunnels will be put into service. This alternative will provide additional storage capacity upstream of the W3, W4 and W5 section to protect the sanitary and combined trunks from excessive surcharging. This is the proposed alternative.

Alternative 5: Rehabilitation in Dry Conditions with Shallow Bypass Pipe and Pumping

45. This alternative will involve installing a temporary lift station to bypass the flows to allow rehabilitate of the existing tunnel. This was not considered viable given the potential high risk of significant tunnel surcharge and the need to build a significant temporary bypass pumping system which would not provide any hydraulic capacity benefits.

Alternative 6: Rehabilitation in Dry Conditions with Deep Bypass (Upper) Tunnel and Pumping

46. This alternative was similar to Alternative 5, though with different bypass pumping configuration. This was not considered viable as the same reasons as Alternative 5.

Alternative 7: Rehabilitation in Dry Conditions with Inline Storage and Pump Bypass

47. This option was similar to Option 5, though with different bypass pumping configuration. This alternative was not considered viable given the risks presented by relying on storage inside the trunk to reduce bypass pumping costs.

Alternative 8: Rehabilitation in Wet Conditions with Sliplining

48. This alternative involves sliplining, pushing a new pipe inside the old pipe, while the sewer is in operation. While this is technically feasible, EWSI determined that there were no contractors available in Canada and that the overall risk of the methodology is high. For these reasons this alternative was rejected.

Alternative 9: Partial Wet Rehabilitation and Chemical Injection (20 Year Horizon)

49. This alternative required patching the worst areas to reduce the further deterioration and reassess in the future. This alternative was rejected because it does not address the long-term risks associated with the deteriorated trunk condition.

5.0 COST FORECAST

50. The program cost estimates for the 2022 to 2024 PBR term are shown in Table 5.0-1 and are based on costs of trunk rehabilitation from previous projects with the similar scope. The assumptions are as follows:

- 2.4 km of rehabilitation in place and 2.5 km of replacement over the PBR period;
- The unit construction costs of trunk replacement range from $10,000/m to $20,000/m depending on the size, depth, and alignments;
- The unit construction costs of rehabilitation in place range from $5,000/m to $10,000/m depending on the size, depth, and locations;
- Except for Mill Creek Combined Trunk Reach 49 Replacement Project where a new replacement trunk is to be installed in a new alignment, all other trunk rehabilitation works are assumed to be rehabilitated in place and the cost forecast was estimated accordingly. In the case that trunk rehabilitation in place is not feasible and the trunk has to be replaced, the cost of replacement may be higher than the forecast cost;
- Trunk rehabilitation construction can be completed by either internal or external resources depending on the scope of work and the availability of in-house construction resources;

- Trunk replacement construction will be completed by external resources;
- The construction costs are based on the unit rate estimate for trunk rehabilitation and trunk replacement from the previous projects with of similar scope;
- An overall contingency of 10% to 30% has been included in the estimates based on the maturity level of each project;
- Geotechnical investigations, environmental assessments and other engineering services as needed will be completed by external engineering consultants;
- MSI inspections will be completed by external contractors;
- The in-house resource will perform: trunk replacement and rehabilitation design, project coordination and management, general engineering during construction, construction completion certification (CCC) inspection, etc.; and
- Based on the project maturity level, contingencies of 30% have been included with the consideration of project uncertainties.

Table 5.0-1
Large Trunk Rehabilitation Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	15.82	21.81	12.62	50.25
2	Internal Labour	1.68	1.40	2.51	5.60
3	Vehicles and Equipment	0.57	0.59	0.27	1.44
4	Abandonments	0.00	0.00	0.75	0.75
5	Contingency	0.64	6.67	7.16	14.47
6	Risk Allowance	1.50	0.73	0.00	2.23
7	**Sub-total Direct Costs**	**20.21**	**31.21**	**23.31**	**74.74**
8	Capital Overhead and AFUDC	0.85	1.47	1.95	4.27
9	**Total Capital Expenditures**	**21.06**	**32.68**	**25.26**	**79.01**

51. The Large Trunk Rehabiliation Program cost estimates broken down into the major projects are shown in Table 5.0-2.

Table 5.0-2
Large Trunk Rehabilitation Program by Project
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
1	Mill Creek Combined Trunk Reach 49 Replacement	4.53	10.18	12.85	27.56
2	99 Avenue and 151 St Trunk Sewer Rehabilitation	13.21	14.45	2.01	29.67
3	Other Large Trunk Rehabilitation	3.32	8.05	10.4	21.75
4	**Total Program Costs**	**21.06**	**32.68**	**25.26**	**79.01**

52. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

53. Completion of the large trunk rehabilitation/replacement work would lower the risks associated with the potential trunk failure. The risks associated with execution of the work have also been identified and summarized in Table 6.0-1.

Table 6.0-1
Program Risks and Mitigations

	Risk Area	A **Risks**	B **Mitigations**
1	Health and Safety	Working in confined space without proper training or permit results in injuries and potential fine from OH&S during construction.	EWSI will ensure that contractors have a safe work plan, emergency response plan and other plans to ensure that it meets EPCOR standards.
2	Environmental	Risk of sewage leakage associated with flow bypass methods during construction results in environmental incompliance and potential fines of several million dollars.	EWSI will develop detailed flow monitoring and bypass plan with sufficient standby capacity to reduce the risk of bypass leakage.
3	Customer Impacts	Stakeholder communication issue/concern during construction results in business, resident and councilor inquiries.	EWSI will prepare a stakeholder communication plan.
		Construction on congested road will disrupt traffic.	EWSI will engage experienced construction manager, and project manager to develop an optimal construction staging plan and coordinate with the City to obtain OSCAM permits.
4	Execution Risk	Limited access to perform the rehabilitation work may result in construction delays and construction cost increase.	EWSI will develop rehabilitation or replacement alternatives to select the most cost effective option to perform the work.
5	Financial	Limited access to the trunk to perform the rehabilitation work may result in construction delays and construction cost increase.	EWSI will develop rehabilitation or replacement alternatives to obtain/construct the required access to perform the work.

Appendix H6

EPCOR WATER SERVICES INC.

Drainage Services
Drill Drop Manholes Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Drill Drop Manhole (DDMH) Renewal Program is an annual program that includes costs to inspect and systematically rehabilitate or replace failing DDMHs which are small diameter shafts extending from the ground surface into the trunk sewer. These were built using corrugated metal pipes (CMP) which are highly susceptible to corrosion. Many of the DDMHs are beyond their expected life. The DDMH Renewal Program was initiated in 2006 to address risk of failure of these manholes. Prior to 2006, a high number of emergency DDMH repairs heightened awareness of this issue and the need for a proactive response. EWSI estimates approximately 300 DDMHs exist in the drainage system and this program has renewed or abandoned approximately 66 since its inception. During the 2022-2024 PBR term, this program is forecast to complete 110 DDMH inspections, 12 DDMH full replacements and 30 DDMH rehabilitations (relining). By the end of 2022-2024 PBR term, EWSI expects that through this program and other capital and operational programs it will have determined baseline conditions for all of the DDMHs through these inspections which will aid in reducing the overall risk of significant failures of these structures.

2. Failure of these manholes may cause road subsidence or sinkhole formation. Risks of failure include health and safety risks to the public and traffic impacts associated with road subsidence/sinkhole formation and financial risks associated with costly emergency repairs and flooding. The most notable recent example of a failure was at a location on Allendale Road and Calgary trail. Upon inspection, it was determined that from 16 m below ground to the trunk sewer, 7 m of the corrugated metal pipe manhole was missing and a large void had formed. Where the DDMH previously connected to the trunk sewer, a hole remained and within several days, settlement of the road surface was seen in the wheel path of vehicles. The location is a very busy intersection and therefore a high safety risk to the public, and has also caused major traffic disruption in the area. As this DDMH is part of the combined system, the failure allowed for flow of untreated wastewater to the soil in the surrounding area. The total cost of emergency repairs were $3.5 million and the work took 16 months to complete. If the trunk sewer had collapsed, EWSI estimates this would have impacted over 200 businesses and a 37 hectare area.

3. Selection of DDMHs for renewal will be based on those identified as requiring immediate rehabilitation or replacement to prevent voids, collapses or sinkholes. Following inspections, EWSI has established criteria to risk rank DDMHs in order to prioritize for rehabilitation or replacement. The criteria includes condition assessment based on the Closed Circuit Televising

(CCTV) inspection, number of inlets/functionality, depth of the trunk, road classification/location and synergy with other projects.

4. This program is categorized as reliability / life cycle replacement and is one of the Drainage System Rehabilitation programs. The scope of this program includes annual inspection of approximately 35 DDMHs, assessment and prioritization of inspected DDMHs and design and construction of approximately 3 to 4 DDMH replacements and 10 DDMH rehabilitations annually. EWSI has forecast total program capital expenditures during 2022-2024 at $13.11 million. This reflects an increase in average annual spending on this program from $2.3 million per year to $4.3 million per year. The increase is required to address the higher frequency of emergency projects emerging from deficient DDMHs in the last few years. More investment is needed to address the DDMHs in the system before they become emergency projects because of the inherent risks of these DDMHs. These system failures present a high safety risk for EWSI employees and the public.

2.0 BACKGROUND/JUSTIFICATION

5. Drill Drop Manholes (DDMHs) were constructed as equipment or emergency access points during tunnel construction of many of Edmonton's deep combined, storm and sanitary trunk sewers. They are small diameter shafts extending from the ground surface into the trunk sewer, and housed power cables, lighting and ventilation systems during construction of the sewer. They are generally constructed of corrugated metal pipe (CMP) or cast iron (CI) pipe. Many of these DDMHs were left in place following completion of the trunk, instead of being properly abandoned at the end of the tunnel construction. Subsequently, numerous DDMHs were utilized as receiving manholes for local sewers. During the connection of local sewers to DDMHs, many of them were modified by replacing the top section of the DDMH (about 5m to 9m deep from ground surface) with standard size manholes to accommodate the sewer connection. Corrugated metal pipe and cast iron are prone to corrosion, and have a typical lifespan of only 30-40 years when used in conditions found in the trunk sewers. Consequently, many of the DDMHs are beyond their expected life span.

6. Records indicate approximately 300 DDMHs existed in the drainage system when the DDMH Renewal program was first initiated. Since its inception, this program has rehabilitated 43 DDMHs and abandoned 23 DDMHs. When DDMH structures are abandoned, the piping must be reconfigured to eliminate the need for the DDMH at that location. Table 2.0-1 provides the

historical data on DDMHs in terms of number within each age range and the number rehabilitated and abandoned since inception of this program.

Table 2.0-1
Historical Drill Drop Manholes Age and # Rehabilitated or Abandoned
(2020 Data)

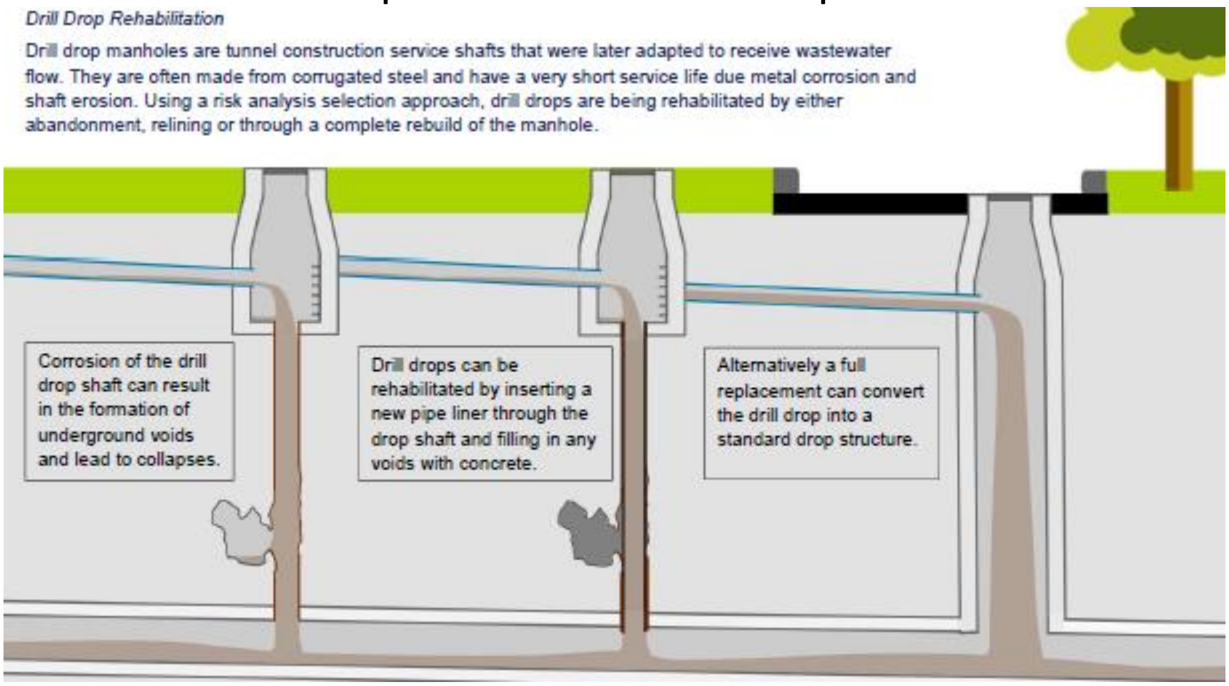
		A	B	C	D	E
	Age of DDMH	**Quantity**	**Percentage**	**Number of Rehabilitated DDMHs**	**Number of Abandoned DDMHs**	**Total Number of DDMHs Abandoned or Rehabilitated**
1	>100 years	3	1.0%			
2	80 - 100 years	6	2.0%			
3	60 - 80 years	8	2.7%			
4	40 - 60 years	224	75.7%	39	20	59
5	30-40 years	43	14.5%	3		3
6	20 - 30 years	12	4.1%	1	3	4
7	< 20 Years	0	0.0%			
8	**Total**	**296**	**100%**	**43**	**23**	**66**

7. There are several alternatives for the renewal methods for DDMHs. The method for each DDMH will be selected based on its structural integrity, connection type to the trunk, access points, and other engineering considerations.

1) Full Replacement – This method must be used where the DDMH is in such poor condition and no viable rehabilitation option is available. Functionality can also be the driver for full replacement if there are a number of sewer connections present, and if there is a risk of back-ups or inability to remove an obstruction.
2) Rehabilitation (Relining) – This includes options such as slip lining or cured in place pipe, and cannot be used where there are side connections to the trunk or if the DDMH is corroded away. This method reduces the hydraulic capacity of the DDMH.

8. Once the condition of the DDMHs are determined through inspection, the best method of remedying any issues found will be explored and documented. Figure 2.0-1 shows both the rehabilitation and full replacement options for renewing DDMHs.

Figure 2.0-1
Drill Drop Manhole Rehabilitation and Replacement

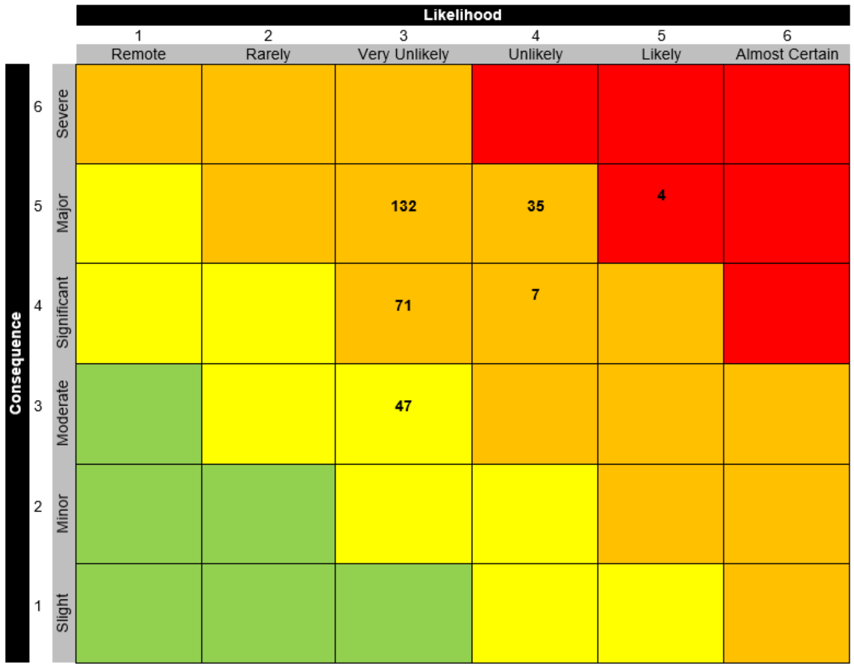


9. The DDMH Renewal Program was initiated in 2006 as a proactive response to concerns about the risk of failure of these manholes, especially as about 40% or 120 of these were approaching or well past their design life of 35 years. Several emergency repairs of failed DDMHs prior to 2006 also heightened awareness of this issue and elevated the need for the program. The potential consequences of failure of these assets include road subsidence or sinkhole formation, resulting in public safety and traffic impacts, flooding and costly emergency repairs.

10. Historically DDMH's selected for inspection were based on the risk ranking using methodologies that were developed prior to the transfer of Drainage from the City of Edmonton to EPCOR. Moving forward, the selection of DDMHs will continue to be risk-based using the EPCOR Risk Matrix and Risk Assessment Standards which continue to take into account age, waste type, proximity to environmentally sensitive areas, number of lateral connections, depth, roadway classification, previous inspection information, etc. The EPCOR Risk Matrix also expands this assessment to consider customer impacts of pipe and roadway failures in addition to these physical risk considerations. Once the program has identified a high priority location, the DDMH is inspected to determine its current condition, and confirm the number of connections into the manhole and type of connection into the trunk, etc.

11. Utilizing the EPCOR Risk Matrix and Risk Assessment Standards, preliminary DDMH results are displayed below in Figure 2.0-2.

Figure 2.0-2
Preliminary DDMH EPCOR Risk Matrix Results



12. The four DDMHs in the red box in Figure 2.0-2 are planned to be completed before the start of the 2022-2024 PBR term. During the 2022-2024 PBR term, EWSI plans to complete the highest risk DDMHs in the orange boxes depending on what is found during inspections. Of the total 296 DDMH's, 249 rank either High or Medium-High risk, due in part to the consequence characteristics noted below:

- located on Arterial or Collector roadways;
- more than 2 incoming lateral connections;
- depth is greater than 20m and are constructed on large sanitary and combined trunks;
- located in close proximity to an extremely high value environmentally sensitive area; or
- financial costs to deal with emergency repair, initial response, etc. is higher due to depth, and by-pass needs.

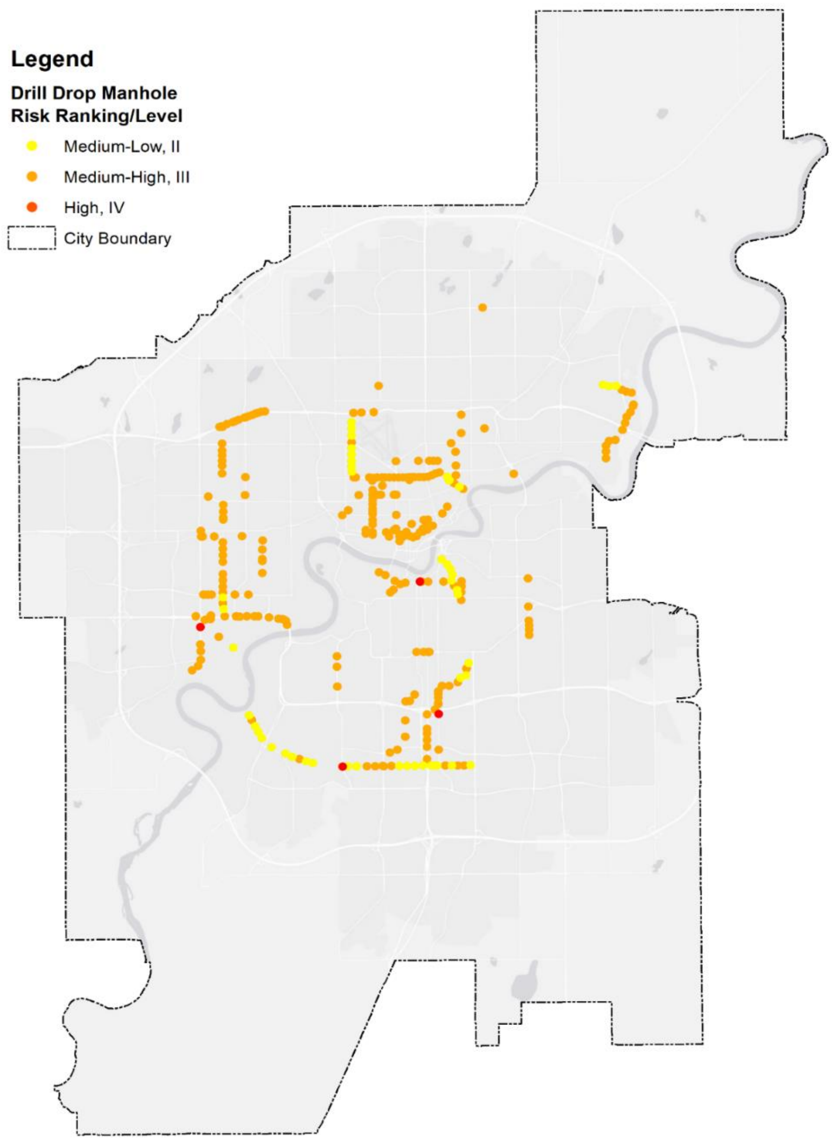
13. The criteria used for selecting a DDMH for rehabilitation or replacement for this program after inspections have been completed are shown below in Table 2.0-2.

Table 2.0-2
Selection Criteria for Renewal

	Selection Criteria for Renewal	A Definition
1	Post Inspection Risk Ranking	CCTV result analysis – significant or very significant defects
2	Synergy with other projects	Rehabilitation, replacement or abandonment could be driven by the presence of other projects in the vicinity of the DDMHs (e.g., CORe projects)

14. A map showing all DDMH locations by risk ranking and level are shown in Figure 2.0-3.

Figure 2.0-3
Drill Drop Manhole Risk Ranking/Level



15. CCTV is used to inspect these DDMHs. High flows in the DDMH can result in unclear CCTV images that are difficult to interpret. In locations where the trunk is deep and flows are high, televising the line may become a significant project itself, requiring flow bypass, road closure and removal of a “wagon wheel” like structure that is used to prevent potential obstructions from falling into the smaller diameter section of the DDMH.

16. Several DDMH failures have occurred in the recent past, most notable near Calgary Trail and Allendale Road, which created a large underground void. The inspection of DDMHs is very important to identify those that require immediate rehabilitation or replacement in order to prevent voids, collapses or sinkholes and proactively manage risk of emergency repairs. This is an ongoing program to systematically renew failing DDMHs which aligns with EPCOR’s objectives to identify and manage risk appropriately to reduce risk exposure, and to reduce the negative impacts of assets on the environment.

3.0 PROGRAM DESCRIPTION

17. The scope of renewal for DDMHs will be either rehabilitation or full replacement depending on the physical condition and functional aspects of the DDMH. If there are significant holes or large pieces of the DDMH missing, a full replacement will be required.

18. This program proposes that each year, inspections on an average of 25 DDMHs will be completed as part of the concept development for the DDMH program. The scope for concept development will include inspections, assessment and review of the videos, defining replacement and rehabilitation needs, and prioritization of the DDMHs. Based on past experience, whenever 20 or more DDMHs are inspected, about 50% usually require rehabilitation, while between 10% to 15% would require replacement. EWSI anticipates that about 10 DDMHs would require rehabilitation and 3 to 4 DDMHs would require replacements. Once a prioritized list has been determined, the program will move forward with design and construction.

19. The program will include the following scope of work on an annual basis:

- Inspection of approximately 25 DDMHs
- Assessment and prioritization of inspected DDMHs
- Design of 3-4 DDMHs going forward for replacement
- Design of 10 DDMHs going forward for rehabilitation
- Geotechnical investigation
- Construction of 3-4 DDMH replacements

- Construction of 10 DDMH rehabilitations
- Assets placed into service

20. Inspections, design and construction will take place each year as shown in the Table 3.0-1 below. If possible, the approvals, concept development and inspections will begin in the year prior to construction to ensure there is sufficient time to complete all the renewal work.

Table 3.0-1
Program Phases

	A **2021 Q3**	B **2021 Q4**	C **2022 Q1**	D **2022 Q2**	E **2022 Q3**	F **2022 Q4**	G **2023 Q1**	H **2023 Q2**	I **2023 Q3**	J **2023 Q4**	K **2024 Q1**	L **2024 Q2**	M **2024 Q3**	N **2024 Q4**
1 Initiation/Approvals	x				x				x				x	
2 Inspections		x	x			x	x			x	x			x
3 Preliminary Design			x	x			x	x			x	x		
4 Detail Design				x				x				x		
5 Procurement				x	x			x	x			x	x	
6 Construction						x	x	x	x	x	x	x	x	x
7 Commissioning										x				x
8 Close-out										x				x

4.0 ALTERNATIVES ANALYSIS

21. The alternative to the program is to leave the DDMHs and deal with them reactively instead of proactively. However, if this program is not continued and existing deterioration in the DDMHs remains unaddressed, failures are likely to occur potentially causing underground voids. This could lead to sink holes in the middle of high traffic arterial roadways where many DDMHs are located. This is a significant safety concern. Other considerations are environmental impacts from holes in sanitary or combined DDMHs which could cause soil contamination, interruption of service to residents and high costs of unplanned emergency repairs. The advantage to this alternative is that there may be lower upfront costs, however if more emergencies continue to occur such as the Allendale Road DDMH failure, the costs in the long term will be increased.

5.0 COST FORECAST

22. The program cost estimates for the 2022-2024 PBR term shown in Table 5.0-1 is based on historical information such as past inspection costs, past design costs and past construction costs of similar DDMH projects that occurred within the last few years.

23. Underlying assumptions are as follows:

- 25 CCTV inspections per year will be completed by internal resources

- 4 replacements will be required each year
- 10 rehabilitations will be required each year
- Replacements will be completed by internal resources
- Rehabilitation (relining) will be completed by external resources
- Geotechnical investigations will be completed by external resources
- Replacements are assumed to cost approximately $900,000 per location
- Rehabilitations are assumed to cost approximately $100,000 per location
- Project cost estimates are based on costs incurred for inspection, design and construction of similar projects that occurred in the past few years

Table 5.0-1
Program Cost Summary
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	3.90	3.48	2.53	9.91
2	Internal Labour	0.50	0.55	1.08	2.13
3	Vehicles and Equipment	0.02	0.16	0.43	0.61
4	Contingency	0.00	0.02	0.06	0.09
5	**Sub-total Direct Costs**	**4.42**	**4.22**	**4.11**	**12.74**
6	Capital Overhead & AFUDC	0.09	0.10	0.19	0.37
7	**Total Capital Expenditures**	**4.50**	**4.31**	**4.29**	**13.11**

24. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. Construction of DDMHs will be completed by internal construction resources. Any DDMH relining will be completed by specialized external contractors.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

25. Table 6.0-1 provides the key risks and mitigations associated with executing this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	**Health and Safety**: • There is a risk that DDMH failure could result in a big void and road settlement which poses as a safety risk to the public and traffic. • Another key risk is that construction on a busy roadway can pose a higher safety concern for the workers on site.	Replacing or rehabilitating DDMH would reduce the risks of asset failure. Ensuring that the contractor and all on site workers follow proper safety procedures will help to mitigate the safety risk.
2	**Financial**: The potential DDMH failure could result in more costly emergency replacement.	The proposed DDMH replacement or rehabilitation program would lower the risks of asset failure and, therefore, reduce the cost.
3	**Customer Impacts**: Road user impacts: construction will cause significant traffic disruption on high traffic roadways Service impacts: incoming connections to DDMH	EWSI will engage experienced construction manager, and project manager to develop an optimal construction staging plan and coordinate with the City to obtain OSCAM permits. Bypass will be required during construction to maintain service to all incoming laterals.
4	**Execution Risk**: There is a high risk that rehabilitation of the DDMHs will be difficult to execute. Rehabilitation of DDMHs must be completed by external resources as EWSI does not currently have the ability to do this type of work. However, there are not many external contractors that willing to do the work due to specialized skill and low profit margin. In 2019, a tender was released for the rehabilitation of several DDMHs and there were no bids received. DDMHs requiring rehabilitation that are not able to be completed will remain in their current condition and will eventually need to be dealt with through a full replacement.	One way to mitigate this risk is to offer contractors several DDMH rehabilitations as one package, or to offer long term contracts that would guarantee them work over a specified number of years. EWSI will undertake project related activities including inspection, project management, design, construction coordination and survey as well as as-built recording. These locations will be risk ranked and prioritized with all other replacement priorities.
5	**Environmental**: Risk of sewage leakage and spills associated with DDMH failure can result in environmental incompliance and potential fines	Replacing or rehabilitating DDMH would reduce the risks of failure for the asset.

Appendix H7

EPCOR WATER SERVICES INC.

Drainage Services
Fleet and Vehicles Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Fleet and Vehicles Program is an annual capital program to upgrade, replace and purchase new vehicles and equipment. This program consists of the purchase of life cycle replacement for existing essential vehicles, as well as additional new vehicle types to support the sanitary and stormwater system as Edmonton continues to grow. This program ensures that EWSI's operations and construction staff are equipped with the appropriate and properly functioning vehicles and mobile equipment to safely and efficiently complete their work to ensure the sanitary and stormwater systems are maintained in a reliable manner.

2. This program is categorized as reliability / life cycle replacement and is one of the Drainage System Rehabilitation programs. EWSI has forecast total program capital expenditures during 2022-2024 at $13.20 million. This reflects a small decrease in average annual spending on this program from $4.48 million per year to $4.40 million per year. The decrease is due to changes in EWSI's construction strategy, reflecting a decreased requirement for heavy duty vehicles and mobile equipment which would have otherwise supported the tunnel construction program.

2.0 BACKGROUND/JUSTIFICATION

3. EWSI operates a wide variety of vehicles and mobile equipment to facilitate staff in the processes of building, servicing, repairing and decommissioning of drainage services in the greater Edmonton area. The Fleet and Vehicles Program is an annual capital program to upgrade, replace and purchase new vehicles and equipment. This program consists of the purchase of life cycle replacement for existing essential vehicles, as well as additional new vehicle types to support the sanitary and stormwater system as Edmonton continues to grow. This program's primary purpose is to equip EWSI staff with the appropriate and properly functioning vehicles and mobile equipment for their ongoing work in operational and construction activities. The availability and dependability of EWSI vehicles is essential to ensuring that EWSI's sanitary and stormwater systems are maintained in a reliable manner and that its operations are carried out safely and effectively. Failure to maintain an appropriate and functioning fleet would result in EWSI staff spending longer periods of time to complete work throughout Edmonton. Additionally, EWSI staff would have to use existing assets for extended use, further diminishing the assets' reliability and potentially leading to critical failure. Critical failure of a fleet asset leads to additional impact to service reliability at best, safety of staff or public at worst.

4. The scope and scale of planned and unplanned vehicle purchases are dependent on construction and operational requirements. EWSI requires reliable fleet assets to ensure the

ability to operate, maintain, repair, or replace aging Drainage systems and respond to emergency situations. The purpose of this program is to ensure that the vehicle & equipment inventory is adequately stocked and in good working condition to meet the dynamic needs of Drainage Services.

5. The scope of this program for the 2022-2024 PBR term includes:

- end of life cycle replacement of existing fleet vehicles to reduce vehicle maintenance costs and increased reliability and vehicle availability; and
- net growth or change of existing fleet vehicles to ensure safe and effective execution of field work.

6. The size and business need of the existing fleet will be continuously assessed as operational reviews are completed and potential synergies and efficiencies are identified. The outcome of this process will accommodate any requirement for growth or changes in the type of fleet vehicles required. Therefore, no growth or change of existing fleet has been specifically identified in the program term. As indicated in Table 2.0-1, the total projected number vehicle replacements over the 2022-2024 PBR term is 64 units. Of the 64 units, 54 units are specialized and must be custom built.

Table 2.0-1
Fleet and Vehicles Program
Vehicle Replacements by Type
2022-2024

	Vehicle Type	A **Number of Vehicle Replacements**
1	Light Duty Vehicle	13
2	Medium Duty Vehicle	15
3	Sewer Flusher	6
4	Boom Truck	2
5	Crane	3
6	Backhoe/Excavator	4
7	Welding Truck	2
8	Construction Trailer	8
9	Skid Steer	1
10	Tandem Dump Trunk	2
11	Font Wheel Loader	1
12	Fork Lift	2
13	Boat	3
14	ATV/mower	2
15	**Total**	**64**

7. EWSI fleet assets approaching end of life cycle require additional repair and maintenance work, leading to higher operational costs and extended periods of downtime. This downtime further impacts operational efficiency of work crews and requires increased use of alternatives such as rental units. Rental vehicles can only be obtained for the 10 units which are not specialized, customer built units. Further, EWSI has experienced an increased level of safety concern with vehicles approaching end of life as they are pushed to the limits of design tolerance levels. As such, failure to replace vehicles which have reached the end of their service lives will result in increased vehicle operating costs and reductions in worker safety and productivity.

3.0 PROGRAM DESCRIPTION

8. There are 64 units designated to be replaced from 2022 to 2024. These units in question have been selected for replacement based on their service lives ending between 2022 and 2025. Project scope will be executed for each Fleet Unit in accordance with a 5-Gate Fleet Capital Project Delivery System (CPDS), which includes the following gates. Only vehicles with high utilization proceed through the CPDS process. Low utilization units will be excluded and disposed without replacement, or replaced with short term alternative rentals when deemed as most feasible alternative.

1.) Gate 1 – Business Assessment
2.) Gate 2 – Design Specifications
3.) Gate 3 – Procurement & Building
4.) Gate 4 – Prep for Delivery
5.) Gate 5 – Turnover Care Custody and Control of Fleet to operation

9. EWSI assesses each Vehicle/Unit in Gate 1 to verify cost effectiveness of purchasing a replacement vehicle compared to rental or contractor alternatives on a net present value basis (NPV). The NPV of net new units will include operator costs and fleet hourly rates.

10. The Fleet manager will ensure fleet vehicles align to crew size and capacity thus maintaining high utilization. Impact on Safety and other operational strategies will be assessed in Gate 1 also. Highly specialized units will be evaluated on an individual bases when exploring replacement. Specialized units with low utilization may be retained due to the cost of replacement and an overall evaluation of the monthly/yearly operating costs.

11. EWSI's goal will be to maintain high utilization of fleet and leveraging capital expenditure to lower utility rates. Gate 1 business assessment will ensure capital is spent in the required areas.

Each fleet sub-project lead-times vary between 5 to 16 months total. Approximate timelines to obtain new vehicles are set out in Table 3.0-1.

Table 3.0-1
Fleet and Vehicles Program Timelines

Fleet Vehicle Type			A **Gate 1 Assessment**	B **Gate 2 Design**	C **Gate 3 Procurement**	D **Gate 3 Build**	E **Gate 5/4 Deliver**	F **Total Lead Time**
1	LD & MD Truck	Chassis	1 week	1 week	2 weeks	10 weeks	2 weeks	5-6
2	(<$100k)	Body	1 week	1 week	2 weeks	6 weeks	2 weeks	months
3	MD & HD Truck	Chassis	2 weeks	4 weeks	4 weeks	8 weeks	4 weeks	10-11
4	($200-$400k)	Body	2 weeks	6 weeks	6 weeks	8 weeks	4 weeks	months
5	Specialty HD & MD Truck	Chassis	3 weeks	8 weeks	8 weeks	8 weeks	4 weeks	13-16
6	(>$500k)	Body	3 weeks	8 weeks	8 weeks	8 weeks	4 weeks	months

*LD – Light Duty, MD- Medium Duty, HD-Heavy Duty.

12. Projects are typically expedited by reviewing combining chassis and body for major complex fleet units, reviewing existing design specification, accelerating internal customer engagement, and leveraging existing master service agreements.

13. While procurement of vehicle/units may be executed by leveraging existing master service agreements, large value/complex purchases will be procured through public tender in order to ensure competitive pricing.

14. This Program includes the costs of replacing 64 units belonging to Drainage Operations and Construction Services. This includes the procurement of the chassis, building the vehicle body, installing safety features, decals, and telematics devices. Operational costs, fuel, and regular maintenance of these units are not included in the scope of this program.

4.0 ALTERNATIVES ANALYSIS

15. EWSI assessed this program against the alternative of not replacing the current fleet and continuing to use these assets beyond their recommended life-cycle. Risks associated with this option were found to be too high. As such, EWSI is recommending to proceed with the Fleet and Vehicles Program as described above. Risks of extending use of the current fleet beyond useful life include:

- higher fleet maintenance and repair costs resulting in increase in Drainage Operating expense;
- reduced availability due to more frequent running repairs and longer scheduled preventative maintenance and inspections;

- reduced reliability which will result in more unpredictable downtime, especially when the vehicle is needed the most to respond to operational needs, therefore impacting external customers;
- reduced fuel economy therefore further increasing operating costs; and
- reduced equipment reliability impacting ability to complete and delivery capital by Drainage construction group.

5.0 COST FORECAST

16. The projected number replacements over the 2022-2024 period is 64 units, of which 54 units are specialized and must be custom built. Pricing for the new units being purchased from 2022 to 2024 reflect 2020 unit replacement pricing. These unit prices are updated to reflect historical costs for the units that will be replaced, in order to account for factors such as safety feature improvements, vendor increases, and other expected fee increases.

17. Capital Costs for each Fleet Vehicle includes:

- Engineering Design – define specification of unit and draft drawings where applicable.
- Chassis – Procure vehicle chassis from chassis manufacturer.
- Upfitting – Fabricate upfitting on chassis.
- Prep-For Service – EPCOR brand decaling, GPS, training materials, pre-delivery inspections etc.

18. EWSI's capital expenditure forecast for this program for the 2022-2024 PBR term is provided in Table 5.0-1.

Table 5.0-1
Fleet and Vehicles Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	3.62	4.46	5.02	13.10
2	Internal Labour	0.03	0.03	0.03	0.09
3	**Sub-total Direct Costs**	3.66	4.49	5.05	**13.19**
4	Indirect Costs	0.01	0.01	0.01	0.02
5	**Total Capital Expenditures**	3.66	4.49	5.05	**13.20**

19. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, upfitting of required units, and ensure quality vehicle builds. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- External vendors will be engaged to supply chassis and outfit the units with all required equipment as specified in their management service agreements.
- Contracted services are performed by pre-qualified external vendors and done on a competitive unit price basis.
- The upfitting will be consistent with EWSI's fleet and industry standards and unit specifications.
- Every vehicle replacement is evaluated to improve economy of scale where possible.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale.

6.0 RISKS AND MITIGATION PLANS

20. The key risks and mitigations associated with executing this program are provided in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Financial: Risk associated with committing costs for chassis by ordering units prior to the year they are to be replaced.	This risk is offset by the earlier delivery of the chassis ordered allowing for upfitting to be completed prior to the specified deadline.
2	Health & Safety: Risk associated with worker injury while upfitting units.	Third party vendors are used to upfit the units at their facilities.

Appendix H8

EPCOR WATER SERVICES INC.

Drainage Services
High Priority Replacement Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EWSI owns and operates over 6,500 km of sanitary, stormwater and combined sewers and over 350,000 service connections. Due to aging and deterioration of drainage infrastructure, unexpected failures may disrupt sewer service to homeowners and businesses causing a safety issue or environmental concerns. These failures lead to high priority and costly emergency replacements that require attention, and in the case of emergencies, immediate attention. These failures can range from sewer collapse, service connection collapse, outfall safety issues, force main break, etc. The average age of the assets being replaced ranges from 48 – 69 years, depending on the type of asset. These need to be dealt with on a timely basis in order to restore service to customers, or to rectify urgent safety or environmental concerns.

2. The forecast scope of work for this program for the 2022-2024 PBR term includes 600 high priority replacements per year including replacement of various asset types (services, catch basins, mainlines, manholes). Actual work completed under this program will depend on the number and type of high priority or emergency replacement required to restore or maintain service to customers.

3. This program is categorized as reliability / life cycle replacement and is one of the Drainage System Rehabilitation programs. EWSI has forecast total program capital expenditures during 2022-2024 at $52.14 million.

2.0 BACKGROUND AND JUSTIFICATION

4. EWSI owns and operates over 6,500 km of sanitary, storm and combined sewers and over 350,000 service connections. The average age of the sewer pipes is 38 years old, with 30% of them over 50 years old. Due to aging and deterioration of drainage infrastructure, unexpected failures may disrupt sewer service to homeowners and businesses causing a safety issue or environmental concerns. These failures lead to high priority and emergency replacements that require attention, and in the case of emergencies, immediate attention. These failures can range from sewer collapse, service connection collapse, outfall safety issues, force main break, etc. The average age of the assets being replaced ranges from 48 – 69 years, depending on the type of asset. These need to be dealt with on a timely basis in order to restore service to customers, or to rectify urgent safety or environmental concerns.

5. High priorities and emergencies are identified either through regular inspections or when a customer calls to EWSI’s Control Center. In a significant impact event, EWSI’s construction

crews may replace a pipe section or full length of mainline or service to rectify the situation or there may be a requirement for further assessment before proceeding with design and replacement. Table 2.0-1 explains the difference between emergency and high priority replacement criteria.

Table 2.0-1
Emergency and High Priority Replacement Criteria

Priority	A **Definitions/Check List**	B **Timeline for Replacement**
1 Emergency	• Sanitary service is collapsed/broken on EPCOR side of the property line. • Service Maintenance (SM)/Operational crews were unable to release the service. • A Service Maintenance foreman has confirmed that the collapsed/broken pipe is on EPCOR side if it was not clear as per the initial crew visit.	24 Hours / Within a day
2 High Priority	• Sanitary service is in poor condition on EPCOR side of the property line. • There can be one factor or multiple factors contributing to the poor condition. • Service Maintenance (SM)/Operational crews were able to release the service. • A Service Maintenance foreman has confirmed the poor condition on EPCOR side if it was not clear as per the initial crew visit. • Service cannot be relined based on the defects.	1 day to 365 days / Within a year

6. Figures 2.0-1 and 2.0-2 provide some images of high priority replacements that have occurred in the sanitary system.

Figure 2.0-1
Sanitary Sewer Service Infiltrated with Roots

Figure 2.0-2
Broken Sanitary Service Line at Entry to Mainline

7. Figures 2.0-3 and 2.0-4 provide some images of high priority replacements work completed for service replacements and deeper mainline replacements.

Figure 2.0-3
Typical Trench for a High Priority Service Replacement

Figure 2.0-3
Typical Job Site for Deeper Mainline Replacement

3.0 PROGRAM DESCRIPTION

8. Locations in the High Priority Replacement program are initially investigated by EWSI Drainage Operations. Technologists review the condition of the asset and prioritize the work based on estimated remaining life expectancy of the asset. For example, an asset that is completely blocked or collapsed is considered an emergency replacement. Crews will respond immediately to mitigate damages to the customer. In 2020, a significant amount of work was done to develop a process in which jobs are prioritized using the EPCOR risk-based approach. Each location is assessed and a risk score given utilizing a standardized assessment tool. This ensures an objective process is followed and the locations presenting higher risk are prioritized. This risk-based approach is expected to be in place in Q1 of 2021.

9. The estimated scope of work for this program for the 2022-2024 PBR term is presented in Table 3.0-1 below. Actual work completed under this program will depend on the number and type of high priority or emergency replacements required to restore or maintain service to customers. Based on high priority replacement requests that have been received from 2017-2019,it was found that of all work completed in the High Priority Replacement program, 69% were Services, 22% were Catch Basins and Leads, 8% were Mainlines and Manholes, with a small percentage of other replacements (i.e., outfalls or force mains, etc.). Based on this history,

EWSI is forecasting the following number of locations for replacements for the 2022-2024 PBR term as shown in Table 3.0-1.

Table 3.0-1
High Priority Replacements Planned for 2022-2024 PBR Term

		A	B	C	D
	Types of Replacement	**%**	**# of Locations (2022)**	**# of Locations (2023)**	**# of Locations (2024)**
1	Services	69%	414	414	414
2	Catch Basins & Leads	22%	132	132	132
3	Mainlines & Manholes	8%	48	48	48
4	Other	1%	6	6	6
5	**TOTAL**	**100%**	**600**	**600**	**600**

10. Large scale extraordinary rehabilitations or replacements (generally $250,000 or greater) are treated as separate standalone projects outside of the scope of this program.

4.0 ALTERNATIVES ANALYSIS

11. EWSI evaluated the following alternatives to this program.

12. **Do Nothing** –This is not a viable option as EPCOR has an obligation to maintain service for its customers. However, EWSI could choose not to replace assets deemed high priority and instead wait for the asset to completely fail. This would mean that EPCOR would have to respond to the same assets and fix them on an emergency basis which is far more costly than when completing planned work.

13. **Contract out all High Priority Replacements and Emergencies** – Due to the reactive nature of the work, these jobs cannot be planned as is typical with work that is completed by external contractors. An ability for immediate response, especially in emergency situations, is critical to mitigate potential safety, environmental reputation and property damage risks that could result. Contractors can be utilized for some high priority work with longer time horizons, however it is difficult to schedule due to this program being highly reactive and work needing to be continually prioritized to ensure the right asset is being worked on at the right time.

14. **Complete all High Priority Replacements and Emergencies In House** - Due to the high public exposure of the work, EWSI crews are held accountable for ensuring effective, timely completion of replacements and communication with customers. They are highly trained and able to respond quickly to emergency situations thus minimizing environmental damage and maintaining employee and public safety. EWSI's in-house crews have the ability to prioritize their

work efficiently and effectively as required. Based on the advantages and disadvantages of each of the options above, EWSI proposes to complete all priority replacements and emergencies in house as the planned approach for this program.

5.0 COST FORECAST

15. Cost estimates for this program are based on historic costs. Operational efficiencies are continuously being explored and implemented, and these efficiencies have brought the costs for each rehabilitation down each year since 2018 as shown in Table 5.0-1 below. Some of these efficiencies include:

- Reduced crew sizes for all types of work;
- Tandem dispatch model resulting in contractor tandem savings;
- Use of Master Service Agreement contractors for restoration services; and
- Improved processes for allocating and planning on site work.

16. As efficiencies continue to be realized, it is assumed that the average cost per location will be less than $29,000 during the 2022-2024 PBR term.

Table 5.0-1
High Priority Replacements
Historical Costs Per Location
2018-2020
($)

	A **2018**	B **2019**	C **2020**
1 Cost per Location	32,165	31,635	30,000

17. Based on these assumptions, the capital expenditure forecast for the High Priority Replacement Program in 2022-2024 is shown in Table 5.0-2.

Table 5.0-2
High Priority Replacement Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	3.77	3.88	4.00	11.65
2	Internal Labour	9.27	9.41	9.56	28.23
3	Vehicles and Equipment	2.76	2.82	2.87	8.45
4	**Sub-total Direct Costs**	15.80	16.11	16.43	48.34
5	Capital Overhead	1.24	1.27	1.29	3.80
6	**Total Capital Expenditures**	**17.04**	**17.38**	**17.73**	**52.14**

18. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the support contractors such as paving and barricading efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. Most of the construction will be performed internally as well, while only surface restoration will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other locations or maintenance activities to minimize costs.
- Every location is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.

- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.

6.0 RISKS AND MITIGATION PLANS

19. EWSI has identified the key risks and mitigations associated with executing this program in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Environmental Risks – Release of untreated sewage	EWSI will train employees to contain potential releases and will hydrovac and dispose of contaminated soil in an approved landfill
2	Customer Service Disruptions	EWSI will inform customers of the issue and upcoming work. Emergency utility locates are acquired and service is restored within 48 hours
3	Customer Property Damage	EWSI would utilize the score based on EPCOR risk approach to ensure that jobs are prioritized appropriately. Allowing construction crews to complete repair prior to failure.
4	Health and Safety Risks – Sink Holes Disrupting Traffic	EWSI will ensure the area is secured immediately and made safe for the public and traffic is diverted. Repairs are prioritized as emergency based on their impact to public safety and disruption to traffic.
5	Financial Risks – Damage to Public Property	EWSI crews ensure utility locates are in place prior to excavation. EWSI will ensure the job is planned to minimize damage to public property.

Appendix H9

EPCOR WATER SERVICES INC.

Drainage Services
LRT Relocates Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Light Rail Transit (LRT) Relocates Program moves drainage infrastructure that falls within the LRT conflict zone. The LRT conflict zone is an approximate 12 meters right-of-way in which all parallel utilities shallower than seven meters must be relocated and all perpendicular utilities must be lowered and cased.

2. EWSI has received formal notification from the City of Edmonton to continue to advance utility relocates for the West Valley Line LRT beginning in 2018. To meet the timeline for this section of the LRT, a portion of utility relocates for the West Valley Line LRT are required to be completed prior to August 2022, and the remainder is to be undertaken by the City's LRT contractor but still funded under this program. These modifications must be completed at the sole cost of EWSI in accordance with Section 9.1 of the Drainage Services Franchise Agreement with the City of Edmonton, which states:

> *Upon receipt of thirty (30) days written notice from the City, EPCOR shall, at its sole cost and expense, arrange to relocate or cause to be relocated any Equipment operated on the City Lands, or perform any other work in connection with any Equipment and Attachments as may be required by the City to comply with safety standards or accommodate any relocate, installation, modification, repair, construction, upgrading or removal of City facilities.*

3. This project is categorized in the growth/customer requirements PBR category. EWSI has forecast total project capital expenditures during 2022-2024 at $48.53 million to complete the remainder of the West Valley Line LRT. Construction is underway and, while assets will be placed into service as the work progresses, the final project will be closed out by 2027. The utility-funded work over 2022 to 2027 undertaken by the City's LRT contractor is what prevents the project to be closed out in 2022.

2.0 BACKGROUND AND JUSTIFICATION

2.1 Program Background

4. As part of the Franchise Agreement, referenced above, EWSI must relocate any drainage infrastructure in conflict with the proposed LRT with no cost recovery from the City of Edmonton. The relocate clause in EWSI's Franchise Agreement applies to all EWSI facilities located within City road right-of-ways, on City bridges, or within City owned land such as parks and school sites.

It also applies to any City-driven facility installation or modification including road and sidewalk realignments, bridge construction/rehabilitation, LRT track extensions, building modifications or new sewer and drainage main installations or modifications.

5. The West Valley and Metro Line LRT Relocation Projects were not part of the capital program or capital commitments at the time of transfer of the drainage utility to EPCOR. Prior to the transfer, all drainage relocations were funded and completed under the City LRT projects. On July 30, 2019 EWSI filed an application with the City Manager seeking a Non-Routine Adjustment (NRA) to sanitary and stormwater rates beginning January 1, 2020 to recover the capital expenditures associated with these the West Valley and Metro Line LRT Relocation Projects incurred during the 2018-2021 term. The approved NRA was based on the City's original schedule, which has been delayed as the City's original Request for Quotes (RFQ) had to be cancelled due to contractors' withdrawal. There has since been an increase in scope, including the cost to add 80 steel casings for pipes crossing the LRT tracks, as well as a revised cost of construction due to changes in the market conditions. [1]

6. EWSI has completed 100% of relocates for Phase One of the Metro Line and 10% of relocates for the West Valley Line. This program will see through the completion of 60% of additional of relocates for the West Valley Line, with the remaining 30% extending beyond 2024.

2.2 Program Justification

7. This program is a requirement under the Franchise Agreement with the City of Edmonton. Relocating drainage infrastructure that is in conflict with the proposed LRT tracks also protects the existing infrastructure from potential damage during the LRT construction, ensures EWSI's ability to operate and maintain the drainage network in the future, and protects the LRT from potential damage of future sewer breaks underneath the tracks.

3.0 PROGRAM DESCRIPTION

8. The purpose of this program is to enable EWSI meet its commitments under the Franchise Agreement within the 2022-2024 PBR period by relocating existing drainage infrastructure as required for LRT construction. Drainage relocates are completed based on EWSI's commitments under the Franchise Agreement and the City of Edmonton LRT Design Guidelines. Sewer mains crossing the LRT tracks must be installed inside a casing, a minimum 2.0 meters from top of rail to top of casing (except small diameter services, which do not have to be constructed in a casing).

[1] A full reconciliation of 2017-2021 NRA variances will be provided in the 2021 Progress Report.

Sewer mains, and other drainage infrastructure, parallel to the LRT tracks must be more than 4 meters from the outside of the track, with an extra meter separation required at a station.

9. Each drainage infrastructure conflict is evaluated to determine if it should be abandoned or relocated. The LRT conflict zone includes a right of way 4 meters from the center of each track in addition to 1 meter around each proposed station. In most cases, this results in an approximate 12 meters right-of-way in which all parallel utility infrastructure must be relocated and all perpendicular sewer main crossings must be lowered and installed inside a casing. Manholes, catch basins and other facilities may have to be relocated due to road widening or other changes in the road profile related to the LRT construction. In addition, existing deep trunk sewers will be inspected for their structural conditions as it is impractical to relocate due to their depth, typically 10m to 30m deep.

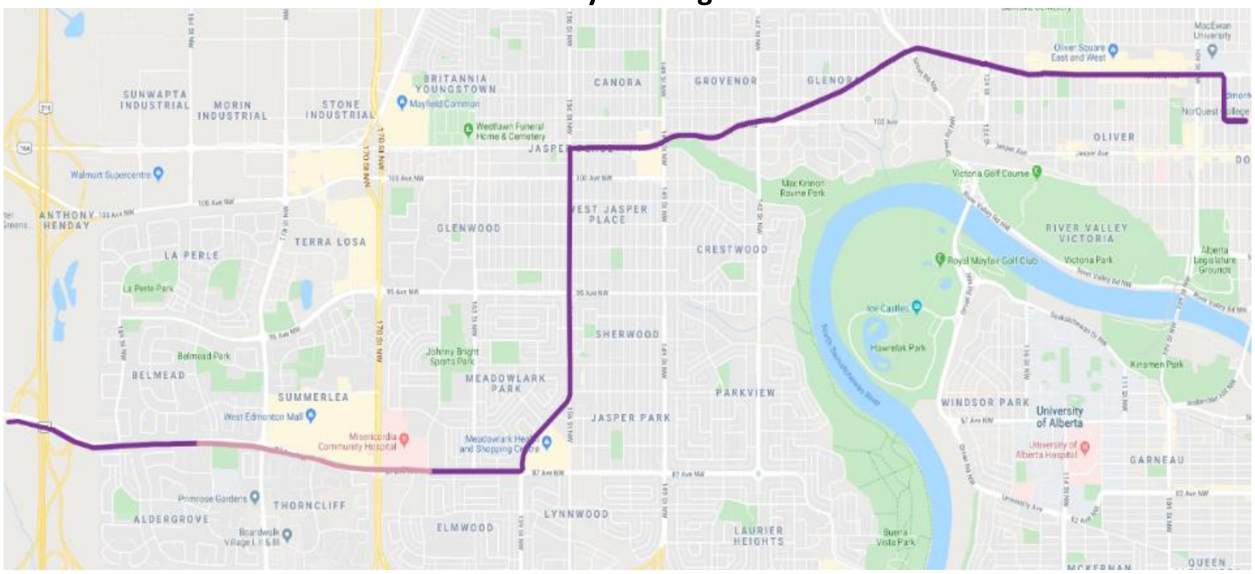
10. Any damage or deterioration to these trunks will need to be repaired prior to the construction of the LRT tracks. Since it is not known at this time whether major repairs will be required, and since the scope of repairs vary significantly, the projected capital expenditures for this program do not include repair costs. In the event that large repairs are required, EWSI will evaluate its options for the recovery of those costs, however small repairs can be accommodated through the contingency for this Program.

11. As shown in Figure 3.0-1, the current focus of this program is completing the sewer relocates for the West extension of the Valley Line LRT (Downtown to Lewis Farms), with the first phase of the construction having begun in 2020. The scope of the work was broken into three priority areas:

- Priority 1 area extends from west of 170 Street to 165 Street on 87 Avenue and is scheduled to be substantially completed in 2020. This includes external open cut relocations and sewer relining in advance of construction. In addition, EPCOR constructed two access manholes on the 87 Ave trunk by in-house crews in order to allow access for future maintenance and inspection.
- Priority 2 areas, planned for construction in 2020-2022 involves contracting our trenchless and open cut restoration work.
- A portion of the priority 3 area, shown in Figure 3.0-2, includes sewer relocations designed by EPCOR and built by the City's LRT contractor. The sewer relocation for these areas is expected to be constructed from 2021 to 2025 by the City's LRT contractor.

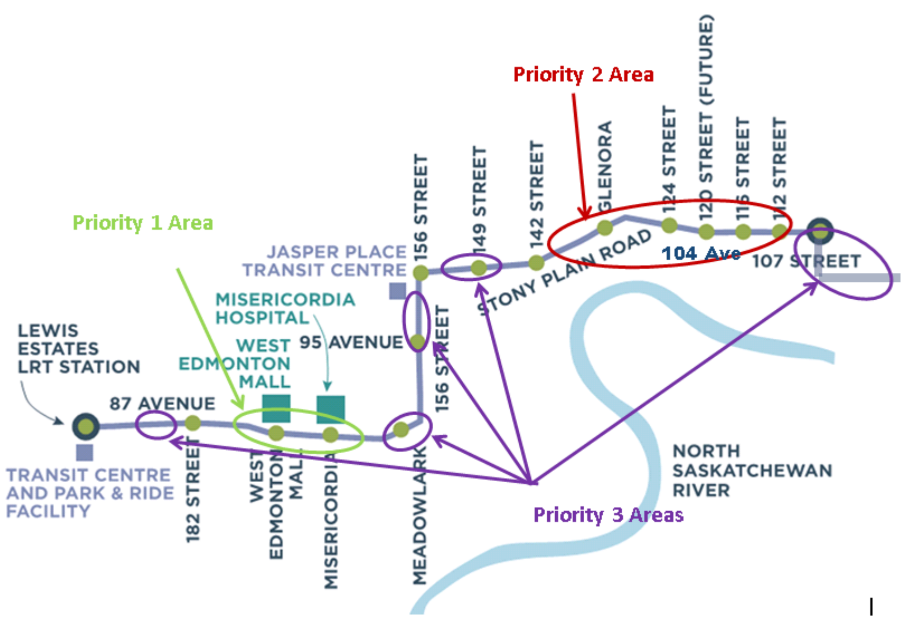
12. The remaining sewer relocations, also part of the priority 3 area, will be designed and constructed by the City's LRT contractor. It is estimated that the detailed design and construction of sewer relocation for these areas are to be conducted from 2021 to 2025.

Figure 3.0-1
West Valley LRT Alignments



*Pink indicates above-ground section.

Figure 3.0-2
West Valley LRT Drainage Priority Areas



13. It is estimated that the West Valley LRT sewer relocations will include:

- Constructing approximately 7.2 km and abandoning approximately 9.8 km of sewer lines with the sizes from 200 mm to 1350 mm in diameter which will include sanitary sewers, storm sewers and combined sewers;
- Installing approximately 120 new manholes; and
- Reconnecting approximately 140 sanitary services.

14. The other future LRT projects, e.g. Metro Line NW Phase 2 (Blatchford to Campbell Road) and Capital Line South LRT, have not been prioritized by City Council for implementation, and as such there are no timelines in place for delivery. Therefore, the sewer relocations associated with Metro Line NW Phase 2 and Capital Line South LRT projects are excluded from this business case. If the City requires EWSI to accelerate these project timelines into the 2022-2024 PBR term, EWSI may seek funding for these additional costs through a non-routine adjustment application.

15. All activities related to project selection, design, drafting, construction coordination and inspection, and as-built recording will be undertaken by internal staff, or by the City's LRT contractor as noted above. The construction and restoration activities will be completed, primarily, by EPCOR's long-term contractors and their sub-contractors. EPCOR has undertaken the construction of two access manholes as part of the Priority Area 1 work. Utility relocate alignments and construction schedules are subject to approval of the ConnectEd Transit Partnership, and also through the Utility Line Assignment (ULA) process.

16. Permits required on every project include approval from the ConnectEd Transit Partnership, a ULA permit, and an OSCAM (required for on-street construction and applied for by the contractor). Certain projects may require Historical Resource Act (e.g., construction near a historical site), contaminated soil awareness (e.g., construction near an abandoned gas station), or land administration items (e.g., utility right of way, crossing agreements, etc.). These items are checked for as part of the project review process and applied for as needed.

4.0 ALTERNATIVES ANALYSIS

17. Each LRT conflict or crossing is evaluated to determine the impacts to the drainage network if it is abandoned, and if it needs to be relocated. The proposed changes to the drainage network are evaluated for hydraulic requirements, customer servicing and future operability and maintenance. If a sewer main needs to be removed/relocated, hydraulic analysis is conducted to determine the necessary upgrades required to maintain the required system capacities including

wet weather storage requirements, and to maintain service to customers. Each design considers the requirements to meet the interim system capacities as well as the future system requirements. The construction methodologies, including relining existing pipes, installing steel casings around the pipes under the tracks and open cut and trenchless methods, were selected in order to meet the requirements of the LRT project, the system requirements as well as minimize project costs. All attempts will be made to minimize construction costs by coordinating project schedules and working with other utilities.

18. If EWSI does not complete the required LRT relocates, the existing sewer mains would likely be damaged during the LRT construction. The sewer mains would also not be accessible once the tracks were built and could cause significant damage to the tracks if a failure was to occur. The relationship between EWSI and the City would be also be negatively impacted, as EWSI would not be adhering to the requirements of the Franchise Agreement.

5.0 COST FORECAST

19. The volume and type of work is entirely driven by the number and type of requests for relocate made by the City. Because the scope of this program is driven by requests from the City of Edmonton Transportation and Drainage departments, it is not within the control of EWSI.

20. The cost estimate for this scope of work was based on the scope identified in the design process which is required to meet the requirements of the City. The capital expenditure forecast for this program is provided in Table 5.0-1.

Table 5.0-1
LRT Relocates Program
2022-2024 Program Capital Expenditure Forecast
($ millions)

		A **Prior 2022**	B **2022**	C **2023**	D **2024**	E **2022-2024 Total**
	Direct Costs					
1	Contractors	38.11	18.55	11.05	12.03	41.63
2	Internal Labour	3.30	0.36	0.30	0.22	0.88
3	Abandonments	0.00	0.40	0.67	0.67	1.74
4	Contingency	0.64	0.33	0.22	0.23	0.78
5	Risk Allowance	1.18	0.73	0.26	0.10	1.09
6	**Sub-total Direct Costs**	**43.65**	**20.37**	**12.49**	**13.25**	**46.11**
7	Indirect Costs	1.75	1.43	0.44	0.55	2.42
8	**Total Project Costs**	**45.41**	**21.80**	**12.93**	**13.80**	**48.53**

21. The contractor costs are based on a combination of actual bid prices (Priority Area 1 and 2) and preliminary design cost estimates for Priority Area 3A and 3B. An agreement is being developed between the City and EPCOR with regards to the construction costs associated with Priority Area 3A and 3B. As the work is being constructed by the City's LRT contractor, and is tightly integrated into the scope that they must complete, it was agreed that EPCOR will pay a set cost for these drainage assets. The initial estimate has been accepted, though updates are in progress to reflect additional costs, such as the inclusion of steel casings where pipes cross under the tracks. In-house construction costs are based on previous actual costs of constructing access manholes.

22. The following assumptions have been made when estimating costs for this program:

- The proposed drainage infrastructure relocates will be approved by the City, including LRT Integrated Infrastructure Services (IIS), and other utilities within a reasonable timeframe.
- There are no significant changes to the LRT design including track alignments, proposed property lines, curbs, sidewalks, elevations, drainage, and streetlights.
- The ConnectEd Transit Partnership will provide the necessary information about the final LRT designs to allow adequate time for approvals & construction of EWSI's relocate projects.
- EPCOR's contractor will have unencumbered access to the project sites, and will have enough resources to complete all the projects within specified timeframes, despite restrictions with regard to road closures, transmission main shutdowns and coordination with other utilities' construction.
- There will be no major changes in the City's pavement restoration specifications, traffic accommodation requirements or costs for services (ex. materials testing).
- Additional sewers, services, and catch basins required for new LRT stations or facilities will be constructed at the cost of the City / ConnectEd Transit Partnership as they do not fall under the Franchise Agreement.
- The inspection program will not identify any significant structural deficiencies which will require major rehabilitation.

23. EWSI will ensure the minimization of capital expenditures through the following:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by

EWSI, eliminating the need for external consultants. A portion of the actual construction, including surface restoration, will be completed by EWSI's internal staff.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis.
- The installations will be consistent with EWSI's construction standards, which will speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- The design and construction of the scope at each location is evaluated to improve economy of scale, to eliminate future throw-away of infrastructure and to facilitate future maintenance.

6.0 RISKS AND MITIGATION PLANS

24. Key risks and planned mitigations associated with execution of this project are described in Table 6.0-1 below.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Financial - Due to limited space and other utility conflicts, it can be difficult to secure the optimum sewer main alignments.	Work with City designers and other utilities and construction coordinators to ensure all sewer main alignments are identified and secured as early as possible. Obtain information on other utility relocate project status' and as-built locations.
2	Financial - Unforeseen construction costs and force accounts due to hidden ground conditions or location and condition of existing utility assets differing from record information that will impact the overall costs of projects.	Work with designers, coordinators, and contractors to identify potential problems, provide accurate design and quantity estimates to minimize the need for extra work. Conduct hydrovac to determine if there are known and unknown utilities at shaft and manhole sites.
3	Customer Service – Drainage relocation work can involve presence and significant disruptions at a single site for long durations and may have negative impacts on the perception of EPCOR, the City and the LRT project.	Proactive communication to customers, such as delivering notices and engaging with key external stakeholders as required by the communications plan.

Appendix H10

EPCOR WATER SERVICES INC.

Drainage Services
Neighbourhood Renewal Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. The Drainage Neighbourhood Renewal Program is an annual program that focuses on the renewal and replacement of aging local sanitary, storm and combined sewers in mature neighbourhoods around the city of Edmonton. Local sewers account for 63% of underground pipe in the entire sewer system at approximately 4,700 km of pipe. As of 2019, local sanitary and storm infrastructure within the poor and very poor categories have an estimated replacement cost of $554 million. Risks associated with deterioration or failure of local sewer infrastructure includes roadway subsidence which poses a safety risk to the public and disruption to traffic; sewage spills to the local environment or to the river; potential service disruption to a large number of customers; potential for sewer backups into customer's basements and financial claims against EPCOR for these backups; and costly emergency repairs which are also disruptive to traffic. As an example, in Rhatigan Ridge, a local sanitary sewer collapsed and several homes had sewage backed up in their basements. There were over 100 residential properties that drain to this local sanitary pipe that could have been impacted in the Riverbend neighbourhood.

2. During the 2022-2024 PBR term, this program will include inspections of 129 km of sanitary, storm and combined pipes with a diameter of 750 mm or less as well as manholes (MHs), catch basins (CBs), and CB leads within 18 neighbourhoods. This workload is comparable to previous years. Historically, EWSI has completed 5 to 6 neighbourhoods per year under this program. Criteria for renewal under this program includes asset condition graded poor or very poor, assets graded moderate where renewal would address operational needs, or where type and severity of defects are sufficient for renewal.

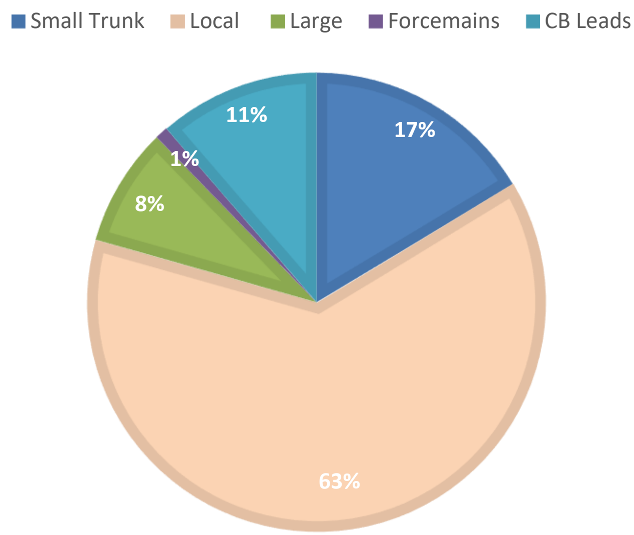
3. This program is categorized as growth / customer requirements. EWSI has forecast total program capital expenditures during 2022-2024 at $76.48 million. From 2006-2011, the average annual budget for neighbourhood renewal was about $26 million per year. From 2012-2018, the budget was about $30 million per year. The forecast of $76.48 million for this program over the three-year PBR term 2022-2024 is slightly lower on an annual average basis, but remains within the range of the annual capital expenditures over the last 14 years.

2.0 BACKGROUND AND JUSTIFICATION

4. The Drainage Neighbourhood Renewal Program focuses on the renewal and replacement of aging local sanitary, storm and combined sewers in mature neighbourhoods around the city. Local sewers account for the largest portion of underground pipe in the entire sewer system at

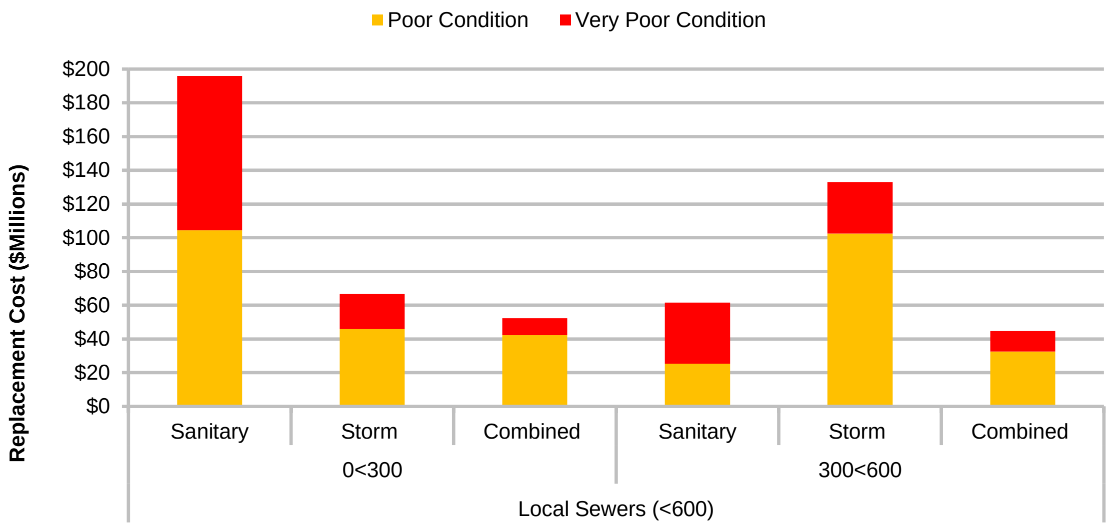
approximately 4,700 km of pipe. The graph in Figure 2.0-1 shows the proportions of sewer infrastructure with local sewers accounting for 63% of the total sewer length.

Figure 2.0-1
Proportion of Sewer Infrastructure



5. As the system ages, it is important to assess its condition to avoid emergencies and to prioritize renewal to deal with structural issues. The chart shown in Figure 2.0-2 indicates how much local infrastructure is in poor and very poor physical condition. As of 2019, assets within the poor and very poor categories have an estimated replacement cost of $554 million. Rehabilitation and replacements that are completed through renewal will have a positive effect on the condition ratings and therefore would reduce those figures.

Figure 2.0-2
Local Sewers Physical Condition Rating
Poor and Very Poor Replacement Cost
($ millions)



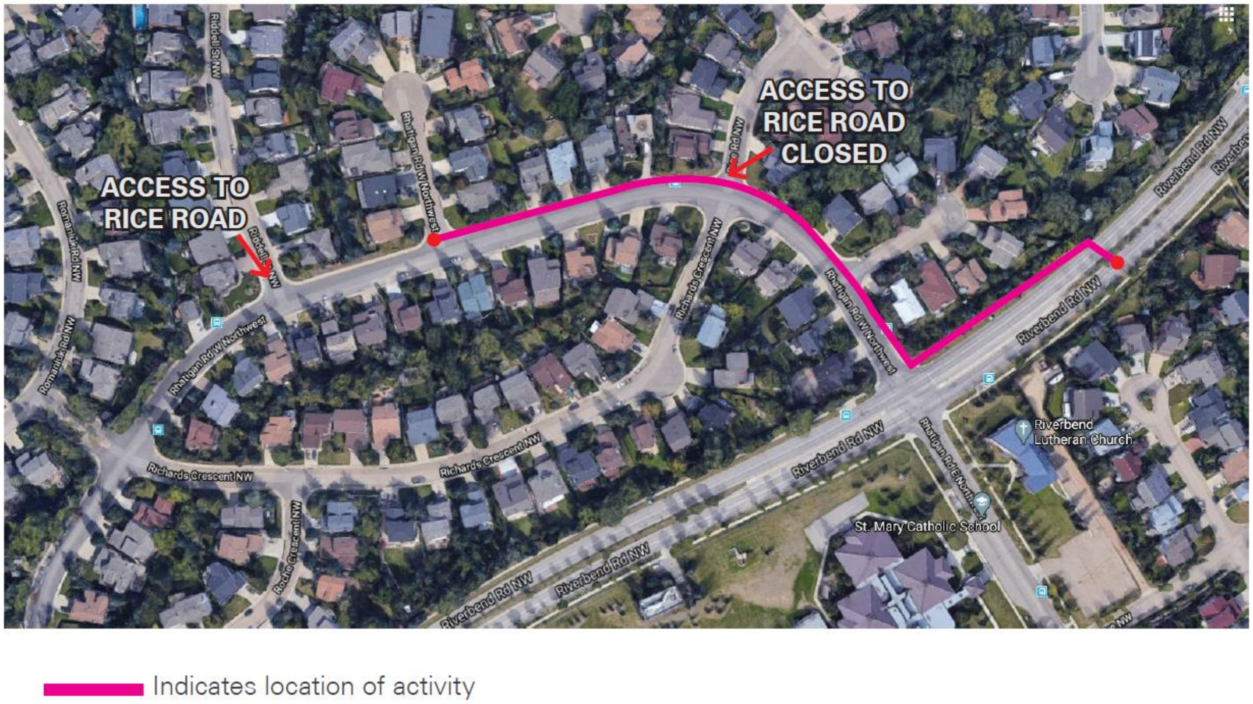
6. There are several risks associated with the deterioration and failure of local sewer infrastructure in neighbourhoods:

- Health and Safety – Failure of local sewer infrastructure could cause a roadway subsidence which poses a safety risk to the public.
- Environmental – Failure of a sanitary or combined local sewer could cause a sewage spill to the local environment or to the river.
- Customer Disruptions – Failure of local sewers can cause disruption to large service areas which would impact many customers, and can also cause sewer backups into customer's basements. Failed sewers also lead to more emergency repairs which are more disruptive to the roadway and therefore to the public.
- Financial – Emergency repairs of failed local sewers can be more costly than proactive renewal. Claims against EPCOR for sewer backups can also lead to a financial impact.

7. One example is the Rhatigan Ridge neighbourhood where a local sanitary sewer collapsed in March 2020. Several homes had sewage backed up in their basements. There are over 100 homes that drain to this sanitary sewer pipe that potentially could have been impacted. During the emergency construction, there were significant operations and construction activity along Rhatigan Road and Riverbend Road for 10 to 12 weeks. Figure 2.0-3 shows the extent of the

emergency construction work. Several homes were asked to restricted water use during construction and potential claims were filed.

Figure 2.0-3
Location of the Emergency Replacement Activity



8. The Drainage Neighbourhood Renewal Program provides EWSI the opportunity to proactively rehabilitate the aging local sewer infrastructure in the selected neighbourhoods through relining and open cut renewal to mitigate the risks listed above. Coordinating the proactive renewal with the reconstruction of roadways also mitigates the risk of having to cut into newly reconstructed pavement. The Drainage Neighbourhood Renewal Program runs in coordination with the City of Edmonton's (City) Building Great Neighbourhoods and Open Spaces Neighbourhood Renewal Program. Each year, the EWSI selects 4-6 neighbourhoods based on current asset condition and coordination with the Neighbourhood Renewal reconstruction schedule.

9. By conducting closed circuit television (CCTV) inspections of all the local sewers in the locations of the City's Neighbourhood Renewal Program, EWSI has the opportunity to rehabilitate or replace sections of pipe, prolonging the useful life of the pipes and improving the overall physical condition of the sewer system. Coordinating the work with the City also provides efficiencies such as reducing the likelihood of having to cut into newly reconstructed pavement,

allowing some CB, CB lead and MH rehabilitation work to be completed by the City under their reconstruction contract, and reducing disruption to the public.

10. Every individual neighbourhood project will take 2-3 years. CCTV and design will be completed in the first year, open cut will be completed in the second year and relining will begin in the second year and be completed in the third year. About 80% of the work will be done through relining which requires little disruption to the pavement. CCTV and smoke testing for the neighbourhood will be completed by EWSI Drainage Operations staff.

11. The scope for the Drainage Neighbourhood Renewal Program includes inspection and renewal of local sewers, MHs, CBs and CB leads within the neighbourhoods selected for renewal. Renewal will also include some previously identified services in need of replacement that fall within these planned neighbourhoods. Pipes that are prioritized for rehabilitation under this program are then renewed through either open cut repair or relining. The Drainage Neighbourhood Renewal Program coordinates with the Arterial Roadway Coordination Program and High Priority Repair to ensure alignment. Concept development will determine the exact scope of work to be completed.

12. The selection criteria for inspection and renewal of infrastructure in this program is shown in Table 2.0-1.

Table 2.0-1
Selection Criteria for Drainage Neighbourhood Renewal Program

	Selection Criteria for Renewal	A **Definition**
1	Pipe Sizes	750 mm and smaller
2	Non-linear Assets	Manholes, Catch Basins and Catch Basin leads
3	Drainage Asset Condition	Grade of 4 or 5 (poor and very poor)
4	Drainage Asset Condition	Grade of 3 and addresses operational needs, or type and severity of defects sufficient for renewal

13. The infrastructure requires CCTV inspection to determine asset conditions. Based on those inspections, the drainage infrastructure will be given a grade according to the Pipe Assessment Certification Program (PACP) and Manhole Assessment Certification Program (MACP) Ranking System shown in Table 2.0-2. PACP is the North American standard for pipe defect identification and assessment, providing standardization and consistency to the methods in which pipe conditions are identified, evaluated, and managed. Once the infrastructure has been reviewed and graded, a risk assessment and evaluation will be undertaken for each segment to determine which pipes require open cut replacement or relining. Pipes with a Likelihood of

Failure (LOF) of 3, 4 or 5 on the EPCOR Risk Matrix will move forward for open cut replacement or relining. There may also be an operational and maintenance reason for renewal or replacement of a lower LOF pipe such as roots or infiltration.

Table 2.0-2
PACP/MACP Condition Grading

	Grade	A **Definition**
1	5	Most significant defects
2	4	Significant defects
3	3	Moderate defects
4	2	Minor to moderate defects
5	1	Minor defects

14. The following items are excluded from the scope of work:

- Any pipe greater than 750 mm, except in some exceptional cases where up to 900 mm can be included;
- Neighbourhood wide service renewal except those that are flagged by Drainage Operations and have a history of issues within the neighbourhood;
- Coordination with neighbourhood renewal projects that are mill and overlay only or drainage infrastructure asset condition is good to very good.

3.0 PROGRAM DESCRIPTION

15. EWSI plans to initiate 18 neighbourhood projects during the 2022-2024 PBR term as shown in Table 3.0-1 below. These neighbourhoods are geographically located in different parts of the City. There are about 129 km of sanitary, storm and combined pipes with a diameter of 750 mm or less, as well as CB leads, MHs and CBs that will be inspected over the 2022-2024 PBR term.

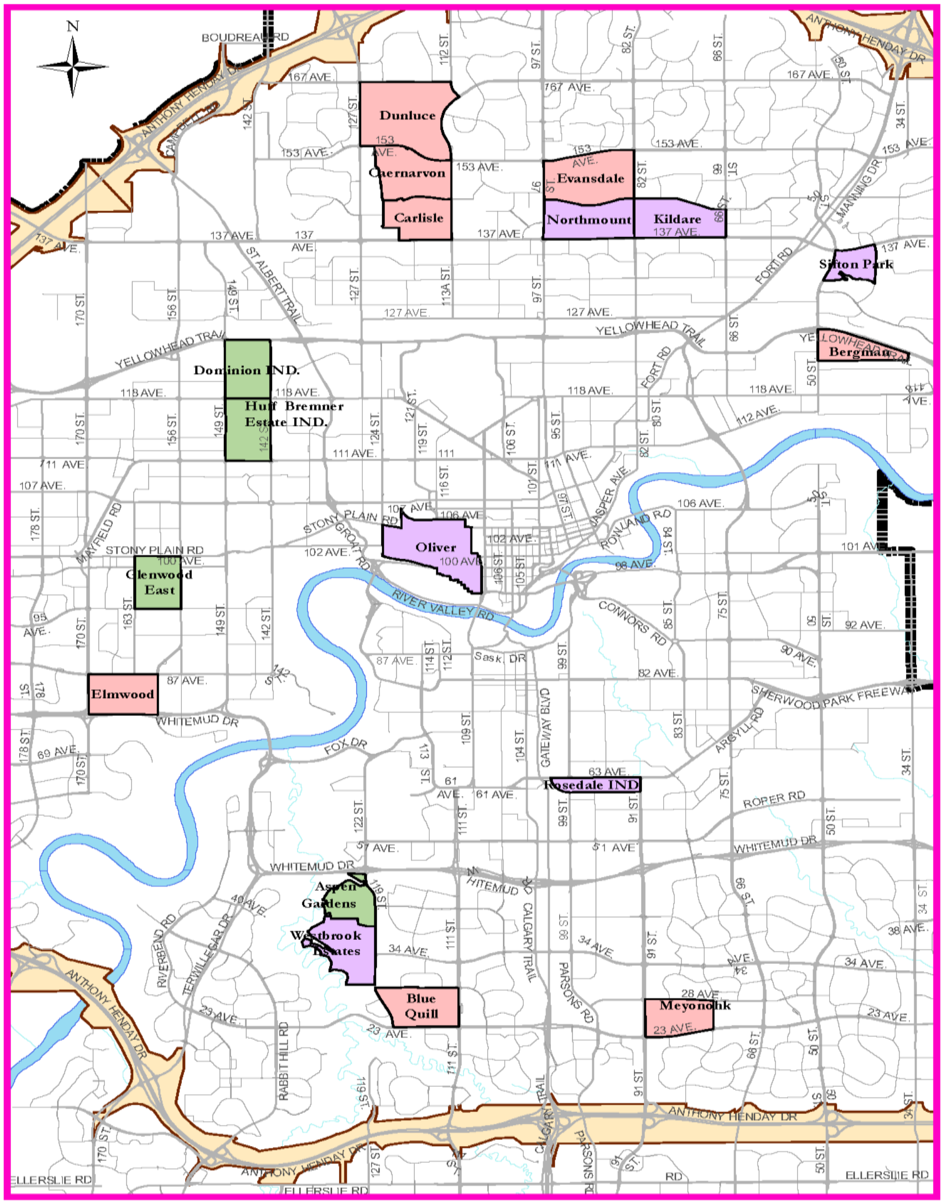
Table 3.0-1
Drainage Neighbourhood Renewal Program
2022-2024 Project List

	Neighbourhood Name	A CCTV & Design	B Open Cut	C Relining
1	Bergman	2022	2023	2024
2	Carlisle	2022	2023	2024
3	Dunluce	2022	2023	2024
4	Meyonohk	2022	2023	2024
5	Blue Quill	2022	2023	2024
6	Caernarvon	2022	2023	2024
7	Elmwood	2022	2023	2024
8	Evansdale	2022	2023	2024
9	Aspen Garden	2023	2024	2025
10	Huff Breamner Industrial	2023	2024	2025
11	Dominion Industrial	2023	2024	2025
12	Glenwood East of 163 St	2023	2024	2025
13	Rossdale Industrial	2024	2025	2026
14	Kildare	2024	2025	2026
15	Northmount	2024	2025	2026
16	Westbrook Estates	2024	2025	2026
17	Sifton Park	2024	2025	2026
18	Oliver	2024	2025	2026

16. A detailed neighbourhood location map is provided in Figure 3.0-1.

Figure 3.0-1
2022-2024 Drainage Neighbourhood Renewal Location Map

2022-2024 DRAINAGE NEIGHBOURHOOD RENEWAL LOCATIONS



NBHD RENEWAL

2022
- Bergman
- Blue Quill
- Caernarvon
- Carlisle
- Dunluce
- Elmwood
- Evansdale
- Meyonohk

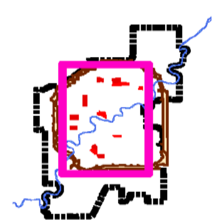
2023
- Aspen Gardens
- Dominion Industrial
- Glenwood East
- Huff Bremner Est. Ind.

2024
- Kildare
- Northmount
- Oliver
- Rosedale Ind.
- Sifton Park
- Westbrook Estates

2022 - WORK DETAILS
CCTV & design in 2022
Open cut & partial relining 2023
Remaining relining 2024

2023 - WORK DETAILS
CCTV & design in 2023
Open cut & partial relining 2024
Remaining relining 2025

2024 - WORK DETAILS
CCTV & design in 2024
Open cut & partial relining 2025
Remaining relining 2026



17. As EWSI plans for infrastructure renewal in a neighbourhood, it will consider additional improvements that have been identified through other initiatives that could be completed and/or coordinated at the same time. These types of improvements include Low Impact Development (LID) features, flood proofing, service renewal, inflow and infiltration reduction, capacity upgrades and/or odour reduction. These improvements will be funded through separate program budgets.

18. The Drainage Neighbourhood Renewal Program will begin with CCTV inspections and concept design development in the first year which will include planning work to identify, prioritize and coordinate neighbourhoods to be initiated for renewal. Once the concept design work is completed, detailed design will begin followed by construction. Open cut and partial relining work will be completed in the second year. The remaining relining will be completed by the end of year three.

19. Table 3.0-2 provides a schedule for this program over the 2022-2024 PBR term.

Table 3.0-2
Drainage Neighbourhood Renewal Program Schedule
(2022-2024)

	Project Phases	A **2021 Q4**	B **2022 Q1**	C **2022 Q2**	D **2022 Q3**	E **2022 Q4**	F **2023 Q1**	G **2023 Q2**	H **2023 Q3**	I **2023 Q4**	J **2024 Q1**	K **2024 Q2**	L **2024 Q3**	M **2024 Q4**
1	Initiation and Approvals	α				β				μ				
2	CCTV & Design	α	α	α	α		β	β	β		μ	μ	μ	
3	Procurement					α				β				μ
4	Construction						α	α	α	α	α β	α β	α β	β
5	Commissioning												α	α
6	Close-out													α

α: Neighbourhoods initiated in 2022.
β: Neighbourhoods initiated in 2023.
μ: Neighbourhoods initiated in 2024.

4.0 ALTERNATIVES ANALYSIS

20. An alternative to the Drainage Neighbourhood Renewal Program is to not rehabilitate local sewers when they are identified and prioritized to be in poor or very poor condition. If nothing is done, the risk is that the local infrastructure under these roadways may be close to failure and if left to deteriorate, will likely cause emergency situations that would result in cutting into newly reconstructed roadways. Emergency repairs are more costly and are more disruptive to the public. As such, this alternative is rejected in favour of continuing the Drainage Neighbourhood Renewal Program.

5.0 COST FORECAST

21. The Drainage Neighbourhood Renewal Program capital cost estimate is based on historical information such as average annual lengths of CCTV required, average annual reline and open cut lengths, and unit costs from design and construction of past neighbourhood projects.

22. Assumptions and approach are as follows based on EWSI's experience and learnings from past years of the program:

- All CCTV inspections are either completed internally when resources are available or by external contractors;
- Any high priority open cut work will be handled by High Priority Repair Program;
- Pipes that have had open cut spot repair work will also have a full reline completed to eliminate joints in the pipe that can lead to more structural issues or root intrusions; and
- Both open cut and relining will be completed by external resources.

23. Table 5.0-1 provides the forecast capital expenditures for this program for the 2022-2024 PBR term.

Table 5.0-1
Drainage Neighbourhood Renewal Program
2022-2024 Program Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	20.90	6.20	13.41	40.51
2	Internal Labour	3.63	8.52	5.93	18.09
3	Vehicles and Equipment	1.27	2.93	1.96	6.15
4	Contingency	0.80	0.99	2.75	4.54
5	**Sub-total Direct Costs**	26.60	18.64	24.05	**69.29**
6	Capital Overhead and AFUDC	1.36	2.63	3.21	7.19
7	**Total Capital Expenditures**	27.96	21.26	27.26	**76.48**

24. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the construction services using the contractor's equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants.
- CCTV inspections will be completed by internal resources as available, and will be contracted out to external resources if required. Open Cut construction will be completed by internal resources, whereas relining will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

25. Table 6.0-1 provides the key risks and mitigations associated with executing this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Execution Risks - The Program is subject to such execution risks including utility conflicts, unexpected scope increases, poor soil conditions, new road restoration requirements, increase in overall construction prices, and csection onflicts with other construction projects in the area.	EWSI will circulate all projects through the Utility Line Assignment (ULA) system, deal with force accounts on an individual basis. To manage program schedules, EWSI will ensure inspectors are recording all delays and force accounts. EWSI will work with the City to identify and clarify new requirements and or changes to the project and will coordinate construction with other utilities and City. EWSI's internal Drainage Services resources will undertake all project related activities including any required inspection, project management, design, construction coordination and survey as well as-built recording. EWSI will employ pre-qualified external contractors for additional CCTV inspection required due to lack of internal resources availability, open cut and relining works to complete construction.
2	Traffic Disruption Risks - The City's commitment to prevent significant traffic impacts from construction, especially downtown, may impact EWSI's ability to get OSCAM permits or restrict our work to off-peak hours.	EWSI will advise the City's Traffic Operations Group of all projects where roads are affected well in advance of construction.
3	Health and Safety - There is a risk of local drainage asset failure such as main lines and services that could result in sewer backup which is a potential health risk to the public.	Replacing or rehabilitating pipe, manhole and service would extend the life of the assets and lower the risks of asset failure.
4	Customer Impacts - There is a risk of sewer failure that could result in service interruption affecting the residents in the neighbourhoods for a few weeks.	The proposed rehabilitation project would lower the risks of sewer failure and service interruption in the neighbourhoods.
5	Financial - The potential sewer main failure could result in more costly emergency replacement.	The proposed neighbourhood renewal program would lower the risks of sewer failure in the neighbourhoods and, therefore, reduce the emergency replacement costs

Appendix H11

EPCOR WATER SERVICES INC.

Drainage Services
Private Development
Construction Coordination Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Private Development Construction Coordination Program is an annual program that includes costs to support the planning and development processes and facilitating the construction of new drainage infrastructure by private developers. The costs in this program covers EWSI's and the City of Edmonton's cost for staff to review land development applications, technical reports, and design drawings, and EWSI's cost to complete inspections during and after construction, recording as-built drawings which are required to ensure that new developments are designed in accordance with the City's Design and Construction Standards. This program also covers the City of Edmonton's costs to administer the Permanent Area Contribution (PAC) system and other development levies for the cost sharing of larger "bulk" infrastructure. The City's personnel costs are paid for by EWSI under the terms of the Urban Form and Corporate Strategic Development Services Agreement, and a portion of those costs are subsequently capitalized by EWSI. This program ultimately facilitates the growth of the drainage network and EWSI's customer base, and ensures that the infrastructure that EWSI inherits is suitable to operate and maintain for its intended life span.

2. This program is essential to the orderly development of the drainage system, ensuring not only that the City of Edmonton Design and Construction Standards are met, but also that sanitary and stormwater mains will be constructed with consideration for future development requirements. As EWSI will assume ownership of these assets upon completion, it is essential that EWSI be involved throughout the planning, design, and construction process to ensure proper asset information is available for future operation and maintenance activities.

3. Costs and recoveries associated with this program are dependent on activity levels in Edmonton's housing market and therefore fluctuate from year to year and can be difficult to forecast. This program is estimated to cost $12.24 million (gross) and covers the internal labour costs associated with construction coordination activities undertaken by EWSI and the City of Edmonton Drainage staff from the planning phase to the point at which EWSI takes ownership of the new drainage infrastructure. These costs are also partially offset by contributions (estimated at $0.92 million over the 2022-2024 PBR term) from the City of Edmonton in the form of inspection fees collected from developers. These fees are intended to cover a portion of the costs associated with the program, specifically engineering drawing review, inspection, and crew time. Net of these contributions, the cost forecast for this program for 2022-2024 is $11.32 million.

4. This program is categorized as growth / customer requirements and is one of the Drainage System Rehabilitation programs. This program was initiated in 2018 following the transfer of Drainage Services to EPCOR in September 2017. Prior to the transfer, Drainage Services under the City of Edmonton operated a similar capital program to fund these activities. Following the transfer, some of the functions under this program stayed with the City of Edmonton (including drawing review, reports and applications review). The Private Development Construction Coordination Program does not include the cost of constructing the drainage infrastructure. Drainage infrastructure construction is funded by private developers as part of the costs of their development, and cost-shared amongst benefiting landowners through the City's PAC system.

2.0 BACKGROUND/JUSTIFICATION

5. This is an annual program that supports planning and development processes, ultimately facilitating the construction of new drainage infrastructure by private developers. Land development in Edmonton is driven by developers who hire planning and engineering consultants to plan and design new neighbourhoods, then hire contractors to construct the infrastructure necessary to serve the development, which infrastructure gets turned over to EWSI as contributed assets.

6. Throughout the stages of planning, rezoning, subdivision, and engineering design, developers are required to submit various applications, technical reports, design drawings, and other documents for review and approval from a drainage utility perspective. EWSI and City of Edmonton collaborate on these processes, as outlined in the Urban Form and Corporate Strategic Development Services Agreement. EWSI performs inspections during and after construction, and also records as-built information. In addition, the City administers development levies for the cost sharing of larger "bulk" infrastructure which ensures that costs are shared appropriately between benefiting landowners, and that funds are collected from developers to support the Sanitary Servicing Strategy Fund (SSSF).

7. These activities, all which are funded by this program, are required to ensure that new developments are designed and built in accordance with the Design and Construction Standards, and that infrastructure is recorded accurately in EWSI's Geographic Information System (GIS). This program ultimately facilitates the growth of the drainage network and EWSI's customer base, and ensures that the infrastructure that EWSI inherits is suitable to operate and maintain for its intended life span.

3.0 PROGRAM DESCRIPTION

8. The cost associated with the following activities are covered under this program:

Activities completed by EWSI Water Services:

- Construction Completion/Final Acceptance inspections (approximately 475 per year);
- Inspector review of developer applications;
- Infill Water and Sewer Servicing staff time for development inquiries and customer account setup; and
- Land administration services.

Activities completed by EWSI Drainage Services:

- Infrastructure as-built recording for contributed assets (approximately 200 subdivisions per year);
- Review of development applications and inspection of specialized infrastructure (approximately 50 per year); and
- Reviews of development applications and program coordination.

Activities completed by City of Edmonton:

- Engineering drawings reviews (approximately 780 per year);
- Land Development Applications reviews; and
- Administration of the PAC system and other drainage development levies.

9. This is an annual program beginning on January 1st and ending on December 31st each year.

4.0 ALTERNATIVES ANALYSIS

10. The alternatives to maintaining the status quo are limited. Some smaller municipalities hire external consultants to review developer design submissions and perform inspections on their behalf where they do not have the internal staff or expertise within the organization. This option is not considered viable in Edmonton due to the volume of submissions and the potential for issues with consistency if the hired consulting firm were to change from year to year. EWSI could risk losing control over the quality of submissions and the infrastructure as it would be entirely dependent on the consulting firm to maintain the quality.

11. Not participating in these processes all together, and thus relying entirely on the engineer who designs and certifies on behalf of the developer that the infrastructure is constructed in accordance with the standards, is also not considered to be a realistic option.

12. Without EPCOR's participation in the City's planning and development processes, the quality, integrity, and reliability of privately constructed drainage infrastructure (around $135 million per year in new assets over the past 5 years) would be jeopardized, as well as compliance with regulations, standards, and environmental requirements. Operational and maintenance costs would increase due to improper planning, design, and installation of drainage infrastructure. In addition, the orderly sequential development of the drainage system could break down, making it difficult or inefficient to service future subdivisions. This would ultimately lead to negative impacts on EPCOR's finances, operation, and reputation.

5.0 COST FORECAST

13. This program has only been in operation for two full calendar years, starting after Drainage was transferred from the City to EPCOR in September 2017. The actual costs and revenues for 2018 and 2019 are broken down as shown in Table 5.0-1.

Table 5.0-1
2018-2019 Private Development Construction Coordination Program Costs
($ millions)

	Year	A City of Edmonton Activity Costs	B EWSI Costs (salaries, mileage, overhead, etc.)	C Recoveries (Inspection Fees)	D Total
1	2018	$ 1.81 (excl. PAC)	$ 1.79	($0.56)	$ 3.03
2	2019	$ 2.38 (incl. PAC)	$ 1.54	($0.18)	$ 3.74

14. The costs and revenues for this program can be somewhat dependent on the economy and housing market, and therefore can fluctuate from year to year. However, it is possible to estimate based on the level of development activity seen over the past two years and the corresponding demand seen on the program, along with the level of development activity anticipated during the PBR period. This is considered the most reasonable approach to estimating future costs and revenue because it is based on actual data.

15. Recent discussions with the City and the development industry suggest that lower activity levels in 2019 represent a new normal. The COVID-19 pandemic may result in a decrease in both costs and revenues, however, no significant changes have been seen as of yet. On the other hand, when the land development industry has went through slower periods in the past,

developers have often shifted their focus to smaller-sized subdivisions that have still had significant demands on this program. To balance these two effects, EWSI has assumed that the costs and revenues seen in 2019 provide a reasonable basis to estimate the annual costs and revenues over the 2022-24 PBR term.

16. For program costs, City of Edmonton costs are estimated at $2.35 million per year (in 2020 dollars), which is similar to 2019. Internal EPCOR staff costs/hours were estimated using a combination of 2019 actual values and input from the applicable business units that charge to the program. Program hours by job type were analyzed for 2019, then similar values were applied to the PBR period, with the majority of hours attributed to recording of as-builts (3,740 hours) and inspections by Drainage Operations labour staff (2,012 hours). Using 2019 as a baseline is expected to provide a reasonable indication of these costs for the PBR term.

17. Program recoveries come solely from Inspection Fees paid by developers when they enter into servicing agreements with the City, just prior to construction. The amount of revenue is dependent on development activity levels, which again, are difficult to predict and fluctuate each year. Revenue was considered to be abnormally low in 2019 ($184,348) when compared to the 10 year average of approximately $625,000 per year, however, revenues are not expected to rebound to historical average levels in the near future due to economic conditions. Therefore, an estimate of $300,000 was used.

18. Forecast capital expenditures for the 2022-2025 PBR term are shown in Table 5.0-2.

Table 5.0-2
2022-2026 Capital Expenditure Forecast
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
1	City of Edmonton Costs	2.5	2.5	2.6	7.6
2	Water Services Costs	0.7	0.8	0.8	2.3
	Drainage Costs:				
	Direct Costs				
3	Contractors	0.00	0.00	0.00	0.00
4	Internal Labour	0.65	0.66	0.68	1.99
5	Vehicles and Equipment	0.03	0.03	0.03	0.10
6	Abandonments	0.00	0.00	0.00	0.00
7	Contingency	0.00	0.00	0.00	0.00
8	Risk Allowance	0.00	0.00	0.00	0.00
9	**Sub-total Direct Costs**	3.89	3.97	4.04	**11.90**
10	Capital Overhead and AFUDC	0.11	0.11	0.12	0.34
11	**Total Capital Expenditures**	4.00	4.08	4.16	**12.24**
12	Less: Inspection Fees (Recoveries)	(0.30)	(0.31)	(0.32)	(0.92)
13	**Net Program Capital Expenditures**	3.70	3.77	3.85	**11.32**

19. EWSI takes steps to minimize the level of these capital expenditures. These include:

- All activities related to project review, coordination, inspection, and as-built recording are undertaken by either EWSI or the City, eliminating the need for external consultants.
- Opportunities for process improvements and Water-Drainage synergies to better manage program costs.

6.0 RISKS AND MITIGATION PLANS

20. Key risks and mitigation plans associated with execution of this program are described in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	**Financial Risks** - The number of submissions and construction projects is under the control of developers and consultants, who are under the influence of market conditions. Costs and revenues can fluctuate if market conditions vary.	EWSI will monitor costs and revenues each month as part of its regular capital management and governance processes with an effort to manage any anticipated cost increases.
2	**Execution Risks -** A key execution risk is the possible lack of adequate staffing to handle workloads, particularly when complex situations or issues arise.	On a regular basis, EWSI will carefully monitor resource and work levels and adjust as necessary.

Appendix H12

EPCOR WATER SERVICES INC.

Drainage Services
Proactive Service Renewal Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Proactive Service Renewal Program is an annual program to inspect and reline services that have structural and/or maintenance issues, but are in adequate condition for relining. Within the City of Edmonton, over 48,000 services are rated as poor and very poor and consist mainly of sanitary clay tile pipe aged 65 years and older. This large cohort of assets are nearing the end of their expected life of 75 years.

2. Failure of services requires more expensive open cut emergency repairs or replacements under EWSI's High Priority Repair Program. The average cost of open cut emergency repairs is approximately $29,000, depending on the length of service. The number of emergency service repairs and replacements have been on an increasing trend. Service failures also impact EWSI's customers through sewer blockages and back up.

3. By proactive relining of services through this program, identified asset risks are mitigated and managed appropriately to reduce risk exposure which aligns with the asset management objectives set out by EPCOR. Proactive relining typically costs between $8,000 and $13,000 depending on service length, which is a significant cost savings over reactive open cut costs (approximately $29,000). Fewer customer impacts will increase EPCOR's reputation and will reduce the number of service complaint calls.

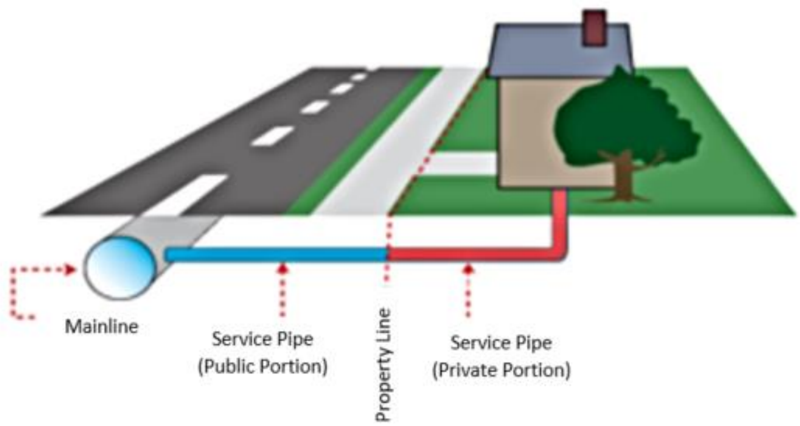
4. The Proactive Service Renewal Program is a new program which will begin in 2023, allowing time to plan for this program and gain experience from the renewal work on services from other programs. For the 2022-2024 PBR period, the scope is estimated to include 350 service renewals per year for 2023 and 2024. The scope of work will include investigation and relining of services and will be limited to the public portion of the service.

5. This program is categorized as reliability / life cycle replacement and is one of the Drainage System Rehabilitation programs. EWSI has forecast total program capital expenditures during 2022-2024 at $10.28 million. This new program will start in 2023 and there is no previous similar program to compare to.

2.0 BACKGROUND/JUSTIFICATION

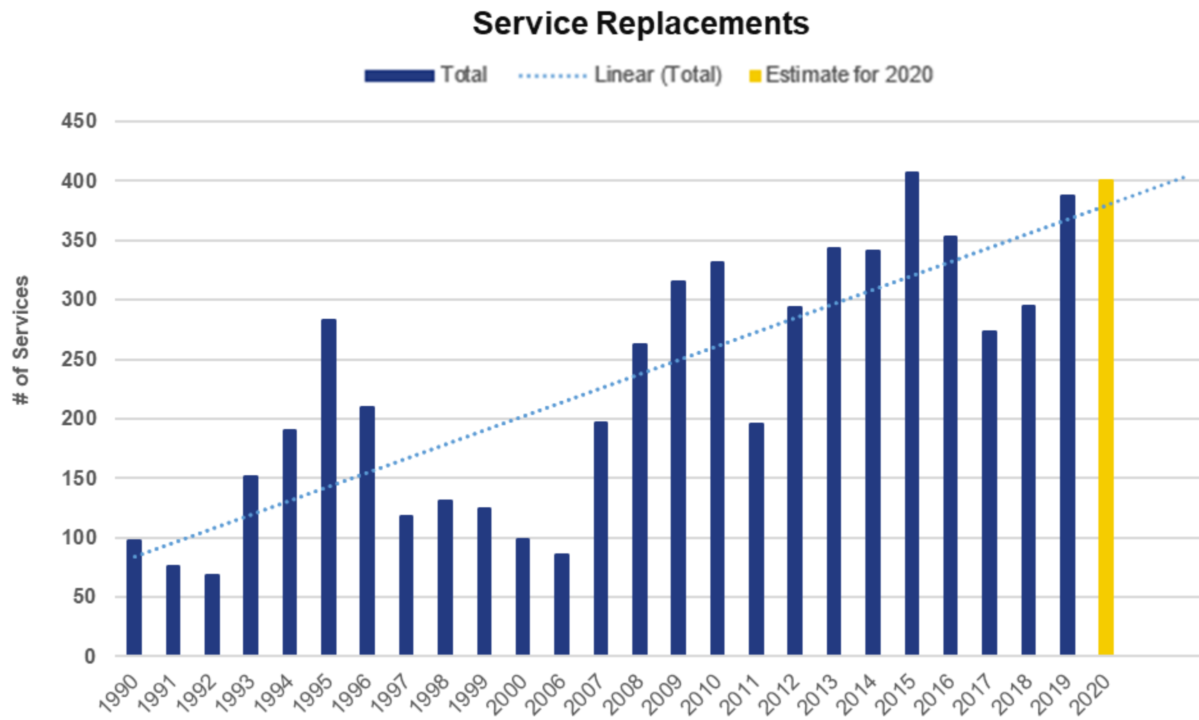
6. Service connections (services) owned by EWSI are defined as the service pipes (see Figure 2.0-1) from the lateral mainline to the property line. Figure 2.0-1 indicates the private and public portions of the service pipe. Services within private property from the property line to the home are owned and maintained by the owner. EWSI maintains over 420,000 sanitary and storm services, and the overall average age of services is 38 years for sanitary services and 30 years for storm services. EWSI receives on average 3,100 annual service calls related to issues with this aging infrastructure. These calls result in a high frequency of reactive maintenance. In 2019, 388 high priority service replacements were required.

Figure 2.0-1
Typical Service Pipe



7. Figure 2.0-2 shows the total number of services replaced annually from 1990 to 2020 (forecast). The chart shows a general increasing trend over this timeframe. EWSI anticipates that as the City of Edmonton grows and the system ages, the number of service replacements required each year will continue to increase. To deal with this ever growing problem, a dedicated Proactive Service Renewal Program has been developed. This program will focus on the renewal of aging services in mature neighbourhoods of the city. The program is currently being developed and will be implemented over the 2022-2024 PBR term.

Figure 2.0-2
Total Number of Services Replaced Per Year



**2020 is projected #, based on 203 completed to June 2020.*

8. The current process for addressing failing services is to replace them at or near failure using open cut technologies. These services are replaced either through EWSI's High Priority Repair Program, Medium Priority Renewal Program, or the Drainage Neighbourhood Renewal Program. The High Priority Repair Program addresses emergency situations where the service needs to be replaced within one year. The Medium Priority Renewal Program addresses services that require replacement but can be completed within 1 to 3 years. The Drainage Neighbourhood Renewal Program addresses services that have been identified as needing replacement and also coordinate within the neighbourhood scheduled for renewal. Services that have not failed, but have operational concerns (blockages, root intrusions, sags, etc.), are maintained using flushing, auguring, flailing and root cutting technologies. Once services become unmaintainable, they are prioritized for replacement through the programs listed above. A typical cost for complete replacement of the public portion of a service using open cut technologies averages approximately $29,000.

9. A proactive service relining project was initiated in 2019 in the Ritchie neighbourhood to address a number of services that were on the root maintenance program or experienced repeat sewer obstructions. The root maintenance program is offered to customers who have

experienced repeated sewer back-up as a result of tree roots in the EPCOR portion of their sanitary service. The roots are augured on a regular schedule. The Ritchie neighbourhood had a high concentration of customers on the root maintenance program, so it was a good candidate for the proactive renewal approach. Approximately 550 services require relining in the Ritchie neighbourhood, and about 250 have been completed. The costs have been close to $13,000 per service. EWSI expects that costs will decrease from this level as more experience is gained and efficiencies are achieved over time. EWSI's experience with the Ritchie neighbourhood will provide information for planning future projects within this program.

10. The Proactive Service Renewal Program will inspect and reline services that have structural and/or maintenance issues but are in adequate condition for relining. Locations will be targeted and prioritized based on a number of factors such as condition assessments, high concentrations of operational and maintenance issues and high concentrations of past service replacements. Locations will be chosen on a neighbourhood basis and then narrowed down to streets or areas based on the above factors. Typically if a street or area has had a significant number of issues with services in the past, it is likely that other services in the same area will also be in a similar condition with similar issues. It is also beneficial to take advantage of efficiencies of renewing a large number of services in close proximity. Mobilization and demobilization costs can be reduced significantly by undertaking renewal of services that are in the same general area. Another factor in choosing locations is to target neighbourhoods that have been through Drainage Neighbourhood Renewal Program since the mainline pipes will have already been relined or replaced.

11. Within the City of Edmonton, over 48,000 services are rated as poor and very poor and consist mainly of sanitary clay tile pipe constructed prior to 1955 (65 years and older). This large cohort of assets are nearing the end of their expected life of 75 years.

12. Risks associated with the growing number of services in poor and very poor condition include:

- Financial Risk – open cut emergency repairs are costly and the number of high priority service replacements are increasing each year.
- Customer Service Disruptions – customer frustration and potential damage to customer properties will increase as more customers deal with service issues such as blockages and sewer back up, and the reputation of EPCOR will be impacted.

13. By proactively relining services through this program, identified asset risks are mitigated and managed appropriately to reduce risk exposure which aligns with the asset management objectives set out by EWSI. Proactive relining typically costs between $8,000 and $13,000 depending on service length, which is a significant cost savings compared to the reactive approach involving open cut and complete replacement of the public portion of a service which averages approximately $29,000. This program will also reduce the number of disruptions and customer complaints associated with services back up and blockages. Work completed in the PBR 2022-2024 term will inform the level of expenditures for future PBR periods.

3.0 PROGRAM DESCRIPTION

14. The Proactive Service Renewal Program will begin in 2023 and continue on an annual basis. For the 2022-2024 PBR period, the scope is estimated to include between 200 and 350 service renewals per year for 2023 and 2024. The number that are completed will depend on the cost per service in order to remain within the targeted budget. While EWSI has been relining services for at least 15 years, this is the first formalized program focusing specifically on this type of work. This program will start in 2023 to coordinate with work completed through other service renewal work and the High Priority Repair Programs. The Medium Priority Renewal Program will continue until the end of 2021 and if any additional medium priority services are required after 2021, they will be prioritized and addressed through the High Priority Repair Program. This Proactive Service Renewal Program will begin in 2023 which allows time to prepare through planning and learning from the Medium Priority Service Renewal Program which ends in 2021. The scope of work for this Program will include investigation and relining of services and will be limited to the public portion of the service line. The scope may also include some relining of the mainline pipes in locations where it has not already been completed through the Drainage Neighbourhood Renewal Program or other local sewer renewal programs.

15. Existing inspection records will help in the selection of areas to target for the 350 service renewals. Additional inspections will also be required on other services in the target area. In order to determine which locations will require rehabilitation, inspections will be reviewed and assessed for condition and operational issues. Condition ratings will be based on the Lateral Assessment Certification Program (LACP) Ranking System index score for pipe condition assessment as shown in Table 3.0-1 below. LACP is the North American standard for lateral defect identification and assessment, providing standardization and consistency to the methods in which lateral conditions are identified, evaluated and managed.

Table 3.0-1
Lateral Assessment Certification Program

	Rating	A Criteria
1	5	Immediate attention needed; most significant defects
2	4	Poor; significant defects
3	3	Fair; moderate defects
4	2	Good; minor to moderate defects
5	1	Excellent; minor to no defects

16. The benefit of relining services that have structural issues and ongoing maintenance needs, identified through LACP, is that it eliminates ongoing, repetitive operational maintenance costs, claims and dissatisfied customers. This program will allow EWSI to continue to provide a high level of service to customers by reducing the risk of service failures and by minimizing disruptions. It is also a less costly alternative than open cut replacements if the services can be addressed before they fail.

17. Table 3.0-2 provides a schedule of the phases of work occurring within this program.

Table 3.0-2
Proactive Service Renewal Program Schedule
(2022-2024)

	Program Phases	A **2022 Q4**	B **2023 Q1**	C **2023 Q2**	D **2023 Q3**	E **2023 Q4**	F **2024 Q1**	G **2024 Q2**	H **2024 Q3**	I **2024 Q4**
1	Initiation/Approvals	x				x				x
2	Preliminary Design	x	x			x	x			x
3	Detail Design		x				x			
4	Procurement			x				x		
5	Construction			x	x	x		x	x	x
6	Commissioning					x				x
7	Close-out					x				x

4.0 ALTERNATIVES ANALYSIS

18. An alternative to this Proactive Service Renewal Program is to maintain the status quo and continue dealing with services either by the open cut repair/replacement method under the existing programs and/or ongoing maintenance programs. Open cut requires excavation to repair or replace a service at an average cost of approximately $29,000 per service. This method commonly requires portions of the public street/sidewalk, private landscaping, and private driveways to be excavated and then restored. Some clay tile services can contain significant deficiencies in the form of breaks, collapsed sections, misalignments, and offset joints which

make relining not possible. In these situations, open-cut excavations are a viable method to renew the pipe and they will be completed through either EWSI's High Priority Repair Program, Medium Priority Renewal Program or the Drainage Neighbourhood Renewal Program. With the implementation of this Proactive Service Renewal Program, EWSI expects that over time the number of severely deteriorated services that require open cut replacement will be reduced.

19. The open cut alternative would also continue to place services on a root maintenance plan. Currently, services that are deemed to be candidates for maintenance are placed on a 1, 2 or 3 year cycle. Service crews auger roots by means of the private cleanout. Maintaining the public portion in this manner does pose a liability risk, but it also benefits the customers as their pipe also receives root removal at the same time. The maintenance cycle does not actually fix the underlying issue which is the poor condition of the service line. This alternative also runs the risk of causing sewer back up in the home.

20. Continuing with the open cut approach will increase the existing backlog of poor condition services requiring repairs/replacements due to lack of capacity and emergency locations. This backlog will continue to increase as the system ages. As the trend in Figure 2.0-2 shows, costs will continue to rise for emergency repairs and operational and maintenance costs will also continue to increase as more homes become dependent on the root maintenance program.

21. The Proactive Service Renewal Program will extends the life of the pipe up to 50 years through relining. Compared to the open cut approach, relining will cause less disruption to the customer by eliminating sewer back up and crews entering the home to perform regular maintenance, and will cause fewer traffic disruptions. Relining eliminates the need to restore the landscaping and work is completed within hours as opposed to days. Relining can now be performed from the mainline access point which provides minimal disturbance to the customer.

5.0 COST FORECAST

22. Provided that the existing service is in adequate condition, relining is a much more cost-effective method of service renewal. EWSI has estimated that the average cost of relining is $8,000 to $13,000 per service based on current contractor rates, far lower than the open-cut alternative. The proactive relining approach will provide benefit beyond the current PBR period by increasing the life of the assets and potentially reducing the number of services requiring future open cut replacement

23. In instances where a service has a long history of root intrusions, the current practice is to send the service for an open-cut replacement. Statistical data shows that 65% of residential/commercial sewer troubles are due to root intrusions. Many services that are prone to root intrusions are also prone to cracks. Relining technology is extremely effective at preventing root intrusions and crack formation/propagation in services, and is therefore a solution that provides a significant reduction in expenses.

24. Drainage Operations maintains root compromised services on average for 10 years until the service eventually fails. There are approximately 2,000 services on the Root Maintenance Program currently. The average cost to maintain these services is $700,000 annually. Since this program is being implemented in 2023, EWSI is not forecasting a reduction in operating expenses during the 2022-2024 PBR term. However, forecast operational savings from the Proactive Service Renewal Program will be included in the future operating cost forecast in the next PBR term.

25. Costs for the 2022-2024 PBR period are shown below in Table 5.0-1. The number of services to be completed within the budget is between 200 and 350 services depending on service length and based on the estimated costs of between $8,000 and $13,000 per service. The work will be contracted out to an external contractor to complete the relines. Internal costs are for design resources, project management, providing direction and review when required, as well as to provide post rehabilitation inspections.

Table 5.0-1
Proactive Service Renewal Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **Pre-2022**	B **2022**	C **2023**	D **Total**
	Direct Costs				
1	Contractors	0.00	4.68	4.98	9.66
2	Internal Labour	0.00	0.11	0.11	0.22
3	Contingency	0.00	0.17	0.19	0.36
4	**Sub-total Direct Costs**	0.00	4.97	5.28	**10.25**
5	Indirect Costs	0.00	0.02	0.02	0.04
6	**Total Capital Expenditures**	0.00	4.99	5.30	**10.28**

26. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of longer-term contracts with vendors to effectively manage the supply, quality and construction of required equipment. This is important for the successful execution of this Program due to the limited available contractors. As such, EWSI has minimized risk of unavailable contractors and reduces the overall costs of all installations and upgrades. Also the longer term construction contractor relationship allows us to mobilize the contractor efficiently and effectively as they are familiar with our and City's standards and master contractor agreements are in place.

- EWSI has started assessing the potential to complete some of this type of work using internal resources.
- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

27. EWSI has identified the key risks and mitigations associated with executing this program in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Health & Safety - Reline material not properly cut-out at connections can cause sewer back up which poses as a health risk to customers.	Ensure EPCOR hires reline contractors that are competent and have a track record of producing quality work.
2	Operational Impact - Damage to reline by service crews when performing sewer auguring.	Deliver proper training to crews as to how to avoid damage to relined pipes. Use smaller cutter heads.
3	Customer Impacts - There is a risk of service failure that could result in service interruption affecting the residents in the neighbourhoods.	The proposed program would lower the risks of service failure and interruption.
4	Financial • Service failure will result in more costly emergency replacement. • Maintain services through Root Maintenance Program is costly and not effective long term.	• The proposed program would lower the risks of service failure and reduce the overall costs. • The proposed program will reduce the dependence on the Root Maintenance Program.
5	Execution Risk - On going root intrusion issue if application of relining material does not cure properly.	Ensure that pipes being relined are in good condition for the reline application.

Appendix H13

EPCOR WATER SERVICES INC.

Drainage Services
Pump Station Rehabilitation Program
Business Case

February 16, 2021

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1.0 OVERVIEW

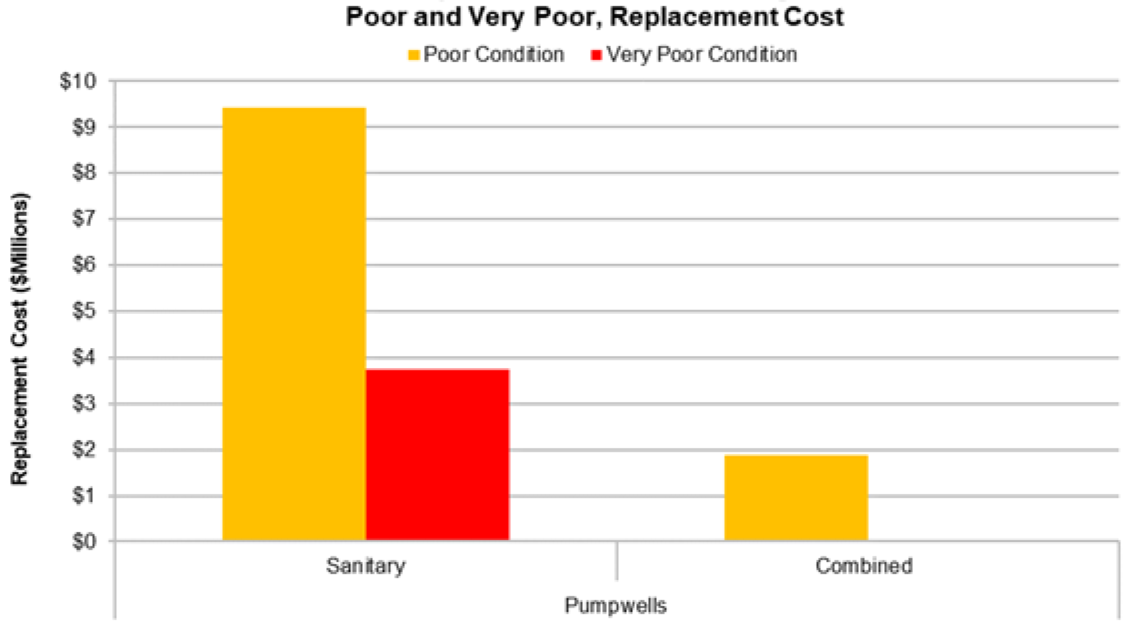
1. The Pump Station Rehabilitation Program is an annual program that focuses on the renewal of aging pump stations within the City of Edmonton. This annual rehabilitation program allows EWSI to rehabilitate or replace deteriorated pump stations to mitigate the risks of pump station deterioration and failure. Maintaining an acceptable level of environmental protection and service requires rehabilitation of the pump stations on an on-going basis. There are several risks associated with the deterioration and failure of pump stations including health and safety risks to EWSI staff and the public associated with spilled sewage and basement backups, environmental risks associated with floods and spills into the local water bodies, financial risks associated with costly emergency repairs and disruptions to customer service.

2. EWSI owns and maintains 91 pump stations across the City of Edmonton, with 46 of these having medium-high or high risk of failure. Failure risk is determined based on likelihood of failure (based on asset condition) and consequence of failure. During the 2022-2024 PBR term, this program will include rehabilitation of 8 pump stations. The amount of rehabilitation work is forecast based on an average value obtained from historical information. Criteria for renewal under this program includes asset condition graded as poor or very poor condition, risk assessment and prioritization. This program is categorized as reliability / life-cycle replacement and is one of the Drainage System Rehabilitation programs. EWSI has forecast total program capital expenditures during 2022-2024 at $15.5 million. This reflects an increase in annual spending on this program from an average of $1.9 million per year over 2020 and 2021 to $5.2 million per year. The increase is required to address the high number of pump stations in poor condition and reduce the risk of failure for this drainage asset.

2.0 BACKGROUND/JUSTIFICATION

3. EWSI owns and maintains 91 pump stations across the city and the average age of pump stations is 27 years. The total expected life for the building superstructure (of a pump station is 50 years, while all other subsystems (such as pumps, valves, etc.) have a life expectancy of 20 years. The total replacement cost for all pump stations in poor and very poor condition is estimated to be $15 million. As the system ages, it is important to assess their condition to avoid emergencies and to prioritize renewal to deal with deterioration, leaking and odour issues. Figure 2.0-1 indicates the replacement cost associated with pump station infrastructure which is in poor and very poor physical condition for sanitary and combined systems.

Figure 2.0-1
Pump Station Physical Condition Rating



4. There are several risks associated with the deterioration and failure of pump stations:

- Health and Safety Risk – deteriorated or failed pump stations could pose a safety risk to the EWSI staff who operate and maintain the pump stations. There is also a safety risk to the public if a pump station fails and causes spilled sewage and basement backups.
- Environmental Risks – deteriorated or failed pump stations could lead to floods and sewage spills to the local environment or water bodies which could lead to violations of EWSI's approval to operate and potential fines. This program will reduce the risk of station failures and the subsequent release of untreated sewage.
- Financial Risks – Emergency repairs to failed pump stations are more costly than proactive rehabilitation or replacement. Failed pump stations can also lead to flooding which are costly to manage and clean up, and can lead to claims from customers with flooded basements.
- Service Disruption Risk – A failed pump station could lead to sewage backup or neighbourhood flooding, which could result in service issues and damage to customer properties. This Pump Station Rehabilitation Program will reduce the risk of station failures and the subsequent impacts to customers.

5. There are several examples of pump stations that demonstrate the consequences of failure and associated risks:

- Walterdale Pump Station: An incident occurred at this station when the level of the North Saskatchewan River started to rise rapidly. The gate closed in response but was unable to close properly due to ice buildup at the bottom of the gate. Failure of the gate to operate properly caused an opportunity for untreated wastewater to be mixed with water from the river resulting in the potential discharge of untreated wastewater to the river. EWSI also identified that working in the confined space of this station is a health and safety risk due to inability to properly isolate the pump system when employees are performing intrusive work.
- Beverly Raylo Pump Station: This station overflowed multiple times due to high discharge volumes as well as a consequence of its internal processes. The overflows spilled untreated wastewater flows to the surrounding environment and river. The events were reported to Alberta Environment and Parks and remediation work is planned to address the situation.
- Elsinore Pump Station: A problem with the forcemain caused leaking in the surrounding area and caused street flooding which posed a safety risk to the public and a potential environmental issue.

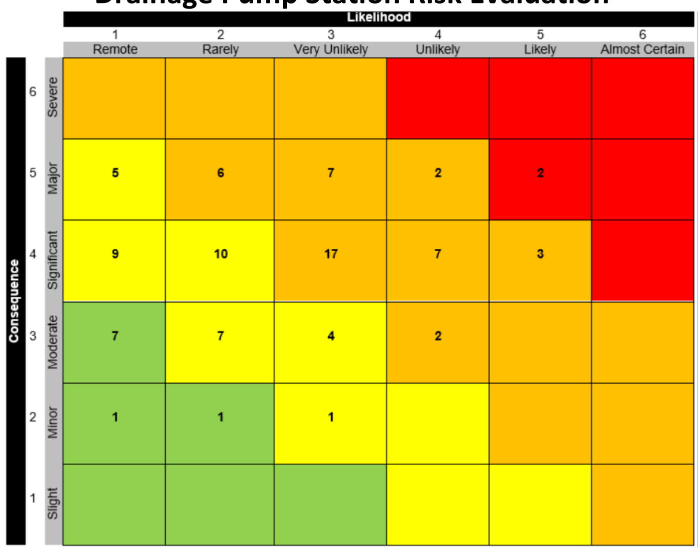
6. This annual rehabilitation program allows EWSI to rehabilitate or replace deteriorated pump stations to mitigate the risks listed above. Maintaining an acceptable level of environmental protection and service requires rehabilitation of the pump stations on an on-going basis. This program aligns with EPCOR's asset management objectives by identifying emerging risks and managing them appropriately, reducing risk exposure and reducing negative impacts on the environment.

7. All pump stations are inspected regularly for a physical condition and performance assessment by Drainage Operations. These inspections include the following:

- site and building;
- substructure;
- pipes and valves;
- motors and pumps; and
- may include forcemains.

8. Deficiencies are cataloged and then assessed to help determine the needs for pump station rehabilitation. The overall risk evaluation of pump stations is shown in Figure 2.0-2. Pump stations in the orange and red areas of the matrix are classified as high and medium high risk. The factors that were included in this risk ranking health and safety, environmental, regulatory, reputation, service interruption and financial consequences.

Figure 2.0-2
Drainage Pump Station Risk Evaluation



9. The highest likelihood pump stations have issues based on Operations inspections such as badly deteriorating site and building, concrete structure cracks, pumps and motors that are beyond their useful life, small wet well that can’t handle severe storm events, dry well leaks, etc.

10. Figure 2.0-3 below provides the pumpstations falling into the red and orange categories indicating those EWSI plans to complete in prior to the 2022-2024 PBR term and for future. EWSI continues to update risk ranking of pumpstations as more information becomes available.

Figure 2.0-3
Drainage Pump Station Risk Evaluation

ID	PW Name	Waste Type	Consequence of Failure Max	Likelihood of Failure	Max Risk Score	Max Risk Level	Sum of Risk	Risk Ranking (Max)
105	Duggan	San	5	5	10000	IV	24579	High
111	Laurier Heights	San	5	5	10000	IV	21487	High
174	Nest	San	4	5	3162	III	11587	Medium-High
102	Westbrook	San	4	5	3162	III	9641	Medium-High
113	Groat Rd. Clifton Place	San	4	5	3162	III	6111	Medium-High
163	Twin Brooks	San	5	4	3162	III	6111	Medium-High
121	Cloverdale	Cmb	5	4	3162	III	5462	Medium-High
200	South Terwillegar	San	4	4	1000	III	3265	Medium-High
104	Kaskitayo Carma-2C	San	4	4	1000	III	3049	Medium-High
203	Windermere Interim Ambleside	San	5	3	1000	III	2832	Medium-High
112	St. Georges Crescent	San	4	4	1000	III	2548	Medium-High
171	Walterdale	Cmb	5	3	1000	III	2479	Medium-High
156	Whitemud Dr & 111 St	Stm	5	3	1000	III	2242	Medium-High
141	Eastgate Industrial	San	4	4	1000	III	2149	Medium-High
116	Rundle Heights	San	4	4	1000	III	2149	Medium-High
182	Beverly (Raylo)	San	4	4	1000	III	1864	Medium-High
115	Riverdale	Cmb	4	4	1000	III	1716	Medium-High
212	Rtq Ravine Stn212	San	5	3	1000	III	1626	Medium-High
173	Yellowhead Trail At 50 Street	Stm	5	3	1000	III	1536	Medium-High
188	North Edmonton San Trunk NC1	San	5	3	1000	III	1511	Medium-High
168	Ellerslie	San	5	3	1000	III	1363	Medium-High
120	Buena Vista	San	3	4	316	III	1897	Medium-High
159	Dunluce Pond	San	4	3	316	III	896	Medium-High
184	The Grange (San)	San	4	3	316	III	874	Medium-High
119	Castle Downs	San	4	3	316	III	874	Medium-High
110	South Westridge	San	4	3	316	III	827	Medium-High
162	Elsinore	San	4	3	316	III	816	Medium-High
130	Dunluce	San	4	3	316	III	748	Medium-High
128	Gold Bar Park	San	3	4	316	III	748	Medium-High
169	Blackburn	San	4	3	316	III	748	Medium-High
157	Whitemud Drive & 106 Street	Stm	5	2	316	III	730	Medium-High
199	Magrath Heights	San	4	3	316	III	726	Medium-High
187	Haddow Neighbourhood	Stm	4	3	316	III	716	Medium-High
158	82 Street & Yellowhead Trail	Stm	5	2	316	III	680	Medium-High
195	The Hamptons (San)	San	4	3	316	III	679	Medium-High
108	William Hawrelak Park	San	4	3	316	III	679	Medium-High
155	Wedgewood Heights	San	4	3	316	III	679	Medium-High
109	Saskatchewan Drive	San	4	3	316	III	589	Medium-High
185	South Edmonton San Trunk	San	5	2	316	III	583	Medium-High
122	Rundle Park	San	4	3	316	III	543	Medium-High
184	The Grange (Stm)	Stm	4	3	316	III	499	Medium-High
195	The Hamptons (Stm)	Stm	4	3	316	III	499	Medium-High
133	Mitchell Ind. (Stm)	Stm	5	2	316	III	443	Medium-High
135	Fort Road	San	4	3	316	III	431	Medium-High
193	South Edmonton Common San	San	5	2	316	III	381	Medium-High
194	South Edmonton Common Stm	Stm	5	2	316	III	353	Medium-High

Legend
Ongoing/Completed Projects
2021 Planned Projects
To Be Abandoned

11. Based on the risk evaluation, the poorest condition pump stations will be reviewed to determine the mitigation requirements to reduce the risk. A high level evaluation of the locations will be completed to look for alternative solutions to rehabilitation such as abandonment. This review will also identify any unique characteristics about the pump stations that need to be

accommodated. For example, a pump station that only services one public washroom could potentially be abandoned and replaced with an alternative solution such as a storage tank. These types of conditions will be evaluated at a high level prior to the start of any concept development. Once the high level review has taken place and a refined list of priorities has been developed, further study will continue through concept development. Concept development will include additional inspections if required, development of rehabilitation options, a constructability assessment and will propose recommendations for the pump stations that will reduce the identified risks.

3.0 PROGRAM DESCRIPTION

12. The scope of this program is to evaluate pump stations, determine what is required to reduce the risk and implement the rehabilitation, replacement or alternative solution. As noted above, the highest risk pump stations will be evaluated at a high level for alternatives and quick wins. Once the evaluation is complete, concept development will begin on the refined priority list. The outcome of the concept development will be recommendations for rehabilitation, replacement or alternative solutions, and these recommendations will be reviewed to determine a program plan and schedule.

13. Based on historical experience of pump station rehabilitation, the following are the major categories and areas of rehabilitation upgrades:

- Site and Building:
  - Structural deterioration and cracks
  - Narrow building access
  - Insufficient/no safety fences
  - Poor roof condition
  - Metal surface corrosion
- Substructure:
  - Wet well/ladder corrosion
  - Insufficient wet well storage
  - Difficult access to remove grit from wet well
  - Leakage in dry well
  - Cracking in concrete base
  - No guard rails or gate to isolate wet well

- Pipes and Valves:
  - Corroded pipe and valves
  - Flow metre missing or needing replacement
- Motors and Pumps:
  - Pumps at the end of service life
  - Undersized pumps that require capacity upgrades
  - Height restriction for pulling out pumps

14. The program will aim to complete about eight pump station rehabilitations over the 2022-2024 PBR term. The number of rehabilitations will be dependent on the size of each project, bid prices and scope of work. As we plan for specific pump station rehabilitation, consideration will be given to additional improvements that have been identified through other initiatives that could be completed and/or coordinated. These types of improvements include capacity upgrades, safety improvements and/or odour reduction modifications. If these improvements are identified, they will be funded through separate capital programs.

15. Preliminary and detailed design will be initiated and completed in 2022. The pump station rehabilitation, replacement or upgrades will be completed in 2023. Another new set of projects will be initiated in late 2023 for construction in 2024. Table 3.0-1 provides the quarterly schedule for this program for the 2022-2024 PBR term.

Table 3.0-1
Pump Station Rehabilitation Program Schedule
(2022-2024)

	Program Phases	A **2022 Q3**	B **2022 Q4**	C **2023 Q1**	D **2023 Q2**	E **2023 Q3**	F **2023 Q4**	G **2024 Q1**	H **2024 Q2**	I **2024 Q3**	J **2024 Q4**
1	Initiation/Approvals	x				x				x	
2	Preliminary/Detailed Design	x	x			x	x			x	x
3	Procurement		x	x			x	x			x
4	Construction	x	x	x	x	x	x	x	x	x	x
5	Commissioning	x	x			x	x			x	x
6	Close-out		x				x				x

4.0 ALTERNATIVES ANALYSIS

16. One alternative to the Pump Station Rehabilitation Program is to do nothing. If nothing is done, the pump stations will be at risk of eventual failure and the likelihood of failure will continue to increase as the assets age. This will continue to increase the risk of flooding to the

surrounding environment, and will increase the safety risk posed to the public and EWSI staff. Although the do nothing alternative can provide cost savings in the short term, delaying rehabilitation or other solutions will not resolve the problem and will ultimately move required work and higher expenditures to future years.

17. There are alternatives to full rehabilitation or replacement that will be considered as part of the evaluation stage of this program to reduce the identified risks. Each pump station is unique and will require a different approach based on the deterioration, risk ranking, age, and location. Alternatives to full rehabilitation that can be evaluated include abandonment or redirection of flows. Hydraulic assessments will be required to support the validity of these alternatives.

5.0 COST FORECAST

18. This program is forecast to cost $15.52 million for the 2022-2024 PBR term to complete 8 pump station rehabilitation projects. The program cost forecast is based on historical costs of inspection, planning, design and construction of past pump station rehabilitation projects. As pump stations are all unique with distinct characteristics, it can be difficult to provide accurate cost estimates for rehabilitation, upgrades or replacement prior to concept development and design. The cost estimates will be tracked and refined as the program progresses.

19. Table 5.0-1 provides the capital expenditure forecast for this program for the 2022-2024 PBR term.

Table 5.0-1
Pump Station Rehabilitation Program
Capital Expenditure Forecast
2022-2024
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	3.88	3.53	5.71	13.11
2	Internal Labour	0.20	0.12	0.19	0.51
3	Vehicles and Equipment	0.03	0.02	0.03	0.07
4	Abandonments	0.00	0.00	0.00	0.00
5	Contingency	0.87	0.00	0.51	1.38
6	Risk Allowance	0.00	0.00	0.00	0.00
7	**Sub-total Direct Costs**	4.98	3.67	6.43	**15.08**
8	Indirect Costs	0.07	0.18	0.20	0.45
9	**Total Capital Expenditures**	5.05	3.85	6.63	**15.52**

20. Forecast costs for each project can vary widely depending on the particular pump station. On average, based on about 15 historical projects, EWSI has estimated that approximately 15% of the capital expenditures will be for superstructure (site and building), 20% for substructure and 65% for equipment, process, pumps, etc. For forcemains, EWSI assumed that each pump station would require some work on the forcemain.

21. Key assumptions in developing the cost forecast are as follows:

- All inspections will be completed internally by Drainage Operations;
- Internal resource estimates are provided by the project management team;
- External cost estimates are taken from historical contractor bid prices;
- Construction and design costs for each pump station are assumed to be $625,000 based on historical projects which breaks down as about $94,000 for site and building, $125,000 for the substructure, and $406,000 for equipment, pumps, process, etc.
- Construction and design costs for each forcemain are assumed to be $675,000 based on historical projects;
- All other costs are based on historical experience with similar projects.

22. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of contracts with vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment reducing the overall costs of all installations and upgrades.
- All activities related to project management, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI. External consultants will be utilized for concept development and design. The actual construction, including surface restoration if required, will be completed by one of EWSI's construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.

- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- All force accounts are documented and reviewed by EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

23. EWSI has identified the key risks and mitigations associated with executing this program in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Execution Risks - As most of the pump stations are located near residential areas, there are potential construction impacts to neighbourhood traffic and noise levels.	EWSI will develop a construction plan to minimize disruption to traffic and use of heavy equipment during morning and evening rush hours.
2	Health & Safety - Risk of sanitary flooding in the neighborhood during construction, particularly during the summer.	EWSI will develop a bypass plan as needed and contingency plan that will ensure minimal adverse impacts especially during rainy season.
3	Financial Risks – Actual contactor bids may vary from the estimates.	EWSI will conduct pre-bid meeting with potential contractors to gauge current market condition.

Appendix H14

EPCOR WATER SERVICES INC.

Drainage Services
SIRP Dry Pond Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. EWSI's Stormwater Integrated Resource Plan (SIRP), presented to the City of Edmonton Utility Committee and Council in 2019, is a system wide integrated approach to mitigate flood risk by reducing the health, and safety and social risk of flooding with lower overall capital investment than compared to traditional engineering approaches. SIRP recommended a five theme strategy for flood mitigation (SLOW, MOVE, SECURE, PREDICT and RESPOND) that included a mix of grey (trunks and tunnels) and green infrastructure (dry ponds and low impact development (LID)) components. One of the larger investment categories of the SIRP strategy is the "SLOW" theme – slow the entry of stormwater into the drainage network by absorbing it in green infrastructure and by holding it in ponds, creating space in the collection system during storm events. Green infrastructure includes dry ponds which capture large volumes of stormwater within a neighbourhood during the storm event and then release the stormwater slowly back into the existing piped storm trunk network after the storm event reducing the requirement for large trunk lines to the river. The SIRP Capital and Operational plan estimated $470 million in dry ponds would be implemented over the next 20 to 30 years.

2. Dry ponds are a critical element of EWSI's Stormwater Integrated Resource Plan (SIRP) to mitigate flood risks across the city of Edmonton. Using dry ponds, EWSI is able to achieve flood mitigation objectives at a lower overall capital investment than seen with traditional engineering approaches. The City of Edmonton had been installing dry ponds throughout the City as part of the City Wide Flood Mitigation capital programs in place prior to the Drainage Utility transferring to EPCOR. The SIRP analysis, completed by EWSI in 2018-2019, reaffirmed that dry ponds are a recommended solution for the flooding risks in Edmonton and prioritized the ponds for future investment over the next 20 to 30 years.

3. The SIRP Dry Pond Program mitigates a number of risks associated with flooding events including: (i) health and safety risks associated with basement flooding puts residents, contractors and EWSI employees at risk of illness through contact with sewage during clean-up and repairs: (ii) environmental risks associated with sewage spills to the local environment or water bodies; (iii) financial risks associated with costly clean up of flooding and basement backups and potential damage claims; and (iv) service disruption risks associated with neighbourhood flooding on roads and private properties.

4. EWSI together with the City submitted an application for federal grant funding for dry ponds projects under the Disaster Mitigation and Adaption Fund (DMAF) and received a total of

$43.6 million dollars to complete fourteen dry pond by 2028. The schedule proposed for the dry ponds in this business case is aligned with the schedule provided to the Federal government as part of the grant application.

5. The SIRP Dry Pond Program is a new program initiated for the 2022-2024 PBR term. While EWSI will manage each individual dry pond as a separate capital project, the individual projects are consolidated within this program in order to manage the overall program investment levels within the PBR term, manage project scheduling and to optimize the grant funding. Each dry pond project due to the size of the project typically requires three to four years to complete the conceptual design, detailed design, construction and commissioning. For the 2022-2024 PBR term, the SIRP Dry Pond Program includes eleven active dry pond projects at various stages of development at a forecast cost of $128.76 million of which $35.63 million is estimated to be covered by grant funding resulting in the net capital expenditures of $93.13 million.

2.0 BACKGROUND AND JUSTIFICATION

6. The dry ponds proposed within EWSI's SIRP strategy are intended to mitigate and reduce flood risk in targeted high risk communities. Two aspects in particular drove the SIRP choice to include dry ponds as a major infrastructure upgrade. These aspects are: (i) the lower risk of sewer backups and basement flooding; and (ii) the reduction of ponding on the road after storm event. Dry ponds, and additional storm pipe infrastructure, reduce the peak stormwater flows and reduce the volume of surface runoff entering the combined sewer system thereby lowering the risk of sewer backups and basement flooding. Dry ponds can remove large volumes of stormwater from the drainage system and reduce flooding risk within clusters of communities, in addition to providing benefits in other adjacent neighbourhoods.

7. Figures 2.0-1 provides examples of two completed dry ponds to provide context on the type of structures that are constructed as part of this capital program.

Figure 2.0-1
Dry Pond Examples

Ellingson Dry Pond

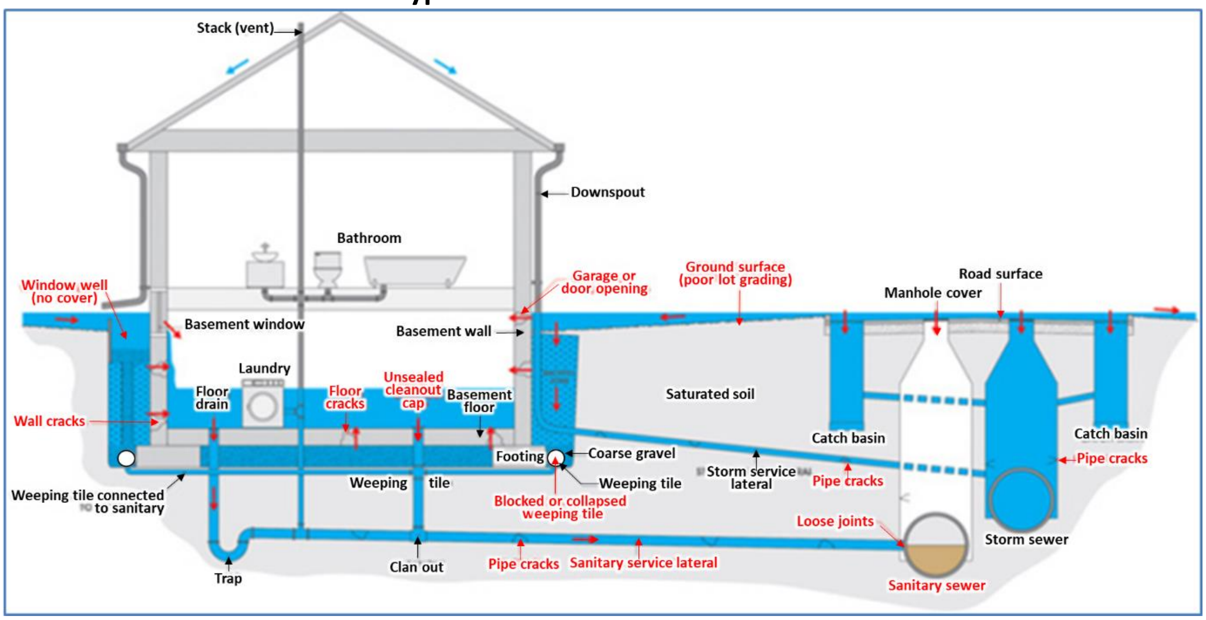
Duggan Dry Pond

8. Dry ponds mitigate a variety of risk categories:

- Health and Safety Risk – Basement flooding, from surface or sewer backup, puts residents, contractors and EPCOR employees at risk of illness through contact with sewage and mold during clean-up and repairs. Surface flooding and prolonged street ponding increases risk of traffic accidents and injuries. Excessive combined sewer flows could pose a safety risk to the EWSI employees who operate and maintain the drainage infrastructure. Frequently flooded basements can also affect the physical and mental health of the occupants.
- Environmental Risks – Excessive combined flows could lead to floods and sewage spills to the local environment or water bodies and may cause damage or contamination to the natural environment and wildlife. This will affect the usage of these facilities by the public and require substantial investment to restore the affected areas. The release of untreated sewage into the environment also violates Drainage's Approval-to-Operate issued by Alberta Environment and Parks.
- Financial Risks – Unmanaged large storm events can lead to surface flooding and basement backups which are costly to manage and clean up and can lead to claims from customers with flooded homes and basements and other property damage (vehicles) worth thousands of dollars to be replaced or fixed.
- Service Disruption Risk – Unmanaged large storm events could lead to neighbourhood flooding especially for houses in a localized sag area. Figure 2.0-2 below from the CSA Standard Z800-18 – Guideline on Basement Flood Protection and Risk Reduction

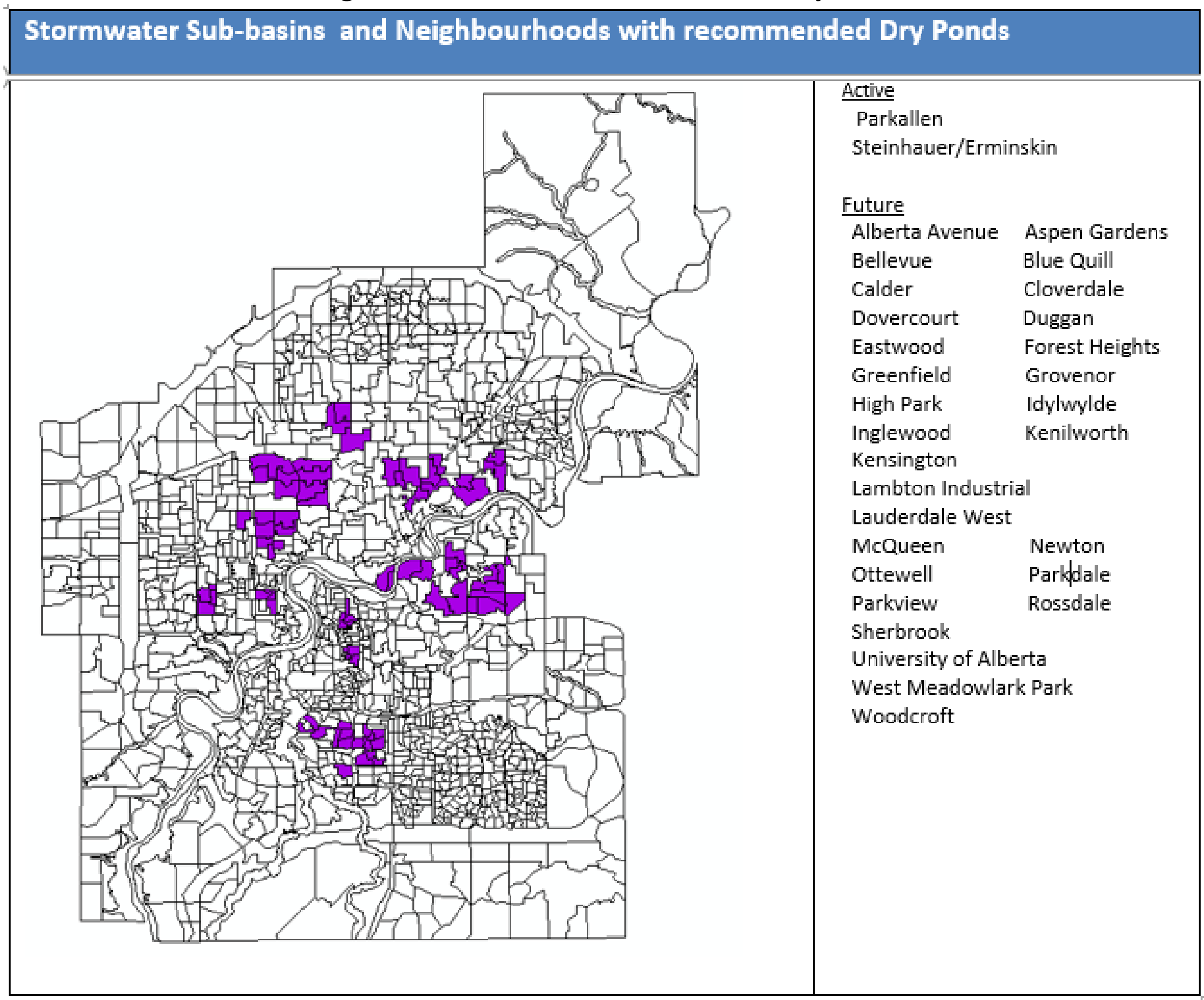
illustrates (in red font) the different paths where stormwater can potentially enter a property that is in a localized sag area. Following a storm event, the longer the duration that the water pools on the road surface the higher the risk that the water will access the sanitary pipes and/or foundation drains of properties without adequate flood proofing and enter the building. By directing storm flows to dry ponds EWSI aims to reduce the risk of water ponding in localized sag areas during large storm events.

Figure 2.0-2
Typical Household Connections



9. Under SIRP, EWSI plans to proceed with the 31 dry pond locations throughout the City as shown in Figure 2.0-3 below. In addition to these projects identified through SIRP, the Malcolm Tweddle dry pond, which was underway prior to SIRP, will also be completed as part of the SIRP Dry Pond Program.

Figure 2.0-3
Stormwater Sub-Basins and
Neighbourhoods with Recommended Dry Ponds



10. EWSI has been working with the City of Edmonton Open Spaces team to review each of the proposed dry pond locations as required under the City's Open Space Policy and in accordance with the Open Spaces Needs Justification and Assessment Reporting Procedure. The procedure includes a two phase review process with the City and entities such as the school boards that utilize or own the open spaces. Phase one of the Open Spaces review process identifies any major constraints for the proposed development. Phase two of the Open Spaces review process identifies more specific recreational and joint use requirements to inform the detailed design of the dry pond.

11. In 2020, the phase one of the Open Spaces review process was completed for all 31 proposed new dry ponds and the majority of locations were confirmed to not have any major

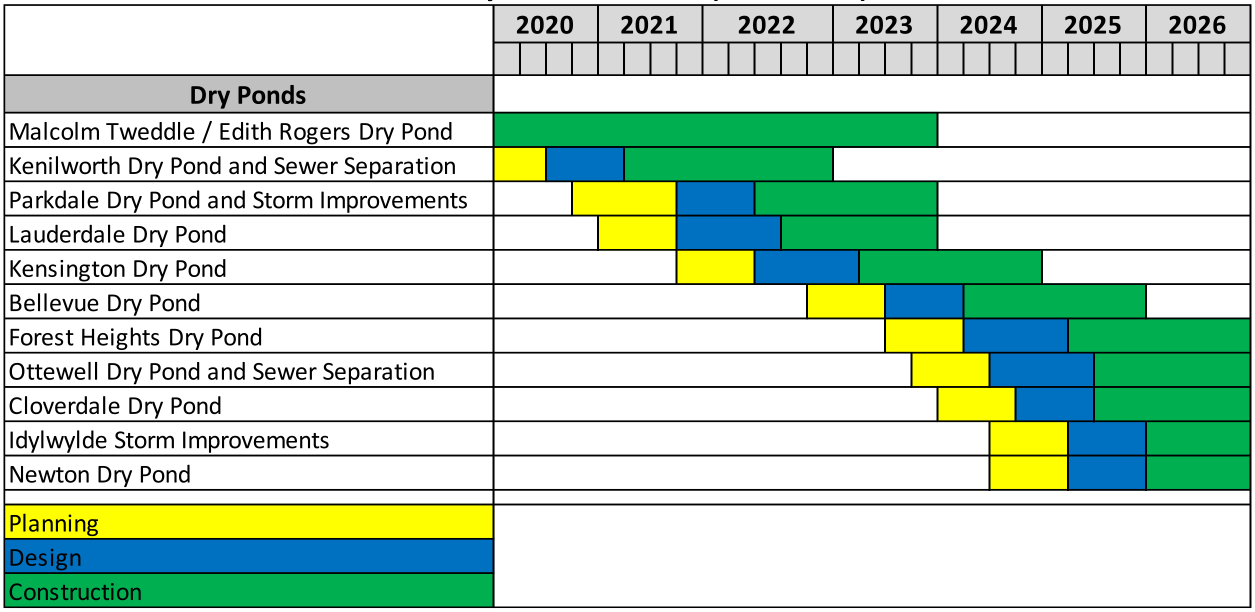
constraints. The City required a delay in the timing for completing the Idylwylde pond to better coordinate with the City's overall plans for that location. To ensure the adjusted timing of this pond will not impact the approved DMAF grant funding, EWSI plans to accelerate the timing of the Ottewell pond location. EWSI anticipates that the phase two review process will occur for each dry pond once the conceptual design is completed in conjunction with the local community consultation activities that occur during this phase of the project.

3.0 PROGRAM DESCRIPTION

12. As part of developing the SIRP Strategy, EWSI identified 31 locations for dry ponds. These 31 locations have been prioritized and scheduled based on SIRP risk ranking and based on the ability to coordinate with other projects. Dry ponds located within higher flood risk areas are proposed to initiate earlier as they will have the greatest impact to reducing the flood risk throughout the city. If EWSI is able to work in concert with a neighbourhood renewal project for example, project costs will be lower and the impact to the residents of the area will be dramatically reduced. This scheduling coordination plays an important role in delivery cost efficiency for the dry pond program. Typically the infrastructure included within a dry pond project includes the dry pond, inlet and outlet structures, and neighbourhood storm piping to move the water to and from the pond. If EWSI is able to coordinate this work with a Drainage or City neighbourhood renewal project, the cost of road resurfacing is reduced.

13. Another important consideration for the scheduling of the program is managing the projects to meet the overall annual program spending budget. Dry pond and storm separation projects have large capital expenditures, which can lead to years with significantly more capital spend than others. In order to mitigate these variances, dry pond project timelines are occasionally adjusted. For the 2022-2024 PBR term, EWSI is planning to have a mix of dry pond projects at different stages of development in any one year to better manage projects resources: two in construction, two in design, and two in conceptual design planning. Figure 3.0-1 shows the ponds scheduled in the SIRP Dry Pond Program for the 2022 to 2024 PBR term.

Figure 3.0-1
SIRP Dry Pond Schedule (2020-2026)



14. Another factor determining the dry pond schedule is the Disaster Mitigation and Adaption Fund (DMAF) grant which EPCOR and the City received from the federal government. This grant funding totals $43.6 million for fourteen approved pond projects to be completed by 2028. This funding applies to 40% of approved external costs, which will significantly reduce the cost to ratepayers for this program for the next decade.

15. The SIRP Dry Pond Program can be categorized as having levels of projects defined within the 2022-2024 PBR term: active pond projects and planned pond projects. Active pond projects include projects that are in construction or design phase and have received approval or a Letter of Support from the City as part of the Open Spaces phase two review process. Planned Pond Projects are those that will initiate their phase two Open Spaces Review and conceptual design within the 2022-2024 PBR term.

Active Projects

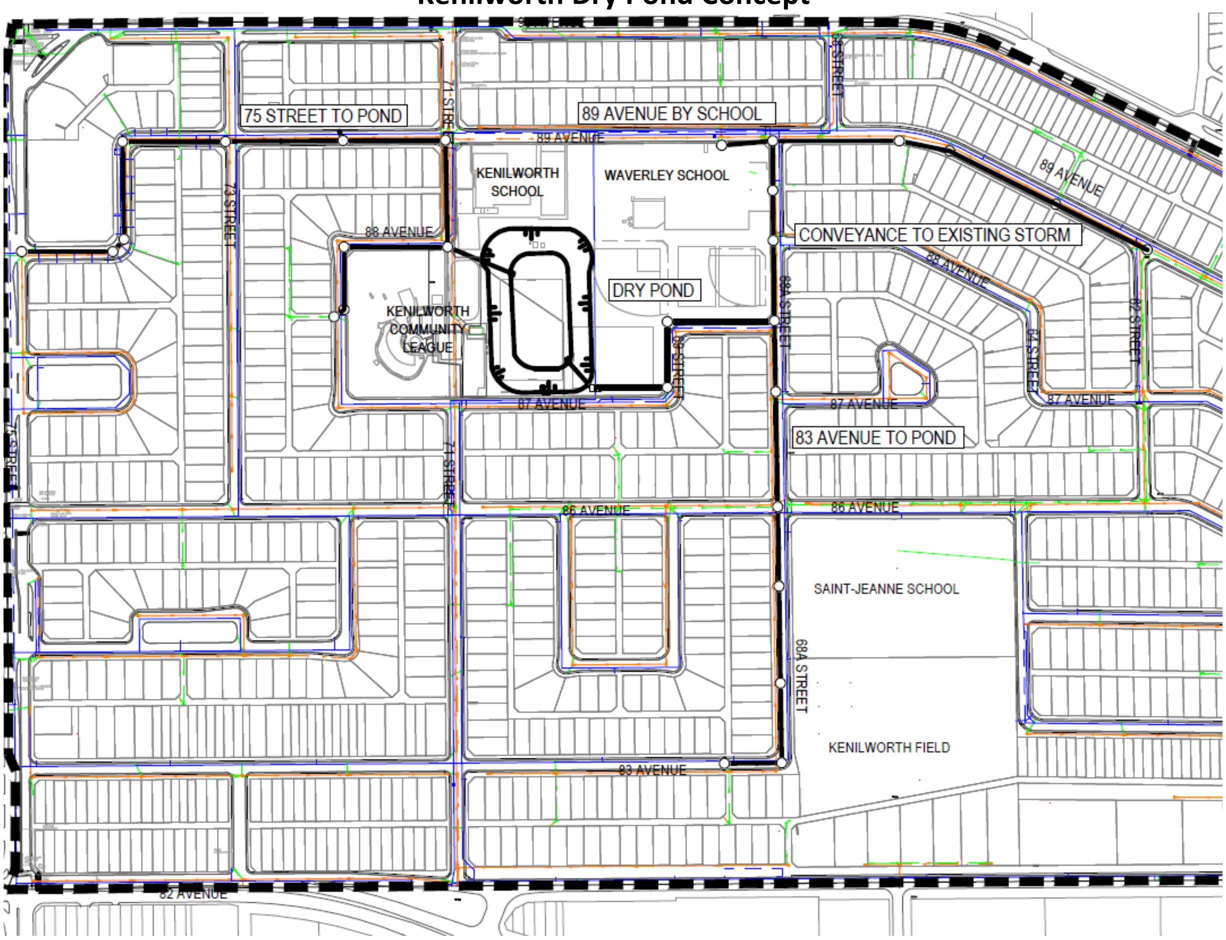
16. Active Pond Projects include projects that are in construction, design, have received internal EWSI approvals or a Letter of Support from the City. The active dry pond projects that fall within this program are:

1. Malcolm Tweddle / Edith Rogers Dry Pond
2. Kenilworth Dry Pond and Sewer Separation
3. Parkdale Dry Pond and Storm Improvements
4. Lauderdale Dry Pond

17. Malcom Tweddle / Edith Rogers Dry Pond project has completed major construction milestones. The north and south ponds are complete and have received their Construction Completion Certificate. The separated storm system portion of the project connecting the local sewers to the new pond is currently in the procurement phase.

18. Kenilworth Dry Pond and Sewer Separation is well into preliminary design, with construction scheduled for 2021. Prior to preliminary design, the concept validation workshop estimated that the SIRP risk ranking for the basins within Kenilworth would improve by 5 ranks, from risk rank "B" to risk rank "G". Figure 3.0-2 below shows the concept of the Kenilworth Dry Pond which is moving forward with design.

Figure 3.0-2
Kenilworth Dry Pond Concept



19. Parkdale Dry Pond is currently being reviewed by the City. These discussions have yielded a potential alternative site which would allow for more storage and potentially increase the

neighbourhood green space. The prospective site will not be fully encompassed by dry ponds, so maximizing storage through the neighbourhood will be critical for a successful project.

20. Lauderdale Dry Pond, has received a Letter of Support from the City following review and discussion of the justification report. The discussion included concerns such as: LRT right of way, slopes and accessibility, lighting, safety and hygiene. The City and EWSI will work to manage space considerations for competing land needs and on-going use during construction.

Planned Projects

21. The planned dry pond projects that fall within the SIRP Dry Pond Program for the 2022-2024 PBR term include:

1. Kensington Dry Pond
2. Bellevue Dry Pond
3. Forest Heights Dry Pond
4. Ottewell Dry Pond and Sewer Separation
5. Cloverdale Dry Pond
6. Idylwylde Storm Improvements
7. Newton Dry Pond

22. The Kensington Dry Pond will work to mitigate a high risk basin within the neighbourhood boundary, as well as high risk areas in the surrounding communities. This project could potentially reduce flooding on Yellowhead Trail by alleviating some of the capacity issues downstream within 107th Street Trunk. This dry pond would work to meet EPCORs commitment to the City to reduce flood risk of nearby and downstream basins to an acceptable level of risk.

23. EWSI found that the Bellevue area is a high risk location. Based on the SIRP assessments, EWSI is proposing that new infrastructure for the Bellevue and the surrounding neighbourhoods includes dry ponds, large scale sewer separation, and one of the few tunnels included in the SIRP capital plan. Though this project will focus on delivery the dry pond in Bellevue, the entire community will need to be examined to ensure that the flood risk reduction solutions are comprehensive and collaborative. EWSI has started discussions with the City to utilize some of the Exhibition Lands redevelopment in order to provide storage for the area and hopefully reduce the requirements for neighbourhood ponds and tunnels.

24. Forest Heights Dry Pond will work to mitigate the high flood risk due to sewer surcharging in the neighbourhood. The identified project site is already in the City land inventory and was ranked as "High Feasibility" during the City Open Space review.

25. EWSI's SIRP assessment ranked the Ottewell neighbourhood to be at high risk. Risk of flooding in Ottewell comes from two sources: sewer backup due to combined sewer surcharging and surface flooding. The size of the Ottewell neighbourhood makes wide scale sewer separation quite expensive, so EWSI is planning a targeted concept for dry pond and sewer separation.

26. The Cloverdale neighbourhood is high risk due to combined sewer surcharging and also surface flooding. Installing a dry pond and additional storm pipe infrastructure would offset the peak flow and reduce the volume of surface runoff entering the combined sewer system, lowering the risk of sewer backups and basement flooding.

27. The Idylwylde Storm Improvement concept includes pocket ponds along with potential coordination with the Bonnie Doon mall redevelopment. This will mitigate the high risk in the neighbourhood which is present due to combined sewer surcharging and surface flooding.

28. The Newton Dry Pond is planned to mitigate combined sewer surcharging and surface flooding in Newton and surrounding neighbourhoods. Newton is very high risk and this project will reduce flooding risk in Newton and surrounding neighbourhoods by alleviating some of the capacity issues downstream.

4.0 ALTERNATIVES ANALYSIS

29. Alternatives considered include: (i) Do Nothing; (ii) Delay timing, and (iii) A grey infrastructure approach through additional neighbourhood sewer pipes, storm tunnels, and outfalls.

Do Nothing Alternative

30. Not implementing dry pond projects and the related sewer separation would provide little to no flood mitigation for Edmonton. EWSI would not be able to achieve the commitments set out in the SIRP Strategy that was presented to City Council in 2019. Residents would see continued flooding during minor and major events. Additionally, there are financial risks associated with potentially losing the DMAF grant funding if EWSI is not able to complete the agreed scope of work prior to the 2028 timelines committed with the Federal Government.

31. EWSI is regulated by Alberta Environment and Parks (AEP) and under approval to operate the collection system there is a commitment and requirement to reduce contaminant loading from collection system entering the river. Dry ponds and separated storm sewers reduce the volume of water going to combined sewer system, which will reduce the frequency of combined sewer overflow events as well as volume of combined sewer discharges resulting in overall contaminant loading reduction. Not proceeding with the ponds would require an assessment of additional measures at the outfall locations to meet the AEP requirements. EWSI chose to not proceed with this alternative given the above risks and its commitments to the City, AEP and its customers.

Delay Timing for Pond Investments Alternative

32. The overall capital investment during the 2022-2024 PBR term could be reduced by extending the timeframe to complete the initial high priority dry ponds. Under this alternative, EWSI would still complete all of the proposed ponds within the 20-30 year period, however, some of the initial ponds would be shifted beyond the 2022-2024 PBR term. Under this alternative, dry ponds in the planning stage would not be initiated within the 2022-2024 PBR period and would be shifted to initiate in the 2025 to 2029 PBR at a higher level of investment that planned originally as part of the SIRP strategy. The risks with this approach is ongoing flooding risks within high risk stormwater subbasins would continue, resulting in higher risk of property damage to residents. Additionally, there are financial risks associated with potentially losing the DMAF grant funding if EWSI is not able to complete the agreed scope of work prior to the 2028 timelines committed with the Federal Government. This alternative was rejected on the basis of this additional risk.

Grey Infrastructure Alternative

33. Without the ability to construction dry ponds throughout the existing urban area, the increased volumes of stormwater would require the construction of a significant network of stormwater trunks and new outfalls throughout the City. This alternative would require building wide-spread neighbourhood sewer separation, storm tunnels and outfalls. In some neighbourhoods additional local pipe sewers would be installed to capture the peak storm volumes while limiting surface ponding of water. In the combined sewer areas, sewer separation would be completed. Additional outfalls would also be required. The City had completed some preliminary estimates of implementing a grey infrastructure approach to manage storm volumes with cost estimates of up to $4.6 billion with an 80 year time frame to construct due to the

complexities of adding a new storm trunk tunnel network through the existing urban area. This alternative was not considered based on the much higher cost impact to ratepayers.

5.0 COST FORECAST

34. Cost estimates for the pond projects that are currently active are based on detailed design construction estimates and/or tender prices for the ponds currently under construction. Cost estimates for each pond project where detailed design is not complete were developed based on historical costs from previously completed pond projects. Cost estimates are based on EWSI's estimate of the area of each pond and generally assumes a depth of two meters or less. EWSI has also assumed no significant utility conflicts and that standard construction methods and timelines will be applied. Some of the ponds also require sewer separation to fully integrate into the neighbourhood. For sewer separation costs, EWSI used standard unit rates for the various lengths of sewers required for each project. Consultant fees were estimated based on previous projects, project complexity and construction costs. Contingencies were estimated based on project phase and complexity and range from 30% to 50%.

35. Land costs can also vary considerably between dry pond locations and depend on the ownership of the parcel selected for the pond construction. For those dry pond projects where the land is already owned by the City, there are minimal land costs. For other dry pond projects where land is owned by the Edmonton Public School Board, EWSI has estimated the cost of acquiring the land based on costs of previous pond acquisitions from these entities. Any land purchased for a dry pond will be owned by the City of Edmonton with access rights provided to EPCOR for the dry pond operation and maintenance.

36. Table 5.0-1 provides the capital expenditure forecast for the SIRP Dry Pond Program by cost category for the 2022-2024 PBR term.

Table 5.0-1
Dry Pond Program
Capital Expenditure Forecast
2022-2024
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	31.20	34.83	26.31	92.34
2	Internal Labour	0.61	0.63	0.74	1.97
3	Vehicles and Equipment	0.04	0.03	0.03	0.11
4	Land	3.60	0.00	4.00	7.60
5	Contingency	1.72	6.99	9.08	17.79
6	Risk Allowance	0.00	2.74	0.00	2.74
7	**Sub-total Direct Costs**	**37.17**	**45.22**	**40.17**	**122.55**
8	Capital Overhead and AFUDC	1.24	1.41	2.56	5.21
9	**Total Project Costs**	**38.40**	**46.63**	**42.72**	**127.76**
10	Less: Grant Funding	(13.29)	(12.33)	(9.00)	(34.63)
11	**Net Project Costs**	**25.11**	**34.30**	**33.72**	**93.13**

37. Table 5.0-2 provides the capital expenditure forecast for the SIRP Dry Pond Program by pond project for the 2022-2024 PBR term.

Table 5.0-2
Dry Pond Program
Capital Expenditure Forecast by Project
2022-2024
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	ACTIVE POND PROJECTS				
1	Malcolm Tweddle & Edith Rogers Dry Ponds*	13.81	22.74	9.74	46.28
2	Kenilworth Dry Pond	11.12	0.00	0.00	11.12
3	Parkdale Dry Pond	6.34	5.62	0.00	11.97
4	Lauderdale West Dry Pond	6.78	14.85	14.87	36.50
	PLANNED POND PROJECTS				
5	Kensington Dry Pond and Sewer Separation	0.35	1.79	9.14	11.28
6	Bellevue Dry Pond	0.00	0.66	4.76	5.42
7	Forest Heights Dry Pond	0.00	0.46	1.12	1.58
8	Ottewell Dry Pond and Sewer Separation	0.00	0.51	1.70	2.21
9	Idylwylde Dry Pond	0.00	0.00	0.43	0.43
10	Cloverdale Dry Pond	0.00	0.00	0.34	0.34
11	Newton Dry Pond	0.00	0.00	0.63	0.63
12	**Total Dry Pond Capital Expenditures**	**38.40**	**46.63**	**42.73**	**127.76**
13	Less: Grant Funding	(13.29)	(12.33)	(9.00)	(34.63)
14	**Total Project Net Costs**	25.11	34.30	33.72	93.13

38. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI will utilized open competitions for consulting and contracting activities for the dry pond program. This allows EWSI to minimize contract expenditure while also qualifying for DMAF grant funding. EWSI will continue to aggressively pursue grant funding options to reduce the overall costs of this program to ratepayers.
- Dry pond projects undertake multi-stakeholder reviews at several checkpoints throughout the process to ensure individual projects meet the goals of SIRP, EWSI operability, and the needs of the community.
- Where possible, work will be coordinated with other projects or maintenance activities within EPCOR, the City and the partner organization if applicable to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale.

6.0 RISKS AND MITIGATION PLANS

39. Table 6.0-1 provides a summary of key risks associated with executing the SIRP Dry Pond Program and EWSI's plans to mitigate these risks.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Execution Risk - Some dry pond project sites may have competing land requirements which may limit the development of a dry pond.	EWSI has engaged with the City as part of the Open Spaces Repurposing procedure. The initial review of the dry pond sites has been complete, with the majority of the sites not showing significant constraints. During project development and initiation, EWSI drafts a land justification report which contains more detail than the initial review. Since dry ponds have the potential to change recreation amenities, neighbourhood greenspaces and have other community impacts, the justification report must be circulated across multiple departments and stakeholders for review prior to approval.
2	Execution Risk – There may be public resistance to the selected project sites.	EWSI will work engage with residents, community leagues, and users to ensure the need for the dry pond is understood. Coordination with the City on construction phasing to be considered when necessary to maintain amenity access. EWSI will identify additional or modified recreational amenities in the final design. EWSI will undertake public consultation throughout the design process to get feedback and make changes to accommodate community needs. EWSI will work with the City to make the area appealing, inviting and part of the community open space inventory and aligned with the City of Edmonton Breathe objectives for green spaces.
3	Financial Risk - Availability of DMAF funding.	EWSI has put together a Grant Funding Committee to assist with development and delivery of grant funding. If projects are undertaken within proposed program timelines then funding should be available. The committee also looks at additional grant funding opportunities from the Province as projects move into active construction phases.

Appendix H15

EPCOR WATER SERVICES INC.

Drainage Services
SIRP - LID Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. EWSI's Stormwater Integrated Resource Plan (SIRP), presented to the City of Edmonton Utility Committee and Council in 2019, is a system wide integrated approach to mitigate flood risk by reducing the health, and safety and social risk of flooding with lower overall capital investment than compared to traditional engineering approaches. SIRP recommended a five theme strategy for flood mitigation (SLOW, MOVE, SECURE, PREDICT and RESPOND) that included a mix of grey (trunks and tunnels) and green infrastructure (dry ponds and low impact development) components. One of the larger investment categories of the SIRP strategy is the "SLOW" theme – slow the entry of stormwater into the drainage network by absorbing it in green infrastructure and by holding it in ponds, creating space in the collection system during storm events. Green infrastructure includes Low Impact Development (LID) which involves incorporating vegetation, engineered soils and natural processes into developed areas to manage stormwater. LID installations have the ability to capture, absorb, slow and filter stormwater before it flows into the sewer system, groundwater or surface waters. The SIRP Capital and Operational plan estimated $480 million in LID would be implemented over the next 20 to 30 years.

2. LID is a critical element of EWSI's SIRP Strategy to mitigate flood risks across the city of Edmonton. LID provides another strategy to achieve climate change adaptation and to maintain and improve the health of the local creeks and the North Saskatchewan River. With LID, EWSI is able to achieve its flood mitigation targets at a lower overall capital investment than seen with traditional engineering approaches. Without LID, EWSI will not meet on site storage requirements for small storm events. By providing on site storage, LID increases the overall capacity of the stormwater system by preventing water from reaching the piping system. Installing more and larger pipes has a higher cost, and only moves the capacity issue from one location to another.

3. The LID Program is a new annual program, initiated in 2019, to construct and design LID installations throughout Edmonton on both public property and privately-owned commercial, industrial, and institutional properties in alignment with the SIRP strategy and to meet the PBR Green Hectares PBR metric. Large-scale LID is an emerging technology in Edmonton, used to improve stormwater management and implementation involves significant coordination with both the City and private owners of industrial and commercial property where LID installation is planned. EWSI's LID Program includes forecast capital expenditures of $53.07 million for the

2022-2024 PBR term. EWSI will adjust its plans for implementing this program as experience is gained with LID through the course of the 2022-2024 PBR term.

2.0 BACKGROUND AND JUSTIFICATION

4. The green infrastructure, including LID, incorporates vegetation, soils, and natural processes into the built environment to mitigate the impacts of climate change and to maintain healthy and sustainable communities. Green infrastructure was first advanced as a component of stormwater management and flood risk mitigation over 20 years ago. Today it is applied in communities across North America. Green infrastructure keeps water on site long enough to allow for volume reduction through natural processes like absorption, evapotranspiration and infiltration that results in runoff volume reduction but it is also crucial to protection of the receiving waterbodies. Green infrastructure installations have two primary functions for flood mitigation - retention and detention. Retention allows surface runoff to infiltrate into the specialized soils to be used by plants or to evaporate. Detention allows a delayed release of the remainder of stormwater runoff into the sewer system, thereby reducing peak stormwater flows and the demand on sewer infrastructure.

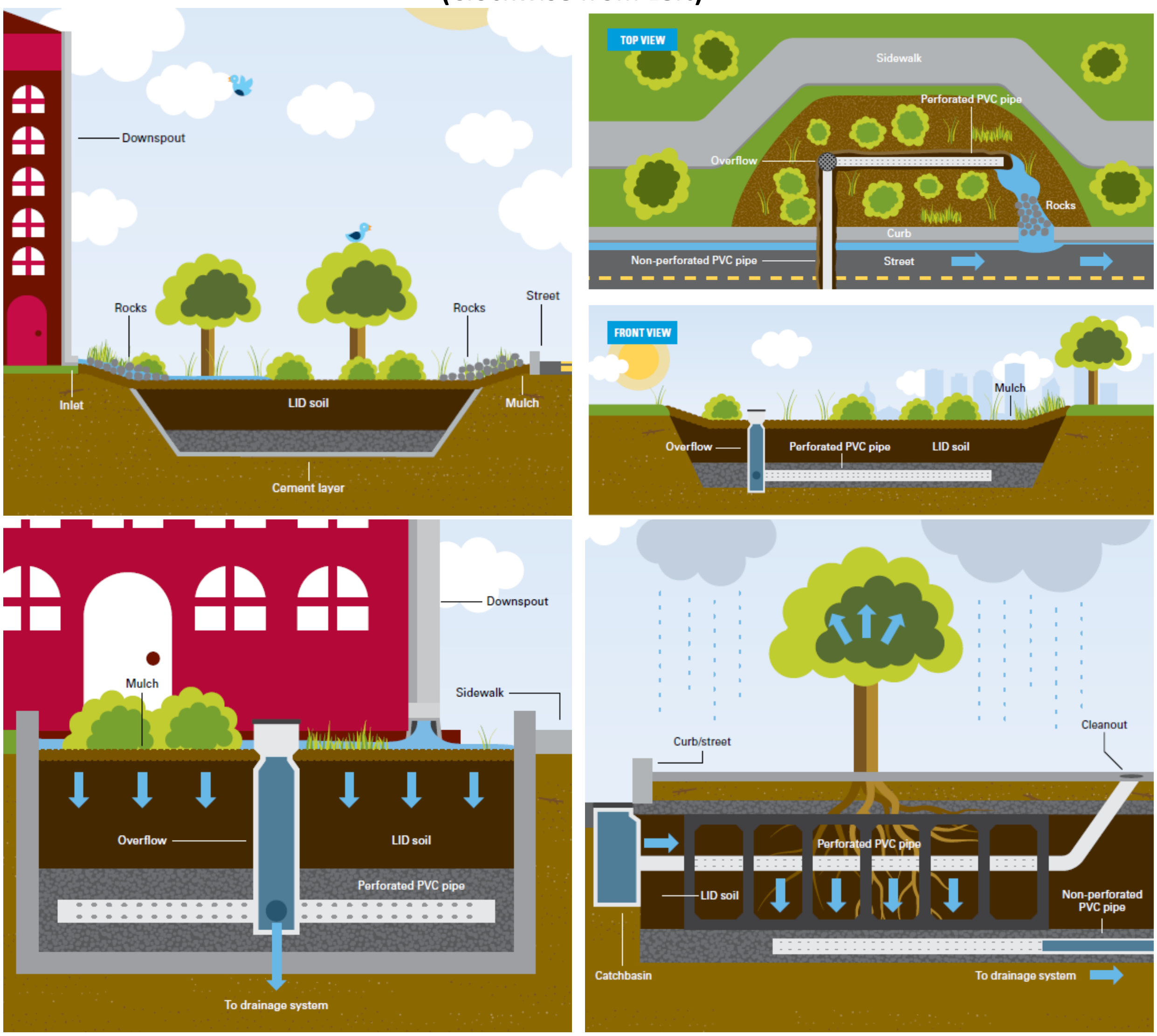
5. LID can be more cost effective over its life span compared to grey stormwater infrastructure. LID also meets multiple land development and stormwater management objectives and is becoming more common throughout North America (City of Vancouver, Philadelphia, New York, Toronto and Calgary to name a few) as measures to adapt to climate change. However, there are still barriers due to unfamiliarity with these types of infrastructure.

6. In addition to the flood mitigation benefits, LID installations provides water quality benefits. Water quality benefits come from green infrastructure's ability to manage surface runoff at the source reducing the volume of water released. The engineered soil and vegetation promote natural processes to capture, absorb and filter the water. Water that isn't captured within the LID feature is filtered, removing solids and other contaminants from the runoff before it leaves the feature.

2.1 Types of LID

7. Four types of LID have been standardized as part of this program. These include: bioretention gardens; bioretention basins; box planters; and soil cells. The four types of LID are depicted in Figure 2.1-1.

Figure 2.1-1
Bioretention Garden, Bioretention Basin, Box Planter, and Soil Cells
(Clockwise from Left)



8. Bioretention Gardens - Bioretention gardens may appear similar to flower/shrub beds however they utilize specified LID soil media and vegetation to capture and treat rainwater and are located at the low point of a landscape. Bioretention gardens are the only LID type that does not contain an underdrain or a connection to the sewer system. They consist of an inlet (with pretreatment), ponding area, LID soil, plant materials, an outlet and a structural storage layer. Structural storage layers are any man-made component that aids in the storage of water such as a concrete barrier, storage tank/pipe, storm chamber, or soil cell structure. This list is not exhaustive and other man-made components could be utilized.

9. Bioretention Basins - The bioretention basin is very similar to the bioretention garden in that it relies on vegetation, specialized soil media and a storage layer to function. However, bioretention basins have an underdrain where excess water is collected and transported to the sewer system. The vegetation, soils, and storage layer help the stormwater infiltrate into the feature, filter the water and be retained in the LID system.

10. Box Planters - Similar to bioretention basins, box planters use vegetation and specialized soil media to filter and retain stormwater. However box planters are contained within a box-like structure which may or may not have a bottom. Box planters are ideal for areas with small footprints such as downtown neighbourhoods. This is because box planters have smaller footprints (vertical sides) and can be located close to buildings. Box planters can be raised or located flush with/below ground. Box planters also contain an underdrain pipe.

11. Soil Cells - Soil cells provide structural support for sidewalks and roadways while allowing space for specialized uncompacted soil media to facilitate tree rooting and provide stormwater management by promoting absorption, evapotranspiration and interception. Stormwater can be directed into the soil cell system through a catch basin with pre-treatment, sheet flow through a curb cut or roof drain connection.

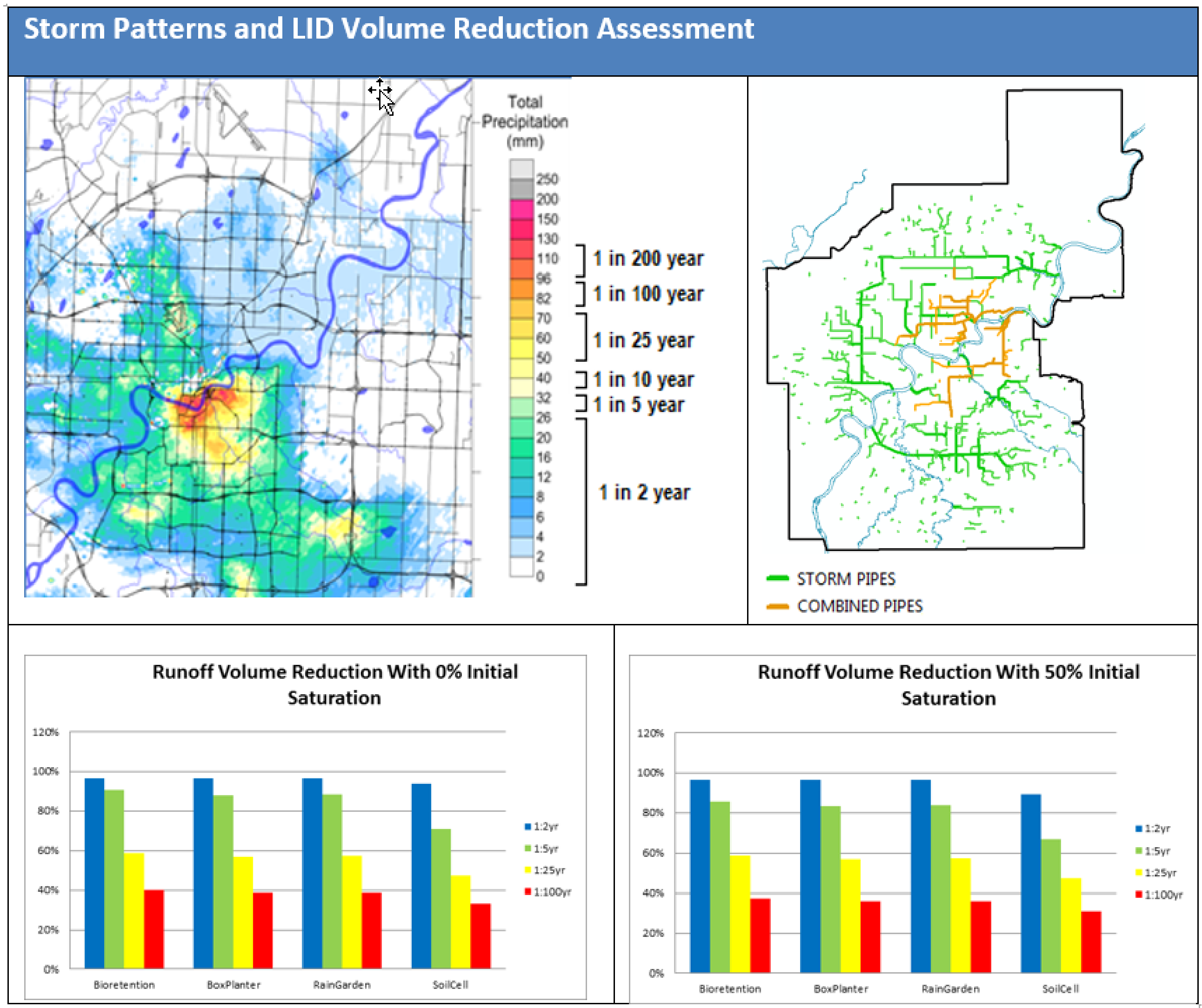
2.2 Storm Events and Flooding in the City of Edmonton

12. To develop its SIRP strategy, EWSI reviewed storm patterns in the Edmonton region. There were two aspects of flooding events in the city of Edmonton that drove EWSI's decision to include green infrastructure as part of its SIRP strategy. These include: (i) the impact of ponding on the road after a storm event; and (ii) the majority of storm events in Edmonton are small, and large intensity events tend to impact smaller localized area over a short duration. The nature of storms in Edmonton is such that unstable atmospheric conditions result in localized events, intense and short in duration surrounded with less intense rainfall around the core of the storm as shown in Figure 2.2-1. The figure shows the variation in water volumes during a 6 hour period over the City of Edmonton during a recent storm event in July 2016 and indicates that one rain event can be extreme in one area and less intense in another.

13. LID is particularly effective in capturing the lower volumes of water in the periphery of the intense storm cell and retaining the water to allow for more capacity in the pipes and ponds in the direct path of the intensive portion of the storm. The bar graphs in Figure 2.2-1 illustrate the runoff volume reduction that each of the standardized LID types can achieve in various storm events (the results for rain gardens are comparable to bioretention gardens). City-wide LID

implementation can keep runoff from the majority of the rainfall impacted areas away from the collection system (peak flow and overall runoff volume reduction). The localized impacts of ponding on the road after a storm event drove the SIRP Operational and Capital Plan to include green infrastructure (LID) in the overall SIRP Capital and Operational Plan.

Figure 2.2-1
Edmonton Storm Patterns and LID Volume Reduction Assessment



14. Water ponding on the roads and sag areas after a storm event increase the risk of flooding due to water reaching sanitary pipes or foundation drains. Green infrastructure/LID will reduce ponding in sag areas and provide additional capacity in the immediate path of the storm and reduce the impact on the entire pipe network as storms travel across the community.

2.3 Strategies for Implementing LID

15. EWSI developed the SIRP Risk Framework for a number of sub-basins (stormwater catchment areas) within the city of Edmonton. EWSI identified approximately 1,300 sub-basins and risk ranked each of them based on urban and riverine flooding hazard levels using four perspectives: (i) social; (ii) financial; (iii) health and safety; and (iv) environmental. EWSI is recommending investment in LID for each sub-basin based on previously completed engineering studies, additional data/information analysis and system wide assessment for hydraulic feasibility. EWSI has determined the number and locations of LID installations at the sub-basin level based on localized ponding conditions and where these capital cost savings can be achieved.

16. EWSI will install LID features on public lands and on privately-owned commercial and industrial sites. EWSI will fund, own and operate LID features on both public and private land. LID features on private land will be covered by a Utility-Right-of-Way Agreement or a Land Use Agreement. EWSI has developed a number of strategies to overcome various technical, physical, regulatory and legal barriers associated with LID implementation. Much of this work has already been completed. These strategies and their status is illustrated in Table 2.3-1.

Table 2.3-1
EWSI LID Strategies and Current Status

	Strategies	A **Status**
1	Develop of LID Design Standards.	Completed August 2020
2	Complete geotechnical assessment of local Edmonton conditions including suitability of LID related to local soils, freeze-thaw conditions, groundwater impacts and cold weather.	Completed May 2020
3	Develop a LID Native Plant Selection Guide to aid in selecting plantings that: (i) compliment local conditions; (ii) reduce maintenance requirements; (iii) are drought and salt tolerant; (iv) are adaptable; and (v) support wildlife.	Completed July 2020
4	Develop a modelling tool to support LID Design and efficiency.	Completed August 2020
5	Prepare communications and education on LID and LID implementation.	Ongoing since 2019
6	Complete outreach material to provide information on LID and LID Implementation.	In progress

17. EWSI will continue to develop these strategies to overcome barriers to implementing LID, ensure cost effectiveness of implementing this annual program and provide positive impacts to local communities. These efforts will include partnering with the City of Edmonton and private property owners.

3.0 PROGRAM DESCRIPTION

18. This LID Program has two components: LID on public lands and LID on privately owned commercial, industrial, and institutional sites. In order to more effectively and efficiently plan LID implementation moving forward, EWSI is prioritizing locations based on the ability to achieve risk reduction and cost-benefit analysis without giving consideration to the land ownership and location – whether public or private lands. This approach allows for more flexibility when making the decision to invest dollars into areas that provide more benefit to the storm/combined system.

19. As EWSI continues to evolve the LID Program over time, a greater focus will be placed on the commercial, industrial and institutional properties as well as opportunistic projects. The portion of funds from this program allocated towards road right of way (ROW) installations through the City's Building Great Neighbourhoods (BGN) program will remain relatively constant. These types of LID installations will be used to build momentum and to showcase the program to privately-owned commercial, industrial and institutional stakeholders. EWSI will also continually evaluate the effectiveness and costs of the different LID types and design standards to be able to more efficiently install LID.

20. EWSI also proposed a metric to assess the implementation and success of SIRP called the Green Hectare. A Green Hectare is the volume of managed runoff spread evenly over an area of 15 mm depth. This proposed metric has been approved by the City of Edmonton's Utility Committee and represents green infrastructure implementation progress measure by tracking/measuring a volume of runoff managed by green infrastructure. EWSI's target for the green hectare PBR metric targets for the 2022-2024 PBR term are shown in Table 3.0-1 below. Green infrastructure may include stormwater storage, LID and small dry ponds[1]. The Green Hectare is based on the approach that utilizes green infrastructure to manage 15 mm of runoff (1 in 2 year frequency event or approximately 90% of rainfalls in Edmonton is from storm events of 15 mm or less) from 1 hectare of impervious area. An equivalent methodology is used in both New York City and Philadelphia to track their flood mitigation efforts.

[1] Larger dry ponds are not included in the Green Hectare performance metric as they are only operational during large storm events.

Table 3.0-1
EWSI 2022-2024 PBR Metric Target for Green Hectares

	Year	A **Annual Green Hectare Target**
1	2022	45
2	2023	90
3	2024	180

21. EWSI has completed design of six neighbourhoods and construction of four neighbourhoods began in summer 2020. Thirteen LID features in the four neighbourhoods were planned for construction with costs for each LID feature ranging from $30,000 to $830,000 for construction. Prior to the 2019-2021 program there were some small one-off projects that included LID however these projects were more focused on using LID as a water quality feature instead of for flood mitigation. 2020 is the first year of implementing LID on privately-owned commercial and industrial lands. EWSI has identified sites for LID on privately-owed property and has begun its communications with customers but has not yet completed design or construction work at the date of this Application.

22. The scope of the LID Program includes design and construction of LID installations throughout Edmonton from 2022-2024 on both public and privately-owned lands. Specific projects for this annual program will be selected based on the following criteria:

- SIRP Risk Ranking of the project location or its upstream proximity to high risk areas;
- catchment size and impervious area size;
- LID Benefits – flood mitigation, total loading or other environmental benefits;
- cost/benefit analysis of the LID including $/m^2 and $/m^3;
- coordination with other EWSI and City of Edmonton capital programs and ease of installation; and
- service type in the area (combined or separate sewers).

23. The scope of work completed under the LID Program includes:

- liaising and coordinating with City departments and customers for LID development and inclusion within programs/properties (completed in-house);
- developing initial neighbourhood designs - including initial assessment of neighbourhood overland drainage plans; identification and delineation of potential LID locations within each confirmed location; calculation of catchment areas and imperviousness; storage provided by LID; type of LID installation; cost-benefit

analysis; and general constraints (such as utilities and existing trees). Initial neighbourhood designs may be developed in-house or externally by a consultant;

- developing preliminary designs - including preliminary layouts of each proposed LID feature; drawing packages; refinement of calculations such as storage capacity, runoff volume reduction, and peak flow attenuation and reduction; cost estimates for construction; and stakeholder engagement. Not all LID features/locations that have undergone preliminary design will move into detailed design. Preliminary designs will be developed externally by a consultant, however EWSI is planning on developing LID expertise in-house and may complete some LID designs in-house in the future;
- developing detailed designs - including detailed grading plans; planting plans; profiles/cross sections; details; specifications; and refined calculations; detailed design will be developed externally by a consultant, however EWSI is planning on developing LID expertise in-house and may complete some LID designs in-house in the future. Planting plans will likely be developed externally by a consultant;
- construction, construction management, inspection, and commissioning of LID (may be conducted in-house or may be conducted externally by a consultant); and
- operation and maintenance of the LID features until features are accepted. During the warranty phase operation and maintenance of the LID features should be conducted by the contractor who completed the construction. After the warranty period EWSI will be responsible for operations and maintenance of the LID features.

24. LID projects chosen may be constructed as part of any number of City programs including but not limited to:

- Building Great Neighbourhood's Program – This City program renews roads, sidewalks, curbs, gutters and streetlights in mature neighbourhoods or arterial roadways. This program has a number of neighbourhoods undergoing planning and design (typically a 1-3 year process depending on the neighbourhood) and construction (typically a 1-3 year process depending on the neighbourhood) every year. During this process, redevelopment of other City-owned areas such as parks and green spaces within each neighbourhood can also be explored.
- Alley Renewal Program – This City program renews back alleys in mature neighbourhoods. This program has a set number of kilometres that are renewed each year.

- Parks and Open Spaces' Program – This City program constructs or renews park and green spaces throughout Edmonton.
- Urban Renewal Program – This City program has two main initiatives that apply to LID; Green and Walkable Downtown and The Quarters revitalization. This program may include streetscapes, park spaces, public mixed-use spaces (such as plazas), or other projects within the revitalization areas.
- Corner Store Grant Program – This City Program is targeted to Neighbourhood Commercial properties or properties that meet the commercial needs of local residents. This program is new for 2020 and often works in conjunction with the Building Great Neighbourhoods program but which also has the potential to provide improvements to standalone commercial properties.
- City Transportation projects such as the Yellowhead Trail widening/redevelopment.
- City Facilities projects such as development/redevelopment of recreational facilities.

25. EWSI is coordinating LID with City projects when possible. EWSI has initiated training sessions with City staff and is actively involved with various City teams and programs. An LID Coordination Team has been created and EWSI is constantly engaging and educating additional groups at the City.

26. For privately-owned commercial and industrial sites, EWSI will reach out to customers to design and construct LID features on their land. LID features will be protected with a registered instrument (utility right of way, easement or similar) or land use agreement. Additional selection criteria for privately-owned commercial, industrial, and institutional sites may include the company's green initiatives and whether or not they have an existing utility right-of-way agreement with EWSI. Customers that approach EWSI to be part of this program will also be considered.

27. Figure 3.0-1 is an example of a commercial site in the Oliver neighbourhood. In this example, simply modifying the existing green spaces and adding soil cells in the parking lot can capture 95% of the required runoff from the site.

Figure 3.0-1
LID at Commercial Site – Oliver Neighbourhood Example

4.0 ALTERNATIVES ANALYSIS

28. When developing the City Wide Flood Mitigation Strategy (prior to SIRP) large scale grey infrastructure such as tunnels and an increased pipe network was considered, but was found to be very expensive. EWSI presented the SIRP Strategy to Utility Committee and City Council during 2019. Based on these discussions, EWSI plans to move forward on the SIRP Strategy and, as such, only alternatives following the basis of SIRP were considered. EWSI evaluated four alternatives including: (i) Do Nothing; (ii) Installation of LID in Public Road ROW and Public Lands Only; (iii) Installation of LID on Commercial/Industrial Properties Only; and (iv) Installation of LID on Public

and Private Lands (proposed LID Program). The risks and benefits of the first three alternatives compared to the proposed alternative are discussed below.

Do Nothing Alternative

29. Not implementing LID infrastructure would require implementing an approach similar to the City's original Flood Mitigation Strategy. Grey infrastructure would collect and divert more runoff to collection system moving problems from one area to another as the overall system capacity would not improve. Adding more pipes without retaining volume at the source would not help with system capacity and would also bring faster and cause more environmental damage to natural watercourses (creeks and North Saskatchewan River).

30. EWSI is regulated by Alberta Environment and Parks (AEP) and under approval to operate the collection system there is a commitment and requirement to reduce solids loading from the collection system entering the river. Green infrastructure implementation will mitigate and reduce loadings (volume reduction through natural processes of plant absorption and infiltration as well as retention and treatment of runoff at the source) and keep EWSI in compliance with its total loading objectives. Providing additional capacity within mature areas would specifically benefit areas with combined sewer service, would support COE infill targets and help with reduction of combined sewer overflow occurrences both frequency and volume. Reaching EWSI's SIRP target would be impossible with the do nothing alternative.

Installation of LID in Public Road Right of Way (ROW) and Public Lands Only

31. EWSI's plan is to utilize public road ROW's for green infrastructure and we are currently coordinating LID installation program with the City's Building Great Neighbourhoods (BGN) Program. A memorandum of understanding with the City has been created for current projects and EWSI is funding design and construction of LID installations with BGN. This work will continue from 2022 to 2024. However, as roadways only make up about 4% of the City's total area, it would be extremely difficult to achieve EWSI's ultimate SIRP targets focused solely on implementing LID on public road ROWs and this work is very disruptive to the public.

32. This LID Program pairs LID construction with neighbourhood and street renewals to minimize this disruption. To execute the LID Program in conjunction with neighbourhood and street renewals, EWSI must rely heavily on the City of Edmonton and work within the scope and confines of their neighbourhood and street renewal projects. Additional restrictions include installation of LID features in areas of the City of Edmonton's choosing, increased costs, project

complexity due to coordination efforts and the reduced benefit of LID as a result of small drainage areas controlled/managed by LID installation (land available within ROW is limited). With these projects there can also be other restrictions that can affect installation of LID such as future land use restrictions and utility conflicts, resident concerns, and inexperienced contractors, to mention few.

33. Because LID installation involves surface type work, implementation of LID in neighbourhoods will follow EWSI's completion of underground upgrades completed as part of EWSI's Neighbourhood Renewal Program. EWSI will coordinate with the City's Building Great Neighbourhoods which also occurs after EWSI's Neighbourhood Renewal Program and often involves adjustment of roads, curb alignment and sidewalk layouts. Coordination with the City's BGN Program is part of the Installation of LID on Public Lands.

Installation of LID on Commercial/Industrial Properties Only

34. Privately-owned commercial and industrial properties make up about 11% of the City's area, and are primarily impervious areas resulting in high volume contribution to the collection system during storm events. Installation of LID features on commercial and industrial properties can be completed with relative ease, and in some cases minimal disturbance to the public. EWSI's main concern with this option is land ownership and property or business owner support. This work will be accompanied with extensive communication and outreach and potentially incentive program for land owners in form of reduced stormwater fee (currently in development). EWSI will fund design and construction and will commit to operate and maintain these facilities. As EWSI has just started to work towards implementing LID on privately owned commercial and industrial properties in 2020, uptake from these customers is currently unknown. However, from the limited dataset, three of the four customers contacted have agreed to move forward with the process.

35. Given the disadvantages of the two more focused programs (city lands only or private lands only), EWSI is proposing a broader approach with more flexibility as set out in this LID Program which includes installation of LID features throughout Edmonton both on public lands, in conjunction with a number of City programs, and on private lands and, on an opportunistic basis, LID included as part of other EWSI capital projects. City-wide installation of LID features through a number of different locations allows EWSI to more effectively and efficiently plan LID implementation moving forward. With these increased options, EWSI has more flexibility to invest dollars into areas that provide more benefit to the storm/combined system. The increased

flexibility also provides the greatest opportunity for EWSI to meet its environmental and performance targets.

5.0 COST FORECAST

36. Table 5.0-1 provides the forecast for the LID Program for the 2022-2024 PBR term.

Table 5.0-1
LID Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	6.69	13.48	25.62	45.78
2	Internal Labour	0.23	0.46	0.59	1.28
3	Contingency	0.63	1.25	2.32	4.21
4	**Sub-total Direct Costs**	7.55	15.19	28.53	**51.27**
5	Capital Overhead and AFUDC Costs	0.28	0.55	0.98	1.80
6	**Total Capital Expenditures**	7.83	15.74	29.51	**53.07**

37. In forecasting the costs for this program for the 2022-2024 PBR term, EWSI has applied the following assumptions:

- Unit rates based on 2020 LID Construction estimates were developed for four LID type and size combinations as follows:
  - 2-layer soil cell streetscape - $5285/m^3$
  - 1-layer soil cell small - $9,150/m^3$
  - Bioretention/box planter small - $4350/m^3$
  - Bioretention large - $1900/m^3$
- Unit rates are based purely on construction costs however cost savings are assumed to be recognized as the program progresses. For commercial/industrial projects, costs are expected to be lower as there are no additional overhead fees from the City.
- The breakdown of LID features based on cost is forecast as:
  - 35% streetscape installations (BGN, Urban Renewal, Transportation, Commercial/Industrial);
  - 5% small soil cell installation (BGN);
  - 20% small bioretention/box planters (BGN, Commercial/Industrial, Parks, Facilities, Urban Renewal); and

  - 40% large bioretention (Parks, Commercial/Industrial, Urban Renewal, Facilities, Transportation).
- On average, 6 neighbourhoods or collector renewals undergo construction each year as part of BGN. This includes multiple construction years for most renewals. For 2022-2024 there are a total of 23 construction years scheduled for 16 different neighbourhoods' costs for each construction year range from \$0.25 million to \$1.5 million.
- Based on conceptual sizing and rough cost estimates, construction costs for the privately-owned commercial and industrial LID installations range from \$0.5 million to \$1.5 million. EWSI estimates 18 commercial/industrial sites identified will be completed during 2022-2024.
- Eight other LID projects are forecast to be completed under the LID Program during 2022-2024 as part of either or the City's urban renewal, transportation projects, facilities projects and parks projects or as part of EWSI''s stand-alone and opportunistic projects. Preliminary costs for some of these projects indicate costs similar to the Commercial/Industrial program.

38. The actual number of sites completed will vary depending on the cost-benefit analysis of the various LID features and programs and available projects; factors that may influence this include the size of the LID feature and catchment area, the ease of installation, coordination with other programs, and LID type. As this program allows flexibility in LID installations project costs may vary as the program progresses. EWSI is in the very early stages of implementing LID and will be able to refine its costs estimates in the future as it gains more experience with implementing LID in coordination with the various programs and at various locations.

39. Table 5.0-2 summarizes the LID Program details as described above using average costs and number of sites/neighbourhoods to illustrate the feasibility of the program. As described the program can be flexible and scope can be added or removed to the individual programs and projects within the overarching LID Program.

Table 5.0-2
Forecast Costs of Proposed LID Program for 2022-2024
($ millions)

	Program	A **Average Construction Cost per Site/Year**	B **Number of Sites/Years**	C **Construction Cost**	D **Design Cost***	E **Total Forecast Costs**
1	BGN	0.9	23	20.7	3.1	**23.8**
2	Commercial/ Industrial	1.0	18	18.0	2.1	**20.1**
3	Other Projects	1.0	8	8.0	1.2	**9.2**
4	**Total Costs**			**46.7**	**6.4**	**53.1**

*Design costs are estimated at 15% of Construction Costs for BGN and Other Projects which are initiated and managed by external contractors. Design costs are estimated at 12% of Construction Costs for Commercial/Industrial which are initiated and managed internally by EWSI.

40. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

41. Key risks and mitigations associated with the execution of this program are detailed in Table 6.0-1.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Risk of Limited uptake by commercial/industrial property owners - As this is a relatively new program, there is a risk that none of the identified properties will agree to be part of the program. Although EPCOR is funding design and construction of the LID, there will always be some impact to the property that the site owner(s) will have to agree to.	EWSI is developing an extensive list of commercial/industrial properties to help mitigate this risk. EWSI's Communication team has been involved and a number of educational materials have been developed to help engage customers to install LID features on their site. To date 3 of the 4 commercial/industrial sites that have been approached have agreed to move forward with the process. EWSI is developing educational materials and an educational program explaining LID to affected stakeholders including the public as necessary.
2	Construction Risks - Risk of utility conflicts, bad soil conditions/high groundwater table, restoration requirements, lack of space, and conflicts with other construction projects.	EWSI has developed LID Standards as part of the City of Edmonton's Volume 3 Drainage & Construction Standards, as part of the standards EWSI developed and released a number of tools and guidance documents including a report addressing geotechnical issues such as soil conditions and groundwater table, that are more specific to Edmonton. To avoid utility conflicts EWSI will circulate all projects through the Utility Line Assignment (ULA) system, or through the City's circulation process. EWSI will work with the City to identify and clarify new requirements and or changes to the project and will coordinate construction with other utilities and City.

Appendix H16

EPCOR WATER SERVICES INC.

Drainage Services
SIRP Proactive Manhole Relining Program
Business Case

February 16, 2021

Table of Contents

1.0 OVERVIEW

1. The Stormwater Integrated Resource Plan (SIRP) has identified that an increased risk of basement flooding occurs in areas where there are localized sag areas with water ponding on the road prior to draining through the piped stormwater network. The Proactive Manhole Relining Program is a new annual program initiated to reduce inflow and infiltration (I/I) into the sanitary and combined sewer system with risk of flooding due to sewer backups from these local sag areas. This program will focus on reducing I/I by relining the 1.5 m top portion of the sanitary and combined manholes. If the relining work is not done, this may lead to increased health and safety risks to EWSI's employees and to its customers due to potential for sewer backups and basement flooding; increased environmental risks associated with sewage spills to the local environment or water bodies; increased financial risks due to costly emergency repairs to failed drainage infrastructure; and increased risks of service disruptions due to neighbourhood flooding.

2. Prior to 2020, there was no previous proactive program to reline manholes and work was done on as needed basis in different programs such as neighbourhood renewal and local sewer rehabilitation. Since the initiation of this program in 2020, more than 1,000 manholes have been relined. The program is targeted to complete proactive relining of 1,000 manholes annually.

3. Sites for manhole relining will be selected according to the priority of SIRP risk ranking. EWSI has identified more than 9,000 sanitary and combined manholes that are located in ponding areas in the City. For the 2022-2024 PBR term, the scope of this program includes inspecting manholes in sag areas, repair severe structural deficits if required, install 1,800 inserts for manholes with critical ponding depth deeper than 0.3 metres and do relining for 3,000 manholes located in sag areas in selected neighbourhoods, as well as replacing the manhole frames and covers.

4. This program is categorized as reliability / life cycle replacement and is one of the SIRP-SECURE programs. EWSI has forecast total program capital expenditures during 2022-2024 at $18.71 million. The first annual Proactive Manhole Relining program was initiated in 2020.

2.0 BACKGROUND AND JUSTIFICATION

5. EWSI presented the Stormwater Integrated Resources Plan (SIRP) to the City of Edmonton Utility Committee and Council in 2019 as part of its non-routine adjustment application, following EWSI's October 2018 presentation of the SIRP Risk Framework Methodology. SIRP is a system wide integrated approach to mitigate flood risk by reducing the health, safety and social risk of flooding with lower overall capital investment than compared to traditional engineering approaches. SIRP recommended a five theme strategy for flood mitigation (SLOW, MOVE, SECURE, PREDICT and RESPOND) that included a mix of grey (trunks and tunnels) and green infrastructure (dry ponds, low impact development) components. The SIRP Proactive Manhole Relining Program is a critical component of the SIRP Strategy under the SECURE theme.

6. This new program was initiated as part of SIRP's "Secure" theme which will focus on securing individual properties in higher risk areas against flooding. SIRP has identified that there is an increased risk of basement flooding in areas where there are localized sag areas with water ponding on the road prior to draining through the piped stormwater network.

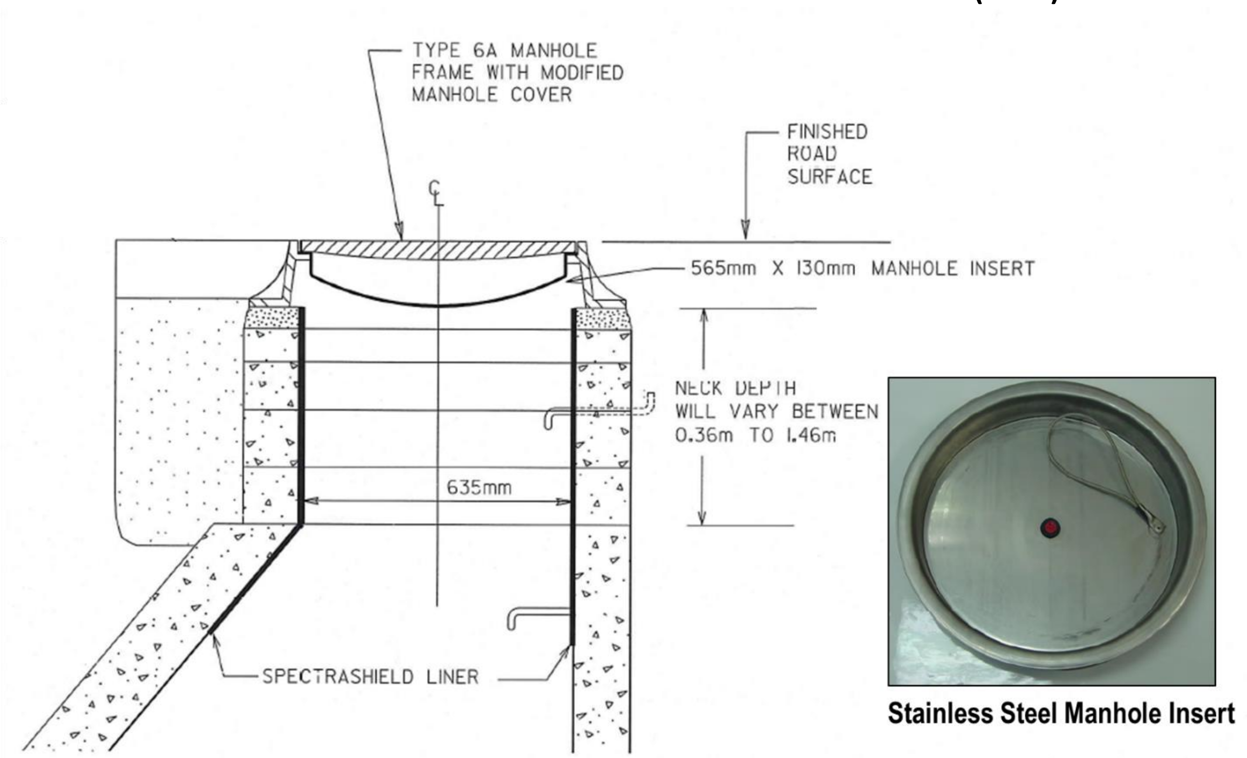
7. If the relining work is not done, excess inflow of rain water will be entering the sewer network over the surface ponding areas. This may overload the sewer capacity, cause sewer backups and increase the risk of basement flooding. Depending on the severity and duration of storm events, property damage may occur due to flooded basements in the area. In addition, there are concerns related to health and safety of customers and the frequent mobilization of operational crews due to basement flooding.

8. As one of the initiatives to reduce inflow and infiltration (I/I) into the sanitary system and the risk of flooding due to sewer backups from these local sag areas, this Proactive Manhole Relining Program will focus on reducing I/I by relining the 1.5 m top portion of the sanitary manholes (see Figures 2.0-1 and 2.0-2). The relining work designed for the top portion of a manhole is recommended by recent studies and field observations. The majority of I/I is due to surface runoff entering a manhole around the manhole neck and cone area which is about 1.2 to 1.5 m below surface. That is the area that receives the most impact from traffic. Unless there is evidence of major cracks along the manhole barrel, the most cost effective approach to minimize I/I from entering to sewer pipe through manhole is to reline the top portion of a manhole. In areas where the depth of ponding exceeds 0.30 metres, a manhole insert bowl will also be installed to seal the manhole lid to further prevent water flowing into the manhole through the pick-holes.

Figure 2.0-1
Typical Manhole Before and After Relining

Before After

Figure 2.0-2
Schematic of a Relined Manhole with Stainless Steel Insert (Bowl)



9. Sites for manhole relining will be selected according to the priority of the SIRP risk ranking. SIRP risk ranking is developed based on a combination of risk level from four different areas: Health and Safety, Environmental, Financial and Social. Each storm sub-area is assigned one of the 8 risk groups (A to H) under 4 Risk Levels (High, Medium High, Medium, Medium Low to Low). However, if these areas are listed under the City's neighbourhood renewal schedule, then the relining works for these sites are grouped and included in another EWSI capital program called

Manhole Relining and Insert Program. That program will be coordinated with the City's neighbourhood renewal schedule.

10. For this Manhole Relining Program, selected manholes will be inspected first and relining will be completed only if such works were not done previously at these locations. Approximately 60 manhole frames that have previously been identified as having maintenance issues will be replaced as part of this program. In addition, after field inspection and condition assessment, EWSI will address manholes with severe structural defects prior to relining if required. Based on site inspections, EWSI estimates that roughly 25% of manholes will require minor repair works and 5% will require major structural rehabilitation. As there are many products available in the market, the most suitable method for relining and sealing will be finalized at the procurement stage.

11. The relined top portion of the manhole will extend the life of the manhole. This program also provides a high level of service to residents by lowering the risk of sewer back-ups due to I/I and reducing service disruptions due to manhole collapses.

12. There are other EWSI programs that will also reduce I/I including:

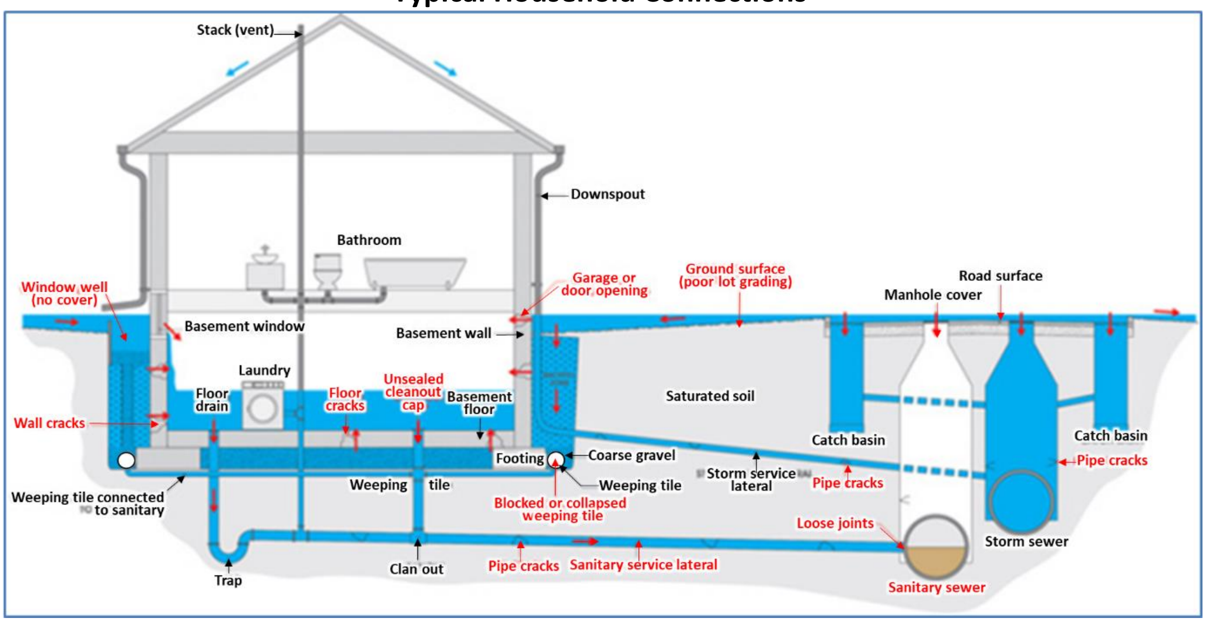
- manhole relines in Drainage Neighbourhood Renewal Program;
- opportunistic manhole and catchbasin repairs done as part of operations activities; and
- relining pipes (sanitary and combined) in ponding areas.

13. The risks associated with not completing this program include:

- Health and Safety Risk – Excessive I/I could pose a safety risk to the EWSI staff who operate and maintain the drainage infrastructure. There is also a safety risk to the public if the area is flooded due to high I/I which can cause spilled sewage and basement backups. Frequently flooded basements can also affect the physical and mental health of the occupants.
- Environmental Risks – Excessive I/I could lead to floods and sewage spills to the local environment or water bodies and may cause damage or contamination to the natural environment and wildlife. This will affect the usage of these facilities by the public and require substantial investment to restore the affected areas. The release of untreated sewage into the environment also violates Drainage's Approval-to-Operate issued by Alberta Environment and Parks.

- Financial Risks –High I/I can also lead to flooding which is costly to manage and clean up and can lead to claims from customers with flooded basements impacting the level of service and expectation of customers.
- Service Disruption Risk – High I/I could lead to neighbourhood flooding especially for houses in a localized sag area. Figure 2.0-3 below from the CSA Standard Z800-18 – Guideline on Basement Flood Protection and Risk Reduction illustrates (in red font) the different paths where stormwater can potentially enter a property that is in a localized sag area. Following a storm event, the longer the duration that the water pools on the road surface the higher the risk that the water will access the sanitary pipes and/or foundation drains of properties without adequate flood proofing and enter the building. This is why the focus for SIRP on programs is to reduce the risk of water ponding in localized sag areas during a storm event.

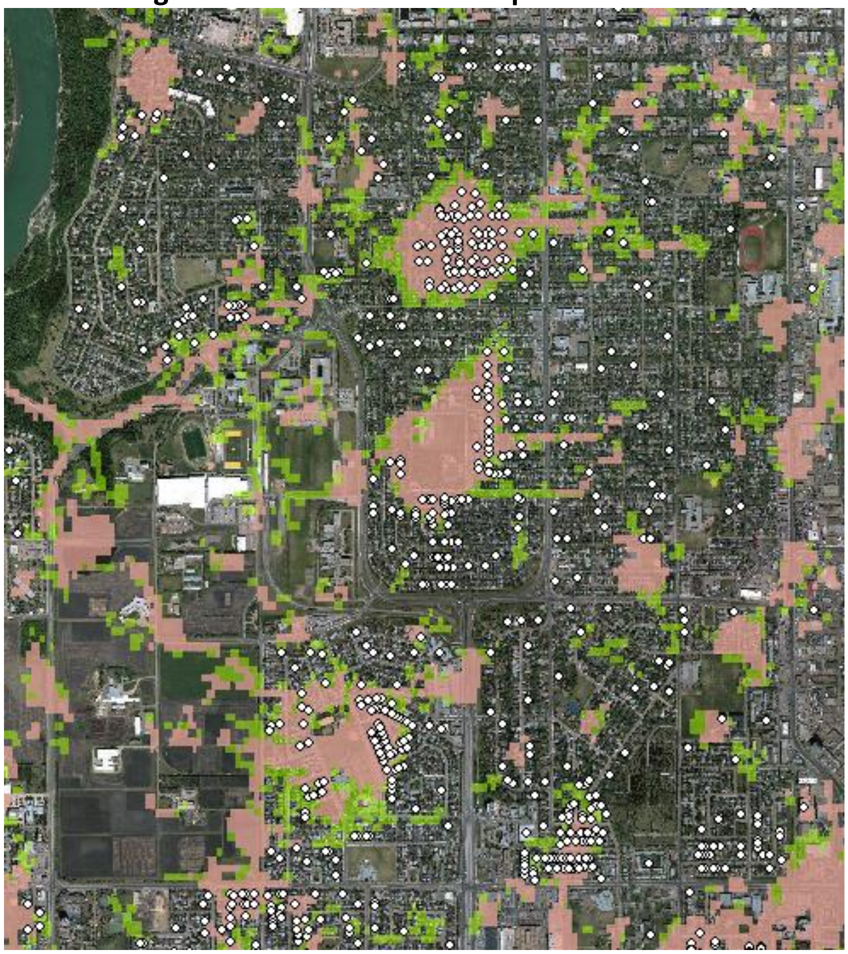
Figure 2.0-3
Typical Household Connections



14. The higher risk of ponding to properties was evident from the risk analysis of the stormwater sub basins where water was predicted to pond on the roads after a storm event. Historical basement flooding records for Edmonton confirmed this increased risk level as shown in Figure 2.0-4. Figure 2.0-4 identifies customer calls to 311 to report flooding events (during 2003-2016) in white dots compared to the pink and green areas which represents the ponding area identified by the insurance industry pluvial flood modelling using federal topographical maps under different storm intensities. There are strong correlation of locations of predicted

ponding locations with historical basement flooding records indicating I/I is a strong driver in causing basement flooding.

Figure 2.0-4
Comparison of Ponding Areas from Insurance Maps with 2003-2016 Basement Floods



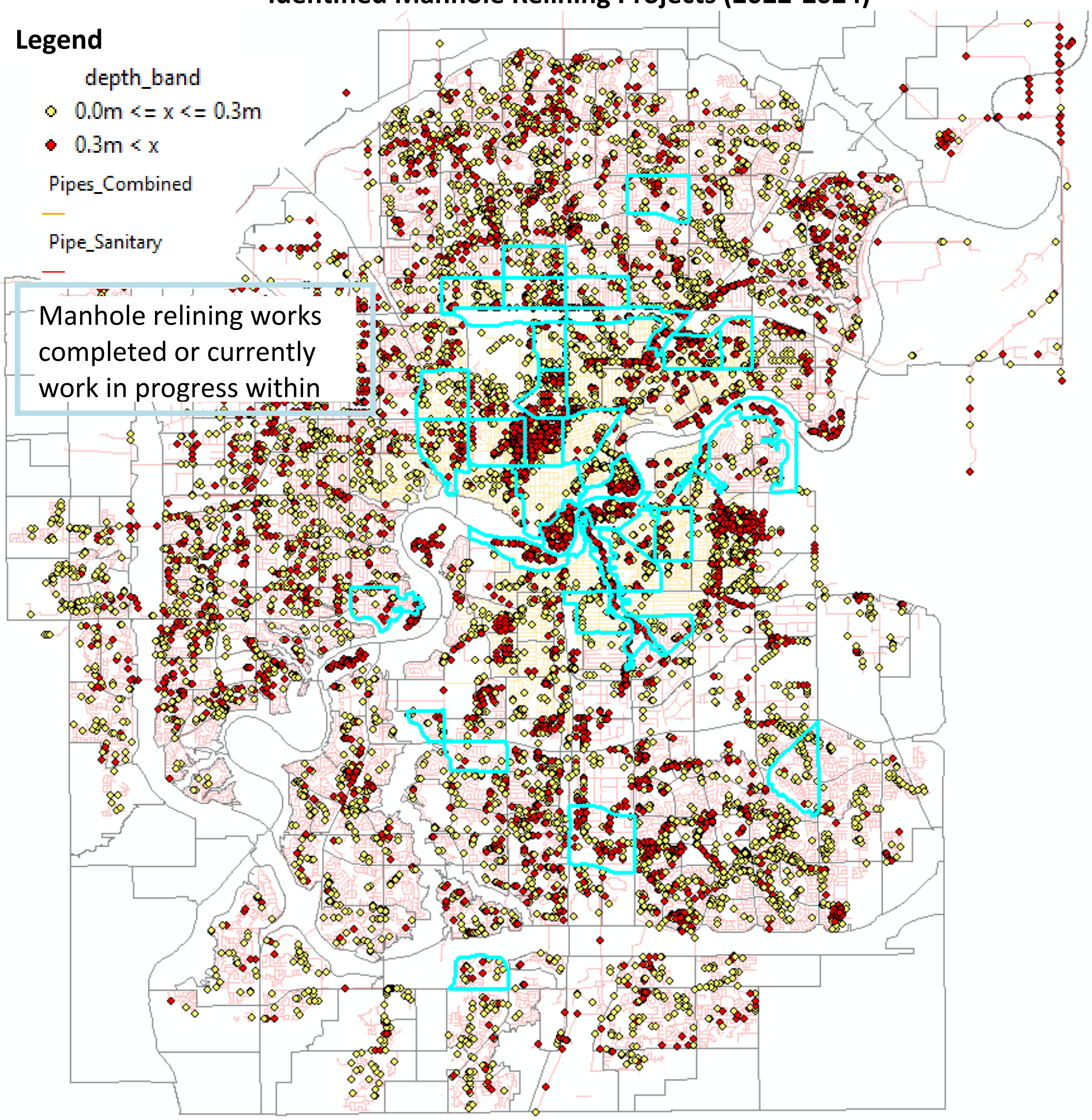
3.0 PROGRAM DESCRIPTION

15. EWSI has identified more than 9,000 sanitary manholes that are located in ponding areas in the City. Of these, EWSI is planning to seal and reline a total of 3,000 manholes during the 2022-2024 PBR term. These manholes will be selected based on ponding depth and SIRP risk ranking of the area. It is estimated from previous projects that approximately 1,800 manholes will be selected for relining and insert installation at locations with surface ponding depth of 0.30 metres or deeper and the remaining 1,200 manholes will require relining only. These manholes will be inspected first to determine if additional work to address structural defects is required. After field inspection and condition assessment, manholes with severe structural defects will be addressed prior to relining if needed. The costs to address these structural defects are included

in the scope of this program. This program is created based on EWSI's 10-year plan to complete a total of a 10,000 manholes in ponding areas by 2030. An additional 1,000 manholes are expected to be identified during the 10-year implementation period to supplement the initial 9,000 locations through site survey and field inspections.

16. Figure 3.0-1 below provides a map of the 9,000 sites identified for manhole relining including those greater than 0.3 metres in ponding depth identified in red and those less than 0.3 metres in depth identified in yellow.

Figure 3.0-1
Identified Manhole Relining Projects (2022-2024)



17. The scope of this program for the 2022-2024 PBR term includes:

- inspect manholes in sag areas;
- repair severe structural defects of manholes prior to relining if needed;
- relining of a total of 3,000 manholes located in sag areas within the selected neighbourhoods;
- installing about 1,800 inserts for manholes located in critical ponding depth deeper than 0.3 metre; and
- replace manhole frames with identified maintenance issues in areas with critical ponding depth.

18. Pipe relining is not included in this program but this program will coordinate with the Proactive Pipe Relining program in order to maximize the effort and avoid any conflicts of schedule.

19. Table 3.0-1 provides the criteria for inclusion in the Manhole Relining Program.

Table 3.0-1
Manhole Relining Program Criteria

	Criteria	A **Rationale**
1	Manholes in any SIRP sub basin identified as at risk of sewer backup and basement flooding	Reduce risk of sewer back up and basement flooding
2	Manholes not included in the current City's neighbourhood renewal List	Relined manholes will not be disturbed with the City's neighbourhood renewal list
3	Manholes in an identified sag location	Location of water ponding contributing to I/I in the sub basin
4	Sewer manholes	Reduce I/I in the sewer system to reduce risk of system overloading, sewer back up and basement flooding
5	Manholes in ponding areas where depth of ponding exceeds 0.30 metres	Insert will be added to seal the manhole lid. For drop manhole, insert will not be installed.

20. Minimal operational impact during program execution is expected to EWSI's Drainage Operations as there will be no interruption to the service connections and flows in the sewer pipes at the construction sites. Advanced notification will be provided to all impacted customers at the proposed construction sites. There are no abandonments or retirements for this program. There will though be a requirement to create a new procedure for on-going maintenance requirements of sealed manholes.

21. There is an opportunity to coordinate this construction with a communication with adjacent home owners to ensure they have flood proofed their properties. EWSI will leverage the opportunity when applicable to increase flood risk awareness to the adjacent properties to these sag locations.

22. This program will be delivered by a design bid build method. EWSI will complete site inspection, design, procurement and construction using existing relining master service agreements as it does not have the equipment and expertise in installing liner to the manholes.

23. This program is an annual program to relining manholes for I/I reduction. The program is targeting the relining of approximately 1,000 manholes each year. The delivery method has been divided into five stages as shown below, including tasks to be completed by internal resources and external contractors:

- Initial Review and Checking: Database review, previous rehabilitation works, types of manhole frame and covers, abandonment, etc. This will be done using internal resources.
- Condition Assessment: Inspection and confirmation of the physical condition of manholes and type of frame and covers, etc. This will be done using internal resources.
- Manhole Rehabilitation: Up to 30% of the selected manholes may require repairs which will be contracted out. The average cost per replacement without capital overhead or salary transfer is $6,500.
- Manhole Relining and Sealing: This work will be contracted out to external resources.
- Installation of Inserts and Type F39 Frames: It will be done using internal resources.

24. Table 3.0-2 provides the program schedule based on the phases of work.

Table 3.0-2
Proactive Manhole Relining Program Schedule

Project Phases		A **2020-2021**	B **2022 Q1/2**	C **2022 Q3/4**	D **2023 Q1/2**	E **2023 Q3/4**	F **2024 Q1/2**	G **2024 Q3/4**	H **2025 Q1/2**	I **2025 Q3/4**
1	Initiation/Approvals	X								
2	Preliminary Design		X		X		X			
3	Detail Design		X	X	X	X	X	X		
4	Procurement			X		X		X		
5	Construction			X	X	X	X	X	X	X
6	Commissioning					X		X		X
7	Close-out					X		X		X

4.0 ALTERNATIVES ANALYSIS

25. I/I can cause drainage system failures and flooding. Alternatives to I/I reduction initiatives include do nothing. As part of the approved SIRP initiatives, do nothing is not a feasible alternative because these areas will continue to have flooding issues.

26. The focus for this program is to reduce the I/I through manholes by relining them at a cost of $4000 to $5000 per manhole. Several alternatives to relining manhole were considered for reducing the I/I:

Alternative 1: Replace Manhole

27. Replacing manholes will be more costly and is estimated to double the cost of relining. Depending on the vertical depth, the cost to replace a standard manhole ranges from $15,000 to $30,000.

Alternative 2: External Wraps

28. Wraps are a flexible and adhesive butyl material with an abrasion resistant backing. Installation of wraps require excavation and is usually more expensive than relining. The cost for excavation, restoration and external wraps is approximately $10,000 per manhole.

Alternative 3: Manhole Plugs

29. These are typically a simple rubber or plastic plugs, sometimes with a metal clamping core, that limit inflows through the venting and lifting holes of the cover only and do not address inflows around the cover-frame interface and are therefore not a reasonable alternative. In addition, the plugs are frequently displaced or broken by traffic or snowplows.

30. Relining manholes is the recommended method to reduce I/I into the sewer system based on the cost, effectiveness, and no disruption of the ground surface. Selected manholes will be inspected first and relining will be completed only if such works were not done previously at these locations. In addition, after field inspection and condition assessment, manholes with severe structural defects will be addressed prior to relining if required. As there are many products available in the market, the most suitable method for relining and sealing will be finalized at the procurement stage.

5.0 COST FORECAST

31. Program costs are estimated based on previous projects of similar types such as the 2019 Manhole Relining and Insert Project and the 2020 Proactive Manhole Sealing Project. Comparison of various relining materials and insert bowls were conducted prior to the implementation of the Proactive Manhole Relining program. The comparison included product costs, specifications, service life, durability, and the need for maintenance. Some products were tested in the field to determine whether there are any issues associated with operation or maintenance. Only those products approved by EWSI's operation team were selected for the annual program. The cost estimate provided in this program is based on the actual spending on similar relining works completed in previous projects.

32. The project scope is well defined, and cost breakdown estimates were developed as follows:

- Contractor costs are based on historical data from similar projects completed in the past. The majority of work will be done for standard manholes and large variations of cost are not expected.
- In-house hours are based on historical data from similar projects completed in the past.

33. Table 5.0-1 provides the capital expenditure forecast for this program for the 2022-2024 PBR term.

Table 5.0-1
Proactive Manhole Relining Program
Capital Expenditure Forecast (2022-2024)
($ millions)

		A **2022**	B **2022**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	5.57	5.68	5.80	17.05
2	Internal Labour	0.36	0.37	0.38	1.11
3	Vehicles and Equipment	0.12	0.12	0.12	0.35
4	**Sub-total Direct Costs**	6.05	6.17	6.29	**18.51**
5	Indirect Costs	0.06	0.06	0.07	0.19
6	**Total Capital Expenditures**	6.11	6.23	6.36	**18.71**

34. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's long term construction contractors.
- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

35. Table 6.0-1 provides a summary of the key risks associated with executing this program and EWSI's plans to mitigate these risks.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Health and Safety – High I/I can cause flooding and sewer backup which pose as a drowning and health risk to residents.	Proactive relining manholes will reduce the amount of I/I and the associated risk of flooding and sewer backup.
2	Environmental - High I/I can cause flooding and sewer backup which can release untreated sewage into the environment and violate the Approval-to-Operate	Proactive relining manholes in the high risk area will reduce the amount of I/I and the associated risk of flooding and sewer backup.
3	Execution Risk - Using equipment such as jackhammers when replacing manhole structure may expose workers to silica dust, which over prolonged exposure can lead to silicosis. This condition is serious and can increase the individual's risk of developing cancer among other diseases.	EWSI will use appropriate kind of respirator to filter out silica (and other harmful substances) particles suspended in the air as well as using mechanized equipment so that workers are not directly exposed to the dust.
4	Financial - Liner not properly cured resulting in rework and extra cost to the project.	Contractors will submit the quality assurance/quality control plan including curing and temperature duration, confirm types of curing using and add clause for contractor to include monitoring for curing time and temperature.
5	Customer Disruptions - Risk of odour release impacting the public/residents.	EWSI will use non-odour releasing products; continuously monitor odour and assess the area during construction. EWSI will ensure coordination so the manholes are not opened for extended periods of time.

Appendix H17

EPCOR WATER SERVICES INC.

Drainage Services
SIRP Proactive Pipe Relining Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Stormwater Integrated Resource Plan (SIRP) identifies that there are a number of neighbourhoods at risk of basement flooding due to sewer surcharge during heavy storm events. One of the main causes of sewer surcharge is stormwater entering the sanitary or combined sewer systems through inflow and infiltration (I/I), especially from surface ponding areas. I/I is an issue because it reduces the capacity of the collection system which could lead to basement flooding due to sewer backup. The flood risk will remain high if the pipe relining work is not done as it may cause basement flooding for a large number of properties located in low lying areas during heavy to extreme rainfall events. In some cases, I/I can also cause untreated sewage discharge to the environment which is in violation of the Approval-to-Operate and could possibly result in a fine.

2. As one of the initiatives to reduce the risk of basement flooding due to I/I , this annual program has been initiated as a new program to focus on relining sanitary and combined sewer pipes in surface ponding areas. These low lying areas have a higher risk for I/I to occur due to cracks and open joints in sewer pipes. Through this program, the volume of stormwater entering the sanitary and combined sewer networks will be reduced.

3. During the 2022-2024 PBR term, EWSI plans to complete relining of 60 km of sanitary and combined sewer pipes with diameters of 750 mm or less, with observed I/I defects (assuming 2,550 metres needing open cut repair first) and 6 km of service line relining.

4. This program is categorized as reliability / life cycle replacement and is one of the SIRP programs to reduce flood risk in Edmonton. EWSI has forecasted total program capital expenditures during 2022-2024 at $22.91 million. This is a new program initiated in 2020 to proactively address local sewers with I/I defects. Previously, sewers were rehabilitated based on structural defects through the different local sewer rehabilitation programs such as neighbourhood renewal.

2.0 BACKGROUND/JUSTIFICATION

5. EWSI presented the Stormwater Integrated Resources Plan (SIRP) to the City of Edmonton Utility Committee and Council in 2019 as part of its non-routine adjustment application, following EWSI's October 2018 presentation of the SIRP Risk Framework Methodology. SIRP is a system wide integrated approach to mitigate flood risk by reducing the health, safety and social risk of flooding with lower overall capital investment than compared to traditional engineering

approaches. SIRP recommended a five theme strategy for flood mitigation (SLOW, MOVE, SECURE, PREDICT and RESPOND) that included a mix of grey (trunks and tunnels) and green infrastructure (dry ponds, low impact development) components. The SIRP Proactive Pipe Relining Program is a critical component of the SIRP Strategy under the SECURE theme.

6. SIRP identifies that there are a number of neighbourhoods at risk of basement flooding due to sewer surcharge during heavy storm events. One of the main causes of sewer surcharge is stormwater entering the sanitary or combined sewer systems through inflow and infiltration (I/I), especially from surface ponding areas where excessive runoff generated from rainfall exceeds the design inlet capacity of nearby storm catch basins. I/I is an issue because it reduces the capacity of the collection system which could lead to basement flooding due to sewer backup. Without this investment in proactive pipe relining program, EWSI faces a number of risks including: health and safety risk to the EWSI staff and to the public if the area is flooded due to high I/I and causes spilled sewage and basement backups; environmental risks due to potential floods and sewage spills to the local environment or water bodies; and financial risks associated with costly emergency repairs to failed drainage infrastructure and potential claims from customers with flooded basements.

7. As one of the initiatives to reduce the risk of basement flooding due to I/I , the Proactive Pipe Relining Program has been initiated to focus on relining sanitary and combined sewer pipes in surface ponding areas. Prolonged surface ponding over low lying areas leads to a higher risk for I/I to occur through cracks and open joints in sewer pipes. Through this program, the volume of stormwater entering the sanitary and combined sewer networks will be reduced. Other EWSI capital programs and maintenance activities that will also reduce I/I include:

- Proactive Manhole Relining Program coordinated with the Drainage Neighbourhood Renewal Program for recently completed neighbourhoods;
- opportunistic manhole and catchbasin repairs completed by Operations; and
- relining pipes in other ponding areas with known I/I defects based on EWSI's annual closed circuit television (CCTV) inspections.

8. Traditionally, pipe relining is done on a reactive basis when there is sewer backup or basement flooding reported and the structural condition for the pipe is found to be deteriorated enough for relining. Similar to the sewer reline in the Neighborhood Renewal Program and arterial road drainage projects in the Arterial Road and Drainage Coordination Program, this Proactive Pipe Relining Program reduces the risk of sewer backup and basement flooding due to excessive I/I entering the sanitary and combined sewers at known surface ponding areas.

9. Approximately 1,300 km of sanitary and combined pipes with varying diameters are located in low lying areas in the city of Edmonton. Surface ponding over the low lying areas occurs when runoff exceeds the design inlet capacity of nearby catch basins. The completion target for the overall Proactive Pipe Relining Program is approximately 500 km of the total 1,300 km over the next 20 years. EWSI is planning to complete 60 km of sanitary and combined pipes during the 2022-2024 PBR term. The 60 km of sanitary and combined pipes are selected based on pipe diameters equal to or less than 750 mm and located in areas with ponding depth greater than the allowable 0.3 m. Relining or rehabilitation works for pipes larger than 750 mm diameter will be completed under the Sewer Trunk Rehabilitation program. Table 2.0-1 below provides the total number and length of sanitary and combined sewer pipes in low lying areas.

Table 2.0-1
Overall Sanitary and Combined Sewer Pipes in Low Lying Areas

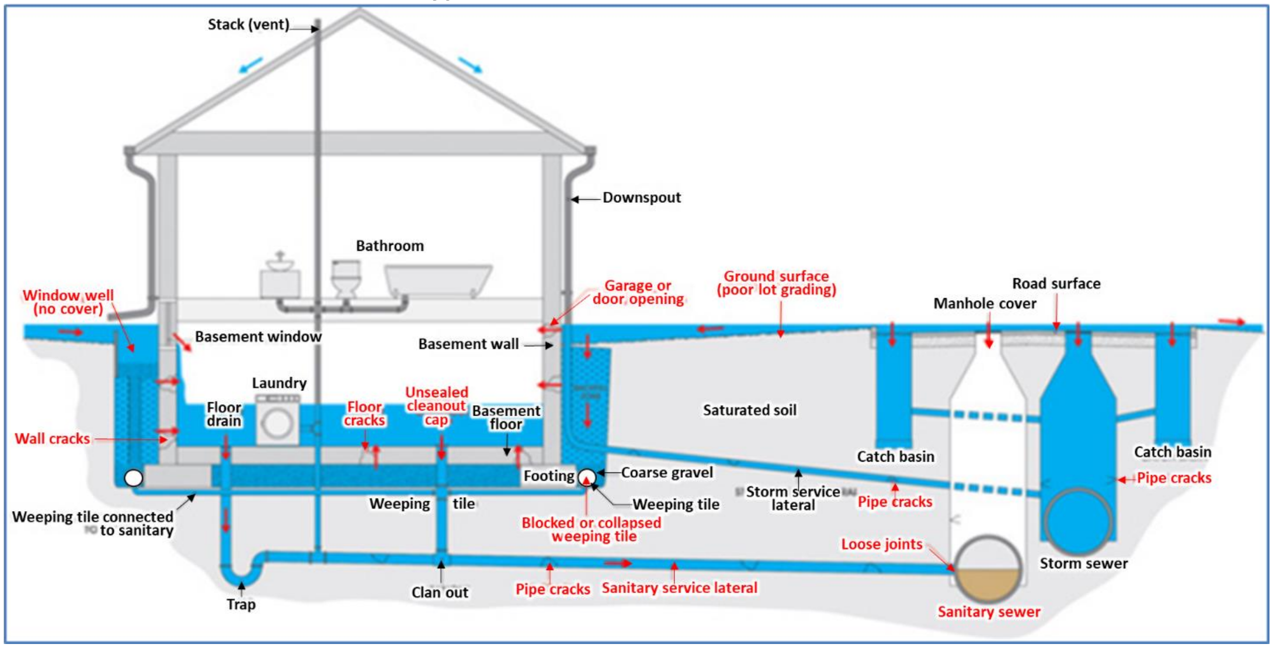
	A	B	C	D
	Pipes with any Diameters, and any Ponding Depth > 0m		**Pipes with Diameter ≤ 750mm, and Ponding Depth > 0.3m**	
	# of pipes	**Total Length (km)**	**# of pipes**	**Total Length (km)**
1 Sanitary	12,525	970	4,832	370
2 Combined	5,059	341	2,004	128
3 **Total**	**17,584**	**1,311**	**6,836**	**498**

10. The consequences of not completing this program includes:

- Health and Safety Risk – Excessive I/I could pose a safety risk to the EWSI staff who operate and maintain the drainage infrastructure. There is also a safety risk to the public if the area is flooded due to high I/I causing spilled sewage and basement backups.
- Environmental Risks – Excessive I/I could lead to floods and sewage spills to the local environment or water bodies.
- Financial Risks – Emergency repairs to failed drainage infrastructure are more costly. High I/I can also lead to flooding which are costly to manage and clean up, and can lead to claims from customers with flooded basements.
- Service Disruption Risk – High I/I could lead to neighbourhood flooding especially for customers in localized sag areas. The higher flood risk in localized sag areas is illustrated in Figure 2.0-1 below from the CSA Standard Z800-18 – Guideline on Basement Flood Protection and Risk Reduction. The figure illustrated the different paths where stormwater can enter a property during a flooding event. The longer the duration that the water pools on the road surface the higher the risk that the water will access the sanitary pipes and/or foundation drains of properties without

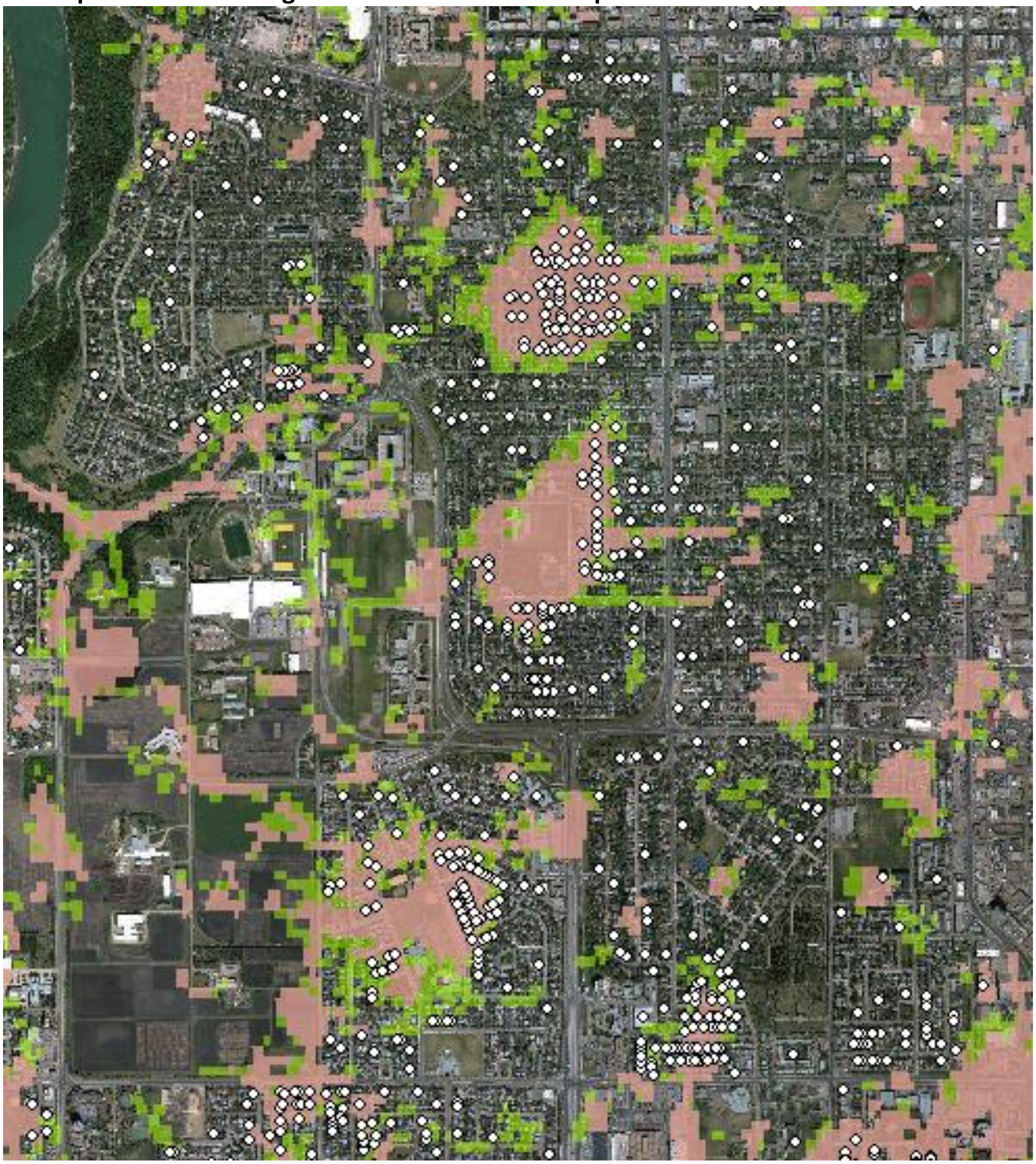
adequate flood proofing and enter the building. Hence the focus for SIRP on programs to reduce the risk of water ponding in these localized sag areas during a storm event.

Figure 2.0-1
Typical Household Connections



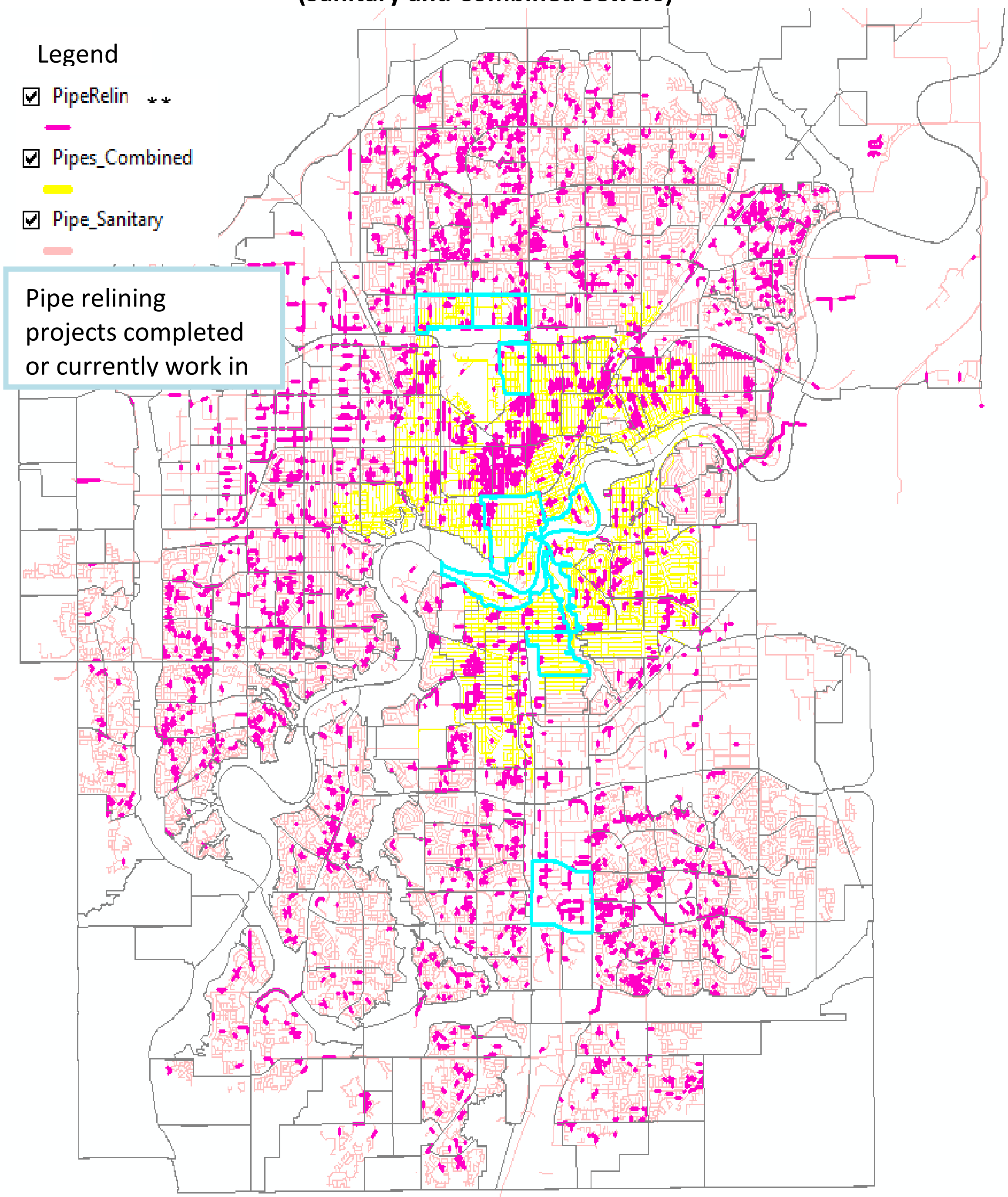
11. The higher risk of ponding to properties was evident from the risk analysis of the stormwater sub basins where water was predicted to pond on the roads after a storm event. Historical basement flooding records for Edmonton confirmed this increased risk level as shown in Figure 2.0-2. Figure 2.0-2 identifies customer calls to 311 to report flooding events (during 2003-2016) in white dots compared to the pink and green areas which represents the ponding area identified by the insurance industry pluvial flood modelling using federal topographical maps under different storm intensities. There are strong correlation of locations of predicted ponding locations with historical basement flooding records indicating I/I is a strong driver in causing basement flooding.

Figure 2.0-2
Comparison of Ponding Areas from Insurance Maps with 2003-2016 Basement Floods



12. Figure 2.0-3 below provides a map of all of the identified proactive pipe relining projects within the city of Edmonton.

Figure 2.0-3
Map of Proactive Pipe Relining Projects
(Sanitary and Combined Sewers)



** for surface ponding greater than 0.3m and pipe diameters equal or less than 750mm.

3.0 PROGRAM DESCRIPTION

13. The focus of this program will be on the selected neighborhoods that are not currently included on the Drainage and City's neighbourhood renewal list within the next 5 to 10 years. Areas are selected according to the SIRP risk ranking and located at low lying areas with surface ponding of greater than 0.3 m. The SIRP risk ranking is developed based on a combination of risk levels from 4 different areas: Health and Safety, Environmental, Financial and Social. Each storm sub-area is assigned one of the 8 risk groups (A to H) under 4 risk levels (High, Medium High, Medium, Medium Low to Low). EWSI plans to complete relining of 60 km of sanitary and combined sewer pipes with diameters of equal or less than 750 mm with observed I/I defects (assuming 2,550 metres needing open cut repair first) under this program for the 2022-2024 PBR term. In addition, EWSI plans to complete 6 km of service line relining under this program for the 2022-2024 PBR term.

14. The scope of this program for 2022-2024 includes:

- review existing CCTV inspection reports of sanitary and combined pipes in low lying areas to confirm the suitability for relining. This process is required to identify if open cut repairs are required prior to relining due to structural damage of the pipe section;
- clean all pipes and carry out CCTV inspections to identify any structural damage, if needed, prior to relining ;
- repair severe structural defects prior to relining if needed (an estimate of 2,550 m of point repairs by open cut for 2022-2024);
- reline an estimate of 60 km of sanitary and combined pipes with diameters of equal or less than 750 mm at low lying areas with surface ponding of greater than 0.3 m;
- reline service line as needed up to the property line (an estimate of 6 km of service lines for 2022-2024);
- temporary bypass pumping during relining of the pipes; and
- restore all service connections.

15. Table 3.0-1 provides a summary of the criteria and rationale used to determine which projects are eligible for inclusion under the Proactive Pipe Relining Program.

Table 3.0-1
Criteria for inclusion in the Proactive Pipe Relining Program

	Criteria	A Rationale
1	Any SIRP sub basin identified as at risk of sewer backup and basement flooding	Reduce risk of sewer back up and basement flooding
2	Not included in the current Drainage and City's neighbourhood renewal list	Supplement to the neighbourhood renewal program
3	Identified sag location	Location of water ponding contributing to I/I in the sub basin
4	Sanitary and combined sewers	Reduce I/I in the sanitary and combined system to reduce risk of system overloading, sewer back up and basement flooding
5	Site selection in conjunction with the proactive manhole relining in ponding areas as much as possible	It could reduce site set up cost

16. Manhole relining and lateral connections relining are out of scope for this program as this work is included in other EWSI capital programs. This program is a supplement to the current Neighbourhood Renewal Program. Similar projects will be coordinated with the Neighbourhood Renewal Program in future years. Relining options will be identified and assessed through the design stage of the program.

17. Advanced notification will be provided to all impacted customers of the proposed construction work. The service connections in the relined sewer pipes will be immediately restored once the curing process is complete. There are no planned abandonments or retirements for this project.

18. This is an annual program to reline sewer within the ponding areas. The program is targeting the relining of about 20 km of sewer pipes each year (total 60 km in 3 years). The delivery method has been divided into four stages as shown below, including tasks to be completed by internal resource and external contractors. This project will be delivered by a design bid build method.

19. The delivery method has been divided into four stages:

- Initial Review and Checking: Database review, previous rehabilitation works, pipe sizes, depth, abandonment, etc. This will be completed by in-house resources.
- Condition Assessment: Review existing CCTV inspection reports, and carry out new CCTV inspections, if needed, to confirm the suitability for relining. This can be completed by in-house resources or external contractors.

- Pipe Rehabilitation: Up to 20% of the selected pipes may require repairs based on CCTV investigation. The work will be contracted out to external resources. EWSI does not currently have the equipment and expertise in relining to rehabilitate sewer pipe within the projected schedule.
- Pipe Relining: Preparation of drawings will be done in-house, relining works will be contracted out to external resources.

20. Table 3.0-2 below provides the schedule for the Proactive Pipe Relining Program.

Table 3.0-2
Proactive Pipe Relining Program Schedule
2022-2024

	Project Phases	A **2020** **2021**	B **2022** **Q1/2**	C **2022** **Q3/4**	D **2023** **Q1/2**	E **2023** **Q3/4**	F **2024** **Q1/2**	G **2024** **Q3/4**	H **2025** **Q1/2**	I **2025** **Q3/4**
1	Initiation/Approvals	X								
2	Preliminary Design		X		X		X			
3	Detail Design		X	X	X	X	X	X		
4	Procurement			X		X		X		
5	Construction			X	X	X	X	X	X	X
6	Commissioning					X		X		X
7	Close-out					X		X		X

4.0 ALTERNATIVES ANALYSIS

21. A do-nothing alternative was considered for this project. Not pursuing I/I reduction poses a risk of continued flooding to the impacted residents. Significant I/I defects could also lead to failure of the sewers, resulting in a significant service disruption to customers. Unplanned emergency repairs also tend to be more costly than a planned approach.

22. Another construction alternative is to install new pipe and replace the existing sewer with an equal or larger diameter pipe. In general, installing new pipe is more costly than relining and new installation may not be effective in preventing I/I. For example, the unit cost for relining a 600 mm diameter pipe is about $500/m, and the unit cost for installing a new 600 mm diameter pipe is about $7,500/m. Therefore, in this example, the unit cost for new pipe installation is about 15 times (or 1500%) higher than the relining works.

5.0 COST FORECAST

23. Project costs are estimated based on previous projects of similar types such as the 2020-2021 Proactive Pipe Relining- Sanitary and Combined Project. EWSI compared various

relining materials prior to the implementation of the Proactive Manhole Relining Program. The comparison included product costs, specifications, especially on the service life and durability. Only those products approved by EWSI's operational team were selected for this annual program. The cost estimate provided in this program is based on the actual spending on similar relining works completed in previous projects, scheduling of major works in each program by phases and optimization of internal and external resources. Table 5.0-1 provides the capital expenditure forecast for this program for the 2022-2024 PBR term.

24. The program cost breakdown estimates were developed based on the EWSI's unit prices and also:

- Contractor costs are based on historical data from similar projects done in the past. Majority of works will be done for standard circular shape pipes and large variations of cost are not expected for these annual programs.
- In-house hours are based on historical data from previous similar projects.

Table 5.0-1
Proactive Pipe Relining Program
Capital Expenditure Forecast
2022-2024
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs				
1	Contractors	6.84	6.98	7.12	20.94
2	Internal Labour	0.45	0.46	0.47	1.38
3	Vehicles and Equipment	0.11	0.12	0.12	0.35
4	**Sub-total Direct Costs**	**7.41**	**7.56**	**7.71**	**22.67**
5	Indirect Costs	0.08	0.08	0.08	0.24
6	**Total Capital Expenditures**	**7.49**	**7.64**	**7.79**	**22.91**

25. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- All activities related to project management, design, drafting, construction coordination and inspection, and as-built recording will be undertaken internally by EWSI, eliminating the need for external consultants. The actual construction, including surface restoration, will be completed by one of EWSI's long term construction contractors.

- Contracted services are performed by pre-qualified external contractors and done on a competitive unit priced basis, using comprehensive engineering packages to ensure cost and scope control.
- The installations will be consistent with EWSI's construction standards which will minimize stock requirements and speed up design and construction.
- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project scope is evaluated to improve economy of scale and to eliminate future throw-away of infrastructure.
- All force accounts are documented and reviewed by several EWSI representatives to ensure the additional cost is justified under the terms of the contract.

6.0 RISKS AND MITIGATION PLANS

26. Table 6.0-1 provides a summary of the key risks associated with executing this program and EWSI's plans to mitigate.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A **Mitigation Plan**
1	Health and Safety – High I/I can cause flooding and sewer backup which pose as a drowning and health risk to residents.	Proactive pipe relining will reduce the amount of I/I and the associated risk of flooding and sewer backup.
2	Environmental - High I/I can cause flooding and sewer backup which can release untreated sewage into the environment and violate the Approval-to-Operate.	Proactive pipe relining in the high risk areas will reduce the amount of I/I and the associated risk of flooding and sewer backup.
3	Execution Risk - Working in confined space without proper equipment, training, or permit results in injuries and potential fine from Occupational Health and Safety.	EWSI will ensure contractors meet EPCOR safety standards and that contractors provide and follow all work safety plans including emergency response and rescue plan.
4	Financial - Liner not properly cured resulting in rework and extra cost to the project.	EWSI will require contractors to submit the quality assurance/quality control plan including curing and temperature duration, confirm types of curing using and add clause for contractor to include monitoring for curing time and temperature
5	Customer Impacts - Risk of odour release through opening manholes during relining operations.	EWSI will use non-odour releasing products, continuously monitor odour and assess the area during construction. EWSI will ensure coordination so the manhole are not opened for extended periods of time.

Appendix H18

EPCOR WATER SERVICES INC.

Drainage Services
Small Trunk Rehabilitation Program
Business Case

February 16, 2021

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1.0 OVERVIEW

1. The Small Trunk Rehabilitation Program focuses on rehabilitating small trunks ranging in diameter from 600 mm to less than 1200 mm. They are gravity fed and are used to convey flow from local drainage pipes to larger trunks throughout the system. In the City of Edmonton's drainage system, there are 1,261 km of small trunks (storm, sanitary and combined), of which approximately 66 km are rated as being in poor and very poor condition.

2. Failure of a small trunk may lead to health and safety risks to the public associated with subsidence on roadways. Environmental risks include potential sewage spills into the local environment, including rivers, creeks, and stormwater management facilities. Failure of small trunks can also disrupt large service areas impacting many customers and cause sewer back up into customer's basements. When a small trunk fails, EWSI must complete emergency repairs, which cost more and are more disruptive to traffic and the public than proactive rehabilitation.

3. The Small Trunk Rehabilitation Program is a program that focuses on rehabilitation (relining or replacement) of damaged and failed small trunks to mitigate these risks. Under this program, small trunks are inspected and ranked in terms of condition and risk ranking to prioritize their rehabilitation. The Small Trunk Rehabilitation Program is a new program initiated in the 2022-2024 PBR term to address risk of failure of small trunks. Previously, small trunk rehabilitation was combined with large trunk rehabilitation or completed on a reactive basis through standalone projects. Small trunks have been separated out as they are a separate asset class where the process for inspections, the type of rehabilitation and the methods of construction differ from large trunks. Initiating a program for small trunk rehabilitation will allow for systematic and proactive upgrades to these assets based on risk so that EWSI can rehabilitate before a major failure occurs.

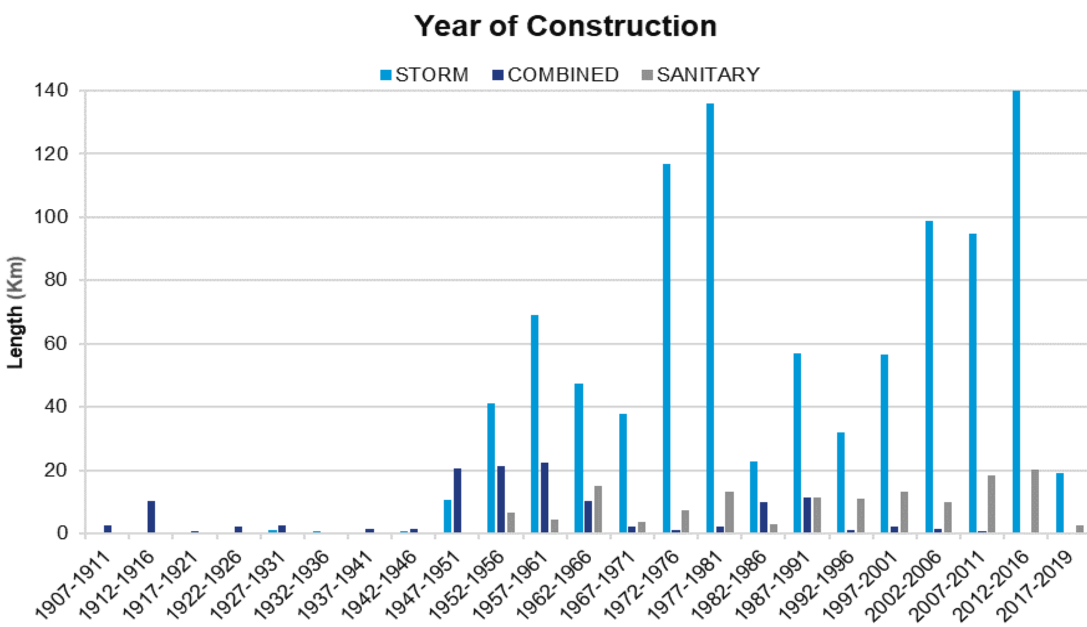
4. During the 2022-2024 PBR term, EWSI expects to complete approximately 10 km of inspections, 5 km of trunk relining and 400 m of small trunks replacement within the Small Trunk Rehabilitation Program. The inspections will focus on the areas which EWSI plans to complete rehabilitation. To ensure the most efficient use of funds within this program, EWSI aims to complete relining where possible as it is far less costly at approximately $3,000 per meter compared to open cut replacements for spot repairs which average $5,000 per meter. However, replacement is required when the pipe has deteriorated so much that it has sags, localized failures, or collapsed. This program is categorized as reliability and life cycle replacement and is

one of the Drainage System Rehabilitation programs. EWSI has forecast $18.8 million capital expenditures for this program during the 2022-2024 period.

2.0 BACKGROUND/JUSTIFICATION

5. The Small Trunk Rehabilitation Program focuses on the rehabilitation of small trunks ranging in diameter from 600 mm to less than 1200 mm. They are gravity fed and are used to convey flow from local drainage pipes to larger trunks throughout the system. Small trunks also include pipes on the trestles across the city. In the City of Edmonton drainage system, there are 1,261 km of small trunks (storm, sanitary and combined) constructed over the past 100 years to varying standards and specifications. Figure 2.0-1 below shows the year of construction for small trunks, indicating that the majority were constructed since the 1950s. The average age of small trunks is 35 years. The useful life for small trunks is dependent on waste type, pipe material and other factors. In general, it is expected to be 75 years for combined and storm pipes, and 60 years for sanitary pipes.

Figure 2.0-1
Small Trunks



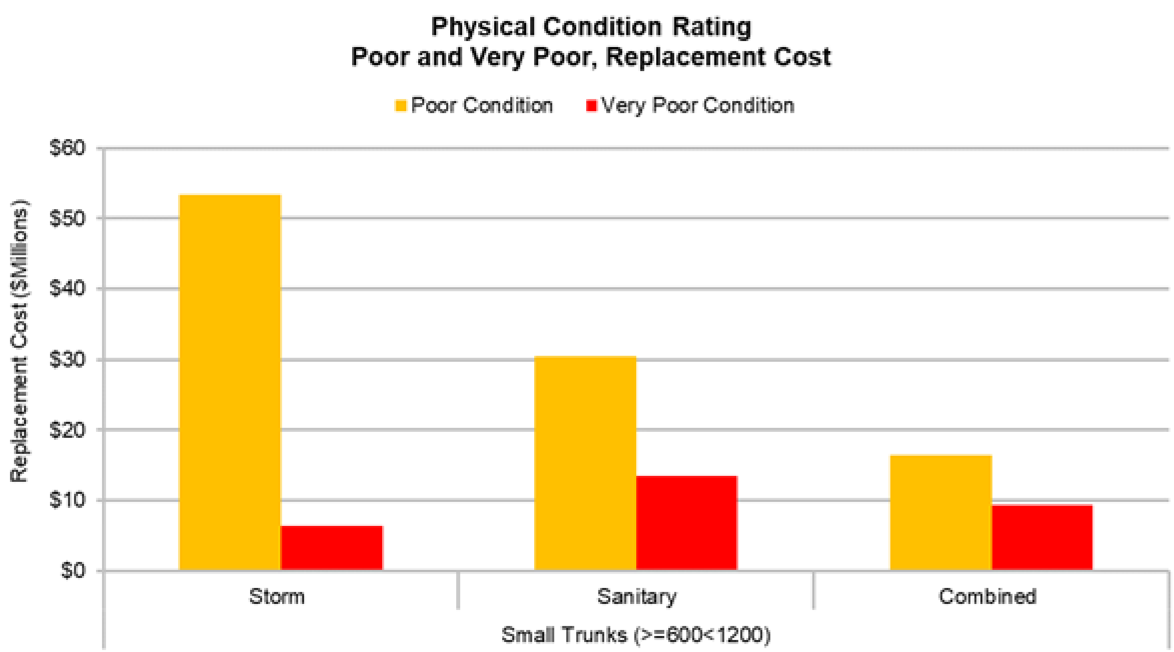
6. As the system ages, the risk of failure and collapse of these small trunks will increase. There is currently about 66 km of small trunks rated as being in poor and very poor condition. The definition of poor and very poor condition is as follows:

- Poor condition – major deterioration evident, extensive ongoing maintenance and/or operational "prop up" actions are required to keep the element operational; and

- Very Poor Condition – element deteriorated to such an extent that it is generally inoperable or unsafe, history of failures, immediate need to replace most or all of the element.

7. As of 2019, assets within the poor and very poor categories have an estimated replacement cost of $130 million, representing approximately 66 km of small trunks within the City of Edmonton. The chart shown in Figure 2.0-2 indicates the replacement value of storm, sanitary and combined small trunk infrastructure in poor and very poor physical condition, based on a system-wide deterioration model. Rehabilitation and replacements that are completed through renewal will positively affect the condition ratings and, therefore, reduce the number of poor and very poor condition trunks.

Figure 2.0-2
Small Trunks Physical Condition Rating



8. EWSI uses a risk-based approach to target the highest risk assets first for rehabilitation. As with other critical asset types, small trunks are prioritized based on risk. There are several risks associated with the deterioration and failure of small trunks:

- Health and Safety Risk – failure of a small trunk could cause a subsidence on roadways which poses a safety risk to the public, as shown in Figure 2.0-3 below. The release of hydrogen sulfide gas (H_2S) can also be a risk when working on sanitary or combined pipes. Over the past few years, we have at least 4 significant failures in the small trunk system including the Lauderdale combined trunk, the trestle in Clareview Sanitary System, the trestle at Whitemud Creek and the sanitary trunk at Calder.

Figure 2.0-3
Image of Roadway Subsidence

- Environmental Risk – Failure of a sanitary or combined small trunk could cause a sewage spill to the local environment or water bodies.
- Customer Disruption Risk – Failure of small trunks can cause disruption to large service areas impacting many customers, and can also cause sewer back up into customer's basements. Failed trunks also lead to emergency repairs, which are more disruptive to high traffic roadways and therefore to the public.
- Financial Risk – Emergency repairs of failed small trunks are more costly than proactive rehabilitation. Typically an emergency repair will require more open cut replacement, which is more expensive than relining. By doing the rehabilitation work proactively through relining there are significant cost savings. As an example, the Lauderdale project was estimated to cost $7.5 million for emergency repairs due to severe deterioration, bypass requirements roadway restoration. Whereas relining of a small trunk project of this size could be completed for about $3 million.

9. As the small trunks age, it is important to prioritize inspections and renewals to deal with structural condition issues and mitigate the risks identified above. The Small Trunk Rehabilitation Program aims to improve the conditions of the asset, which will, therefore, reduce the risk of failure for these assets. This program supports EWSI's asset management objectives by

identifying emerging asset risks through inspections and managing them appropriately, reducing risk exposure. Since much of the pipe material is concrete, several failure modes and defects would require attention, such as wall loss due to corrosion, joint separation, fractures, breaks and holes. Figure 2.0-4 below shows some typical deterioration found within small trunks such as visible steel reinforcement, corrosion, concrete wall loss, and a PVC material change which may indicate a past failure.

Figure 2.0-4
Deterioration of Small Trunks

10. Over the last 25 years, the amount of fully rehabilitated small trunks from manhole (MH) to MH is represented in Table 2.0-1 below. Relining can be done when the pipe has deteriorated but is still structurally intact. Replacement is required when the pipe has deteriorated so much that it has sags, localized failures, or collapsed. Typically, relining would be the full pipe from MH to MH. Open cut replacement is often just a spot repair. Relining is less costly at $3,000/m versus open cut averaging about $5,000/m.

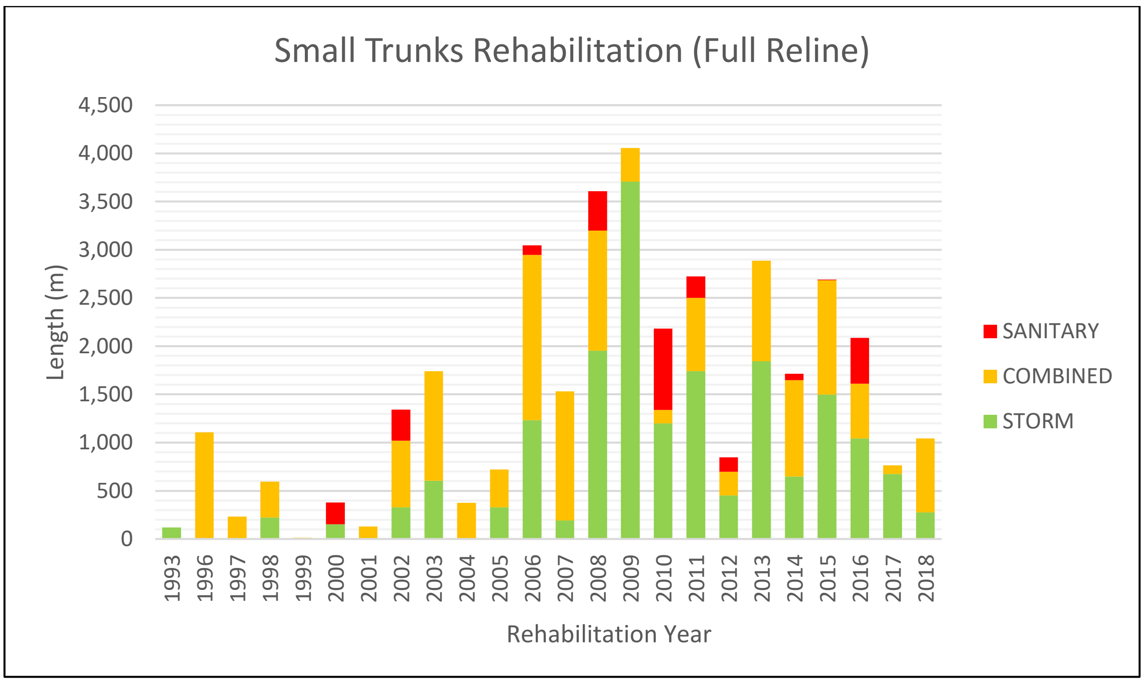
Combined pipes have the highest percentage of rehabilitation versus total length per waste type, but overall only 2.85% of the total small trunks have been rehabilitated, as summarized in Table 2.0-1. On average, 1.5 km of small trunks have been fully relined each year. Higher amount years (2006-2011) have been in the range of 2 to 4 km, when small trunks were the focus under the former Trunk Sewer Rehabilitation Program.

Table 2.0-1
Historical Small Trunks Rehabilitation
(1993-2018)

	Type	A **Total Length (km)**	B **Full Reline (km)**	C **Average Age at Reline**	D **% of Total**
1	Storm	992	18.2	50	1.8%
2	Combined	129	14.9	64	11.6%
3	Sanitary	140	2.8	46	2.0%
4	**Total**	**1,261**	**36**	**-**	**2.9%**

11. Historical small trunk rehabilitation is presented on an annual basis in Figure 2.0-5 below.

Figure 2.0-5
Historical Small Trunks Rehabilitation
1993-2018



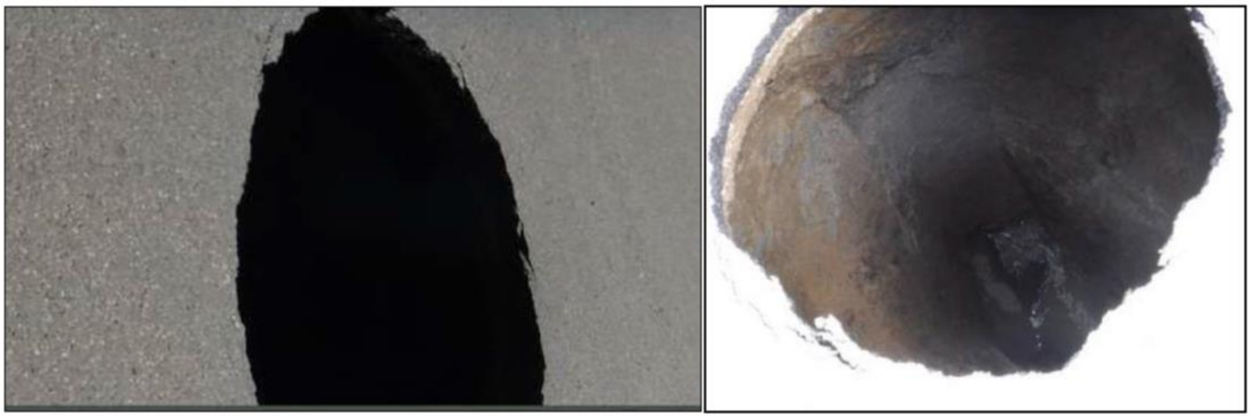
*Note: There were no records of rehabilitation in 1994 and 1995.

12. There are currently two small trunk rehabilitation projects underway that provide good examples of the type of projects, the needs, and the importance of timely assessment and implementation of corrective actions of small trunk deficiencies.

13. The Lauderdale Combined Trunk, consisting of 750 mm and 900 mm diameter reinforced concrete pipes, had a history of issues from 2014-2016, including sinkhole and spot repairs. The project was initiated in 2017, and then inspected with multi-sensor inspection (MSI) in 2018. A

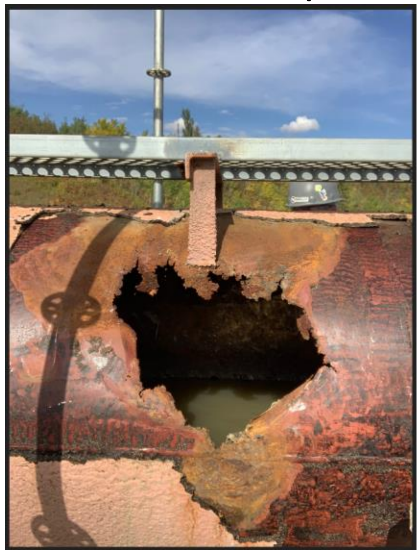
sinkhole developed in 2019 before the project could be completed. This led to an increase in scope, with project costs estimated at $7.5 million. The scope includes 770 m of reline and 50 m of replacement. Figure 2.0-6 shows the sinkhole found in Lauderdale taken from the street level.

Figure 2.0-6
Pictures of Sinkhole at Lauderdale



14. The Clareview Sanitary Trunk Rehabilitation Project includes relining of approximately 650 m of 900 mm-1,050 mm reinforced concrete, and replacement and rehabilitation of approximately 70 m of 900 mm steel pipe on Trestle No.3. This project was initially assessed in 2017 and initiated for a rehabilitation project. Replacement of the steel pipe was found to be required as the pipe is fully deteriorated, and several holes have developed. In accordance with regulatory reporting requirements, EWSI reported the condition of the trestle to Alberta Environment and Parks given the potential for untreated wastewater to spill out to the environment from these holes. Overall the project cost for the relining and trestle pipe replacement is estimated at $7 million. Figure 2.0-7 shows one of the corroded and failed sections from the steel pipe on the trestle after the protective coating was removed.

Figure 2.0-7
Failed Section from the Steel Pipe on the Trestle



15. The Small Trunk Rehabilitation Program will focus on rehabilitating small trunks rated as poor and very poor. The program will contribute to an improvement in the asset conditions and a reduction in risk. For the 2022-2024 PBR term, EWSI plans to rehabilitate 5.4 km of small trunks (storm and sanitary trunks). This would result in a direct reduction of the small trunks in poor and very poor condition by 8.2%.

16. Table 2.0-2 provides the Small Trunk Rehabilitation Program's quarterly schedule for the 2022-2024 PBR term. Initiation and approvals will be completed in late 2022 in order to start design and some construction in 2023. Construction will carry into 2024 and be completed by year-end.

Table 2.0-2
Small Trunks Rehabilitation Program Schedule
2022-2024

	Project Phases	A **2022 Q3**	B **2022 Q4**	C **2023 Q1**	D **2023 Q2**	E **2023 Q3**	F **2023 Q4**	G **2024 Q1**	H **2024 Q2**	I **2024 Q3**	J **2024 Q4**
1	Initiation/Approvals	x	x								
2	CCTV Inspections		x	x							
3	Design			x	x	x	x				
4	Procurement					x	x				
5	Construction					x	x	x	x	x	x
6	Commissioning										x
7	Close-out										x

3.0 PROGRAM DESCRIPTION

17. The scope of work for this program will include relining and replacement of small trunk sewers. Some closed-circuit televising (CCTV) inspections may also be required depending on the selected locations for renewal. CCTV will be reviewed and coded by the Inspection Assessment team based on the Pipe Assessment Certification Program (PACP) Ranking System, as shown in Table 3.0-1. PACP is the North American standard for pipe defect identification and assessment, providing standardization and consistency to the methods in which pipe conditions are identified, evaluated and managed.

Table 3.0-1
PACP/MAP Condition Grading

	A **Grade**	B **Definition**
1	5	Most significant defects
2	4	Significant defects
3	3	Moderate defects
4	2	Minor to moderate defects
5	1	Minor defects

18. Over the course of the 2022-2024 PBR period, 5.4 km of small trunk sewer (including trestles) will be renewed. This estimate assumes that 5 km will be renewed through relining, and 400 m will be replaced. This work may also include rehabilitation of trestle structures if required and will also include some MH renewal. Initial plans for this program have been developed based on condition rating, past inspection and repair data, projected conditions of this asset type over time and risk assessment. The criteria for small trunk renewal is shown in Table 3.0-2.

Table 3.0-2
Selection Criteria for Small Trunk Rehabilitation

Selection Criteria for Renewal		A Definition
1	Pipe Sizes	600 mm to less than 1,200 mm
2	Non-linear Assets	MHs, Trestle Structures
3	Drainage Asset Condition	Poor and very poor condition (modelled), likelihood of 4 and higher (EPCOR Matrix), pipes with inspections having defects of 4 or 5 severity as per PACP, MHs and Trestles with inspections assessed to be in poor or very poor condition, or known issues
4	Operational Issues	Sags, inflow/infiltration, sediment
5	Risk Level	High, Medium-High
6	Synergy with Other Projects	Coordination potential with other EPCOR projects

4.0 ALTERNATIVES ANALYSIS

19. An alternative to this program is to do nothing and not rehabilitate any small trunks. If nothing is done, the infrastructure will be at risk of eventual failure, especially the sanitary and combined trunks made of concrete and steel, as they can be subject to significant corrosion from H_2S. Failure of storm trunks may result in subsidence, blockages and flooding. Although the advantage of doing nothing may be short-term cost savings, more expensive repairs will result from emergencies and customers will experience loss of service. Due to aging and deterioration of drainage infrastructure, unexpected failures may occur that disrupt sewer services to homeowners, cause roadway subsidences, or accidental sewage releases to the ground or river. It is more expensive to fix an unexpected failure than to address it proactively. As mentioned before, typical planned relining is at $3,000/m. Unplanned emergency replacements require open cut spot replacement which averages about $5,000/m.

5.0 COST FORECAST

20. The program cost estimates for the 2022-2024 PBR term are shown in Table 5.0-1. They are based on historical information such as past inspection costs, past design costs and past construction costs of similar small trunk projects such as Lauderdale and CST, including emergency repairs that have occurred within the last few years. Assumptions for the 2022-2024 PBR term are as follows:

- 5 km of full relining completed;
- 400 m of full replacement completed;
- relining and replacement will be completed by external contractors;
- geotechnical investigations will be completed by external contractors; and

- any required inspections will be completed by internal resources.

Table 5.0-1
Small Trunk Rehabilitation Program
Capital Expenditure Forecast
2022-2024
($ millions)

		A **2022**	B **2023**	C **2024**	D **Total**
	Direct Costs:				
1	Contractors	0.06	4.24	11.10	15.40
2	Internal Labour	0.03	0.21	0.27	0.50
3	Vehicles and Equipment	0.00	0.02	0.02	0.03
4	Contingency	0.01	0.77	1.96	2.74
5	**Sub-total Direct Costs**	**0.10**	**5.23**	**13.35**	**18.68**
6	Capital Overhead and AFUDC	0.00	0.04	0.05	0.09
7	**Total Capital Expenditures**	**0.10**	**5.27**	**13.39**	**18.76**

21. EWSI takes a number of steps to minimize the level of these capital expenditures. These include:

- EWSI has taken advantage of vendors to effectively manage the supply, quality and construction of required equipment. As such, EWSI has minimized the need to stock much of the required equipment, reducing the overall costs of all installations and upgrades. Projects will be procured competitively across pre-qualified contractors.
- To ensure receiving coordinated results of adequate quality level, project management, preliminary and detailed design, drafting, stakeholder notification, construction coordination, inspection, and as-built recording will be undertaken internally by EWSI. The actual construction, including surface restoration, will be completed by one of EWSI's pre-qualified construction contractors. Environmental and geotechnical assessments will be completed externally as required.
- Contracted services are performed by pre-qualified external relining or open-cut contractors and done on a competitive unit priced basis, using comprehensive engineering packages. The procurement package also considers the requirements to protect nearby underground infrastructures, perform safe and adequate quality construction work and complete appropriate traffic accommodation strategies to ensure that cost and scope are controlled.
- The installations will be consistent with EWSI's construction standards, which will minimize stock requirements and expedite design and construction.

- Where possible, work will be coordinated with other projects or maintenance activities to minimize costs.
- Every project is evaluated individually to determine the appropriate construction method to meet requirements at the lowest cost.
- Every project scope is evaluated to improve economies of scale.
- The project manager will carefully review any change requests.

6.0 RISKS AND MITIGATION PLANS

22. Table 6.0-1 provides key risks and mitigation plans associated with this program.

Table 6.0-1
Key Risks and Risk Mitigations

	Risk	A Mitigation Plan
1	Execution Risks – Utility conflicts, unexpected scope increases, bad soil conditions, new road restoration requirements, and conflicts with other construction projects in the area.	EWSI will circulate all projects through the Utility Line Application (authorization for utility installations within public road right of way) system. EWSI will deal with force accounts (additional work not within the original scope in the contract) on an individual basis and ensure inspectors are recording all delays and force accounts.
2	Financial – Potential trunk failure could result in more costly emergency replacement. Increase to overall construction prices based on market conditions.	This program will reduce the risks of trunk failure and the associated emergency replacement costs. EWSI will include contractors early on in the process, clearly identify scope requirements and evaluate options such as bundling multiple project scope or using a design-build approach when efficiencies can be identified.
3	Health and Safety – Failed small trunks could result in sinkholes on busy roadways and a safety risk to pedestrians and motorists. Failed trestle pipes could result in collapse above public trails and result in danger to the public	This program will reduce the risks of small trunk failures and the associated occurrence of sinkholes or trestle pipe collapse.
4	Environment – Failed small trunks can allow the release of untreated sewage into the environment which violates the Approval-to-Operate.	This program will reduce the risks of small trunk failures and the associated environmental risks.

Appendix I1

EPCOR WATER SERVICES INC.

SIRP Strategy

February 16, 2021

Table of Contents

Stormwater Integrated Resource Plan (SIRP) Strategy Summary

1.0 INTRODUCTION

1. EWSI's Stormwater Integrated Resource Plan (SIRP), presented to the City of Edmonton Utility Committee and City Council in 2019, is a $1.6 billion system wide integrated approach which will be completed over the next 20 to 30 years to mitigate flood risk by reducing the health and safety, financial and social risks of flooding with lower overall capital investment than compared to traditional engineering approaches, through the incorporation of green infrastructure and operational programs that support building community resiliency and leveraging advanced technologies to better manage stormwater volumes during storm events. In addition to $1.6 billion in capital expenditures, annual operating costs for SIRP include an average of $2.2 million per year for EWSI's operational activities plus the backwater valve subsidies which are forecast to increase over a 20 year period from approximately $0.8 million per year to $1.76 million per year. The SIRP program proposed through the SIRP can be classified into the following five themes of investment: (i) SLOW; (ii) MOVE; (iii) SECURE; (iv) PREDICT; and (v) RESPOND.

2. Implementation of SIRP began in 2019 and since that time has been funded by the SIRP Non-Routine-Adjustment (NRA) to stormwater rates that was approved by City Council and became effective January 1, 2020. EWSI is proposing to continue to implement SIRP in stages at each successive PBR period. This approach will provide Utility Committee and City Council with the opportunity to review the SIRP performance and proposed strategy at the time of each PBR renewal.

3. EWSI's SIRP Strategy includes the proposed capital and operational program investments to mitigate flood risks across the city of Edmonton by using a mix of grey (SIRP – MOVE trunks and tunnels) and green (SIRP – SLOW dry ponds and low impact development (LID)) infrastructure installed both in public right-of-way or on City-owned or EPCOR-owned land. The SIRP approach is to capture the stormwater volumes in dry ponds prior to reaching the storm trunk network to provide additional capacity in the pipes in the immediate path of the storm. The addition of LID throughout the catchment area will further retain these volumes and reduce the impact on the entire pipe network as storms travel across the community. The SIRP Strategy does include tunnels, trunks and sewer separation in locations where there is limited space to install additional ponds or LID components to fully capture the expected water volumes during a major storm event.

4. Due to the topography of the urban environment there exists numerous low or sag locations throughout the city of Edmonton. The SIRP Strategy prioritizes investment in low-lying sag locations because there is potential for water to pool in these areas during major storm events. The objective is to redirect stormwater to dry ponds and LID in order to reduce peak flows to the stormwater system. Under the SECURE theme, SIRP will rehabilitate the grey infrastructure in these sag locations to reduce inflow and infiltration and includes an enhanced building flood proofing program for the properties adjacent to these localized sag areas to further protect the property from damage. The SECURE theme also includes improvements to the existing outfalls and control gates to secure the pipe network and properties from river flooding during high water level events. The PREDICT theme includes adding monitoring and real time controls to transition the entire stormwater system (including both pipes and ponds) into a "smart" system. This will aid in improving response times to major storm events and will allow for real time management of flow volumes between adjacent stormwater retention locations. Finally, the RESPOND theme includes the development of emergency response stations located throughout the city. These stations will be outfitted with emergency response equipment such as portable flood barriers, pumps and hoses to allow for efficient deployment during a major flooding event.

5. Table 1.0-1 provides a summary of the proposed capital expenditures within the 2022-2024 PBR term under each of these themes. Business cases have been provided as well for the specific projects/programs that support the SIRP Strategy that have a total expenditure at the project/program level greater than $10 million. For details on these SIRP programs over $10 million, refer to the Drainage Business Cases in Appendices H14, H15, H16, and H17.

Table 1.0-1
SIRP Projects/Programs Capital Expenditures (2019-2024)
($ millions)

	Theme	A Project/Program	B 2019	C 2020	D 2021	E 2022	F 2023	G 2024	H 2022-2024 PBR Total
1	**SLOW**	SIRP Dry Pond Program[1]	0.4	8.5	3.0	15.8	18.1	26.5	60.4
2		SIRP LID Program	0.1	3.7	6.5	7.8	15.8	29.5	53.1
3		Other projects < $10 million	0.9	2.5	7.1	6.6	0.9	1.2	8.7
4	**MOVE**	Kinnaird Sewer Separation	0.2	2.3	10.2	4.1	0.0	0.0	4.1
5		Other projects < $10 million	0.2	1.7	0.0	0.0	0.0	0.0	0.0
6	**SECURE**	SIRP Proactive Manhole Relining Program	0.0	1.4	7.0	6.1	6.2	6.4	18.7
7		SIRP Proactive Pipe Relining Program	0.5	0.9	5.2	7.5	7.6	7.8	22.9
8		Outfall and Control Gates Program	0.0	0.0	0.1	2.0	3.4	4.1	9.5
9		Other projects < $10 million	0.0	0.0	0.0	0.0	3.5	3.6	7.2
10	**PREDICT**	Other projects < $10 million	0.0	0.3	1.5	2.2	3.1	3.3	8.6
11	**RESPOND**	Other projects < $10 million	0.2	0.4	1.7	3.9	4.2	4.3	12.4
12	**Total**		**2.5**	**21.7**	**42.3**	**56.0**	**62.8**	**86.7**	**205.6**

[1] Included within SIRP Dry Pond is approximately $38.3m for investment in drainage pipes that aligns with the SIRP MOVE theme (with $4.6M over the 2019-2021 period)

2.0 SLOW

6. One of the larger investment categories of the SIRP strategy is the "SLOW" theme. The slow theme involves slowing the entry of stormwater into the drainage network by absorbing it in green infrastructure and holding it in ponds, creating space in the collection system during storm events. Green infrastructure includes both dry ponds and LID. Dry ponds are designed to capture the large intensity rainfall events and hold the water within the neighbourhood until after the storm event has ended and then slowly release the water into the adjacent trunk networks. LID installations are designed to capture the lower intensity stormwater volumes that occur around the periphery of the large storm and have the ability to capture, absorb, slow and filter stormwater before it flows into the sewer system, groundwater or surface waters. LID installations also provide water quality enhancement for the primary storm events that do occur throughout the year helping EPCOR to meet the environmental regulations surrounding discharges to the rivers and creeks in Edmonton. The slow theme is the largest area of investment and is estimated to include $470 million in dry ponds and $480 million in LID over the 20-year SIRP plan.

SIRP Dry Ponds Program

7. EWSI has identified 31 locations across the city where dry ponds should be considered to support flood mitigation in a community. The final siting, sizing and design will be part of a coordinated discussion between EWSI and the City and working closely with local communities. EWSI has developed the dry pond schedule over the next 20 years assuming that typically there will be 6 active pond projects per year (2 in planning, 2 in design and 2 in construction). This timing aligns with the recently approved Federal Government Disaster Mitigation and Adaptation Fund (DMAF) grant of $44 million supporting construction of 13 dry ponds over the next 10 years.

SIRP Low Impact Development (LID) Program

8. SIRP includes wide scale implementation of LID throughout the entire city to reduce the peak stormwater flows that are entering the storm pipe network and pooling at low areas on the city streets. A feasibility study identified over 80,000 potential locations where LID could be installed to control stormwater runoff. EWSI plans to implement four types of LID: bioretention basins, box planters, rain gardens and tree soil cells. LID has the ability to support the capture, detention and retention of large stormwater events. In 2020, EWSI added the Greened Hectare as a new PBR performance metric and target to measure its performance in implementing LID. An increase in LID through the City of Edmonton will also result in improved performance on the total loadings to the river and the combined sewer overflow reduction strategies. LID has also been shown to reduce the impacts of drought and heat wave, two other climate scenarios that Edmonton will be required to adapt to in the coming years.

3.0 MOVE

9. The move theme involves moving excess water away from areas at risk, quickly and efficiently through both stormwater tunnels, trunks and sewer separation. The SIRP proposed investment in tunnels, trunks and sewer separation is estimated at $300 million over 20 years. The proposed capital investment in tunnels, trunks and sewer separation was developed by first assessing the flood mitigation that would be obtained by investing in dry ponds and LID as an initial option in the communities at higher risk of flooding. Depending on the volumes of water to be managed over the range of storm scenarios and volumes of water that could be diverted to either a dry pond or LID in the neighbourhood, this determined the residual amount of water that needed to be managed using a piped network solution of tunnels, trunks and sewer separation. For the 2022 to 2024 PBR term, the infrastructure investments identified in the SIRP-

MOVE theme are aligned with the SIRP-SLOW initiatives and captured in the SIRP Dry Pond and SIRP LID Program business cases.

4.0 SECURE

10. There are three components to the SECURE theme: (i) addition of outfalls and control gates and improvements to existing gates; (ii) reduction of inflow and infiltration (I&I); and (iii) an enhanced building flood-proofing program to protect individual properties in higher risk areas against sewer backups. The SIRP Strategy includes a $30 million investment in outfalls and control gates, a $100 million investment in I&I reductions and a $60 million investment in enhanced flood proofing over the 20-30 year period. EWSI is also expanding the backwater valve subsidy program increase to support the targeted installation of an additional 40,000 backwater valves in homes immediately adjacent to localized sag areas where stormwater will continue to pool due to the topography of the city. EWSI will continue to invest in the Backwater Valve Subsidy Program with a subsidy amount of $800 per property for backwater valve installation for eligible properties. This program has been supported by the utility since 2004 and is consistent with programs offered in other communities across Canada.

Outfalls and Control Gates Program

11. Additional control gates will be added to existing outfalls located within the river valley to provide additional protection to the residential homes located within these areas from river water backing up through the pipe network. EWSI will initially focus on the conversion of existing gates from manual to automatic controls which will improve response time to close the gates prior to a flooding event and open gates once the river levels have receded. EWSI is planning to install the proposed automatic controls and new outfalls over the next 12 years due to the higher damage risk exposure for river valley neighbourhoods. Exact timing for installation of the new gates will be dependent on obtaining the necessary regulatory approvals for construction and completion of the archaeological assessments and indigenous consultations required when constructing within the River Valley. Some outfall control gates will be partially funded by Federal DMAF grant programs.

Inflow and Infiltration (I&I) Reductions

12. I&I occurs when inflow flood waters enter the piped network either through openings in manhole lids or through cracks in the manhole frames and in the pipe network when the soils are fully saturated. Minor leaks on these pipes can induce a high volume of infiltration into the pipe

network when the soils are fully saturated with water. SIRP includes implementation of increased maintenance and repair on drainage infrastructure that is at higher risk of exposure to flooding in numerous sag locations along the road network. EWSI plans to invest $2 million per year to upgrade 500 manholes per year in local sag areas over the next 10 years. These upgrades include sealing manhole barrels, installing new manhole covers and completing drainage pipe rehabilitation to reduce I&I. The longer term approach to manage and reduce the stormwater pooling in these locations is addressed in the capital investments in dry ponds, tunnels and sewer separation and LID elements being proposed. The manhole sealing is a method to bring partial risk reduction over a shorter time frame. The SIRP Proactive Manhole Relining Program and SIRP Proactive Pipe Relining Program documents provide additional detail on the planned implementation of this aspect of SIRP-SECURE for the 2022-2024 PBR term.

Enhanced Building and Flood Proofing Program

13. EWSI's analysis of the localized sag areas with higher flooding risk has identified that there are approximately 6,000 properties (including 2,500 in the river valley neighbourhoods) that have a higher flooding risk due to being adjacent to areas where the water in the road could pool at depths above the 1 meter depth during an extreme storm event. There are an additional 40,000 properties with a mid-high exposure risk where ponding in the road network could be between 0.35 and 1 meter depth during these extreme events. The dry ponds, LID and tunnels, trunks and sewer separation projects proposed will reduce the flooding depths at these locations. However it will take many years to install all of these flood mitigation components under the SIRP Strategy. Even with all of the planned flood mitigation efforts under SIRP, these homes will continue to have flood risk exposure from storms due to the topography of the land adjacent to these homes. Therefore, EWSI is providing capital and operational funding to support and encourage flood proofing on private property as the least cost approach to reduce flooding risks in the short term for these high risk locations.

14. As part of the SIRP Strategy, the Enhanced Building Flood Proofing Program will be available to residential, multifamily and commercial properties in the higher risk locations. This program provides both funding expertise beyond what is provided by the existing residential backwater subsidy program to assist property owners in identifying flooding risk on their property. Under SIRP, $60 million will be invested over 20 years for the Enhanced Building and Flood Proofing Program to support correction of lot grading on public-owned portion of the parcel and repairs to public-owned portion of drainage service lines in conjunction with the property owner implementing these improvements on the privately-owned portion of the service

line. Properties with reverse driveways in higher risk flood locations will also have outreach to determine reconfigurations required to reduce exposure to damages during flooding events. This is based on an estimated $10,000 per property for improvements made on the publicly owned portions of the drainage system for the highest risk locations (6,000 properties). Individual property owners would be required to fund any additional improvements required on the privately-owned portion of their parcel or service line.

5.0 PREDICT

15. Under the predict theme, EWSI will predict and manage the movement of stormwater through implementation of smart sensors and technologies that integrate into the collection system. EWSI estimates total investment in $70 million in monitoring and controls under SIRP over 20 years. The SIRP Strategy includes the conversion of the existing stormwater pipe and pond network into a smart network with increase situational awareness of real time storm tracking and ability to respond to major storm events through the diversion of stormwater where the controls exist. Leading utilities are now implementing systems that allow the stormwater network to respond in real time to changing weather events. The capital plan for SIRP includes the installation of permanent early warning systems at 20 locations identified as being at higher risk of flooding with depths where there is a higher risk to public safety. EWSI is working with City of Edmonton Roadways Operations to finalize the designs and timing for installation for each of these locations. EWSI is implementing a SIRP Dashboard in 2021 to integrate the current multiple monitoring and control systems in place with the GIS tools. This tool will also be set up to incorporate the addition of real time data from third party sensors, such as weather radar stations and will allow for additional sensors throughout the network on pipes, ponds and underground storage locations to increase ability to respond to flooding events in real time.

6.0 RESPOND

16. The respond theme will enable EWSI to effectively respond to flood events through fast rollout of flood barriers, traffic diversions, and public communications to protect life, safety and property. EWSI and the City of Edmonton Emergency Management group currently have in place formalized protocols for response to flooding events which were developed in 2009. The Office of Emergency Management takes the lead role in the flooding event response and EWSI provides support through the deployment of personnel and temporary barriers (sand bags) to control water volumes. The SIRP Strategy includes a $45 million investment over 10 years to modernize

emergency response equipment to ensure effective response to flooding events at emergency response locations within the river valley and at other high risk locations.

17. These staging locations would consist of a building structure on City owned land and be equipped with portable flood barriers, pumps and hoses that could be deployed efficiently in the event of a river flooding risk. Sandbags are expected to still be part of the flood response solution, but rather than storing filled sandbags in the open air, it is proposed that an automated sandbag filling machine be acquired and that the bags alone be stored in a weather-resistant location. The SIRP approach broadens the role of the traditional stormwater utility from one that focuses primarily on the installation of pipes to move stormwater, to one where the utility is an active participant in the response to the flooding event and proactively develops emergency response protocols in advance of the flooding events to support the Office of Emergency Management who leads the response efforts.

7.0 SIRP MAJOR ACCOMPLISHMENTS 2019-2020

18. Since the implementation of SIRP in 2019, EWSI has completed the accomplishments listed in Table 7.0-1.

Table 7.0-1
SIRP - Major Accomplishments 2019-2020

	SIRP Theme	A Accomplishment
1	**SIRP** - General	EPCOR participated in numerous industry initiatives within the water and insurance sectors to share the SIRP strategy and the risk focused approach to reducing flooding impacts in a community. Technical outreach training was also provided to the major consulting firms within the Edmonton region and with multiple City of Edmonton departments to explain the SIRP strategy and how to incorporate the new risk based approach in future designs for the community.
2	**SLOW** - SIPR Dry Ponds Program	All 31 proposed new dry ponds were submitted into the City of Edmonton Open Spaces Repurposing Phase 1 review procedure and initial assessments were completed to confirm that all can proceed to Phase 2 reviews. One pond location had the recommended timing for implementation shift and another location the City of Edmonton was able to identify an alternative location for the pond that better met the community and EWSI flood mitigation needs. In addition to the future ponds proposed by SIRP the dry ponds that were previously initiated by the Drainage department continued as planned with design underway or construction

SIRP Theme	A **Accomplishment**
	completed or substantially completed for a number of ponds including Tawa, Malcolm Tweddle, Steinhaurer, Park Allen and Hurstwood. The ponds planned for construction in the current and upcoming PBR are progressing through the Phase 2 reviews to confirm sizing, configuration and amenity needs with the City and adjacent communities.
3 **SLOW** - SIRP LID Program	LID Design standards were developed and approved through consultation with the City of Edmonton and the development community. Previously LID installation information was only available as a guideline requiring additional engineering and consultant reviews prior to construction. The introduction of LID formally into the design and construction standards reduces the costs for all future implementations. LID was designed and installed as part of Building Great Neighbourhoods along with Imagine Jasper Avenue projects during the 2020 construction season. This allowed both EPCOR and City of Edmonton construction groups to identify opportunities to streamline construction processes and address concerns from the contractors and adjacent community with neighbourhood scale LID installations. A number of commercial properties were also approached to allow implementation of LID on their properties to support community flood risk mitigation. This program will move to construction phases in 2021. Greened Hectare as a performance measure was implemented along with the development of a calculator tool for industry and EPCOR to assess the number of greened hectares their proposed LID installation provides. EWSI continues to work closely with the City of Edmonton Infill development team to identify opportunities and barriers to LID installation in redeveloping areas of the City.
4 **SIRP** - MOVE	With the COVID-19 restrictions limiting the ability to move forward with activities related to in home property specific enhanced flood proofing, the focus shifted to developing strategies to reduce the historical on-going flooding risks related to ditches and swales. Working closely with the City of Edmonton, EWSI identified historical surface flooding locations associated with ditches and swale flooding. Through this review a number of locations requiring regrading and culvert upgrades were identified. Ownership of culverts under roadways and private driveways was confirmed and responsibilities for maintenance are being articulated in the Operations Service Level Agreement between the City and EWSI which is expected to be completed in Q2 2021. Both the City and EPCOR are working closely in 2021 to leverage the recently announced Municipal Stimulus funding grant to upgrade the ditches and swales in the Mistatim area in particular.

SIRP Theme	A **Accomplishment**
	A ditches and swales maintenance guidance document was prepared and new equipment requirements and a proposal for maintenance schedules required for vegetation management in ditches was developed. A formal process was developed to manage and track any new ditches and swales flooding concerns, as historically these were only addressed each season. EWSI supported the industrial area servicing review being led by the City of Edmonton in particular for the areas not currently with full infrastructure servicing. EWSI completed a detailed review of the partially separated sewer areas to identify quick win reconfigurations to reduce stormwater entry into the combined system if there was an adjacent storm pipe, and identify locations where catch basins connected to sanitary pipes lead to increased flooding risk in neighbourhoods. Pipes required to support the ponds moving into the detailed design phase were identified and included in the capital programs for these specific locations.
5 **SECURE** - Outfall and Control Gates Program	The locations for the proposed outfall gates were confirmed along with discussions on method to manage the installation of these gates. Two approaches for construction were considered; do all at once with a single contract covering the entire river valley locations, or do river valley neighbourhood. From this review it was determined to start with the existing gates in the Cloverdale neighbourhood to confirm control logic requirements and then approach the remaining as a single contract to complete construction. Outreach was also done to City of Calgary that have also recently installed these types of gates to leverage their learnings during implementation.
6 **SECURE** - I&I reduction	The topographical sag locations across the City of Edmonton were reviewed and all manholes and pipes requiring relining were identified and prioritized completion in the coming years. More than 290 manholes have been relined in 2020. Detailed I&I monitoring, smoke testing and modelling analysis was completed for the northwest areas contributing excess storm flows into the NEST sanitary trunk system. Detailed community outreach plans are in development for the neighbourhoods showing higher levels of infiltration after a major storm event. Direct inflow connections due to storm pipes connected to sanitary pipes were confirmed as not a contributing factor to the flooding risks in these locations,

SIRP Theme	A Accomplishment
	Additional analysis was completed on the sanitary system coming from southwest Edmonton to confirm that Inflow/infiltration levels from new subdivisions are lower than the current design standards, providing the opportunity to reduce the size of new infrastructure trunks to support growth in the region. This finding will be captured in the development of the SanIRP and has impact on the timing of the SSSF trunk segments.
7 **SECURE** - Enhanced Flood Proofing Program	Due to COVID-19 the in-home flood inspection program was paused in March of 2020 and resumed using alternative virtual technology later in the summer until the second wave of restrictions were put in place requiring the program to pause again. This reduced the number of full in-home inspections from what was planned at the start of the year. EWSI also saw decreased uptake from the home owners that completed their inspection to have the additional plumbing work completed to install the backwater valve and obtain the subsidy. Additional outreach is underway with these customers to better understand why they have not installed the backwater valve as recommended. EWSI hired a new manager for the flood inspection team and will manage this program as well as the root intrusion programs for EPCOR providing the customers with a single point of contact for support on drainage issues related to their property. The manager and all of the flood inspectors completed the formal flood inspection trainer program as endorsed by the Intact Center for Climate Adaptation. A detailed review of reverse slope driveways within the river valley neighbourhoods was initiated and alternative approaches to sandbags are being assessed for each individual property in the Provincial designated flood way and flood fringe regions. EWSI supported the City of Edmonton Climate Change team Green leagues program with presentations on flood risks in the community and how to access the flood inspection services from EPCOR. We will continue to support this program as it rolls out across multiple community leagues allowing us to leverage this forum with the Edmonton Federation of Community Leagues to build community resiliency to flooding events.
8 **PREDICT**	The SIRP Dashboard project was initiated and a formal RFP process was completed and vendor selected at the end of 2020. The Dashboard will be operational mid 2021. Capital projects to add additional flow and level monitors were initiated with acquisition starting in 2021.

SIRP Theme	A Accomplishment
	Underpass warning systems were design and implemented in conjunction with the City of Edmonton at Whitemud Drive/Gateway Boulevard and 63 Avenue/Gateway Boulevard. The remaining underpass locations for warning systems were confirmed. A detailed analysis of the geyser location at 30th avenue and Calgary trail was completed and the probable root cause of the geyser has been determined to allow for the implementation of mitigation measures through the SIRP-SLOW and SIRP-PREDICT within the two basins directing stormwater to this location has been confirmed. Updated IDF curve analysis was completed based on an additional 5 years of rain gauge data in the Edmonton region. Consultation with the City and UDI to update the design standards based on this new information will occur in 2021.
9 **RESPOND**	EWSI presented to the Fire Chief and Deputy Fire Chiefs the SIRP strategy in late 2019 and provided information on flooding risks specific to each fire station in the City. EWSI in 2020 completed a flood risk assessment review of all 1300 City owned properties and provided this information back to the City Risk Management and Asset management teams to allow them to assess mitigation measures for these locations. Additional coordination will occur in 2021 to provide our expertise in mitigating these risks going forward. Similar analysis was completed for Water Services and EPCOR Electricity Distribution and Transmission (EDTI). Water Services was able to secure grant funding to implement flood protection measures at their facilities and purchased additional equipment to protect high risk electrical equipment. EDTI has also incorporated flood mitigation measures into their future capital planning. Analysis is currently being completed for the Edmonton Public School Boards to inform their emergency response protocols and to allow for identification of opportunities to align the SIRP-SLOW and SIRP SECURE initiatives not only for property protection but to also identify opportunities to incorporate these initiatives into the curriculum at each school. This work was initiated prior to COVID-19 and delayed due to resources focused on this response. Due to COVID-19 outreach to other critical sectors was delayed as emergency response resources within EWSI were focused on the immediate response requirements to keep the essential utility and employees working in the community.

Appendix I2

EPCOR WATER SERVICES INC.

CORe Strategy

February 16, 2021

Table of Contents

1.0 INTRODUCTION

1. Over the past decade, residents of Edmonton have reported over 10,000 instances of odours related to the sanitary and combined sewer network. To develop a robust strategy to address odour issues, EWSI has conducted public consultation, engaged with community members across the city, conducted advanced sewer air monitoring campaigns and expanded its sewer asset inspections. The assessment has determined that odours is a precursor to the more serious corrosion and premature failure of sewer assets. EWSI has thus produced a Corrosion and Odour Reduction (CORe) Strategy that focuses on preventing the formation of hydrogen sulphide (H_2S) gas, which will reduce community odour impacts and lengthen the life of sewer network assets. In addition to the odour impacts the H_2S gases are extremely corrosive to the sewer trunk network which can result in major system failures as impacts to roads above the pipes. The corrosion is typically at locations of major flow intersections or drop structures and typically on the crown of the pipe where the gases accumulate. When corrosion results in a complete loss of the pipe structure the above soil enters the pipe creating a void which impacts above road stability.

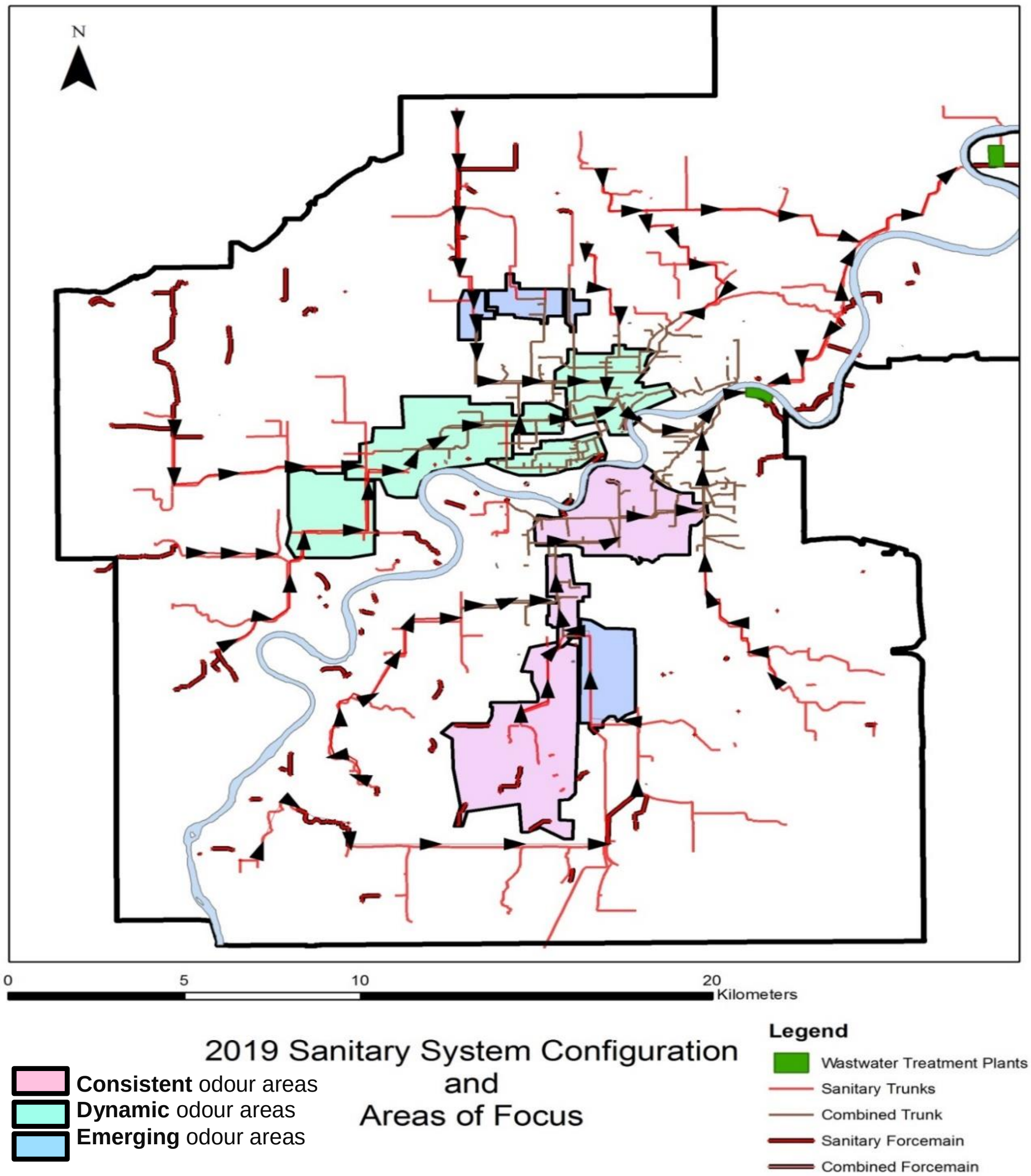
2. EWSI presented its CORe Strategy to Utility Committee on June 24, 2019. The CORe Strategy was developed using similar principles and approaches to EWSI's Stormwater Integrated Resource Plan (SIRP) to determine an optimized mix of operational and capital solutions to reduce corrosion and odour. The CORe Strategy includes roughly $200 million capital investment and $18 million in operating expenditures to address early action items over the period of 2019 to 2026. Implementation of CORe began in 2019 and since that time has been funded by the CORe Non-Routine-Adjustment (NRA) to sanitary rates that was approved by City Council and became effective January 1, 2020. EWSI is proposing to continue to implement CORe in stages at each successive PBR period. This approach will provide Utility Committee and City Council with the opportunity to review the CORe performance and proposed strategy at the time of each PBR renewal.

3. Previous odour mitigation plans focused on reducing community impacts by controlling and treating sewer gas releases across the City. EWSI recognizes that the H_2S created in septic areas of the sanitary network is also significant because of its impact on sewer asset condition and employee safety. H_2S gas is extremely reactive with metals and concrete. Its presence causes assets to corrode and fail before the end of their expected service life. As a result, the focus was enhanced to also include: (i) elimination and/or reducing the sources for the formation of H_2S in

the sewer system because H_2S causes corrosion in the sewer system; and (ii) management of the odour as the gas escapes from the system.

4. The current CORe Strategy differs from previous plans by segregating the city into areas with consistent odour issues, those with dynamic odour issues and those with emerging odour issues (refer to Figure 1.0-1) rather than focusing on reducing community impacts by controlling and treating sewer gas releases across the City as proposed in the previous odour mitigation plans. EWSI is implementing different approaches for each area to ensure that causes of the odour are fully understood and to ensure that capital projects will provide sustainable relief. Odours within different areas have distinct causes and require a different mix of solutions. By incorporating the additional information from the more recent assessment into the strategy, CORe expands the previous plan by focusing on preventing the formation of H_2S gas, which will reduce community odour impacts and lengthen the life of sewer network assets. This strategy will address the worst areas first and will also provide the most cost-effective solution.

Figure 1.0-1
Odour Areas of Focus in the City of Edmonton



5. EWSI's CORe Strategy includes the capital and operational program investments to focus on preventing the formation of H_2S gas by keeping the wastewater moving, adding chemical treatment, and expanding inspections and cleaning. Construction and rehabilitation of tunnels and the provision of improved access points for both inspection and cleaning purposes can eliminate the obstacles to flow and significantly reduce deposits of sediment and fats causing H_2S

gas formation. Pump station enhancements can also reduce wastewater stagnation time at the station and can further inhibit H_2S gas formation by adding chemical treatment to the system.

6. Another focus for CORe is to adapt the system using real-time monitoring technologies and improved inspection data. Sewer trunks are 30 to 40 meters underground. Those built before 1990 generally do not meet current standards for access. Approximately 80 km of trunk lines are currently beyond the reach of inspection technologies and do not allow inspections to identify whether H_2S is forming and causing corrosion and odour issues, or whether the line contains sags or deposits of sediment/fat that require cleaning and may cause odour or operational issues in the future. Adapting the system can be accomplished by expanding inspection and reporting data, developing real-time monitoring capability, and advancing modelling and mitigation research.

7. The CORe Strategy also recognizes that sewer gases will be venting out of the system as part of the normal process of moving wastewater through the system. Although it maybe impractical to stop such venting in the system, venting locations can be controlled in order to reduce community impacts. Odours venting can be controlled by reducing air pressure in the sewers, adding containment structures, and providing controlled release points.

8. EWSI’s investments in CORe can be classified into four themes: PREVENT, OPTIMIZE, MONITOR and CONTROL. Details on the specific activities within each theme are provided further below. Table 1.0-1 provides a summary of the proposed capital expenditures over 2020 to 2024 under each CORe theme. Business cases are included in this Application for the specific projects/programs that support the CORe Strategy that have a total capital expenditure at or above $10 million (refer to Appendices H2, H3, H4 and H5). Since the CORe Strategy was first presented to Utility Committee on June 24, 2019, EWSI has expanded the PREVENT theme to include the rehabilitation projects required due to high levels of H_2S, which induces corrosion and causes odours. These additional rehabilitation projects primarily include those within the CORe Large Trunk Rehabilitation Program which are required primarily to prevent further corrosion and to extend the lives of large trunks as well as some other smaller rehabilitation projects.

Table 1.0-1
CORe Projects/Programs Capital Expenditure Forecast
(2020-2024)
($ millions)

	A	B	C	D	E	F	G	H
Theme	**Category**	**2020**	**2021**	**2022**	**2023**	**2024**	**2022-24 PBR Total**	**NRA**
1	CORe Duggan Tunnel Project	0.6	4.5	11.7	19.2	25.4	56.3	Yes
2 Prevent	CORe Access Manhole Program	6.4	6.3	6.2	5.0	6.7	17.9	Yes
3	CORe Large Trunk Rehabilitation Program*	25.8	33.2	21.0	32.7	25.3	79.0	
4 Optimize	CORe Pump Station Enhancement &Treatment	0.1	1.8	1.0	1.1	0.6	2.7	Yes
5 Monitor	CORe Monitor Project	-	0.3	0.3	-	-	0.3	Yes
6 Control	CORe Drop Structure Modification Program	0.5	9.7	6.1	8.9	7.0	22.0	Yes
7	CORe Odour Ventilation Program	0.0	0.2	0.5	1.5	0.2	2.2	Yes
8 **Total**		**33.4**	**56.0**	**46.8**	**68.4**	**65.2**	**180.4**	

*The CORe Large Trunk Rehabilitation Program is being initiated in 2022. Prior to 2022, these large trunk rehabilitation projects are completed as individual projects.

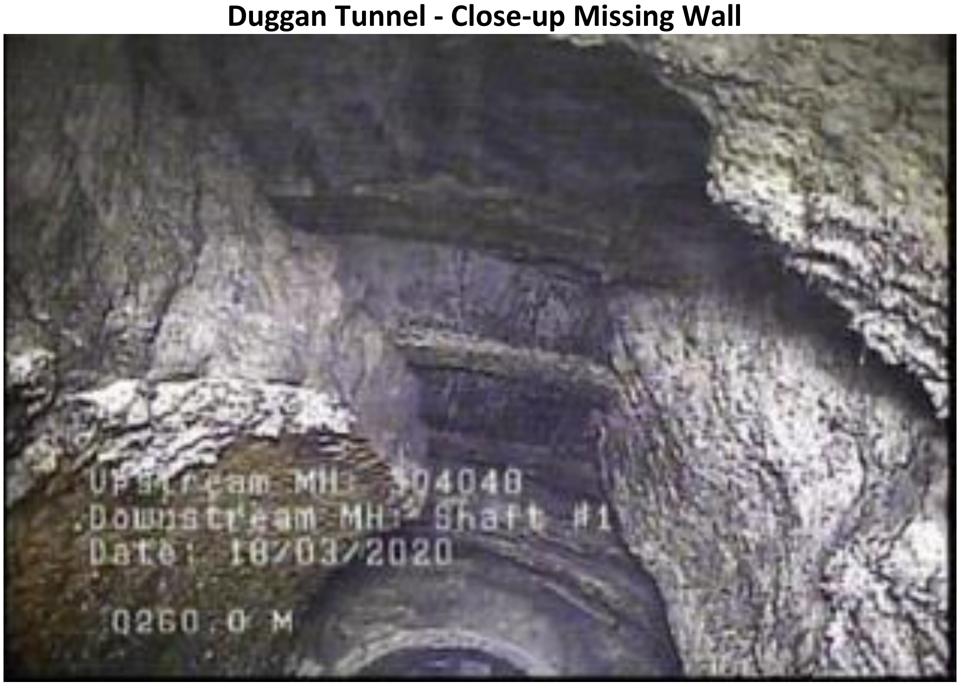
2.0 PREVENT

9. One of the larger investment categories of the CORe Strategy is the “PREVENT” theme. Under this theme, the objectives is to prevent the formation of H_2S gas in the sewer system and to eliminate significant deposits of sediments and fats through the construction of bypass tunnels and improved access points for both inspection and cleaning purposes. The PREVENT theme involves the elimination of known obstacles in moving sewage flow through the construction of the CORe Duggan Tunnel Project and the provision of access points for both inspection and cleaning purposes. The PREVENT theme is the largest area of investment in the early action period of 2019 to 2026.

10. The PREVENT theme investments in the 2022-2024 PBR term includes the CORe Large Trunk Rehabilitation Program. Large trunk rehabilitation is required to mitigate the risk of H_2S gas causing corrosion of large trunks and shortening the useful life of these major assets in the sanitary and combined systems. To prevent further corrosion EWSI is proposing to rehabilitate or replace large trunks that are at high risk of failure due to H_2S corrosion to extend the life of these assets. The new access manhole installed in Duggan allowed EWSI to inspect downstream of the Duggan Pump Station. The inspection identified advanced trunk deterioration due to corrosion as shown in Figures 2.0-1 and 2.0-2. It demonstrates the urgent needs to address corrosion deterioration especially in trunk sewers.

Figure 2.0-1
Duggan Tunnel - Missing Wall in the Trunk Sewer

Figure 2.0-2
Duggan Tunnel - Close-up Missing Wall



11. Advanced corrosion and deterioration was also found in the concrete sanitary tunnel along 99 Avenue in west Edmonton. The existing 99 Avenue sanitary trunk was constructed in 1972. This trunk system is part of the West Edmonton Sanitary Sewer (WESS) system which services over 117,000 customers in west Edmonton. The existing 99 Avenue sanitary trunk has

been identified as having sections in very poor condition as shown in Figure 2.0-3 below. The deterioration was caused by H_2S gas, which reduces the thickness and strength of the concrete wall and increases the risk of collapses. As a result, approximately 1,080 m of the trunk is currently in poor to very poor conditions and in need of rehabilitation.

Figure 2.0-3
Deteriorated Condition of the 99 Avenue Trunk

12. Another example of trunk sewer deterioration due to corrosion is in the Mill Creek area. A large hole was found in Reach 49. Multi-sensor inspections (MSI) completed provided more information on the trunk condition including identification of another large hole in Reach 41. To reduce the risk of imminent trunk failure, local repair of the two large hole locations (at Reaches 41 and 49) was completed in early 2020 to avoid trunk failure. Figures 2.0-4 and 2.0-5 below show the poor to very poor conditions at the junction of Reaches 40 and 49.

Figure 2.0-4
Large Void Upstream of Reach 49

Figure 2.0-5
Severe Corrosion in Manhole 246631
At Junction of Reach 40 and 49

CORe Duggan Tunnel Project

13. The $86 million CORe Duggan Tunnel Project is essential for addressing sewer corrosion and odour issues in the Steinhauer-Duggan area. The Steinhauer-Duggan sewer corridor is an area that suffers from chronic, intense sewer odours and rapid asset corrosion. The area has accounted for one out of every ten sewer odour complaints received in the city of Edmonton

over the past 20 years. The CORe Duggan Tunnel Project includes the abandonment of the existing Duggan Tunnel and Duggan Pump Station and the construction of a new, shallower sewer trunk. The proposed new trunk will create a gravity-flow system that eliminates the need to operate the existing Duggan Pump Station. The CORe Duggan Tunnel Project was initiated in 2019 to provide timely odour mitigation in the community. Construction start is planned for late 2021, and the project is expected to be completed and placed in service in mid-2025.

CORe Access Manhole Program

14. The CORe Access Manhole Program is a critical component of the CORe Strategy under the PREVENT theme. The CORe Access Manhole Program is an annual program that initiates projects to construct access manholes in major trunk lines. There are approximately 170 km of sanitary and combined large trunk sewers (1,200 mm diameter and large) constructed over the past 100 years to varying standards and specifications. Approximately 80 km of the large trunk lines in the city of Edmonton have insufficient access provisions for safe inspection and cleaning purposes. To date, six access manholes have been completed and a further thirteen access manhole projects have been initiated and are proceeding towards or undergoing construction. The scope of this program for the 2022-2024 PBR term is to construct a total of 24 additional access locations on major trunk lines. The forecast total program capital expenditures during 2022-2024 is estimated at $17.9 million.

CORe Large Trunk Rehabilitation Program

15. The CORe Large Trunk Rehabilitation Program focuses on the rehabilitation of large trunk sewers greater than or equal to 1,200 mm in diameter. The CORe Large Trunk Rehabilitation Program is a new program which will be initiated in 2022 and is a key component of CORe Strategy. During 2018 to 2020, EWSI estimates its capital expenditures on discrete large trunk rehabilitation projects are approximately $70 million. In addition, EWSI has spent approximately $12 million on addressing unplanned trunk failures over the same three year period. As EWSI continues to install access manholes as another component of the CORe strategy (through the CORe Access Manholes Program), it expects to be able to identify additional trunk locations requiring immediate rehabilitation work at critical locations. EWSI has forecasted total program capital expenditures for this program during 2022-2024 PBR term at $79.0 million. This program includes two large discrete projects: the Mill Creek Combined Trunk Reach 49 and the 99 Avenue and 151 Street Trunk Sewer Rehabilitation Project at an estimated cost of $28 million and $30 million respectively during the 2022-2024 PBR term. The other large trunk rehabilitation projects

within this program will address trunk repairs required with an imminent risk of failure and by prioritizing the projects based on risks.

3.0 OPTIMIZE

16. In the sewer system wastewater flows become stagnant for a variety of intentional and unintentional reasons. Sanitary wastewater can intentionally be held for multiple hours at pumping stations, storm surge storage areas and at flow control structures. The purpose for the OPTIMIZE theme is to improve pumping operations to reduce the stagnation time in a pump station and reduce the opportunity for H_2S generation by adding chemical treatment to the system. Table 3.0-1 provides a list of pump stations that are mentioned in the original CORe Strategy presented to Utility Committee in 2019 as candidates to be optimized and their status.

Table 3.0-1
CORe OPTIMIZE Pump Stations

	Pump Station Name	A **PS #**	B **Odour Region**	C **Implementation Status**
1	Kaskitayo	104	Consistent	2019-2021
2	Blackburne	169	Consistent	2019-2021
3	Twin Brooks	163	Consistent	2019-2021
4	Westbrook	102	Consistent	Candidate for 2022
5	Walterdale	121	Consistent	2023
6	Cloverdale	171	Consistent	2023
7	Cameron Heights	197	Dynamic	2021
8	St. Georges Crescent	112	Dynamic	Removed from scope, analysis confirmed low flow, low hydraulic retention time, anticipated low H_2S
9	William Hawrelak Park	108	Dynamic	Removed from scope-analysis confirmed low flow limiting risk to cause odours
10	Quesnell Heights	212	Dynamic	Removed from scope – testing confirmed no H_2S
11	Buena Vista	120	Dynamic	Removed from scope – testing confirmed no H_2S
12	Laurier Heights	111	Dynamic	Removed from scope – testing confirmed no H_2S
13	Wolf Ridge Estates	151	Dynamic	Removed from scope – analysis and testing confirmed very low hydraulic retention time, no H_2S
14	Fort Edmonton Park	101	Dynamic	Removed from scope- analysis confirmed flow too low
15	South Westridge	110	Dynamic	Awaiting monitoring data
16	Trumpeter Station	213	Dynamic	2020-2021
17	Clifton Place	113	Dynamic	Candidate for 2023
18	Starling Station	217	Dynamic	2021
19	Hawks Ridge	223	Dynamic	Candidate for 2022-2023
20	NC1	188	Emerging	Station operation optimization occurred in 2020 as part of detailed review of flooding risks along NEST system. Pumping capacity increased and operational procedures updated.
21	SESS	185	Emerging	2024
22	Elsinore	162	Emerging	2021
23	Dunluce	130	Emerging	Under Review, Candidate for 2022

	Pump Station Name	A PS #	B Odour Region	C Implementation Status
24	Baranow	202	Emerging	2021
25	South Edmonton Common	193	Emerging	Under Review, Candidate for 2023
26	Mistatim	218	Emerging	Candidate for 2022-2023
27	Wedgewood	155	Dynamic	Under Review for 2023-2024
28	Eastgate	141	Dynamic	Under Review for 2023-2024
29	Beverly	182	Dynamic	Under Review for 2023-2024
30	Edgemont	220	Dynamic	Under Review for 2023-2024
31	Brander Gardens	103	Dynamic	Under Review for 2023-2024

17. Operationally there are opportunities to improve pump station and storage area operations to reduce storage times and inspection and cleaning can be employed to target blockages and sediment. By removing impediments to flow and keeping wastewater moving, sewer odours can be drastically reduced. A number of projects have been initiated to improve the pumping operations at pump stations since 2019 under the CORe Pump Station Enhancements Program. During the 2022-2024 PBR term, the total capital expenditures for pump station improvements is estimated to be $2.7 million.

4.0 MONITOR

18. The MONITOR theme is to improve EWSI's understanding on the H_2S generation mechanism within the sewer system by using real-time monitoring technologies and improved inspection data. Such knowledge can help EWSI to identify and understand present and future problem areas along with the effectiveness of the remediation measures. This theme will be implemented under the CORe Monitor Project which will be coordinated with the SIRP PREDICT theme and involves using real-time monitoring technologies to improve wastewater management. Both CORe MONITOR and SIRP PREDICT themes will be coordinated in using the same common platform to capture and store the monitoring and sensor data, and in deploying the same IT portal tools for individuals to access and analyze the sensor data. Adapting the system can be accomplished by expanding inspection and reporting data, developing real-time monitoring capability, and advancing modelling and mitigation research. Permanent monitoring locations will be developed and will be installed to connect to the Drainage SCADA system. The total expenditure on EWSI's CORe Monitor Project will be $0.3 million in the 2022-2024 PBR term.

5.0 CONTROL

19. The purpose for the CONTROL theme is to control the release of air from the sewer system by reducing air pressure in the sewers, adding containment structures, and providing controlled release points in areas with lower community impact. Odours are pushed out of the sewers when

the air inside the sewer is pressurized and there is an opening to the atmosphere. The major component for this theme is to retrofit existing drop manholes with proper ventilation systems. Other containment work will include the installation of flaps, ventilation units, and sealing manholes. EWSI is forecasting capital expenditures under this theme to be $24 million during the 2022-2024 PBR term in the CORe Drop Structure Modification Program ($22 million) and in other containment projects ($2 million).

CORe Drop Structure Modification

20. The CORe Drop Structure Modification Program is a critical component of in the CONTROL theme to understand, mitigate and prevent sewer odour issues. This program initiates projects to construct structures that reduce the downstream air pressurization of a sewer headspace that results from the normal operation of the drop structure. This helps prevent sewer air from exiting the sewer at catch basins and manholes in neighbourhoods. This program started in 2019 as part of the CORe Strategy. Since then, EWSI has initiated six drop structure modification projects which are currently under design and construction. During the 2022-2024 PBR term, this program will complete construction of 21 drop shaft air recirculation structures.

6.0 CORe ACCOMPLISHMENTS 2019-2020

21. Since the implementation of CORe in 2019, EWSI has achieved the major accomplishments detailed in Table 6.0-1 below.

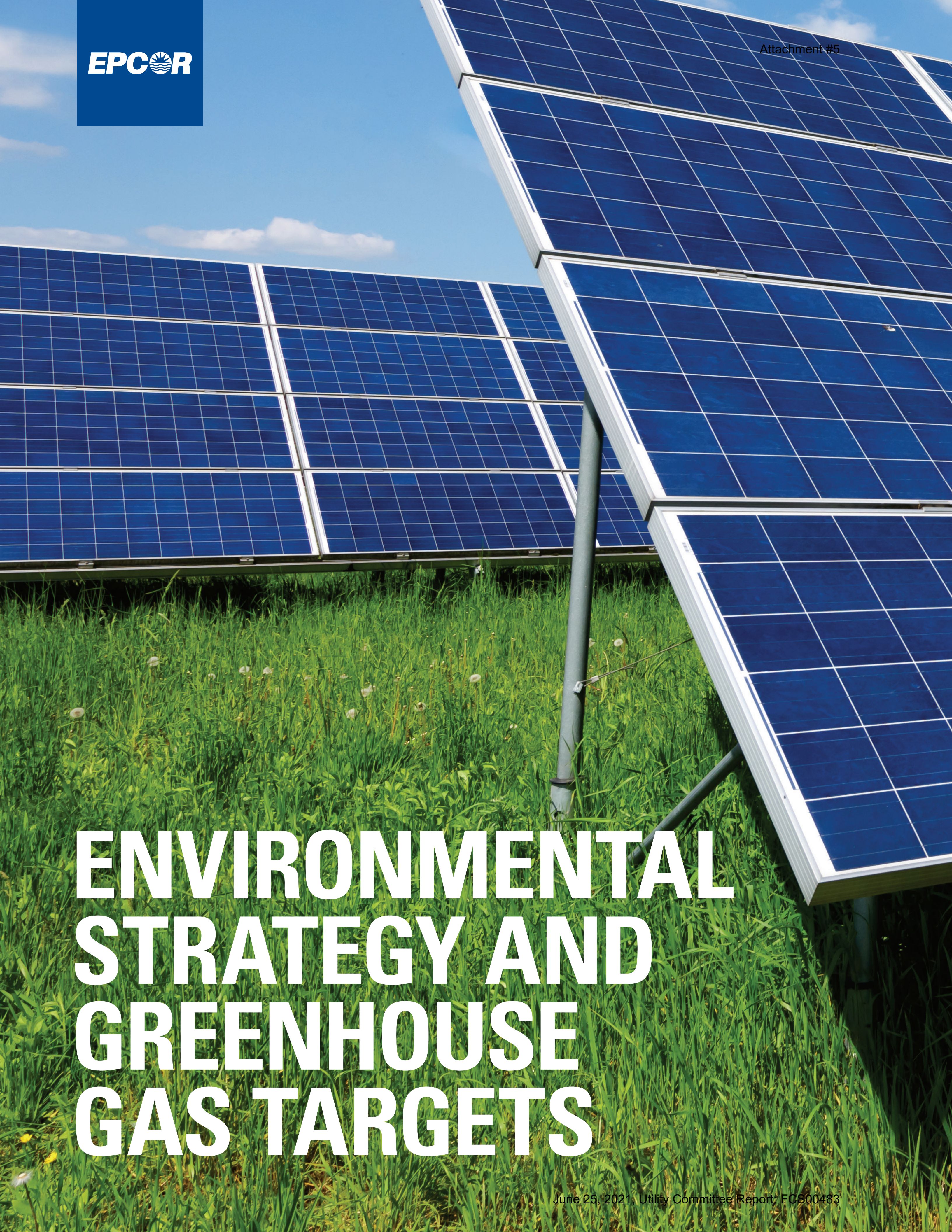
Table 6.0-1
CORe - Major Accomplishments 2019-2020

	CORe Theme	A **Accomplishment**
1	CORe General	• Developed the Sewer Hotspot performance matrix and reported on the progress. • Updated the Strategy with the 4 themes: PREVENT, OPTIMIZE, MONITOR and CONTROL. This will allow the implementation effort of the CORe Strategy through alignment and synergies to other initiatives.
2	PREVENT - CORe Duggan Tunnel Project	• Performed extensive analysis to compare different construction and alignment alternatives and confirmed the cost effective approach for this project. • Initiated the project in 2019 and the project is currently in design phase.
3	PREVENT CORe Access Manholes Program	• Completed 6 access manholes. • 13 additional access manholes are being designed and constructed in 2021. • access manholes were installed in the Brookside neighbourhood and these access manholes were used to facilitate the repair and bypassing required for the trestle across Whitemud Creek (Trestle No.7).

	CORe Theme	A Accomplishment
4	PREVENT - CORe Large Trunk Rehabilitation Program	• To reduce the risk of imminent trunk failure, local repair of the two large holes (at Reaches 41 and 49) was completed in early 2020 to avoid trunk failure. • The first stage to rehabilitate the trunk at 99 Avenue and 151 Street started in 2020 and is expected to be completed in mid-2022. • Confirmed the deteriorated conditions for the following locations: – Significant evidence of corrosion and other structural defects were found in in Area C-2 which is located adjacent to downtown in the McCauley, Parkdale, and Alberta Avenue neighbourhoods. – Numerous instances of material loss throughout the tunnel at 151 Street between 93 Avenue and 99 Avenue, and four holes identified in the crown region of the tunnel. – Portions of the divider wall (membrane) in the 1,650 mm diameter double barrel pipe along 116 Street and 108 Avenue were missing. – With the completion of the access manholes, a major defect along the trunk downstream of the Duggan Pump Station was identified. The rehabilitation work for this major defect is on-going. • Other significant trunk rehabilitation projects that were completed: – The Lauderdale Combined Trunk, consisting of 750 mm and 900 mm diameter reinforced concrete pipes, had a history of issues from 2014-2016, including sinkhole and spot repairs. – The Clareview Sanitary Trunk Rehabilitation Project includes relining of approximately 650 m of 900 mm-1,050 mm reinforced concrete, and replacement and rehabilitation of approximately 70 m of 900 mm steel pipe on Trestle No.3. – Significant corrosion was discovered at the Goldbar Utilidor north chamber and extensive effort was done to clean the debris and rehabilitate the chamber. – Trestle No.7 pipe runs along the trestle east to west across the Whitemud Creek at approximately 56th Avenue failed during rainstorm event in July 2020. The steel pipe was found to be significantly weakened due to corrosion. The repair effort is on-going. – A subsidence occurred over the 1,500 mm trunk along 61 Avenue at 109 Street due to missing pipe wall and severe corrosion in the area. Extensive effort is being expended to rehabilitate the trunk.
5	OPTIMIZE	• Initiated the projects to optimize the pump stations at Kaskitayo, Twin Brooks and Blackburn. • Additional pump stations are being initiated including Pembina and Mistatim. • Collaborated with University of Alberta to conduct field research on chemical dosing. Preliminary results are available.
6	MONITOR	• During the summer and fall of 2019 odour monitoring was completed at 26 locations. The monitoring included gas phase monitoring and liquid grab samples for lab analysis. • Historical data has been collected and reviewed to determine its quality and reliability. In many instances, the pre-existing data can be effectively used in place of dedicated monitoring. • 10 low level H_2S data loggers (sub 2 ppm) for ambient surface trend monitoring and 10 liquid phase total sulfide monitors are being purchased.

	CORe Theme	A Accomplishment
7	CONTROL - CORe Drop Structure Modification Program	• Initiated 6 drop structure modification projects which are currently under design and construction. • Installed a vortex drop structure in Lauderdale area and the effectiveness of this structure is being evaluated. There is some potential for using this vortex system as an alternative for future drop structure modification.
8	CONTROL - Other Containment	• Confirmed the deficiencies at Station PW #901, located at 963-167 Avenue NE. A project will be initiated to build ventilation and air treatment system of enough capacity to maintain internal air phase H_2S concentration below occupational health and safety exposure limits. • Conducted a Management of Change process to optimize the design for one-way flaps. • Completed a review of 5 odour control facilities and concluded that the two dormant stations at King Edward Park and Kenilworth can be abandoned in place.

EPCOR



ENVIRONMENTAL STRATEGY AND GREENHOUSE GAS TARGETS

EPCOR ENVIRONMENTAL STRATEGY

At EPCOR, we take our role as environmental stewards to heart. Being an environmental leader is an integral part of who we are as a company and how we operate — the environment and climate affect EPCOR's operations daily and in the long term.

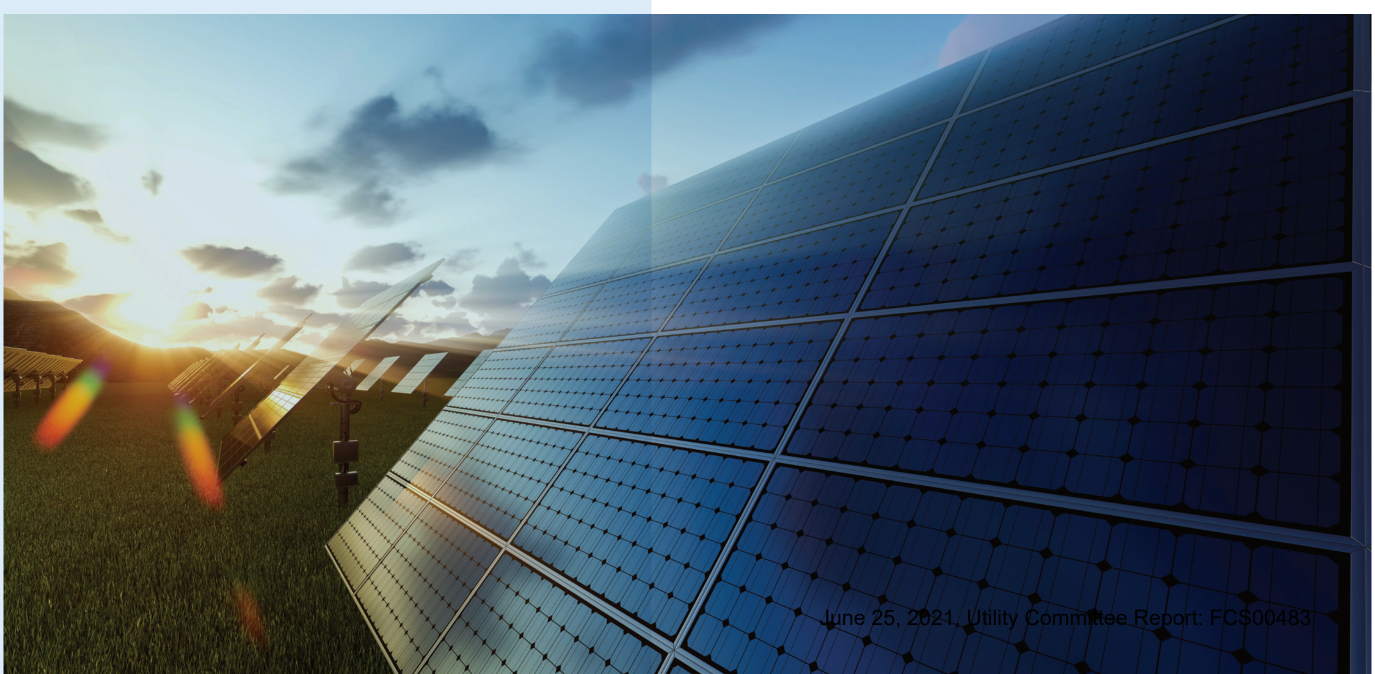
To protect the environment is to protect the communities where we live and work, and preserve the resources that we rely on to deliver essential services to our customers. At EPCOR, being an environmental leader is about doing the right thing in the day-to-day operations and pursuing opportunities where we can apply our expertise.

EPCOR'S ENVIRONMENTAL STRATEGY HAS THREE GOALS

1. **Reducing the company's environmental footprint.** EPCOR is eliminating PCBs (polychlorinated biphenyls) in electricity infrastructure by 2023; reducing utility impacts to air, land, water and ecosystems; enhancing watershed monitoring and protection; reducing greenhouse gas (GHG) emissions; reducing emissions and energy use from fleet vehicles; increasing potable water re-use; and increasing local renewable electricity generation.

2. **Improving the resilience of utility infrastructure.** EPCOR is studying the potential impacts of extreme weather events on the ability to delivery reliable utility services, and is implementing action plans to improve system resiliency and reliability.

3. **Helping communities and customers to reduce their footprint and increase their resilience.** EPCOR is implementing flood mitigation initiatives in Edmonton that protect homes, businesses and essential services; implementing education initiatives that promote efficiency and resource conservation; and preparing the local electricity grid to support customer choice as households adopt electric vehicles or self-generation of electricity.



GREENHOUSE GAS INVENTORY

EPCOR first established and reported on its greenhouse gas ("GHG") emissions more than twenty years ago, through the Voluntary Challenge and Registry program. The company continues to maintain an inventory of GHG emissions and an ongoing plan to reduce these emissions.

EPCOR seeks to achieve utility performance that supports the City of Edmonton reaching the citywide targets set in its Community Energy Transition Strategy, which includes a 35% reduction in GHG emisisons by 2035 and 10% of Edmonton's electricity being produced locally produced by 2035.

BY 2025, EPCOR PLANS TO UTILIZE **100% GREEN ENERGY ELECTRICITY** FOR ALL EDMONTON BASED OPERATIONS

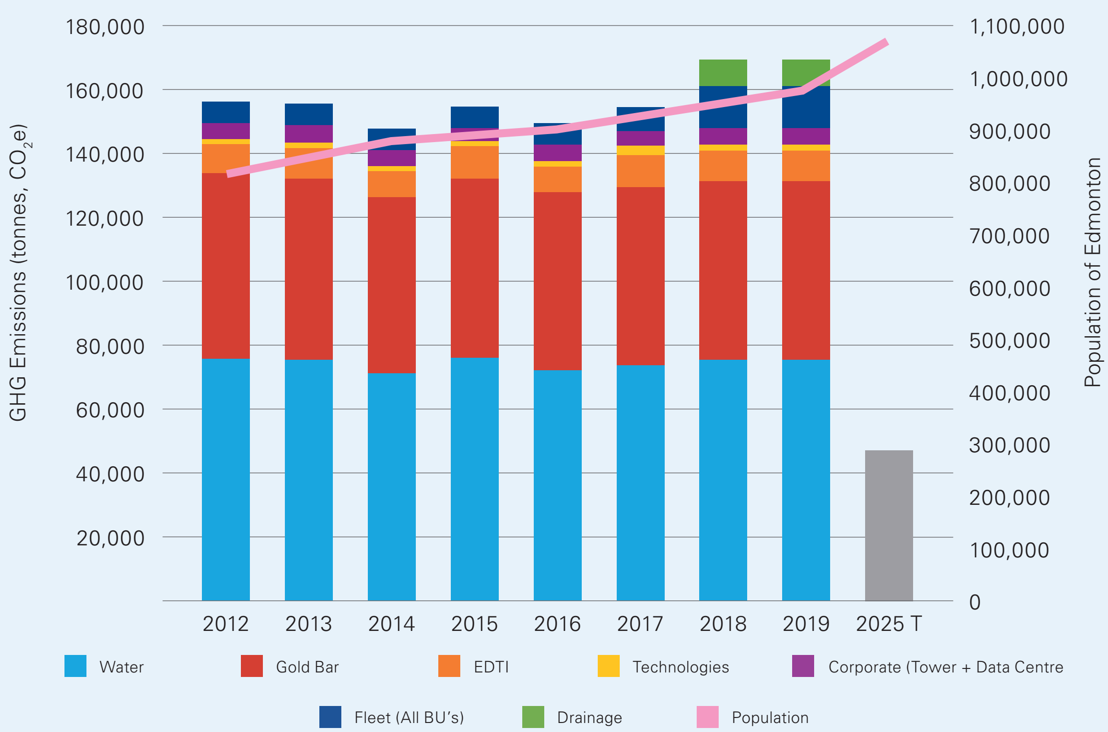
EPCOR has selected 2012 as the baseline year that reduction efforts will be measured against. In the baseline year, EPCOR's Scope 1 and Scope 2 GHG emissions were 156,590 tonnes of carbon dioxide equivalent ("CO_2e"). The trend of GHG emissions since 2012 has been relatively flat with a small increase in 2018 when Edmonton drainage operations were included in EPCOR's total.

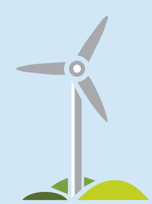
In 2018, EPCOR's Scope 1 and Scope 2 GHG emissions were 169,779 tonnes of CO_2e. Electricity consumption accounted for just over 70% of EPCOR's 2018 GHG emissions, with most of those emissions coming from electricity use at the E.L. Smith and Rossdale Water Treatment Plants, and from the drinking water pumping and distribution system.

EPCOR has a long standing energy efficiency program that includes life cycle optimization of pumps and other assets as well as building envelope improvements. However, there are limited opportunities for further reducing electricity consumption volumes through energy efficiency alone. In order to achieve the deep emission reductions that are required to mitigate the effects of climate change, EPCOR must utilize cleaner electricity for its operations.

EPCOR GHG EMISSIONS (2012-2018)

AND EDMONTON'S POPULATION





Credits from developing a new wind farm will be used to offset electricity-related emissions

Solar farm electricity used directly at the EL Smith Water Treatment Facility will reduce electricity use from the grid.

2025 REDUCTION TARGET

By 2025, EPCOR will reduce its GHG footprint inside the City of Edmonton by 70% relative to the 2012 baseline. This goal will be achieved by utilizing 100% green electricity for all of EPCOR's Edmonton based operations.

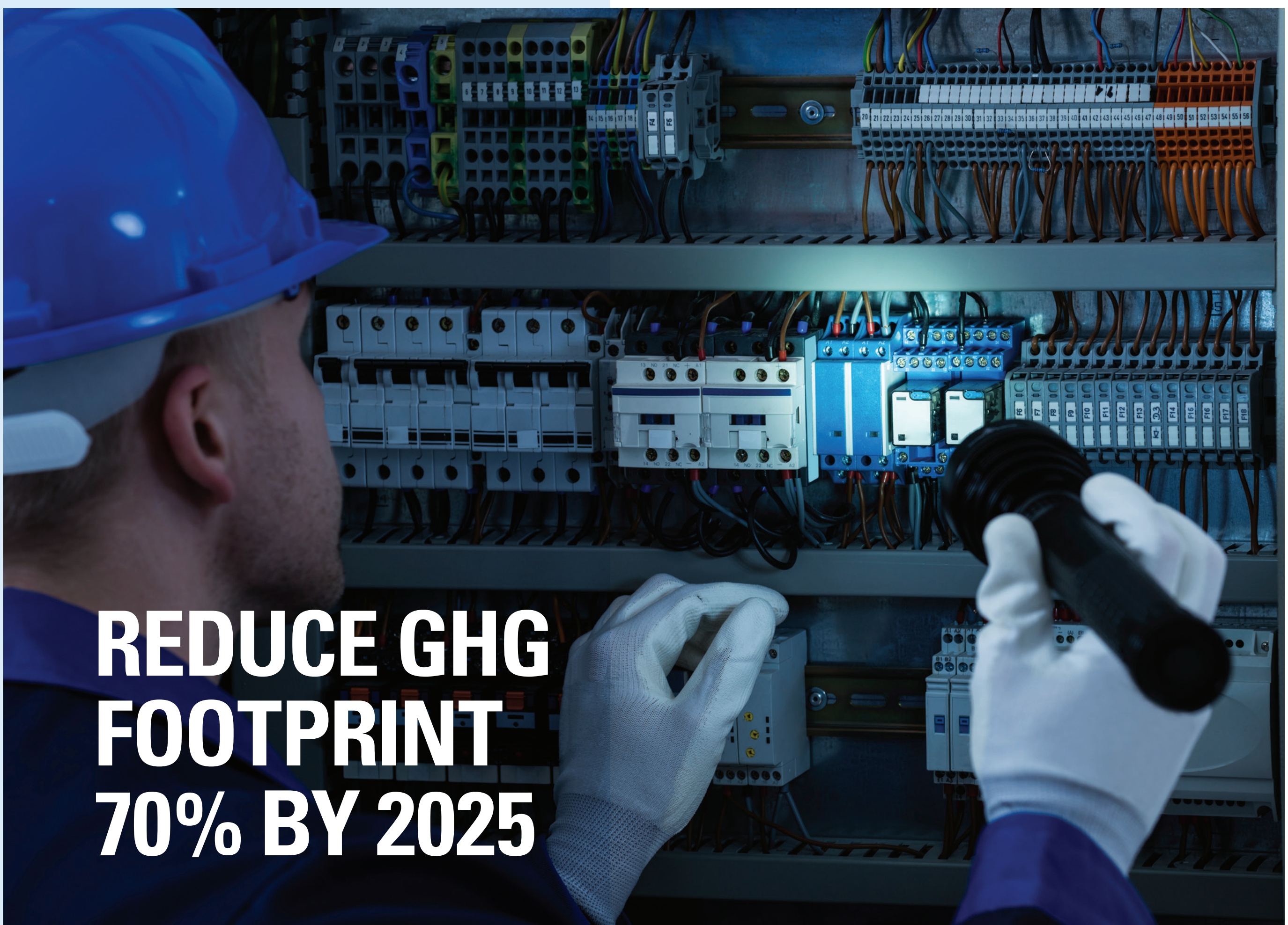
Reducing the carbon intensity of electricity generation is the single largest opportunity for EPCOR to achieve GHG emission reductions, and essential for attaining meaningful results.

Two projects have been identified to deliver on this target – the E.L. Smith Water Treatment Plant Solar Farm located in Edmonton, and an offtake agreement for Renewable Electricity Certificates ("RECs") from a newly constructed wind farm in Southern Alberta. These projects will provide EPCOR and its customers with a portfolio of green electricity generation that balances local development and affordability while significantly reducing EPCOR GHG footprint within Edmonton.

The electricity generated by the E.L. Smith Water Treatment Plant Solar Farm will be utilized directly at E.L. Smith. Electric energy generated by the wind farm will provide a new source of green electricity to the Alberta grid that would otherwise not be developed and EPCOR has secured the rights to claim the Renewable Electricity Credits for the 20-year life of the project.

These projects will provide enough green electricity to reduce EPCOR's Scope 1 and Scope 2 emissions from electricity consumption inside the City of Edmonton to zero.

EPCOR believes that it can achieve and sustain this substantial reduction in GHG emissions by 2025, with a **stretch target of full implementation in 2023.**



REDUCTION OF 85% BY 2035

2035 REDUCTION TARGET

By 2035, EPCOR will further reduce in its GHG footprint inside the City of Edmonton such that a reduction of 85% will be achieved relative to the 2012 baseline.

EPCOR believes that emerging and improving technologies will lead to cost effective opportunities to act. Some of the tactics that EPCOR will consider include electrifying fleet vehicles, utilizing biomethane, synthetic natural gas, and hydrogen for heating and transportation, and evaluating alternative process technologies for water and wastewater treatment.

EPCOR will refine the 2035 reduction target as additional tactics are identified, evaluated, and approved for implementation.

EPCOR PROVIDING MORE

EPCOR Performance Based Regulation

Water Services • Wastewater Treatment • Drainage Services

Consolidated Phase 1-3 Report, January 2020

Stone — Olafson

Stone — Olafson

Contents

Stone — Olafson

Engagement Purpose

EPCOR Water Services Inc. is regulated by City Council in accordance with their Performance Based Regulation (PBR) plan. The purpose of this type of regulatory framework is to create incentives for operators to improve their efficiency, and to focus on both price (rates) and quality of service in areas that are important to stakeholders. As EPCOR prepares for PBR renewal with Water Services, Wastewater Treatment, and the first PBR plan for Drainage Services, they would like learn how important their current areas of performance are to stakeholders. In addition, they want to hear unbiased and top-of-mind opinions from stakeholders in terms of any new or unknown concerns or priorities that should be part of the plan. To support this, Stone-Olafson was asked to conduct a broad stakeholder consultation for EPCOR with the following objectives:

- **Have public and stakeholder input to inform policy choices, priority-setting for operations and capital programs**, performance measurement and rate design;
- **Provide stakeholders with opportunities to ask questions, express concerns and raise issues with respect to the PBR renewal** and their utility services;
- **Maintain positive and productive relationships with the key decision makers and stakeholders** on the PBR development and implementation;
- **Report back to stakeholders** as the PBR renewal process **progresses on how their feedback was used by EPCOR.**
- **Help inform communications and campaigns** to educate customers on their water & wastewater utilities.

There is also a need to clearly define decisions on which the public can provide input, and EPCOR's ability to act on the input. EPCOR is seeking input on four key areas;

- **Values**
- **Performance Priorities**
- **Cost and Risk Sharing**
- **Rates**

Stone — Olafson

Topics for Public Engagement

Values. Understanding the values held by stakeholders, and using these to guide the evolution of the utilities including the performance measures in the PBR.	**Performance Priorities.** Understanding the types of performance most valued by stakeholders, and the level of performance they are seeking, to guide the prioritization capital and operating programs.	**Cost and Risk Sharing.** Understand stakeholder views on how costs and risks should be shared between ratepayers, service recipients, and the utilities, and use these views as input to guide rate design and future communications;	**Rates.** Understanding stakeholder views on the cost and benefit tradeoffs from different levels of investment in their utility services, and their preferences for future rates.

Values

- Current satisfaction with EPCOR services
- Rating of service within the context of their community
- Top mind (unprompted) concerns about Water Services, Wastewater Treatment, and Drainage Services (voice of customer)
- Specific (prompted) impacts of potential decisions to determine values (e.g., environmental impact, potential sewer back-up, etc.)

Performance Priorities

- Test EPCOR's current performance areas in more detail and determine weight of importance to customers;
  - ❑ Quality,
  - ❑ Customer Service,
  - ❑ System Reliability & Optimization,
  - ❑ Environment, and
  - ❑ Safety

Cost and Risk Sharing

- Explore the appetite for investment on a continuum from lower performance and higher risk with *lower levels of investment*, to a 'maintain status quo' strategy for *moderate investment*, and finally a *higher level of investment* with the potential to improve performance and reduce risk.
- Explore appetite for payment timing (absorb or defer) and discuss rate structure concerns with key stakeholders.

Rates

- Explore current perceptions of;
  - Cost of service
  - Fairness of current cost (rates), and
  - Tolerance for increasing rates.

A multi-phased approach was used, going from broad to specific.

Stone — Olafson

1 Gather broad public opinion on values, issues, priorities.

Visioning & Framing
Dimensions of Performance & Values with EPOR's customers

- Identify overarching and most sensitive areas of performance that matter from customer perspective (their top-of-mind concerns, thoughts).
- Gather feedback on existing or proposed broad areas of performance with the Edmonton public (residential customers), and business customers where possible.

Methodology: 8/10/2020 – 09/03/2020

1. **Residential Customers**; Online survey with option for phone if preferred (n=1,238)
2. **Commercial Customers**; Online survey (n=134)
3. **Multi-residential Customers;** Online survey (n=21)
4. **Open Public Forum** EPCOR Website

2 Talk to key stakeholders with specific needs and sensitivity to PBR outcomes

Detailed consultation
Detailed exploration with a variety of stakeholder groups with strong interest

- Conduct qualitative research with customer groups that could not be reached through the quantitative survey, and/or require more time for discussion of specific areas of concern
- Explore performance area concerns, key context, and confirm performance areas

Methodology: 09/23/2020 – 11/20//2020

- Large volume/industrial customers (6)
- Multi-residential users (8)
- Metis Nation, Confederacy of Treaty Six Nations(10)
- Gold Bar Community Liaison Committee (7)
- Community Advisory Panel (8)
- Homeward Trust (4)
- Water Quality Technical Advisory Committee (5)
- Infill Development in Edmonton Association (6)
- Edmonton Federation of Community Leagues (25)
- Canadian Homebuilders Association (9)
- Urban Development Institute (declined)

Combination of virtual focus groups, in-depth interviews, and custom surveys targeted to specific stakeholders.

3 Validate priorities, investment intentions and rate sensitivity.

Validation
Confirm PBR values, priorities, and validate investment intentions/ rate sensitivity.

- Final confirmation of preferences and recommendations
- Validation of investment appetite/intentions, and testing of rate sensitivity

Methodology: 11/23/2020 – 11/30//2020

Edmonton Public; Online survey (complete, n=500) with follow up public forum (launching January)

Due to Covid restrictions, most of the engagements did not have a single approach used. Throughout the process, we would fast-adapt with a combination of methods in order to capture as many participants as possible.

Stone — Olafson

What we learned:

Values.
Stakeholder values to guide the evolution of the utilities including PBR Measures

- Customers are satisfied with EPCOR services, and show a pattern of improved opinion over time. Reliability, water quality, and delivering on expectations drive this.
- In terms of top-of-mind concerns, *protecting communities from flooding,* followed by *cost,* and *maintaining the integrity/ quality of tap water* are the strongest themes.
- Note that stakeholder groups elevated the desire/need for more formal plans that show alignment to the city, but with a broader time horizon. They also elevated environmental protection (more informed opinion).

Performance Priorities.
Performance valued most by Stakeholders, and the level of performance they are seeking

EPCOR's performance areas are right and exhaustive, with priorities indicated as follows:

#1 Quality

#2 System Reliability & Optimization

#3 Safety

#4 *Tie between* Environment, *and* Customer Service

When asked if anything could be added, customers would like EPCOR to ensure costs are kept in line and provide more information/education wherever possible.

Stakeholder groups elevated *environment, more rigorous planning*, and EPCOR *using their expertise to provide leadership in setting standards*.

Cost and Risk Sharing.
Understand stakeholder views on costs, risks and sharing.

Both public and stakeholders lean toward investing slightly more than status quo (between 6.3 and 6.7 on a 10-point scale) to improve efficiencies and reduce risks and environmental impact. All three phases indicate support for this approach. Note that the second wave of research was conducted during the most severe Covid restrictions, and during this time, investment tolerance softened slightly (0.4%). It remained within the same range, i.e., slightly more than status quo.

In terms of the timing of investment and rate structure, overall participants leaned toward paying now rather than waiting, and had little concern/feedback on the existing rate structure itself.

Rates.
Understanding stakeholder views on the cost and benefit tradeoffs and preferences for future rates.

Between 15% and 20% of participants had a hard time recalling current costs, and of those who did, one third indicated it is difficult to judge if the cost is fair or not (unsure how to judge). Of those who had an opinion, most feel rates are fair even though they over-estimate the bill they currently pay by roughly 50%. Using price modelling, the acceptable monthly rate increase is \$6.63 to \$10.51, with the optimal price point being \$7.82. There is some variance by quadrant. Note that this is within the range EPCOR has planned to put forward. The only groups that will be challenged include low-income residents and multi-residential owners/managers.

What we learned:

Stone — Olafson

	Quality	Customer Service	System Reliability	Environment	Safety
Water	25% (↑ slightly)	20% (↓ *exception information)*	25% (=)	15% (=)	15% (=)
	#1 Priority	Tertiary	#2 Priority	Tertiary	Tertiary
Wastewater treatment	55% (↓)	15% (↓)	15% (↑)	0% (↑)	15% (↑)
	#1 Priority *(Reduce contaminants, reduce odour)*	Tertiary *(continue with improved communication)*	#2 Priority *(manage treatment volumes)*	Tertiary *(Protect river valley in planning is higher, efficiency is tertiary)*	#2 Priority *(Public/employee safety)*

	Customer Service	System Reliability	Environment	Safety
Drainage	20% (=)	40% (↑)	30% (↓)	10% (=)
	#2 Priority *(quick response time for blocked sewers, all other tertiary)*	#1 Priority	#1 Priority *(Reduce contaminants entering river specifically)*	Tertiary

Environment: Not less important with drainage, but if system reliability improves, environmental impact will also.

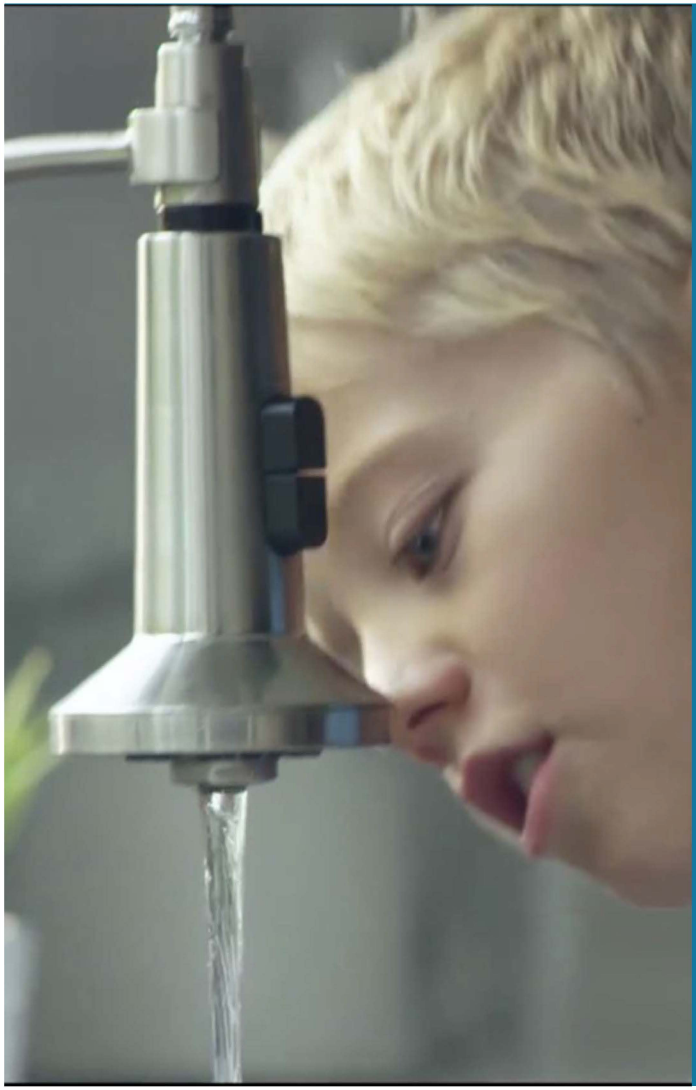
About safety: Viewed as table stakes (hence lower). Safety is license to do business.

SUMMARY IDEA

Use Success to Lead
Water is critical. Invest to keep standards and protect. Reduce risk. Share knowledge and expertise.

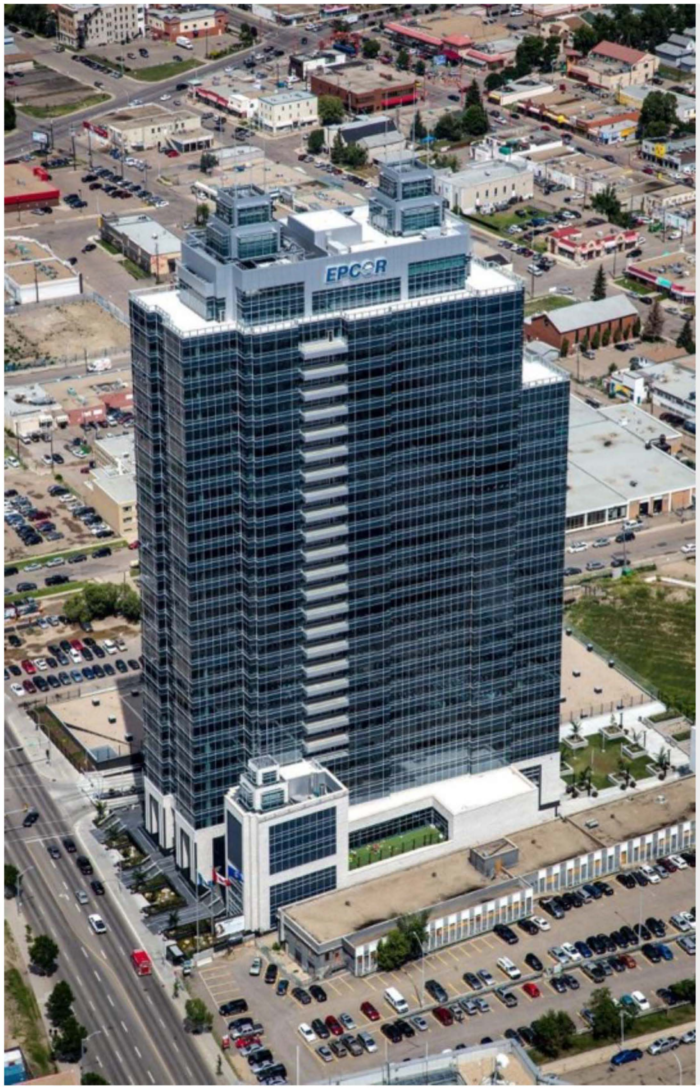
Continue Collaboration
Location is greatest concern. Continue collaboration and communication. Desire for coordination with planning to protect river valley through city growth (protect asset).

Invest, Evolve, Plan
Drainage is a higher concern for both public and stakeholder groups, but **significantly** more for stakeholders. Desires are to: modernize business practices, standards, align plans to city strategy and beyond, and (overall) simply advance system upgrade.



DETAILED RESULTS

THE CONTEXT



Stone — Olafson

TOPLINE
Current Satisfaction Levels

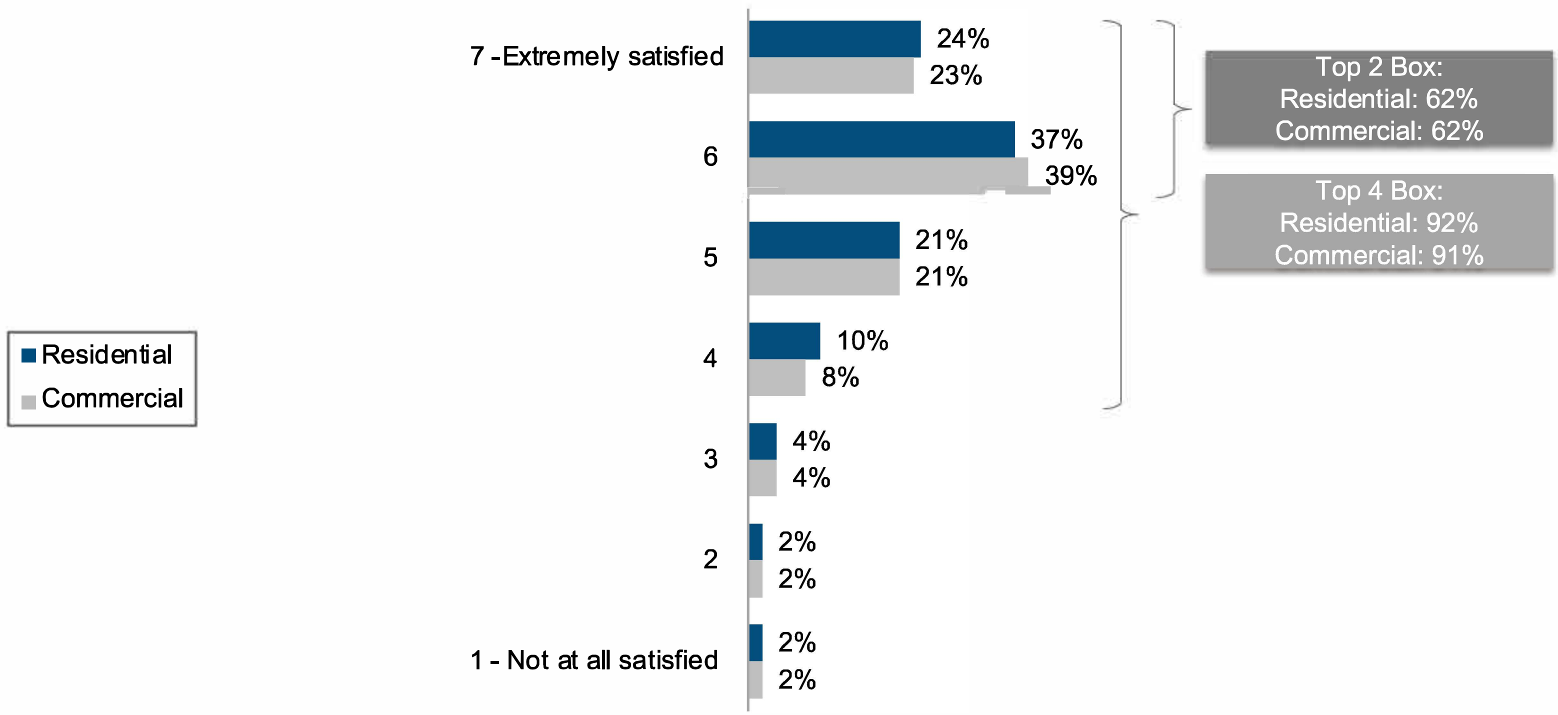
- Edmontonians indicate they are satisfied with EPCOR Water Services, and demonstrate a history of gradual improvement over the past five years of tracking
- Reasons for satisfaction are a lack of problems, good/reliable service, and the high quality of their drinking water
- Within a set of community characteristics that influence whether they enjoy their community, Edmontonians rate ‘reliable utilities’ in their community the highest.

The Details >

THE CONTEXT

Edmontonians (both residential & commercial) are satisfied with EPCOR Water Services, with two-thirds very satisfied.

Overall Satisfaction with EPCOR Water Services

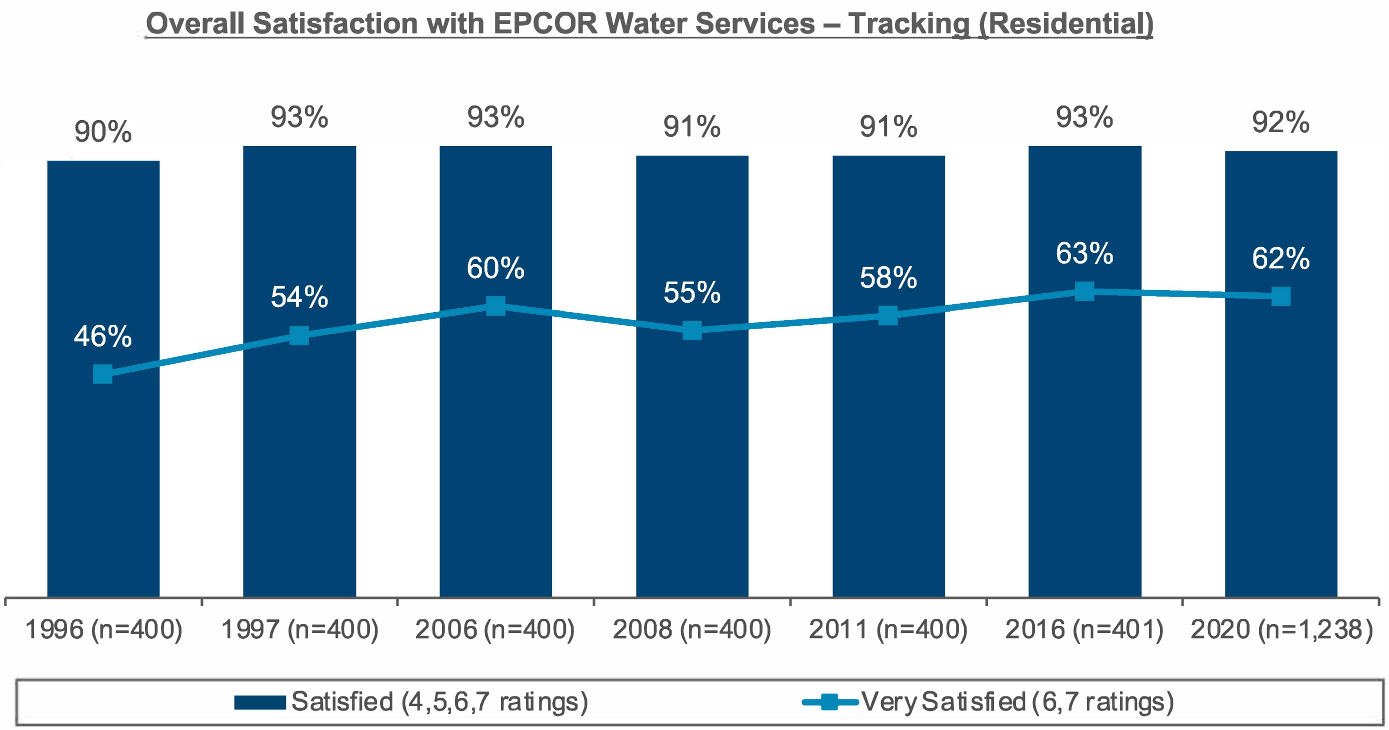


Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q7. How would you rate your OVERALL satisfaction with your water services, wastewater treatment, and sewer services?

THE CONTEXT

Stone — Olafson

Satisfaction with EPCOR water, wastewater treatment, and drainage services is consistent with 2016 and shows a history of improvement over time.



Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q7. How would you rate your OVERALL satisfaction with your water services, wastewater treatment, and sewer services?

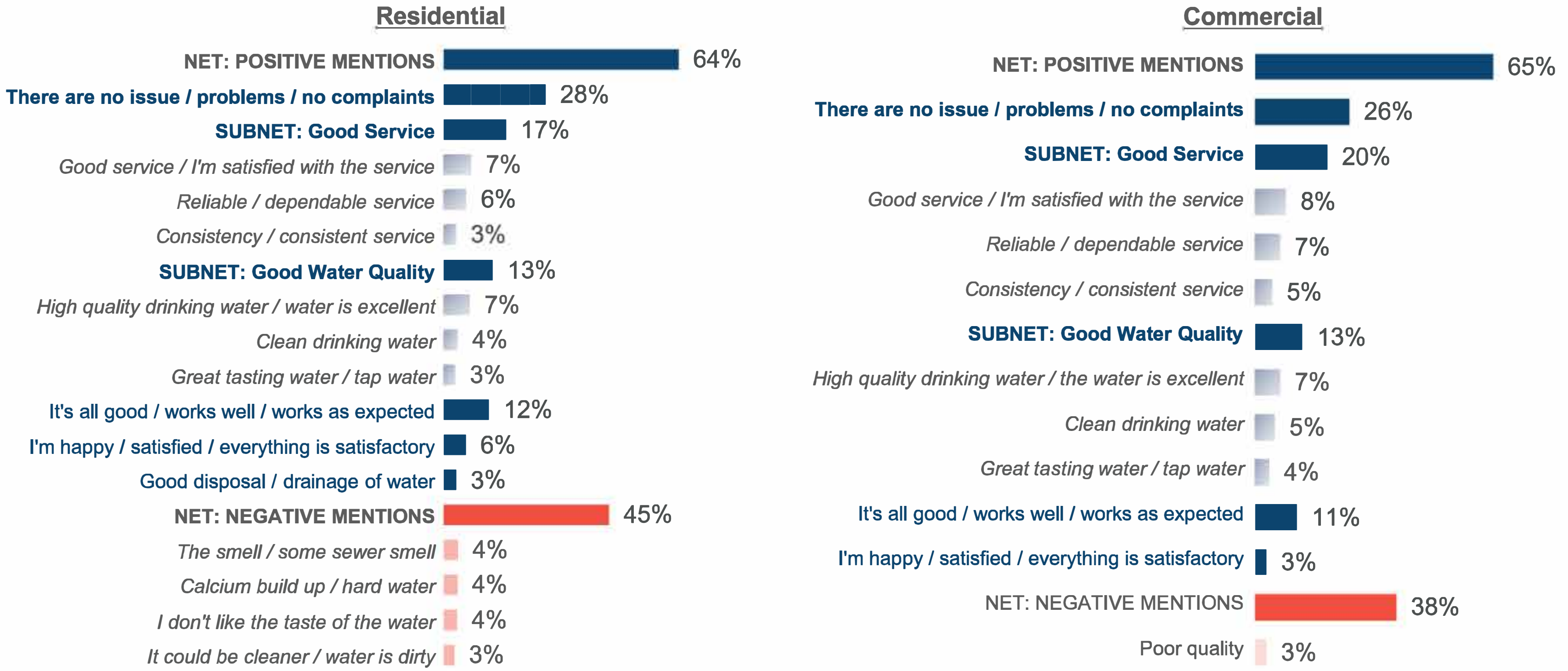
THE CONTEXT

Stone — Olafson

Top of mind reasons respondents are satisfied with EPCOR is because they have not experienced problems, followed by good service and high-quality water.

Negative satisfaction is driven by odour, calcium build-up, taste, dirty water, and poor quality.

Reason Behind Satisfaction Rating – Open End



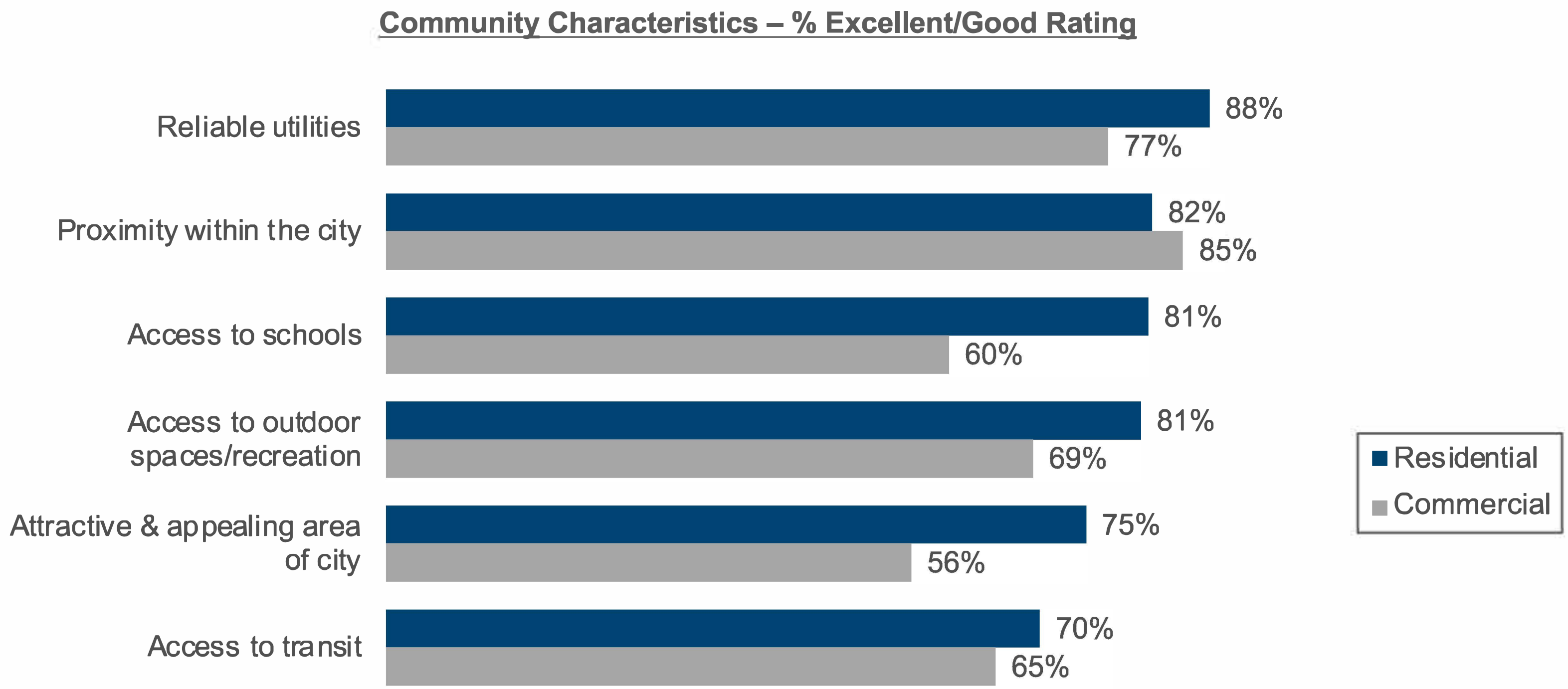
Base: All respondents: Residential (n=1,208); Commercial (n=134) **Only responses greater than 2% shown in charts.*
Q8. What is the main reason that you gave this rating?

THE CONTEXT

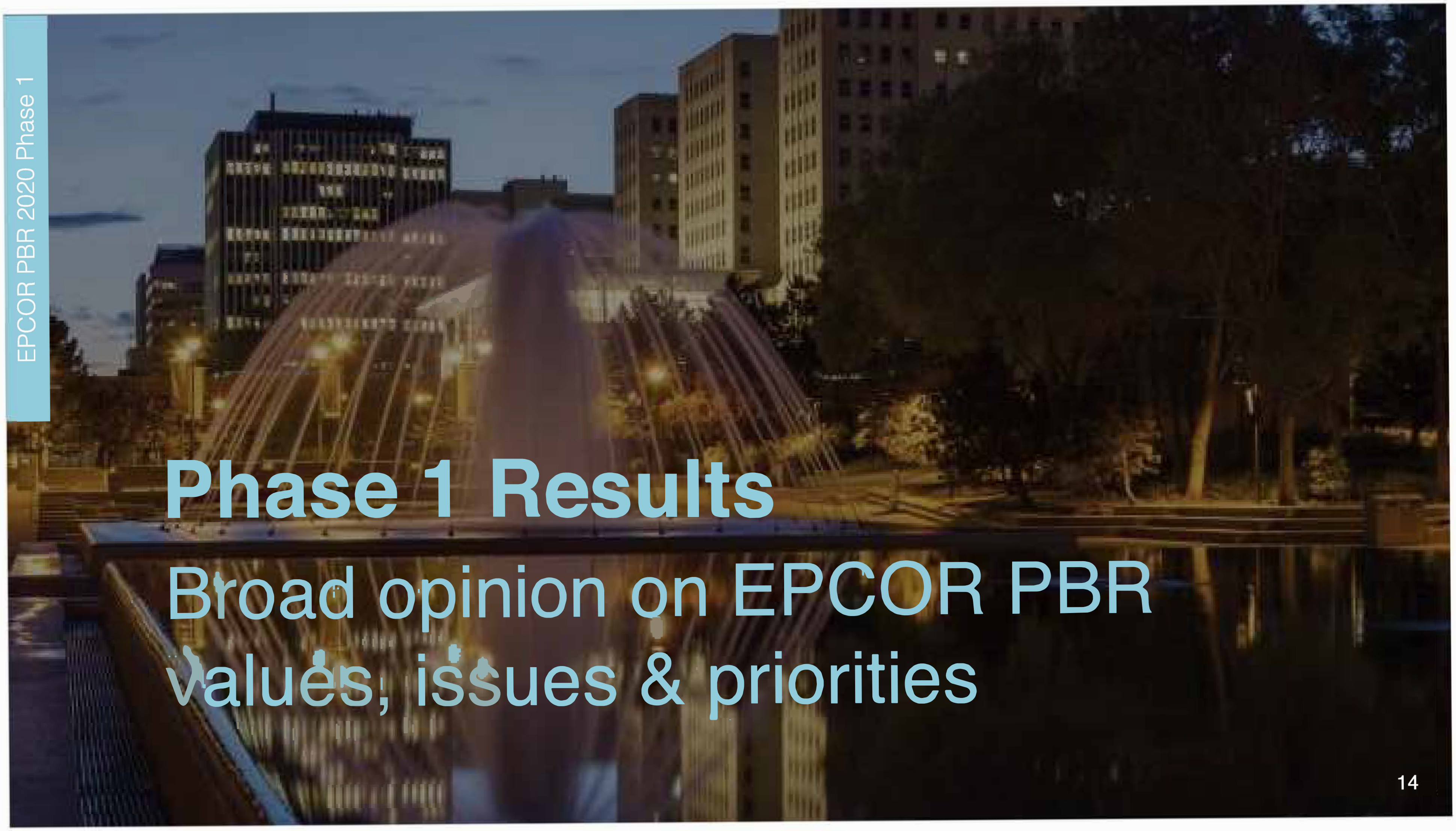
Stone — Olafson

Residential respondents are positive about their communities, and rank reliability of utilities the highest among a set of community attributes.

Commercial respondents appreciate their proximity within the city the most, reliability of utilities second, and are more critical of remaining communal aspects.



Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q4. Thinking about the community you live in, please rate how well your community does on each of the below characteristics.


EPCOR PBR 2020 Phase 1
Phase 1 Results
Broad opinion on EPCOR PBR
Values, issues & priorities
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EPCOR PBR 2020 Phase 1

Stone—
Olafson

TOPLINE
Values, Concerns, & PBR:

- Top-of-mind concerns indicate a high value placed on protecting communities from flooding (recent flooding in Edmonton likely elevated the issue). Flood protection was followed by *cost* and *maintaining the integrity/quality* of tap water.
- EPCOR's current PBR areas are relatively exhaustive, with solid alignment to customer values and priorities.
- Thurstone modelling indicates that some slight weighting adjustments could be made to increase emphasis on; protecting quality (water), increasing system reliability (wastewater treatment), and giving priority weighting to system reliability for drainage.
- Commercial customers do have slightly different priorities than residential, particularly with wastewater treatment (managing volumes and contaminants), and with drainage (maintaining infrastructure/performance).
- The only other areas suggested to expand on are cost/rates and education. Customers highly value information and rationale for decision making.

The Details >

EPCOR PBR 2020 Phase 1

Stone — Olafson

CURRENT PBR Summary: Performance Categories & Weighting

PERFORMANCE CATEGORIES & WEIGHTING					
	Quality	**Customer Service**	**System Reliability & Optimization**	**Environment**	**Safety**
Water Services	25%	20%	25%	15%	15%
Wastewater Treatment Services	55%	15%	15%	n/a	15%
Drainage Services	TBD				

Both Water Services and Wastewater Treatment Services have been through a Performance Based Regulation (PBR) engagement and plan, and therefore have an existing PBR framework that identified five performance areas (above) based on customer and stakeholder values. The weighting of each performance area to measure is based on customer and stakeholder priorities. Specific *metrics* for each performance area are indicated on the next page.

Drainage Services (Stormwater and Sewer drainage) is a newer business unit for EPCOR, and therefore this PBR Engagement is the first time the work has been done on behalf of Drainage Services. As such, the team put forward *proposed* performance areas to test and validate. Weighting for each performance area is the product of this work.

EPCOR PBR 2020 Phase 1

Stone — Olafson

CURRENT PBR Summary: Performance Categories, Weighting & Detailed Metrics

PERFORMANCE CATEGORIES & WEIGHTING					
	Quality	**Customer Service**	**System Reliability & Optimization**	**Environment**	**Safety**
Water	25%	20%	25%	15%	15%
	• % of tests non-suspicious 99.7% (~60K tests)	• Post service audit (% completely/very satisfied with EWSI emergency group) • Home water sniffing % satisfaction • Ave # min from main-break alert ot dispatch break < 25 • % planned construction events compliant with notification prcdr	• Water main break factor (# in reporting period less than 419) • Water main break repair duration (% within 24 hours) 93.7% • Water loss factor; index quantifying distro management for real water loss (< 2) • System energy efficiency; kWh/annual water production < 309	• Water conservation factor; 10 year monthly rolling ave. consumption/HH <17.2 • Environmental incident factor; # reportable/preventable env. Incidents < 6 • Solids residual mgmt. factor; Ave # days plants operating in direct filtration mode > 120	• # near miss reports > 550 • Work site inspections/observation factor; # completed ea. Year > 1,032 • Loss time frequency factor < .57 • Injury frequency < 1.54
Wastewater Treatment	55% (includes environment)	15%	15%	n/a	15%
	• Wastewater effluent limit performance value (aggregate % discharge for 5 parameters) > 28% • Environmental incident factor; # of incidents both reportable/preventable < 10	• 1 hr H2S exceedance factor (# of exceedances of 1-hour limit registered @ air quality stations) < 6 • 24 hr H2S; " " < 2 • Scrubber uptime factor (% time online) > 90%	• Enhanced primary treatment factor (% performance during wet weather events) > 80% • Biogas utilization factor (biogas – flare / total vol) > 60% • Energy efficiency factor; kWh/vol treated < 514	Could also be classified as environment.	• Near miss reported in ESS system >220 • Worksite inspections/ year > 919 • Loss time frequency <.75 • All injury frequency < 1.5
Drainage	TBD (includes environment)				
	• Edmonton watershed contaminant reduction index score > 6.9 • Total load, suspended solids (kg/d) to river from sewers & treatment plants < 50,000	• Emergencies responded to within 2 hours > 87% • # of blocked mainline sewers per 100 km of pipe < 2.1 • % of neighbourhoods protected against 100-year flood out of 157 identified as 'at risk' > 16% • # of odour complaints < 647	• Sanitary, Storm, and combined sewer pipe capacity rating; % of linear infrastructure with hydraulic condition rating of B or better, 96%, 50%, and 80% respectively • % of infrastructure at or above minimum condition rating 90% • Capital reinvested vs. total system replacement replacement value .81%	Could also be classified as environment.	• Employee engagement level 70% • Employee turnover (excl. retirement) vis. headcount 6% • Loss time frequency factor; # of lost time hours from injury vs. Total hrs .5

Stone—Olafson

To validate PBR performance areas and weighting, we asked participants questions in three different ways (below).

Recommendations based on our findings are shown on the next page followed by the detailed results

1. Top of mind (unaided or unprompted) concerns.

This allowed us to explore customer's own language and any issues they felt were important about their water, wastewater treatment, and drainage services that may not have been identified in the existing PBR.

2. Importance of possible (prompted) concerns and performance areas for each line of business

A list of potential impact areas (concerns) as well as performance areas were identified through past research, customer listening tools, and secondary sources. The lists were then tailored for each line of business and presented for customers to rate importance (i.e., prompted ratings).

3. A sorting task of PBR performance areas and Thurstone analysis to identify *degree* of importance

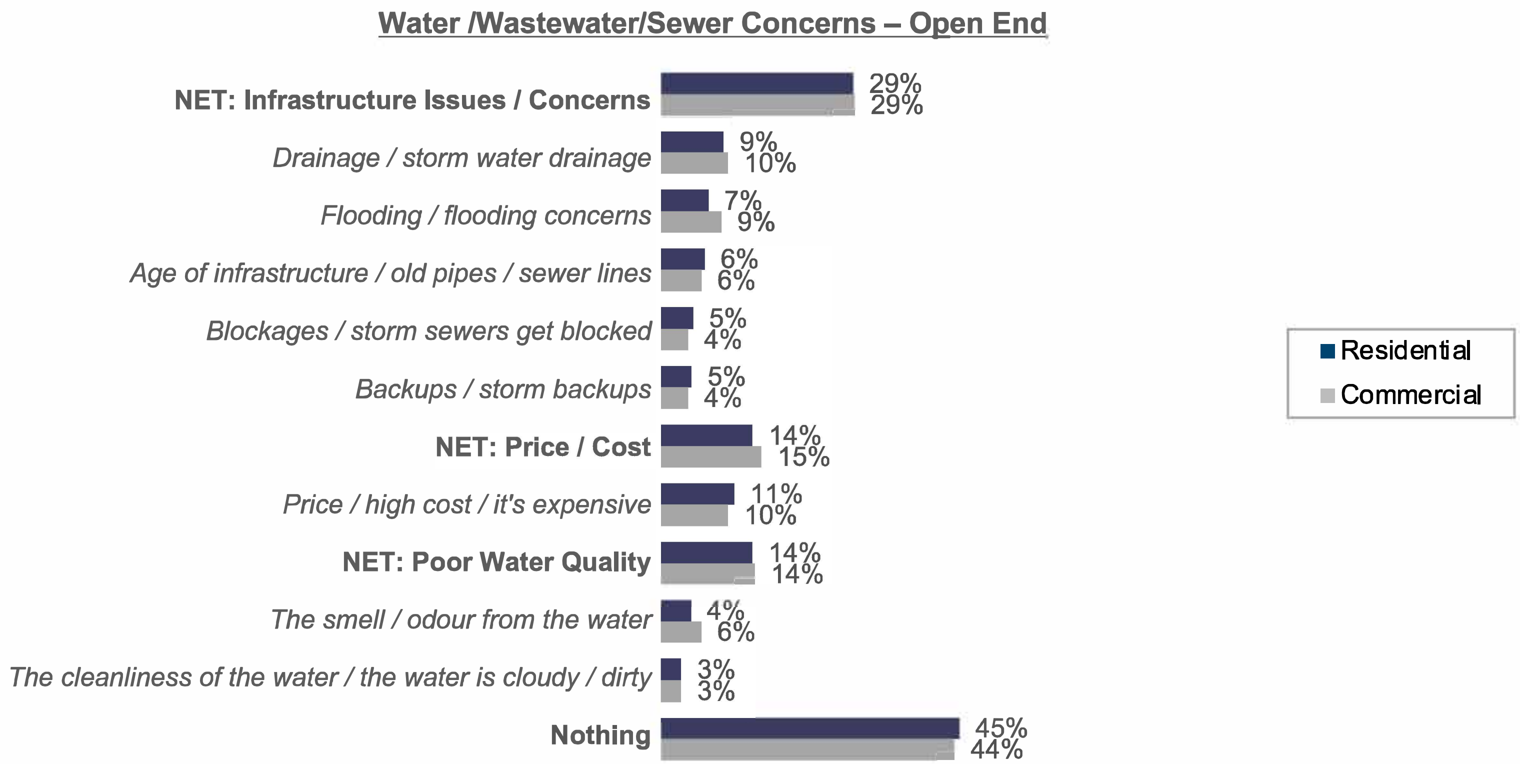
Finally, customers were asked to conduct a ranking of potential future areas of performance for each line of business in terms of what mattered to them most.

This was followed up by a direct question asking if there are any other areas EPCOR should be considering.

Stone—Olafson

Unaided concerns about water services are mainly *infrastructure* in nature (i.e., drainage and flooding), *high cost*, and *water quality* (odour/cleanliness).

Although, nearly half of all customers have no concerns.



Base: All respondents: Residential (n=1,165); Commercial (n=125)
Q10. What concerns, if any, do you have about water, wastewater treatment, and/or drainage storm or sewer in your neighbourhood?

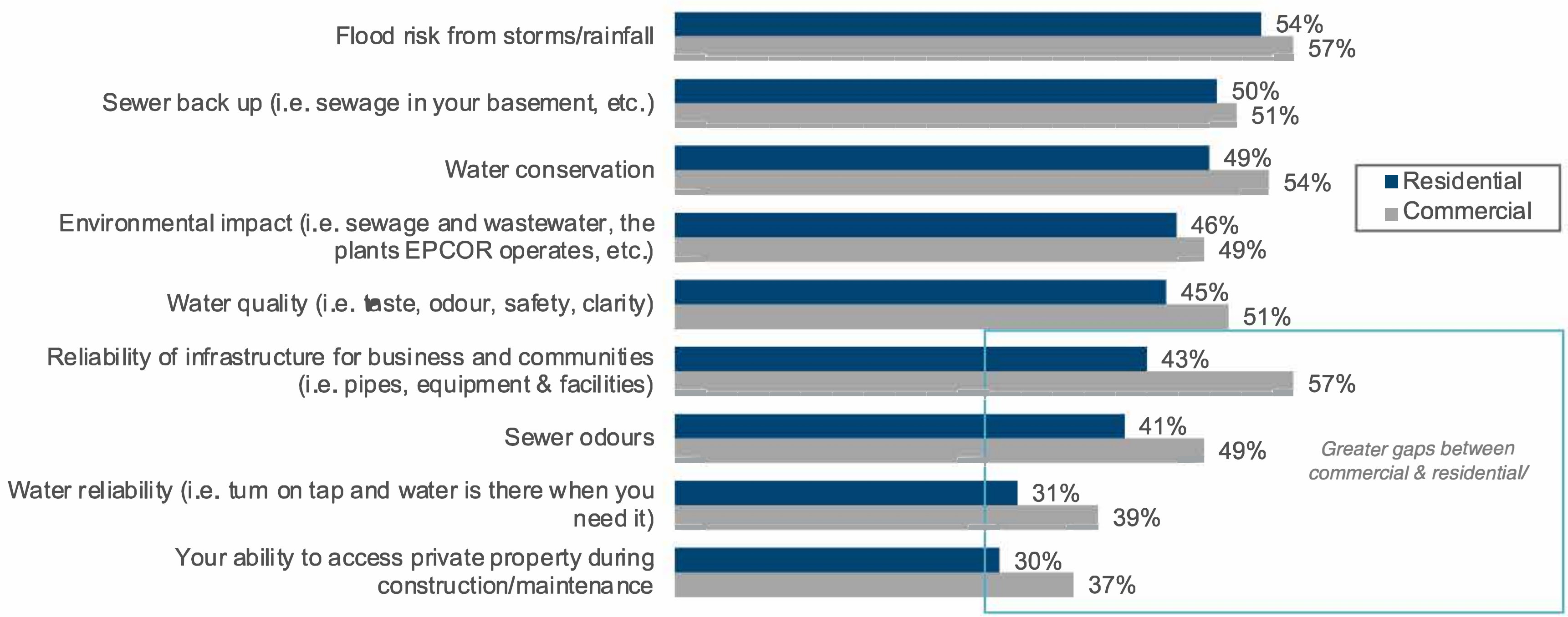
EPCOR PBR 2020 Phase 1

Stone – Olafson

When pressed for concerns, commercial customers are slightly more concerned than residential on specific issues

Particularly infrastructure reliability, water reliability, odour, and access to property during maintenance.

Level of Concern with Water Supplier - % Very Concerned/Concerned Rating

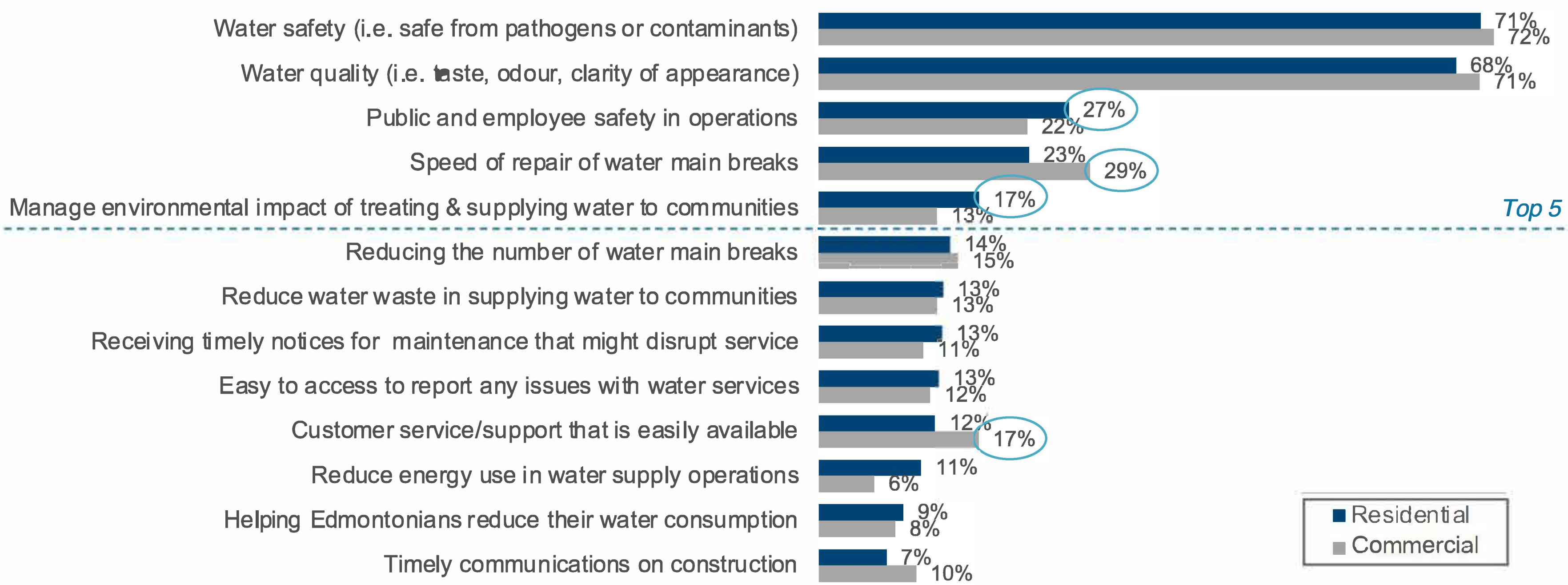


Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q11. How concerned are you with the following in your neighbourhood?

EPCOR PBR 2020 Phase 1

Ranked importance starts to reveal values and top performance areas, with water safety & water quality by far the most important to both types of customers.

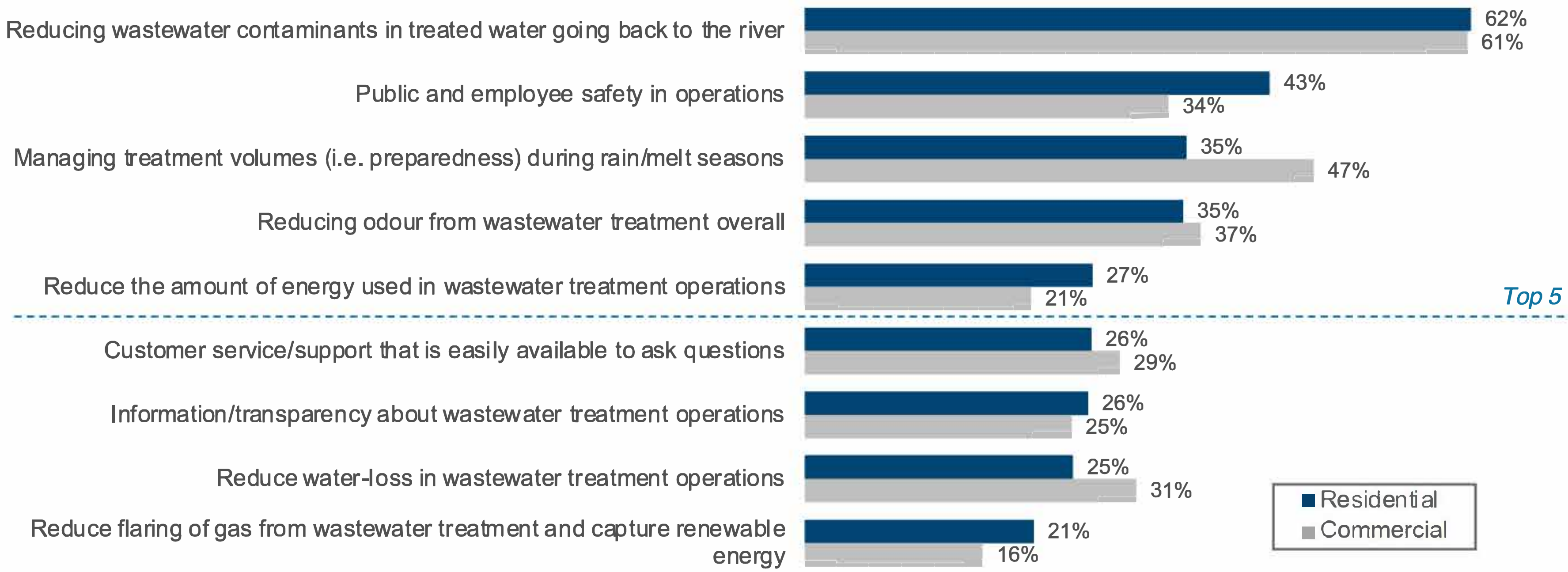
Considerations When Supplying Water – % Importance (Top 3)



Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q12A. We would like you to rank how important each one is to you personally, where 1 is most important to you, followed by 2, 3, etc.

Reducing wastewater contaminants, safety in operations, and treatment volumes (especially amongst commercial customers) are the most important performance areas for wastewater treatment.

Considerations When Treating Wastewater – % Importance (Top 3)

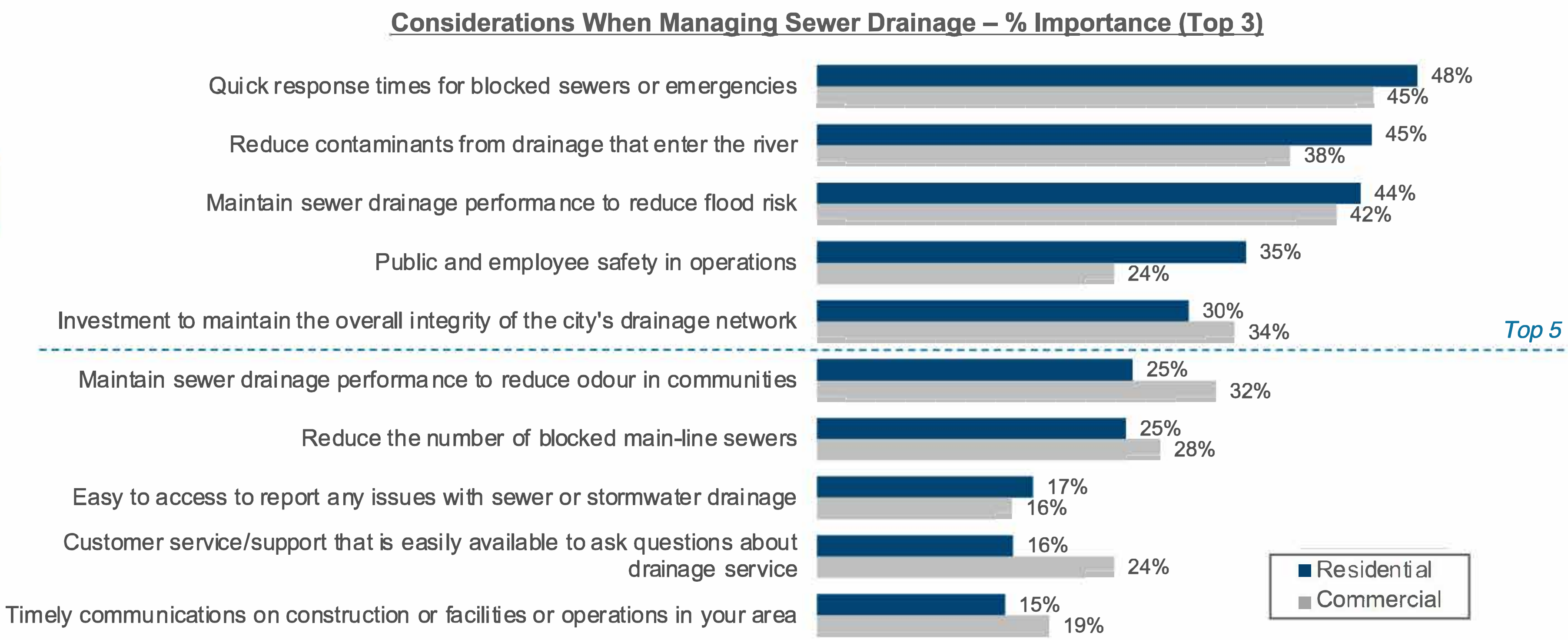


Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q12B. We would like you to rank how important each one is to you personally, where 1 is most important to you, followed by 2, 3, etc.

EPCOR PBR 2020 Phase 1

Stone — Olafson

The main priorities for sewer drainage include quick response times, reducing contaminants, and maintain sewer drainage performance.



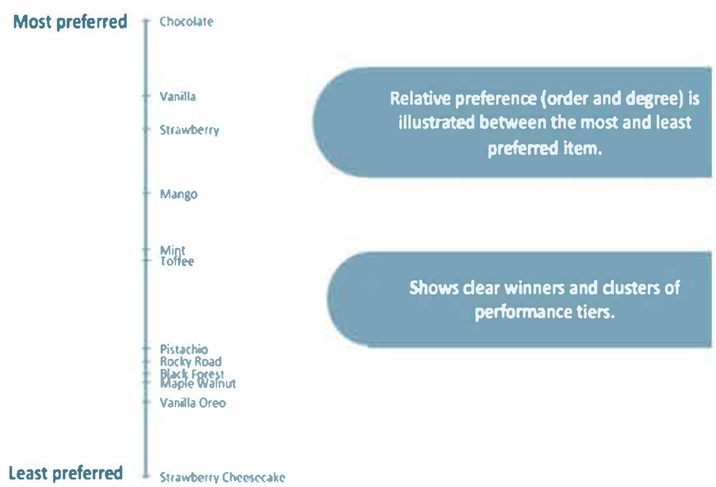
Base: All respondents: Residential (n=1,238); Commercial (n=134)
Q12C. We would like you to rank how important each one is to you personally, where 1 is most important to you, followed by 2, 3, etc.

Stone — Olafson

To help determine the *weight of importance* of PBR areas, customers were asked to rank them. We then conducted Thurstone Analysis to identify the magnitude of importance to determine weighting.

What is a Thurstone Analysis?

Example: Sorting preferred ice cream flavours



As part of the survey, customers were asked to rank performance areas in terms of what is most important to them.

While sorting and ranking preferences is helpful, it is limiting in that it doesn't allow us to understand the degree of preference within options.

A **Thurstone Case V Scaling** analysis is a simple analytic tool that takes a ranking question from beyond order of preference to showing *how much more* each item is preferred, relative to the other choices. This technique eliminates any "ties" that occur in preference ratings.

Stone Olafson

Water Supply Results: safety and quality are most important for all customers.

IMPORTANCE — Residential (n=1238)

MOST

TIER 1 — Weighting : 50%
- Water Safety
- Water Quality

Tier 2 — Weighting 20%
- Speed of Repair (main breaks)

Tier 3 — WEIGHTING: 30%
- Public & employee safety in operations
- Reduce number of water main breaks
- Manage environmental impact to communities
- Receiving timely notices for maintenance disruptions
- Reduce water waste in supplying water to communities
- Easy access to report any issues
- Customer service/support easily available
- Reduce energy use in water supply operations
- Helping Edmontonians reduce water consumption
- Timely communications on construction/facilities/operations

LEAST

IMPORTANCE — Commercial (n=133)

MOST

TIER 1 — Weighting : 40%
- Water Safety
- Water Quality

Tier 2 — Weighting 30%
- Speed of Repair (main breaks)
- Reduce number of water main breaks
- Customer service/support easily available
- Public & employee safety in operations

Tier 3 — WEIGHTING: 25%
- Reduce water waste in supplying water to communities
- Receiving timely notices for maintenance disruptions
- Timely communications on construction/facilities/operations
- Easy access to report any issues
- Manage environmental impact to communities

Tier 4 — WEIGHTING: 5%
- Helping Edmontonians reduce water consumption
- Reduce energy use in water supply operations

LEAST

EPCOR PBR 2020 Phase 1

Stone — Olafson

Wastewater Treatment: After reducing contaminants, treatment priorities vary slightly with residential focused on protecting public and employee safety, and commercial focused on managing volumes/odour

IMPORTANCE Residential (n=1238)

MOST

TIER 1 — Weighting : 50%
- Reducing wastewater contaminants in treated water going back to the river

Tier 2 — Weighting 30%
- Pubic & employee safety in operations
- Managing treatment volumes during rain/melt season
- Reducing odour from treatment

Tier 3 — WEIGHTING: 20%
- Reduce water-loss in waste-water treatment
- Reduce energy used in wastewater treatment
- Information/transparency about wastewater treatment
- Customer service/support easily available
- Reduce wastewater gas flaring & capture renewable energy

LEAST

IMPORTANCE Commercial (n=133)

MOST

TIER 1 — Weighting : 35%
- Reducing wastewater contaminants in treated water going back to the river

Tier 2 — Weighting 30%
- Managing treatment volumes during rain/melt season
- Reducing odour from treatment

Tier 3 — WEIGHTING: 20%
- Pubic & employee safety in operations
- Reduce water-loss in waste-water treatment
- Customer service/support easily available
- Reduce energy used in wastewater treatment

Tier 4 — WEIGHTING: 15%
- Information/transparency about wastewater treatment
- Reduce wastewater gas flaring & capture renewable energy

LEAST

Stone-Olafson

Drainage: for both residential & commercial customers, drainage performance areas are clustered into three tiers.

IMPORTANCE — Residential (n=1238)

MOST

TIER 1
Weighting : 45%

- Quick response times for blocked sewers/emergencies
- Maintain sewer drainage performance to reduce flood risk
- Reduce contaminants from drainage that enter the river

Tier 2
Weighting 35%

- Public/employee safety in operations
- Invest to maintain integrity of drainage network
- Reduce the number of blocked main-line sewers
- Maintain sewer drainage performance to reduce odour

Tier 3
WEIGHTING: 20%

- Easy access to report issues
- Customer service/support to ask questions
- Timely communication on constructions/ facilities in area

LEAST

IMPORTANCE — Commercial (n=133)

MOST

TIER 1
Weighting : 40%

- Quick response times for blocked sewers/emergencies
- Maintain sewer drainage performance to reduce flood risk

Tier 2
Weighting 35%

- Maintain sewer drainage performance to reduce odour
- Reduce contaminants from drainage that enter the river
- Invest to maintain integrity of drainage network
- Reduce the number of blocked main-line sewers

Tier 3
WEIGHTING: 25%

- Public/employee safety in operations
- Customer service/support to ask questions
- Timely communication on constructions/ facilities in area
- Easy access to report issues

LEAST

Stone — Olafson

Applying the results of Thurstone Analysis to our original PBR framework

PERFORMANCE CATEGORIES & WEIGHTING					
	Quality	**Customer Service**	**System Reliability & Optimization**	**Environment**	**Safety**
Water	25%	20%	25%	15%	15%
	• % of tests non-suspicious 99.7% (~60K tests)	• Post service audit (% completely/very satisfied with EWSI emergency group) • Home water sniffing % satisfaction • Ave # min from main-break alert ot dispatch break < 25 • % planned construction events compliant with notification prcdr	• Water main break factor (# in reporting period less than 419) • Water main break repair duration (% within 24 hours) 93.7% • Water loss factor; index quantifying distro management for real water loss (< 2) • System energy efficiency; kWh/annual water production < 309	• Water conservation factor; 10 year monthly rolling ave. consumption/HH <17.2 • Environmental incident factor; # reportable/preventable env. Incidents < 6 • Solids residual mgmt. factor; Ave # days plants operating in direct filtration mode > 120	• # near miss reports > 550 • Work site inspections/observation factor; # completed ea. Year > 1,032 • Loss time frequency factor < .57 • Injury frequency < 1.54
Wastewater Treatment	55% (includes environment)	15%	15%	n/a	15%
	• Wastewater effluent limit performance value (aggregate % discharge for 5 parameters) > 28% • Environmental incident factor; # of incidents both reportable/preventable < 10	• 1 hr H2S exceedance factor (# of exceedances of 1-hour limit registered @ air quality stations) < 6 • 24 hr H2S; " " < 2 • Scrubber uptime factor (% time online) > 90%	• Enhanced primary treatment factor (% performance during wet weather events) > 80% • Biogas utilization factor (biogas – flare / total vol) > 60% • Energy efficiency factor; kWh/vol treated < 514	Could also be classified as environment.	• Near miss reported in ESS system >220 • Worksite inspections/ year > 919 • Loss time frequency <.75 • All injury frequency < 1.5
Drainage	TBD (includes environment)				
	• Edmonton watershed contaminant reduction index score > 6.9 • Total load, suspended solids (kg/d) to river from sewers & treatment plants < 50,000	• Emergencies responded to within 2 hours > 87% • # of blocked mainline sewers per 100 km of pipe < 2.1 • % of neighbourhoods protected against 100-year flood out of 157 identified as 'at risk' > 16% • # of odour complaints < 647	• Sanitary, Storm, and combined sewer pipe capacity rating; % of linear infrastructure with hydraulic condition rating of B or better, 96%, 50%, and 80% respectively • % of infrastructure at or above minimum condition rating 90% • Capital reinvested vs. total system replacement replacement value .81%	Could also be classified as environment.	• Employee engagement level 70% • Employee turnover (excl. retirement) vis. headcount 6% • Loss time frequency factor; # of lost time hours from injury vs. Total hrs .5

Results in the following recommended adjustments (next page) >

(to be validated in phase 2)

EPCOR PBR 2020 Phase 1

RESULTS: #1 Priority = attributes that customers rated as most important, #2 = second most important, Tertiary = all other

PERFORMANCE CATEGORIES & WEIGHTING					
High level recommendation for each business line	**QUALITY**	**CUSTOMER SERVICE**	**SYSTEM RELIABILITY & OPTIMIZATION**	**ENVIRONMENT**	**SAFETY**
WATER	25% **#1 PRIORITY**	20% **Tertiary**	25% **2nd Priority**	15% **Tertiary**	15% **Tertiary****
Results indicate increasing weighting of quality (See Thurstone section starting slide 22)	• Water quality (i.e. taste, odour, clarity of appearance) • Water safety (i.e. safe from pathogens or contaminants)	• Easy to access to report any issues with water services • Customer service/support that is easily available to ask questions • Receiving timely notices for maintenance that might disrupt your service	• Reducing the number of water main breaks** • Speed of repair of water main breaks • ***More important for commercial customers*	• Helping Edmontonians reduce their water consumption • Reduce water waste in supplying water to communities • Reduce energy use in water supply operations • Overall mitigation of the environmental impact in supplying water to communities	• Public and employee safety in operations • ***More important for residential*
WASTEWATER TREATMENT	55% **#1 PRIORITY/2nd Priority**	15% **Tertiary**	15% **2nd Priority/Tertiary**	n/a (included in quality) **Tertiary**	15% **2nd Priority**
Results indicate increasing weighting of System Reliability (managing treatment volumes), & safety in operations.	• Reducing wastewater contaminants in treated water going back to the river • Reducing odour from wastewater treatment overall	• Customer service/support that is easily available to ask questions • Information/transparency about wastewater treatment operations	• Reducing the number of air-quality flare-ups in wastewater treatment • Managing treatment volumes (i.e. preparedness) during rain/melt seasons	• Reduce water-loss in waste-water treatment operations • Reduce the amount of energy used in wastewater treatment operations	• Public and employee safety in operations • ***More important for residential*
DRAINAGE	TBD **#1 PRIORITY**	**#1 PRIORITY/Tertiary**	**#1 PRIORITY/2nd Priority**	n/a (included in quality)	**2nd Priority**
Results indicate higher weighting for System Reliability (40%-45%), followed by quality (30%), then customer service (20%) and finally safety.	• Reduce contaminants from drainage that enter the river *Note: For drainage only, #1 priorities fall under three different areas. It would make sense to re-organize them to align weighting more easily.*	• Quick response to blocked sewers or emergencies • Easy to access to report any issues with sewer or stormwater drainage • Customer service/support that is easily available to ask questions about drainage service • Timely communications on construction or facilities or operations in your area	• Reduce the number of blocked main-line sewers • Maintain sewer drainage performance to reduce flood risk • Maintain sewer drainage performance to reduce odour in communities • Investment to maintain the overall integrity of the cities drainage network		• Public and employee safety in operations • ***More important for residential*

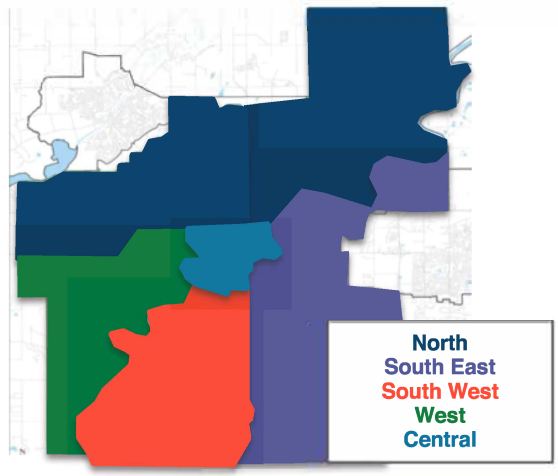
While the order of priorities were similar, we compared index scores to determine if priorities were higher or lower by quadrant.

Southwest

Satisfaction % Top 2 box	67%
Invest to Improve % Top 4	56%

More Concerned with?
- **Reducing odour** from wastewater treatment
- **Quick response time** for blocked sewers/emergencies
- **Reduce number of blocked** main-line sewers

Less Concerned with?
- Easy access to report issues
- Reducing number of water main breaks
- Reduce flaring of gas from wastewater treatment and capture renewable energy



North

Satisfaction % Top 2	57%
Invest to Improve % Top 4	50%

More Concerned with?
- **Environmental issues** (Helping Edmontonians conserve water, reducing energy in supplying water)
- **Customer Service** (CS that's easy to access, timely notices, ease/quick to report issues)
- **Reducing water main breaks**

Less Concerned with?
- Speed of main-break repair
- Maintaining sewer/drainage performance

West

Satisfaction % Top 2 box	64%
Invest to Improve % Top 4	55%

More Concerned with?
- **Reduce flaring of gas** from wastewater treatment and capture renewable energy
- **Speed of repair of water main** breaks
- Reduce energy use in water supply
- **Customer service/support** easily available

Less Concerned with?
- Reduce number of blocked sewers
- Reduce odour from wastewater treatment

Southeast

Satisfaction Top 2 box	67%
Invest to Improve % Top 4	53%

More Concerned with?
- **Timely communication** of construction/ operations in their neighbourhood
- **Invest to maintain** integrity of drainage network

Less Concerned with?
- Reducing water loss in treatment operations
- Customer service that is easy to access

Central/Inner city

Satisfaction % Top 2 box	57%
Invest to Improve % Top 4	63%

More Concerned with?
- **Environmental impact** (Reduce energy use and water loss in treatment)
- **Public & employee safety in operations**
- Reduce number of blocked main-line sewers

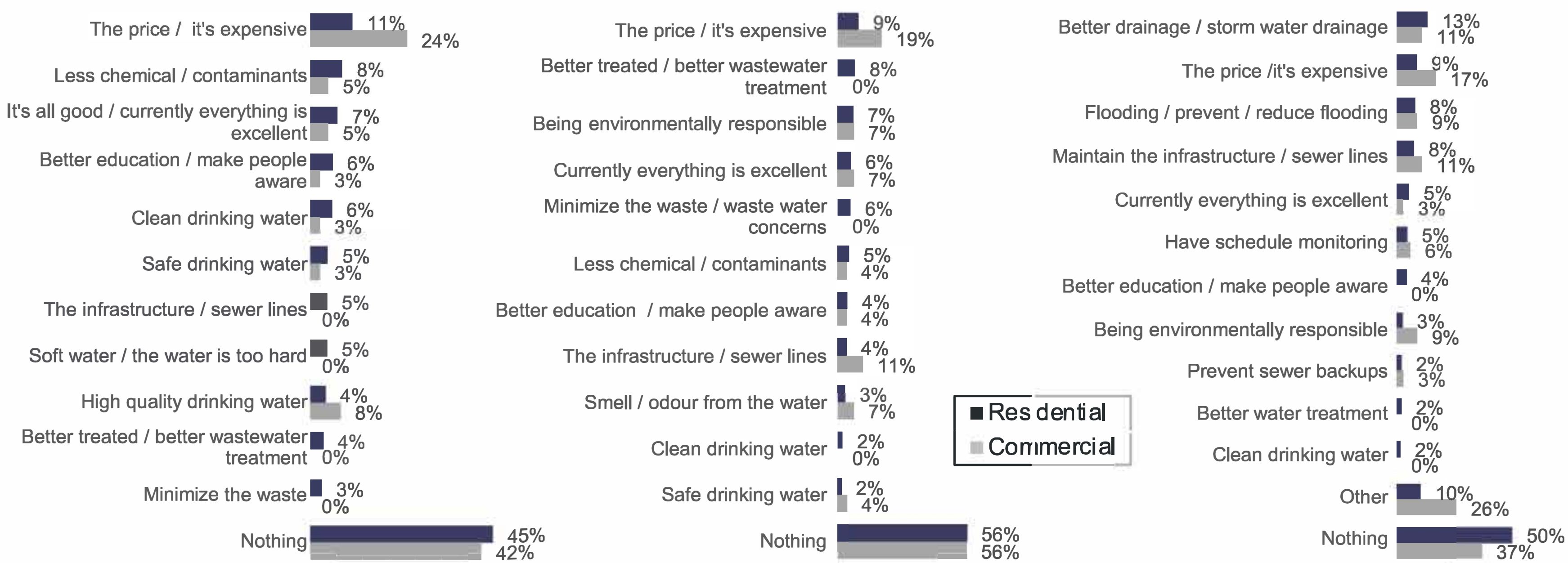
Less Concerned with?
- **Timely communication** of construction/ operations in their neighbourhood
- **Reducing odour** from wastewater treatment

EPCOR PBR 2020 Phase 1

We asked a final question to confirm if PBR areas covered all concerns. For half, performance areas tested are exhaustive. Additional recommendations are *lower price* and *better education* (especially amongst commercial customers)

Other Considerations – Open End

Water Supply | **Wastewater** | **Drainage**



Base: Provided other considerations
Q13. Now that you have had a chance to think about your water services, wastewater treatment, and stormwater/sewer drainage utilities, we would like to know what else (if anything) is important to you in how these services are managed that was not already mentioned. Do you have any other considerations you would like to suggest?

Stone—
Olafson

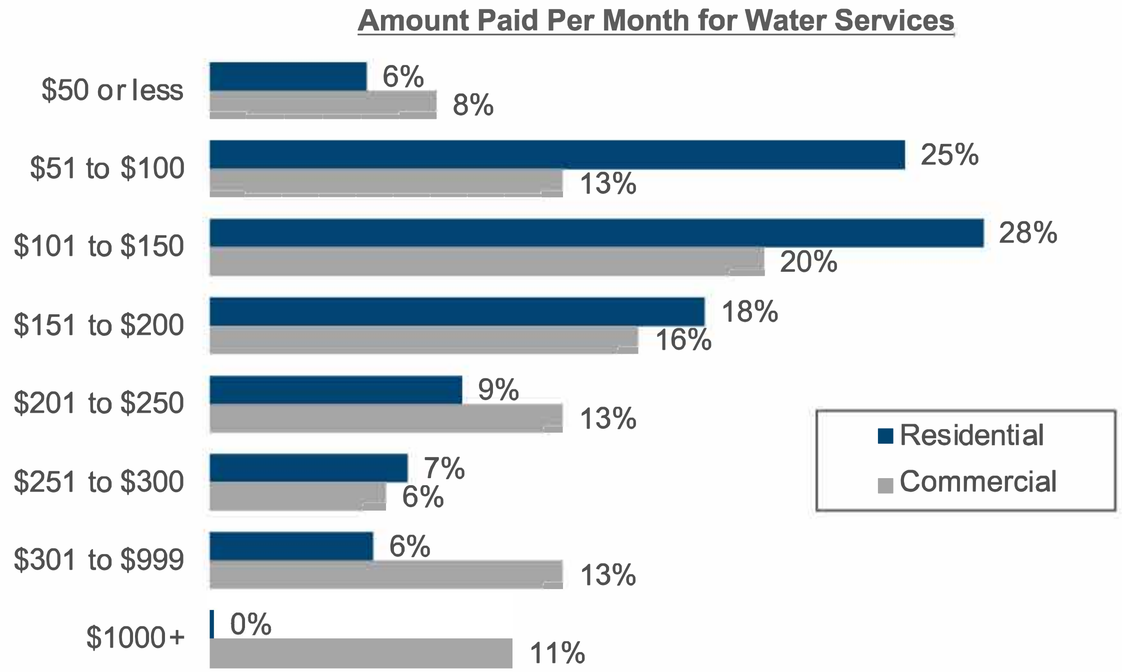
Support for Investment & Rate Sensitivity

- In terms of context, nearly one fifth (19%) of commercial customers are unaware of their cost of their services, while 14% of residential customers are unsure.
- Of those who are aware of the cost of service, both residential and Commercial customers tend to over-estimate their cost of service today; residential customers on average indicate their monthly cost is $173, Commercial $1,013. While less than half believe their prices are fair, commercial are more likely to indicate so. The more satisfied with service, the more likely to perceive value.
- While cost sensitivities are prominent throughout the open ends and other areas of reporting, overall Edmontonians agree to ‘slightly more investment’ to improve efficiencies rather than simply remain status quo. An investment sensitivity scale indicates a mean score of 6.6 out of 10, though higher income and education customers are more likely to give a higher rating. Having said that, very few believe decreasing investment to (at minimum) maintain current standards and quality should be considered.

EPCOR PBR 2020 Phase 1

Stone — Olafson

On average, residential customers report their water services are $173.60 monthly (this is 50% more than the *actual average* residential customer who pays $88.03 for all three services combined). Commercial customers pay more monthly: on average $1,013.30.



Average:
Residential: $173.60
Commercial: $1,013.30

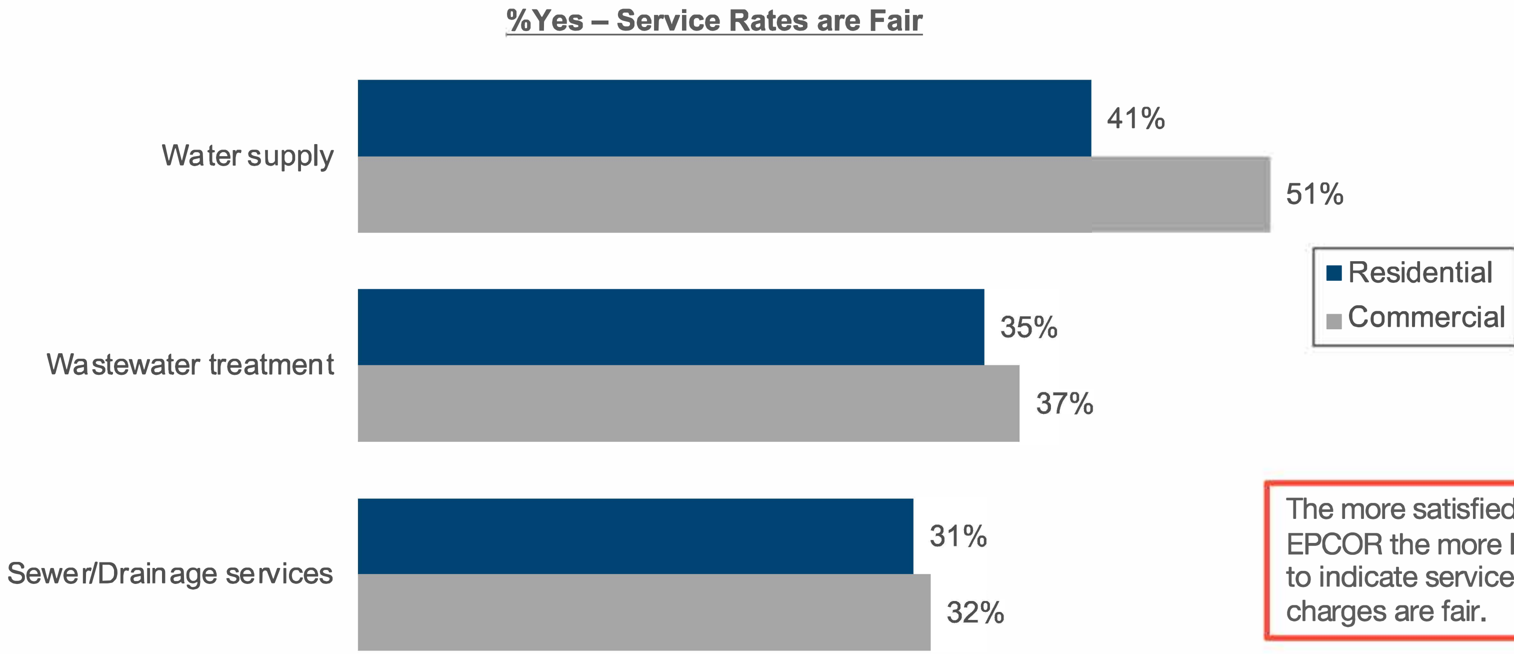
Unsure:
Residential: 14%
Commercial: 19%

Base: Answered question, outliers removed: Residential (n=1,061); Commercial (n=109)
PS1. The monthly rates charged for water supply, wastewater treatment, and sewer/drainage services are determined through bylaw principles and used to both operate and maintain/improve the system. Approximately how much do you pay per month for these services for your household?

EPCOR PBR 2020 Phase 1

Stone — Olafson

Commercial customers are more likely than residential customers to believe their water service charges are fair, especially in terms of water supply & wastewater treatment.



The more satisfied with EPCOR the more likely to indicate service charges are fair.

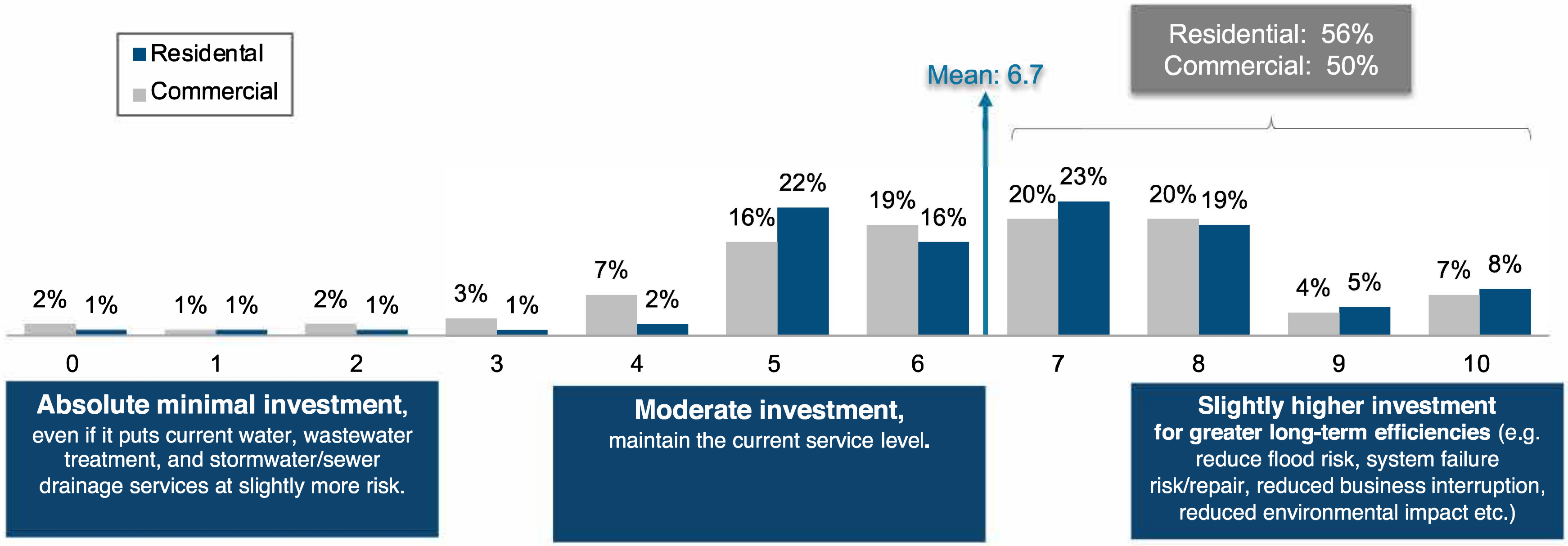
Base: All respondents: Residential (n=1,238); Commercial (n=134)
PS2. The monthly rates charged for water supply, wastewater treatment, and sewer/drainage services are determined through bylaw principles and used to both operate and maintain/improve the system. In your opinion, is the rate you pay for these services today fair?

Stone — Olafson

To avoid risk, Edmontonians (both commercial & residential) are willing to invest more in these services to allow for longer-term benefits and efficiencies, with very few calling for minimal investments.

Those most likely to be willing to invest are: highly educated, have a household income of over $100,000/annually, have not been impacted by COVID-19, believe current rates are fair, and are satisfied with EPCOR services.

Personal Position on Investment Scale



Base: All respondents: Residential (n=1,238); Commercial (n=134)
PS3. Looking ahead to the next several years, in principal, where would you position yourself on the following investment scale?

Phase 2 Results

Stakeholder groups with specific needs & sensitivity to PBR outcomes

EPCOR PBR 2020 Phase 2

Stone— Olafson

Who we talked to:

Stakeholder Group / Methodology Used	# of Participants
1. Large Water Users* (Combination Online Focus Group + In-Depth Interviews, or IDIs)	6
2. Multi Residential Users* (Combination Online Focus Group + IDIs)	8
3. Metis Nation & Confederacy of Treaty Six Nations* (Online focus group + IDI)	10
4. Gold Bar Community Liaison Committee (In-Depth Interviews)	7
5. Edmonton Community Advisory Panel (CAP) (Two online focus groups, two IDIs)	8
6. Homeward trust (Digital focus group, note, other groups were approached by declined)	4
7. Water Quality Technical Advisory Committee (Online focus group + individual response)	5
8. IDEA (Online focus group + IDI)	6
9. Edmonton Federation of Community Leagues (custom online survey)	25
10. ADDED: Canada Home Builders Association (custom online survey)	9
UDI Infrastructure Committee	Declined
Total Participants (all stakeholder groups)	**88**

**Note: These groups also had broader representation in the Phase 1 quantitative survey.*

Stone — Olafson

Summary of Key Findings (Overarching Themes)

1. The PBR priorities identified by the public, quantitative survey align with those of key stakeholder groups in terms of the #1 Priority being water quality and safety and #2 Protecting the river from contaminants and #3 managing operations to avoid issues (though responsiveness to current issues is seen as a stop-gap).
   EPCOR is generally seen as a trusted operator that is doing a good job, so many areas such as public and employee safety were not given high priority as they feel EPCOR would never ignore this. Regardless, safe/quality water is so valued by Edmontonians it is seen as worth protecting above all else.
2. Somewhat more concerning to stakeholder groups vs. the public is the drainage system. Consistently drainage services rated lower in terms of performance, but with the acknowledgement that EPCOR is trying to move drainage services to a more acceptable level (i.e. inherited issues that are in the plans to address over time). While the public has less knowledge of the area, many of the stakeholder groups we connected with have technical expertise for deeper understanding of the issues, and/or connections to business issues that arise from an aging system, and/or have more exposure to city council discussions. In this regard, stakeholder groups believe drainage services need greater investment and a more aggressive plan. This point dove-tails into future PBR planning (next slide).
3. The risks EPCOR is managing are viewed to be increasing. While emergency plans were cited as a forward-thinking strategy, other areas (such as forecast models based on historical trends) are felt to be at risk. While the nature and source of risk varied by group, the overarching theme is that risks are increasing, and the cost associated with issues will in fact be greater with a negative social consequence if left unattended, than spending now to avoid it.

Edmonton

Stone — Olafson

Summary of Key Findings (Overarching Themes)

3. While the current PBR plan is felt by the public to be complete and comprehensive, stakeholder groups we consulted with identified **additional the performance areas not covered by the plan**;
   i. An overarching, forward-looking strategic plan that supports the new City of Edmonton urban growth strategy yet extends further out. While basic renewal plans are in place, these are perceived as reactionary and not in line with City of Edmonton's urban development plans. Further, they feel that the province is slightly behind on drainage standards, and the method of planning (targeting most likely to fail next) is antiquated. A more forward-looking strategic plan is desired.
   ii. For businesses (particularly small business) including developers, they would like to see a PBR area developed that speaks to collaboration, ease of doing business, and the ability to work with small to medium-sized businesses more easily (also desired by multi-residential). This encompasses things like making plans available, streamlining processes, and allowing greater flexibility for smaller builders.
4. Rates are not seen as overly sensitive today, and stakeholder groups lean toward smart investment (i.e. more than status quo) with protecting water, protecting the river, and elevating drainage renewal being top priorities for investment. This aligns with the public priorities as well.
5. Stakeholders like and appreciated PBR engagement. While groups varied in their ability to rate or comment on specific areas, they took comfort in the breadth of engagement EPCOR was willing to pursue. Nearly all indicated they would be willing to both continue participation and/or participate again. In addition, the desire for access to information was echoed by many of the stakeholder groups. Some for basic understanding (e.g. Indigenous communities wanting to have more informed opinion), and some for the sake of business planning (small to medium sized builders, multi-residential managers).

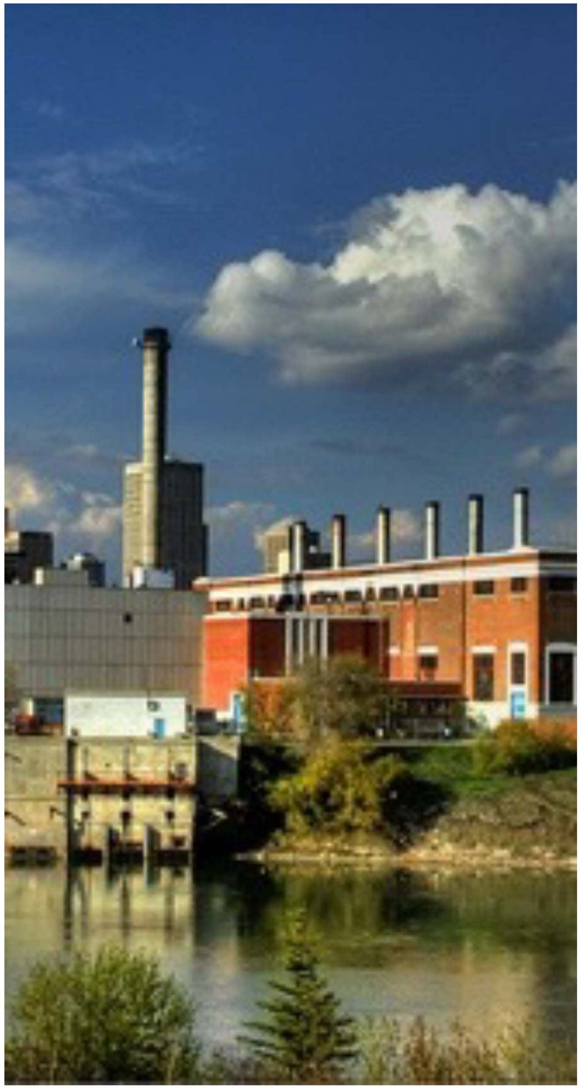
New areas are not expected in this PBR, but seen as important to develop through this phase for the next PBR.

The underlying values are prevention vs. reaction, holistic view (all systems are interconnected), and err on the side of collaboration and transparency (too much information vs. too little)

Stakeholder Summary for

Water Services

- Water Services **has the most confidence of stakeholder groups**, with high praise for water quality, confidence in operational management, and engaging scientists and knowledgeable experts to maintain that standard.
- While there are some (very minor) seasonal issues (particularly in older communities), overall **stakeholder groups feel EPCOR is managing Water Services well and agree with the current performance measures, as well as align to the public weighting of priorities**. If there are any differences at all, stakeholder groups elevate environmental concerns/ management slightly more than the public somewhat for the sake of environment, and somewhat out of deeper understanding of how environment and water quality work together.
- **Water Services is not viewed as a business service that requires remedial attention, rather, it's given highest priority to maintain the standards it has established**. Current rates are not felt to be out of line, and in-spite-of economic concerns, **stakeholder groups would rather see preventative investment rather than remedial repair to mitigate increasing risks.** The only group concerned with rates and encouraging consumer conservation is multi-residential owners/managers, and the client side of social service agencies (i.e., vulnerable and low-income populations). Their tenants are more vulnerable to costs and their usage is often blind (not individually metered) though the business cost side of residential management is more significant as a % of total business costs than other groups.
- **Suggestions for improvement with water have more to do with innovation and forward-looking practices** vs. remediation. E.g., supporting indigenous communities to improve water quality in their areas, environmental innovation, and providing more leadership to improve standards in up and down stream aspects of provincial water management.



Summary of Performance Area Ranking – Public vs. Stakeholder Groups

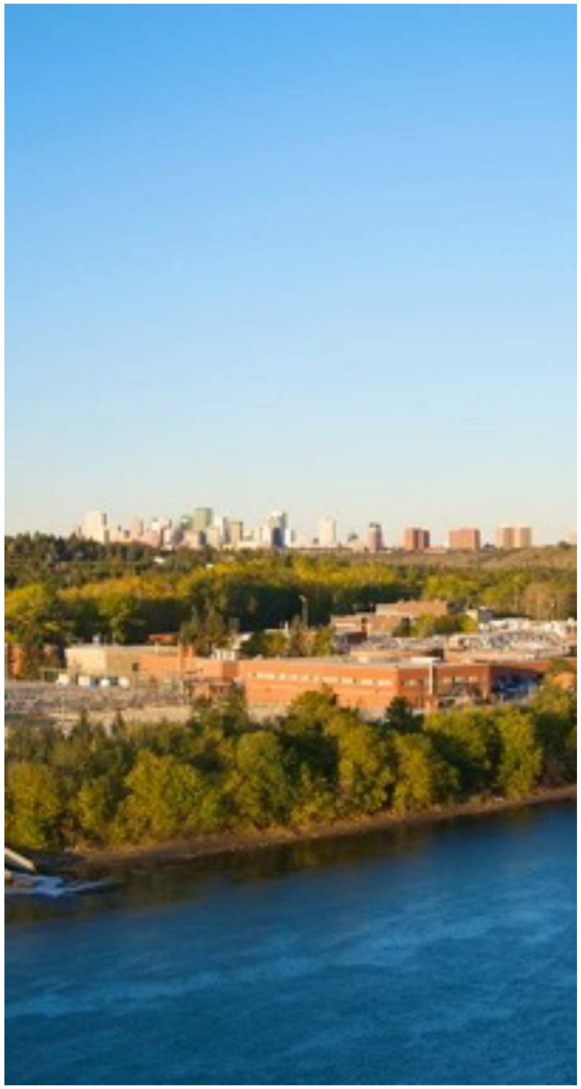
Stone—Olafson

	PBR AREA	WATER SERVICES	Public Survey	STAKEHOLDER GROUPS										
				Multi-Res	Large Users	T6 MNA	Gold bar CLC	CAP	HW Trust	WQTAC	EFCL	IDEA	CHBA	
1st PRIORITY	1. Quality	• Water Quality (safety, clarity, taste, smell)	1	1	1	1	1	1	1	1	1		1	Quality remains the #1 priority for all.
TERTIARY	2. Customer Service	• Customer service (easy access, timely notice of disruptions)	6	6*	4	8	2	5	6	6	3 (timely notice)		4	Community groups show greater concern for transparency of information and notices (desire consultation).
2nd PRIORITY	3. System Reliability & Optimization	• Reduce number of water main breaks	4	4	3	5	6	8	2	5	5		3	Social service agencies are more concerned with breaks (far more vulnerable to interruptions and the resulting costs to recover).
		• Speed of repair of water main breaks	2	5	2	6	5	3	4	8	2		2	
TERTIARY	4. Environment	• Reduce water waste and energy use in supplying water	7	3	7	3	4	7	5	2	7		4	Concerns about environmental impact are higher with a number of stakeholder groups than the public for a variety of reasons; some for general ecosystem protection, while others because they have the technical knowledge of 'whole system impact'.
		• Manage environmental impact to communities	5	8	6	2	3	2	3	7	6		5	
		• Help Edmontonians reduce water consumption	8	2	8	4	8	9	7	4	8		7	
	5. Safety	• Public & employee safety in operations	3	7	5	7	7	4	8	3	4		6	Stakeholder groups have a closer relationship with EPCOR and rank this lower as they see it as table-stakes (a given).

Stakeholder Summary for

Wastewater Treatment

- Wastewater Treatment **has the second highest confidence by stakeholder groups**, with recognition that this is an area that has improved over time and is on a path towards continuous improvement. For many, wastewater treatment is 'invisible' (which is a good thing). The most engaged group was the CLC for Gold bar, who gave full credit to EPCOR for their recent engagement work and improvements in odour management.
- Having said that, **improvements are viewed as a response to previous issues** and is a service area of concern due to the potential impact on the environment. **Greater sharing of information and continued stakeholder/public engagement is strongly desired** for wastewater treatment. Indigenous communities expressed concern about contamination of the North Saskatchewan River. Those with the WQTAC group also indicated that there is an opportunity for greater collaboration and influence with the province to improve standards as more of an integrated view of water quality and management. They feel this is an opportunity for EPCOR's leadership, as the feeling is that provincial standards today are too low.
- **The only real area of question/criticism came from the lack of alignment to city plans**. This came from two groups who felt that Gold Bar would be stressed if urban densification proceeds and feel wastewater routing should be to other locations rather than to Gold Bar.
- Finally, the PBR areas overall are generally consistent with the public priorities, though stakeholder groups raised the priority level of *managing treatment levels*, indicated modelling should be updated (they feel historical factors are less relevant), and would like to see environmental protection represented in a more significant way.



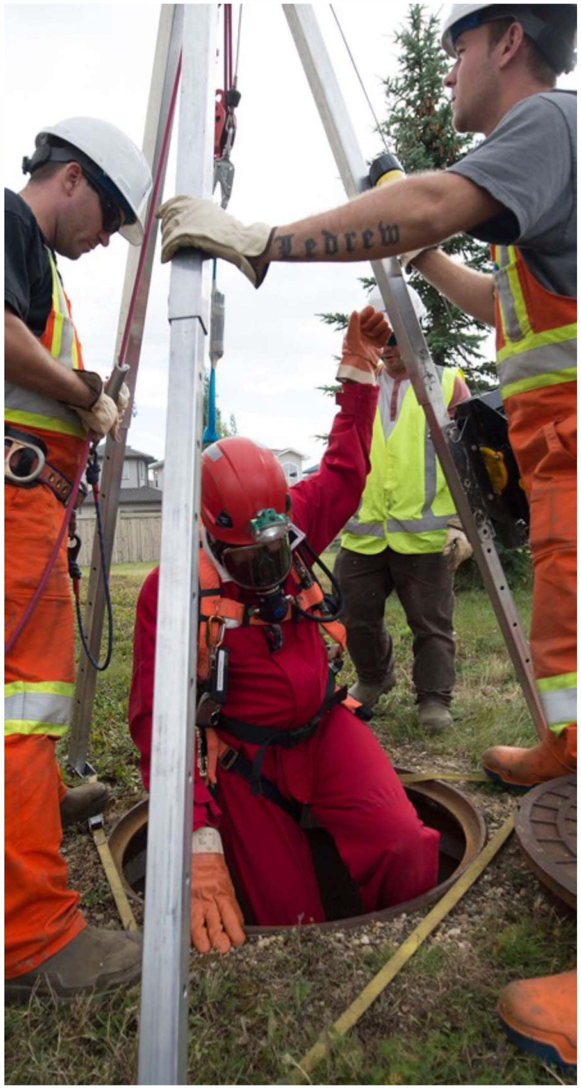
Summary of Performance Area Ranking – Public vs. Stakeholder Groups

	PBR AREA	WASTEWATER TREATMENT	Public Survey	STAKEHOLDER GROUPS: Multi-Res	Large Users	T6 MNA	Gold bar CLC	CAP	H.Ward Trust	WQTAC	EFCL	IDEA	CHBA	
1st PRIORITY	1. Quality	• Reduce wastewater contaminants in treated water going back to the river	1	1	2	1	1	1	1	2	1		1	Reducing contaminants going into the river remains #1 priority for all.
TERTIARY	2. Customer Service	• Customer service (easy access, transparency in information)	6	5	6	7	4	7	4	6	5 Information, transparency		5 *Information, transparency*	The desire for greater information and transparency, including strategic plans that align to urban density strategy are desired.
2nd PRIORITY	3. System Reliability & Optimization	• Managing treatment volumes during rain/melt season	3	3	1	5	2	5	2	1	2		2	Stakeholder groups rate operational performance even higher. Those with a technical background feel more science and innovation is needed, and improved provincial standards.
		• Reducing odor from wastewater treatment	4	6	4	3	3	3	6	4	6		3	
TERTIARY	4. Environment	• Reduce wastewater gas flaring and capture renewable energy	7	7	7	2	7	5	5	7	7		6	Indigenous communities are more concerned with the environmental protection aspect of wastewater treatment. They feel that there are infractions today and more should be done.
		• Reduce water loss and energy use in wastewater treatment	5	4	5	6	5	6	3	5	4		4	
2nd PRIORITY	5. Safety	• Public & employee safety in operations	2	2	3	4	6	2	7	3	3		6	Public and employee safety rated lower with stakeholder groups. Again, not because it's viewed as unimportant, but because it is deemed 'table-stakes'.

Stakeholder Summary for:

Drainage Services

- **Drainage Services is cited by stakeholder groups as the business area most in need of investment for EPCOR**. Satisfaction ratings were slightly lower than other areas, though it was truly not viewed as a competency issue – rather, there is clear understanding that the age of infrastructure requires renewal and this is a costly and time-consuming process with significant interruptions.
- **Drainage services is different from other PBR areas in that the priorities don't align as neatly along the same dimensions.** Further, Drainage Services reflected the greatest variance in opinion between stakeholder groups and the public survey (residential customers). Stakeholder groups placed a higher priority on reducing contaminants going back into the river, and favoured investment to avoid future issues over responsiveness to emergencies.
- **Further, two unique performance areas for Drainage were raised**;
  a) more strategic plan that aligns with the urban densification strategy newly approved by the city of Edmonton, and
  b) a performance area that reflects ease of doing business with the size of companies required to deliver the Edmonton urban strategy (namely, small to medium sized builders). Note that these areas are seen as requiring time to prepare for and develop, thus, they would like to see them worked on in this PBR cycle and added in the next (see IDEA and CBHA).
- Overall, there is a strong push for investment in drainage. This is seen as a shared resource, a significant liability for the city (old standards, old infrastructure, old models, new risks), and an impediment to growth if more aggressive renewal is not achieved. While economic sensitivity was raised by stakeholder groups representing low income and at-risk individuals, the environmental implications and emergency costs associated with issues (particularly back-ups as insurance becomes more stringent) put investment now ahead of any inclinations to hold back. Further, EPCOR is trusted to invest in a prudent and responsible way.



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Summary of Performance Area Ranking – Public vs. Stakeholder Groups

PBR areas did not align to priorities as neatly as other busines units

	PBR Area	DRAINAGE	Public Survey	STAKEHOLDER GROUPS: Multi Res	Large Users	T6 MNA	Gold bar CLC	CAP	H.Ward Trust	W!TAC	EFCL	IDEA	CHBA
1st PRIORITY	**1. Quality/ Environment**	• Reduce contaminants from sewer that enter the river	3	3	5	1	2	1	2	1	4		2
TERTIARY	**2. Customer Service**	• Customer service (easy access for reporting, questions, timely communication)	7	7	7	7	7	9	6	7	7		7
1st PRIORITY		• Quick response time for blocked sewers/emergencies	1	1	3	4	3	3	3	4	1		1
	3. System Reliability & Optimization	• Maintain performance to reduce flood risk	2	2	1	5	1	2	4	2	5		4
2nd PRIORITY		• Investment to maintain integrity of drainage network/reduced blocked sewers	5	4	2	6	4	6	1	5	3		3
TERTIARY		• Reduce water loss and energy use in wastewater treatment	6	6	6	3	5	4	5	6	6		6
2nd PRIORITY	**5. Safety**	• Public & employee safety in operations	4	5	4	2	6	5	7	3	2		5

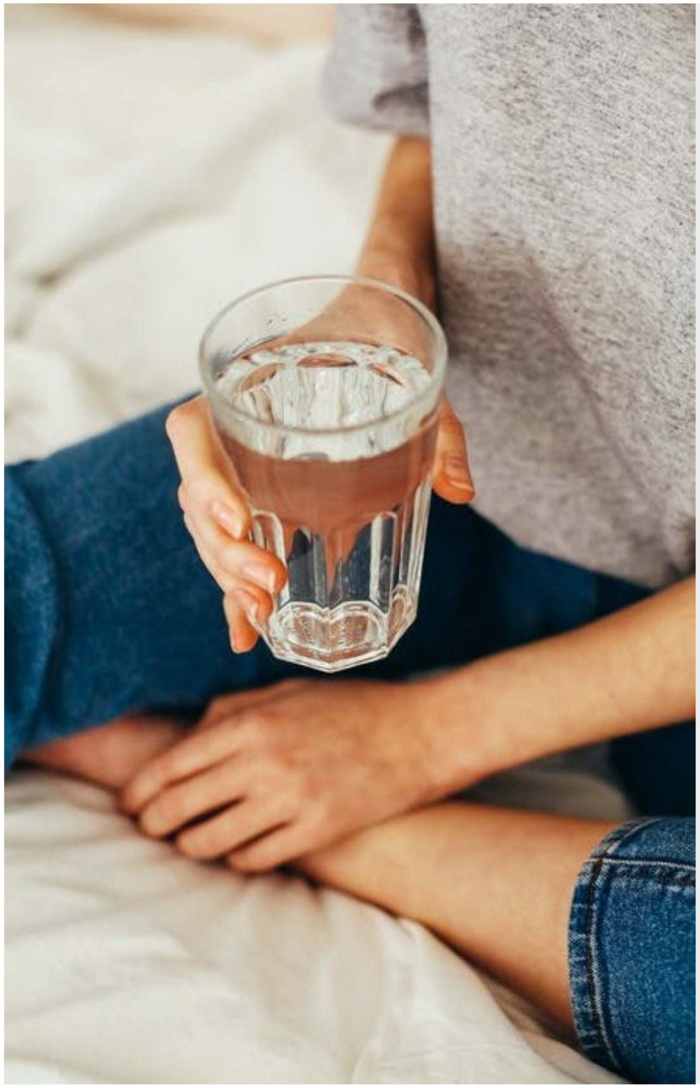
Reducing contaminants was the highest-ranking priority among stakeholder groups, though for it is secondary to flood prevention.

For most, response time is priority #2, though some groups said this is not ideal as prevention is more important than response.

Stakeholder groups were decidedly more interested in expanding investment to become more aggressive with infrastructure renewal vs. maintenance alone. Further, they want to see a new strategy focusing on preparedness vs. maintenance.

Phase 3 Results

Validation of investment intentions and rate sensitivity.



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TOPLINE

Investment Intentions & Rate Sensitivity

- In terms of PBR performance areas, the final validation survey indicates that EPCOR has identified the main issues of importance and customers are in agreement with the priorities.
- Similar to Phase 1 results, customers tend to over-estimate their costs by 50%, yet still agree that their rates are fair. One third are unsure or don't feel they can judge if costs are appropriate.
- Edmontonians support EPCOR investing in services for longer-term benefits, efficiencies, and to reduce risk. At minimum, they want to maintain status quo. This is consistent with Phase 1 results, with only minor softening (.4%)
- Edmontonians are willing to pay an additional $7.82 per month for their water services. Although, because they expect they pay more for their services than they actually do, this number is likely closer to the maximum they can handle. There are some differences by quadrant: residents in West & Central more price sensitive, and those in the Southwest the least sensitive to price increases. Thus, EPCOR's plan of a $4/month increase should be generally accepted by Edmontonians.
- Although, as many are feeling economic hardships because of COVID-19 it will be important to communicate what residents are actually paying and how these price increases will be put to use (i.e., investing in infrastructure), the reasons for making these investment choices, and the benefits for the community.

The Details >

Description of priorities outlined by Phase 1 & 2 research:

EPCOR recently asked a wide range of customers about priorities for the upcoming 5-year period. We learned that top priorities of the community are:

#1 Quality (i.e. water quality/ safety; reducing wastewater contaminants in treated water going back to the river, and reducing contaminants from drainage that enter the river

#2 System reliability & Optimization (i.e. reducing the number of water main breaks and speed of repairs, managing wastewater treatment volumes during rain/melt seasons, reducing number of blocked sewers)

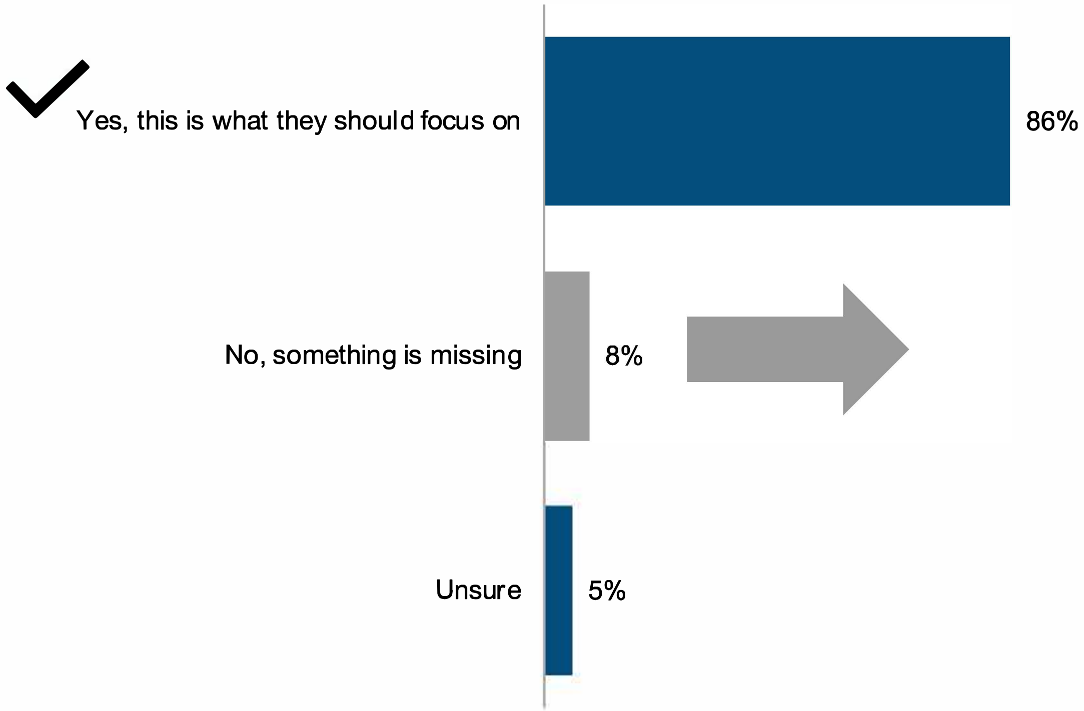
#3 Safety (i.e. public and employee safety in operations)

#4 is a tie between:

- **Customer service** (i.e. easy access to report any issues, customer service/support that is easily available to ask questions, receiving timely notices of maintenance that may disrupt service, information transparency about wastewater treatment operations)
- **Environment** (i.e. reducing water consumption, reducing water waste, reducing energy use in water supply, overall mitigation of environmental impact in supplying water to communities)

The vast majority of Edmontonians agree with the priorities laid out from phases 1 & 2.

Agreement with PBR Priorities

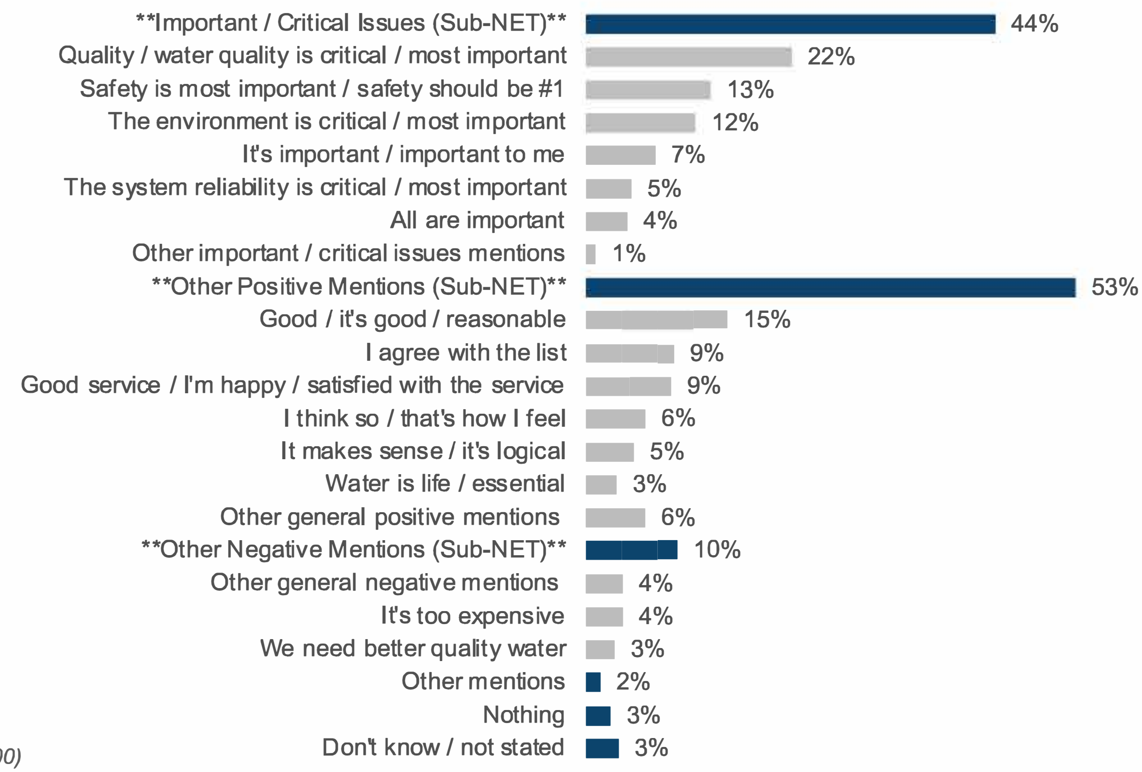


Residents satisfied with EPCOR Water Services and believe current rates are fair are most likely to agree with PBR focus.

Missing mentions include:
- The cost/lower the price (38%)
- Safety should be number 1 (14%)
- Environment should be priority (12%)
- It should be all about quality (10%)
- Water should be softer, less hard (6%)

Base: All respondents: (n=500)
Q3. Do you agree with these priorities?

In general, Edmontonians agree with the list because water quality is critical, it is good (quality), and reasonable. Although once reviewing the final list, some emphasized safety and environment are also important.



Base: All respondents: (n=500)
Q4. Why do you say that?

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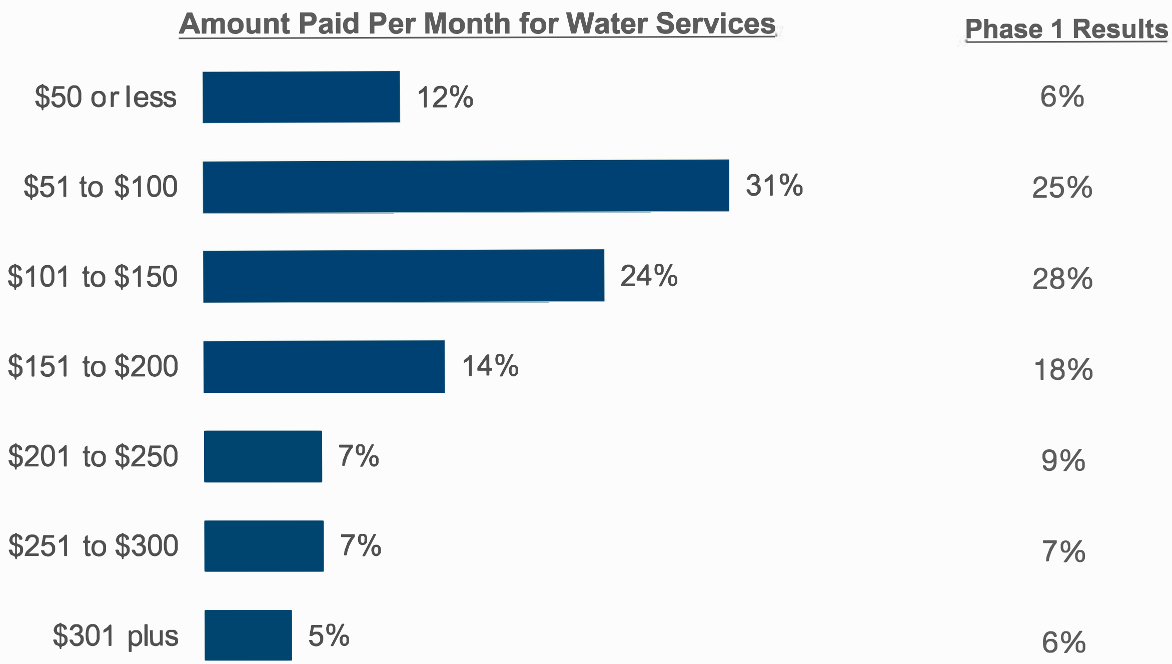
Consistent with the first phase of research, residential customers report their water services are 50% higher than actual at $148.30 monthly (actual average residential customer pays $88.03 for all three services combined).

Although nearly one-third are unsure of how much they pay for these services.



Average:
$148.30
Phase 1 average:
$173.60

Unsure:
30%
Phase 1: 14%

Base: All respondents: (n=500)
PS1. The monthly rates charged for water supply, wastewater treatment, and sewer/drainage services are determined through bylaw principles and used to both operate and maintain/improve the system. Approximately how much do you pay per month for these services for your household?

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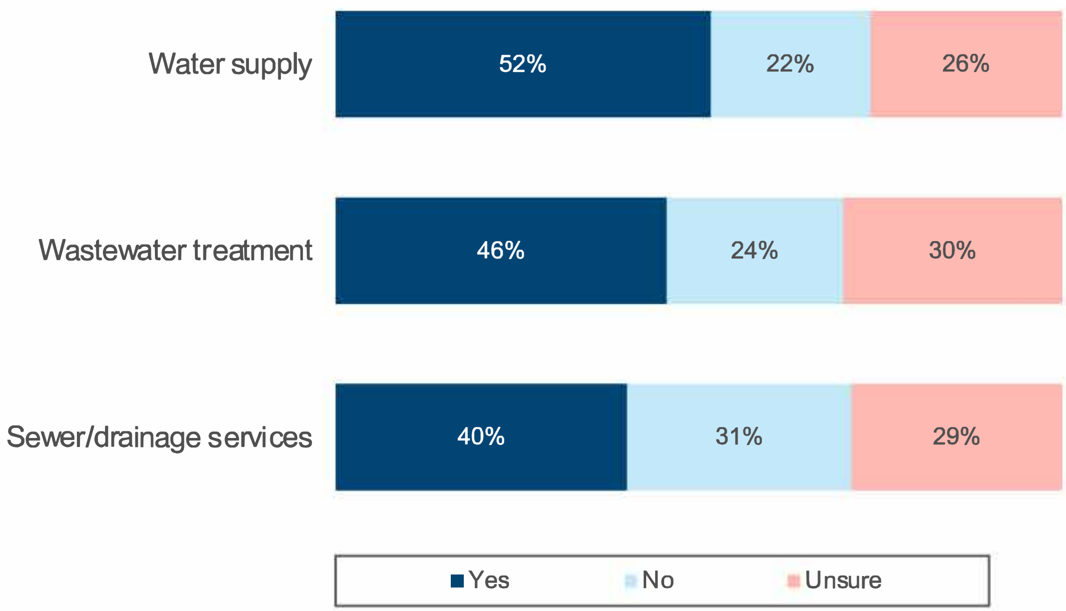
Residential customers are more likely to believe their rates are fair than unfair, with one-in-four unsure.

Detailed Breakdown: Fair Services (Residential)



Phase 1 Results: %Yes

41%

35%

31%

The more satisfied with EPCOR the more likely to indicate service charges are fair.

Males and West residents are most likely to believe rates are not fair.

Base: All respondents: (n=500)
PS2. The monthly rates charged for water supply, wastewater treatment, and sewer/drainage services are determined through bylaw principles and used to both operate and maintain/improve the system. In your opinion, is the rate you pay for these services today fair?

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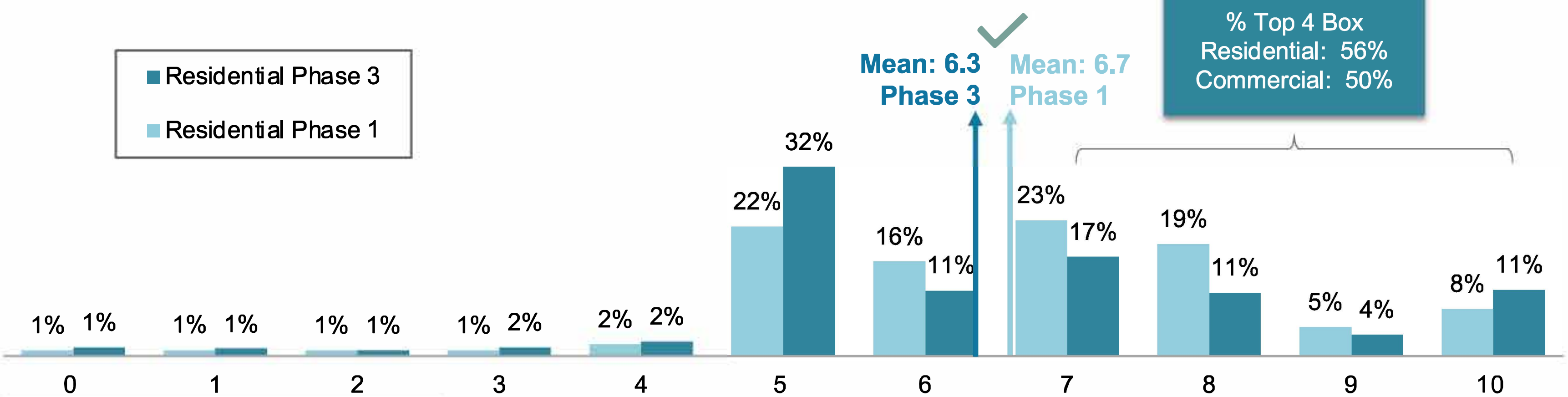
Edmontonians are willing to invest more in services to avoid risk and allow for longer-term benefits and efficiencies, with very few calling for minimal investments. Comparing investment appetite between the first phase of research and second, there was a slight softening (.4 per below). It should be noted more stringent lock-down measures were put in place because of COVID-19, Edmontonians may be more sensitive to rate increases than in July.

Those most likely to be willing to invest have: a household income of over $100,000/annually, have not been impacted by COVID-19, believe current rates are fair, and are satisfied with EPCOR services.

Personal Position on Investment Scale



Absolute minimal investment, even if it puts current water, wastewater treatment, and stormwater/sewer drainage services at slightly more risk.

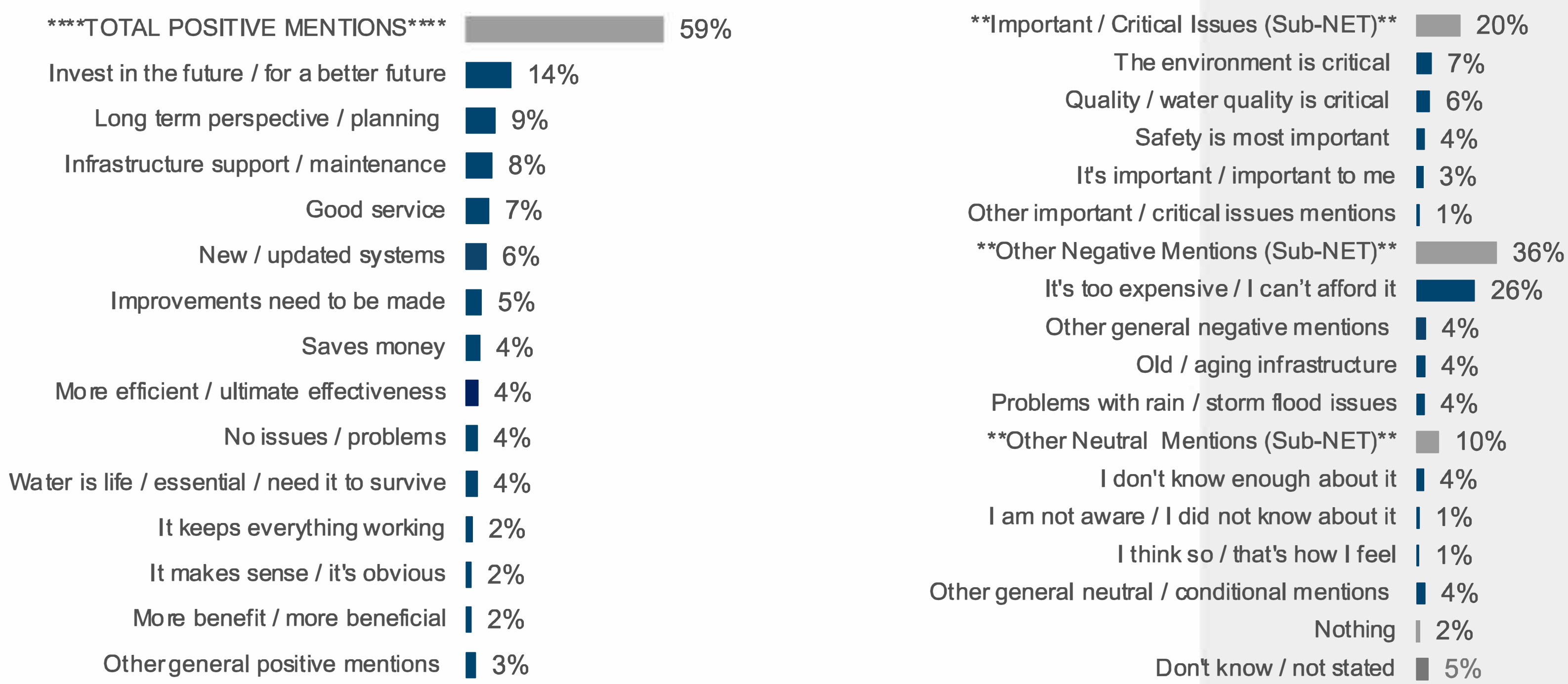
Moderate investment, maintain the current service level.

Slightly higher investment for greater long-term efficiencies (e.g. reduce flood risk, system failure risk/repair, reduced business interruption, reduced environmental impact etc.)

Base: All respondents: (n=500)
PS3. Looking ahead to the next several years, in principal, where would you position yourself on the following investment scale?

EPCOR PBR 2020 Phase 3

In general, Edmontonians believe that increased investment is positive: investing and planning for the future is necessary. Although, one-in-four are worried about their own finances, indicating it is already expensive.



Base: All respondents: (n=500)
PS4. And why do you feel that way?

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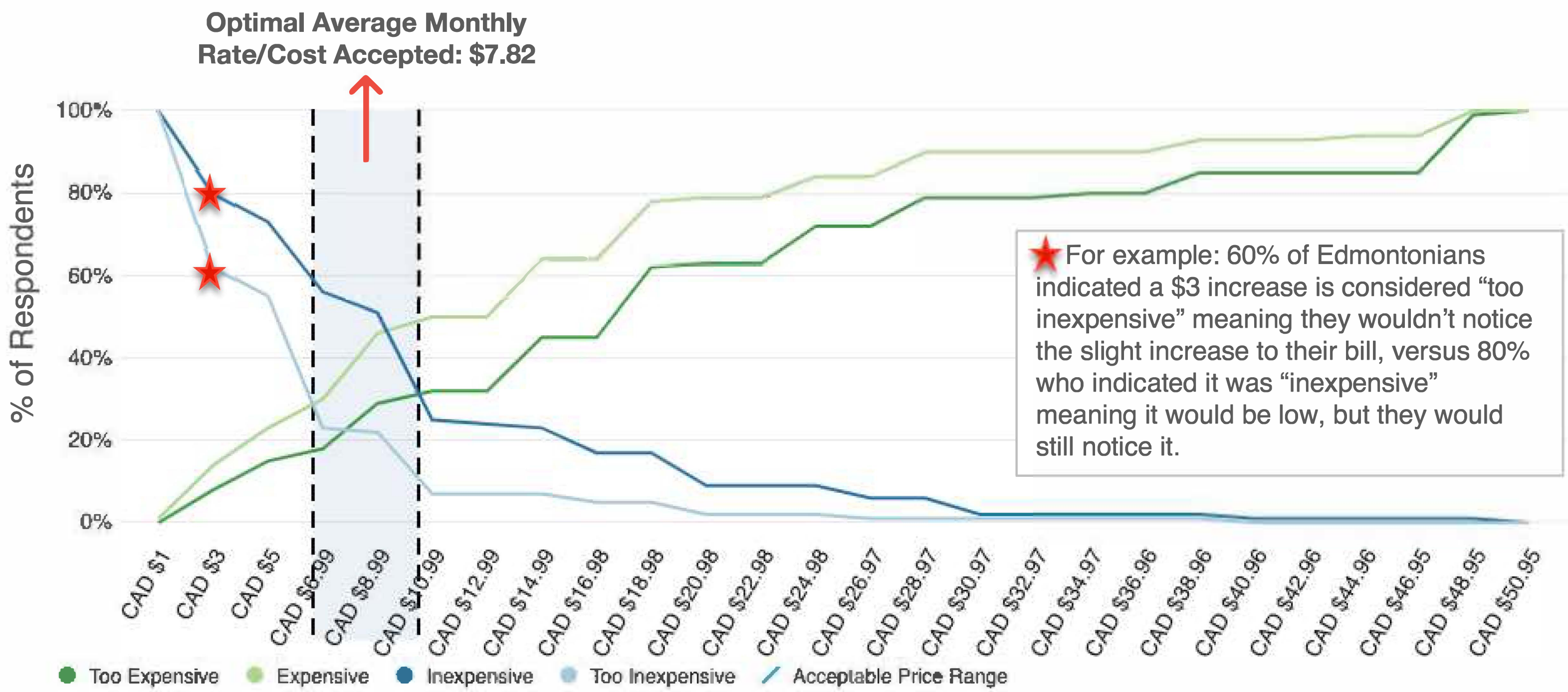
Price Expectations: Edmontonians indicate the ideal monthly price increase should be around $7.82, although are open to a range of $6.63-$10.51.



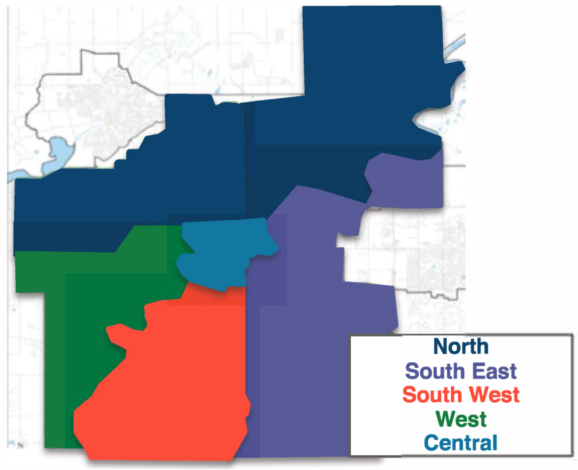
Optimal Monthly Cost Range: CAD $6.63 to CAD $10.51

For more information on this type of analysis, please see the Appendix slide: Van Westendorp Pricing Methodology.

By Quadrant: Edmontonians who live in the West & Central are most price sensitive, with those in the Southwest the least price sensitive.

Southwest

	Phase 3	Phase 1
Satisfaction % Top 2	64%	67%
Invest to Improve % Top 4	41%	56%
Range of **Acceptable** Prices	$6.37 - $7.93	
Ideal price	$6.62	



North

	Phase 3	Phase 1
Satisfaction % Top 2	60%	57%
Invest to Improve % Top 4	41%	50%
Range of **Acceptable** Prices	$4.80 - $6.57	
Ideal price	$5.36	

West

	Phase 3	Phase 1
Satisfaction % Top 2 box	47%	64%
Invest to Improve % Top 4	39%	55%
Range of **Acceptable** Prices	$4.17 - $5.24	
Ideal price	$4.27	

Most likely to disagree that EPCOR rates are fair.

Southeast

	Phase 3	Phase 1
Satisfaction Top 2 box	65%	67%
Invest to Improve % Top 4	43%	53%
Range of **Acceptable** Prices	$5.34 - $7.05	
Ideal price	$5.65	

Central / Inner City

	Phase 3	Phase 1
Satisfaction % Top 2 box	54%	57%
Invest to Improve % Top 4	52%	63%
Range of **Acceptable** Prices	$5.23 - $5.44	
Ideal price	$4.61	

Thank you.

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Appendix L1

EPCOR WATER SERVICES INC.

Corporate Costs Allocation Methodology

February 16, 2021

1.0 OVERVIEW

1. EPCOR Water Services Inc. ("EWSI") obtains corporate service from its parent corporation, EPCOR Utilities Inc. ("EUI" or "EPCOR"). Corporate services are comprised of activities that are centrally managed within the EPCOR group due to their nature and/or for the purpose of realizing economies of scale and greater effectiveness. The amounts paid by EWSI in respect of these services include Corporate Shared Service costs. The Corporate Shared Service costs are determined on a cost recovery basis in accordance with EPCOR's Inter-Affiliate Code of Conduct and are reflected in a Service Agreement between the parties.

2. This section describes the corporate services received from EUI and the allocation process used by EUI to EWSI as well as the allocation process from EWSI to the City of Edmonton water and wastewater treatment operations. To the extent possible the same allocation methodology was used by EWSI to allocate costs to City of Edmonton water and wastewater treatment operations as those used by EUI; however, in certain cases, the methodology was changed to better reflect the cost drivers or to choose cost drivers where an equivalent cost driver was not available at the EWSI level. The process used to develop the forecast of Corporate Shared Services costs is described in Section 1.1.1. The process used to allocate Corporate Shared Services costs to the business units is described in Section 1.1.2 below.

3. Appendix N-02 describes the services and associated costs related to shared services that are provided from EWSI to the City of Edmonton water and wastewater treatment operations. These services are provided by functional groups that are part of the EWSI business unit. For some functional categories, such as Human Resources, Supply Chain and Public and Government Affairs, services are provided from both EUI and EWSI. In these instances, the services provided by EUI tend to be limited to governance, oversight and broad policy considerations, while the services provided by EWSI are more tactical and are specifically driven by the business needs of EWSI. In the case of Information Services, the EUI cost allocation is generally related to corporate applications such as the financial and human resources systems while EWSI Information Services costs are generally related to applications and technical infrastructure unique to EWSI, such as the geographic information system (GIS).

1.1 Corporate Service Cost Forecast Process

4. The forecast Corporate Shared Services costs for the 2021 base year are based on EUI's 2021 budget, which was prepared in Q1, 2020. In developing its budget, EUI used a "bottom up" approach to forecast expenditures based on the best available information with respect to expected work activity and cost levels.

1.2 Corporate Service Cost Allocation Process

5. Consistent with its approach in previous years, EUI allocates Corporate Shared Services costs to the EPCOR business units using the following five step process:

1. Categorize Corporate Shared Services costs as directly assignable or allocable.
2. Assign directly assignable costs to the appropriate business unit.
3. Review/develop/modify allocation method for allocable costs.
4. Apply allocation method to allocable costs.
5. Conduct a final review for reasonableness.

Step 1 - Categorize Corporate Shared Services costs as either directly assignable or allocable.

6. The first step in developing Corporate Service Charges was to review the components of Corporate Shared Services costs and categorize them into two defined groups:

- Directly assignable costs; and
- Allocable costs.

7. Directly assignable costs are those costs that are directly associated with a particular business unit's activity or operation. The relevant Corporate Services department and business unit work together to determine the quantum of directly assigned costs, if any, related to the Corporate Service in question.

8. Allocable costs are those costs that provide benefits to EUI business units but by their nature cannot be directly assigned and are charged to business units using an appropriate cost allocator. These costs are allocated among EPCOR business units using cost allocators that reflect the factor or factors that drive the cost of providing the Corporate Service to each business unit.

9. Directly assignable Corporate Services costs include the following:

- Certain information system operating costs that can be directly attributable to business units (e.g., support costs for business unit specific applications and databases; server costs and licensing fees that relate to business unit specific applications; and desktop support costs for desktops that are used by a business unit).
- Space Rent costs for office space in the EPCOR Tower.
- Security costs incurred directly on behalf of business units.
- Health and Safety costs incurred directly on behalf of business units to develop and implement an ergonomics program.

Step 2 - Assign directly assignable costs to Business Units

10. Once the directly assignable costs are identified and determined they are charged directly to each business unit. Directly assignable costs are included in the budgets of the business units and are not included in the budgets of the respective Corporate Service departments.

Step 3 - Review/develop/modify allocation method for allocable costs

11. EPCOR's cost allocation process is designed to ensure that the allocation of Corporate Shared Services costs among business units is appropriate, fair and reasonable, cost-effective, predictable, reflects the benefit received by function (i.e., cost causation), and is consistent with the transfer pricing principles in EPCOR's Inter-Affiliate Code of Conduct.

12. The costs associated with a Corporate Services department, except for the Treasury department, are allocated on one of two bases: (i) using a "functional cost causation allocator"; or (ii) using a "composite cost allocator".

13. A functional cost causation allocator has been used where the costs can be logically allocated using an identified cost causation driver, such as headcount. The composite cost causation allocator has been used where the costs cannot be allocated using a particular functional cost causation allocator. The latter types of costs tend to be related to Corporate Services that are of a governance nature, and it is appropriate that these types of costs be allocated based on a composite cost allocator which factors in the business unit's share of EPCOR's group revenues, assets, and headcount.

14. The allocation methods applicable to EUI's allocable Corporate Shared Services costs for 2021 to 2026 are summarized in Table 1.2-1 below.

Table 1.2-1
Allocation Methods by Department and Function

	Department and Function	A EUI – EWSI Allocators	B EWSI – Edmonton water and wastewater operations Allocators
	Board Costs		
1	All Costs	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
	Executive and Executive Assistants		
2	Executive & Executive Assistants	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount Headcount – (SVP Corporate Services)
	Corporate Finance Services		
3	Corporate Finance	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
4	Accounts Payable	Functional Cost Causation – AP Invoice Lines	Functional Cost Causation – EWSI Invoice Lines
5	Management Development Program	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
6	Accounts Receivable	Functional Cost Causation – AR Invoice Lines	Composite – EWSI Revenue, Assets, Headcount
	Treasury		
7	Treasurer - Corporate Finance	40% PPE, 30% Capital Expenditures, 30% Acquisitions	Composite – EWSI Revenue, Assets, Headcount
8	Treasury Operations	50% of (Net Income + Depreciation), 50% Debt	50% of (Net Income + Depreciation), 50% Debt
9	Taxation	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
	Audit & Risk Management		
10	Internal Audit	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
11	Risk Management	Functional Cost Causation - PP&E	Functional Cost Causation - PP&E
12	Centre of Excellence	Composite - EUI Revenue, Assets, Headcount	Composite - EUI Revenue, Assets, Headcount
	Human Resources		
13	Total Rewards	Functional Cost Causation – Headcount	Functional Cost Causation –EWSI Headcount
14	Human Resources Consulting	Functional Cost Causation – Headcount	Functional Cost Causation –EWSI Headcount
15	Talent Management	Functional Cost Causation – Headcount	Functional Cost Causation –EWSI Headcount
16	Learning and Development	Functional Cost Causation – Headcount	Functional Cost Causation –EWSI Headcount
	Information Services		
17	Application Services	Functional Cost Causation - Headcount	Functional Cost Causation – Total Assets
18	Infrastructure Operations	Functional Cost Causation - Direct IS Costs	Functional Cost Causation – PC Count

	Department and Function	A EUI – EWSI Allocators	B EWSI – Edmonton water and wastewater operations Allocators
19	Major Capital Projects	Functional Cost Causation - Headcount	Functional Cost Causation – Total Assets
	Supply Chain Management		
20	Corporate procurement	Functional Cost Causation - Purchase Order Lines	Functional Cost Causation - Purchase Order Lines
21	Real Estate	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
22	Mailroom	Functional Cost Causation – Canadian Headcount	Functional Cost Causation – EWSI Headcount
23	Security	Functional Cost Causation – Canadian Headcount	Functional Cost Causation – EWSI Headcount
24	SCM Corporate Services - Tower Rent, Maintenance, Security	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
25	Disaster Recovery Planning	Functional Cost Causation - Direct IS Costs - Canadian	Functional Cost Causation – PC Count
	Public and Government Affairs ("P&GA")		
26	Community Relations	Functional Cost Causation - Net Income	Composite – EWSI Revenue, Assets, Headcount
27	Corporate Communications	Functional Cost Causation - Net Income	Composite – EWSI Revenue, Assets, Headcount
28	Government Relations	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
29	Director, Public & Government Affairs	Functional Cost Causation - Weighted Average of Costs for P&GA	Functional Cost Causation - Weighted Average of Costs for P&GA
	Legal Services		
30	All functions	Composite - EUI Revenue, Assets, Headcount	Composite – EWSI Revenue, Assets, Headcount
	Health, Safety and Environment		
31	All Functions	Functional Cost Causation - Headcount	Functional Cost Causation - Headcount
	Incentive Compensation		
32	All Costs	Average Corporate Cost Allocation	Average Corporate Cost Allocation
	Asset Usage Fees		
33	Leasehold Assets	Proportional Corporate Costs.	Composite – EWSI Revenue, Assets, Headcount
34	Human Resource System	Functional Cost Causation - Headcount	Functional Cost Causation – EWSI Headcount
35	Information Systems	Direct IS Operating Costs	Average Corporate IS Costs Allocated
36	Financial System	Corporate Finance & Purchasing Cost	Corporate Finance & Purchasing Cost
37	Furniture and Fixtures	Proportional Corporate Costs	Composite – EWSI Revenue, Assets, Headcount
38	Customer Information System	Proportional Customer Sites	Proportional Customer Sites

Step 4 – Apply allocation methods to allocable costs

15. Once the allocation methods are determined, they are applied against EUI's final budgeted Corporate Services costs to arrive at the amounts charged to each business unit.

Step 5 - Final review of Corporate Service Charges for reasonableness

16. The resulting Corporate Services charges were carefully reviewed by EUI and EWSI senior management to confirm that the process set out above was properly applied, and that the resulting charges were reasonable.

1.3 Direct Assigned Corporate Costs

17. Certain costs are directly assigned from EUI to its business units. These direct assigned costs include information services ("IS") application support, IS infrastructure support (i.e., desktops, servers, network, databases, printers, etc.), space rent at EPCOR Tower, corporate security and health and safety costs.

1.4 Allocated Corporate Costs

18. Further details regarding the allocated corporate costs are provided for each Corporate Service department in the subsections that follow.

1.4.1 Board Costs

19. EUI's Board of Directors (the "Board") provides corporate governance functions to EWSI and other EPCOR subsidiaries. The governance functions include:

- Establishing the strategic objectives and direction of the EPCOR group.
- Maintaining and enforcing articles and corporate bylaws.
- Electing and appointing corporate officers.
- Delegating special authorities to management.
- Reviewing and approving corporate policies.
- Providing direction and oversight to safeguard and maintain the long-term value of corporate assets.
- Reviewing and approving significant financial matters.
- Making recommendations to the shareholder.

- Participating in the strategic planning process for the EPCOR group.
- Approving capital and operating budgets to meet the objectives established in the EPCOR group's strategic plan.
- Approving compensation policies and programs for employees.
- Evaluating and assessing corporate performance against strategic, operating and capital plans.
- Understanding and monitoring corporate business risks.
- Approving and monitoring compliance with all significant corporate policies and procedures.
- Directing management to ensure compliance with legal requirements.

20. Board costs include Director's fees, Director and Officer insurance costs, travel expenses, legal fees incurred at the Board level and other related expenses.

21. The Board is comprised of members that are independent from EPCOR, which ensures that there is an appropriate segregation of duties and responsibilities between the Board and CEO. This independence in oversight is a best practice in governance and is necessary to ensure that EUI and its subsidiaries meet their obligations and responsibilities free from conflicts of interest.

22. The Board members are not members of management and have no direct or indirect material relationships with EPCOR; as such, the Board members provide a third party service to EUI and its subsidiaries. Board members are appointed by the City of Edmonton in its role as shareholder of EUI, and are compensated for their services. Director compensation is regularly reviewed by the Corporate Governance & Nominating Committee, which receives independent advice from a third party compensation expert, and makes recommendations to the City of Edmonton to determine Directors' compensation.

1.4.2 Executive and Executive Assistants

23. Executives provide governance and leadership services to EWSI and other EUI subsidiaries. These activities include:

- Establishing and recommending broad corporate policies for approval by the Board of Directors.

- Reviewing and recommending significant financial matters/decisions for approval by the Board of Directors.
- Developing corporate-level strategy and plans for approval by the Board of Directors.
- Carrying out the special authorities delegated by the Board of Directors.
- Establishing and maintaining an adequate control framework in relation to internal controls over financial reporting and disclosure controls and procedures, conducive to fulfilling compliance with National Instrument 52-109, the Canadian legislation equivalent to the United States Sarbanes–Oxley Act (commonly referred to as "CSOx").
- Establishing appropriate processes, procedures and controls to ensure the EPCOR group fulfills its statutory obligations to provide utility services and contractual obligations to service its commercial customers.
- Corporate Secretarial services include providing assistance with Board, Committee and Shareholder material submissions and preparing resolutions.

24. The costs are made up of salaries and related costs for four senior EUI Executives and their respective Executive Assistants ("EAs"). The four senior Executives include:

- President and Chief Executive Officer ("CEO");
- Senior Vice President and Chief Financial Officer ("CFO")
- Senior Vice President, General Counsel and Corporate Secretary; and
- Senior Vice President Corporate Services.

25. Four EAs provide administrative support for the four Executives' activities.

26. Executive leadership and related support is needed to provide corporate governance and oversight over EPCOR group business operations; to develop policies and provide strategic direction for EUI and its subsidiaries; to make strategic-level decisions on significant financial matters; to manage the enterprise risk of EUI and its subsidiaries; and to ensure that the EPCOR group has the overall resources necessary to enable it to meet the group's duties and obligations.

1.4.3 Corporate Finance

27. The Corporate Finance department provides services to EWSI and other EUI subsidiaries in the areas of:

- Accounts Payable;
- Corporate Accounting;
- Consolidated Reporting and Analysis;
- Management Development Program;
- Audit Fees; and
- Accounts Receivable.

1.4.3.1 Accounts Payable

28. The Accounts Payable function maintains vendor master files that are used for various purchasing, contract management and vendor payment functions. In addition, the Accounts Payable department is responsible for the management of procurement cards and processes all vendor invoices, credit notes and adjustments for payment on a periodic basis. The Accounts Payable function also develops and maintains all of the accounts payable related forms, policies, procedures and controls to be applied by all EPCOR's activities.

29. Accounts Payable is necessary for EWSI and other EUI subsidiaries to provide utility service as each utility incurs costs from external parties related to utility service and these costs require payment. Accounts Payable classifies costs for management reporting and analysis purposes and ensures that invoices are paid on time. In doing so, Accounts Payable can take advantage of cash discount terms where appropriate.

1.4.3.2 Corporate Accounting

30. The Corporate Accounting function provides accounting support for corporate operating and capital costs incurred by EPCOR's shared services. Corporate Accounting also includes accounting activities in support of the financing provided to EUI subsidiaries as well as calculating the allocation of corporate costs to each of the EPCOR subsidiaries and maintaining and reviewing the allocation methodologies applied to those corporate costs to ensure they are fair, reasonable and reflective of services provided. In connection with these activities, the Corporate Accounting group assists with the preparation of all regulatory related documentation and filings involving the allocation of corporate costs.

1.4.3.3 Consolidated Reporting and Analysis

- The Consolidated Reporting and Analysis group is responsible for the preparation of consolidated financial statements and analysis and discussion of the results. More specifically, this includes:
  - Ensuring appropriate accounting policies are developed and the relevant accounting standards are properly and consistently applied by all EPCOR subsidiaries;
  - Ensuring appropriate internal controls over financial reporting are developed and consistently applied by all EPCOR subsidiaries to ensure that EUI interim and annual consolidated financial statements accurately and fairly present the financial results of the company;
  - Preparing EUI interim and annual consolidated financial statements and management discussion and analysis as required under securities regulation;
  - Preparing internal consolidated financial statements and analysis for executives.
  - Reviewing audited financial statements prepared by EUI subsidiaries to ensure they are prepared in accordance with accounting standards and consistent presentation and disclosure with the audited consolidated financial statements of EUI;
  - Providing the executive with profitability, cost-effectiveness and other analyses as required; and
  - Managing the annual budgeting and quarterly re-forecasting processes for all of EPCOR including performing various ad hoc analyses as required by EUI and its various subsidiaries.

1.4.3.4 Management Development Program

31. The Management Development Program develops junior level finance, accounting and business management employees for mid-level roles across the EPCOR group. The program was designed to internally develop trainees in EPCOR's processes and its systems, policies and procedures with the aim of developing employees with greater familiarity with EPCOR businesses as an alternative to hiring external candidates to fill vacancies. The program increases the retention of talent, knowledge and the continuation of good practices and departmental policies. Finally, program trainees form a pool of resources to draw from as necessary as an alternative to using higher cost temporary workers and contractors to assist with special projects.

1.4.3.5 Audit Fees

32. Audit Fees relate to the outsourced function of performing audits and quarterly reviews of EUI's annual and quarterly interim consolidated financial statements.

33. External financial statement audit services are necessary for EWSI to provide utility service. In order to access capital, EWSI relies on EUI to meet the financial reporting requirements set by creditors. If EUI's financial statements are not audited, access to capital could be restricted, which could in turn limit the utilities' ability to make infrastructure investments.

34. By statute, financial statement audits can only be provided by chartered accounting firms. Therefore, the Audit fees function is solely comprised of external resources.

1.4.3.6 Accounts Receivable

35. The Accounts Receivable function established January 1, 2021 is responsible for the management and processing of all customer invoices (excluding customer utility billings), credit notes and adjustments on a periodic basis. The Accounts Receivable function also develops and maintains all of the accounts receivable related forms, policies, procedures and controls to be applied by all EPCOR's activities.

36. Accounts Receivable is necessary for EWSI and other EUI subsidiaries to provide utility service as each utility has commercial and intercompany activities that require invoicing to external and intercompany parties to ensure timely collection.

1.4.3.7 Treasury

37. The Treasury department provides the following services to EWSI and other EUI subsidiaries:

- Treasurer – Corporate Finance;
- Treasury Operations; and
- Taxation.

1.4.3.8 Treasurer – Corporate Finance

38. The Treasurer – Corporate Finance function performs the services associated with raising capital, primarily through the issuance of debt, necessary to finance EWSI's and other EPCOR

subsidiaries' capital expenditures and working capital requirements. The activities within this service include:

- Arranging and maintaining operating credit facilities with lenders.
- Preparing prospectuses for EUI's issuance of public debt for the benefit of EWSI and other EPCOR subsidiaries.
- Raising capital in the public and private markets for EUI and its subsidiaries.
- Meeting with credit rating agencies and providing the information required by the rating agencies to provide credit ratings.
- Preparing short-term and long-term loan arrangements between EUI and the subsidiaries.
- Performing credit reviews and analysis of commercial counterparties for EUI and its subsidiaries.
- Providing subsidiaries with financing and capital structuring advice for capital projects and acquisitions.
- Managing the strategic planning process and developing EUI's corporate strategy and annually refreshing its five year long-term plan; assisting EUI subsidiaries in developing their long-term plans; developing and maintaining the EPCOR groups' long-term planning model; providing financial and analytical support to EUI subsidiaries in relation to long-term planning; and completing an annual valuation of EUI and its subsidiaries.
- Providing financial projections that underlie the strategic plan and preparing other long range financial forecasts.
- Providing business development support to EUI and its subsidiaries.

39. The Treasurer – Corporate Finance function's activities are necessary for EWSI to provide utility service. The ability to raise capital is fundamental to the sustainability of utility operations and the Treasurer – Corporate Finance function lowers costs by optimizing borrowings and negotiating cost-effective terms and conditions.

1.4.3.9 Treasury Operations

40. Treasury Operations provides banking and cash management services to EWSI and other EPCOR subsidiaries. The activities within this service include:

- opening and closing bank accounts;
- cash forecasting and processing;
- accounting for all of the treasury transactions and loans between EPCOR entities; and
- managing exposure to foreign currency and interest rate fluctuations on behalf of all EPCOR entities.

41. Treasury Operations services are activities that are necessary for EWSI to provide utility service. This function ensures that the EPCOR group's short-term working capital requirements are met and that there is an availability of cash on a day-to-day basis.

1.4.3.10 Taxation Services

42. Taxation Services include all reporting and compliance related to taxes, inclusive of property taxes and linear taxes related to business unit property and utility assets, Goods and Services Taxes ("GST") and harmonized Sales taxes ("HST") related to business unit operations, Provincial Sales Taxes ("PST") related to business unit operations, Canadian and U.S. federal, provincial and state income taxes in relation to taxable business units, non-resident withholding taxes ("NRWT") on services performed on behalf of the business units by non-resident corporations, contractors and consultants, and customs duties related to materials and equipment imported by the business units.

43. The activities performed by the Taxation group include:

- Preparing and filing returns and remittances related to GST, HST, PST, income taxes, property and linear taxes, and NRWT.
- Reviewing the appropriateness and accuracy of assessments and reassessments issued by tax authorities in relation to all forms of tax, including the preparation and filing of any required notices of objection.
- Performing research and generally maintaining a current level of knowledge related to all present and proposed forms of tax to ensure compliance with related rules and regulations conducive to minimizing interest and penalties on assessment and reassessment.
- Planning and executing system and process changes required to implement new and revised taxes and tax rates (e.g., changes in HST and GST rates).
- Performing employee training sessions on the various forms of tax to ensure compliance at the business unit level.

- Providing advice to Corporate and business unit management on the development of policies and procedures that may be affected by any form of tax.
- Performing acquisition due diligence.
- Liaising with federal, provincial, state, municipal and county auditors on behalf of the business units in relation to audits performed of any form of tax.
- Providing tax planning services to minimize tax expenses.

44. The Taxation group ensures that EWSI is compliant with all tax legislation. This group also devises tax strategies to ensure that EWSI has minimized its GST, PST, and NRWT, property tax, linear tax and income tax liabilities.

1.4.4 Audit and Risk Management

45. The Audit and Risk Management department provides the following services to EDTI and other EUI subsidiaries:

- Internal Audit;
- Risk Management; and
- Centre of Excellence.

1.4.4.1 Internal Audit

46. The Internal Audit ("IA") department, formerly referred to as Risk Assurance and Advisory Services ("RAAS"), provides services to EWSI and other EUI subsidiaries in the areas of:

- Administration of the EPCOR group's internal program that ensures compliance with National Instrument 52-109, the Canadian legislation equivalent to the United States' Sarbanes-Oxley Act (commonly referred to as "CSOx"), including:
  - Providing administration, oversight, advisory and testing services to assist management in meeting its reporting obligations with respect to Disclosure Controls and Procedures ("DC&P'') and Internal Controls over Financial Reporting ("ICoFR").
  - Coordinating quarterly CSOx sub-certifications with internal business process owners on the design and effectiveness of the key controls mitigating financial reporting risk.

  - Continuing to improve and align internal business processes and accompanying controls with the external auditor to effectively meet the objectives of this program and improve overall internal and external audit efficiencies.
- Providing assurance and advisory services under the EPCOR group's annual risk based audit plan to independently examine, evaluate and report on the adequacy, effectiveness and efficiency of the systems of internal controls across EPCOR's operations. Specific types of services include operational audits, information systems audits, environmental, health and safety audits, fraud detection and prevention, and audit advisory services.
- Managing the follow-up of open audit items, including reporting to Senior Management and the Audit Committee, to ensure audit items are remediated in a timely manner.

47. The activities performed by IA are necessary for EWSI to provide utility service. These activities serve to reduce risks by evaluating the design and/or effectiveness of systems of internal controls in addition to risk mitigation strategies that provide management and the Board with assurance information needed to fulfill their managerial and governance responsibilities. They also serve to reduce or avoid costs, especially through the performance of operational audits.

1.4.4.2 Risk Management

48. Risk Management provides insurance and enterprise risk management ("ERM") services to EWSI and other EUI subsidiaries. The activities within this service include:

- Managing all EPCOR business units' insurance requirements with overall responsibility for EPCOR's corporate insurance program. This includes coverage determination, negotiation and placement of insurance contracts as well as surety bonds, facilitating insurer loss control activities, negotiating and settling insured losses and insurance contract/legal review including risk identification.
- Developing and maintaining an ERM framework and risk management process standard for all EPCOR business units and facilitating operational risk assessments across EPCOR. This program includes the integrated identification, analysis and monitoring of the top risks across EPCOR, including strategic and operational activities, with quarterly reporting to the Board of Directors.

49. Risk Management activities are necessary for EWSI to provide utility service. The Risk Management group manages the risk of damage to or caused by physical assets owned by EWSI. This service ensures that all EPCOR group operations are protected by the broadest coverage available in the insurance market. Having the appropriate amount of insurance is commonly required for debt issuances that might be secured by physical assets.

1.4.4.3 Centre of Excellence

50. The Centre of Excellence has been established to provide leadership, best practices, research, support and training for the Oracle Financial suite of products and the Adaptive budgeting and forecasting tool, as well as leading other efficiency and effectiveness initiatives for EPCOR's Finance function. As part of the Finance Optimization Program EPCOR has taken the opportunity to standardize its processes and procedures across the company where possible. EPCOR is also planning to develop and provide finance specific training and support of its ERP system across the company. The Centre of Excellence will foster a culture of process improvement while ensuring that existing processes are maintained.

51. The activities performed by the Centre of Excellence group include:

- Identification and analysis of issues that impact operational performance and lead the implementation of any new improvements across EPCOR.
- Leading groups of knowledgeable employees that are assigned to contribute to specific group objectives on a part time basis (Communities of Practice).
- Delivery of training and support utilizing multiple methods of delivery such as eLearning, face-to face instruction, on the job support tools and knowledge portals.
- Performing conversion and training related to acquisition integration.

52. The Centre of Excellence group ensures that EWSI staff are properly trained and following consistent EPCOR wide processes and procedures. The focus on process improvement and a consistent approach fosters best practices and allows the finance groups across EPCOR to rotate staff with minimal disruption.

1.4.5 Human Resources Services The functions in the HR department include the administration and management of employee compensation and benefits programs, support of recruitment efforts, job and organizational design, coaching and conflict resolution, succession and workforce planning and performance management for corporate shared service departments and the continued delivery of professional development courses. The Human Resources ("HR") department provides the following services to EWSI and other EUI business units:

- Total Rewards;
- Human Resources Consulting;
- Talent Management; and
- Learning and Development

1.4.5.1 Total Rewards

54. Total Rewards provides services related to the planning, design and administration of the EPCOR groups' compensation, pension and savings plans and employee benefits to attract, retain and engage employees. These services include absentee and leave of absence management and wellness initiatives and programs for all employees. The compensation planning and administration is provided for professional, management and executive positions.

55. Human Resources Information System ("HRIS") support is also included in the Total Rewards area. This involves managing the development, ongoing enhancements and maintenance of the Oracle-based HRIS application. HRIS activities include data management and analysis, troubleshooting, and managing system enhancements.

56. The payroll processing function performs the following activities in connection with paying employees' wages:

- Maintains the employee master files, which form the foundation for all human resources and payroll functions including new-hire, life event changes, transfers, promotions, termination, and wage rate changes.
- Performs pension administration.
- Performs full payroll services, including bi-weekly payroll processing.
- Preparation of all statutory filings and source deduction and other remittances including workers compensation remittances.
- Develops and maintains appropriate payroll policies, procedures and controls for all EPCOR subsidiaries and assists in developing employee benefit policies.

57. The services provided by Total Rewards are required to enable EWSI to provide utility service to customers. Total Rewards provides EWSI and other EUI subsidiaries with compensation programs, benefit and retirement programs, maintains employee records and provides all payroll

and pension administration services, including any payroll-related compliance requirements. Total Rewards performs a key strategic function in developing a compensation program that positions EWSI and other EUI subsidiaries to successfully attract and retain employees and ensuring that employees are paid for the work performed.

1.4.5.2 Human Resources Consulting

58. Human Resources Consulting ("HR Consulting") provides services such as recruitment and selection, job and organizational design, coaching and conflict resolution, succession and workforce planning, performance management, engagement action planning and labour relations activities including working with the EPCOR groups' unionized workforce and labour unions to support the dispute resolution processes.

59. The services provided by HR Consulting are required to ensure that each department is staffed appropriately to provide the services they deliver. HR Consulting provides recruitment services and labour relations expertise for managing grievances and disputes that arise related to the administration and application of collective agreements. HR Consulting also conducts succession planning, and provides advice and support to managers regarding EPCOR's corporate policies and legislative and regulatory requirements for employee performance management. HR Consulting provides support to managers to develop and implement action plans to improve employee engagement based on employee responses to EPCOR's engagement survey. HR Consulting also ensures that the recruiting process enables EPCOR to attract qualified candidates, while adhering to corporate standards and policies and the requirements of collective agreements in place for unionized employees. These services are necessary for the recruitment, training and retention of high quality staff with technical and operational knowledge and experience for EWSI and other EUI subsidiaries. .

1.4.5.3 Talent Management

60. Talent Management provides services related to the provision of programs and tools that support the attraction and development of highly qualified employees through the creation and presentation of employee development and leadership courses. This area is also responsible for new employee orientations that contribute to the success of integrating new hires into EPCOR and training for managers as they move into more senior leadership positions. In addition, Talent Management also engages in position succession planning, employee engagement, as well as talent planning to meet the overall business needs within EUI and its subsidiaries.

61. The services provided by Talent Management are required to enable EWSI to provide utility service to customers. Talent Management provides EWSI and other EUI subsidiaries with training and professional development opportunities to ensure their workforces are properly trained and engaged in their work. Talent Management provides vital leadership and assistance in developing well-trained, skilled and knowledgeable personnel, positioning EWSI to successfully operate and manage their businesses.

1.4.5.4 Learning and Development

62. The Learning and Development group within Corporate Services was established in early 2019 to provide the processes, programs, systems, and structures to ensure that each business unit is able to meet its legislated training requirements. The Corporate Services Learning and Development group is focused on the following activities:

- Developing core curriculum that can be augmented and delivered by embedded business unit teams.
- Delivering training programs that are generic across the company (e.g., First Aid, Contractor Management, and Ethics training).
- Developing the learning systems and processes required to support records administration, course hosting, and tracking information related to competency-based assessments.
- Developing and maintaining processes, standards, tools and templates to enable the work of embedded business unit teams (e.g., competency framework).
- Developing, delivering and tracking legislatively mandated compliance training (i.e., Workplace Hazard Materials Information System (“WHMIS”), Transportation of Dangerous Goods (“TDG”), and legislation awareness training about key sections of Alberta’s OH&S Act, Regulation and Code).
- Developing, delivering and tracking conformance training (i.e., Alcohol and Drug Standard training, Life Saving Rules, and driving training).

63. The services provided by Corporate Services Learning and Development are required to enable EWSI to provide utility service to customers. Corporate Services Learning and Development provides EWSI and other EUI subsidiaries with effective, consistent and efficient training services. The various activities carried out by the Corporate Services Learning and Development group outlined earlier in this section are all required to enable EWSI to provide utility service.

1.4.6 Information Services

64. The IS department provides the following services to EWSI and other EUI subsidiaries:

- Major Capital Projects;
- Application Services; and
- Infrastructure Operations.

1.4.6.1 Major Capital Projects

65. Major Capital Projects manages the implementation of major applications and the installation of major computer hardware devices. In addition, project management services may extend to managing major projects of a non-IT nature for EPCOR subsidiaries, such as constructing leasehold improvements in the EPCOR Tower. Major Capital Projects services include:

- Planning and architecture services, including the creation and continuing maintenance of EPCOR's information services strategic plan, 5-year tactical business system plans (including 5-year and annual capital planning), IT architectural design services, as well as the elicitation and completion of all business requirements related to information technology projects.
- Development of business cases to support utilities' requirements and the regulatory process, as well as the post-implementation review process.
- Overall program and project execution management, including a governance and approval structure. Services include: management and oversight of all IT projects and project management services such as project integration, scope, time, cost, quality, human resource, communications, risk, and procurement management.
- Project planning and architecture services such as data analysis and database design to integrate data.
- Project Management Office services, including progress reporting, cost forecasting, training, scheduling and continuous improvement.

66. Major Capital Project services are required for EWSI to provide utility service. EWSI is heavily dependent on IS infrastructure in providing utility services. The activities outlined above performed by the Major Capital Projects team are generally required by most major corporations that have a significant IS capital project budget. It is a prudent practice for organizations to take

a hands-on role in large Capital IT projects and to have in place capital project processes and governance to manage both the delivery of and capital expenditures for each project.

1.4.6.2 Application Services

67. Application Services provides user support services related to shared business system applications such as the various Oracle modules (Financials, Human Resources Information System, Projects, Assets, Time and Labour) as well the various EWSI specific business systems such as the GIS systems, internet and intranet user support and database administration support.

68. Application Services are required for EWSI to provide utility services. EWSI is heavily dependent on IS infrastructure in providing utility services. The activities as outlined above, performed by the Application Services function are required to support the corporate Enterprise Resource Planning ("ERP") application used by Corporate Services staff and staff within EWSI. These systems provide the core finance and HR system functions to the organization. These systems must be maintained, and occasionally upgraded to meet vendor and other stakeholder requirements (e.g., regulatory change).

69. In addition to the important role this team plays in supporting and maintaining the critical Finance and HR applications used by EWSI, the Application Services team provides both Database and Web design services. Both of these services increase the quality of the systems implemented at EUI and in the case of the Web designer team they also enhance the customer contact experience with EWSI.

1.4.6.3 Infrastructure Operations

70. Infrastructure Operations provides the following services:

- Manages the operation and maintenance of the computer hardware platforms (i.e., servers, networks, etc.) and operating systems that shared applications (i.e., Oracle business system) and EWSI and other EUI subsidiaries specific systems applications (i.e., CIS retail utility billing and information system).
- Supports telecommunications services and desktop applications (i.e., all Microsoft applications including electronic mail) for EWSI and other EUI subsidiaries.
- Conducts cyber security threat and risk analysis and delivers IT security planning and services. The group ensures that data which is stored cannot be compromised and provides mitigation plans for threats or vulnerabilities that may jeopardize the systems.

- Provides governance services such as oversight, management compliance monitoring of EPCOR's internal information services governance and control policies and procedures and oversight.
- Manages EPCOR's internal system recovery for contingency planning testing such as disaster recovery and pandemic planning.

71. Infrastructure Operations services are required for EWSI to provide utility service. EWSI is heavily dependent on IS infrastructure in providing utility services. The Infrastructure Operations service is by nature a critical operational role, in that it provides oversight as well as strategic infrastructure and governance activities. This team provides governance and control services, including the development and maintenance of internal policies, procedures and controls for the outsourced services that provide the infrastructure backbone that EUI and its subsidiaries rely on. The infrastructure they support provides the base for the corporate and business specific applications and the communication network used by EWSI and is sourced through this group to external service providers. As such, this group relies heavily on third party service providers. Infrastructure Operations' use of third party service providers is appropriate and fiscally prudent.

1.4.7 Supply Chain Management Services

72. The services in Corporate Supply Chain Management are:

- Mailroom;
- Disaster Recovery Planning;
- Corporate procurement;
- Corporate security;
- Facilities management; and
- Supply Chain Management Corporate Services.

1.4.7.1 Mailroom

73. Mailroom services are provided to EPCOR locations and include processing incoming and outgoing internal mail between all EPCOR locations as well as external mail through outsourced couriers and Canada Post.

1.4.7.2 Disaster Recovery Planning Facilities

74. Disaster Recovery Planning Facilities provides services for maintaining continuity of the critical information systems of EUI, EWSI, and other members of the EPCOR group in the event of a disaster, including the operation and maintenance of an off-site data centre for IT infrastructure.

75. Disaster Recovery Planning Facilities services are a core competency for a utility such as EWSI. It is vital to ensure that the information systems critical to the utility's operations are maintained without disruption in the event of a disaster. Given the vital role of this function, it would not be reasonable for EWSI to entrust this function to an outsource provider.

1.4.7.3 Procurement

76. The Corporate Procurement group works to maintain policy and procedures; ensure compliance with legislation; manage vendors; manage / develop vendor contract terms and conditions; provide training and support of procurement processes; and conduct vendor contract negotiations, ensuring standardization and mitigation of contract risk exposures as required by EUI's remaining Corporate Services departments. Procurement will perform market analysis, develop procurement strategies and manage the end to end procurement processes to ensure that Corporate Services departments obtain the best pricing available for their required goods and services.

1.4.7.4 Facilities

77. The Facilities department maintains and operates EPCOR's Corporate facilities including budgeting and administration; planning, design, space and project management and move coordination; and tenant services such as managing of landscaping and snow removal at buildings. The services also include negotiating and managing facility leases; and paying the rent and operating costs associated with premises leased by members of the EPCOR group.

78. Real Estate services are required to ensure the staff and contractors operating within EWSI and other EUI subsidiaries have a safe, clean environment to work in, and that those facilities are leased or purchased at a reasonable price.

1.4.7.5 Security

79. Security provides continuous threat and risk analysis of all physical security respecting EPCOR's businesses and facilities, including those arising from criminals, terrorists and employees. Other services provided by this function include conducting training exercises, awareness sessions, and providing guidance to prepare EWSI and other EUI subsidiaries to prevent and minimize losses during an emergency or disaster. Security guard protection services are entirely outsourced across EPCOR.

1.4.7.6 Supply Chain Management Corporate Services

80. Supply Chain Management Corporate Services is comprised of space rent and security associated with EPCOR's Corporate Services departments that are located in EPCOR Tower. These costs support for the various Corporate Service departments and allow them to supply the shared services to EWSI and other EUI subsidiaries.

1.4.8 Public and Government Affairs

81. Public and Government Affairs ("P&GA") provides the following services to EWSI and other EUI subsidiaries:

- Director – Corporate Communications;
- Corporate Communications;
- Government Relations; and
- Community Relations.

1.4.8.1 Corporate Communications and Director Corporate Communications

82. Corporate Communications provides services related to external communications, which includes corporate profile and reputation management, reporting of quarterly and annual financial results, issues management, and online communications for customers and the general public. Corporate Communications provides strategic advice in responding to customer or other issues that may arise in relation to the EPCOR group's business activities, or broader industry developments. Corporate Communications also provides internal communication support services to the Corporate Services departments and manages issues of corporate wide interest and impact.

83. Corporate Communications services are required for EWSI and other EUI subsidiaries to provide utility services to customers through facilitating timely and relevant communications and providing access to information.

84. The Director Corporate Communications is the director responsible for the Corporate Public and Government Affairs department.

1.4.8.2 Government Relations

85. Government Relations provides liaison services and briefing support in relation to all three levels of government (federal, provincial, and municipal), as well as government agencies and staff, with respect to existing or proposed policies and legislation. Government Relations also provides analysis and advice to EPCOR businesses respecting the impact of current or contemplated government policy and legislation.

86. Government Relations services are required to enable EWSI to provide utility services to customers by ensuring that government at all three levels are aware of issues that could impact EWSI and its customers. Government Relations staff work directly with elected officials and their key staff on behalf of EWSI on a regular basis to influence policy development and regulation change to minimize any potential negative impact on EWSI's customers.

1.4.8.3 Community Relations

87. Community Relations services utilizes community engagement tools, processes and investment strategies to support EPCOR's reputation and relationship objectives. This includes establishing the brand design and creative guidelines for all EPCOR communications productions, developing and delivering education programs such as public safety awareness and school electrical safety awareness and developing on-line educational materials about electricity, water and energy conservation. The Community Relations group is also responsible for advancing the achievement of EPCOR's long-term plans by implementing strategies that enhance the profile, reputation, and image of EPCOR with key audiences and providing strategic advice on the most effective means to interface with customers to ensure consistent, clear and proper messaging.

88. Services are also provided by this group to EPCOR Human Resources in support of employee recruiting, retention and engagement. This includes planning and delivering recruiting materials and planning and executing employee events.

89. Services provided by Community Relations are required to enable EWSI and other EUI subsidiaries to provide utility services to customers. Community Relations is EPCOR's face in the community and ensures customers are aware as to who is providing utility services. Community Relations also makes items such as conservation, customer service and safety matters accessible and understandable to the general public.

1.4.9 Legal Services

90. Legal Services is responsible for providing legal, governance, corporate secretarial and compliance related activities to EWSI and other EUI business units and subsidiaries.

91. Legal Services include:

- Managing all claims and litigation affecting EUI and its business units and subsidiaries.
- Negotiating, drafting and monitoring material contracts and contractual matters with employees, vendors and other parties.
- Creating and updating EUI and its business units and subsidiaries' standard form contracts and other precedent documents to reflect changes in law or business context.
- Providing advice with respect to contracts entered into by EUI and its business units and subsidiaries with its suppliers and customers.
- Providing legal research, advice, drafting of various documents and agreements and services on capital projects, mergers and acquisitions and other transactions undertaken by EUI and its business units and subsidiaries.
- Analyzing legal risks and providing advice to project teams regarding all legal issues which may affect the viability of a business initiative and/or project.
- Providing legal research, advice and services on numerous other corporate/commercial, financing and securities matters.
- Providing advice, research and assistance on regulatory law matters, including regulatory applications.

1.4.9.1 Governance oversight services include:

- Reporting all material claims and litigation affecting EUI and its business units and subsidiaries.

- Providing oversight, advice and reports on transactions undertaken by EUI and its business units and subsidiaries.
- Providing advice regarding corporate governance matters, including information on company structure, ownership and directors' and officers' information.
- Providing input into annual reports and filings as well as numerous corporate policies.
- Maintaining corporate records including registrations and preparation of supporting documentation of applications as it relates to changes to directors, officers and/or shareholders to comply with legislation.
- Preparing corporate documentation including supporting annual resolutions for all subsidiary corporations in order to comply with legislation. For example, appointing or dispensing with an auditor is requirement of business corporation legislation.

92. Corporate Secretarial services include providing assistance with Board, Committee and Shareholder material submissions, preparing resolutions, attending and recording meeting minutes of all Board, Committee and Shareholder meetings.

93. Legal Services provides records management services, which include developing, implementing and overseeing hardcopy and electronic document retention policies and practices.

94. Legal Services also provides internal oversight, advice and corporate governance respecting: legal matters related to company structure and ownership; claims and litigation affecting EUI and its subsidiaries; compliance with statutes (e.g., privacy legislation); and administration and compliance with the Code of Conduct Regulation, EPCOR Inter-Affiliate Code of Conduct and EPCOR's Ethics Policy. Legal Services also includes corporate secretarial services required to assist the Board, Board Committees and EUI's shareholder. Performing these oversight, governance and corporate secretarial services internally ensures that there is an appropriate level of control in EUI and its subsidiaries and is consistent with best practices in industry.

1.4.10 Health, Safety and Environment

95. The Health, Safety and Environment ("HSE") department functions include:

- Maintenance and ongoing implementation of the Integrated Health, Safety and Environment Management System, which conforms to ISO 14001 (Environment) and

OHSAS 18001 (Health and Safety) requirements and is implemented across all business units within EPCOR.

- Trend analysis, evaluation, and reporting for the EPCOR group to assist business units in ensuring that regulatory monitoring and reporting requirements are met.

96. EWSI has an obligation to ensure that its employees can perform their duties in a safe environment. Corporate HSE reduces potential costs associated with operational and litigation risk by creating corporate policies that minimize workplace and environmental incidents. These services are necessary to enable EWSI to provide utility service to its customers, and the costs of providing these services are reasonable.

1.4.11 Incentive Compensation

97. Corporate incentive compensation is paid to Corporate Services employees based on individual performance ratings and EUI's overall annual corporate targets. The EPCOR groups' structure for compensating its non-union employees has four components: base compensation (annual salary), employer paid benefits, Short Term Incentive ("STI"), and Mid Term Incentive ("MTI") for participating Directors, VPs and Executives. EPCOR's structure for compensating unionized employees has three components: base compensation (hourly wages / annual salaries), employer paid benefits and STI. The compensation was designed to bring employee total compensation to a level which is at par with comparable positions in the market from which EPCOR must draw employees (i.e., to market value).

1.5 Asset Usage Fees

1.5.1 Overview of Allocated Corporate Asset Usage Fees

98. EUI charges fees relating to general plant assets owned by EUI that are used in providing Corporate Services to EPCOR business units. These fees are referred to as Corporate Asset Usage Fees. The categories of assets for which Corporate Asset Usage Fees are charged include the following:

- Leasehold Assets;
- Human Resources Information System ("HRIS");
- Information System ("IS") Infrastructure;
- Financial System
- Furniture and Fixtures; and

- Customer Information System ("CIS").

99. The forecast Asset Usage Fee for each category of corporate assets comprises both a "return of" capital (or depreciation expense) and a "return on" capital. The return on capital component is calculated using EWSI's weighted average cost of capital

1.5.2 Leasehold Assets

100. Leasehold Assets include:

- Disaster Recovery Leasehold; and
- EPCOR Tower Leasehold Improvements.

1.5.3 Human Resources Information System

101. The HRIS is a software application that is used by EUI's HR department to manage the employees of the EPCOR group, including such things as recruiting, hiring, managing and paying employees (including the calculation of pensions, CPP, UIC, income tax and other payroll deductions).

1.5.4 Information Systems Infrastructure

102. The Information System's assets include servers, electronic storage devices, information system networks, desktops and Information System Applications used by Corporate Services departments to provide services to EWSI and other EUI subsidiaries.

1.5.5 Financial System

103. The Financial System costs represent the current financial application that is used to pay invoices, record and report financial information, prepare financial statements, calculate depreciation, purchase goods and services and manage project costs. The software application, Oracle Financials, uses modules that include Accounts Payable, Accounts Receivable, General Ledger, Purchasing, Projects and Fixed Assets.

1.5.6 Furniture and Fixtures

104. These asset costs represent furniture such as offices, workstations, chairs, tables, file cabinets and shelves used by employees in Corporate Services departments.

1.5.7 Customer Information System ("CIS")

105. The Customer Information System ("CIS") is a single, integrated CIS that replaces EEA's existing customer billing application and relationship management systems to ensure that EPCOR continues to be able to respond to customer account inquiries, set up or remove services, maintain customer accounts and transaction history, calculate and generate bills, and receive payments.

Appendix L2

EPCOR WATER SERVICES INC.

Shared Service Charges Allocation Methodology

February 16, 2021

1.0 OVERVIEW

1. EWSI provides various Shared Service functions to the regulated Water, Wastewater Treatment and Drainage operations and to EWSI's other businesses which are held within the EWSI legal entity or as subsidiaries of EWSI. The services provided by EWSI include Shared Services, which are financial, administrative and other services are provided on a shared basis in order to achieve cost efficiencies within the businesses supported by EWSI.

2. Appendix L-01 describes the services and associated costs related to services that are provided from EUI to EWSI. These services are provided by functional groups that are part of the EUI corporate group while Shared Services are provided by functional groups from within EWSI. For some functional categories, such as Human Resources, Health, Safety & Environment, Supply Chain and Public and Government Affairs, services are provided from both EUI and EWSI. In these instances, the services provided by EUI tend to be limited to governance, oversight and broad policy considerations, while the services provided by EWSI are more tactical and are specifically driven by the business needs of EWSI. In the case of Information Services, the EUI cost allocation is generally related to corporate applications such as the financial and human resources systems while EWSI Information Services costs are generally related to applications and technical infrastructure unique to EWSI

3. The specific shared services that EWSI provides, including the methodologies used to determine the inter-corporate service charges, are described below.

2.0 SHARED SERVICES PROVIDED BY EWSI

4. Sections 2.1 to 2.10 below sets out the allocated Shared Services provided by EWSI to the regulated Water, Wastewater Treatment and Drainage operations and to the other business supported within EWSI.

2.1 Executive Administration

5. Executive Administration includes compensation of the Senior Vice President of EWSI and resources together with associated ancillary costs required to provide administrative and management oversight on operational and business related matters. As well, Executive Administration includes the compensation of the Divisional Vice President of EWSI Shared Services and resources together with associated ancillary costs required to provide

administrative and management oversight of the embedded shared services that provide support to operations within EWSI.

2.2 Controller

6. Controller includes the compensation together with associated ancillary costs related to the EWSI Controller required to provide financial oversight and accounting services. Controller includes the following functions:

- financial oversight;
- preparation of financial reports and analysis;
- administration of the financial reporting services;
- asset accounting administration;
- budget administration;
- development and maintenance of corporate accounting policies and procedures;
- financial support for regulatory applications; and
- costs associated with maintaining office space in EPCOR Tower.

2.3 Health, Safety & Environment

7. Health, Safety and Environment includes the compensation together with associated ancillary costs related to the EWSI Health, Safety and Environment required to maintain appropriate health and safety practices that are in compliance with legislation. Specific functions include:

- ensuring that existing Health and Safety practices and procedures are well designed and in compliance with legislation and compatible with Service Provider Safety Management Policies;
- business services including internal loss management, safety and training and related support staff;
- Health, Safety and Environment Audit and Inspections;
- Environmental Issues Management; and
- Health, Safety, Environment and Training, Legal Compliance and Reporting.

2.4 Information Services

8. Information Services includes charges related to EWSI's unique applications as well as costs associated with desktops, printers and network support. Specific functions include:

- application support;
- relationship management; and
- license fees, desktop support and server support.

2.5 Public & Government Affairs

9. Public & Government Affairs includes compensation together with associated ancillary costs of EWSI Public & Government Affairs required to provide stakeholder and public consultation requirements. Specific functions include:

- stakeholder relations and public consultation services;
- internal communications (related to business unit matters); and
- external communications (includes coordination of business' unit considerations such as public safety notices, performance reports, public addresses and presentations, print collateral, operational issues management, etc.).

2.6 Technical Training

10. Technical Training includes the compensation together with associated ancillary costs of EWSI Technical Training required to design, develop and deliver technical training to operations staff and monitor that the operating staff are compliant with regulatory requirements to maintain continuous and current health, safety and technical training.

2.7 Human Resources

11. Human Resources includes the compensation together with associated ancillary costs of EWSI Human Resources, which includes human resources management; human resources consulting, talent management, facilitating the management of return to work scenarios for short-term disability, long-term disability as well as Workers' Compensation Board and non-supported claims management.

2.8 Regulatory & Operational Excellence

12. Regulatory & Operational Excellence includes the compensation together with associated ancillary costs of EWSI Regulatory & Operational Excellence related to the regulated Water, Wastewater Treatment and Drainage operation's regulatory applications and associated requirements. Specific functions include:

- applications development: regulatory proceeding participation, relationship management, and regulatory research;
- develop and co-ordinate business unit strategic plans on behalf of the SVP;
- monitor and coordinate responses to regulatory and policy activities or initiatives within various government ministries, departments and/or agencies which may affect the business;
- manage regulatory interfaces with government, regulatory and market agencies, and other industry participants;
- manage and co-ordinate tariff and facility applications with business units;
- facilitate and manage process improvement projects to drive operational efficiencies and achieve strategic objectives;
- ensure the equitable and accurate application of the stormwater utility to all properties in Edmonton;
- coordinate and manage the Management of Change (MOC) program for Drainage Services; and
- track, coordinate and report on Performance Based Reporting (PBR), Short-term Incentive Plan (STIP) and Shareholder and Operational Metrics.

2.9 Supply Chain Management

13. Supply Chain Management includes the compensation together with associated ancillary costs of EWSI Supply Chain Management required to provide services for warehousing, inventory, reverse logistics, purchasing and strategic sourcing including management of the end-to-end procurement process for the goods required by the regulated Water, Wastewater Treatment, Drainage operations and to the other business supported within EWSI. Specific functions include:

- administration of procurement services, including but not limited to competitive bidding, PO creation resulting from the competitive bidding process, issuing requests for quotations and requests for proposals, contract negotiation and execution, contract administration and Supplier Relationship management;
- administration of the Warehousing and Materials Management Services; and
- administration of Facility Services for building related activities such as administration of the operations and maintenance of buildings and surrounding land and also lease agreement management.

2.10 Incentive Compensation

14. Incentive Compensation is paid to EWSI employees based on individual performance ratings and overall annual corporate targets. The EPCOR group's structure for compensating its non-union employees has four components: base compensation (annual salary), employer paid benefits, Short Term Incentive (STI), and Mid-Term Incentive (MTI) for participating Directors, VPs and Executives. EPCOR's structure for compensating unionized employees has three components: base compensation (hourly wages / annual salaries), employer paid benefits and STI. The compensation was designed to bring employee total compensation to a level which is at par with comparable positions in the market from which EPCOR must draw employees (i.e., to market value).

3.0 DRAINAGE OPERATIONS ALLOCATION

15. Prior to the allocation of Shared Services costs to the EWSI's Water, Wastewater Treatment operations and to the other business supported within EWSI, there is an allocation of specific shared services costs to Drainage operations only for those functional areas where support is provided.

16. For these specific functional areas noted below and described in Section 2.0 above, an equal allocation of the costs of these functional areas is allocated to drainage operations:

(a) Regulatory & Operational Excellence – 100% of all costs of the functional area are shared equally with Drainage Services;
(b) Supply Chain Management - 100% of Facility Operations and Contract Management / Procurement are shared equally with Drainage Services;
(c) Executive Administration – costs associated only with the Divisional Vice President of Water Services and resources together with associated ancillary costs are shared equally with Drainage Services; and
(d) Incentive Compensation – only the Incentive Compensation directly associated with the employees in the functional areas noted in paragraphs (a) to (c) immediately above are allocated to Drainage Services.

17. The remaining amounts associated with these functional areas are then allocated in accordance with the equivalent allocator noted in Table 4.0-1.

4.0 SHARED SERVICES ALLOCATION

18. Table 4.0-1 below provides information on the cost allocators used to allocate Shared Services costs to the regulated Water and Wastewater Treatment operations and to the other business supported within EWSI. The allocation methodologies have been designed to ensure that the allocation of EWSI's shared service costs are fair and reasonable, cost-effective, predictable and reflect the benefit received by function or cost causation.

Table 4.0-1
Allocation of EWSI Financial and Administrative Costs
Cost Allocators

	Responsibility Centre and Function	A **Allocator**
1	Executive Administration	Composite – EWSI Revenue, Assets, Headcount
2	Controller	Composite - EWSI Revenue, Assets, Headcount
3	Health, Safety & Environment	Functional Cost Causation – EWSI Headcount
4	Information Services	Functional Cost Causation – EWSI Total Assets
5	Public & Government Affairs	Composite – EWSI Revenue, Assets, Headcount
6	Technical Training	Functional Cost Causation – EWSI Headcount
7	Human Resources	Functional Cost Causation – EWSI Headcount
8	Regulatory & Operational Excellence	Functional Cost Causation –EWSI Regulated Assets
9	Supply Chain Management	Composite - EWSI Revenue, Assets, Headcount
10	Incentive Compensation	Average based on allocated costs above

Appendix M

EPCOR WATER SERVICES INC.

Consumption Forecast Validation Studies

February 16, 2021

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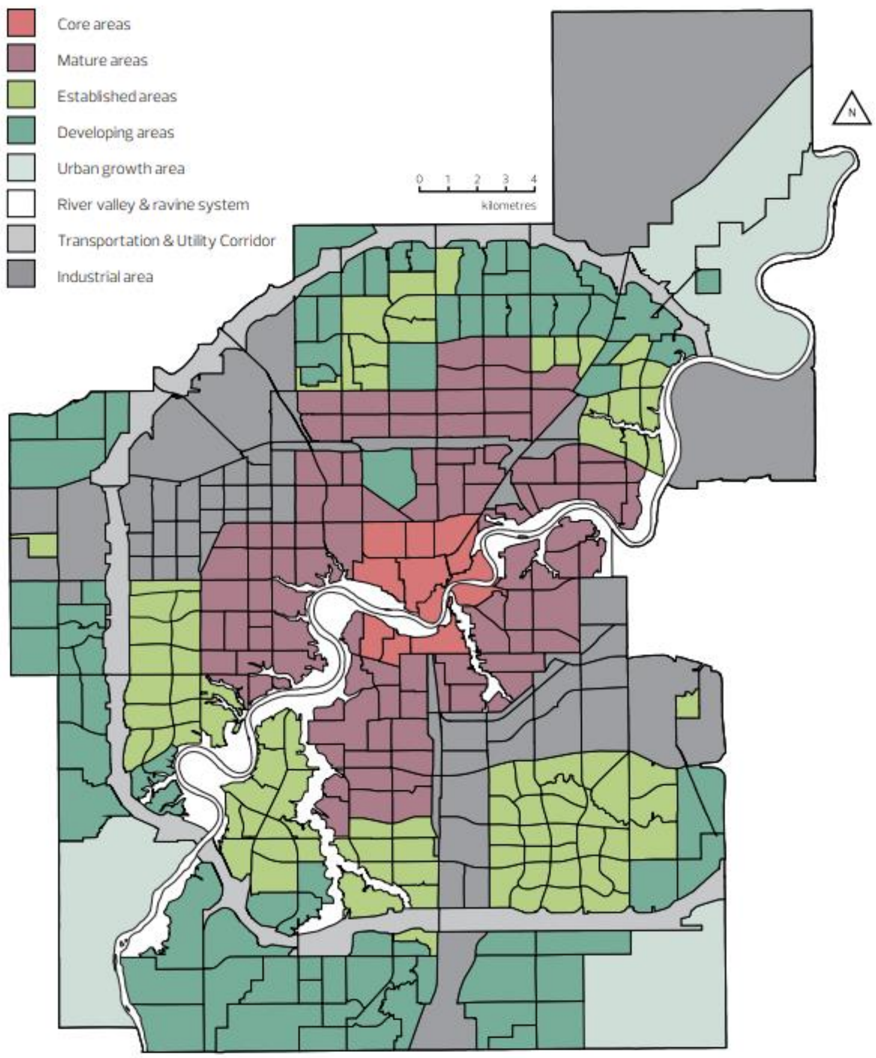
1.0 RESIDENTIAL VALIDATION STUDY

1.1 Residential Decomposition

1. Residential consumption is calculated based on spatial disaggregation of residential customers. The aggregation categories are core, mature, established, and developing neighbourhood classification areas, as defined in the City of Edmonton's The Way We Grow document and shown in Figure 1.1-1.

Figure 1.1-1
Neighborhood Classifications (City of Edmonton, 2017)[1]



[1] City of Edmonton (2017). Our Growing City – 2017 Annual Growth Monitoring Report. Retrieved from https://www.edmonton.ca/city_government/documents/PDF/GrowthMonitoringReport2017.pdf

1.2 Historical Trends

2. As shown in Table 1.2-1, established neighbourhoods have the highest average annual rate of decline of the four neighbourhood classifications over the past five years. Since 2015, established base consumption has reduced annually on average by -2.37%, followed by mature (-2.16%), and core (-2.15%). Developing shows the slowest rate of decline at -0.73%. These trends are anticipated to continue into the near term.

Table 1.2-1
Annual Reduction in Water Consumption by Neighborhood Classification

	Classification	A **2015-2019 Average**
1	**Edmonton**	**-1.77%**
2	Developing	-0.73%
3	Established	-2.37%
4	Mature	-2.16%
5	Core	-2.15%

3. The differences in historical trends across neighborhood classifications is most likely attributable to differences in average household size and use of water efficiency fixtures/appliances.

1.3 Validation Using Household Size

4. Household size in Edmonton varies by structure type and by the area of the City (City of Edmonton, 2016). Based on *Edmonton Census Atlas* and *Our Growing City – 2015 Annual Growth Monitoring Report*, each neighbourhood classification has a different average household density that is expected to remain constant, grow, or contract over the short term. The reports establish that developing areas primarily attract families, established areas have aging families where children are predicted to leave the family home, mature areas have an older demographic and less families, and core areas primarily attract young professionals.

5. The single detached house is the most common housing type in Edmonton and within the residential rate code. However it is important to note that while the residential rate code is primarily made up of single detached houses, the *Water Services and Wastewater Treatment EPCOR Bylaw 15816*, states that up to "four separate dwelling units metered by a single water meter" are also classified as residential consumption. Based on the bylaw definition, the residential rate code can include single detached houses, duplexes, tri-/four-plexes, and row houses.

6. Based on single detached housing stats, household size is smallest in the mature sector (including core), and highest in developing neighborhoods. Household size for single detached homes in the mature neighbourhoods have stabilized after decades of decline, whereas household sizes in the established sector shows continued declines. Single detached housing in the developing areas has the highest household size in the city. With a young demographic, and the dominant preference for lower-density housing among Edmonton homeowners, household sizes are not predicted to decline for many years in the developing neighbourhoods (Watson & Associates, 2019, City of Edmonton, 2016).

7. *Based on the Residential End Uses of Water Study Version 2* (DeOreo, B. & Mayer, P., 2016), 11.5m^3/month is the base (indoor) efficiency benchmark that is suggested for future planning purposes; however this is based on a household occupancy of 2.6 to 2.7 people per household. The relationship between indoor use and number of residents follows a power curve relationship rather than linear. If a linear relationship is assumed when forecasting future use, homes with fewer residents would be predicted to use too little water, and homes with more residents would be over-allocated. This is because there is an economy of scale factor; for example, water use to launder clothing does not normally double when another person joins a household.

8. To determine the theoretical low base consumption per household in Edmonton for residential consumption, the demand curve for high efficiency households y=59.58x0.53 (gallons per day) was utilized (DeOreo, B. & Mayer, P., 2016). The household density per residential customer was assumed to be 2.5 (City of Edmonton, 2017). The theoretical low base consumption assuming all residential customers are equipped by high efficiency fixtures and appliances is 11.1 m^3/month in Edmonton. As a reasonability check, the residential consumption forecast in 2026 is above the theoretical low base consumption signaling that reductions in efficiency will continue to occur past the 2026 timeframe.

1.4 Validation Using Water Efficient Fixtures and Appliances

9. With household size being projected to remain the same in developing, core and mature areas, and average per service water consumption still falling, it has been established that the use of efficient fixtures and appliances is the main reason for these continued decreases. The impact varies by neighborhood classification, as shown in Table 1.4-1.

10. This is supported by the following research from the *Residential End Uses of Water Study Update* (REUWS2) (DeOreo, B. & Mayer, P., 2016). Key finding include:

- Average North American indoor water use is measurably reduced on both a household and a per capita basis since the original study (1999).
- The primary technologies that have contributed to the reductions in indoor use are high efficiency toilets and washing machines.

Table 1.4-1
Impact of Efficiency on Water Use per Household

	Classification	A **Household Size Changes**	B **Impact of Efficiency**
1	**Edmonton**	**No**	**Yes**
2	Developing	No	Low
3	Established	Yes	High
4	Mature	No	Medium
5	Core	No	Medium

1.5 Conclusions

11. Based on the above literature review, it is prudent to suggest that both renovation (change to water efficient fixtures and appliances) and a decrease in the number of people per household (established classification area only) will continue to reduce consumption per customer in the city of Edmonton. This validates the final PBR forecast.

2.0 MULTI-RESIDENTIAL VALIDATION STUDY

2.1 Background

12. The multi-residential customer class is the smallest EWSI customer class by both percent of total consumption and percent of revenues. However, it has also proven to be the most challenging to forecast.

13. The forecast methodology utilized for the multi-residential rate class is the simplest of the three rate classes, due to data limitations. The PBR forecast proposed within this Application, consistent with prior applications, is simply based on the historical average of total consumption. Forecast variance in previous PBR terms has been higher for the multi-residential rate class than for the Residential and Commercial rate classes due to data limitations.

14. During the period EWSI was developing the forecast for the 2017-2021 PBR Application, historical data (i.e., pre-2017) exhibited an increasing trend in total multi-residential consumption. As a result, EWSI proposed an increasing consumption forecast over the years

2017-2021. However, consumption actuals over the 2017-2020 term have not followed the proposed linear trend and 2019 actual total consumption was lower than 2016 total consumption.

15. In order to increase EWSI's confidence in its forecast of multi-residential consumption, EWSI developed the following validation analysis. Multiple forecasts were developed in the validation analysis, and EWSI ultimately selected the trend line that most closely matched the linear trend line based on the previous six years of consumption data, 2014-2019. For this reason, the 2022–2026 PBR forecast methodology based on the linear trend line is considered validated.

2.2 Total Consumption: Validation Analysis

16. The validation analysis normalizes consumption to the number of dwelling units per customer, addressing the impact of varying building size on per-service consumption. Dwelling units refer to each individual suite of a multi-residential building. For example, a single family residential house has 1 dwelling unit, while a multi-residential building, by definition, has 5 or more dwelling units (e.g., a low rise apartment with 20 units).

17. The number of dwelling units for all multi-residential customers is calculated using two datasets from City of Edmonton. The first dataset is based on verified dwelling unit counts from the Assessment and Taxation department, and the second dataset is a download from the Edmonton open data portal. Suite count from assessment and taxation is given priority, and the data downloaded from the open data portal is used to fill any missing information in the assessment and taxation data.

18. Once consumption per dwelling unit is calculated for 2009–2019, it is projected forward to 2026 using an exponential trend line. The exponential form provides the most realistic trend (i.e., eventually flattens over time rather than decreasing to zero and does not increase to unrealistically high values) of all functional forms examined.

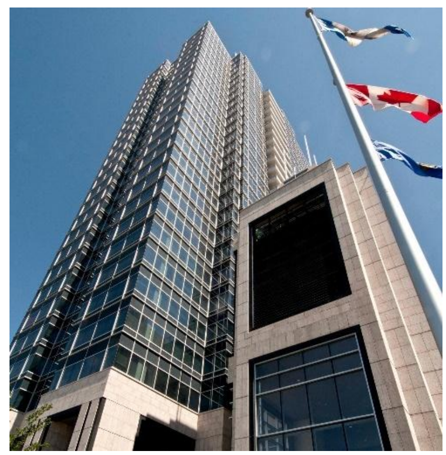
19. The dwelling unit count forecast is based on the net increase in multi-residential lots over time. This measure is based on EWSI's customer billing information paired with parcel information from City of Edmonton. The dwelling unit count forecast is created by pairing forecast multi-residential lot growth with an average number of dwelling units per lot. The calculation results in a forecast for multi-residential dwelling units.

20. Consumption is normalized by multiplying the dwelling unit count forecast and the consumption per dwelling unit forecast to calculate a total consumption forecast.

21. Historically there have been periods with stagnating total consumption growth: 1998-2004, 2007-2012 (recession), 2014-2019. The proposed forecast trend likewise presents a slightly decreasing annual total consumption year over year, which is considered realistic given the challenging economic conditions.

Attachment #5

Final Report



EPCOR

2020 Wastewater Treatment Cost of Service Study

January 2021

January 8, 2021

Mr. Darrell Manning
EPCOR Water Services, Inc.
9496 Rossdale Road
Edmonton, Alberta T5J 3B1

Subject: Comprehensive Wastewater Treatment Cost of Service Study Final Report

Dear Mr. Manning:

HDR Engineering, Inc. (HDR) was retained by EPCOR Water Services, Inc. (EPCOR) to provide technical assistance in the update of EPCOR's wastewater treatment cost of service analysis to support EPCOR's efforts in establishing cost-based rates for its wastewater treatment customers.

EPCOR was responsible for the development of the revenue requirement data which was provided to HDR for input into the cost of service analysis (model). The model and analysis were developed utilizing EPCOR's accounting, operating and management records. Based on the revenue requirement developed by EPCOR, HDR then developed a cost of service analysis to determine the equitable distribution of costs between the various wastewater treatment customer classes of service. HDR has relied on this information to develop our analyses, from which we draw our findings, conclusions and recommendations.

The analysis and model developed for EPCOR was prepared using generally accepted cost of service and rate making methodologies and principles. These generally accepted industry standard cost of service methodologies and principles are defined by the Water Environment Federation (WEF). The cost of service methodology used for EPCOR has been tailored to the specific and unique circumstances and facilities owned and operated by EPCOR. This report details the findings and conclusions of the analysis conducted herein. The development of the model and technical analysis is intended to provide cost-based, defensible, and equitable wastewater rates to EPCOR's wastewater treatment customers.

We appreciate the opportunity to provide technical assistance to EPCOR. We also appreciate the assistance provided by EPCOR management and staff in the development of this study.

Sincerely yours,
HDR Engineering, Inc.

Shawn Koorn
Associate Vice President

Table of Contents

1 Introduction and Overview

1.1 Introduction

HDR Engineering, Inc. (HDR) was retained by EPCOR, Inc. (EPCOR) to provide technical assistance in the development of a wastewater treatment cost of service analysis to support EPCOR's historical practice of establishing cost-based rates. This report outlines the approach, methodology, findings, and conclusions of the cost of service analysis developed for EPCOR's wastewater treatment services.

This report was developed utilizing EPCOR's accounting, operating and management records. HDR has relied on this information to develop the wastewater treatment cost of service analysis, from which we have drawn our findings, conclusions, and recommendations. At the same time, this study was developed utilizing "generally accepted" utility rate setting methodologies and principles. This report provides EPCOR with the basis for developing and implementing wastewater rates which are cost-based, equitable and defensible to its customers.

1.2 Study Goals and Objectives

The development of this study was based on several key rate study goals and objectives. In general, these were as follows:

- Develop a wastewater treatment cost of service analysis that is consistent with the principles and methodologies established by the Water Environment Federation (WEF) Manual of Practice No. 27, Financing and Charges for Wastewater Systems.
- Develop a cost of service methodology to equitably distribute the cost of providing wastewater treatment to various customer classes of service.
- Review the current wastewater treatment rate structure and provide alternatives for discussion and review by EPCOR for their future consideration.
- Provide EPCOR with a cost of service model to use and evaluate the distribution of future wastewater treatment costs and rate impacts.

1.3 Overview of the Comprehensive Rate Study Process

Provided below in Figure 1 – 1 is an overview of the steps required to conduct a comprehensive rate study.

Figure 1 – 1
Overview of the Comprehensive Rate Study Process

Revenue Requirement Analysis	*Compares the revenues to the expenses of the utility to determine the overall adjustment to rates for the test year*
Cost of Service Analysis	*Distributes the test period revenue requirement to the various customer classes of service in a "fair and equitable" manner*
Rate Design Analysis	*Design rates to yield the revenue requirement and meet the goals and objectives of the study*

The framework or methodology shown in Figure 1-1 provides an overview of the typical components of a comprehensive study. Each of these steps of the rate setting process and the technical analyses associated with them are based on the generally accepted wastewater rate-setting methodologies and principles described in the Water Environment Federation (WEF) Manual of Practice (MOP) #27. An important aspect of this study is incorporating and "tailoring" each of these analytical elements to reflect the specific and unique circumstances and characteristics of EPCOR's wastewater treatment system.

1.4 Report Organization

This report is organized as follows:

- Section 2 provides an overview of the wastewater treatment revenue requirement analysis which was developed by EPCOR and is used as a basic input into the cost of service analysis.
- Section 3 discusses and reviews the development of the wastewater treatment cost of service analysis.
- Section 4 provides an overview of rate setting goals and objectives and a summary of EPCOR's current treatment rates.

At the conclusion of this report, a technical appendix is attached which provides the detailed exhibits and technical analyses completed to support the wastewater treatment cost of service analysis.

1.5 Summary

This report provides a summary of the technical analyses undertaken to develop EPCOR's wastewater treatment cost of service analysis. HDR's study has been developed using generally accepted wastewater cost of service methodologies and principles. This report and our analyses are designed and intended to provide EPCOR with the information necessary to continue to develop cost-based and equitable rates applicable to its wastewater treatment utility.

2 Wastewater Treatment Revenue Requirement

2.1 Introduction

This section of the report discusses the revenue requirement for EPCOR's wastewater treatment utility. EPCOR management and staff developed the test period wastewater treatment costs and associated revenue requirement analysis. The results of the revenue requirement analysis provide a framework around which to evaluate the overall adequacy of EPCOR's current wastewater treatment rates. Provided below is a detailed discussion of the revenue requirements as independently developed by EPCOR management and staff. This wastewater treatment revenue requirement is then carried forward and utilized within the cost of service analysis developed for EPCOR by HDR.

2.2 Revenue Requirement Framework

By virtue of the differences between a public utility and a private utility, the revenue requirement is often based upon different elements or methodologies. Most private or regulated utilities utilize what is known as a "utility or accrual" basis of determining revenue requirements for setting rate levels. This convention calculates a utility's annual revenue requirement by aggregating a test period's operation and maintenance (O&M) expenses, taxes, depreciation expense and a fair return on investment.

In contrast to the "utility or accrual" method of developing revenue requirements for privately-owned public utilities, a different method of determining annual revenue requirements is often used for governmentally-owned public utilities. The convention used by most governmental or public utilities is called the "cash basis" methodology of setting revenue requirements. As the name implies, a public utility aggregates its cash expenditures to determine its total revenue requirements for a specified period of time.

Table 2 - 1 summarizes and compares the "cash" and "utility/accrual" basis methodologies.

Table 2 – 1
Cash versus Utility Basis Comparison

	Cash Basis		Utility Basis (Accrual)
+	O&M Expenses	+	O&M Expenses
+	Taxes/Transfer Payments	+	Taxes/Transfer Payments
+	Capital Improv. Funded From Rates (≥ Depreciation Expense)	+	Depreciation Expense
+	Debt Service (Principal + Interest)	+	Return on Investment
=	**Total Revenue Requirement**	=	**Total Revenue Requirement**

For this particular study, given that EPCOR is a regulated utility providing wastewater treatment services, the "utility/accrual basis" approach was utilized. This methodology is consistent with EPCOR's past rate setting methodologies and practices.

2.3 Development of the Wastewater Treatment Revenue Requirement

As noted above, the wastewater treatment revenue requirement used for this study was developed by EPCOR management and staff. This portion of the report will summarize and discuss the basic components and results of EPCOR's wastewater treatment revenue requirement analysis. The initial step in calculating the revenue requirement was to establish a time period around which the revenue requirement would be reviewed. For this particular study, the revenue requirement developed by EPCOR was based on budgeted 2019 expenditures and projected for 2020 through 2029.

The second step is to determine a method of accumulating costs. As discussed above, EPCOR used a utility/accrual basis methodology. Given this basic analytical framework, the wastewater treatment revenue requirement was developed for the review period.

2.4 Summary of EPCOR's Wastewater Treatment Revenue Requirement

HDR was provided with EPCOR's projected 2020 - 2029 wastewater treatment revenue requirement. Provided below in Table 2 -2 is a summary of the wastewater treatment revenue requirement developed by EPCOR. As noted previously, the costs included within this revenue requirement analysis provide the starting point for the costs to be equitably allocated within the wastewater treatment cost of service analysis. These costs will be equitably distributed to EPCOR's various customer classes of service.

Table 2 – 2
Summary of the Wastewater Treatment Revenue Requirement ($000)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenues										
Rate Revenues	$104,301	$110,825	$114,874	$117,442	$119,848	$127,875	$132,224	$134,959	$137,760	$140,628
Other Revenues	18,649	20,112	20,494	20,884	21,281	21,685	22,097	22,517	22,945	23,381
Total Revenues	**$122,950**	**$130,937**	**$135,368**	**$138,326**	**$141,129**	**$149,560**	**$154,321**	**$157,476**	**$160,705**	**$164,009**
Expenses										
O&M Expenses	$70,597	$73,907	$76,227	$77,706	$79,196	$81,161	$82,857	$84,449	$86,072	$87,728
Taxes	$616	$647	$659	$671	$684	$697	$710	$724	$738	$752
Depreciation	19,530	20,737	21,747	22,606	23,627	24,800	26,695	29,227	30,000	31,395
Financing Costs	11,951	13,464	14,359	15,197	15,561	15,598	16,243	17,007	17,194	18,809
Return on Investment	20,256	22,183	22,377	22,145	22,060	27,304	27,817	26,070	26,701	25,326
Total Expenses	**$122,950**	**$130,937**	**$135,368**	**$138,326**	**$141,129**	**$149,560**	**$154,321**	**$157,476**	**$160,705**	**$164,009**
Bal./(Deficiency) of Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

As noted previously, the above wastewater treatment revenue requirement was developed by EPCOR and provided to HDR as the basis for the costs to be equitably distributed within the cost of service analysis.

2.5 Summary

This section of the report has provided a summary of the wastewater treatment revenue requirements as developed by EPCOR. The costs within the revenue requirement analysis were used by HDR as the starting point for the wastewater treatment cost of service analysis. The next section of the report will discuss the development of the EPCOR's wastewater treatment cost of service analysis.

3 Wastewater Treatment Cost of Service Analysis

3.1 Introduction

This section of the report details the wastewater treatment cost of service analysis developed by HDR Engineering, Inc. (HDR) for EPCOR's wastewater treatment utility. The cost of service utilizes and equitably distributes the revenue requirement as provided in Section 2. Provided below is a more detailed discussion of the key technical steps of the cost of service analysis undertaken and a summary of our findings, conclusions and recommendations.

3.2 Cost of Service Analysis

The objective of the cost of service analysis is to equitably distribute the revenue requirement to the various customer classes of service (e.g., residential, commercial, etc.). By following the generally accepted guidelines and principles of a cost of service analysis, it will inherently lead to wastewater treatment rates which are equitable, cost-based, and not viewed as arbitrary or capricious in nature.

As discussed in Section 2, the "utility basis" approach is the generally accepted methodology used by EPCOR to establish the level of costs to be equitably distributed within the cost of service analysis. There are two primary objectives in conducting a cost of service analysis:

1. Equitably distribute the revenue requirement among the customer classes of service
2. Derive average unit costs for subsequent reference/use in designing final rates

The objectives of the cost of service analysis are different from determining the revenue requirement. As noted in the previous section, a revenue requirement analysis determines the utility's overall financial needs, while the cost of service analysis provides a methodology to determine the fair and equitable manner in which to collect the revenue requirement.

The second rationale for conducting a cost of service analysis is to ensure a rate is designed such that it properly reflects the costs incurred by the utility. For example, a wastewater utility incurs costs related to wastewater flow, strength, and customer cost components. A wastewater utility typically must designed and built to sufficiently handle both the total flow and treat wastewater strengths. Therefore, those customers impacting the wastewater treatment system in these different ways should contribute their equitable share of the costs, based upon the respective burdens each place upon the system (e.g., high flow / low strength vs. low flow / high strength, etc.). Each of these types of costs may be collected in a slightly different manner as to allow for the development of wastewater treatment rates that collect costs in roughly (i.e., proportionally) the same manner as they are incurred.

3.3 Establishing Customer Classes of Service

The first step in a cost of service study is to determine the customer classes of service. For a cost of service analysis to equitably allocate costs, the utility must group customers in classes of service that have similar usage patterns and facility requirements. EPCOR's current wastewater treatment rate schedules (classes of service) are as follows:

- Single Family
- Multi-Family
- Commercial
- Overstrength (High Strength Wastewater Customers)

During the development of the cost of service study, various alternative customer classes of service were discussed with EPCOR staff. As a starting point for that discussion, HDR noted that EPCOR has established a set of customer classes of service which appear to be very reasonable and, in HDR's opinion, follow current wastewater utility industry approaches. The establishment of customer classes of service allows for the development of cost-based rates and the ability to establish rate structures for each customer class of service that reflects the overall goals and objectives of EPCOR.

3.4 Key Assumptions of the Cost of Service

A number of key assumptions were used within EPCOR's wastewater treatment cost of service study. Listed below is a brief discussion of the major assumptions used.

- The test year used for the wastewater treatment cost of service analysis was the forecasted or projected 2021 revenue requirement.
- The revenue and expense data utilized by HDR within this study was provided by EPCOR.
- A "utility basis" approach or methodology was utilized for the cost of service analysis. This is a generally accepted methodology for accumulating costs and allocating them within a cost of service analysis. This generally accepted methodology is described in detail in the Water Environment Federation, Manual of Practice No. 27.
- The allocation and distribution of EPCOR's plant in service and revenue requirement was also developed based on generally accepted methodologies as described in the Water Environment Federation, Manual of Practice No. 27. The methodologies were tailored to be reflective of EPCOR's specific and unique treatment plant facilities and operations.
- The distribution factors for volume and strength, used within EPCOR's cost of service analysis to equitably assign costs to the various classes of service, were developed using EPCOR specific data which was provided by EPCOR.

3.5 General Cost of Service Procedures

In order to determine the cost to serve each customer class of service on the system, a cost of service analysis is conducted. A cost of service study utilizes a three-step approach to equitably and proportionally distribute the revenue requirement. These steps take the form of functionalization, allocation, and distribution. Provided below is a more detailed discussion of the wastewater treatment cost of service study, and the specific steps taken within EPCOR's analysis.

3.5.1 Functionalization of Costs

The first analytical step in the wastewater treatment cost of service process is called *functionalization*. Functionalization is the arrangement of expenses and asset (plant) data by major operating components and functions within the treatment plant. Within this study, the functionalization of the cost data was already largely accomplished through EPCOR's accounting and asset records.

3.5.2 Allocation of Costs

The second analytical task performed in a wastewater treatment cost of service study is the *allocation* of the costs. Allocation determines why the expenses were incurred or what type of need is being met. The utility's plant accounts (assets) and revenue requirement were reviewed and allocated.

- **Volume Related Costs:** Volume related costs are those costs which tend to vary with the total quantity or volumes of wastewater treated.
- **Strength-Related Costs:** Wastewater strength is a label which describes the physical, biological and chemical characteristics of the wastewater. Strength-related costs refer to specific wastewater characteristics and the process/cost associated with treating different contaminants and their concentration in the effluent. Higher strength discharges require additional treatment to meet discharge requirements. Strength levels or the parameters of wastewater can be measured in a variety of ways. For purposes of EPCOR's cost of service analysis, strength was characterized/measured around the following parameters: biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total nitrogen (TKN), total phosphorous (TP), and oil and grease (OG). As already noted, increased or higher levels of these strength constituents generally equate to increased treatment costs for most wastewater treatment systems.
- **Customer-Related Costs:** Customer-related costs vary with the addition or deletion of a customer or a cost which varies as a function of the number of customers served. Customer related costs typically include the costs of billing, collecting, and accounting.
- **Revenue-Related Costs:** Some costs associated with the utility may vary with the amount of revenue received by the utility. An example of a revenue related cost would be a utility tax, or franchise fee, which is based on gross utility revenue.

Given the above types of costs, EPCOR's revenue requirement is allocated to the various cost components based upon the reason why the cost was incurred (e.g., to meet a volume-related need, etc.) as outlined in industry standard wastewater cost of service principles.

3.5.3 Development of Distribution Factors

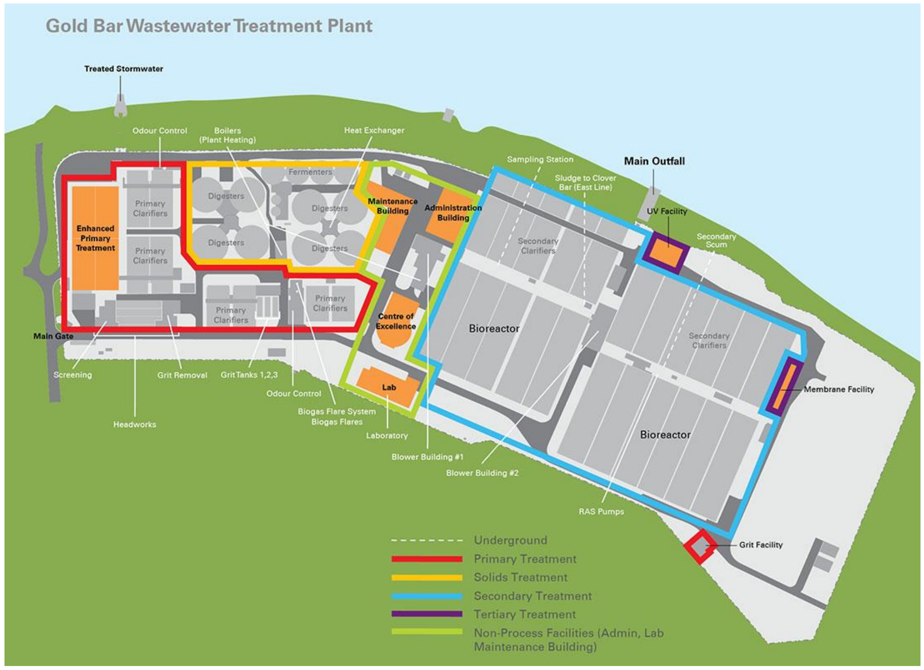
Once the allocation process is complete, and the customer groups have been defined, the various allocated costs are equitably distributed to each customer class of service, or rate schedule. EPCOR's wastewater treatment utility's allocated costs were distributed to the various customer groups using the following distribution factors.

- **Volume Distribution Factor:** Volume-related costs are distributed on the basis of estimated class contributions to wastewater flows. Wastewater flows are not typically metered and given that, a reasonable methodology or surrogate must be used in order to estimate each customer class's contribution. As part of the data and information that EPCOR provided HDR, there was an estimate developed for each customer type which was used as the basis for the distribution of costs related to volume allocated costs. To verify the reasonableness of the estimated flows, the calculated total flows used in this distribution factor was compared to the recent historical flows at the treatment plant. The total volume in the distribution factor was approximately the same as the historical flows at the treatment plant. The calculation of the volume distribution factor is shown in Exhibit 3 of the technical appendix.
- **Customer Distribution Factor:** Customer costs, within the cost of service analysis, are distributed to the various customer classes of service based upon their respective number of customer accounts. Two types of customer distribution factors were developed – actual and weighted. The actual customer distribution factor assumes that there is no disproportionate cost associated with serving a customer (e.g., postage for bills is the same cost per customer, regardless of the size or usage of the customer). In contrast, a weighted customer distribution factor assumes that there is some disproportionality associated with serving different types of customers and attempts to estimate the level of difference in serving the customers. It is important to note that for this particular utility and this study, no per customer cost differences or weighting differences between customers was assumed. Exhibit 4 of the technical appendix provides the calculation of the customer allocation factors.
- **Strength-Distribution Factor:** Strength-related costs are allocated (i.e., assigned) between the wastewater parameters of BOD, COD, TKN, TP, TKN, OG, and TSS. Each of these specific types of strength-related costs are then equitably distributed to each class of service based upon flow contributions and the assumed strength level the class of service is contributing. For the residential, multi-family and commercial customers, their assumed wastewater strength-levels were set at domestic level strengths. In contrast to this, overstrength customers reflect those customers with higher strength wastewater discharged to EPCOR's wastewater treatment system and their strength levels are based on actual kilograms removed for each constituent from the actual testing done on overstrength customers. Exhibit 5 in the technical appendix provides the calculation of the strength-distribution factors.
- **Revenue-Related Distribution Factor:** The revenue related distribution factor was developed from the projected rate revenues for 2021 for each customer class of service. These revenue projects were developed as a part of the revenue requirement analysis (Exhibit 2). A summary of the revenue-related distribution factor is provided in Exhibit 6 of the technical appendix.

Given the development of the distribution factors, the final step in the wastewater treatment cost of service analysis was to distribute the allocated costs to the various customer classes of service.

3.6 Functionalization and Allocation of Plant in Service (Rate Base)

A necessary step of the cost of service is the functionalization and allocation of wastewater treatment plant in service (assets and infrastructure). In performing the functionalization of plant in service, HDR utilized EPCOR's historical plant account records. The purpose of the allocation step of the cost of service is to determine why the specific plant assets (treatment plant components) are in place, and what function they provide in the treatment process. In other words, which allocation component (Vol, BOD, COD, TKN, etc.) does the asset support or provide a benefit to.



The functionalization of EPCOR's wastewater treatment plant assets (plant in service) was largely accomplished from the existing asset records. Once the treatment assets were functionalized, the analysis shifted to allocation of the asset. The allocation process included reviewing each line item and determining which allocation cost components the assets were related to. During the course of the development of this portion of the analysis, there was significant discussion and analysis around the functionalization and allocation of the treatment plant and its components. HDR treatment process engineering staff initially worked through the assets based on knowledge of the treatment plant and general treatment plant functions. The allocation approach was then reviewed and discussed with EPCOR treatment plant and engineering staff to finalize the allocations of the treatment plant assets. The proposed allocations are based on HDR and EPCOR's understanding of the treatment facilities which are currently in place, their current operations, and generally accepted allocation methodologies for wastewater treatment. Table 3 - 1 provides the basis for the allocation of EPCOR's Gold Bar Wastewater Treatment Plant in service.

Table 3 – 1
Summary of the Wastewater Treatment Plant in Service ($000)

		Strength – Related						
	VOL	BOD	COD	TKN	TP	OG	TSS	Cust
Land	$0	$0	$0	$0	$0	$0	$0	$421
WWTP								
Admin	$0	$0	$0	$0	$0	$0	$0	$3,246
Air Scrub	0	0	0	0	0	5,766	5,766	0
Main Control Room	51	96	169	227	251	205	304	10
Aux Control Room	14	27	47	64	70	57	85	3
Blowers	0	1,124	450	2,474	450	0	0	0
Boilers	658	1,229	2,169	2,918	3,219	2,628	3,904	127
CBF (inc. Ostara)	739	1,381	2,436	3,277	3,615	2,951	4,384	143
Center of Excellence	5,701	0	0	0	0	0	0	0
Digesters	0	9,990	4,281	14,271	14,271	14,271	14,271	0
Distribution Station	1	2	3	4	4	3	5	0
Enhanced Prim. Treat.	0	0	2,829	1,297	0	4,244	3,419	0
Flare	0	123	53	176	176	176	176	0
Grit	0	0	22,792	7,597	0	7,597	37,986	0
Laboratory	469	1,689	1,689	1,689	1,689	469	1,689	0
Maintenance Building	146	273	482	648	715	583	867	28
Outfall	16	0	0	0	0	0	0	0
Penthouse	17	33	58	77	85	70	104	3
Primary Clarifier	0	0	20,051	9,190	0	30,076	24,228	0
Screens	970	0	0	0	0	0	2,263	0
Sampling	2	7	7	7	7	2	7	0
Scum	0	318	0	0	0	742	0	0
Bioreactor/Secondary Clarifier	0	13,258	5,682	28,411	37,881	0	9,470	0
Substation	53	98	173	233	257	210	312	10
UV	11,581	0	0	0	0	0	0	0
Waste Activated Sludge	0	1,149	492	2,461	3,282	0	820	0
EPT - Polymer System	0	0	849	389	0	1,273	1,026	0
Hydrogen Peroxide	125	0	0	0	0	0	0	0
Secondary Alum Room	91	0	0	0	257	0	257	0
Biogas	0	1,945	834	2,779	2,779	2,779	2,779	0
Blend Tanks	0	206	88	294	294	294	294	0
Fermenter	0	0	0	5,015	23,642	0	0	0
Sludge	0	5,609	2,404	8,012	8,012	8,012	8,012	0
CWIP	0	0	0	0	0	0	0	0
Total	**$20,634**	**$38,556**	**$68,038**	**$91,510**	**$100,957**	**$82,410**	**$122,428**	**$3,991**
General Plant	$2,472	$4,619	$8,151	$10,964	$12,095	$9,873	$14,668	$478
Total Net Plant in Service	**$23,106**	**$43,175**	**$76,190**	**$102,474**	**$113,053**	**$92,283**	**$137,096**	**$4,470**

Table 3 - 1 provides a summary of the basic functionalization and allocation of EPCOR's wastewater treatment plant assets. A detailed exhibit of the functionalization and allocation of plant investment can be found in the Technical Appendix, Exhibit 7c.

Provided in Table 3 – 2 is a summary of the percentage allocation to the various cost components of EPCOR's total wastewater treatment plant in service.

Table 3 – 2
Summary of the Wastewater Treatment Net Plant in Service Allocation ($000)

			Strength – Related						
	Total	**VOL**	**BOD**	**COD**	**TKN**	**TP**	**OG**	**TSS**	**Cust**
Total Allocation	100.0%	3.2%	7.0%	13.5%	17.0%	18.4%	15.8%	24.2%	0.9%

3.7 Functionalization and Allocation of Operating Expenses

Operating expenses are generally functionalized and allocated in a manner similar to the corresponding plant account (i.e., Tables 3-1 and 3-2). This approach to allocation of operating expenses was used for the allocation of expenses within EPCOR's wastewater treatment analysis. For the cost of service study, the 2021 revenue requirement for the wastewater treatment utility prepared by EPCOR was functionalized and allocated based on the allocation of treatment plant.

As noted previously, the revenue requirement was developed utilizing the utility/accrual basis methodology which was comprised of operation and maintenance expenses, annual depreciation expense, revenue tax, and a return on rate base (net plant in service). Similar to the allocation of plant in service, the analysis reviewed each line of the revenue requirement to determine the appropriate allocation of the revenue requirement component. In general, the majority of the revenue requirement was allocated as "net plant", or the overall percentages shown above in Table 3-2. However, there were also specific line items that were allocated to specific cost components. As examples, item such as franchise fees were allocated as revenue-related, chemicals were assigned to the strength related categories of phosphorus (TP) and suspended solids (TSS), and billing, meters, and customer service were allocated to the customer-related cost component.

One key objective of EPCOR's cost of service analysis is to review the costs associated with providing high strength treatment services, or service to "overstrength" customers. In reviewing the allocation of the revenue requirement, EPCOR has a separate line item that is related to managing and monitoring the overstrength customer program. This cost was directly assigned to the overstrength customer class of service so that the overstrength customers assume the cost responsibility for the administration and activities associated with the overstrength program. Provided in Table 3 – 3 is summary of the allocated revenue requirement for EPCOR's wastewater treatment utility.

Table 3 – 3 Summary of the 2021 Wastewater Treatment Expense Allocation ($000)											
			Strength – Related								
	Total	VOL	BOD	COD	TKN	TP	OG	TSS	Cust	RR	DA
Total Alloc. - $	110,825	2,699	5,969	11,464	14,433	16,643	13,381	20,383	16,075	8,149	1,629
Total Alloc. - %	100.0%	2.4%	5.4%	10.3%	13.0%	15.0%	12.1%	18.4%	14.5%	7.4%	1.5%

As shown in Table 3-3, EPCOR's total revenue requirement has been allocated between the various cost components. A more detailed review of the allocation of EPCOR's wastewater treatment revenue requirement can be found in the Technical Appendix on Exhibit 8. These totals are then distributed between each customer class of service (rate schedule) based on their proportional share (i.e., contribution) of each allocation cost component. As a point of reference, the DA (direct assignment) is the allocation of the overstrength program costs to the overstrength customers.

3.8 Distribution of the Revenue Requirement

The next step in the cost of service process is the equitable *distribution* of the allocated costs to the customer classes of service. As noted in Section 3.5.3, a distribution factor was developed for each cost component. The distribution factor provides the basis for the proportional distribution of each cost component to each customer class of service. Provided below in Table 3-4 is a summary of the distributed revenue requirement to each customer class of service.

Table 3 – 4 Summary of the Distributed 2021 Revenue Requirement ($000)					
	Total	**Single Family**	**Multi-Family**	**Commercial**	**Over-Strength**
Volume Related	**$2,699**	**$1,420**	**$554**	**$725**	**$0**
Strength Related					
Biochemical Oxygen Demand	$5,969	$2,567	$1,001	$1,310	$1,092
Total Suspended Solids	20,383	10,293	4,013	5,252	824
Chemical Oxygen Demand	11,464	5,716	2,229	2,917	602
Total Nitrogen	14,433	7,076	2,759	3,611	987
Oil & Grease	13,381	6,601	2,574	3,368	839
Total Phosphorous	16,643	8,486	3,309	4,330	519
Total Strength Related	**$82,273**	**$40,738**	**$15,885**	**$20,786**	**$4,864**
Customer Related					
Actual Customer	$0	$0	$0	$0	$0
Weighted Customer	16,075	14,922	209	944	0
Total Customer Related	**$16,075**	**$14,922**	**$209**	**$944**	**$0**
Revenue Related	**$8,149**	**$4,914**	**$1,430**	**$1,806**	**$0**
Direct Assignment	**$1,629**	**$0**	**$0**	**$0**	**$1,629**
Total Revenue Requirement	**$110,825**	**$61,994**	**$18,077**	**$24,261**	**$6,492**

As shown in Table 3-4, the distribution of the revenue requirement is developed for each allocation component. Another key component to note is that overstrength customers are only allocated strength-related costs and the direct assignment costs. This reflects the fact that the volume component is picked up through the treatment rate for the customer (e.g., commercial rate), and the overstrength component is for the additional impacts over and above typical (domestic) strength levels for each constituent as developed by EPCOR. A more detailed summary of the distribution of the revenue requirement is provided in Exhibit 9b of the technical appendix.

3.9 Summary of the Cost of Service Results

In summary form, EPCOR's wastewater treatment cost of service analysis began by functionalizing the plant asset records and revenue requirement. The functionalized plant and expense accounts were then allocated into their various cost components. The individual allocation totals were then distributed to the various customer groups based upon the appropriate and equitable (proportional) distribution factors. The distributed expenses for each customer group were then aggregated to determine each customer group's overall revenue responsibility. The total distributed costs are then compared to the current revenues received from each customer class of service to provide a measure of the current rates to each class' cost responsibility, if the cost of service results were implemented. A summary of the detailed cost responsibility developed for each class of service for 2021 is summarized below in Table 3 - 5.

Table 3 – 5 Summary of the EPCOR 2021 Cost of Service Results ($000)				
	Present Revenue	Allocated Costs	$ Difference	% Difference
Single Family	$64,338	$61,994	$2,344	-3.6%
Multi-Family	18,716	18,077	639	-3.4%
Commercial	23,643	24,261	(617)	2.6%
Overstrength	4,127	6,492	(2,366)	57.3%
Total	**$110,825**	**$110,825**	**$0**	**0.0%**

The distribution of costs reflects the facilities and costs equitably distributed to each customer class, reflective of their respective benefit. The cost of service results indicated that some costs differences exist between the customer classes of service. A cost of service analysis is a dynamic analysis and the results change over time as costs change and as customer usage changes. Given that dynamic, HDR typically reviews a cost of service to determine whether a class of service is within a "reasonable range of their cost of service." The metric that HDR utilizes is a class of service is assumed to be within a "reasonable range of their cost of service" if the class is within ± 5% of the overall required adjustment. In other words, given EPCOR's 0.0% overall adjustment in this analysis, a class of service would be considered within a "reasonable range of their cost of service" if they are within the range of +5.0% to –5.0%.

The results above indicate that all but the overstrength customer class of service are "within a reasonable range of their cost of service." These results would seem to indicate that the Overstrength customers are not within a reasonable range of their cost of service. However, as noted previously, a key component of this study was the review of costs allocated to the overstrength customers to determine if overstrength rates are set at an appropriate level. Given these results, it would support the movement, or adjustment, of overstrength rates towards the cost of service results. In more closely reviewing the results, HDR would note that the amount of the short fall shown for this class of service ($2.36 million) is close to the direct assignment of overstrength costs (i.e., $1.66 million for regulatory services/strength testing). EPCOR would be advised to examine this more closely to better assure that these costs are the sole responsibility of the overstrength customers.

As noted above, this cost of service has been based upon a specific time period (2021), and costs and usage can change over time. As a result, HDR believes that cost of service is often best determined over an extended number of studies. It is recommended that EPCOR continues to review the wastewater treatment cost of service for the various customer classes before making interclass adjustments. The detailed summary of the water cost of service analysis can be found in the Wastewater Treatment Technical Appendix, Exhibits 9 and 10.

3.10 PBR Rate Setting and the Use of the Cost of Service Analysis

EPCOR uses a performance-based-ratemaking (PBR) approach for establishing its wastewater treatment rates. As the name implies, the PBR approach to ratemaking attempts to link rate adjustments (price) to performance. In contrast, traditional ratemaking simply links price to cost, regardless of performance or efficiency. Under either ratemaking framework, including PBR, the starting point for establishing the final wastewater treatment rates is the cost of service analysis. The following notes this cost of service perspective:

> *"The starting point for utility rates generally is a cost of service study. The subsequent years' rates are determined by applying the PBR formula to adjust the previous rates for the effects of inflation and for productivity improvements."*[1]

As cited above, the starting point for establishing utility rates, including EPCOR's wastewater treatment rates, is the cost of service analysis (study). In particular, the cost of service analysis provides two important items of information which are used to establish the initial PBR rates. These items are as follows:

- ✓ Target revenue levels by customer class of service
- ✓ Average unit costs (cost-based rates)

The target revenue levels establish the level of revenue to be derived from each customer class of service. The average unit costs, as developed in the cost of service, provide the cost-basis for beginning to establish the fixed and variable wastewater treatment charges associated with each customer group. The average unit costs from the cost of service study are shown in Exhibits 11a and 11b of the Technical Appendix.

3.11 Summary

This section of the report has provided a summary of the wastewater treatment utility cost of service analysis completed for EPCOR. This analysis was prepared using generally accepted cost of service techniques, which have been tailored to reflect EPCOR's specific and unique wastewater treatment system and operations.

[1] Performance-Based Ratemaking: Theory and Practice, Dr. Michael R. Schmidt, Public Utilities Reports, Inc., Vienna, Virginia, 2000, p. 2.

4 Wastewater Treatment Rate Design

4.1 Introduction

The final step of a comprehensive wastewater treatment rate study is the design of rates to collect the desired levels of revenue, based on the results of the revenue requirement and cost of service analyses. This section of the report will discuss the key considerations and costs for the development of EPCOR's wastewater treatment rates.

4.2 Rate Design Goals and Objectives

In reviewing water rate designs, consideration is given to both the *level* of the rates and the *structure* of the rates. Level refers to the total revenue to be collected from a rate design; while structure refers to the way or manner (fixed vs. variable) the revenue is collected (i.e., how the customer is ultimately assessed for service). Provided below is an overview of the rate design process for EPCOR's wastewater treatment cost of service study.

4.2.1 Rate Design Criteria and Considerations

The key starting point for developing EPCOR's wastewater treatment rate design is to gain an understanding of EPCOR's specific rate design goals and objectives. Understanding EPCOR's rate design goals and objectives for their wastewater treatment rates can lead to exploring different rate structures, including the relationship between the monthly fixed charges and volumetric charges, along with how strength charges may be handled. Typical utility rate design goals and objectives include items such as rates being cost-based, easy to understand and administer, and that are set at a level that produce adequate revenues.

The rate manual, Principles of Public Utility Rates[2] by James C. Bonbright, is often cited as an important source or guide on the development of rates, particularly as it relates to determining rate design goals and objectives. In this rate manual, Bonbright created a list of key attributes (i.e. goals and objectives) that may be considered in the establishment of utility rates. Provided below is a paraphrased list of Bonbright's key rate design attributes.

Revenue-Related Attributes:

- Rates should be designed to **meet the total revenue requirement needs** under the "utility/accrual basis approach".[3]
- Rates should provide **revenue stability and predictability**; with a minimum of unexpected changes seriously adverse to the utility (e.g., annual swings in planned revenue should,

[2] James C. Bonbright; Albert L. Danielsen and David R. Kamerschen, Principles of Public Utility Rates, (Arlington, VA: Public Utilities Report, Inc., Second Edition, 1988), p. 383-384.

[3] The AWWA M-1 Manual, Principles of Water Rates, Fees and Charges, discusses two "generally-accepted" methodologies for establishing revenue requirements; the cash basis and utility/accrual basis. Most private utilities, including EPCOR utilize the "utility/accrual basis" methodology. Under this approach, a utility sums its O&M, taxes, depreciation expense and return on rate base (investment) to equal its revenue requirements.

for example, be no greater than +10% or –10%).

- From the customer's perspective, the rates should result in **customer bills that are stable and predictable**. The implementation of new rate structures should be consistent with past rate setting philosophy and minimize customer bill impacts during any change in rate structure.

Cost-Related Attributes:

- The rate structure should **promote efficient use** of services and discourage or penalize inefficient uses.
- The rate structure should **reflect all traditional internal costs** (direct and indirect) incurred, **and under appropriate situations and conditions** (e.g., severe drought) may also **include present and future costs and benefits** (i.e., marginal cost and/or value of commodity).
- **Fairness of the rates** in the allocation of total costs of service among the different ratepayers so as to **avoid arbitrariness, capriciousness and to attain equity**. The rates and the rate structure shall be based upon a fair allocation of total cost of service among the customer classes of service by use of a "generally accepted" cost of service methodology such as defined in the Water Environment Federation Manual of Practice #27.
- The rates should be, as practically possible, **non-discriminatory**, between customer groups, and within each customer group. The rate structures should avoid interclass subsidies whenever possible to ensure each class pays its full cost of service.
- The **responsiveness of the rate to respond to changes in demand and supply patterns**. The rate structure should be developed such that it either responds appropriately or alternatively, contains the flexibility to allow the utility to respond to the changing needs as a result of supply, demand, and/or environmental concerns (e.g., drought conditions).

Practical-Related Attributes:

- From the customer's perspective, the rate structure should be **simple to understand**, such that the customer can easily understand the bill. From the utility's perspective, the rate structure should be **easy to administer**. Finally, the rate structure should have acceptance by the majority of the customers that the rate structure and resulting bills are "fair and equitable."
- **Freedom from controversies** as to the application of the rate schedule to the customer and calculation of the customer's bill. It should be simple to explain and understand by the average customer to minimize any misinterpretation regarding the customer's bill and the overall goals that the rate structure has been developed to meet.

4.3 Current Wastewater Treatment Rates

In reviewing the above rate design goals and objectives it is important to understand that all of these goals and objectives cannot be achieved in a single rate design, and in some cases, certain goals and objectives may be in conflict with each other. For example, rates that are cost-based may be challenging from a customer affordability perspective. In that respect, EPCOR must consider each of these goals and objectives and attempt to balance them in a way that meets the utility's overall rate design goals and objectives.

Table 4 - 1 summarizes the present wastewater treatment rate schedules for EPCOR's customers. EPCOR's rates generally reflect what is considered industry best-practices in that the rates are composed of a fixed service charge and a volumetric charge as well as overstrength charges for applicable customers.

Table 4 - 1
Present Wastewater Treatment Rates

Rate Component	Present Rates
Flat Monthly Service Charge –	$4.83/month
Variable Monthly Charges –	***$ / m³***
Residential	$0.9842
Commercial	
0 – 10,000 m^3	$0.9842
10,000 – 100,000 m^3	0.7613
100,000 + m^3	0.3973
Overstrength Charges –	
(Exceeding Domestic Strength Levels)	***$ / kg***
BOD (>300 mg/L)	$0.6161
COD (>600 mg/L)	0.6161
Oil and Grease (>100 mg/L)	0.5386
Phosphorous (10 mg/L)	5.1263
TSS (>300 mg/L)	0.5591
TKN (>50 mg/L)	1.3085
BOD (>3000 mg/L)	$0.6161
COD (>6000 mg/L)	0.6161
Oil and Grease (>400 mg/L)	0.5386
Phosphorous (75 mg/L)	5.1263
TSS (>3000 mg/L)	0.5591
TKN (>200 mg/L)	1.3085

There are three rate components to EPCOR's current wastewater treatment rates; a flat monthly service charge, a variable (volumetric) charge and an overstrength charge. The flat monthly service charge applies to all customer classes of service. In contrast, the variable or volumetric charges are segregated between residential and commercial customers and the billing is based total water consumption. Finally, the overstrength charges are applicable to those customers with strength levels which exceed EPCOR's defined domestic level strengths. These specific customers are part of the overstrength program and their strength levels are monitored and tested for purposes of billing the overstrength charges. At the present time, the overstrength charges reflect two levels of high strength waste. The first is for over domestic strength, but under the higher next step. These customers are charged the overstrength charge for the loadings. The second step adds the same charge, for all loadings over the higher strength loadings. This essentially doubles the overstrength charge for those over the higher strength level.

4.4 Future Wastewater Treatment Rate Structure Considerations

The results of the revenue requirement and cost of service analysis provide the basis for establishing cost-based rates. However, other policy considerations - other than strictly cost of service - may be considered when establishing final proposed wastewater treatment rates. Some examples of other considerations may include policy items such as revenue stability or sufficiency, economic development, ease of understanding and administration, ability to pay, etc.

It appears that EPCOR has taken policy considerations into account in the PBR process that has established the current wastewater treatment rates. As EPCOR continues forward with the development of the final proposed rates, a policy decision will need to be made whether to follow cost of service results; smoothly transition to a cost of service basis to attempt to minimize overall rate impacts to customers; or apply an “across the board” rate adjustment to all classes of service.

While the cost of service did show cost differences between classes of service for the wastewater treatment utility, a smooth transition to rates may take precedence over attempting to strictly follow the cost of service results. This recommendation of implementing a smooth transition towards cost of service results allows for better customer outreach, avoids rate shock, and allows the utility to track cost of service results over a number of years and adjust rates accordingly.

4.5 Summary

This section of the report has provided an overview of the rate design process. The results of the revenue requirement and cost of service analysis provide the basis and guidance for establishing and implementing cost-based wastewater treatment rates. A key objective of a cost of service study is to develop rates that are cost based while, at the same time, providing equity between customers.

5 Wastewater Treatment Technical Appendix

EPCOR
Wastewater Treatment COSA
Summary of the Revenue Requirement
Exhibit 1

	Budgeted	*Projected*									
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Revenues											
Rate Revenue	$96,723,177	$104,300,933	$110,824,643	$114,873,847	$117,442,306	$119,848,226	$127,875,041	$132,224,099	$134,959,372	$137,760,173	$140,628,260
Miscellaneous Revenues	17,270,978	18,649,308	20,112,305	20,494,438	20,883,833	21,280,626	21,684,957	22,096,972	22,516,814	22,944,634	23,380,582
Total Revenues	**$113,994,154**	**$122,950,241**	**$130,936,947**	**$135,368,285**	**$138,326,138**	**$141,128,852**	**$149,559,998**	**$154,321,071**	**$157,476,186**	**$160,704,807**	**$164,008,841**
Expenses											
Franchise Fees	$7,199,561	$7,856,176	$8,346,136	$8,750,362	$8,947,488	$9,131,451	$9,764,925	$10,104,013	$10,313,830	$10,528,719	$10,748,816
Total Power, Other Utilities & Chemicals	4,697,800	4,362,800	4,362,800	4,865,693	4,958,141	5,052,346	5,148,341	5,246,159	5,345,836	5,447,407	5,550,908
Total Wastewater Treatment Plant	33,934,196	36,051,995	38,268,376	39,245,475	39,991,139	40,750,971	41,525,239	42,314,219	43,118,189	43,937,435	44,772,246
Total Operational Support Services	4,947,273	5,477,757	5,542,731	5,648,043	5,755,356	5,864,707	5,976,137	6,089,683	6,205,387	6,323,290	6,443,432
Capital Overhead	0	0	0	0	0	0	0	0	0	0	0
Total Billing, Meters, & Customer Service	7,110,749	7,731,598	7,651,659	7,797,041	7,945,184	8,096,143	8,249,970	8,406,719	8,566,447	8,729,209	8,895,064
Total EWSI Shared Service	4,067,609	4,554,661	4,702,825	4,792,178	4,883,230	4,976,011	5,070,555	5,166,896	5,265,067	5,365,103	5,467,040
Corporate Shared Services	4,108,401	4,562,395	5,032,286	5,127,899	5,225,329	5,324,610	5,425,778	5,528,868	5,633,916	5,740,961	5,850,039
Total O&M Expenses	**$66,065,591**	**$70,597,382**	**$73,906,812**	**$76,226,691**	**$77,705,867**	**$79,196,240**	**$81,160,944**	**$82,856,557**	**$84,448,673**	**$86,072,123**	**$87,727,545**
Property Taxes	$649,363	$615,508	$646,653	$658,939	$671,459	$684,217	$697,217	$710,464	$723,963	$737,718	$751,735
Depreciation	17,950,263	19,530,017	20,736,688	21,747,371	22,605,951	23,627,205	24,799,670	26,694,641	29,226,772	29,999,914	31,394,923
Total Financing Costs	10,618,465	11,951,116	13,463,775	14,358,593	15,197,366	15,561,347	15,598,096	16,242,543	17,007,164	17,194,150	18,808,878
Return on Investment	18,710,473	20,256,218	22,183,020	22,376,691	22,145,496	22,059,844	27,304,072	27,816,867	26,069,615	26,700,902	25,325,762
Total Revenue Requirement	**$113,994,155**	**$122,950,242**	**$130,936,948**	**$135,368,286**	**$138,326,139**	**$141,128,852**	**$149,559,999**	**$154,321,072**	**$157,476,187**	**$160,704,807**	**$164,008,842**
Bal. / (Def.) of Funds	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)	($0)
Balance a % of Rate Adj. Req'd	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

EPCOR
Wastewater Treatment COSA
Revenue Requirement
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	*Notes*
Revenues												
Rate Revenue												
Residential	$55,784,266	$60,190,845	$64,338,221	$66,958,009	$68,687,926	$70,326,745	$75,402,989	$78,263,819	$80,143,174	$82,071,836	$84,051,220	Schedule F-1
Multi-Res	16,299,259	17,540,298	18,716,369	19,458,048	19,938,598	20,389,438	21,824,844	22,631,937	23,143,677	23,666,989	24,202,133	Schedule F-1
Commercial	20,902,244	22,443,071	23,643,333	24,252,663	24,530,756	24,765,603	26,197,805	26,794,402	27,052,435	27,313,481	27,577,589	Schedule F-1
Overstrength Surcharges	3,737,408	4,126,720	4,126,720	4,205,127	4,285,025	4,366,440	4,449,403	4,533,941	4,620,086	4,707,868	4,797,317	Schedule I-2
Total Rate Revenues	**$96,723,177**	**$104,300,933**	**$110,824,643**	**$114,873,847**	**$117,442,306**	**$119,848,226**	**$127,875,041**	**$132,224,099**	**$134,959,372**	**$137,760,173**	**$140,628,260**	
Other Revenue												
Late Payment Charges	$255,999	$261,119	$266,341	$271,401	$276,558	$281,813	$287,167	$292,623	$298,183	$303,849	$309,622	Schedule I-2
Surplus Sales	5,219	5,220	5,220	5,319	5,420	5,523	5,628	5,735	5,844	5,955	6,068	Schedule I-2
ACRWC Swap	893,520	933,573	943,233	961,154	979,416	998,025	1,016,988	1,036,311	1,056,000	1,076,064	1,096,510	Schedule I-2
Suburban	485,677	512,844	542,274	552,577	563,076	573,775	584,676	595,785	607,105	618,640	630,394	Schedule I-2
Lab	400,000	400,002	400,002	407,602	415,346	423,238	431,280	439,474	447,824	456,333	465,003	Schedule I-2
Ostara	360,000	400,000	400,000	407,600	415,344	423,236	431,277	439,472	447,822	456,330	465,001	Schedule I-2
Biosolids												
ACRWC Recovery	$4,976,800	$4,100,000	$4,200,000	$4,279,800	$4,361,116	$4,443,977	$4,528,413	$4,614,453	$4,702,127	$4,791,468	$4,882,506	Schedule I-2
EPCOR Drainage Recovery	9,393,200	11,505,987	12,824,672	13,068,341	13,316,639	13,569,655	13,827,479	14,090,201	14,357,915	14,630,715	14,908,699	Schedule I-2
AESO DR Participation	70,000	100,000	100,000	101,900	103,836	105,809	107,819	109,868	111,955	114,083	116,250	Schedule I-2
Suburban - Strathcona	430,563	430,563	430,563	438,743	447,079	455,574	464,230	473,050	482,038	491,197	500,530	Schedule I-2
Total Other Revenues	**$17,270,978**	**$18,649,308**	**$20,112,305**	**$20,494,438**	**$20,883,833**	**$21,280,626**	**$21,684,957**	**$22,096,972**	**$22,516,814**	**$22,944,634**	**$23,380,582**	
Total Revenues	**$113,994,154**	**$122,950,241**	**$130,936,947**	**$135,368,285**	**$138,326,138**	**$141,128,852**	**$149,559,998**	**$154,321,071**	**$157,476,186**	**$160,704,807**	**$164,008,841**	
Franchise Fees	**$7,199,561**	**$7,856,176**	**$8,346,136**	**$8,750,362**	**$8,947,488**	**$9,131,451**	**$9,764,925**	**$10,104,013**	**$10,313,830**	**$10,528,719**	**$10,748,816**	Schedule I-2
Power, Other Utilities & Chemicals												
Power	$3,961,800	$3,737,800	$3,737,800	$4,228,818	$4,309,166	$4,391,040	$4,474,470	$4,559,485	$4,646,115	$4,734,391	$4,824,344	Schedule I-2
Water	423,000	400,000	400,000	407,600	415,344	423,236	431,277	439,472	447,822	456,330	465,001	Schedule I-2
Natural Gas	313,000	225,000	225,000	229,275	233,631	238,070	242,594	247,203	251,900	256,686	261,563	Schedule I-2
Total Power, Other Utilities & Chemicals	**$4,697,800**	**$4,362,800**	**$4,362,800**	**$4,865,693**	**$4,958,141**	**$5,052,346**	**$5,148,341**	**$5,246,159**	**$5,345,836**	**$5,447,407**	**$5,550,908**	
Wastewater Treatment Plant												
Plant Operations	$5,579,460	$5,600,143	$5,871,443	$5,983,000	$6,096,677	$6,212,514	$6,330,552	$6,450,832	$6,573,398	$6,698,292	$6,825,560	Schedule I-2
Ostara (Phosphorous)	1,053,715	1,099,170	1,117,792	1,139,030	1,160,671	1,182,724	1,205,196	1,228,094	1,251,428	1,275,205	1,299,434	Schedule I-2
Clover Bar (Biosolids)	14,750,062	15,905,715	17,344,764	17,674,315	18,010,127	18,352,319	18,701,013	19,056,332	19,418,403	19,787,352	20,163,312	Schedule I-2
Suncor - Recycled Water	0	0	0	0	0	0	0	0	0	0	0	Schedule I-2
General Maintenance	1,327,732	2,819,327	2,982,279	3,288,942	3,351,432	3,415,110	3,479,997	3,546,117	3,613,493	3,682,149	3,752,110	Schedule I-2
Process Maintenance	4,553,934	4,117,664	4,218,931	4,299,090	4,380,773	4,464,008	4,548,824	4,635,251	4,723,321	4,813,064	4,904,513	Schedule I-2
Facilities & Site Maintenance	3,061,019	2,894,287	2,965,489	3,021,833	3,079,248	3,137,754	3,197,371	3,258,121	3,320,025	3,383,106	3,447,385	Schedule I-2
Plant Controls and Automation	1,482,799	1,453,358	1,529,810	1,558,877	1,588,495	1,618,677	1,649,431	1,680,771	1,712,705	1,745,247	1,778,406	Schedule I-2
Plant Engineering	2,125,475	2,162,330	2,237,869	2,280,389	2,323,716	2,367,867	2,412,856	2,458,700	2,505,416	2,553,018	2,601,526	Schedule I-2
Abandonments	0	0	0	0	0	0	0	0	0	0	0	Schedule I-2
Total Wastewater Treatment Plant	**$33,934,196**	**$36,051,995**	**$38,268,376**	**$39,245,475**	**$39,991,139**	**$40,750,971**	**$41,525,239**	**$42,314,219**	**$43,118,189**	**$43,937,435**	**$44,772,246**	

EPCOR
Wastewater Treatment COSA
Revenue Requirement
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	*Notes*
Operational Support Services												
Quality Assurance and Environment	$3,453,190	$4,598,432	$4,694,072	$4,783,259	$4,874,141	$4,966,750	$5,061,118	$5,157,279	$5,255,268	$5,355,118	$5,456,865	Schedule I-2
Project Engineering	(541,112)	(789,430)	(898,868)	(915,946)	(933,349)	(951,083)	(969,153)	(987,567)	(1,006,331)	(1,025,451)	(1,044,935)	Schedule I-2
Gold Bar Administration	930,215	1,236,905	1,282,023	1,306,382	1,331,203	1,356,496	1,382,269	1,408,532	1,435,295	1,462,565	1,490,354	Schedule I-2
Centre of Excellence	500,089	0	0	0	0	0	0	0	0	0	0	Schedule I-2
Operations Communications	65,908	66,658	91,085	92,815	94,579	96,376	98,207	100,073	101,974	103,912	105,886	Schedule I-2
Legal Services	25,575	20,400	20,788	21,183	21,585	21,995	22,413	22,839	23,273	23,715	24,166	Schedule I-2
SCM Security	275,437	138,250	140,773	143,447	146,173	148,950	151,780	154,664	157,603	160,597	163,648	Schedule I-2
SCM Inventory Management	237,971	206,542	212,858	216,903	221,024	225,223	229,503	233,863	238,307	242,834	247,448	Schedule I-2
Total Operational Support Services	**$4,947,273**	**$5,477,757**	**$5,542,731**	**$5,648,043**	**$5,755,356**	**$5,864,707**	**$5,976,137**	**$6,089,683**	**$6,205,387**	**$6,323,290**	**$6,443,432**	
Capital Overhead	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	Schedule I-2
Billing, Meters, & Customer Service												
CUS Charges - Metering	$2,588,460	$2,523,773	$2,572,484	$2,621,361	$2,671,167	$2,721,919	$2,773,636	$2,826,335	$2,880,035	$2,934,756	$2,990,516	Schedule I-2
CUS Charges - Billing & Collections	3,248,399	3,587,822	3,411,173	3,475,986	3,542,029	3,609,328	3,677,905	3,747,785	3,818,993	3,891,554	3,965,494	Schedule I-2
Regulatory Services (Strength Testing)	1,273,891	1,620,002	1,668,002	1,699,694	1,731,988	1,764,896	1,798,429	1,832,599	1,867,418	1,902,899	1,939,054	Schedule I-2
Total Billing, Meters, & Customer Service	**$7,110,749**	**$7,731,598**	**$7,651,659**	**$7,797,041**	**$7,945,184**	**$8,096,143**	**$8,249,970**	**$8,406,719**	**$8,566,447**	**$8,729,209**	**$8,895,064**	
EWSI Shared Service												
Allocation from BU 8F	$2,870,680	$3,051,141	$3,153,952	$3,213,877	$3,274,941	$3,337,165	$3,400,571	$3,465,181	$3,531,020	$3,598,109	$3,666,473	Schedule I-2
Controller, Water Services	20,647	308,695	323,697	329,847	336,114	342,500	349,008	355,639	362,396	369,281	376,298	Schedule I-2
Controller & Fringe/SRP True-up	0	0	0	0	0	0	0	0	0	0	0	Schedule I-2
Health, Safety and Environment	165,829	172,883	178,639	182,033	185,491	189,016	192,607	196,267	199,996	203,796	207,668	Schedule I-2
Incentive	1,010,453	1,021,944	1,046,538	1,066,422	1,086,684	1,107,331	1,128,370	1,149,809	1,171,655	1,193,917	1,216,601	Schedule I-2
Total EWSI Shared Service	**$4,067,609**	**$4,554,661**	**$4,702,825**	**$4,792,178**	**$4,883,230**	**$4,976,011**	**$5,070,555**	**$5,166,896**	**$5,265,067**	**$5,365,103**	**$5,467,040**	
Corporate Shared Services	**$4,108,401**	**$4,562,395**	**$5,032,286**	**$5,127,899**	**$5,225,329**	**$5,324,610**	**$5,425,778**	**$5,528,868**	**$5,633,916**	**$5,740,961**	**$5,850,039**	Schedule I-2
Total O&M Expenses	**$66,065,591**	**$70,597,382**	**$73,906,812**	**$76,226,691**	**$77,705,867**	**$79,196,240**	**$81,160,944**	**$82,856,557**	**$84,448,673**	**$86,072,123**	**$87,727,545**	
Property Taxes	**$649,363**	**$615,508**	**$646,653**	**$658,939**	**$671,459**	**$684,217**	**$697,217**	**$710,464**	**$723,963**	**$737,718**	**$751,735**	Schedule I-2
Depreciation	$18,880,548	$20,460,302	$21,666,973	$22,677,656	$23,536,236	$24,557,490	$25,729,955	$27,624,926	$30,157,057	$30,930,199	$32,325,208	Schedule I-3
Less: Contributions Amortization	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	*($930,285)*	
Total Depreciation	**$17,950,263**	**$19,530,017**	**$20,736,688**	**$21,747,371**	**$22,605,951**	**$23,627,205**	**$24,799,670**	**$26,694,641**	**$29,226,772**	**$29,999,914**	**$31,394,923**	
Financing Costs												
Interest on LTD	$10,855,491	$11,690,853	$12,153,884	$12,326,160	$13,173,192	$13,359,819	$14,250,041	$14,766,897	$15,288,600	$15,885,995	$16,771,861	Schedule F-1
Interest on STD	1,355,747	1,947,931	2,359,004	2,155,238	2,026,736	2,007,284	1,980,503	2,075,769	2,011,956	1,918,632	1,938,540	Schedule F-1
AFUDC	(1,592,773)	(1,687,668)	(1,049,113)	(122,806)	(2,562)	194,243	(632,448)	(600,124)	(293,393)	(610,476)	98,477	Schedule F-1
Total Financing Costs	**$10,618,465**	**$11,951,116**	**$13,463,775**	**$14,358,593**	**$15,197,366**	**$15,561,347**	**$15,598,096**	**$16,242,543**	**$17,007,164**	**$17,194,150**	**$18,808,878**	
Return on Investment												
Retained Earnings	$8,710,473	$10,256,218	$7,183,020	$12,376,691	$2,145,496	$12,059,844	$17,304,072	$12,816,867	$11,069,615	$6,700,902	$5,325,762	Schedule F-1
Dividends / Equity Issue	10,000,000	10,000,000	15,000,000	10,000,000	20,000,000	10,000,000	10,000,000	15,000,000	15,000,000	20,000,000	20,000,000	Schedule F-1
Total Return on Investment	**$18,710,473**	**$20,256,218**	**$22,183,020**	**$22,376,691**	**$22,145,496**	**$22,059,844**	**$27,304,072**	**$27,816,867**	**$26,069,615**	**$26,700,902**	**$25,325,762**	
Total Revenue Requirement	**$113,994,155**	**$122,950,242**	**$130,936,948**	**$135,368,286**	**$138,326,139**	**$141,128,852**	**$149,559,999**	**$154,321,072**	**$157,476,187**	**$160,704,807**	**$164,008,842**	

EPCOR
Wastewater Treatment COSA
Exhibit 3
Volume Distribution Factor

	Annual Flow (m^3) [1]	15.5% Inflow and Infiltration [2]	Total Annual Flow at Plant (m^3)	Avg. Daily Flow at Plant (ML / Day)	% of Total
Single Family	45,061,664	6,984,558	52,046,222	142.59	52.6%
Multi-Family	17,570,250	2,723,389	20,293,639	55.60	20.5%
Commercial	22,992,247	3,563,798	26,556,045	72.76	26.9%
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Total	**85,624,161**	**13,271,745**	**98,895,906**	**270.95**	**100.0%**
		Actual Flows [3]	**98,884,000**	***270.92***	
					(VOL)

Notes

[1] - Based on 2019 projection
[2] - Estimated
[3] - Per EPCOR data, CY 2018

EPCOR
Wastewater Treatment COSA
Exhibit 4
Customer Distribution Factors

	Actual Customer		Cust. Serv. & Acntg		
	Number of Account [1]	% of Total	Weight Factor	Wt. Accounts	% of Total
Single Family	269,705	92.8%	1.00	269,705	92.8%
Multi-Family	3,786	1.3%	1.00	3,786	1.3%
Commercial	17,058	5.9%	1.00	17,058	5.9%
Overstrength	0	0.0%	0.00	0	0.0%
	----------	----------		----------	----------
Total	**290,549**	**100.0%**		**290,549**	**100.0%**
		(AC)			***(WCA)***

Notes

[1] - Based on 2019 projection

EPCOR
Wastewater Treatment COSA
Exhibit 5
Strength Distribution Factors

	Biochemical Oxygen Demand				Total Suspended Solids		
	Daily Flow (ML / Day)	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total
Single Family	142.59	180	9,368,320	43.0%	330	17,175,253	50.5%
Multi-Family	55.60	180	3,652,855	16.8%	330	6,696,901	19.7%
Commercial	72.76	180	4,780,088	21.9%	330	8,763,495	25.8%
Overstrength			3,985,731	18.3%		1,375,641	4.0%
Tier 1			3,713,741	*17.0%*		1,297,402	*3.8%*
Tier 2			271,990	*1.2%*		78,239	*0.2%*
Total	**270.95**		**21,786,994**	**100.0%**		**34,011,290**	**100.0%**
		Total Kg's Removed [2] [3]	*20,377,287*	***(BOD)***	*Total Kg's Removed [2]*	*32,719,553*	***(TSS)***

	Chemical Oxygen Demand				Oil & Grease		
	Daily Flow (ML / Day)	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total
Single Family	142.59	89	4,606,091	49.9%	45	2,342,080	49.3%
Multi-Family	55.60	89	1,795,987	19.4%	45	913,214	19.2%
Commercial	72.76	89	2,350,210	25.4%	45	1,195,022	25.2%
Overstrength			485,380	5.3%		297,695	6.3%
Tier 1			477,820	*5.2%*		278,924	*5.9%*
Tier 2			7,560	*0.1%*		18,771	*0.4%*
Total	**270.95**		**9,237,668**	**100.0%**		**4,748,011**	**100.0%**
		Total Kg's Removed [2] [3]	*8,733,123*	***(COD)***	*Total Kg's Removed [2]*		***(OG)***

	Total Nitrogen				Total Phosphorous		
	Daily Flow (ML / Day)	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total	Avg. Factor (mg/l)	Calculated Kilograms [1]	% of Total
Single Family	142.59	36	1,873,664	49.0%	7.27	378,376	51.0%
Multi-Family	55.60	36	730,571	19.1%	7.27	147,535	19.9%
Commercial	72.76	36	956,018	25.0%	7.27	193,062	26.0%
Overstrength			261,334	6.8%		23,148	3.1%
Tier 1			223,629	*5.9%*		23,148	*3.1%*
Tier 2			37,705	*1.0%*		0	*0.0%*
	270.95		**3,821,587**	**100.0%**		**742,121**	**100.0%**
		Total Kg's Removed [2]	*3,559,898*	***(TKN)***	*Total Kg's Removed [2]*	*700,628*	***(TP)***

Notes

[1] - Calculated Kilograms = Daily Flow * Factor
[2] - Based on CY 2018 performance data
[3] - BOD / COD Kg removed split is 70% / 30%

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Wastewater Treatment COSA
Exhibit 6
Revenue Distribution Factor

	Projected 2021	% of Total
Single Family	$64,338,221	60.3%
Multi-Family	18,716,369	17.5%
Commercial	23,643,333	22.2%
Overstrength		0.0%
Tier 1	3,854,224	
Tier 2	272,496	
	-----------------	----------
Total	**$106,697,923**	**100.0%**
		(RR)

EPCOR
Wastewater Treatment COSA
Exhibit 7a
Plant in Service - Original Cost

	As of 12/31/18	**Volume** *(VOL)*	*Strength Related* **Biochemical Oxygen Demand** *(BOD)*	**Chemical Oxygen Demand** *(COD)*	**Total Nitrogen** *(TKN)*	**Total Phosphorous** *(TP)*	**Oil & Grease** *(OG)*	**Total Suspended Solids** *(TSS)*	**Actual Customer** *(AC)*	**Customer Serv & Actng.** *(WCA)*	**Revenue Related** *(RR)*	**Direct Assignment** *(DA)*	*Basis of Classification*
Land	$420,842	$0	$0	$0	$0	$0	$0	$0	$0	$420,842	$0	$0	100.0% WCA
WWTP													
Admin	$3,245,752	$0	$0	$0	$0	$0	$0	$0	$0	$3,245,752	$0	$0	100.0% WCA
Air Scrub	11,532,557	0	0	0	0	0	5,766,279	5,766,279	0	0	0	0	50.0% TSS 50.0% OG
Main Control Room	1,313,227	51,269	95,800	169,054	227,375	250,849	204,764	304,197	0	9,918	0	0	*As all other treatment*
Aux Control Room	368,529	14,388	26,884	47,442	63,808	70,395	57,463	85,366	0	2,783	0	0	*As all other treatment*
Blowers	4,497,543	0	1,124,386	449,754	2,473,649	449,754	0	0	0	0	0	0	25.0% BOD 10.0% COD 55.0% TKN 10.0% TP
Boilers	16,851,663	657,899	1,229,334	2,169,350	2,917,740	3,218,956	2,627,582	3,903,539	0	127,265	0	0	*As all other treatment*
CBF (inc. Ostara)	18,924,085	738,807	1,380,518	2,436,137	3,276,564	3,614,824	2,950,722	4,383,597	0	142,916	0	0	*As all other treatment*
Center of Excellence	5,700,657	5,700,657	0	0	0	0	0	0	0	0	0	0	100.0% VOL
Digesters	71,356,464	0	9,989,905	4,281,388	14,271,293	14,271,293	14,271,293	14,271,293	0	0	0	0	BOD/COD, TKN, TP, OG, & TSS Equally
Distribution Station	22,376	874	1,632	2,881	3,874	4,274	3,489	5,183	0	169	0	0	*As all other treatment*
Enhanced Prim. Treat.	11,789,236	0	0	2,829,417	1,296,816	0	4,244,125	3,418,878	0	0	0	0	24.0% COD 29.0% TSS 11.0% TKN 36.0% OG
Flare	879,115	0	123,076	52,747	175,823	175,823	175,823	175,823	0	0	0	0	*As Biogas*
Grit	75,972,290	0	0	22,791,687	7,597,229	0	7,597,229	37,986,145	0	0	0	0	10.0% TKN 50.0% TSS 30.0% COD 10.0% OG
Laboratory	9,381,794	469,090	1,688,723	1,688,723	1,688,723	1,688,723	469,090	1,688,723	0	0	0	0	5.0% VOL 5.0% OG 18.0% BOD/COD/TKN/TSS/TP
Maintenance Building	3,742,193	146,097	272,994	481,740	647,933	714,823	583,498	866,846	0	28,261	0	0	*As all other treatment*
Outfall	16,168	16,168	0	0	0	0	0	0	0	0	0	0	100.0% VOL
Penthouse	446,830	17,445	32,596	57,521	77,365	85,352	69,672	103,504	0	3,374	0	0	*As all other treatment*
Primary Clarifier	83,545,085	0	0	20,050,820	9,189,959	0	30,076,231	24,228,075	0	0	0	0	24.0% COD 29.0% TSS 11.0% TKN 36.0% OG
Screens	3,232,363	969,709	0	0	0	0	0	2,262,654	0	0	0	0	30.0% VOL 70.0% TSS
Sampling	40,289	2,014	7,252	7,252	7,252	7,252	2,014	7,252	0	0	0	0	5.0% VOL 5.0% OG 18.0% BOD/COD/TKN/TSS/TP
Scum	1,059,928	0	317,978	0	0	0	741,950	0	0	0	0	0	30.0% BOD 70.0% OG
Bioreactor/Secondary Clarifier	94,702,662	0	13,258,373	5,682,160	28,410,799	37,881,065	0	9,470,266	0	0	0	0	20.0% COD 30.0% TKN 10.0% TSS 40.0% TP
Substation	1,346,727	52,577	98,244	173,367	233,176	257,248	209,987	311,957	0	10,171	0	0	*As all other treatment*
UV	11,581,041	11,581,041	0	0	0	0	0	0	0	0	0	0	100.0% VOL
Waste Activated Sludge	8,204,482	0	1,148,627	492,269	2,461,345	3,281,793	0	820,448	0	0	0	0	20.0% COD 30.0% TKN 10.0% TSS 40.0% TP
EPT - Polymer System	3,536,974	0	0	848,874	389,067	0	1,273,311	1,025,722	0	0	0	0	24.0% COD 29.0% TSS 11.0% TKN 36.0% OG
Hydrogen Peroxide	125,159	125,159	0	0	0	0	0	0	0	0	0	0	100.0% VOL
Secondary Alum Room	605,024	90,754	0	0	0	257,135	0	257,135	0	0	0	0	42.5% TSS 15.0% VOL 42.5% TP
Biogas	13,892,651	0	1,944,971	833,559	2,778,530	2,778,530	2,778,530	2,778,530	0	0	0	0	As Digesters
Blend Tanks	1,471,994	0	206,079	88,320	294,399	294,399	294,399	294,399	0	0	0	0	As Digesters
Fermenter	28,657,560	0	0	0	5,015,073	23,642,487	0	0	0	0	0	0	17.5% TKN 82.5% TP
Sludge	40,062,412	0	5,608,738	2,403,745	8,012,482	8,012,482	8,012,482	8,012,482	0	0	0	0	As Digesters
CWIP		0	0	0	0	0	0	0	0	0	0	0	*As all other treatment*
Plant Before General Plant	**$528,525,672**	**$20,633,947**	**$38,556,112**	**$68,038,205**	**$91,510,274**	**$100,957,459**	**$82,409,931**	**$122,428,295**	**$0**	**$3,991,450**	**$0**	**$0**	
% Plant Before General Plant	***100.0%***	***3.9%***	***7.3%***	***12.9%***	***17.3%***	***19.1%***	***15.6%***	***23.2%***	***0.0%***	***0.8%***	***0.0%***	***0.0%***	*Factor PBGP*

EPCOR
Wastewater Treatment COSA
Exhibit 7a
Plant in Service - Original Cost

	As of 12/31/18	Volume (VOL)	Strength Related: Biochemical Oxygen Demand (BOD)	Chemical Oxygen Demand (COD)	Total Nitrogen (TKN)	Total Phosphorous (TP)	Oil & Grease (OG)	Total Suspended Solids (TSS)	Actual Customer (AC)	Customer Serv & Actng. (WCA)	Revenue Related (RR)	Direct Assignment (DA)	Basis of Classification
General Plant													
Furnature	$504,685	$19,703	$36,817	$64,969	$87,382	$96,403	$78,693	$116,906	$0	$3,811	$0	$0	*As Factor PBGP*
Software	5,065,203	197,748	369,508	652,054	877,002	967,541	789,788	1,173,309	0	38,253	0	0	*As Factor PBGP*
Hardware	13,717,394	535,535	1,000,688	1,765,869	2,375,064	2,620,257	2,138,873	3,177,513	0	103,594	0	0	*As Factor PBGP*
Tools	2,079,471	81,184	151,698	267,695	360,045	397,215	324,240	481,691	0	15,704	0	0	*As Factor PBGP*
Vehicles	1,280,019	49,973	93,378	164,779	221,626	244,506	199,586	296,505	0	9,667	0	0	*As Factor PBGP*
Guardhouse	48,792	1,905	3,559	6,281	8,448	9,320	7,608	11,302	0	368	0	0	*As Factor PBGP*
Fencing	736,696	28,761	53,742	94,836	127,553	140,722	114,869	170,649	0	5,564	0	0	*As Factor PBGP*
Security	2,829,112	110,450	206,385	364,197	489,840	540,409	441,127	655,339	0	21,366	0	0	*As Factor PBGP*
Paving, Roads, Parking, etc.	1,731,131	67,584	126,287	222,852	299,732	330,676	269,925	401,001	0	13,074	0	0	*As Factor PBGP*
Utilities	29,100,816	1,136,113	2,122,914	3,746,208	5,038,589	5,558,754	4,537,521	6,740,947	0	219,771	0	0	*As Factor PBGP*
Generator	3,334,854	130,195	243,279	429,303	577,405	637,014	519,984	772,489	0	25,185	0	0	*As Factor PBGP*
Glycol	2,892,953	112,943	211,042	372,416	500,893	552,604	451,081	670,127	0	21,848	0	0	*As Factor PBGP*
Total General Plant	**$63,321,126**	**$2,472,093**	**$4,619,296**	**$8,151,460**	**$10,963,580**	**$12,095,420**	**$9,873,295**	**$14,667,779**	**$0**	**$478,204**	**$0**	**$0**	
Total Plant in Service	**$591,846,798**	**$23,106,040**	**$43,175,408**	**$76,189,665**	**$102,473,854**	**$113,052,878**	**$92,283,226**	**$137,096,073**	**$0**	**$4,469,654**	**$0**	**$0**	

EPCOR
Wastewater Treatment COSA
Exhibit 8.1
Allocation of the Revenue Requirement

	Test Year 2021	Volume (VOL)	Strength Related: Biochemical Oxygen Demand (BOD)	Chemical Oxygen Demand (COD)	Total Nitrogen (TKN)	Total Phosphorous (TP)	Oil & Grease (OG)	Total Suspended Solids (TSS)	Actual Customer (AC)	Customer Serv & Actng. (WCA)	Revenue (RR)	Direct (DA)	*Basis of Classification*
Franchise Fees	**$8,346,136**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$8,346,136**	**$0**	100% RR
Power, Other Utilities & Chemicals													
Power	$3,737,800	$119,102	$263,416	$505,918	$636,942	$686,335	$590,548	$903,464	$0	$32,075	$0	$0	As Net Plant
Water	400,000	12,746	28,189	54,141	68,162	73,448	63,197	96,684	0	3,432	0	0	As Net Plant
Natural Gas	225,000	7,169	15,857	30,454	38,341	41,315	35,549	54,385	0	1,931	0	0	As Net Plant
Chemicals	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Salaries-OT CompTime Cashout	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Furlough Savings	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Labor Concessions	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Year-End Accrual -Sal & Bene	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Vacation Cashout (Annual)	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Total Power, Other Utilities & Chemicals	**$4,362,800**	**$139,017**	**$307,462**	**$590,513**	**$743,445**	**$801,098**	**$689,294**	**$1,054,533**	**$0**	**$37,438**	**$0**	**$0**	
Wastewater Treatment Plant													
Plant Operations	$5,871,443	$187,089	$413,782	$794,710	$1,000,526	$1,078,115	$927,650	$1,419,187	$0	$50,384	$0	$0	As Net Plant
Ostara (Phosphorous)	1,117,792	0	0	0	0	1,117,792	0	0	0	0	0	0	100% TP
Clover Bar (Biosolids)	17,344,764	0	0	0	0	0	0	17,344,764	0	0	0	0	100% TSS
Suncor - Recycled Water	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
General Maintenance	2,982,279	95,028	210,172	403,657	508,197	547,606	471,181	720,847	0	25,591	0	0	As Net Plant
Process Maintenance	4,218,931	134,433	297,323	571,040	718,929	774,680	666,564	1,019,758	0	36,203	0	0	As Net Plant
Facilities & Site Maintenance	2,965,489	94,493	208,989	401,384	505,336	544,523	468,528	716,788	0	25,447	0	0	As Net Plant
Plant Controls and Automation	1,529,810	48,746	107,811	207,063	260,688	280,904	241,700	369,771	0	13,128	0	0	As Net Plant
Plant Engineering	2,237,869	71,308	157,711	302,900	381,345	410,918	353,569	540,915	0	19,203	0	0	As Net Plant
Abandonments	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Total Wastewater Treatment Plant	**$38,268,376**	**$631,097**	**$1,395,789**	**$2,680,753**	**$3,375,022**	**$4,754,537**	**$3,129,192**	**$22,132,030**	**$0**	**$169,956**	**$0**	**$0**	
Operational Support Services													
Quality Assurance and Environment	$4,694,072	$149,573	$330,808	$635,351	$799,896	$861,926	$741,633	$1,134,604	$0	$40,280	$0	$0	As Net Plant
Project Engineering	(898,868)	(28,642)	(63,346)	(121,663)	(153,172)	(165,050)	(142,015)	(217,265)	0	(7,713)	0	0	As Net Plant
Gold Bar Administration	1,282,023	40,851	90,349	173,524	218,464	235,405	202,551	309,878	0	11,001	0	0	As Net Plant
Centre of Excellence	0	0	0	0	0	0	0	0	0	0	0	0	As Net Plant
Operations Communications	91,085	2,902	6,419	12,328	15,521	16,725	14,391	22,016	0	782	0	0	As Net Plant
Legal Services	20,788	662	1,465	2,814	3,542	3,817	3,284	5,025	0	178	0	0	As Net Plant
SCM Security	140,773	4,486	9,921	19,054	23,988	25,849	22,241	34,026	0	1,208	0	0	As Net Plant
SCM Inventory Management	212,858	6,783	15,001	28,811	36,272	39,085	33,630	51,450	0	1,827	0	0	As Net Plant
Total Operational Support Services	**$5,542,731**	**$176,615**	**$390,617**	**$750,218**	**$944,512**	**$1,017,757**	**$875,716**	**$1,339,734**	**$0**	**$47,563**	**$0**	**$0**	

EPCOR
Wastewater Treatment COSA
Exhibit 8.1
Allocation of the Revenue Requirement

			Strength Related											
	Test Year 2021	**Volume (VOL)**	**Biochemical Oxygen Demand (BOD)**	**Chemical Oxygen Demand (COD)**	**Total Nitrogen (TKN)**	**Total Phosphorous (TP)**	**Oil & Grease (OG)**	**Total Suspended Solids (TSS)**	**Actual Customer (AC)**	**Customer Serv & Actng. (WCA)**	**Revenue (RR)**	**Direct (DA)**	*Basis of Classification*
Capital Overhead	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	As Net Plant
Billing, Meters, & Customer Service													
CUS Charges - Metering	$2,572,484	$0	$0	$0	$0	$0	$0	$0	$0	$2,572,484	$0	$0	100% WCA
CUS Charges - Billing & Collections	3,411,173	0	0	0	0	0	0	0	0	3,411,173	0	0	100% WCA
Regulatory Services (Strength Testing)	1,668,002	0	0	0	0	0	0	0	0	0	0	1,668,002	100% DA
Total Billing, Meters, & Customer Service	**$7,651,659**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$5,983,657**	**$0**	**$1,668,002**	
EWSI Shared Service													
Allocation from BU 8F	$3,153,952	$0	$0	$0	$0	$0	$0	$0	$0	$3,153,952	$0	$0	100% WCA
Controller, Water Services	323,697	0	0	0	0	0	0	0	0	323,697	0	0	100% WCA
Controller & Fringe/SRP True-up	0	0	0	0	0	0	0	0	0	0	0	0	100% WCA
Health, Safety and Environment	178,639	0	0	0	0	0	0	0	0	178,639	0	0	100% WCA
Incentive	1,046,538	0	0	0	0	0	0	0	0	1,046,538	0	0	100% WCA
Total EWSI Shared Service	**$4,702,825**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$4,702,825**	**$0**	**$0**	
Corporate Shared Services	**$5,032,286**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$5,032,286**	**$0**	**$0**	100% WCA
Total O&M Expenses	**$73,906,812**	**$946,729**	**$2,093,868**	**$4,021,484**	**$5,062,979**	**$6,573,392**	**$4,694,202**	**$24,526,297**	**$0**	**$15,973,725**	**$8,346,136**	**$1,668,002**	
Property Taxes	**$646,653**	**$20,605**	**$45,572**	**$87,526**	**$110,193**	**$118,738**	**$102,167**	**$156,303**	**$0**	**$5,549**	**$0**	**$0**	As Net Plant
Depreciation	$21,666,973	$690,401	$1,526,951	$2,932,663	$3,692,173	$3,978,491	$3,423,242	$5,237,125	$0	$185,927	$0	$0	As Net Plant
Less: Contributions Amortization	($930,285)	(29,643)	(65,561)	(125,916)	(158,526)	(170,819)	(146,979)	(224,859)	0	(7,983)	0	0	As Net Plant
Total Depreciation	**$20,736,688**	**$660,758**	**$1,461,390**	**$2,806,748**	**$3,533,647**	**$3,807,672**	**$3,276,263**	**$5,012,266**	**$0**	**$177,944**	**$0**	**$0**	
Financing Costs													
Interest on LTD	$12,153,884	$387,274	$856,529	$1,645,050	$2,071,089	$2,231,697	$1,920,235	$2,937,716	$0	$104,294	$0	$0	As Net Plant
Interest on STD	2,359,004	75,168	166,248	319,295	401,987	433,160	372,707	570,195	0	20,243	0	0	As Net Plant
AFUDC	(1,049,113)	(33,429)	(73,935)	(141,999)	(178,775)	(192,638)	(165,753)	(253,581)	0	(9,003)	0	0	As Net Plant
Total Financing Costs	**$13,463,775**	**$429,012**	**$948,842**	**$1,822,346**	**$2,294,302**	**$2,472,219**	**$2,127,190**	**$3,254,330**	**$0**	**$115,534**	**$0**	**$0**	

EPCOR
Wastewater Treatment COSA
Exhibit 8.1
Allocation of the Revenue Requirement

	Test Year	**Volume**	**Biochemical Oxygen Demand**	**Chemical Oxygen Demand**	**Total Nitrogen**	**Total Phosphorous**	**Oil & Grease**	**Total Suspended Solids**	**Actual Customer**	**Customer Serv & Actng.**	**Revenue**	**Direct**	
			Strength Related										
	2021	*(VOL)*	*(BOD)*	*(COD)*	*(TKN)*	*(TP)*	*(OG)*	*(TSS)*	*(AC)*	*(WCA)*	*(RR)*	*(DA)*	*Basis of Classification*
Return on Investment													
Retained Earnings	$7,183,020	$228,881	$506,214	$972,235	$1,224,027	$1,318,947	$1,134,871	$1,736,208	$0	$61,638	$0	$0	As Net Plant
Dividends / Equity Issue	15,000,000	477,963	1,057,105	2,030,277	2,556,083	2,754,301	2,369,903	3,625,651	0	128,717	0	0	As Net Plant
Total Return on Investment	**$22,183,020**	**$706,844**	**$1,563,319**	**$3,002,511**	**$3,780,110**	**$4,073,247**	**$3,504,774**	**$5,361,859**	**$0**	**$190,355**	**$0**	**$0**	
Total Revenue Requirement	**$130,936,948**	**$2,763,948**	**$6,112,990**	**$11,740,615**	**$14,781,232**	**$17,045,268**	**$13,704,595**	**$38,311,054**	**$0**	**$16,463,108**	**$8,346,136**	**$1,668,002**	
Less: Non-Operating Revenue													
Late Payment Charges	$266,341	$5,622	$12,435	$23,882	$30,067	$34,672	$27,877	$77,929	$0	$33,488	$16,977	$3,393	As Revenue Requirement
Surplus Sales	5,220	110	244	468	589	680	546	1,527	0	656	333	66	As Revenue Requirement
ACRWC Swap	943,233	19,911	44,036	84,576	106,480	122,789	98,724	275,982	0	118,596	60,123	12,016	As Revenue Requirement
Suburban	542,274	11,447	25,317	48,624	61,216	70,593	56,757	158,665	0	68,182	34,565	6,908	As Revenue Requirement
Lab	400,002	8,444	18,675	35,867	45,155	52,072	41,866	117,037	0	50,293	25,497	5,096	As Revenue Requirement
Ostara	400,000	8,444	18,675	35,866	45,155	52,072	41,866	117,037	0	50,293	25,497	5,096	As Revenue Requirement
Biosolids													
ACRWC Recovery	$4,200,000	0	0	0	0	0	0	4,200,000	0	0	0	0	100% TSS
EPCOR Drainage Recovery	12,824,672	0	0	0	0	0	0	12,824,672	0	0	0	0	100% TSS
AESO DR Participation	100,000	2,111	4,669	8,967	11,289	13,018	10,467	29,259	0	12,573	6,374	1,274	As Revenue Requirement
Suburban - Strathcona	430,563	9,089	20,101	38,607	48,605	56,050	45,065	125,979	0	54,136	27,445	5,485	As Revenue Requirement
Total Other Revenues	**$20,112,305**	**$65,177**	**$144,151**	**$276,856**	**$348,557**	**$401,946**	**$323,169**	**$17,928,087**	**$0**	**$388,218**	**$196,811**	**$39,333**	
Net Revenue Requirement	**$110,824,643**	**$2,698,772**	**$5,968,839**	**$11,463,759**	**$14,432,674**	**$16,643,323**	**$13,381,427**	**$20,382,967**	**$0**	**$16,074,890**	**$8,149,325**	**$1,628,669**	

EPCOR
Wastewater Treatment COSA
Exhibit 8.2
Direct Assignment of the Revenue Requirement

	Total	Single Family	Multi-Family	Commercial	Overstrength *Tier 1*	Overstrength *Tier 2*	*Notes*
Franchise Fees	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Power, Other Utilities & Chemicals							
Power	$0	$0	$0	$0	$0	$0	
Water	0	0	0	0	0	0	
Natural Gas	0	0	0	0	0	0	
Chemicals	0	0	0	0	0	0	
Salaries-OT CompTime Cashout	0	0	0	0	0	0	
Furlough Savings	0	0	0	0	0	0	
Labor Concessions	0	0	0	0	0	0	
Year-End Accrual -Sal & Bene	0	0	0	0	0	0	
Vacation Cashout (Annual)	0	0	0	0	0	0	
Total Power, Other Utilities & Chemicals	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Wastewater Treatment Plant							
Plant Operations	$0	$0	$0	$0	$0	$0	
Ostara (Phosphorous)	0	0	0	0	0	0	
Clover Bar (Biosolids)	0	0	0	0	0	0	
Suncor - Recycled Water	0	0	0	0	0	0	
General Maintenance	0	0	0	0	0	0	
Process Maintenance	0	0	0	0	0	0	
Facilities & Site Maintenance	0	0	0	0	0	0	
Plant Controls and Automation	0	0	0	0	0	0	
Plant Engineering	0	0	0	0	0	0	
Abandonments	0	0	0	0	0	0	
Total Wastewater Treatment Plant	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Operational Support Services							
Quality Assurance and Environment	$0	$0	$0	$0	$0	$0	
Project Engineering	0	0	0	0	0	0	
Gold Bar Administration	0	0	0	0	0	0	
Centre of Excellence	0	0	0	0	0	0	
Operations Communications	0	0	0	0	0	0	
Legal Services	0	0	0	0	0	0	
SCM Security	0	0	0	0	0	0	
SCM Inventory Management	0	0	0	0	0	0	
Total Operational Support Services	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Capital Overhead	$0	$0	$0	$0	$0	$0	

EPCOR
Wastewater Treatment COSA
Exhibit 8.2
Direct Assignment of the Revenue Requirement

	Total	Single Family	Multi-Family	Commercial	Overstrength Tier 1	Overstrength Tier 2	Notes
Billing, Meters, & Customer Service							
CUS Charges - Metering	$0	$0	$0	$0	$0	$0	
CUS Charges - Billing & Collections	0	0	0	0	0	0	
Regulatory Services (Strength Testing)	1,668,002	0	0	0	834,001	834,001	
Total Billing, Meters, & Customer Service	**$1,668,002**	**$0**	**$0**	**$0**	**$834,001**	**$834,001**	
EWSI Shared Service							
Allocation from BU 8F	$0	$0	$0	$0	$0	$0	
Controller, Water Services	0	0	0	0	0	0	
Controller & Fringe/SRP True-up	0	0	0	0	0	0	
Health, Safety and Environment	0	0	0	0	0	0	
Incentive	0	0	0	0	0	0	
Total EWSI Shared Service	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Corporate Shared Services	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Total O&M Expenses	**$1,668,002**	**$0**	**$0**	**$0**	**$834,001**	**$834,001**	
Property Taxes	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Depreciation	$0	$0	$0	$0	$0	$0	
Less: Contributions Amortization	0	0	0	0	0	0	
Total Depreciation	$0	$0	$0	$0	$0	$0	
Financing Costs							
Interest on LTD	0	0	0	0	0	0	
Interest on STD	0	0	0	0	0	0	
AFUDC	0	0	0	0	0	0	
Total Financing Costs	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	
Return on Investment							
Retained Earnings	$0	$0	$0	$0	$0	$0	
Dividends / Equity Issue	0	0	0	0	0	0	
Total Return on Investment	**$0**	**0**	**0**	**0**	**0**	**0**	
Total Revenue Requirement	**$1,668,002**	**$0**	**$0**	**$0**	**$834,001**	**$834,001**	
Less: Non-Operating Revenue							
Late Payment Charges	$3,393	$0	$0	$0	$1,696	$1,696	
Surplus Sales	66	0	0	0	33	33	
ACRWC Swap	12,016	0	0	0	6,008	6,008	
Suburban	6,908	0	0	0	3,454	3,454	
Lab	5,096	0	0	0	2,548	2,548	
Ostara	5,096	0	0	0	2,548	2,548	
Biosolids	0	0	0	0	0	0	
ACRWC Recovery	0	0	0	0	0	0	
EPCOR Drainage Recovery	0	0	0	0	0	0	
AESO DR Participation	1,274	0	0	0	637	637	
Suburban - Strathcona	5,485	0	0	0	2,742	2,742	
Total Other Revenues	**$39,333**	**$0**	**$0**	**$0**	**$19,667**	**$19,667**	
Net Revenue Requirement	**$1,628,669**	**$0**	**$0**	**$0**	**$814,334**	**$814,334**	

EPCOR
Wastewater Treatment COSA
Exhibit 9a
Distribution of Total Revenues Requirement

					Overstrength		
		Single Family	**Multi-Family**	**Commercial**	*Tier 1*	*Tier 2*	*Basis of Allocation*
Volume Related	**$2,698,772**	**$1,420,290**	**$553,793**	**$724,688**	**$0**	**$0**	*(VOL)*
Strength Related							
Biochemical Oxygen Demand	$5,968,839	$2,566,577	$1,000,749	$1,309,569	$1,017,429	$74,515	*(BOD)*
Total Suspended Solids	20,382,967	10,293,129	4,013,453	5,251,963	777,533	46,889	*(TSS)*
Chemical Oxygen Demand	11,463,759	5,716,065	2,228,784	2,916,563	592,965	9,382	*(COD)*
Total Nitrogen	14,432,674	7,076,114	2,759,088	3,610,514	844,561	142,397	*(TKN)*
Oil & Grease	13,381,427	6,600,737	2,573,731	3,367,958	786,098	52,903	*(OG)*
Total Phosphorous	16,643,323	8,485,722	3,308,716	4,329,752	519,133	0	*(TP)*
	$82,272,988	**$40,738,345**	**$15,884,520**	**$20,786,318**	**$4,537,719**	**$326,086**	
	$84,971,760	**$42,158,635**	**$16,438,314**	**$21,511,006**	**$4,537,719**	**$326,086**	

EPCOR
Wastewater Treatment COSA
Exhibit 9b
Distribution of Total Revenue Requirement

		Single Family	Multi-Family	Commercial	Overstrength	*Basis of Allocation*
Volume Related	**$2,698,772**	**$1,420,290**	**$553,793**	**$724,688**	**$0**	*(VOL)*
Strength Related						
Biochemical Oxygen Demand	$5,968,839	$2,566,577	$1,000,749	$1,309,569	$1,091,944	*(BOD)*
Total Suspended Solids	20,382,967	10,293,129	4,013,453	5,251,963	824,422	*(TSS)*
Chemical Oxygen Demand	11,463,759	5,716,065	2,228,784	2,916,563	602,347	*(COD)*
Total Nitrogen	14,432,674	7,076,114	2,759,088	3,610,514	986,959	*(TKN)*
Oil & Grease	13,381,427	6,600,737	2,573,731	3,367,958	839,001	*(OG)*
Total Phosphorous	16,643,323	8,485,722	3,308,716	4,329,752	519,133	*(TP)*
Total Strength Related	**$82,272,988**	**$40,738,345**	**$15,884,520**	**$20,786,318**	**$4,863,805**	
Customer Related						
Actual Customer	$0	$0	$0	$0	$0	*(AC)*
Weighted Customer	16,074,890	14,921,672	209,487	943,731	0	*(WCA)*
Total Customer Related	**$16,074,890**	**$14,921,672**	**$209,487**	**$943,731**	**$0**	
Revenue Related	**$8,149,325**	**$4,913,995**	**$1,429,510**	**$1,805,820**	**$0**	*(RR)*
Direct Assignment	**$1,628,669**	**$0**	**$0**	**$0**	**$1,628,669**	*(DA)*
Total Revenue Requirements	**$110,824,643**	**$61,994,301**	**$18,077,311**	**$24,260,557**	**$6,492,474**	

EPCOR
Wastewater Treatment COSA
Exhibit 10
Cost of Service Analysis Summary

	Test Year 2021	Single Family	Multi-Family	Commercial	Overstrength
Revenues at Present Rates	**$110,824,643**	$64,338,221	$18,716,369	$23,643,333	$4,126,720
Allocated Revenue Requirement	**$110,824,643**	$61,994,301	$18,077,311	$24,260,557	$6,492,474
Balance / (Deficiency) of Funds	**($0)**	**$2,343,920**	**$639,058**	**($617,224)**	**($2,365,754)**
Required % Change in Rates	**0.0%**	**-3.6%**	**-3.4%**	**2.6%**	**57.3%**

EPCOR
Wastewater Treatment COSA
Exhibit 11a
Unit Costs Summary

	System Average	Single Family	Multi-Family	Commercial	Overstrength Tier 1	Overstrength Tier 2
Variable						
Volume Costs - $ / m^3	$0.0315	$0.0315	$0.0315	$0.0315		
BOD Costs - $ / m^3	0.0697	0.0570	0.0570	0.0570		
TSS Costs - $ / m^3	0.2381	0.2284	0.2284	0.2284		
COD Costs - $ / m^3	0.1339	0.1268	0.1268	0.1268		
TKN Costs - $ / m^3	0.1686	0.1570	0.1570	0.1570		
OG Costs - $ / m^3	0.1563	0.1465	0.1465	0.1465		
TP Costs - $ / m^3	0.1944	0.1883	0.1883	0.1883		
RR+DA Costs - $ / m^3	0.0095	0.0091	0.0068	0.0065		
Total	**$1.0019**	**$0.9447**	**$0.9424**	**$0.9421**		
Fixed						
Customer - $ / Acct. / Mo	$4.61	$4.61	$4.61	$4.61		
Total	**$4.61**	**$4.61**	**$4.61**	**$4.61**		
Basic Data						
Billed Volumes	85,624,161	45,061,664	17,570,250	22,992,247	0	0
Number of Accounts	290,549	269,705	3,786	17,058	0	
Number of Wt Units	290,549	269,705	3,786	17,058	0	
Kilograms						
BOD	21,786,994	9,368,320	3,652,855	4,780,088	3,713,741	271,990
TSS	34,011,290	17,175,253	6,696,901	8,763,495	1,297,402	78,239
COD	9,237,668	4,606,091	1,795,987	2,350,210	477,820	7,560
TKN	3,821,587	1,873,664	730,571	956,018	223,629	37,705
OG	4,748,011	2,342,080	913,214	1,195,022	278,924	18,771
TP	742,121	378,376	147,535	193,062	23,148	0

EPCOR
Wastewater Treatment COSA
Exhibit 11b
Unit Costs Summary - Kilograms

					Overstrength	
		Single Family	**Multi-Family**	**Commercial**	*Tier 1*	*Tier 2*
Surcharge per Kilogram						
BOD Costs - $ / Kg	$0.27	$0.27	$0.27	$0.27	$0.37	$0.37
TSS Costs - $ / Kg	0.60	0.60	0.60	0.60	0.80	0.80
COD Costs - $ / Kg	1.24	1.24	1.24	1.24	1.66	1.66
TKN Costs - $ / Kg	3.78	3.78	3.78	3.78	5.04	5.04
OG Costs - $ / Kg	2.82	2.82	2.82	2.82	3.76	3.76
TP Costs - $ / Kg	22.43	22.43	22.43	22.43	29.94	0.00
Limits (mg/l)						
BOD		N/A	N/A	N/A	> 300	> 3,000
TSS		N/A	N/A	N/A	> 300	> 3,000
COD		N/A	N/A	N/A	> 600	> 6,000
TKN		N/A	N/A	N/A	> 50	> 200
OG		N/A	N/A	N/A	> 100	> 400
TP		N/A	N/A	N/A	> 10	> 75

Attachment #5

Final Report



EPCOR

2020 Sanitary and Stormwater Drainage Cost of Service Study

January 2021

January 18, 2021

Mr. Darrell Manning
EPCOR Water Services, Inc.
9496 Rossdale Road
Edmonton, Alberta T5J 3B1

Subject: Comprehensive Sanitary and Stormwater Drainage Cost of Service Study Final Report

Dear Mr. Manning:

HDR Engineering, Inc. (HDR) was retained by EPCOR Water Services, Inc. (EPCOR) to provide technical assistance in the update of EPCOR's sanitary and stormwater drainage cost of service analyses to support EPCOR's efforts in establishing cost-based rates for its customers. This study is a companion effort to HDR's wastewater treatment cost of service analysis. In this case, EPCOR's drainage utility provides two key services: wastewater collection and stormwater management.

For the sanitary and stormwater drainage study, EPCOR was responsible for the development of the development of the revenue requirement analysis and HDR was responsible for the development of the cost of service analysis. The objective of the cost of service analysis is to equitably distribute EPCOR's sanitary and stormwater drainage costs to the various customer classes of service. This is accomplished by using industry accepted cost of service principles and methodologies and tailoring them to the specific and unique characteristics and operations of EPCOR's drainage system.

In developing these analyses, HDR has relied upon EPCOR's accounting, operating and management records. From our analyses, HDR has provided our findings, conclusions, and recommendations. This report details our approach and methodology for the sanitary and stormwater drainage utilities. The model and technical analyses are intended to provide cost-based, defensible, and equitable sanitary and stormwater drainage rates.

We appreciate the opportunity to provide technical assistance to EPCOR. We also appreciate the assistance provided by EPCOR management and staff in the development of this study.

Sincerely yours,
HDR Engineering, Inc.

Shawn Koorn
Associate Vice President

Table of Contents

1 Introduction and Overview

1.1 Introduction

EPCOR Water Services, Inc. (EPCOR) provides drainage utility services. More specifically, drainage utility services are related to the collection of wastewater (sanitary drainage) and the management of stormwater runoff (stormwater drainage). These services are provided under the drainage utility. While they appear to be two separate and distinct utility services, which they are, they do share certain facilities and resources. Given that, this cost of service study will examine each service, sanitary drainage, and stormwater drainage, on a separate cost/rate basis.

HDR Engineering, Inc. (HDR) was retained by EPCOR to provide technical assistance in the development of a sanitary and stormwater drainage cost of service analysis to support EPCOR's historical practice of establishing cost-based rates. This report outlines the approach, methodology, findings, and conclusions of the sanitary and stormwater cost of service analyses.

This report was developed utilizing EPCOR's accounting, operating and management records. HDR has relied on this information to develop our analyses, from which we draw our findings, conclusions, and recommendations. The sanitary and stormwater cost of service analyses were developed utilizing "generally accepted" utility rate setting and cost of service principles and methodologies. This report provides EPCOR with the basis for developing and implementing sanitary and stormwater drainage rates which are cost-based and defensible to its customers.

1.2 Study Goals and Objectives

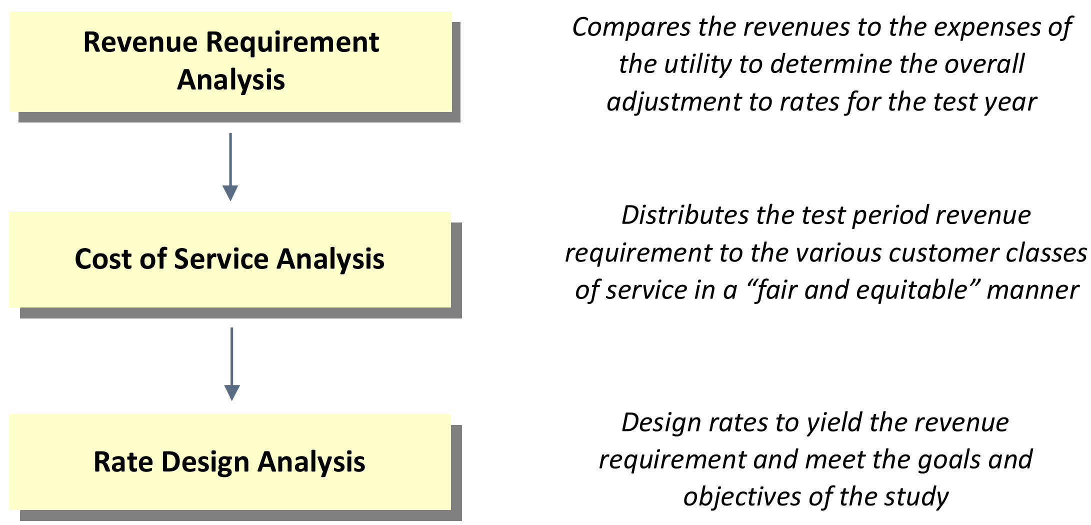
The development of this study was based on several key rate study goals and objectives. In general, these were as follows:

- Develop a sanitary drainage (wastewater collection) cost of service analysis that is consistent with the principles and methodologies established by the Water Environment Federation (WEF) Manual of Practice No. 27, Financing and Charges for Wastewater Systems.
- Develop a stormwater drainage cost of service analysis that is consistent with industry best-practices and cost of service principles and methodologies for stormwater utilities.
- Develop sanitary and stormwater cost of service methodologies to equitably distribute the cost of providing these services to the various customer classes served.
- Review the current sanitary and stormwater drainage rate structures and provide alternatives for discussion and review by EPCOR for their future consideration.
- Provide EPCOR with a sanitary and stormwater cost of service model to use and evaluate the distribution of future sanitary and stormwater drainage costs and rate impacts.

1.3 Overview of the Comprehensive Rate Study Process

Provided in Figure 1 – 1 is an overview of the steps required to conduct a comprehensive rate study.

Figure 1 – 1
Overview of the Comprehensive Rate Study Process



These "generally accepted" methodologies are based on rate-setting principles and practices described in the Water Environment Federation (WEF) Manual of Practice (MOP) #27. The framework or methodology shown in Figure 1 - 1 provides an overview of the typical components of a comprehensive rate study, regardless of the utility being analyzed. An important aspect of this study is incorporating and "tailoring" those analytical elements to reflect the specific circumstances of EPCOR's sanitary and stormwater drainage system.

1.4 Report Organization

This report is designed to discuss and document the technical analyses undertaken within this study. To that end, this report is organized as follows:

- Section 2 provides an overview, discussion, and summary of the sanitary and stormwater drainage revenue requirement analyses, which was developed by EPCOR.
- Section 3 reviews the development of the sanitary drainage cost of service analysis.
- Section 4 reviews and discusses the development of the stormwater cost of service analysis.
- Section 5 provides a discussion of the current sanitary and stormwater drainage rates.
- Technical Appendix A - detailed technical exhibits of the analyses completed to support the sanitary drainage cost of service analysis.

- Technical Appendix B - detailed technical exhibits of the analyses completed to support the stormwater drainage cost of service analysis.

1.5 Summary

This report provides a summary of the technical analyses undertaken to develop the sanitary and stormwater drainage cost of service analysis based on generally accepted methodologies which will provide EPCOR with the information necessary to continue to develop cost-based and equitable rates applicable to its sanitary and stormwater utility.

2 Drainage Utility Revenue Requirement

2.1 Introduction

This section of the report discusses the development of the revenue requirement for EPCOR's sanitary and stormwater drainage utility. A revenue requirement analysis provides a technical framework around which to evaluate the overall adequacy of EPCOR's current drainage rates, both sanitary and stormwater.

It is important to note that EPCOR's drainage utility is operated and accounted for on a combined utility basis. For purposes of the comprehensive rate study, and the cost of service analyses in particular, the revenue requirement will be segregated between sanitary drainage and stormwater drainage. EPCOR management and staff were responsible for the development of the revenues and expenses (i.e., costs) included in the drainage revenue requirement analysis. In addition, EPCOR was largely responsible for the final segregation of drainage costs between the sanitary and stormwater utility functions/services.

Provided below is a detailed discussion of the drainage utility revenue requirement analysis. This section of the report will also discuss the assignment/allocation of the drainage utility revenue requirement between the sanitary drainage and stormwater drainage functions/services. The segregated revenue requirement analyses for the sanitary and stormwater drainage ultimately becomes the initial input into the sanitary and stormwater drainage cost of service analyses developed for EPCOR by HDR.

2.2 Revenue Requirement Framework

By virtue of the differences between a public utility and a private utility, the revenue requirement is often based upon different elements or methodologies. Most private or regulated utilities utilize what is known as a "utility or accrual" basis of determining revenue requirement for setting rate levels. This convention calculates a utility's annual revenue requirement by aggregating a test period's operation and maintenance (O&M) expenses, taxes, annual depreciation expense and a fair return on investment.

In contrast to the "utility or accrual" method of developing the revenue requirement for privately-owned public utilities, a different method of determining the revenue requirement is often used for governmentally-owned public utilities. The convention used by most governmental or public utilities is called the "cash basis" methodology of setting revenue requirement. As the name implies, a public utility aggregates its cash expenditures to determine its total revenue requirement for a specified period of time.

Table 2 - 1 summarizes and compares the "cash" and "utility/accrual" basis methodologies.

Table 2 – 1 Cash versus Utility Basis Comparison			
	Cash Basis		**Utility Basis (Accrual)**
+	O&M Expenses	+	O&M Expenses
+	Taxes/Transfer Payments	+	Taxes/Transfer Payments
+	Capital Improv. Funded From Rates (≥ Depreciation Expense)	+	Depreciation Expense
+	Debt Service (Principal + Interest)	+	Return on Investment
=	**Total Revenue Requirement**	=	**Total Revenue Requirement**

For this particular study, given that EPCOR is a regulated utility, the "utility/accrual basis" approach was utilized. This methodology is consistent with EPCOR's past rate setting methodologies and practices.

2.3 Development of the Drainage Revenue Requirement

The first step of the comprehensive rate study process is the development of the revenue requirement analysis. The drainage utility revenue requirement used for this study was developed by EPCOR management and staff. This section of the report will discuss and summarize EPCOR's drainage utility revenue requirement analysis.

The initial step in calculating the drainage utility revenue requirement was to establish a test period or time frame around which the revenue requirement would be reviewed. For this particular analysis, the drainage utility revenue requirement analysis has been developed based on EPCOR's budgeted 2019 expenditures and projected out from 2020 through 2029.

The drainage utility expenses are budgeted and accounted for between the following major cost groups:

- Franchise Fees
- Drainage Operations
- Planning
- Billing and Meter Reading
- Project Support Costs
- Drainage Services Administration
- Corporate Allocations
- Efficiencies
- O&M Expenses - NRAs

For each major cost group there are numerous subaccounts. The revenue requirement developed herein for the drainage utility utilized the subaccounts and projected costs for the ten-year projected test period. Provided below in Table 2-2 is a summary of the drainage utility revenue requirement analysis for 2020 through 2029.

Table 2 – 2
Summary of the Drainage Utility Revenue Requirement ($000)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenues										
Rate Revenues	$200,073	$209,954	$233,067	$253,439	$275,613	$299,774	$312,102	$320,320	$329,056	$337913
Other Revenues	(1,635)	735	7,391	10,298	16,348	22,123	30,542	40,828	52,725	63,316
Total Revenues	**$198,438**	**$210,689**	**$240,458**	**$263,737**	**$291,961**	**$321,898**	**$342,644**	**$361,148**	**$381,781**	**$401,228**
Expenses										
O&M Expenses	$112,903	$120,230	$115,155	$116,882	$120,926	$123,376	$126.106	$129,103	$131,742	$134,433
Property Tax	772	811	827	842	858	875	891	908	925	943
Depreciation Exp.[1]	37,859	38,755	42,408	45,142	50,615	54,846	56,769	61,926	66,486	71,525
Financing Costs	18,387	22,048	31,609	35,276	38,291	45,613	55,145	60,538	64,932	70,546
Return on Investment	28,517	28,846	50,460	65,594	81,271	97,188	103,417	108,673	117,695	123,781
Total Expenses	**$198,438**	**$210,689**	**$240,458**	**$263,737**	**$291,961**	**$321,898**	**$342,644**	**$361,148**	**$381,781**	**$401,228**
Bal./(Deficiency) of Funds	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

[1] – Annual depreciation expense is net of contributions.

Given the drainage utility total revenue requirement, the next step of the revenue requirement analysis was to segregate, or assign, the drainage costs between the sanitary drainage and stormwater drainage services. To accomplish this, the budget/projected expenses provided by EPCOR were split between sanitary drainage and stormwater drainage based on a number of different factors. For example, the factors used were based on assets, customers, revenues, and percentage split between each utility (e.g., 50%/50% split). Provided below in Table 2-3 is a summary of the segregated costs between sanitary and stormwater drainage for test year 2021.

Table 2 – 3
Summary of the TY 2021 Drainage Utility Revenue Requirement
Segregated Between Sanitary Drainage and Stormwater Drainage ($000)

Account	Composite Cost Split [1]		Total	Total	Total
	Sanitary	Stormwater	Drainage	Sanitary	Stormwater
Oper. & Maint. Exp. –					
Franchise Fee	100%	0%	$10,695	$10,695	$0
Drainage Operations	55%	45%	43,070	23,485	19,585
Planning	48%	52%	12,444	6,021	6,423
Billing/Meter Reading	97%	3%	7,366	7,122	243,354
Project Support Costs	50%	50%	4,673	2,336	2,336
Drainage Svces Admin.	63%	37%	13,778	8,727	5,051
Corporate Allocation	63%	37%	19,609	12,420	7,189
Efficiencies	65%	35%	0	0	0
O&M Expense – NRA's	52%	48%	8,595	4,471	4,123
Total O&M Exp.			**$120,230**	**$75,278**	**$44,952**
Property Taxes	50%	50%	811	406	406
Depreciation (Net)	39%	61%	38,755	15,287	23,468
Financing Costs	65%	35%	22,048	14,383	7,665
Return on Investment	65%	35%	28,846	18,818	10,028
Total Revenue Require.			**$210,689**	**$124,170**	**$86,519**

[1] – Percentages shown are the composite of all allocations within each cost group.

The percentage allocations and results shown above are for test year 2021. While Table 2-3 has summarized the percentage allocations as a composite percentage for the major cost groups, different allocation percentages (i.e., methods) were often used to assign different costs within a major cost group. For that reason, the composite split may vary slightly over time as the same percentage allocation factors were used for all years, but the costs and relationships between costs can vary over time.

2.4 Summary of the Drainage Revenue Requirement

The approach shown in Table 2-3 was used for each year of the drainage utility revenue requirement (Table 2-2). Summarized below in Table 2-4 is a summary of the sanitary drainage revenue requirement for test years 2020 – 2029. Table 2-5 on the following page is the stormwater drainage revenue requirement for test years 2020 – 2029.

Table 2 – 4
Summary of the Sanitary Drainage Revenue Requirement ($000)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenues -										
Rate Revenues	$129,448	$134,390	$147,314	$159,588	$172,900	$187,350	$194,374	$198,763	$203,543	$208,314
Other Revenues	(5,794)	(4,402)	(4,139)	(3,886)	(1,546)	(405)	4,305	9,250	11,006	12,542
Total Revenues	**$123,654**	**$129,988**	**$143,175**	**$155,703**	**$171,353**	**$186,945**	**$198,680**	**$208,013**	**$214,549**	**$220,857**
Expenses -										
O&M Expenses	$70,773	$75,278	$71,733	$72,635	$75,838	$77,432	$79,606	$81,396	$83,129	$84,896
Property Tax	386	406	413	421	429	437	446	454	463	471
Depreciation	14,933	15,287	16,728	17,806	19,965	21,634	22,392	24,426	26,225	28,213
Financing Costs	11,995	14,383	20,620	23,012	24,979	29,756	35,974	39,492	42,358	46,021
Return on Investment	18,603	18,818	32,917	42,791	53,017	63,401	67,464	70,893	76,779	80,749
Total Expenses	**$116,690**	**$124,170**	**$142,411**	**$156,665**	**$174,228**	**$192,659**	**$205,881**	**$216,661**	**$228,954**	**$240,350**
Bal./(Defic.) of Funds	$6,964	$5,817	$764	($963)	($2,875)	($5,714)	($7,201)	($8,649)	($14,405)	($19,943)

Table 2 – 5
Summary of the Stormwater Drainage Revenue Requirement ($000)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Revenues –										
Rate Revenues	$70,625	$75,564	$85,753	$93,850	$102,714	$112,424	$117,728	$121,557	$125,513	$129,599
Other Revenues	4,159	5,138	11,530	14,184	17,894	22,529	26,237	31,578	41,720	50,773
Total Revenues	**$74,784**	**$80,702**	**$97,283**	**$108,034**	**$120,608**	**$134,953**	**$143,965**	**$153,135**	**$167,232**	**$180,372**
Expenses –										
O&M Expenses	$42,130	$44,952	$43,422	$44,247	$45,088	$45,945	$46,818	$47,707	$48,613	$49,537
Property Tax	386	406	413	421	429	437	446	454	463	471
Depreciation	22,926	23,468	25,680	27,336	30,650	33,212	34,377	37,500	40,261	43,313
Financing Costs	6,392	7,665	10,989	12,264	13,312	15,857	19,171	21,046	22,573	24,525
Return on Investment	9,914	10,028	17,542	22,804	28,254	33,787	35,953	37,780	40,917	43,032
Total Expenses	**$81,748**	**$86,519**	**$98,047**	**$107,072**	**$117,733**	**$129,239**	**$136,763**	**$144,487**	**$152,827**	**$160,879**
Bal./(Defic.) of Funds	($6,964)	($5,817)	($764)	$963	$2,875	$5,714	$7,201	$8,649	$14,405	$19,493

As noted previously, both the sanitary and stormwater drainage revenue requirement analyses summarized above were developed by EPCOR and provided to HDR. This revenue and cost information provides the basis for the cost of service analysis.

2.5 Summary

This section of the report has provided a summary of the sanitary and stormwater drainage revenue requirement as developed by EPCOR. The revenue requirement results for test year 2021 were used by HDR as the starting point for the sanitary and stormwater drainage cost of service analyses. The next section of the report will discuss the development of the sanitary drainage cost of service analysis.

3 Sanitary Drainage Cost of Service Analysis

3.1 Introduction

This section of the report details the development of the sanitary drainage cost of service analysis. Sanitary drainage is related to the collection of wastewater for treatment at EPCOR's wastewater treatment facilities. The sanitary drainage cost of service analysis equitably distributes the sanitary drainage revenue requirement previously summarized in Table 2-4. Provided below is a more detailed discussion of the key technical steps of the sanitary drainage cost of service analysis conducted by HDR, along with our findings, conclusions, and recommendations.

3.2 Overview and Purpose of the Cost of Service Analysis

The objective of a cost of service analysis is to equitably distribute the utility's revenue requirement to the various customer classes of service. Following generally accepted cost of service guidelines, principles and methodologies will inherently lead to sanitary drainage rates which are equitable, cost-based, and not viewed as arbitrary or capricious in nature.

There are two primary objectives in conducting a cost of service analysis:

1. Equitably distribute the revenue requirement among the customer classes of service
2. Derive average unit costs for subsequent reference/use in designing final rates

The objectives of a cost of service analysis are different than determining a revenue requirement. As noted in the previous section, a revenue requirement analysis determines the utility's overall financial needs, while the cost of service analysis provides a methodology to determine the fair and equitable manner in which to apportion or collect the revenue requirement across the various customer groups (e.g., residential, commercial).

The second rationale for conducting a cost of service analysis is to design a rate such that it properly reflects the costs incurred by the utility. For example, a sanitary drainage (or collection) system primarily incurs costs related to the total flow of wastewater. Given that, those customers impacting the system and total flows should be assigned an equitable (i.e., proportional) share of the costs based upon their proportional contribution to total wastewater flow. Wastewater flow is one type of cost incurred on a wastewater system. Each type of cost may be collected in a slightly different manner as to allow for the development of rates that collect costs in roughly the same manner as they are incurred.

3.3 Establishing Sanitary Drainage Customer Classes of Service

The first step in a cost of service study is to determine the customer classes of service which costs will be equitably distributed to. To establish the classes of service, the utility must segregate customers into groups of customers (i.e., classes of service) that have similar usage patterns and facility requirements. For EPCOR's sanitary drainage cost of service analysis, the following customer classes of service were utilized.

- Residential
- Multi-Residential
- Commercial
- University of Alberta (UofA)

During the development of the sanitary drainage cost of service, a review of the classes of service for this analysis was conducted. After discussions with EPCOR staff, it was concluded that the current sanitary drainage customer classes of service appear to be very reasonable and follow current industry practices. The establishment of customer classes of service allows for the development of cost-based rates and the ability to establish sanitary drainage rate structures, by customer class of service, reflective of their cost of service.

3.4 General Cost of Service Procedures

A cost of service analysis utilizes a three-step approach to review costs and these analytical steps take the form of *functionalization*, *allocation*, and *distribution*. Provided below is a more detailed discussion of the sanitary drainage cost of service analysis, and the specific steps taken within the analysis.

3.4.1 Functionalization of Sanitary Drainage Costs

The first analytical step of the sanitary drainage cost of service analysis is called *functionalization*. Functionalization is the arrangement of asset (plant/infrastructure) data and expenses (costs) by major operating functions within the utility (e.g., collection, pumping, etc.). Within this study, the functionalization of the sanitary drainage cost data was accomplished through EPCOR's sanitary drainage system of accounts. EPCOR's plant accounts are segregated between the major categories of sanitary, stormwater, and common. The sanitary plant assets were included within the sanitary cost of service analysis. The common (shared) plant assets were proportionally assigned between the sanitary and stormwater drainage utilities based upon the relative plant assets of each utility.

3.4.2 Allocation of Sanitary Drainage Costs

The second analytical task performed in the sanitary drainage cost of service analysis is the *allocation* of the costs. The allocation of sanitary drainage costs is a process which reviews each cost and determines why the expense was incurred or what type of need (e.g., volume/flow-, customer-related) is being met. The sanitary drainage utility's plant accounts and revenue requirement were reviewed and allocated using generally accepted cost of service principles and methodologies. Provided below is an overview of the various types of allocated costs used in the sanitary drainage cost of service analysis.

- **Volume-Related Costs:** Volume-related costs are those costs which tend to vary with the total quantity of wastewater collected and conveyed.
- **Capacity/Demand-Related Costs:** Capacity/demand costs are costs which are related to the capacity requirements of the system. This allocation method is used to reflect that the sanitary collection system is a function of both the number of customers on the system (i.e., a network of pipes, pumps), but also a function of the maximum flows that customers place on the system.

- **Customer-Related Costs:** Customer-related costs are those costs which vary with the addition or deletion of a customer or a cost which is a function of the number of customers served. Customer-related costs typically include the costs of accounting, billing, and collecting, and accounting. Customer costs can also be segregated between *actual* and *weighted*. An actual customer cost does not vary on a per customer basis, regardless of the size or usage of the customer (e.g., postage on a bill). In contrast, certain customer-related costs may vary by customer, on a per customer cost basis. For example, the cost of metering can vary given a customer with a larger sized meter. This study has utilized the concept of actual versus weighted customer costs.
- **Revenue-Related Costs:** Revenue-related costs are those costs which vary with the amount of revenue received by the utility. An example of a revenue-related cost would be a utility tax which is based (i.e., assessed) on gross utility revenue.

The basis, or methodology, for the allocation of EPCOR's sanitary drainage plant assets and costs is based on generally accepted wastewater cost of service principles and methodologies. These wastewater cost of service principles and methodologies are discussed and outlined in the Water Environment Federation, Manual of Practice #27, Financing and Charges for Wastewater Systems. The principles and methodologies discussed and outlined in this wastewater rate setting manual were adapted and tailored to be reflective of EPCOR's specific and unique facilities, customers, costs, and operations.

3.4.3 Development of the Sanitary Drainage Distribution Factors

Once the allocation of sanitary drainage assets and costs is complete, and the customer groups have been defined, the various allocated costs are proportionally and equitably distributed to each customer group using distribution factors. EPCOR's sanitary drainage allocated assets and costs were distributed to the various customer classes of service using the following sanitary drainage distribution factors.

- **Volume Distribution Factor:** Volume-related costs are generally distributed on the basis of estimated contributions to wastewater flows. Wastewater flows are not typically metered and must be estimated using a reasonable surrogate for a customer class's contribution. In wastewater cost of service analyses, metered water consumption, adjusted for outdoor irrigation usage, is often used as a reasonable surrogate for wastewater volume contributions. As part of the data and information provided by EPCOR to HDR, estimates of volume contributions of each class of service was provided. These volumetric estimates by sanitary drainage customer class of service were used as the basis for the volume distribution factor. The development and calculation of the volume distribution factor is shown in Exhibit 3 of the Sanitary Drainage Technical Appendix.
- **Capacity/Demand Distribution Factor:** Capacity/demand-related costs, and the distribution factor developed for them, considers both the number of customers served by the system, but also the capacity use or maximum volumes a customer can place upon the system. This distribution factor is based on an equivalent meter analysis which takes into consideration the number of meters by customer class of service (i.e., number of customers), but also the size of each individual meter and the capacity flow from that meter. This capacity/demand concept was used to equitably allocate and distribute a

portion of the sanitary drainage systems collection lines. The development and calculation of the capacity/demand distribution factor is shown in Exhibit 4 of the Sanitary Drainage Technical Appendix.

- **Customer Distribution Factors:** Customer costs within the sanitary drainage cost of service analysis are distributed to the various customer classes of service based upon their respective number of customer accounts. For EPCOR's sanitary drainage cost of service analysis, two basic types of customer distribution factors were developed – actual and weighted. The actual customer distribution factor reflects that there is no disproportionate cost associated with serving a customer and distributes costs on the basis of the number of customers/accounts. In contrast, a weighted customer distribution factor typically assumes that there is some disproportionality associated with serving different types of customers and attempts to estimate the level of difference in serving the customers. For EPCOR's weighted distribution factor for customer service and accounting, no disproportionate cost difference was assumed. Exhibit 5 of the Sanitary Drainage Technical Appendix provides the development and calculation of the actual and weighted customer distribution factors.
- **Revenue Related Distribution Factor:** The revenue related allocation factor was developed from the projected rate revenues for 2021 for each customer class of service, as developed in Exhibit 2. A summary of the revenue distribution factor is provided in Exhibit 6 of the Sanitary Drainage Technical Appendix.

The development of the distribution factors is based on generally accepted principles and methodologies. Given the development of the distribution factors, the final step in the cost of service analysis is to distribute the allocated costs to the various customer classes of service and summarize the results.

Given the general overview above of the procedures used in EPCOR's sanitary drainage cost of service analysis, the focus shifts to a more specific discussion of the key assumptions and details used in this analysis.

3.5 Functionalization and Allocation of Net Plant in Service

A necessary step of the cost of service is the functionalization and allocation of the sanitary drainage net plant in service. Net plant in service is defined as the original cost (OC) of plant in service, less the accumulated depreciation. The net plant in service balances were provided by EPCOR and were reflective of December 31, 2018.

In performing the *functionalization* of net plant in service, HDR utilized EPCOR's historical plant records. The drainage utility's total assets were then split into three categories: sanitary, stormwater, and common. The shared or common plant assets are related to sections of EPCOR's system where there are legacy "combined" sanitary and stormwater drainage system components. For the shared or common assets, a determination was made on how to equitably divide or split the costs. In general, the costs of common plant assets were split based on the percentage of the sanitary and stormwater drainage assets as a percent of the total assets less the common assets. HDR reviewed with EPCOR staff the assignment of the common plant assets to confirm the appropriateness of their assignment between sanitary and stormwater drainage net plant assets.

Provided below in Table 3 – 1 is a summary of the allocation of the common net plant in service to the sanitary and stormwater drainage plant in service.

Table 3 – 1
Summary of the Assignment of Net Plant in Service [1]
Between Sanitary and Stormwater Drainage ($000)

Plant Components	Total	Sanitary	Stormwater
Common Plant			
Collection	$24,181	$11,254	$12,926
General Plant	55,068	34,074	20,995
Storage	2,237	167	2,160
Subtotal Common Plant	$81,576	$45,495	$36,080
Sanitary Plant	1,512,446	1,512,446	0
Stormwater Plant	2,117,018	0	2,117,018
Total Net Plant in Service	**$3,711,039**	**$1,557,941**	**$2,153,098**

[1] – Net plant as of December 31, 2018

Given the assignment of the common plant in service and the functionalization of net plant in service, HDR then *allocated* each plant asset category (i.e., collection, pumping, and storage) to the various cost allocation components previously described.

The allocation process included reviewing each plant line item and determining which cost components the assets were related to. The proposed allocations are based upon HDR's understanding of EPCOR's current sanitary drainage facilities, their current operations, and generally accepted allocation methodologies for sanitary/wastewater utilities. HDR's proposed allocations of net plant in service to the various cost components were reviewed with EPCOR's staff to confirm that the allocated plant components reasonably reflect the facilities and operations of EPCOR's sanitary drainage plant. Table 3 - 2 provides a summary of the allocated net plant in service for the sanitary drainage utility.

Table 3 – 2
Summary of the Allocation of Sanitary Drainage Plant in Service ($000)

	Total Net Plant	Volume	Capacity/ Demand	Actual Customer	Weighted Customer	Revenue Related	Dir. Assign
Collection	$1,390,309	$1,112,247	$278,062	$0	$0	$0	$0
Collection - Common	11,254	9,003	2,251	0	0	0	0
Pumping Stations	68,281	68,281	0	0	0	0	0
Storage	39,250	31,400	7,850	0	0	0	0
Storage - Common	167	134	33	0	0	0	0
Biosolids	10,387	0	10,387	0	0	0	0
Total before General	**$1,519,648**	**$1,221,065**	**$298,583**	**$0**	**$0**	**$0**	**$0**
General Plant	$38,293	$30,769	$7,524	$0	$0	$0	$0
Grand Total	**$1,557,941**	**$1,251,834**	**$306,107**	**$0**	**$0**	**$0**	**$0**

Tables 3 - 2 provides a summary of the basic functionalization and allocation of EPCOR's sanitary drainage net plant in service. A detailed exhibit of the functionalization and allocation of plant investment can be found in the Sanitary Drainage Technical Appendix A, Exhibit 7.

3.6 Functionalization and Allocation of the Revenue Requirement

Operating expenses are generally functionalized and allocated in a manner similar to the corresponding plant account. This approach to allocation of operating expenses was used for this analysis. For the cost of service study, the 2021 revenue requirement for the sanitary drainage utility prepared by EPCOR was functionalized, allocated, and distributed. As noted previously, the revenue requirement was developed utilizing the utility/accrual basis methodology which was comprised of operation and maintenance expenses, depreciation, revenue tax, and a return on rate base. Provided in Table 3 – 3 is summary of the allocated revenue requirement for EPCOR's sanitary drainage.

Table 3 – 3
Summary of the Allocation of the Sanitary Drainage
2021 Revenue Requirement ($000)

	Total Rev. Req.	Volume	Capacity/ Demand	Actual Customer	Weighted Customer	Revenue Related	Dir. Assign
Total O&M	$75,278	$ 49,535	$7,925	$7,122	$0	$10,695	$0
Property Taxes	406	0	0	0	0	406	0
Depreciation (Net)	15,287	10,059	1,609	1,446	0	2,172	0
Financing Costs	14,383	9,464	1,514	1,361	0	2,043	0
Return on Investment	18,818	12,382	1,981	1,780	0	2,673	0
Total Rev. Require.	**$124,170**	**$81,440**	**$13,030**	**$11,7100**	**$0**	**$17,990**	**$0**
Less: Non-Op Rev.	($4,402)	($2,887)	($461)	($415)	$0	($638)	$0
Net Rev. Require.	**$128,573**	**$84,327**	**$13,492**	**$12,125**	**$0**	**$18,628**	**$0**

A more detailed exhibit of the functionalization and allocation of the 2021 sanitary drainage revenue requirements can be found on Exhibit 8 of the Sanitary Drainage Technical Appendix.

3.7 Sanitary Drainage Key Cost of Service Assumptions

A number of key assumptions were used within the EPCOR sanitary drainage cost of service study. Listed below is a brief summary of the key assumptions used.

- The test year used for the sanitary drainage cost of service analyses was the test period 2021 forecasted revenue requirement.
- The revenue and expense data utilized by HDR within this study was provided by EPCOR.
- A "utility basis" approach was utilized for the revenue requirement and cost of service analysis. This is a generally accepted cost of service methodology.
- The allocation and distribution of plant in service and the revenue requirement was based on EPCOR specific data and information. Where key assumptions or estimates were required, HDR relied on EPCOR's staff understanding of the system and customers and HDR's direct industry experience in similar cost of service studies.
- The distribution factors developed as a part of the sanitary drainage cost of service analysis used EPCOR specific customer data. In particular, the data and information used to develop the volume distribution factor was provided by EPCOR.

3.8 Summary of the Sanitary Drainage Cost of Service Analysis

In summary form, the sanitary drainage cost of service analysis began by functionalizing the sanitary drainage net plant asset records and revenue requirements. The functionalized net plant and expense accounts were then allocated into their various cost components. The individual allocation totals were then distributed to the various customer classes of service based upon the use of proportional and equitable distribution factors. The distributed revenue requirement (i.e., expenses) for each customer class of service were then aggregated to determine each customer group's overall revenue responsibility. A summary of the detailed cost responsibility developed for each sanitary drainage class of service for 2021 is shown below in Table 3 - 4.

Table 3 – 4
Summary of the Sanitary Drainage Cost of Service Analysis ($000)

	Present Revenue	Allocated Costs	$ Difference	% Difference
Residential	$84,028	$78,703	$5,325	–6.3%
Multi-Residential	21,164	21,313	(150)	0.7%
Commercial	27,990	27,233	757	–2.7%
University of Alberta	1,209	1,323 [1]	(114)	9.5%
Total	**$134,573**	**$128,573**	**$5,817**	**–4.3%**

[1] – Allocated cost shown includes a "Large Wholesale with Collection System" discount of 44% to UofA.

The distribution of costs reflects the facilities and costs equitably distributed to each customer class, reflective of their respective benefit. The cost of service results indicated that some cost differences exist between the customer classes of service. A cost of service analysis is a dynamic analysis, and the results can change over time as changes in costs and customer usage occurs. Given that dynamic, HDR typically reviews the summary of a cost of service analysis to determine whether a class of service is within a "reasonable range of their cost of service." The metric that HDR utilizes is a class of service is assumed to be within a "reasonable range of their cost of service" if the class is within ± 5% of the overall required adjustment. In other words, given EPCOR's –4.3% overall adjustment in this analysis, a class of service would be considered within a "reasonable range of their cost of service" if they are within the range of +1.3% to –9.3%.

The results above indicate that the majority of classes of service are within a reasonable range of covering their respective costs. The University is somewhat outside of the presumed range of reasonableness assumed by HDR. It is important to note that the above results are based upon a specific time period (i.e., one year) and a specific time period's costs and usage characteristics. As a result, "cost of service" for a class of service is often best determined over an extended number of studies. It is recommended that EPCOR continues to review and update the sanitary drainage cost of service before making interclass adjustments.

The detailed summary of the sanitary drainage cost of service analysis can be found in the Sanitary Drainage Technical Appendix A, Exhibits 9 and 10.

3.9 Sanitary Drainage Average Unit Costs

Average unit costs are essentially cost-based rates. In this case, the distributed sanitary drainage costs are converted from dollars to per unit costs. The per unit costs take the form of a fixed and variable (volumetric) average cost. Provided in Table 3-5 is a summary of the calculated average unit cost for the sanitary drainage utility.

Table 3 – 5
Summary of the Sanitary Drainage Average Unit Costs

	System Average	Residential	Multi-Residential	Commercial	Univ. of Alberta [1]
Variable Costs – Volume-Related $/m³	**$0.85**	**$0.86**	**$0.86**	**$0.86**	**$0.48**
Fixed Costs – $/Eq. Mtr./Mth					
Actual Customer	$3.02	$3.45	$0.73	$1.31	$0.02
Weighted Customer	0.00	0.00	0.00	0.00	0.00
Capacity/Demand	3.36	3.36	3.36	3.36	3.36
RR/Dir. Assign.	4.63	3.58	13.53	7.16	65.56
Total Fixed Costs	**$11.01**	**$10.39**	**$17.62**	**$11.83**	**$68.94**

[1] – Calculated average unit costs has included the discount for UofA.

The calculated average unit costs for the sanitary drainage utility have placed the distributed "variable" costs in the context of $/m^3$ and the "fixed" costs in a $/equivalent meter/month. It is important to understand that these average unit costs are the starting point for proposed sanitary drainage rate designs. Final rate designs, as discussed in Section 5 can consider other rate design attributes other than strictly cost of service. In addition, the average unit costs are also impacted by those costs which are considered "fixed" versus "variable." For example, in this calculation of the average unit costs, the capacity/demand-related costs have entirely been included in the fixed (meter charge) costs. There certainly could be a perspective that these specific costs could be semi-fixed/semi-variable which, in that case, would shift some costs to the variable average unit cost and increase that component, while decreasing the fixed average unit cost.

EPCOR uses a performance-based-ratemaking (PBR) in the development of many of their utility rates. In short, PBR attempts to link rate adjustments (price) to performance. In contrast, traditional ratemaking simply links price to cost. Regardless of the ratemaking method utilized, including PBR, the starting point for establishing the rates is the cost of service analysis. The following notes this cost of service perspective:

> *"The starting point for utility rates generally is a cost of service study. The subsequent years' rates are determined by applying the PBR formula to adjust the previous rates for the effects of inflation and for productivity improvements."* [1]

As noted above, the starting point for establishing the sanitary drainage rates is the cost of service analysis. In particular, the sanitary drainage cost of service analysis provides two important items of information which may be used to establish the sanitary drainage rates. These items are as follows:

- Target revenue levels by customer class of service
- Average Unit Costs

The target revenue levels or allocated costs from the cost of service analysis (Table 3-4) establish the level of revenue to be derived from each customer class of service. In comparison, the average unit costs (Table 3-5), as developed in the cost of service analysis, provide the cost basis for the fixed and variable charges associated with each customer class of service. The detailed exhibit of the development of the sanitary drainage average unit costs can be found in the sanitary drainage technical appendix A, Exhibit 11.

3.10 Summary

This section of the report has reviewed the sanitary drainage cost of service analysis. This analysis was developed using EPCOR specific asset and expense records and information. The overall cost of service methodology for the sanitary drainage utility was based upon generally accepted cost of service principles and methodologies, tailored to reflect EPCOR's specific and unique system.

[1] Performance-Based Ratemaking: Theory and Practice, Dr. Michael R. Schmidt, Public Utilities Reports, Inc., Vienna, Virginia, 2000, p. 2.

4 Stormwater Drainage Cost of Service Analysis

4.1 Introduction

This section of the report details the development of the stormwater drainage cost of service analysis. Stormwater drainage is related to the management of stormwater runoff. The stormwater drainage cost of service analysis developed herein equitably distributes the stormwater drainage revenue requirement summarized in Table 2-5. Provided below is a more detailed discussion of the key technical steps of the stormwater drainage cost of service analysis, conducted by HDR, along with our findings, conclusions, and recommendations.

4.2 Overview and Purpose of the Cost of Service Analysis

The objective of a cost of service analysis is to equitably distribute a utility's revenue requirement to the various customer classes of service. Following generally accepted cost of service guidelines, principles and methodologies will inherently lead to stormwater drainage rates which are equitable, cost-based, and not viewed as arbitrary or capricious in nature.

There are two primary objectives in conducting a cost of service analysis:

1. Equitably distribute the revenue requirement among the customer classes of service
2. Derive average unit costs for subsequent reference/use in designing final rates

The objectives of a cost of service analysis are different than determining a revenue requirement. As noted previously, a revenue requirement analysis determines the utility's overall financial needs, while the cost of service analysis provides a methodology to determine the fair and equitable manner in which to apportion or collect the revenue requirement across the various customer groups (e.g., residential, commercial, etc.).

The second rationale for conducting a cost of service analysis is so that the proposed stormwater drainage rate is designed such that it properly reflects the costs incurred by the utility. For example, stormwater runoff and costs are a function of a parcel's impervious area and intensity of development/runoff coefficient. Given that, those customers with larger areas and higher intensity development should have rates reflective of those parcel characteristics and relative stormwater runoff contributions.

4.3 Establishing Stormwater Drainage Customer Classes of Service

The first step in a cost of service study is to determine the customer classes of service which costs will be equitably distributed to. To establish the classes of service, the utility must segregate customers into groups of customers (i.e., classes of service) that have similar stormwater characteristics, parcels and/or facility requirements. For EPCOR's stormwater drainage cost of service analysis, the following customer classes of service were utilized.

- Residential
- Multi-Residential
- Commercial

During the development of the stormwater drainage cost of service, a review of the classes of service for this analysis was conducted. After discussions with EPCOR staff, it was concluded that these stormwater drainage customer classes of service appear to be very reasonable and are reflective of current industry practices. The establishment of customer classes of service allows for the development of cost-based rates and, if desired, the ability to establish stormwater drainage rate structures, by customer class of service, reflective of their cost of service.

4.4 General Cost of Service Procedures

A cost of service analysis utilizes a three-step approach to review costs and these analytical steps take the form of *functionalization*, *allocation*, and *distribution*. Provided below is a more detailed discussion of the stormwater drainage cost of service analysis, and the specific steps taken within the analysis.

4.4.1 Functionalization of Stormwater Drainage Costs

The first analytical step of the stormwater drainage cost of service analysis is called *functionalization*. Functionalization is the arrangement of asset (plant) data and expenses (costs) by major operating functions within the utility (e.g., collection, pumping, storage, etc.). Within this study, the functionalization of the stormwater cost data was accomplished through EPCOR's existing stormwater drainage system of accounts. EPCOR's plant accounts are segregated between the major categories of sanitary, stormwater and common. In this case, the stormwater plant assets were included within the stormwater cost of service analysis. The common (shared) plant assets were proportionally assigned between the sanitary and stormwater drainage utilities based upon the relative plant assets of each utility.

4.4.2 Allocation of Stormwater Drainage Costs

The second analytical task performed in the stormwater drainage cost of service analysis is the *allocation* of the costs. The allocation of stormwater drainage costs is a process which reviews each cost and determines why the expense was incurred or what type of need (e.g., volume/flow, customer-related, etc.) is being met. The stormwater drainage utility's plant accounts and revenue requirement were reviewed and allocated using generally accepted cost of service principles and methodologies. Provided below is an overview of the various types of allocated costs used in the stormwater drainage cost of service analysis.

- **Equivalent Stormwater Unit (ESU)-Related Costs:** An equivalent stormwater unit (ESU) is an equivalency measure of run-off contributions (i.e., volume) and typically this approach, or similar approaches, are used for billing stormwater customers. An ESU considers a parcel's area, development intensity, and runoff coefficient.
- **Customer-Related Costs:** Customer-related costs are those costs which vary with the addition or deletion of a customer or a cost which is a function of the number of customers served. Customer-related costs typically include the costs of accounting,

billing, and collecting, and accounting. Similar to the sanitary drainage cost of service analysis, a weighted customer cost reflects a disproportionate customer-related cost.

- **Revenue-Related Costs:** Revenue-related costs are those costs which vary with the amount of revenue received by the utility. An example of a revenue-related cost would be a utility tax which is based (i.e., assessed) on gross utility revenue.

The basis, or methodology for the allocation of EPCOR's stormwater drainage plant assets and costs is based upon generally accepted cost of service principles and methodologies. These generally accepted cost of service principles and methodologies were adapted and tailored to be reflective of EPCOR's specific and unique facilities, customers, costs, and operations.

4.4.3 Development of the Stormwater Drainage Distribution Factors

Once the allocation of stormwater drainage assets and costs is complete, and the customer groups have been defined, the allocated costs are proportionally and equitably distributed to each customer group using distribution factors. EPCOR's stormwater drainage allocated assets and costs were distributed to the various customer classes of service using the following stormwater drainage distribution factors.

- **Equivalent Stormwater Unit (ESU) Distribution Factor:** Equivalent stormwater units are an equivalency measure for estimating surface water runoff from a parcel. EPCOR's existing stormwater rates develop billing units reflective of a parcel's area, stated in m^2, along with a development intensity factor and a runoff coefficient which is based upon the zoning of the premises. The intensity factor is assumed to be 1.0, except for properties where the parcel owners have demonstrated that they contribute less stormwater per m^2 (e.g., retention/detention) during rainfall than similarly zoned parcels. This distribution factor was based upon EPCOR's current billing units which take these factors into account and are reflective of the relative runoff contributions. Exhibit 3 of the stormwater drainage technical appendix provides the calculation of the ESU distribution factor.
- **Customer Distribution Factor:** Customer costs within the cost of service analysis are distributed to the various customer classes of service based upon their respective number of customer accounts. Two types of customer distribution factors were developed – actual and weighted. The actual customer distribution factor assumes that there is no disproportionate cost associated with serving a customer (e.g., postage for bills is the same regardless of the size or usage of the customer). In contrast, a weighted customer distribution factor assumes that there is some disproportionality associated with serving different types of customers and attempts to estimate the level of difference in serving the customers. It is important to note that this Study assumes no weighting for differences between customers. Exhibit 4 of the stormwater drainage technical appendix provides the calculation of the customer allocation factor.
- **Revenue Related Distribution Factor:** The revenue related allocation factor was developed from the projected rate revenues for 2021 for each customer class of service, as developed in Exhibit 2. A summary of the revenue allocation factor is provided in Exhibit 5 of the Stormwater Drainage Technical Appendix.

The development of the distribution factors is based on generally accepted principles and methodologies. Given the development of the distribution factors, the final step in the cost of service analysis is to distribute the allocated costs to the various customer classes of service and summarize the results.

Given the general overview above of the procedures used in EPCOR's stormwater drainage cost of service analysis, the focus shifts to a more specific discussion of the key assumptions and details used in this analysis.

4.5 Functionalization and Allocation of Net Plant in Service

A necessary step of the cost of service is the functionalization and allocation of the stormwater drainage net plant in service. Net plant in service is defined as the original cost (OC) of plant in service, less the accumulated depreciation. The net plant in service balances were provided by EPCOR and were reflective of December 31, 2018.

Section 3.5 provided a detailed discussion of the process used to assign net plant in service for sanitary and stormwater drainage. Provided below in Table 4 – 1 is a summary of the allocation of the common net plant in service to the sanitary and stormwater drainage plant in service.

Table 4 – 1
Summary of the Assignment of Net Plant in Service [1]
Between Sanitary and Stormwater Drainage ($000)

Plant Components	Total	Sanitary	Stormwater
Common Plant			
Collection	$24,181	$11,254	$12,926
General Plant	55,068	34,074	20,995
Storage	2,237	167	2,160
Subtotal Common Plant	$81,576	$45,495	$36,080
Sanitary Plant	1,512,446	1,512,446	0
Stormwater Plant	2,117,018	0	2,117,018
Total Net Plant in Service	**$3,711,039**	**$1,557,941**	**$2,153,098**

[1] – Net plant as of December 31, 2018

Given the assignment of the common plant in service and the functionalization of net plant in service, HDR then *allocated* each stormwater plant asset category (i.e., collection, pumping, and storage) to the various cost allocation components previously described.

The allocation process included reviewing each plant line item and determining which cost components the assets were related to. The proposed allocations are based on HDR's understanding of EPCOR's current stormwater drainage facilities, their current operations, and "generally accepted" allocation methodologies for stormwater utilities. HDR's proposed allocations of net plant in service to the various cost components were reviewed with EPCOR's staff to confirm that the allocated stormwater plant components reasonably reflect the facilities and operations of EPCOR's stormwater drainage plant. Table 4 - 2 provides a summary of the allocated net plant in service for the stormwater drainage utility.

Table 4 – 2
Summary of the Allocation of Stormwater Drainage Plant in Service ($000)

	Total Net Plant	Eqv. Storm Unit	Actual Customer	Weighted Customer	Revenue Related	Dir. Assign
Collection	$1,596,871	$1,596,871	$0	$0	$0	$0
Collection - Common	12,926	12,926	0	0	0	0
Pumping Stations	9,774	9,774	0	0	0	0
Storage	507,773	507,773	0	0	0	0
Storage - Common	2,160	2,160	0	0	0	0
Biosolids	0	0	0	0	0	0
Total before General	**$2,129,504**	**$2,129,504**	**$0**	**$0**	**$0**	**$0**
General Plant	$23,594	$23,594	$0	$0	$0	$0
Grand Total	**$2,153,098**	**$2,153,098**	**$0**	**$0**	**$0**	**$0**

Tables 4 - 2 provides a summary of the basic functionalization and allocation of EPCOR's stormwater drainage net plant in service. A detailed exhibit of the functionalization and allocation of plant investment can be found in the Stormwater Drainage Technical Appendix, Exhibit 6.

4.6 Functionalization and Allocation of the Revenue Requirement

Operating expenses are generally functionalized and allocated in a manner similar to the corresponding plant account. This approach to allocation of operating expenses was used for this analysis. For the cost of service study, the 2021 revenue requirement for the stormwater drainage utility prepared by EPCOR was functionalized, allocated, and distributed. As noted previously, the revenue requirement was developed utilizing the utility/accrual basis methodology which was comprised of operation and maintenance expenses, depreciation, revenue tax, and a return on rate base. Shown below in Table 4 – 3 is summary of the allocated revenue requirement for EPCOR's stormwater drainage utility.

Table 4 – 3 Summary of the Allocation of the Stormwater Drainage 2021 Revenue Requirement ($000)						
	Total Rev. Req.	**Eqv. Storm Unit**	**Actual Customer**	**Weighted Customer**	**Revenue Related**	**Dir. Assign**
Total O&M	$44,952	$44,952	$0	$0	$0	$0
Property Taxes	406	406	0	0	0	0
Depreciation (Net)	23,468	23,468	0	0	0	0
Financing Costs	7,665	7,665	0	0	0	0
Return on Investment	10,028	10,028	0	0	0	0
Total Rev. Require.	**$86,519**	**$86,519**	**$0**	**$0**	**$0**	**$0**
Less: Non-Op Rev.	$5,138	$5,138	$0	$0	$0	$0
Net Rev. Require.	**$81,381**	**$81,381**	**$0**	**$0**	**$0**	**$0**

A more detailed review of the allocation of EPCOR's stormwater drainage revenue requirement can be found in the Technical Appendix B in Exhibit 7.

4.7 Stormwater Drainage Key Cost of Service Assumptions

A number of key assumptions were used within the EPCOR stormwater drainage cost of service analysis. Listed below is a brief summary of the key assumptions used.

- The test year used for the stormwater drainage cost of service analyses was the test period 2021 forecasted revenue requirement.
- The revenue and expense data utilized by HDR within this study was provided by EPCOR.
- A "utility basis" approach was utilized for the revenue requirement and cost of service analysis. This is a generally accepted cost of service methodology.
- The allocation and distribution of plant in service and the revenue requirement was based upon EPCOR specific data and information. Where key assumptions or estimates were required, HDR relied upon our direct industry experience in similar cost of service studies and EPCOR staff's understanding of the stormwater drainage system and facilities.
- The equivalent stormwater unit distribution factor developed as a part of the stormwater drainage cost of service analysis used EPCOR specific customer data and billing information. These ESUs by customer class of service were provided by EPCOR to HDR.

4.8 Summary of the Stormwater Drainage Cost of Service Analysis

In summary form, the stormwater drainage cost of service analysis began by functionalizing the stormwater drainage net plant asset records and revenue requirements. The functionalized net plant and expense accounts were then allocated into their various cost components. The individual allocation totals were then distributed to the various customer classes of service based upon the use of proportional and equitable distribution factors. The distributed revenue requirement (i.e., expenses) for each customer class of service were then aggregated to determine each customer group's overall revenue responsibility. A summary of the detailed cost responsibility developed for each stormwater drainage class of service for 2021 is shown below in Table 4 - 4.

Table 4 – 4
Summary of the Stormwater Drainage Cost of Service Analysis ($000)

	Present Revenue	Allocated Costs	$ Difference	% Difference
Residential	$40,403	$42,795	($2,392)	5.9%
Multi-Residential	3,792	4,169	(377)	9.9%
Commercial	31,369	34,417	(3,048)	9.7%
Total	**$75,564**	**$81,381**	**($5,817)**	**7.7%**

The distribution of costs reflects the facilities and costs equitably distributed to each customer class, reflective of their respective benefit. The cost of service results indicated that small costs differences exist between the customer classes of service. A cost of service analysis is a dynamic analysis, and the results may change over time as costs and development impacts change. Given that dynamic, HDR typically reviews the summary of a cost of service analysis to determine whether a class of service is within a "reasonable range of their cost of service." The metric that HDR utilizes is a class of service is assumed to be within a "reasonable range of their cost of service" if the class is within ± 5% of the overall required adjustment. In other words, given EPCOR's 7.7% overall adjustment in this analysis, a class of service would be considered within a "reasonable range of their cost of service" if they are within the range of 2.7% to 12.7%.

The results above indicate that all classes of service are within a reasonable range of covering their respective costs. As noted above, a cost of service analysis is a dynamic analysis and as such, the "cost of service" for a class of service is often best determined over an extended number of studies. It is recommended that EPCOR continue to review and update the stormwater drainage cost of service. This will provide a sound basis for any future interclass adjustments that may be proposed by EPCOR.

The detailed summary of the stormwater drainage cost of service analysis can be found in the Wastewater Treatment Technical Appendix B, Exhibits 8 and 9.

4.9 Stormwater Drainage Average Unit Costs

Average unit costs are essentially cost-based rates. In this case, the distributed stormwater drainage costs are converted from dollars to per unit costs, stated as $/square metre ($m^2$). Provided below in Table 4-5 is a summary of the calculated average unit cost for the sanitary drainage utility.

Table 4 – 5 Summary of the Stormwater Drainage Average Unit Costs				
	System Average	**Residential**	**Multi-Residential**	**Commercial**
Unit Costs – $/square metre				
Equiv. Storm Unit (ESU)	$0.0519	$0.0519	$0.0519	$0.0519
Actual Customer	0.0000	0.0000	0.0000	0.0000
Weighted Customer	0.0000	0.0000	0.0000	0.0000
RR/Dir. Assign.	0.0000	0.0000	0.0000	0.0000
Total $/square metre (m^2)	**$0.0519**	**$0.0519**	**$0.0519**	**$0.0519**

The calculated average unit costs for the stormwater drainage utility are very straight-forward. The total stormwater drainage costs were allocated to the equivalent stormwater unit (ESU) cost component. Thus, all costs are placed in the context of a $/ESU.

Similar to EPCOR's other utility rates, performance-based-ratemaking (PBR) is a component of the development of stormwater drainage utility rates. Like the sanitary drainage cost of service analysis, the stormwater drainage cost of service analysis provides two important items of information which may be used to establish the stormwater drainage rates. These items are as follows:

- Target revenue levels by customer class of service
- Average Unit Costs

The target revenue levels or allocated costs from the cost of service analysis (Table 4-4) establish the level of revenue to be derived from each customer class of service. In comparison, the average unit costs, as developed in the cost of service analysis, provide the cost basis for any fixed and variable charges associated with each customer class of service. At the present time, and as a point of reference, EPCOR does not have stormwater rates by class of service, and the utility assesses a flat rate per m^2. The average unit costs from the stormwater drainage cost of service analysis are shown in Exhibit 10 of the Stormwater Drainage Technical Appendix.

4.10 Summary

This section of the report has reviewed the stormwater drainage cost of service analysis. This analysis was developed using EPCOR specific asset and expense records and information. The overall cost of service methodology for the stormwater drainage utility was based upon generally accepted cost of service principles and methodologies, tailored to reflect EPCOR's specific and unique stormwater system.

5 Drainage Rate Design

5.1 Introduction

The final step of a comprehensive sanitary and stormwater drainage rate study is the review of rates for both utilities which meet the overall rate design goals and objectives of EPCOR and collect the appropriate (i.e., cost-based) levels of revenue, based on the results of the revenue requirement and cost of service analyses.

5.2 Rate Design Goals and Objectives

In reviewing all utility rate designs, consideration is given to the ***level*** of the rates and the ***structure*** of the rates. *Level* refers to the total revenue to be collected from a rate design; while *structure* refers to how (fixed vs. variable) the revenue is collected, or how the customer is ultimately charged. Provided below is an overview of the rate design considerations for EPCOR's sanitary and stormwater drainage utilities.

5.2.1 Rate Design Criteria and Considerations

The key to developing a successful rate design is to gain an understanding of the utility's goals and objectives and how different rate structures and the relationship between the monthly fixed charges and consumption/volumetric charges can help achieve those goals and objectives. Typical rate design goals and objectives include items such as rates being cost-based, easy to understand and administer and that are set at a level that produce sufficient revenues.

Principles of Public Utility Rates[2] by James C. Bonbright's is often cited as an important source or guide on the development of rates. Bonbright developed a list of key attributes (i.e., goals and objectives) that may be considered in the establishment of utility rates. Provided below is a paraphrased list of Bonbright's attributes.

Revenue-Related Attributes:

- Rates should be designed to **meet the total revenue requirement needs** under the "utility/accrual basis approach".[3]
- Rates should provide **revenue stability and predictability**; with a minimum of unexpected changes seriously adverse to the utility (e.g., annual swings in planned revenue should, for example, be no greater than +10% or –10%).
- From the customer's perspective, the rates should result in **customer bills that are stable and predictable**. The implementation of new rate structures should be consistent with

[2] James C. Bonbright; Albert L. Danielsen and David R. Kamerschen, Principles of Public Utility Rates, (Arlington, VA: Public Utilities Report, Inc., Second Edition, 1988), p. 383-384.

[3] The Water Environment Federation, Manual of Practice #27, Financing and Charges for Wastewater Systems, discusses two "generally-accepted" methodologies for establishing revenue requirements; the cash basis and utility/accrual basis. Most private utilities, including EPCOR utilize the "utility/accrual basis" methodology. Under this approach, a utility sums its O&M, taxes, depreciation expense and return on rate base (investment) to equal its revenue requirements.

past rate setting philosophy and minimize customer bill impacts during any change in rate structure.

Cost-Related Attributes:

- The rate structure should **promote efficient use** of services and discourage or penalize inefficient uses.
- The rate structure should **reflect all traditional internal costs** (direct and indirect) incurred, **and under appropriate situations and conditions** (e.g., rapid growth) may also **include present and future costs and benefits** (i.e., marginal cost and/or value of commodity).
- **Fairness of the rates** in the allocation of total costs of service among the different ratepayers so as to **avoid arbitrariness, capriciousness and to attain equity**. The rates and the rate structure shall be based upon a fair allocation of total cost of service among the customer classes of service by use of a "generally accepted" cost of service methodology such as defined in the Water Environment Federation Manual of Practice #27.
- The rates should be, as practically possible, **non-discriminatory**, between customer groups, and within each customer group. The rate structures should avoid interclass subsidies whenever possible to ensure each class pays its full cost of service.
- The **responsiveness of the rate to respond to changes in demand and supply patterns**. The rate structure should be developed such that it either responds appropriately or alternatively, contains the flexibility to allow the utility to respond to the changing needs as a result of supply, demand, and/or environmental concerns.

Practical-Related Attributes:

- From the customer's perspective, the rate structure should be **simple to understand**, such that the customer can easily understand the bill. From the utility's perspective, the rate structure should be **easy to administer**. Finally, the rate structure should have acceptance by the majority of the customers that the rate structure and resulting bills are "fair and equitable."
- **Freedom from controversies** as to the application of the rate schedule to the customer and calculation of the customer's bill. It should be simple to explain and understand by the average customer to minimize any misinterpretation regarding the customer's bill and the overall goals that the rate structure has been developed to meet.

While the above rate design goals and objectives (i.e., attributes) are intended for all rate designs, certain goals and objectives may be more relevant than others, particularly when comparing the differences between an electric, water, wastewater, or stormwater utility. For that reason alone, EPCOR should review the different rate design goals and objectives and determine those with the highest relevance and priority for the particular utility rates being reviewed.

5.3 Review of the Current Drainage Rates

As noted above, it is important to understand that all of the rate design goals and objectives cannot be achieved in a single rate design, and in some cases, certain goals and objectives may be in conflict with each other. For example, rates which promote conservation may so complex that they do not achieve the objective of ease of customer understanding and administration. In that respect, EPCOR must consider each of these goals and objectives and attempt to balance them in a way that meets the utility's overall rate goals and objectives. The rate design goals and objectives for the sanitary drainage rates may be different than the goals and objectives for the stormwater utility.

For EPCOR, these rate design goals and objectives can be used as a starting point in considering proposed changes to the sanitary and stormwater drainage rate designs.

5.3.1 Current Sanitary Drainage Rates

The current sanitary drainage rates are designed to collect the costs associated with wastewater collection services. The current sanitary drainage rate design is composed of a flat monthly service charge and a variable charge. Provided below in Table 5 - 1 is a summary of the current sanitary drainage rate design.

Table 5 - 1
Overview of the EPCOR's Present Sanitary Drainage Rates[1]

Rate Component	Present Rates
Flat Monthly Service Charge (Per Meter Size)	
16mm	$10.52
20mm	18.93
25mm	29.45
40mm	56.79
50mm	77.83
75mm	160.93
100mm	299.77
150mm	566.92
200mm	904.55
250mm	2,244.55
300mm	2,244.55
400mm	2,455.57
500mm	2,644.77
Variable Monthly Charge - $/m^3	
All Customers	$1.11740
Large Wholesale w/ collection system	0.62572

[1] – Rates shown are effective January 1, 2021.

EPCOR's present sanitary drainage rate schedules use the same schedule for fixed charges for all customer classes of service. The flat monthly service charge is based on meter size. In contrast to the fixed monthly service charge, the variable or volumetric charge for sanitary drainage is a uniform volumetric structure which is the same for all residential, multi-residential and commercial customers. The variable rate is stated in $/cubic metre ($/m^3). There is a separate variable rate for the University of Alberta (UofA). The UofA is a large wholesale customer with it's own sanitary collection system. Given that, the UofA has their own variable rate. UofA is provided with a lower rate since they own and operate their own on-campus collection system. For billing of variable charges, the volume billing is determined based upon the following:

i. Water consumption for the premises;
ii. Sewer discharge for a premises on which a sewer meter has been installed; or
iii. Water consumption for the premises as discounted by the application of a utility credit as approved in accordance with EPCOR's bylaws (e.g., wholesale w/ collection system).

The current rate design approach used by EPCOR for their sanitary drainage utility rates is contemporary in approach and design. Most wastewater utilities have sewer rates (i.e., treatment and collection) which contain a fixed and variable component. The variable component is typically based upon metered water consumption, similar to EPCOR's approach, but in some cases, the volume billed may be "capped" at a specified volume to try and segregate water consumption between indoor and outdoor uses. In areas with significant outdoor water use, the approach of using average winter water use (AWWU) to cap sewer volumes is common.

5.3.2 Current Stormwater Drainage Rates

Provided below in Table 5-2 is EPCOR's current stormwater drainage rate.

Table 5 - 2
Overview of EPCOR's Present Stormwater Drainage Rate [1]

Rate Component	Rate
All Parcels (Customers)	\$0.046159/square metre

[1] – Rates shown are effective January 1, 2021.

As can be seen, EPCOR's current stormwater rate appears to be very simple and straight-forward. While that may appear to be the case, in actuality, the basis for the billing of the stormwater rate is more complex. Specifically, EPCOR's stormwater fee is a monthly charge that is calculated using the following formula:

A x **I** x **R** x **Rate**, where:

A: The area of the property in square metres (m^2), and the proportion of the building lot area attributable to each unit for multiple units sharing a single building of property.

I: The measure of the portion of lot being used for its intended development. The development intensity factor is 1.0 as default, except for properties where owners demonstrate they contribute significantly less stormwater runoff per property area to the City's land drainage system during rainfalls than other similarly-zone properties.

R: Runoff coefficient—the permeability of your lot's surface (i.e., grass versus concrete), based on land zoning.

Rate: The monthly charge of \$0.046159 per square metre (m2).

The runoff coefficient has a specific schedule for each land zone. The runoff coefficient ranges from 0.20 (e.g., agricultural zone AG) to 0.95 (e.g., commercial business zone CB2). As point of reference, a single-detached residential home (Zone RF1) has a runoff coefficient of 0.50.

For each parcel, EPCOR calculates a billable stormwater area stated in square metres (m^2). The determination of this billable area is accomplished by reviewing the area of each parcel and then adjusting for development intensity and runoff coefficient. The use of development intensity (**I**) takes into consideration those parcels which have significantly less runoff than similarly zoned parcels. This lowering of runoff is often accomplished via retention/detention ponds or other stormwater best practices.

EPCOR's approach to stormwater rates contains all of the elements and components that would be expected from a contemporary stormwater rate design. Stormwater utilities may administer these elements in a slightly different manner, but their rate design approach considers area, development intensity and any credits for stormwater management (e.g., retention/detention, etc.). One area where EPCOR may differ from other stormwater utilities is their billing of single-family residential parcels. For administrative and cost reasons, many stormwater utilities charge residential customers on a flat, $/month, basis regardless of the parcel size or intensity. While there are certain inequities with this approach, it eliminates a number of administrative issues and concerns with a large majority of the system's parcels. EPCOR has obviously gone one step further and refined their residential rates to be reflective of the specific residential lot size (area) and development intensity. HDR would not recommend EPCOR going backwards on their stormwater rate design, but rather, points this out to highlight the enhanced equity of this approach. Whether EPCOR's residential customers can understand or appreciate this level of refinement in the stormwater drainage rate design

5.4 Future Drainage Rate Structure Considerations

The results of the revenue requirement and cost of service analysis provide the basis for establishing cost-based rates. However, other policy considerations, other than strictly cost of service, may be considered when establishing final proposed sanitary and stormwater drainage rates.

As EPCOR continues forward with the development of alternative sanitary or stormwater drainage rates, a decision will need to be made as to how closely the proposed rates should follow cost of service results, and if so, how best to transition to a cost of service based rate. In this transition process, EPCOR will likely want to attempt to minimize overall rate impacts over time. While the cost of service analyses for both drainage utilities did show some minor cost differences, there does not appear to be any huge cost of service or transition issues on the horizon. If changes are proposed, implementing a smooth transition towards the cost of service results allows for customer outreach, avoids rate shock, and allows the utility to track cost of service results over a number of years and adjust rates accordingly.

5.5 Summary

This section of the report has provided an overview of the rate design process. The results of the sanitary and stormwater drainage revenue requirement and cost of service analysis provide the basis and guidance for establishing and implementing cost-based utility rates. A key objective of a cost of service analysis is to develop rates that are cost-based while, at the same time, providing equity between customers.

Sanitary Drainage Technical Appendix A

EPCOR
Drainage COSA
Summary of the Revenue Requirement - Sanitary
Exhibit 1

	Budgeted	*Projected*									
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Revenues											
Rate Revenues	$125,131,192	$129,447,867	$134,389,862	$147,314,091	$159,588,513	$172,899,532	$187,350,186	$194,374,288	$198,762,716	$203,542,984	$208,313,894
Miscellaneous Revenues	(8,779,498)	(5,794,213)	(4,402,246)	(4,139,205)	(3,885,783)	(1,546,284)	(405,083)	4,305,460	9,249,880	11,005,523	12,542,737
Total Revenues	**$116,351,694**	**$123,653,654**	**$129,987,615**	**$143,174,886**	**$155,702,730**	**$171,353,248**	**$186,945,103**	**$198,679,748**	**$208,012,597**	**$214,548,507**	**$220,856,631**
Expenses											
Franchise Fees	$9,382,041	$10,019,416	$10,695,294	$11,840,587	$12,871,063	$14,132,030	$15,361,415	$16,329,275	$17,053,661	$17,563,904	$18,085,462
Total Drainage Operations	21,648,842	22,512,000	23,484,650	23,930,858	24,385,544	24,848,870	25,320,998	25,802,097	26,292,337	26,791,891	27,300,937
Total Planning	5,301,847	5,458,850	6,021,064	6,135,464	6,252,038	6,370,827	6,491,873	6,615,218	6,740,907	6,868,984	6,999,495
Total Billing and Meter Reading	6,824,777	7,296,701	7,122,456	7,257,783	7,395,681	7,536,199	7,679,387	7,825,295	7,973,976	8,125,481	8,279,865
Total Project Support Costs	2,158,941	2,149,739	2,336,430	2,380,823	2,426,058	2,472,153	2,519,124	2,566,988	2,615,760	2,665,460	2,716,103
Total Drainage Services Administration	8,640,535	8,706,091	8,726,729	8,892,537	9,061,495	9,233,664	9,409,103	9,587,876	9,770,046	9,955,677	10,144,835
Corporate Allocations	11,130,426	11,812,989	12,419,753	13,049,173	13,297,107	13,549,752	13,807,198	14,069,534	14,336,855	14,609,256	14,886,832
Efficiencies	0	0	0	(5,218,816)	(5,317,974)	(5,419,015)	(5,521,977)	(5,626,894)	(5,733,805)	(5,842,748)	(5,953,760)
O&M Expenses - NRAs	18,201	2,816,809	4,471,419	3,464,149	2,264,207	3,113,527	2,364,759	2,436,191	2,346,161	2,390,738	2,436,162
Total O&M Expenses	**$65,105,609**	**$70,772,596**	**$75,277,796**	**$71,732,557**	**$72,635,220**	**$75,838,006**	**$77,431,879**	**$79,605,579**	**$81,395,899**	**$83,128,644**	**$84,895,932**
Property Taxes	$385,639	$386,238	$405,552	$413,257	$421,109	$429,110	$437,264	$445,572	$454,037	$462,664	$471,455
Depreciation	13,715,467	14,933,363	15,286,699	16,727,560	17,806,132	19,964,858	21,633,526	22,392,008	24,426,333	26,225,138	28,212,760
Financing Costs	12,463,057	11,994,704	14,382,776	20,620,489	23,012,289	24,979,402	29,755,858	35,973,970	39,491,999	42,358,359	46,020,596
Retained Earnings	17,343,838	18,603,012	18,817,537	32,917,445	42,790,503	53,017,103	63,400,885	67,463,967	70,893,148	76,778,802	80,748,993
Total Revenue Requirement	**$109,013,608**	**$116,689,913**	**$124,170,361**	**$142,411,310**	**$156,665,253**	**$174,228,479**	**$192,659,412**	**$205,881,097**	**$216,661,416**	**$228,953,607**	**$240,349,736**
Bal. / (Def.) of Funds	$7,338,086	$6,963,741	$5,817,255	$763,577	($962,523)	($2,875,231)	($5,714,308)	($7,201,349)	($8,648,820)	($14,405,100)	($19,493,105)
Balance a % of Rate Adj. Req'd	-5.9%	-5.4%	-4.3%	-0.5%	0.6%	1.7%	3.1%	3.7%	4.4%	7.1%	9.4%

EPCOR
Drainage COSA
Revenue Requirement - Sanitary
Exhibit 2

	Budgeted	Projected										
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Notes
Revenues												
Rate Revenues												
Residential	$77,662,968	$80,685,332	$84,027,701	$92,431,999	$100,479,082	$109,233,500	$118,766,926	$123,637,707	$126,941,597	$130,341,904	$133,841,655	Schedule - R-2
Multi-Residential	19,718,304	20,370,818	21,163,534	23,194,134	25,121,122	27,208,154	29,470,785	30,561,392	31,231,599	31,965,184	32,691,083	Schedule - R-2
Commercial	26,596,593	27,213,225	27,989,588	30,380,149	32,590,302	34,963,452	37,514,864	38,540,040	38,939,026	39,569,912	40,099,538	Schedule - R-2
U of A	1,153,328	1,178,492	1,209,039	1,307,809	1,398,007	1,494,425	1,597,612	1,635,149	1,650,494	1,665,983	1,681,618	Schedule - R-2
Total Rate Revenues	**$125,131,192**	**$129,447,867**	**$134,389,862**	**$147,314,091**	**$159,588,513**	**$172,899,532**	**$187,350,186**	**$194,374,288**	**$198,762,716**	**$203,542,984**	**$208,313,894**	
Other Revenues												
Odour	$0	$3,275,649	$5,963,473	$6,423,463	$6,877,576	$9,421,579	$10,771,169	$15,694,061	$20,854,865	$22,831,002	$24,592,900	Schedule - F-1
Biosolids	(11,130,598)	(11,505,987)	(12,824,672)	(13,068,341)	(13,316,639)	(13,569,655)	(13,827,479)	(14,090,201)	(14,357,915)	(14,630,715)	(14,908,699)	As Allocation (100% sanitary)
Hazardous and Sanitary Waste	710,411	731,939	731,939	745,846	760,017	774,457	789,172	804,166	819,445	835,015	850,880	As Allocation (65.2% sanitary)
Compliance	676,877	709,330	717,159	730,785	744,669	758,818	773,236	787,927	802,898	818,153	833,698	As Allocation (65.2% sanitary)
Pipeline Maintenance	335,962	391,411	391,411	398,848	406,426	414,148	422,017	430,035	438,206	446,532	455,016	As Allocation (65.2% sanitary)
Industrial Monitoring	19,571	19,571	19,571	19,942	20,321	20,707	21,101	21,502	21,910	22,327	22,751	As Allocation (65.2% sanitary)
General Maintenance	14,290	14,290	14,290	14,562	14,839	15,121	15,408	15,701	15,999	16,303	16,613	As Allocation (65.2% sanitary)
Pumping - Maintenance	9,785	9,785	9,785	9,971	10,161	10,354	10,550	10,751	10,955	11,163	11,375	As Allocation (65.2% sanitary)
9K-611 - Late Pmt Chg & UIS Sewer Trouble	340,000	350,000	360,000	366,840	373,810	380,912	388,150	395,525	403,039	410,697	418,500	As Allocation (100% sanitary)
9L-611 - Late Pmt Chg & UIS Sewer Trouble	152,000	155,000	160,000	163,040	166,138	169,294	172,511	175,789	179,129	182,532	186,000	As Allocation (100% sanitary)
Inventory Management (asset sales)	54,798	54,798	54,798	55,839	56,900	57,981	59,082	60,205	61,349	62,514	63,702	As Allocation (65.2% sanitary)
Operations Mgmt and Admin	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Infrastructure Planning	37,406	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Customer Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Project Management	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Operations Mgmt and Admin	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Information Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Open Cut Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Total Other Revenues	**(8,779,498)**	**(5,794,213)**	**(4,402,246)**	**(4,139,205)**	**(3,885,783)**	**(1,546,284)**	**(405,083)**	**4,305,460**	**9,249,880**	**11,005,523**	**12,542,737**	
Total Revenues	**$116,351,694**	**$123,653,654**	**$129,987,615**	**$143,174,886**	**$155,702,730**	**$171,353,248**	**$186,945,103**	**$198,679,748**	**$208,012,597**	**$214,548,507**	**$220,856,631**	
Franchise Fees	**$9,382,041**	**$10,019,416**	**$10,695,294**	**$11,840,587**	**$12,871,063**	**$14,132,030**	**$15,361,415**	**$16,329,275**	**$17,053,661**	**$17,563,904**	**$18,085,462**	As Allocation (100% sanitary)
Drainage Operations												
Operations Mgmt and Admin	$950,214	$951,040	$974,816	$993,337	$1,012,211	$1,031,443	$1,051,040	$1,071,010	$1,091,359	$1,112,095	$1,133,225	As Allocation (50% sanitary)
Hazardous and Sanitary Waste	538,214	549,502	562,036	572,714	583,596	594,684	605,983	617,497	629,229	641,185	653,367	As Allocation (100% sanitary)
Industrial Monitoring	2,924,519	3,178,191	3,337,418	3,400,829	3,465,445	3,531,288	3,598,383	3,666,752	3,736,420	3,807,412	3,879,753	As Allocation (100% sanitary)
Compliance	578,845	399,106	451,370	459,946	468,685	477,590	486,664	495,910	505,333	514,934	524,718	As Allocation (50% sanitary)
General Maintenance (2)	1,013,950	1,038,342	1,036,031	1,055,716	1,075,774	1,096,214	1,117,042	1,138,266	1,159,893	1,181,931	1,204,387	As Allocation (50% sanitary)
Pipeline Maintenance	9,876,669	10,094,114	10,550,611	10,751,073	10,955,343	11,163,495	11,375,601	11,591,737	11,811,980	12,036,408	12,265,100	As Allocation (50% sanitary)
Pumping - Maintenance	5,766,430	6,301,705	6,572,368	6,697,243	6,824,491	6,954,156	7,086,285	7,220,924	7,358,122	7,497,926	7,640,387	As Allocation (50% sanitary)
Total Drainage Operations	**$21,648,842**	**$22,512,000**	**$23,484,650**	**$23,930,858**	**$24,385,544**	**$24,848,870**	**$25,320,998**	**$25,802,097**	**$26,292,337**	**$26,791,891**	**$27,300,937**	

EPCOR
Drainage COSA
Revenue Requirement - Sanitary
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	***Notes***
Planning												
Biosolids	$1,900,469	$1,914,499	$2,023,337	$2,061,781	$2,100,954	$2,140,873	$2,181,549	$2,222,999	$2,265,236	$2,308,275	$2,352,132	As Allocation (100% sanitary)
Engineering	656,836	762,144	1,130,153	1,151,626	1,173,507	1,195,803	1,218,523	1,241,675	1,265,267	1,289,307	1,313,804	As Allocation (50% sanitary)
Infrastructure Planning	736,160	684,183	710,327	723,823	737,576	751,590	765,870	780,422	795,250	810,359	825,756	As Allocation (39.4% sanitary)
System Planning and Analysis	1,105,880	994,552	1,060,744	1,080,898	1,101,435	1,122,362	1,143,687	1,165,417	1,187,560	1,210,124	1,233,116	As Allocation (39.4% sanitary)
Project Management	9,219	9,920	10,040	10,231	10,425	10,624	10,825	11,031	11,241	11,454	11,672	As Allocation (39.4% sanitary)
Customer Services	148,691	50,460	150,518	153,378	156,292	159,262	162,288	165,371	168,513	171,715	174,977	As Allocation (50% sanitary)
Project Management (2)	744,590	1,043,092	935,945	953,728	971,849	990,314	1,009,130	1,028,303	1,047,841	1,067,750	1,088,037	As Allocation (39.4% sanitary)
Total Planning	**$5,301,847**	**$5,458,850**	**$6,021,064**	**$6,135,464**	**$6,252,038**	**$6,370,827**	**$6,491,873**	**$6,615,218**	**$6,740,907**	**$6,868,984**	**$6,999,495**	
Billing and Meter Reading												
Meter Reading	$6,433,366	$6,872,672	$6,665,810	$6,792,460	$6,921,517	$7,053,026	$7,187,033	$7,323,587	$7,462,735	$7,604,527	$7,749,013	As Allocation (100% sanitary)
CUS Charges	391,411	424,029	456,646	465,323	474,164	483,173	492,353	501,708	511,240	520,954	530,852	As Allocation (65.2% sanitary)
Total Billing and Meter Reading	**$6,824,777**	**$7,296,701**	**$7,122,456**	**$7,257,783**	**$7,395,681**	**$7,536,199**	**$7,679,387**	**$7,825,295**	**$7,973,976**	**$8,125,481**	**$8,279,865**	
Project Support Costs												
Operations Mgmt and Admin	$426,518	$666,940	$472,485	$481,463	$490,610	$499,932	$509,431	$519,110	$528,973	$539,023	$549,265	As Allocation (50% sanitary)
Open Cut Services	718,636	681,748	769,473	784,093	798,990	814,171	829,640	845,404	861,466	877,834	894,513	As Allocation (50% sanitary)
In-house Tunnelling	747,164	694,118	790,906	805,933	821,245	836,849	852,749	868,951	885,462	902,285	919,429	As Allocation (50% sanitary)
Survey Operations	266,623	106,933	303,567	309,335	315,212	321,201	327,304	333,523	339,859	346,317	352,897	As Allocation (50% sanitary)
Total Project Support Costs	**$2,158,941**	**$2,149,739**	**$2,336,430**	**$2,380,823**	**$2,426,058**	**$2,472,153**	**$2,519,124**	**$2,566,988**	**$2,615,760**	**$2,665,460**	**$2,716,103**	
Drainage Services Administration												
Security Operations & Investigations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Allocation (63.3% sanitary)
Fleet Services	105,487	126,695	131,526	134,025	136,571	139,166	141,810	144,505	147,250	150,048	152,899	As Allocation (63.3% sanitary)
Equipment Dispatch	(1,798,952)	(2,063,004)	(2,267,756)	(2,310,844)	(2,354,750)	(2,399,490)	(2,445,080)	(2,491,537)	(2,538,876)	(2,587,114)	(2,636,270)	As Allocation (63.3% sanitary)
General Maintenance	(646,912)	(765,381)	(836,936)	(852,838)	(869,042)	(885,554)	(902,379)	(919,524)	(936,995)	(954,798)	(972,940)	As Allocation (63.3% sanitary)
None	631,937	837,603	918,100	935,544	953,319	971,432	989,889	1,008,697	1,027,862	1,047,392	1,067,292	As Allocation (63.3% sanitary)
Operations Mgmt and Admin	(885,778)	(862,076)	(834,768)	(850,629)	(866,791)	(883,260)	(900,042)	(917,143)	(934,568)	(952,325)	(970,419)	As Allocation (63.3% sanitary)
Information Services	682,317	699,120	720,371	734,058	748,005	762,217	776,699	791,456	806,494	821,817	837,432	As Allocation (63.3% sanitary)
Security - Operations & Investigations	213,129	120,334	124,293	126,654	129,061	131,513	134,012	136,558	139,152	141,796	144,490	As Allocation (63.3% sanitary)
Facility Operations	1,898,803	2,207,912	2,428,339	2,474,478	2,521,493	2,569,401	2,618,220	2,667,966	2,718,658	2,770,312	2,822,948	As Allocation (63.3% sanitary)
Inventory Management	786,028	772,654	790,285	805,300	820,601	836,192	852,080	868,269	884,766	901,577	918,707	As Allocation (63.3% sanitary)
Contract Management	159,748	169,985	178,385	181,774	185,228	188,747	192,334	195,988	199,712	203,506	207,373	As Allocation (63.3% sanitary)
General Admin (1)	514,380	469,545	483,563	492,751	502,113	511,653	521,374	531,281	541,375	551,661	562,143	As Allocation (63.3% sanitary)
Health Safety and Loss Prevention	967,703	980,445	1,056,355	1,076,426	1,096,878	1,117,718	1,138,955	1,160,595	1,182,647	1,205,117	1,228,014	As Allocation (63.3% sanitary)
Training	1,219,061	1,164,028	1,170,052	1,192,283	1,214,936	1,238,020	1,261,542	1,285,512	1,309,936	1,334,825	1,360,187	As Allocation (63.3% sanitary)
General Admin (2)	897,222	942,280	961,526	979,795	998,411	1,017,381	1,036,711	1,056,409	1,076,480	1,096,933	1,117,775	As Allocation (63.3% sanitary)
None (2)	(560,004)	(560,367)	(659,180)	(671,705)	(684,467)	(697,472)	(710,724)	(724,228)	(737,988)	(752,010)	(766,298)	As Allocation (63.3% sanitary)
General and Tax Accounting	1,639,727	1,727,370	1,616,251	1,646,960	1,678,252	1,710,139	1,742,631	1,775,741	1,809,480	1,843,860	1,878,894	As Allocation (63.3% sanitary)
General Admin (4)	9,518	0	0	0	0	0	0	0	0	0	0	As Allocation (63.3% sanitary)
General Admin (5)	806,041	892,534	937,546	955,360	973,512	992,008	1,010,856	1,030,063	1,049,634	1,069,577	1,089,899	As Allocation (63.3% sanitary)
Internal Communications	2,001,080	1,846,413	1,808,780	1,843,147	1,878,167	1,913,852	1,950,215	1,987,269	2,025,027	2,063,503	2,102,709	As Allocation (63.3% sanitary)
Total Drainage Services Administration	**$8,640,535**	**$8,706,091**	**$8,726,729**	**$8,892,537**	**$9,061,495**	**$9,233,664**	**$9,409,103**	**$9,587,876**	**$9,770,046**	**$9,955,677**	**$10,144,835**	

EPCOR
Drainage COSA
Revenue Requirement - Sanitary
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	***Notes***
Corporate Allocations	**$11,130,426**	**$11,812,989**	**$12,419,753**	**$13,049,173**	**$13,297,107**	**$13,549,752**	**$13,807,198**	**$14,069,534**	**$14,336,855**	**$14,609,256**	**$14,886,832**	As Allocation (63.3% sanitary)
Efficiencies	**$0**	**$0**	**$0**	**($5,218,816)**	**($5,317,974)**	**($5,419,015)**	**($5,521,977)**	**($5,626,894)**	**($5,733,805)**	**($5,842,748)**	**($5,953,760)**	As Allocation (65.2% sanitary)
O&M Expenses - NRAs												
Planning and Estimation (LRT Relocates)	$18,201	$18,547	$18,899	$19,258	$19,624	$19,997	$20,377	$20,764	$21,159	$21,561	$21,970	As Allocation (50% sanitary)
Engineering (SIRP)	0	0	0	0	0	0	0	0	0	0	0	As Allocation (0% sanitary)
Odour and Corrosion Mitigation	0	2,798,262	4,452,520	3,444,891	2,244,583	3,093,530	2,344,382	2,415,427	2,325,003	2,369,178	2,414,192	As Allocation (100% sanitary)
Total Corporate Allocations	**$18,201**	**$2,816,809**	**$4,471,419**	**$3,464,149**	**$2,264,207**	**$3,113,527**	**$2,364,759**	**$2,436,191**	**$2,346,161**	**$2,390,738**	**$2,436,162**	
Total O&M Expenses	**$65,105,609**	**$70,772,596**	**$75,277,796**	**$71,732,557**	**$72,635,220**	**$75,838,006**	**$77,431,879**	**$79,605,579**	**$81,395,899**	**$83,128,644**	**$84,895,932**	
Property Taxes	**$385,639**	**$386,238**	**$405,552**	**$413,257**	**$421,109**	**$429,110**	**$437,264**	**$445,572**	**$454,037**	**$462,664**	**$471,455**	As Allocation (50% sanitary)
Depreciation	$29,098,240	$31,129,361	$32,465,373	$34,929,835	$37,152,403	$40,411,096	$43,042,122	$44,755,834	$47,730,680	$50,395,694	$53,210,283	As Allocation (39.4% sanitary)
Less: Contributions Amortization	(15,382,774)	(16,195,998)	(17,178,674)	(18,202,275)	(19,346,271)	(20,446,238)	(21,408,596)	(22,363,826)	(23,304,346)	(24,170,556)	(24,997,523)	As Allocation (39.4% sanitary)
Total Depreciation	**$13,715,467**	**$14,933,363**	**$15,286,699**	**$16,727,560**	**$17,806,132**	**$19,964,858**	**$21,633,526**	**$22,392,008**	**$24,426,333**	**$26,225,138**	**$28,212,760**	
Financing Costs												
Interest on LTD	$12,877,794	$13,641,241	$17,385,115	$25,526,953	$28,116,090	$30,576,977	$34,543,645	$38,900,688	$42,255,936	$45,382,580	$48,663,063	As Allocation (65.2% sanitary)
Interest on STD	1,247,850	1,597,390	753,962	850,830	970,553	1,110,181	1,132,166	990,017	953,476	985,094	1,030,424	As Allocation (65.2% sanitary)
AFUDC	(1,662,587)	(3,243,926)	(3,756,301)	(5,757,295)	(6,074,355)	(6,707,756)	(5,919,953)	(3,916,734)	(3,717,413)	(4,009,315)	(3,672,891)	As Allocation (65.2% sanitary)
Total Financing Costs	**$12,463,057**	**$11,994,704**	**$14,382,776**	**$20,620,489**	**$23,012,289**	**$24,979,402**	**$29,755,858**	**$35,973,970**	**$39,491,999**	**$42,358,359**	**$46,020,596**	
Return on Investment												
Retained Earnings	$17,343,838	$18,603,012	$18,817,537	$32,917,445	$42,790,503	$53,017,103	$63,400,885	$67,463,967	$70,893,148	$76,778,802	$80,748,993	As Allocation (65.2% sanitary)
Dividends / Equity Issue	0	0	0	0	0	0	0	0	0	0	0	As Allocation (65.2% sanitary)
Total Return on Investment	**$17,343,838**	**$18,603,012**	**$18,817,537**	**$32,917,445**	**$42,790,503**	**$53,017,103**	**$63,400,885**	**$67,463,967**	**$70,893,148**	**$76,778,802**	**$80,748,993**	
Total Revenue Requirement	**$109,013,608**	**$116,689,913**	**$124,170,361**	**$142,411,310**	**$156,665,253**	**$174,228,479**	**$192,659,412**	**$205,881,097**	**$216,661,416**	**$228,953,607**	**$240,349,736**	
Bal. / (Def.) of Funds	$7,338,086	$6,963,741	$5,817,255	$763,577	($962,523)	($2,875,231)	($5,714,308)	($7,201,349)	($8,648,820)	($14,405,100)	($19,493,105)	
Balance a % of Rate Adj. Req'd	-5.9%	-5.4%	-4.3%	-0.5%	0.6%	1.7%	3.1%	3.7%	4.4%	7.1%	9.4%	

EPCOR
Drainage COSA
Exhibit 3
Volume Distribution Factor - Sanitary

	2021 Annual Flow (ML)	15.5% Inflow and Infiltration [1]	Total Annual Flow at Plant (ML)	Avg. Daily Flow At Plant (ML)	% of Total	% of Total
Residential	45,062	6,985	52,046	52,046	53.9%	52.6%
Multi-Residential	17,570	2,723	20,294	20,294	21.0%	20.5%
Commercial	20,912	3,241	24,154	24,154	25.0%	24.4%
U of A	2,080	322	2,403	2,403	0.0%	2.4%
Total	**85,624**	**13,272**	**98,896**	**98,896**	**100.0%**	**100.0%**
		Actual Flows [2]	**0**			
					(VOL w/o)	***(VOL)***

Notes

[1] - Estimated
[2] -

EPCOR
Drainage COSA
Exhibit 5
Customer Distribution Factors - Sanitary

	Actual Customer			*Cust. Serv. & Acntg*		
	Number of Account [1]	**% of Total**		**Weight Factor** [2]	**Wt. Acct.**	**% of Total**
Residential	266,841	92.8%		1.00	266,841	92.8%
Multi-Residential	3,753	1.3%		1.00	3,753	1.3%
Commercial	16,886	5.9%		1.00	16,886	5.9%
U of A	1	0.0%		1.00	1	0.0%
	----------	----------			----------	----------
Total	**287,482**	**100.0%**			**287,482**	**100.0%**
		(AC)				***(WCA)***

Notes

[1] - Based on 2018 Billing Data
[2] - No Cost Difference Identified

EPCOR
Drainage COSA
Exhibit 6
Revenue Distribution Factor - Sanitary

	Projected 2021	% of Total
Residential	$84,027,701	62.5%
Multi-Residential	21,163,534	15.7%
Commercial	27,989,588	20.8%
U of A	1,209,039	0.9%
	-----------------	----------
Total	**$134,389,862**	**100.0%**
		(RR)

EPCOR
Drainage COSA
Exhibit 7
Net Plant in Service - Sanitary

	As of 12/31/18	Volume (VOL)	Weighted for Actual Customer (AC)	Customer Acct/Svcs (ESU)	Capacity Demand (CD)	Revenue (RR)	Direct (DA)	Basis of Classification	
Collection	$1,390,309,155	$1,112,247,324	$0	$0	$278,061,831	$0	$0	80.0% VOL	20.0% CD
Collection - Common	11,254,229	9,003,383	0	0	2,250,846	0	0	80.0% VOL	20.0% CD
Pumping Stations	68,280,578	68,280,578	0	0	0	0	0	100.0% VOL	0.0% CD
Storage	39,249,760	31,399,808	0	0	7,849,952	0	0	80.0% VOL	20.0% CD
Storage - Common	166,983	133,586	0	0	33,397	0	0	80.0% VOL	20.0% CD
Biosolids	10,386,741	0	0	0	10,386,741	0	0	100.0% AC	
Plant Before General Plant	**$1,519,647,445**	**$1,221,064,679**	**$0**	**$0**	**$298,582,766**	**$0**	**$0**		
% Plant Before General Plant	***100.0%***	***80.4%***	***0.0%***	***0.0%***	***19.6%***	***0.0%***	***0.0%***	*Factor PBGP*	
General Plant									
General Plant	$4,219,597	$3,390,524	$0	$0	$829,073	$0	$0	*As Factor PBGP*	
General Plant - Common	34,073,653	27,378,807	0	0	6,694,846	0	0	*As Factor PBGP*	
Total General Plant	**$38,293,250**	**$30,769,331**	**$0**	**$0**	**$7,523,919**	**$0**	**$0**		
Net Plant in Service	**$1,557,940,695**	**$1,251,834,010**	**$0**	**$0**	**$306,106,685**	**$0**	**$0**		

EPCOR
Drainage COSA
Exhibit 8
Allocation of the Revenue Requirement - Sanitary

	Test Year 2021	Volume (VOL)	*Weighted* Actual Customer (AC)	Customer Acct/Svcs (ESU)	Equivalent SW Unit (CD)	Revenue (RR)	Direct (DA)	*Basis of Classification*	
Franchise Fees	**$10,695,294**	$0	$0	$0	0	$10,695,294	$0	100.0%	RR
Drainage Operations									
Operations Mgmt and Admin	$974,816	$783,282	$0	$0	$191,533	$0	$0		As Net Plant
General Maintenance	0	0	0	0	0	0	0		As Net Plant
Operations Mgmt and Admin (2)	0	0	0	0	0	0	0		As Net Plant
Hazardous and Sanitary Waste	562,036	451,606	0	0	110,430	0	0		As Net Plant
Industrial Monitoring	3,337,418	2,681,677	0	0	655,741	0	0		As Net Plant
Compliance	451,370	362,684	0	0	88,686	0	0		As Net Plant
General Maintenance (2)	1,036,031	832,470	0	0	203,561	0	0		As Net Plant
Pipeline Maintenance	10,550,611	10,550,611	0	0	0	0	0	100.0%	VOL
Pumping - Maintenance	6,572,368	6,572,368	0	0	0	0	0	100.0%	VOL
Total Drainage Operations	**$23,484,650**	**$22,234,698**	**$0**	**$0**	**$1,249,951**	**$0**	**$0**		
Planning									
Biosolids	$2,023,337	$1,625,789	$0	$0	$397,549	$0	$0		As Net Plant
Engineering	1,130,153	908,099	0	0	222,054	0	0		As Net Plant
Infrastructure Planning	710,327	570,761	0	0	139,566	0	0		As Net Plant
System Planning and Analysis	1,060,744	852,327	0	0	208,417	0	0		As Net Plant
Stormwater Strategies	0	0	0	0	0	0	0		As Net Plant
Project Management	10,040	8,068	0	0	1,973	0	0		As Net Plant
Customer Services	150,518	120,944	0	0	29,574	0	0		As Net Plant
Engineering (pre-SIRP)	0	0	0	0	0	0	0		As Net Plant
Planning and Estimation (LRT Relocates)	0	0	0	0	0	0	0		As Net Plant
Project Management (2)	935,945	752,049	0	0	183,896	0	0		As Net Plant
Total Planning	**$6,021,064**	**$4,838,036**	**$0**	**$0**	**$1,183,028**	**$0**	**$0**		
Billing and Meter Reading									
Meter Reading	$6,665,810	$0	$6,665,810	$0	$0	$0	$0	100.0%	AC
CUS Charges	456,646	0	456,646	0	0	0	0	100.0%	AC
Total Billing and Meter Reading	**$7,122,456**	**$0**	**$7,122,456**	**$0**	**$0**	**$0**	**$0**		
Project Support Costs									
Operations Mgmt and Admin	$472,485	$379,651	$0	$0	$92,835	$0	$0		As Net Plant
Open Cut Services	769,473	618,285	0	0	151,187	0	0		As Net Plant
In-house Tunnelling	790,906	635,507	0	0	155,398	0	0		As Net Plant
Survey Operations	303,567	243,922	0	0	59,645	0	0		As Net Plant
Total Project Support Costs	**$2,336,430**	**$1,877,365**	**$0**	**$0**	**$459,066**	**$0**	**$0**		

EPCOR
Drainage COSA
Exhibit 8
Allocation of the Revenue Requirement - Sanitary

	Test Year 2021	Volume (VOL)	Weighted Actual Customer (AC)	Customer Acct/Svcs (ESU)	Equivalent SW Unit (CD)	Revenue (RR)	Direct (DA)	Basis of Classification
Drainage Services Administration								
Security Operations & Investigations	$0	$0	$0	$0	$0	$0	$0	As Net Plant
Fleet Services	131,526	105,683	0	0	25,842	0	0	As Net Plant
Equipment Dispatch	(2,267,756)	(1,822,184)	0	0	(445,572)	0	0	As Net Plant
General Maintenance	(836,936)	(672,494)	0	0	(164,443)	0	0	As Net Plant
None	918,100	737,710	0	0	180,390	0	0	As Net Plant
Operations Mgmt and Admin	(834,768)	(670,752)	0	0	(164,017)	0	0	As Net Plant
Inspection Services	0	0	0	0	0	0	0	As Net Plant
Capital OH Clearing	0	0	0	0	0	0	0	As Net Plant
Information Services	720,371	578,831	0	0	141,540	0	0	As Net Plant
Security - Operations & Investigations	124,293	99,871	0	0	24,421	0	0	As Net Plant
Facility Operations	2,428,339	1,951,215	0	0	477,124	0	0	As Net Plant
Security Operations & Investigations (2)	0	0	0	0	0	0	0	As Net Plant
Inventory Management	790,285	635,008	0	0	155,276	0	0	As Net Plant
Contract Management	178,385	143,336	0	0	35,049	0	0	As Net Plant
General Admin (1)	483,563	388,552	0	0	95,011	0	0	As Net Plant
Health Safety and Loss Prevention	1,056,355	848,801	0	0	207,554	0	0	As Net Plant
Training	1,170,052	940,158	0	0	229,894	0	0	As Net Plant
General Admin (2)	961,526	772,604	0	0	188,922	0	0	As Net Plant
None (2)	(659,180)	(529,664)	0	0	(129,517)	0	0	As Net Plant
General and Tax Accounting	1,616,251	1,298,687	0	0	317,564	0	0	As Net Plant
General Admin (3)	0	0	0	0	0	0	0	As Net Plant
General Admin (4)	0	0	0	0	0	0	0	As Net Plant
General Admin (5)	937,546	753,336	0	0	184,211	0	0	As Net Plant
General Admin (6)	0	0	0	0	0	0	0	As Net Plant
Internal Communications	1,808,780	1,453,388	0	0	355,392	0	0	As Net Plant
Comm Relations & Public Consultation	0	0	0	0	0	0	0	As Net Plant
Total Drainage Services Administration	**$8,726,729**	**$7,012,088**	**$0**	**$0**	**$1,714,642**	**$0**	**$0**	
Corporate Allocations	**$12,419,753**	**$9,979,500**	**$0**	**$0**	**$2,440,253**	**$0**	**$0**	As Net Plant
Efficiencies	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	As Net Plant
O&M Expenses - NRAs								
Planning and Estimation (LRT Relocates)	$18,899	$15,186	$0	$0	$3,713	$0	$0	As Net Plant
Engineering (SIRP)	0	0	0	0	0	0	0	As Net Plant
Odour and Corrosion Mitigation	4,452,520	3,577,682	0	0	874,838	0	0	As Net Plant
Total Corporate Allocations	**$4,471,419**	**$3,592,867**	**$0**	**$0**	**$878,552**	**$0**	**$0**	
Total O&M Expenses	**$75,277,796**	**$49,534,554**	**$7,122,456**	**$0**	**$7,925,491**	**$10,695,294**	**$0**	

EPCOR
Drainage COSA
Exhibit 8
Allocation of the Revenue Requirement - Sanitary

			Weighted					
			Actual	**Customer**	**Equivalent**			
	Test Year	**Volume**	**Customer**	**Acct/Svcs**	**SW Unit**	**Revenue**	**Direct**	
	2021	*(VOL)*	*(AC)*	*(ESU)*	*(CD)*	*(RR)*	*(DA)*	*Basis of Classification*
Property Taxes	**$405,552**	**$0**	**$0**	**$0**	**0**	**$405,552**	**$0**	100.0% RR
Depreciation	$32,465,373	$21,362,977	$3,071,732	$0	$3,418,060	$4,612,605	$0	As O&M Expenses
Less: Contributions Amortization	(17,178,674)	(11,303,970)	(1,625,371)	0	(1,808,627)	(2,440,706)	0	As O&M Expenses
Total Depreciation	**$15,286,699**	**$10,059,006**	**$1,446,361**	**$0**	**$1,609,433**	**$2,171,899**	**$0**	
Financing Costs								
Interest on LTD	$17,385,115	$11,439,813	$1,644,904	$0	$1,830,362	$2,470,037	$0	As O&M Expenses
Interest on STD	753,962	496,125	71,337	0	79,380	107,121	0	As O&M Expenses
AFUDC	(3,756,301)	(2,471,734)	(355,405)	0	(395,476)	(533,687)	0	As O&M Expenses
Total Financing Costs	**$14,382,776**	**$9,464,204**	**$1,360,836**	**$0**	**$1,514,266**	**$2,043,471**	**$0**	
Return on Investment								
Retained Earnings	$18,817,537	$12,382,381	$1,780,433	$0	$1,981,172	$2,673,552	$0	As O&M Expenses
Dividends / Equity Issue	0	0	0	0	0	0	0	As O&M Expenses
Total Return on Investment	**$18,817,537**	**$12,382,381**	**$1,780,433**	**$0**	**$1,981,172**	**$2,673,552**	**$0**	
Total Revenue Requirement	**$124,170,361**	**$81,440,145**	**$11,710,086**	**$0**	**$13,030,362**	**$17,989,768**	**$0**	
Less: Non-Operating Revenue								
Odour	$5,963,473	$3,911,289	$562,395	$0	$625,803	$863,986	$0	As Revenue Requirement
Biosolids	(12,824,672)	(8,411,372)	(1,209,451)	0	(1,345,813)	(1,858,035)	0	As Revenue Requirement
Hazardous and Sanitary Waste	731,939	480,060	69,027	0	76,809	106,043	0	As Revenue Requirement
Compliance	717,159	470,366	67,633	0	75,258	103,902	0	As Revenue Requirement
Pipeline Maintenance	391,411	256,717	36,913	0	41,074	56,708	0	As Revenue Requirement
Industrial Monitoring	19,571	12,836	1,846	0	2,054	2,835	0	As Revenue Requirement
General Maintenance	14,290	9,373	1,348	0	1,500	2,070	0	As Revenue Requirement
Pumping - Maintenance	9,785	6,418	923	0	1,027	1,418	0	As Revenue Requirement
9K-611 - Late Pmt Chg & UIS Sewer Trouble	360,000	236,115	33,950	0	37,778	52,157	0	As Revenue Requirement
9L-611 - Late Pmt Chg & UIS Sewer Trouble	160,000	104,940	15,089	0	16,790	23,181	0	As Revenue Requirement
Inventory Management (asset sales)	54,798	35,940	5,168	0	5,750	7,939	0	As Revenue Requirement
Operations Mgmt and Admin	0	0	0	0	0	0	0	As Revenue Requirement
Infrastructure Planning	0	0	0	0	0	0	0	As Revenue Requirement
Customer Services	0	0	0	0	0	0	0	As Revenue Requirement
Project Management	0	0	0	0	0	0	0	As Revenue Requirement
Operations Mgmt and Admin	0	0	0	0	0	0	0	As Revenue Requirement
Information Services	0	0	0	0	0	0	0	As Revenue Requirement
Open Cut Services	0	0	0	0	0	0	0	As Revenue Requirement
Total Other Revenues	**($4,402,246)**	**($2,887,320)**	**($415,161)**	**$0**	**($461,969)**	**($637,796)**	**$0**	
Net Revenue Requirement	**$128,572,607**	**$84,327,465**	**$12,125,247**	**$0**	**$13,492,331**	**$18,627,564**	**$0**	

EPCOR
Drainage COSA
Exhibit 9
Distribution of Total Revenue Requirement - Sanitary

		Residential	Multi-Residential	Commercial	U of A	*Basis*
Volume Related	$84,327,465	$44,379,248	$17,304,166	$20,595,460	$2,048,591	*(VOL)*
*Less: Collection Discount**	0	486,183	189,570	225,627	(901,380)	*(VOL w/o)*
Net Volume Related Costs	**$84,327,465**	**$44,865,431**	**$17,493,736**	**$20,821,087**	**$1,147,211**	
Customer Related						
Actual Customer	$12,125,247	$11,254,679	$158,303	$712,223	$42	*(AC)*
Weighted Customer	0	0	0	0	0	*(ESU)*
Capacity Demand	13,492,331	10,936,134	727,741	1,819,876	8,580	*(CD)*
Total Customer Related	**$25,617,578**	**$22,190,813**	**$886,044**	**$2,532,099**	**$8,622**	
Revenue Related	$18,627,564	$11,646,946	$2,933,444	$3,879,592	$167,583	*(RR)*
Direct Assignment	$0	$0	$0	$0	$0	*(DA)*
Total Revenue Requirements	**$128,572,607**	**$78,703,189**	**$21,313,223**	**$27,232,778**	**$1,323,416**	

EPCOR
Drainage COSA
Exhibit 10
Cost of Service Analysis Summary - Sanitary

	2021	Residential	Multi-Residential	Commercial	U of A
Revenues at Present Rates	**$134,389,862**	$84,027,701	$21,163,534	$27,989,588	$1,209,039
Allocated Revenue Requirement	**$128,572,607**	$78,703,189	$21,313,223	$27,232,778	$1,323,416
Balance / (Deficiency) of Funds	**$5,817,255**	**$5,324,511**	**($149,689)**	**$756,810**	**($114,377)**
Required % Change in Rates	**-4.3%**	**-6.3%**	**0.7%**	**-2.7%**	**9.5%**

EPCOR
Drainage COSA
Exhibit 11
Unit Costs Summary - Sanitary

	System Average	Residential	Multi-Residential	Commercial	U of A
Variable					
Volume Related	$0.85	$0.86	$0.86	$0.86	$0.48
Fixed					
Actual Customer	$3.02	$3.45	$0.73	$1.31	$0.02
Weighted Customer	0.00	0.00	0.00	0.00	0.00
Capacity Demand	3.36	3.36	3.36	3.36	3.36
RR / DA	4.63	3.58	13.53	7.16	65.56
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Total	**$11.01**	**$10.39**	**$17.62**	**$11.83**	**$68.94**
Basic Data					
Volume / Flow (m^3)	98,895,906	52,046,222	20,293,639	24,153,539	2,402,506
Customers	287,482	266,841	3,753	16,886	1
Wt. Customers	287,482	266,841	3,753	16,886	1
Equiv. Meters	334,944	271,487	18,066	45,178	213

Stormwater Drainage Technical Appendix B

EPCOR
Drainage COSA
Summary of the Revenue Requirement - Stormwater
Exhibit 1

	Budgeted	*Projected*									
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**
Revenues											
Rate Revenues	$66,684,244	$70,625,215	$75,564,007	$85,753,292	$93,850,487	$102,713,644	$112,423,901	$117,727,669	$121,557,096	$125,512,770	$129,598,904
Miscellaneous Revenues	990,741	4,159,107	5,137,859	11,530,157	14,183,899	17,894,469	22,528,992	26,236,952	31,578,394	41,719,693	50,772,875
Total Revenues	**$67,674,985**	**$74,784,321**	**$80,701,866**	**$97,283,449**	**$108,034,386**	**$120,608,112**	**$134,952,893**	**$143,964,621**	**$153,135,490**	**$167,232,463**	**$180,371,779**
Expenses											
Franchise Fees	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Drainage Operations	$18,186,109	$18,784,307	$19,585,196	$19,957,314	$20,336,503	$20,722,897	$21,116,632	$21,517,848	$21,926,687	$22,343,294	$22,767,817
Total Planning	5,670,337	5,943,791	6,423,058	6,545,096	6,669,453	6,796,172	6,925,299	7,056,880	7,190,961	7,327,589	7,466,813
Total Billing and Meter Reading	208,589	225,971	243,354	247,977	252,689	257,490	262,382	267,368	272,447	277,624	282,899
Total Project Support Costs	2,158,941	2,149,739	2,336,430	2,380,823	2,426,058	2,472,153	2,519,124	2,566,988	2,615,760	2,665,460	2,716,103
Total Drainage Services Administration	5,001,615	5,039,562	5,051,509	5,147,487	5,245,290	5,344,950	5,446,504	5,549,988	5,655,437	5,762,891	5,872,386
Corporate Allocations	6,442,900	6,838,005	7,189,233	7,553,576	7,697,094	7,843,338	7,992,362	8,144,217	8,298,957	8,456,637	8,617,313
Efficiencies	0	0	0	(2,781,184)	(2,834,026)	(2,887,873)	(2,942,742)	(2,998,654)	(3,055,629)	(3,113,686)	(3,172,846)
Total O&M Expenses - NRAs	18,201	3,148,529	4,123,462	4,371,102	4,454,153	4,538,782	4,625,018	4,712,894	4,802,439	4,893,685	4,986,665
Total O&M Expenses	**$37,686,691**	**$42,129,906**	**$44,952,241**	**$43,422,191**	**$44,247,213**	**$45,087,910**	**$45,944,580**	**$46,817,527**	**$47,707,060**	**$48,613,494**	**$49,537,151**
Property Taxes	$385,639	$386,238	$405,552	$413,257	$421,109	$429,110	$437,264	$445,572	$454,037	$462,664	$471,455
Depreciation	21,056,212	22,925,948	23,468,395	25,680,428	27,336,270	30,650,382	33,212,149	34,376,583	37,499,713	40,261,268	43,312,698
Financing Costs	6,641,745	6,392,153	7,664,792	10,988,961	12,263,586	13,311,889	15,857,332	19,171,055	21,045,864	22,573,389	24,525,049
Retained Earnings	9,242,785	9,913,817	10,028,141	17,542,189	22,803,685	28,253,590	33,787,260	35,952,536	37,779,996	40,916,548	43,032,320
Total Revenue Requirement	**$75,013,071**	**$81,748,062**	**$86,519,121**	**$98,047,026**	**$107,071,863**	**$117,732,881**	**$129,238,584**	**$136,763,272**	**$144,486,671**	**$152,827,363**	**$160,878,673**
Bal. / (Def.) of Funds	($7,338,086)	($6,963,741)	($5,817,255)	($763,577)	$962,523	$2,875,231	$5,714,308	$7,201,349	$8,648,820	$14,405,100	$19,493,105
Balance a % of Rate Adj. Req'd	11.0%	9.9%	7.7%	0.9%	-1.0%	-2.8%	-5.1%	-6.1%	-7.1%	-11.5%	-15.0%
Proposed Rate Adjustment	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Add'l Revenue with Rate Adj.	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Bal. / (Def.) After Rate Adj.	($7,338,086)	($6,963,741)	($5,817,255)	($763,577)	$962,523	$2,875,231	$5,714,308	$7,201,349	$8,648,820	$14,405,100	$19,493,105
Additional Rate Adjustment Required	**11.0%**	**9.9%**	**7.7%**	**0.9%**	**-1.0%**	**-2.8%**	**-5.1%**	**-6.1%**	**-7.1%**	**-11.5%**	**-15.0%**

EPCOR
Drainage COSA
Revenue Requirement - Stormwater
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	***Notes***
Revenues												
Rate Revenues												
Residential	$35,066,775	$37,434,513	$40,403,032	$46,118,298	$50,636,346	$55,597,011	$61,048,300	$64,132,658	$66,429,493	$68,808,587	$71,272,885	Schedule - R-3
Multi-Residential	3,416,114	3,582,936	3,792,285	4,384,240	4,756,989	5,161,429	5,600,680	5,814,270	5,951,488	6,091,945	6,235,717	Schedule - R-3
Commercial	28,201,355	29,607,766	31,368,691	35,250,754	38,457,152	41,955,204	45,774,920	47,780,741	49,176,115	50,612,238	52,090,301	Schedule - R-3
Total Rate Revenues	**$66,684,244**	**$70,625,215**	**$75,564,007**	**$85,753,292**	**$93,850,487**	**$102,713,644**	**$112,423,901**	**$117,727,669**	**$121,557,096**	**$125,512,770**	**$129,598,904**	
Other Revenues												
Storm - Revenue Leakage	$0	$0	$0	$6,125,384	$8,641,858	$9,311,548	$10,033,899	$10,344,299	$10,514,980	$10,688,477	$10,864,837	Schedule - F-1
SIRP	0	3,129,982	4,104,563	4,351,844	4,469,107	7,489,600	11,381,000	14,757,392	19,906,583	29,852,405	38,706,830	Schedule - F-2
Biosolids	0	0	0	0	0	0	0	0	0	0	0	As Allocation (0% storm)
Hazardous and Sanitary Waste	378,589	390,061	390,061	397,472	405,024	412,720	420,561	428,552	436,694	444,992	453,446	As Allocation (34.8% storm)
Compliance	360,718	378,012	382,184	389,446	396,845	404,385	412,069	419,898	427,876	436,006	444,290	As Allocation (34.8% storm)
Pipeline Maintenance	179,039	208,589	208,589	212,552	216,590	220,706	224,899	229,172	233,526	237,963	242,485	As Allocation (34.8% storm)
Industrial Monitoring	10,429	10,429	10,429	10,628	10,830	11,035	11,245	11,459	11,676	11,898	12,124	As Allocation (34.8% storm)
General Maintenance	7,616	7,616	7,616	7,760	7,908	8,058	8,211	8,367	8,526	8,688	8,853	As Allocation (34.8% storm)
Pumping - Maintenance	5,215	5,215	5,215	5,314	5,415	5,518	5,622	5,729	5,838	5,949	6,062	As Allocation (34.8% storm)
9K-611 - Late Pmt Chg & UIS Sewer Trouble	0	0	0	0	0	0	0	0	0	0	0	As Allocation (0% storm)
9L-611 - Late Pmt Chg & UIS Sewer Trouble	0	0	0	0	0	0	0	0	0	0	0	As Allocation (0% storm)
Inventory Management (asset sales)	29,202	29,202	29,202	29,757	30,323	30,899	31,486	32,084	32,694	33,315	33,948	As Allocation (34.8% storm)
Operations Mgmt and Admin	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Infrastructure Planning	19,934	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Customer Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Project Management	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Operations Mgmt and Admin	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Information Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Open Cut Services	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Total Other Revenues	**990,741**	**4,159,107**	**5,137,859**	**11,530,157**	**14,183,899**	**17,894,469**	**22,528,992**	**26,236,952**	**31,578,394**	**41,719,693**	**50,772,875**	
Total Revenues	**$67,674,985**	**$74,784,321**	**$80,701,866**	**$97,283,449**	**$108,034,386**	**$120,608,112**	**$134,952,893**	**$143,964,621**	**$153,135,490**	**$167,232,463**	**$180,371,779**	
Franchise Fees	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	As Allocation (0% storm)
Drainage Operations												
Operations Mgmt and Admin	$950,214	$951,040	$974,816	$993,337	$1,012,211	$1,031,443	$1,051,040	$1,071,010	$1,091,359	$1,112,095	$1,133,225	As Allocation (50% storm)
Compliance	578,845	399,106	451,370	459,946	468,685	477,590	486,664	495,910	505,333	514,934	524,718	As Allocation (50% storm)
General Maintenance (2)	1,013,950	1,038,342	1,036,031	1,055,716	1,075,774	1,096,214	1,117,042	1,138,266	1,159,893	1,181,931	1,204,387	As Allocation (50% storm)
Pipeline Maintenance	9,876,669	10,094,114	10,550,611	10,751,073	10,955,343	11,163,495	11,375,601	11,591,737	11,811,980	12,036,408	12,265,100	As Allocation (50% storm)
Pumping - Maintenance	5,766,430	6,301,705	6,572,368	6,697,243	6,824,491	6,954,156	7,086,285	7,220,924	7,358,122	7,497,926	7,640,387	As Allocation (50% storm)
Total Drainage Operations	**$18,186,109**	**$18,784,307**	**$19,585,196**	**$19,957,314**	**$20,336,503**	**$20,722,897**	**$21,116,632**	**$21,517,848**	**$21,926,687**	**$22,343,294**	**$22,767,817**	

EPCOR
Drainage COSA
Revenue Requirement - Stormwater
Exhibit 2

	Budgeted	***Projected***										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	***Notes***
Planning												
Biosolids	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Allocation (0% storm)
Engineering	656,836	762,144	1,130,153	1,151,626	1,173,507	1,195,803	1,218,523	1,241,675	1,265,267	1,289,307	1,313,804	As Allocation (50% storm)
Infrastructure Planning	1,130,165	1,050,370	1,090,506	1,111,225	1,132,339	1,153,853	1,175,776	1,198,116	1,220,880	1,244,077	1,267,714	As Allocation (60.6% storm)
System Planning and Analysis	1,697,766	1,526,853	1,628,472	1,659,413	1,690,941	1,723,069	1,755,808	1,789,168	1,823,162	1,857,802	1,893,101	As Allocation (60.6% storm)
Stormwater Strategies	879,617	937,364	971,117	989,569	1,008,370	1,027,529	1,047,052	1,066,946	1,087,218	1,107,876	1,128,925	As Allocation (100% storm)
Project Management	14,153	15,229	15,414	15,707	16,005	16,309	16,619	16,935	17,257	17,585	17,919	As Allocation (60.6% storm)
Customer Services	148,691	50,460	150,518	153,378	156,292	159,262	162,288	165,371	168,513	171,715	174,977	As Allocation (50% storm)
Engineering (pre-SIRP)	0	0	0	0	0	0	0	0	0	0	0	As Allocation (100% storm)
Planning and Estimation (LRT Relocates)	0	0	0	0	0	0	0	0	0	0	0	As Allocation (60.6% storm)
Project Management (2)	1,143,108	1,601,372	1,436,878	1,464,179	1,491,998	1,520,346	1,549,233	1,578,668	1,608,663	1,639,227	1,670,373	As Allocation (60.6% storm)
Total Planning	**$5,670,337**	**$5,943,791**	**$6,423,058**	**$6,545,096**	**$6,669,453**	**$6,796,172**	**$6,925,299**	**$7,056,880**	**$7,190,961**	**$7,327,589**	**$7,466,813**	
Billing and Meter Reading												
Meter Reading	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Allocation (0% storm)
CUS Charges	208,589	225,971	243,354	247,977	252,689	257,490	262,382	267,368	272,447	277,624	282,899	As Allocation (34.8% storm)
Total Billing and Meter Reading	**$208,589**	**$225,971**	**$243,354**	**$247,977**	**$252,689**	**$257,490**	**$262,382**	**$267,368**	**$272,447**	**$277,624**	**$282,899**	
Project Support Costs												
Operations Mgmt and Admin	$426,518	$666,940	$472,485	$481,463	$490,610	$499,932	$509,431	$519,110	$528,973	$539,023	$549,265	As Allocation (50% storm)
Open Cut Services	718,636	681,748	769,473	784,093	798,990	814,171	829,640	845,404	861,466	877,834	894,513	As Allocation (50% storm)
In-house Tunnelling	747,164	694,118	790,906	805,933	821,245	836,849	852,749	868,951	885,462	902,285	919,429	As Allocation (50% storm)
Survey Operations	266,623	106,933	303,567	309,335	315,212	321,201	327,304	333,523	339,859	346,317	352,897	As Allocation (50% storm)
Total Project Support Costs	**$2,158,941**	**$2,149,739**	**$2,336,430**	**$2,380,823**	**$2,426,058**	**$2,472,153**	**$2,519,124**	**$2,566,988**	**$2,615,760**	**$2,665,460**	**$2,716,103**	
Drainage Services Administration												
Security Operations & Investigations	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	As Allocation (36.7% storm)
Fleet Services	61,061	73,338	76,134	77,581	79,055	80,557	82,087	83,647	85,236	86,856	88,506	As Allocation (36.7% storm)
Equipment Dispatch	(1,041,332)	(1,194,179)	(1,312,701)	(1,337,643)	(1,363,058)	(1,388,956)	(1,415,346)	(1,442,238)	(1,469,640)	(1,497,563)	(1,526,017)	As Allocation (36.7% storm)
General Maintenance	(374,468)	(443,044)	(484,465)	(493,669)	(503,049)	(512,607)	(522,347)	(532,271)	(542,384)	(552,690)	(563,191)	As Allocation (36.7% storm)
None	365,800	484,851	531,446	541,544	551,833	562,318	573,002	583,889	594,983	606,288	617,807	As Allocation (36.7% storm)
Operations Mgmt and Admin	(512,737)	(499,017)	(483,210)	(492,391)	(501,746)	(511,279)	(520,994)	(530,892)	(540,979)	(551,258)	(561,732)	As Allocation (36.7% storm)
Information Services	394,962	404,689	416,990	424,913	432,986	441,213	449,596	458,138	466,843	475,713	484,751	As Allocation (36.7% storm)
Security - Operations & Investigations	123,371	69,656	71,947	73,314	74,707	76,127	77,573	79,047	80,549	82,079	83,639	As Allocation (36.7% storm)
Facility Operations	1,099,131	1,278,060	1,405,656	1,432,363	1,459,578	1,487,310	1,515,569	1,544,365	1,573,708	1,603,608	1,634,077	As Allocation (36.7% storm)
Inventory Management	454,996	447,254	457,460	466,152	475,009	484,034	493,230	502,602	512,151	521,882	531,798	As Allocation (36.7% storm)
Contract Management	92,471	98,397	103,259	105,221	107,220	109,257	111,333	113,449	115,604	117,801	120,039	As Allocation (36.7% storm)
General Admin (1)	297,751	271,798	279,913	285,231	290,650	296,173	301,800	307,534	313,377	319,332	325,399	As Allocation (36.7% storm)
Health Safety and Loss Prevention	560,160	567,535	611,476	623,094	634,933	646,997	659,290	671,816	684,581	697,588	710,842	As Allocation (36.7% storm)
Training	705,659	673,803	677,290	690,159	703,272	716,634	730,250	744,125	758,263	772,670	787,351	As Allocation (36.7% storm)
General Admin (2)	519,361	545,444	556,584	567,159	577,935	588,916	600,105	611,507	623,126	634,965	647,029	As Allocation (36.7% storm)
None (2)	(324,161)	(324,371)	(381,570)	(388,819)	(396,207)	(403,735)	(411,406)	(419,223)	(427,188)	(435,304)	(443,575)	As Allocation (36.7% storm)
General and Tax Accounting	949,164	999,896	935,574	953,350	971,464	989,922	1,008,730	1,027,896	1,047,426	1,067,327	1,087,607	As Allocation (36.7% storm)
General Admin (4)	5,510	0	0	0	0	0	0	0	0	0	0	As Allocation (36.7% storm)
General Admin (5)	466,581	516,648	542,703	553,014	563,522	574,229	585,139	596,257	607,586	619,130	630,893	As Allocation (36.7% storm)
Internal Communications	1,158,334	1,068,805	1,047,021	1,066,914	1,087,186	1,107,842	1,128,891	1,150,340	1,172,197	1,194,468	1,217,163	As Allocation (36.7% storm)
Total Drainage Services Administration	**$5,001,615**	**$5,039,562**	**$5,051,509**	**$5,147,487**	**$5,245,290**	**$5,344,950**	**$5,446,504**	**$5,549,988**	**$5,655,437**	**$5,762,891**	**$5,872,386**	

EPCOR
Drainage COSA
Revenue Requirement - Stormwater
Exhibit 2

	Budgeted	*Projected*										
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	***Notes***
Corporate Allocations	**$6,442,900**	**$6,838,005**	**$7,189,233**	**$7,553,576**	**$7,697,094**	**$7,843,338**	**$7,992,362**	**$8,144,217**	**$8,298,957**	**$8,456,637**	**$8,617,313**	As Allocation (36.7% storm)
Efficiencies	**$0**	**$0**	**$0**	**($2,781,184)**	**($2,834,026)**	**($2,887,873)**	**($2,942,742)**	**($2,998,654)**	**($3,055,629)**	**($3,113,686)**	**($3,172,846)**	As Allocation (34.8% storm)
O&M Expenses - NRAs												
Planning and Estimation (LRT Relocates)	$18,201	$18,547	$18,899	$19,258	$19,624	$19,997	$20,377	$20,764	$21,159	$21,561	$21,970	As Allocation (50% storm)
Engineering (SIRP)	0	3,129,982	4,104,563	4,351,844	4,434,529	4,518,785	4,604,642	4,692,130	4,781,280	4,872,125	4,964,695	As Allocation (100% storm)
Odour and Corrosion Mitigation	0	0	0	0	0	0	0	0	0	0	0	As Allocation (0% storm)
Total O&M Expenses - NRAs	**$18,201**	**$3,148,529**	**$4,123,462**	**$4,371,102**	**$4,454,153**	**$4,538,782**	**$4,625,018**	**$4,712,894**	**$4,802,439**	**$4,893,685**	**$4,986,665**	
Total O&M Expenses	**$37,686,691**	**$42,129,906**	**$44,952,241**	**$43,422,191**	**$44,247,213**	**$45,087,910**	**$45,944,580**	**$46,817,527**	**$47,707,060**	**$48,613,494**	**$49,537,151**	
Property Taxes	**$385,639**	**$386,238**	**$405,552**	**$413,257**	**$421,109**	**$429,110**	**$437,264**	**$445,572**	**$454,037**	**$462,664**	**$471,455**	As Allocation (50% storm)
Depreciation	$44,672,102	$47,790,312	$49,841,381	$53,624,863	$57,036,986	$62,039,786	$66,078,981	$68,709,900	$73,276,932	$77,368,307	$81,689,311	As Allocation (60.6% storm)
Less: Contributions Amortization	(23,615,890)	(24,864,365)	(26,372,986)	(27,944,435)	(29,700,716)	(31,389,404)	(32,866,832)	(34,333,318)	(35,777,220)	(37,107,040)	(38,376,613)	As Allocation (60.6% storm)
Total Depreciation	**$21,056,212**	**$22,925,948**	**$23,468,395**	**$25,680,428**	**$27,336,270**	**$30,650,382**	**$33,212,149**	**$34,376,583**	**$37,499,713**	**$40,261,268**	**$43,312,698**	
Financing Costs												
Interest on LTD	$6,862,765	$7,269,617	$9,264,782	$13,603,687	$14,983,476	$16,294,919	$18,408,814	$20,730,746	$22,518,807	$24,185,041	$25,933,259	As Allocation (34.8% storm)
Interest on STD	664,998	851,272	401,798	453,420	517,222	591,631	603,348	527,594	508,121	524,971	549,128	As Allocation (34.8% storm)
AFUDC	(886,017)	(1,728,736)	(2,001,788)	(3,068,147)	(3,237,112)	(3,574,661)	(3,154,830)	(2,087,285)	(1,981,064)	(2,136,623)	(1,957,337)	As Allocation (34.8% storm)
Total Financing Costs	**$6,641,745**	**$6,392,153**	**$7,664,792**	**$10,988,961**	**$12,263,586**	**$13,311,889**	**$15,857,332**	**$19,171,055**	**$21,045,864**	**$22,573,389**	**$24,525,049**	
Return on Investment												
Retained Earnings	$9,242,785	$9,913,817	$10,028,141	$17,542,189	$22,803,685	$28,253,590	$33,787,260	$35,952,536	$37,779,996	$40,916,548	$43,032,320	As Allocation (34.8% storm)
Dividends / Equity Issue	0	0	0	0	0	0	0	0	0	0	0	As Allocation (34.8% storm)
Total Return on Investment	**$9,242,785**	**$9,913,817**	**$10,028,141**	**$17,542,189**	**$22,803,685**	**$28,253,590**	**$33,787,260**	**$35,952,536**	**$37,779,996**	**$40,916,548**	**$43,032,320**	
Total Revenue Requirement	**$75,013,071**	**$81,748,062**	**$86,519,121**	**$98,047,026**	**$107,071,863**	**$117,732,881**	**$129,238,584**	**$136,763,272**	**$144,486,671**	**$152,827,363**	**$160,878,673**	
Bal. / (Def.) of Funds	($7,338,086)	($6,963,741)	($5,817,255)	($763,577)	$962,523	$2,875,231	$5,714,308	$7,201,349	$8,648,820	$14,405,100	$19,493,105	
Balance a % of Rate Adj. Req'd	11.0%	9.9%	7.7%	0.9%	-1.0%	-2.8%	-5.1%	-6.1%	-7.1%	-11.5%	-15.0%	
Proposed Rate Adjustment	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	

EPCOR
Drainage COSA
Exhibit 3
Equivalent Unit Distribution Factor - Stormwater

	# of Storm Equivalents [1]	% of Total
Residential	824,984,120	52.6%
Multi-Residential	80,367,807	5.1%
Commercial	663,467,628	42.3%
	--------------------	----------
Total	**1,568,819,555**	**100.0%**
		(ESU)

Notes

[1] - Based on Historical data and 2019 projection

EPCOR
Drainage COSA
Exhibit 4
Customer Distribution Factors - Stormwater

	Acutal Customer		*Cust. Serv. & Acntg*		
	Number of Account [1]	**% of Total**	**Weight Factor [2]**	**Wt. Acct.**	**% of Total**
Residential	266,841	92.8%	1.00	266,841	92.8%
Multi-Residential	3,753	1.3%	1.00	3,753	1.3%
Commercial	16,886	5.9%	1.00	16,886	5.9%
Total	**287,481**	**100.0%**		**287,481**	**100.0%**
		(AC)			***(WCA)***

Notes

[1] - Based on Historical data and 2019 projection
[2] - No Cost Difference Identified

EPCOR
Drainage COSA
Exhibit 5
Revenue Distribution Factor - Stormwater

	Projected 2021	% of Total
Residential	$40,403,032	53.5%
Multi-Residential	3,792,285	5.0%
Commercial	31,368,691	41.5%
	------------------	----------
Total	**$75,564,007**	**100.0%**
		(RR)

EPCOR
Drainage COSA
Exhibit 6.1
Net Plant in Service - Storm

	As of 12/31/18	Volume (VOL)	Actual Customer (AC)	Customer Acct/Svcs (WCA)	Equivalent SW Unit (ESU)	Revenue (RR)	Direct (DA)	Basis of Classification
			Weighted for					
Collection	$1,596,871,139	$0	$0	$0	$1,596,871,139	$0	$0	100.0% ESU
Collection - Common	12,926,300	0	0	0	12,926,300	0	0	100.0% ESU
Pumping Stations	9,773,971	0	0	0	9,773,971	0	0	100.0% ESU
Storage	507,772,869	0	0	0	507,772,869	0	0	100.0% ESU
Storage - Common	2,160,248	0	0	0	2,160,248	0	0	100.0% ESU
Plant Before General Plant	**$2,129,504,527**	**$0**	**$0**	**$0**	**$2,129,504,527**	**$0**	**$0**	
% Plant Before General Plant	***100.0%***	***0.0%***	***0.0%***	***0.0%***	***100.0%***	***0.0%***	***0.0%***	*Factor PBGP*
General Plant								
General Plant	$2,599,942	$0	$0	$0	$2,599,942	$0	$0	*As Factor PBGP*
General Plant - Common	20,994,785	0	0	0	20,994,785	0	0	*As Factor PBGP*
Total General Plant	**$23,594,727**	**$0**	**$0**	**$0**	**$23,594,727**	**$0**	**$0**	
Net Plant in Service	**$2,153,099,254**	**$0**	**$0**	**$0**	**$2,153,099,254**	**$0**	**$0**	

EPCOR
Drainage COSA
Exhibit 7
Allocation of the Revenue Requirement - Stormwater

	Test Year 2021	Volume (VOL)	*Weighted* Actual Customer (AC)	Customer Acct/Svcs (WCA)	Equivalent SW Unit (ESU)	Revenue (RR)	Direct (DA)	*Basis of Classification*
Franchise Fees	**$0**	$0	$0	$0	$0	$0	$0	100.0% RR
Drainage Operations								
Operations Mgmt and Admin	$974,816	$0	$0	$0	$974,816	$0	$0	As Net Plant
General Maintenance	0	0	0	0	0	0	0	As Net Plant
Operations Mgmt and Admin (2)	0	0	0	0	0	0	0	As Net Plant
Hazardous and Sanitary Waste	0	0	0	0	0	0	0	As Net Plant
Industrial Monitoring	0	0	0	0	0	0	0	As Net Plant
Compliance	451,370	0	0	0	451,370	0	0	As Net Plant
General Maintenance (2)	1,036,031	0	0	0	1,036,031	0	0	As Net Plant
Pipeline Maintenance	10,550,611	0	0	0	10,550,611	0	0	As Net Plant
Pumping - Maintenance	6,572,368	0	0	0	6,572,368	0	0	As Net Plant
Total Drainage Operations	**$19,585,196**	**$0**	**$0**	**$0**	**$19,585,196**	**$0**	**$0**	
Planning								
Biosolids	$0	$0	$0	$0	$0	$0	$0	As Net Plant
Engineering	1,130,153	0	0	0	1,130,153	0	0	As Net Plant
Infrastructure Planning	1,090,506	0	0	0	1,090,506	0	0	As Net Plant
System Planning and Analysis	1,628,472	0	0	0	1,628,472	0	0	As Net Plant
Stormwater Strategies	971,117	0	0	0	971,117	0	0	As Net Plant
Project Management	15,414	0	0	0	15,414	0	0	As Net Plant
Customer Services	150,518	0	0	0	150,518	0	0	As Net Plant
Engineering (pre-SIRP)	0	0	0	0	0	0	0	As Net Plant
Planning and Estimation (LRT Relocates)	0	0	0	0	0	0	0	As Net Plant
Project Management (2)	1,436,878	0	0	0	1,436,878	0	0	As Net Plant
Total Planning	**$6,423,058**	**$0**	**$0**	**$0**	**$6,423,058**	**$0**	**$0**	
Billing and Meter Reading								
Meter Reading	$0	$0	$0	$0	$0	$0	$0	As Net Plant
CUS Charges	243,354	0	0	0	243,354	0	0	As Net Plant
Total Billing and Meter Reading	**$243,354**	**$0**	**$0**	**$0**	**$243,354**	**$0**	**$0**	
Project Support Costs								
Operations Mgmt and Admin	$472,485	$0	$0	$0	$472,485	$0	$0	As Net Plant
Open Cut Services	769,473	0	0	0	769,473	0	0	As Net Plant
In-house Tunnelling	790,906	0	0	0	790,906	0	0	As Net Plant
Survey Operations	303,567	0	0	0	303,567	0	0	As Net Plant
Total Project Support Costs	**$2,336,430**	**$0**	**$0**	**$0**	**$2,336,430**	**$0**	**$0**	

EPCOR
Drainage COSA
Exhibit 7
Allocation of the Revenue Requirement - Stormwater

	Test Year 2021	Volume (VOL)	Actual Customer (AC)	Weighted Customer Acct/Svcs (WCA)	Equivalent SW Unit (ESU)	Revenue (RR)	Direct (DA)	Basis of Classification
Drainage Services Administration								
Security Operations & Investigations	$0	$0	$0	$0	$0	$0	$0	As Net Plant
Fleet Services	76,134	0	0	0	76,134	0	0	As Net Plant
Equipment Dispatch	(1,312,701)	0	0	0	(1,312,701)	0	0	As Net Plant
General Maintenance	(484,465)	0	0	0	(484,465)	0	0	As Net Plant
None	531,446	0	0	0	531,446	0	0	As Net Plant
Operations Mgmt and Admin	(483,210)	0	0	0	(483,210)	0	0	As Net Plant
Inspection Services	0	0	0	0	0	0	0	As Net Plant
Capital OH Clearing	0	0	0	0	0	0	0	As Net Plant
Information Services	416,990	0	0	0	416,990	0	0	As Net Plant
Security - Operations & Investigations	71,947	0	0	0	71,947	0	0	As Net Plant
Facility Operations	1,405,656	0	0	0	1,405,656	0	0	As Net Plant
Security Operations & Investigations (2)	0	0	0	0	0	0	0	As Net Plant
Inventory Management	457,460	0	0	0	457,460	0	0	As Net Plant
Contract Management	103,259	0	0	0	103,259	0	0	As Net Plant
General Admin (1)	279,913	0	0	0	279,913	0	0	As Net Plant
Health Safety and Loss Prevention	611,476	0	0	0	611,476	0	0	As Net Plant
Training	677,290	0	0	0	677,290	0	0	As Net Plant
General Admin (2)	556,584	0	0	0	556,584	0	0	As Net Plant
None (2)	(381,570)	0	0	0	(381,570)	0	0	As Net Plant
General and Tax Accounting	935,574	0	0	0	935,574	0	0	As Net Plant
General Admin (3)	0	0	0	0	0	0	0	As Net Plant
General Admin (4)	0	0	0	0	0	0	0	As Net Plant
General Admin (5)	542,703	0	0	0	542,703	0	0	As Net Plant
General Admin (6)	0	0	0	0	0	0	0	As Net Plant
Internal Communications	1,047,021	0	0	0	1,047,021	0	0	As Net Plant
Comm Relations & Public Consultation	0	0	0	0	0	0	0	As Net Plant
Total Drainage Services Administration	**$5,051,509**	**$0**	**$0**	**$0**	**$5,051,509**	**$0**	**$0**	
Corporate Allocations	**$7,189,233**	**$0**	**$0**	**$0**	**$7,189,233**	**$0**	**$0**	As Net Plant
Efficiencies	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	As Net Plant
O&M Expenses - NRAs								
Planning and Estimation (LRT Relocates)	$18,899	$0	$0	$0	$18,899	$0	$0	As Net Plant
Engineering (SIRP)	4,104,563	0	0	0	4,104,563	0	0	As Net Plant
Odour and Corrosion Mitigation	0	0	0	0	0	0	0	As Net Plant
Total O&M Expenses - NRAs	**$4,123,462**	**$0**	**$0**	**$0**	**$4,123,462**	**$0**	**$0**	
Total O&M Expenses	**$44,952,241**	**$0**	**$0**	**$0**	**$44,952,241**	**$0**	**$0**	

EPCOR
Drainage COSA
Exhibit 7
Allocation of the Revenue Requirement - Stormwater

	Test Year 2021	Volume (VOL)	Actual Customer (AC)	*Weighted* Customer Acct/Svcs (WCA)	Equivalent SW Unit (ESU)	Revenue (RR)	Direct (DA)	*Basis of Classification*
Property Taxes	**$405,552**	**$0**	**$0**	**$0**	**$405,552**	**$0**	**$0**	As O&M Expenses
Depreciation	$49,841,381	$0	$0	$0	$49,841,381	$0	$0	As O&M Expenses
Less: Contributions Amortization	(26,372,986)	0	0	0	(26,372,986)	0	0	As O&M Expenses
Total Depreciation	**$23,468,395**	**$0**	**$0**	**$0**	**$23,468,395**	**$0**	**$0**	
Financing Costs								
Interest on LTD	**$9,264,782**	$0	$0	$0	$9,264,782	$0	$0	As O&M Expenses
Interest on STD	**401,798**	0	0	0	401,798	0	0	As O&M Expenses
AFUDC	**(2,001,788)**	0	0	0	(2,001,788)	0	0	As O&M Expenses
Total Financing Costs	**$7,664,792**	**$0**	**$0**	**$0**	**$7,664,792**	**$0**	**$0**	
Return on Investment								
Retained Earnings	**$10,028,141**	$0	$0	$0	$10,028,141	$0	$0	As O&M Expenses
Dividends / Equity Issue	**0**	0	0	0	0	0	0	As O&M Expenses
Total Return on Investment	**$10,028,141**	**$0**	**$0**	**$0**	**$10,028,141**	**$0**	**$0**	
Total Revenue Requirement	**$86,519,121**	**$0**	**$0**	**$0**	**$86,519,121**	**$0**	**$0**	
Less: Non-Operating Revenue								
Storm - Revenue Leakage	$0	$0	$0	$0	$0	$0	$0	As Revenue Requirement
SIRP	4,104,563	0	0	0	4,104,563	0	0	As Revenue Requirement
Biosolids	0	0	0	0	0	0	0	As Revenue Requirement
Hazardous and Sanitary Waste	390,061	0	0	0	390,061	0	0	As Revenue Requirement
Compliance	382,184	0	0	0	382,184	0	0	As Revenue Requirement
Pipeline Maintenance	208,589	0	0	0	208,589	0	0	As Revenue Requirement
Industrial Monitoring	10,429	0	0	0	10,429	0	0	As Revenue Requirement
General Maintenance	7,616	0	0	0	7,616	0	0	As Revenue Requirement
Pumping - Maintenance	5,215	0	0	0	5,215	0	0	As Revenue Requirement
9K-611 - Late Pmt Chg & UIS Sewer Trouble	0	0	0	0	0	0	0	As Revenue Requirement
9L-611 - Late Pmt Chg & UIS Sewer Trouble	0	0	0	0	0	0	0	As Revenue Requirement
Inventory Management (asset sales)	29,202	0	0	0	29,202	0	0	As Revenue Requirement
Operations Mgmt and Admin	0	0	0	0	0	0	0	As Revenue Requirement
Infrastructure Planning	0	0	0	0	0	0	0	As Revenue Requirement
Customer Services	0	0	0	0	0	0	0	As Revenue Requirement
Project Management	0	0	0	0	0	0	0	As Revenue Requirement
Operations Mgmt and Admin	0	0	0	0	0	0	0	As Revenue Requirement
Information Services	0	0	0	0	0	0	0	As Revenue Requirement
Open Cut Services	0	0	0	0	0	0	0	As Revenue Requirement
Total Other Revenues	**$5,137,859**	**$0**	**$0**	**$0**	**$5,137,859**	**$0**	**$0**	
Net Revenue Requirement	**$81,381,262**	**$0**	**$0**	**$0**	**$81,381,262**	**$0**	**$0**	

EPCOR
Drainage COSA
Exhibit 8
Distribution of Total Revenue Requirement - Stormwater

		Residential	Multi-Residential	Commercial	*Basis*
Volume Related	$0	$0	$0	$0	*(VOL)*
Customer Related					
Actual Customer	$0	$0	$0	$0	*(AC)*
Weighted Customer	0	0	0	0	*(WCA)*
Capacity Demand	81,381,262	42,795,393	4,169,016	34,416,853	*(ESU)*
Total Customer Related	**$81,381,262**	**$42,795,393**	**$4,169,016**	**$34,416,854**	
Revenue Related	$0	$0	$0	$0	*(RR)*
Direct Assignment	$0	$0	$0	$0	*(DA)*
Total Revenue Requirements	**$81,381,262**	**$42,795,393**	**$4,169,016**	**$34,416,854**	

EPCOR
Drainage COSA
Exhibit 9
Cost of Service Analysis Summary - Stormwater

	2021	Residential	Multi-Residential	Commercial
Revenues at Present Rates	**$75,564,007**	$40,403,032	$3,792,285	$31,368,691
Allocated Revenue Requirement	**$81,381,262**	$42,795,393	$4,169,016	$34,416,854
	----------------	----------------	----------------	--------------
Balance / (Deficiency) of Funds	**($5,817,255)**	**($2,392,361)**	**($376,731)**	**($3,048,162)**
Required % Change in Rates	**7.7%**	**5.9%**	**9.9%**	**9.7%**

EPCOR
Drainage COSA
Exhibit 10
Unit Costs Summary - Stormwater

	System Average	Residential	Multi-Residential	Commercial
Unit Cost - $ / Storm Equiv.				
Volume Related	$0.0000	$0.0000	$0.0000	$0.0000
Actual Customer	0.0000	0.0000	0.0000	0.0000
Weighted Customer	0.0000	0.0000	0.0000	0.0000
Capacity Demand	0.0519	0.0519	0.0519	0.0519
RR / DA	0.0000	0.0000	0.0000	0.0000
	-----------	-----------	-----------	-----------
Total	**$0.0519**	**$0.0519**	**$0.0519**	**$0.0519**
	Current Rates			
Basic Data				
Equivalent Stormwater Units	1,568,819,555	824,984,120	80,367,807	663,467,628

Appendix O1

EPCOR WATER SERVICES INC.

Water Services
Lead-Lag Study

February 16, 2021

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1.0 INTRODUCTION

1. This lead-lag study has been undertaken to support the necessary working capital allowance for EPCOR Water Services Inc. (EWSI) for the 2022 to 2026 PBR filing with the City of Edmonton. A lead-lag study recognizes the timing differences between EWSI's provision of a service and payment, (revenue lag), and the timing differences between when an expense is incurred and subsequently paid, (expense lag). The net lag for an expense category is the difference between the associated revenue lag and the expense lag.

2. Lags are derived from analysis of each revenue and expenses stream and are broken down into their individual components in order to more precisely determine the total lag. EWSI's revenues are derived from fixed and metered charges for residential, multi-residential, commercial and regional customers, and other sources. Since revenue cycles and the lead periods for each are not significantly different, they are considered together. Operating expenses are broken down into labour, salary and benefits, incentives, general expenses, property taxes, parent charges and franchise fees. An overall operating expense lag is then calculated on a weighted average and netted against the appropriate revenues. Net lags are also calculated for GST and individual capital expenses including debt interest, retained earnings, dividends, and depreciation.

3. The working capital ratio (net lag/365) is then applied against the corresponding expense amount in order to determine the portion of necessary working capital related to each component.

4. Lags are made up of two general components: consumption and payment.

- Consumption lag is the lag between when a service is provided or good consumed and the end of a consumption period. For example, if a service is billed on a weekly basis, the consumption period is a week and the consumption lag would vary between zero and seven days, depending on when the service was provided. As it is generally assumed that consumption occurs evenly over the consumption period, the mid-point of a consumption period is used to determine the consumption lag. In a weekly consumption period, the consumption lag would be 3.5 days (7/2) or in a monthly consumption period with 30 days the consumption lag would be 15 days (30/2).
- Payment lag is the time between the end of the consumption period and the receipt of cash. The payment lag sometimes includes a processing lag, which is time required

to receive, process, and issue the order to proceed, however this is not always considered separately from the payment lag. The payment lag is also measured in days and is the length between the last day of the consumption period and payment issue.

5. The lead-lag methodology used in this report is consistent with public lead-lag studies completed for Hydro One Networks Inc., AltaLink, and Atco Gas among others. In addition, despite some changes in the assumptions, the underlying methodology is consistent with the principles applied in EDTI's 2020-2022 Transmission General Tariff Application with respect to necessary working capital. See further discussion in the Study Results section.

2.0 EXECUTIVE SUMMARY

6. The overall impact of the lead-lag study using 2019, 2018, 2017 and 2016 actual financial results are shown in Table 2.0-1.

Table 2.0-1
Summary of Necessary Working Capital
($ thousands)

		2019			2018			2017			2016		
		A	B	C	D	E	F	G	H	I	J	K	L
		Actual	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**
1	Operating Expense, net of revenue offsets	115,792	5.0 %	5,844	112,592	4.9 %	5,570	113,273	5.5 %	6,258	110,858	5.0 %	5,553
2	Depreciation	36,162	13.9 %	5,044	34,236	13.6 %	4,654	32,610	14.3 %	4,669	27,911	14.1 %	3,948
3	Retained Earnings	43,369	13.9 %	6,049	49,947	13.6 %	6,790	45,248	14.3 %	6,479	46,558	14.1 %	6,585
4	Dividends	15,000	(50.0 %)	(7,500)	20,000	(50.0 %)	(10,000)	20,000	(50.0 %)	(10,000)	31,500	(50.1 %)	(15,793)
5	Interest Expense	34,671	9.3 %	3,239	33,477	10.0 %	3,364	32,021	12.0 %	3,847	31,070	12.9 %	4,008
6	GST Collection	62	1.4 %	1	50	1.1 %	1	45	1.8 %	1	27	1.6 %	0
7	GST Input Tax Credit	6,835	5.8 %	393	5,935	5.8 %	341	6,114	5.8 %	352	5,537	5.8 %	319
8	**Necessary Working Capital**			**13,070**			**10,721**			**11,606**			**4,619**

7. The ratios used to determine EWSI's necessary working capital requirements reflect the revenue and expense lags as shown in Tables 2.0-2 to 2.0-5.

Table 2.0-2
Summary of Lags and Working Capital Ratio – 2019
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	50.9	32.5	18.4	5.0 %
2	Fixed	50.9	32.5	18.4	5.0 %
3	Regional	50.9	32.5	18.4	5.0 %
4	Fire & Miscellaneous	50.9	32.5	18.4	5.0 %
5	GST Collection	50.9	45.6	5.3	1.4 %
6	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
7	Debt interest	50.9	16.8	34.1	9.3 %
8	Retained Earnings	50.9	-	50.9	13.9 %
9	Dividends	-	182.5	(182.5)	(50.0 %)
10	Depreciation	50.9	-	50.9	13.9 %

Table 2.0-3
Summary of Lags and Working Capital Ratio – 2018
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	49.6	31.6	18.1	4.9 %
2	Fixed	49.6	31.6	18.1	4.9 %
3	Regional	49.6	31.6	18.1	4.9 %
4	Fire & Miscellaneous	49.6	31.6	18.1	4.9 %
5	GST Collection	49.6	45.6	4.0	1.1 %
6	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
7	Debt interest	49.6	12.9	36.7	10.0 %
8	Retained Earnings	49.6	-	49.6	13.6 %
9	Dividends	-	182.5	(182.5)	(50.0 %)
10	Depreciation	49.6	-	49.6	13.6 %

Table 2.0-4
Summary of Lags and Working Capital Ratio – 2017
(days)

		A	B	C	D
		Revenue	**Expense**	**Net**	**Ratio**
1	Metered	52.3	32.1	20.2	5.5 %
2	Fixed	52.3	32.1	20.2	5.5 %
3	Regional	52.3	32.1	20.2	5.5 %
4	Fire & Miscellaneous	52.3	32.1	20.2	5.5 %
5	GST Collection	52.3	45.6	6.6	1.8 %
6	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
7	Debt interest	52.3	8.4	43.9	12.0 %
8	Retained Earnings	52.3	-	52.3	14.3 %
9	Dividends	-	182.5	(182.5)	(50.0 %)
10	Depreciation	52.3	-	52.3	14.3 %

Table 2.0-5
Summary of Lags and Working Capital Ratio – 2016
(days)

		A	B	C	D
		Revenue	**Expense**	**Net**	**Ratio**
1	Metered	51.6	33.3	18.3	5.0 %
2	Fixed	51.6	33.3	18.3	5.0 %
3	Regional	51.6	33.3	18.3	5.0 %
4	Fire & Miscellaneous	51.6	33.3	18.3	5.0 %
5	GST Collection	51.6	45.8	5.9	1.6 %
6	GST Input Tax Credit	66.8	45.8	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
7	Debt interest	51.6	4.5	47.1	12.9 %
8	Retained Earnings	51.6	-	51.6	14.1 %
9	Dividends	-	183.0	(183.0)	(50.1 %)
10	Depreciation	51.6	-	51.6	14.1%

8. Working capital lags between 2016 and 2019 have remained relatively consistent, with the changes in revenue lags attributable to changes in customer payment lag (account receivable balance). Changes in expense lags are primarily attributable to changes in the levels of incentives, which are paid annually in arrears, and decreases in the net lag for debt interest, reflecting debt issuances in the latter part of each year and interest payments shifting to mid-year, decreasing the overall debt interest expense lag.

3.0 REVENUE

9. The revenue lag is the measure of time from consumption or provision of a service by EWSI to the receipt of payment from the customer. All of EWSI's revenue streams, including:

metered, fixed and regional water revenues; fire protection and other revenues derived from water connections, water permits, temporary water services, service charges and various miscellaneous revenues, are subject to the same billing and payment cycles. Therefore, since these revenues are all billed in the same manner and are based on the same payment and consumption schedules, the lag period is similar for each revenue function and will not be considered separately for purposes of this report.

10. The revenue lag calculation considers several key components. Each has been broken down for clarity in understanding.

3.1 Average Consumption Period Lag

11. In order to determine the average lag for each consumption period, an average consumption period between meter readings must be determined. Each site is billed once per month, or 12 times per year. Given 365 days in 1 year, the average consumption period billed is calculated to be 30.42 days (365 divided by 12). EWSI has used the mid-point of the average consumption period billed as the consumption period lag. (30.4 days divided by 2 = 15.2 days).

3.2 Average Tariff Bill File Publish Lag and Invoice Lag

12. EWSI publishes each billing cycle exactly 6 business days after the scheduled reading date. This is in accordance with performance requirements as specified in section 2.14 of the Tariff Billing Code. Due to the fact that meter reading operations and billing cycles are performed on a business day schedule, the actual calendar day lag is 8 days for 4 (Tuesday – Friday) of the 5 cycles billed in a week and 10 days for the tariff files published on Mondays due to an extra weekend coming into play. These dates are summarized in Table 3.2-1.

Table 3.2-1
Tariff Bill File Publish Lag and Invoice Lag
(days)

		A	B	C	D	E
	Bill Cycle	**Meter Reading**	**Tariff Bill File Publish**	**Billing**	**TBF Lag**	**Invoice Lag**
1	1	Friday	Monday	Wednesday	10.0	2.0
2	2	Monday	Tuesday	Thursday	8.0	2.0
3	3	Tuesday	Wednesday	Friday	8.0	2.0
4	4	Wednesday	Thursday	Monday	8.0	4.0
5	5	Thursday	Friday	Tuesday	8.0	4.0
6				**Average**	**8.4**	**2.8**

13. These lags are unchanged from EWSI's 2016 Lead-Lag Study, which is as expected since the billing schedule is also unchanged.

3.3 Customer Payment Lags

14. Payment is due from customer 21 days after the invoice date. Analysis of year end accounts receivable showed collections lags of 25.2 days in 2016, 25.9 days in 2017, 23.2 days in 2018 and 24.5 days in 2019.

15. The overall revenue lags for EWSI revenues are summarized in Table 3.3-1.

Table 3.3-1
Revenue Lag Summary
(days)

		A **2019**	B **2018**	C **2017**	D **2016**
1	Consumption period mid-point	15.21	15.21	15.21	15.25
2	TBF Publish lag	8.40	8.40	8.40	8.40
3	Invoicing lag	2.80	2.80	2.80	2.80
4	Customer payment	24.50	23.21	25.85	25.17
5	**Total**	**50.91**	**49.62**	**52.26**	**51.62**

16. As most expense lags are netted against these revenue lags to determine the corresponding working capital ratios and requirements, revenue lags play a significant role in the determination of EWSI's overall working capital requirement.

4.0 EXPENSES

17. EWSI examined operating expenses by breaking them down into the categories of labour, salary and benefits, incentive, property taxes, franchise fees, parent charges (inter-company allocations) and general operating expenses. The total operating expense lag is calculated by taking the weighted average of these components on a yearly basis.

4.1 Labour, Salary and Benefits

18. Labour expense is comprised of salary and benefits, including remittances to CRA, Sun Life and other employee benefit and withholding categories. The total labour and benefits lag is calculated using the weighted average of all expenses types (incentive is calculated separately). Contractor fees are included in general operating expense as they are paid through the general accounts payable cheque runs.

19. The individual labour and benefit lag for EWSI was essentially unchanged between 2016 and 2019, which is as expected. The overall lag remained relatively flat from the 2016 lead lag study.

20. Components of the labour lag other than salaries, overtime and wages are based on lag times and weightings calculated by EUI's Payroll department for EPCOR as a whole. These weighting reflect the fact that these payments are processed centrally for all EPCOR subsidiaries, so the lag times will not differ between the various EPCOR subsidiaries, including EWSI. In addition, the weighting of categories within labour and benefits is comparable between areas.

4.2 Incentive Payments

21. Employee incentives are categorized separately from other operating costs as they have a longer payment lag of approximately 290 days compared to 46 days for other operating costs and only 16-17 days for other labour costs. Employee incentives are paid annually in the second pay period of April for the previous fiscal year, resulting in a consumption lag of 182 days and a payment lag of 111 days in 2016, 110 days in 2017, and 108 days in 2018, and 2019. Total lags for incentives were 293.5 days in 2016, 292 days in 2017 and 290 days for 2018 and 2019.

4.3 Property and Business Taxes

22. Property taxes are due June 30 for the current fiscal year, halfway through the consumption period. Accordingly, the property tax lead is 1 day for 2016 and 1.5 days for 2017 to 2019. Business taxes are paid March 31, so the expense lag for business taxes is 92.0 days for 2016 and 92.5 days for 2017 to 2019. Total weighted lead for property and business taxes are 4.0 days 2016, 4.5 days in 2017, 4.7 days in 2015 and 3.8 days in 2019.

4.4 Franchise Fees

23. Franchise fees are paid monthly to municipalities; EPCOR pays these bills in the same fashion as the general operating expenses discussed below. It is therefore assumed that the lag period is the same as general operating expenses of 45.8 days in 2016 and 45.6 days in 2017, 2018, and 2019.

4.5 Parent Charges

24. EPCOR Corporate or "Parent" charges are categorized separately from other operating costs such as material costs and contractor costs as they have a shorter payment lag. Parent

charges are allocated from corporate on a monthly basis therefore the lag is the average monthly consumption period of 15.0 days compared to 45.6 days for other operating costs.

4.6 General Operating Expenses

25. A majority of EPCOR's general operating expenses are paid within 30 days of receiving the invoice; therefore, assuming expenses are incurred evenly over a month, the average consumption period is approximately 15 days. Assuming all expenses incurred in the month are paid at the end of the next month, the total lag for general operating expenses is 45.8 days in 2016, and 45.6 days in each of 2017, 2018, and 2019.

26. Net lags for revenues and expenses are summarized in Tables 4.6-1 to 4.6-4.

Table 4.6-1
Net Lag (Lead) for Revenues and Expenses – 2019
($ thousands)

		A	B	C	D
		Amount	**Percentage**	**Lag days**	**Weighted Days**
	REVENUE				
1	Metered	159,262	67.3%	50.9	34.2
2	Fixed	26,588	11.2%	50.9	5.7
3	Regional	31,616	13.4%	50.9	6.8
4	Fire & Miscellaneous	19,301	8.2%	50.9	4.2
5	**Subtotal**	236,767	100%		50.9
6	**NET REVENUE LAG**				**50.9**
	EXPENDITURES				
7	Labour, salaries & benefits	45,448	37.5%	16.6	6.2
8	Incentive	2,323	1.9%	290.0	5.6
9	Other operating expenses	46,051	38.0%	45.6	17.3
10	Parent charges	12,504	10.3%	15.0	1.5
11	Property tax	241	0.2%	(3.8)	(0.0)
12	Franchise fees	14,663	12.1%	15.2	1.8
13	**Subtotal**	121,230	100%		32.5
14	**NET EXPENSE LAG**				**32.5**
15	**Net Lag (Lead) For Receipts & Payments 2019**				**18.4**

Table 4.6-2
Net Lag (Lead) for Revenues and Expenses – 2018
($ thousands)

		A **Amount**	B **Percentage**	C **Lag days**	D **Weighted Days**
	REVENUE				
1	Metered	160,770	67.8%	49.6	33.7
2	Fixed	26,394	11.1%	49.6	5.5
3	Regional	30,927	13.0%	49.6	6.5
4	Fire & Miscellaneous	18,942	8.0%	49.6	4.0
5	**Subtotal**	237,034	100%		49.6
6	**NET REVENUE LAG**				**49.6**
	EXPENDITURES				
7	Labour, salaries & benefits	45,445	38.5%	16.7	6.4
8	Incentive	2,045	1.7%	290.0	5.0
9	Other operating expenses	43,040	36.5%	45.6	16.6
10	Parent charges	12,427	10.5%	15.0	1.6
11	Property tax	241	0.2%	(4.7)	(0.0)
12	Franchise fees	14,770	12.5%	15.2	1.9
13	**Subtotal**	117,969	100%		31.6
14	**NET EXPENSE LAG**				**31.6**
15	**Net Lag (Lead) For Receipts & Payments 2018**				**18.1**

Table 4.6-3
Net Lag (Lead) for Revenues and Expenses – 2017
($ thousands)

		A **Amount**	B **Percentage**	C **Lag days**	D **Weighted Days**
	REVENUE				
1	Metered	154,498	67.0%	52.3	35.0
2	Fixed	27,349	11.9%	52.3	6.2
3	Regional	30,038	13.0%	52.3	6.8
4	Fire & Miscellaneous	18,860	8.2%	52.3	4.3
5	**Subtotal**	230,744	100%		52.3
6	**NET REVENUE LAG**				**52.3**
	EXPENDITURES				
7	Labour, salaries & benefits	44,508	37.5%	16.7	6.3
8	Incentive	2,214	1.9%	292.0	5.4
9	Other operating expenses	43,839	36.9%	45.6	16.8
10	Parent charges	13,703	11.5%	15.0	1.7
11	Property tax	230	0.2%	(4.5)	(0.0)
12	Franchise fees	14,349	12.1%	15.2	1.8
13	**Subtotal**	118,842	100%		32.1
14	**NET EXPENSE LAG**				**32.1**
15	**Net Lag (Lead) For Receipts & Payments 2017**				**20.2**

Table 4.6-4
Net Lag (Lead) for Revenues and Expenses – 2016
($ thousands)

		A **Amount**	B **Percentage**	C **Lag days**	D **Weighted Days**
	REVENUE				
1	Metered	149,618	67.2%	51.6	34.7
2	Fixed	26,137	11.7%	51.6	6.1
3	Regional	28,794	12.9%	51.6	6.7
4	Fire & Miscellaneous	18,039	8.1%	51.6	4.2
5	**Subtotal**	222,588	100%		51.6
6	**NET REVENUE LAG**				**51.6**
	EXPENDITURES				
7	Labour, salaries & benefits	38,325	33.3%	16.7	5.6
8	Incentive	2,282	2.0%	293.5	5.8
9	Other operating expenses	45,920	39.9%	45.8	18.2
10	Parent charges	14,509	12.6%	15.0	1.9
11	Property tax	212	0.2%	(4.0)	(0.0)
12	Franchise fees	13,868	12.0%	15.3	1.8
13	**Subtotal**	115,116	100%		33.3
14	**NET EXPENSE LAG**				**33.3**
15	**Net Lag (Lead) For Receipts & Payments 2016**				**18.3**

27. Overall for EWSI, the net lags for receipts and payments are 18.3 days in 2016, 20.2 days in 2017, 18.1 days in 2018, and 18.4 days in 2019. The changes in net lag times between 2016 and 2019 are primarily due to changes in customer payment lag each year. These values are based on actual costs for 2016, 2017, 2018, and 2019. The working capital ratios of 5.0% in 2016, 5.5% in 2017, 4.9% in 2018, and 5.0% in 2019 are calculated from the expense net lags (18.3/365, 20.2/365 and 18.1/365, 18.4/365) and then applied to the overall operating expenses, net of revenue offsets, to provide the appropriate necessary working capital for this component (see Table 2.0-1).

5.0 GST

28. GST is not applicable to water sales, so EWSI only collects GST on a small proportion of its revenues, mainly for surplus sales, facility revenues and miscellaneous fees. Accordingly, EWSI is always in a refund position with the CRA. GST returns are filed monthly (usually on the last business day of the following month). Per discussions with EPCOR tax group, input credits are normally received from the CRA within 2-4 weeks of filing. Calculation of the GST remittance lag is shown in Appendix 5.

Table 5.0-1
GST Impact on Working Capital
($ thousands)

		A	B 2019	C 2018	D 2017	E 2016
	REVENUE					
1	Net Receipts applicable to GST		1,244	990	890	548
2	GST rate		5.00%	5.00%	5.00%	5.00%
3	GST collected	(a)	62	50	45	27
4	Day factor - revenue lag		50.9	49.6	52.3	51.6
5	Day factor - GST remittance		45.6	45.6	45.6	45.8
6	Net	(b)	5.3	4.0	6.6	5.9
7	Impact on Working Capital	(a)*(b)/365	1	1	1	0
	EXPENDITURES					
8	Other operating costs		46,051	43,040	43,839	45,920
9	Capital expenditures excluding labour		90,645	75,667	78,434	64,816
10	Net costs applicable to GST		136,696	118,707	122,274	110,736
11	GST rate		5.00%	5.00%	5.00%	5.00%
12	GST remitted	(d)	6,835	5,935	6,114	5,537
13	Day factor- GST refund lag		66.6	66.6	66.6	66.8
14	Day factor - GST applicable expense lag		45.6	45.6	45.6	45.8
15	Net	(e)	21.0	21.0	21.0	21.0
16	Impact on Working Capital	(d)*(e)/365	393	341	352	319
17	**Net GST impact on Working Capital**		**394**	**342**	**353**	**319**

29. GST collected by EWSI is based on analysis of 2016-2019 revenues, with input tax credits based on total operating expenses less labour, salaries, benefits and incentives and property taxes plus capital expenditures excluding labour components.

30. The day factor on GST applicable expenses is based on lead-lag days for general operating expenses, since capital expenditures (excluding labour) are assumed to be on the same payment schedule as all other operating costs.

31. As shown in Table 5.0-1, the impact of GST on working capital is negligible; resulting in an increase to necessary working capital of $0.32 million in 2016, $0.35 million in 2017, $0.34 million in 2018, and $0.39 million in 2019.

6.0 CAPITAL EXPENSES

32. Capital expenses include four categories: interest, retained earnings, common dividends and depreciation. As EWSI had not consistently issued a common dividend in the past, dividends were not included in the 2016 lead lag study. However, EWSI has issued a dividend annually over the 2016 to 2019 period and is forecast to continue annual dividends over the 2022 to 2026

period. As a result, common dividends have been included in the current lead lag study. Table 6.0-1 provides the capital expense lags for 2016 to 2019.

Table 6.0-1
Capital Expense Lags for 2016, 2017, 2018, and 2019
($ thousands)

		2019		2018		2017		2016	
		A	B	C	D	E	F	G	H
	Expense	**Lag Days**	**Expense**	**Lag Days**	**Expense**	**Lag Days**	**Expense**	**Lag Days**	**Expense**
1	Interest	16.8	34,671	12.9	33,477	8.4	32,021	4.5	31,070
2	Retained Earnings	-	43,369	-	49,947	-	45,248	-	46,558
3	Dividends	182.5	15,000	182.5	20,000	182.5	20,000	183.0	31,500
4	Depreciation	-	36,162	-	34,236	-	32,610	-	27,911

6.1 Retained Earnings and Depreciation

33. Consistent with accepted practice for lead-lag studies, retained earnings and depreciation both have expense lags equivalent to zero days.

6.2 Interest on Long Term Debt

34. EWSI pays interest on inter-company long term debt issued by EPCOR Utilities Inc. (EUI) as well as interest on the City of Edmonton Debentures (COE debt). Both the COE debt and inter-company notes are paid at various times throughout the year. All interest is paid on a semi-annual basis. The midpoint of the consumption period for long term interest is 182.5 days, or July 2. The overall lag (lead) for interest expense is calculated as the weighted average lag (lead) of each individual debt issue.

35. Tables 6.2-1 to 6.2-4 show the calculation of long term debt lag (lead) days. The interest expense lag was 4.5 days in 2016, the lag increased to 8.4 days in 2017, 12.9 days in 2018, and 16.8 days in 2019. The change in the net lag for long term debt are attributable to new debt issuances in the latter part of each year, with interest payments shifting back to mid-year, decreasing the overall long term debt expense lag.

Table 6.2-1
Long Term Debt Lag (Lead) – 2019

					Payment Dates			Payment Lags				
		A	B	C	D	E	F	G	H	I	J	K
	Description	Interest Rate	Face Value	Interest Expense	First	Second	Mid-Year	First	Second	Average	Weight	Weighted Total Lag
1					3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	7.8%	2.5
2	IC-EUI-80-0013	6.06%	50,400	3,054	2-May	2-Nov	1-Jul	(60.5)	123.5	31.5	8.8%	2.8
3	IC-EUI-80-0014	5.60%	40,000	1,073	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	3.1%	(0.0)
4	IC-EUI-80-0016	5.60%	15,000	402	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	1.2%	(0.0)
5	IC-EUI-80-0017	5.38%	30,000	825	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	2.4%	1.5
6	IC-EUI-80-0032	5.96%	100,000	3,310	1-Jan	1-Jul	1-Jul	(181.5)	(0.5)	(91.0)	9.5%	(8.7)
7	IC-EUI-80-0036	6.75%	30,000	1,239	1-Apr	1-Oct	1-Jul	(91.5)	91.5	-	3.6%	-
8	IC-EUI-80-0042	5.85%	30,000	1,178	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	3.4%	2.1
9	IC-EUI-80-0046	5.20%	30,000	1,089	1-May	1-Nov	1-Jul	(61.5)	122.5	30.5	3.1%	1.0
10	IC-EUI-80-0047	4.88%	30,000	1,081	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	3.1%	1.9
11	IC-EUI-80-0070	4.62%	110,000	5,077	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	14.6%	(8.8)
12	IC-EUI-80-0075	4.73%	60,000	2,838	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	8.2%	5.0
13	IC-EUI-80-0076	4.12%	40,000	1,647	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	4.8%	2.9
14	IC-EUI-80-0082	4.41%	45,000	1,985	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.7%	3.5
15	IC-EUIC-80-2016	4.01%	45,000	1,805	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.2%	3.2
16	IC-EUIC-80-2017	3.72%	65,000	2,418	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	7.0%	4.3
17	IC-EUIC-80-2018	4.16%	55,000	2,289	3-Jun	3-Dec	1-Jul	(28.5)	154.5	63.0	6.6%	4.2
18	IC-EUIC-80-2019	3.23%	80,000	108		31-Dec	1-Jul		182.5	182.5	0.3%	0.6
19	11247 A	7.25%	10,000	168	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	0.5%	(0.4)
20	11317 A	7.25%	16,000	269	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	0.8%	(0.6)
21	11247 B	6.38%	429	7	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.0%	0.0
22	11496 A	6.38%	4,866	83	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.2%	0.1
23	11317 B	5.75%	261	4	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
24	11664 A	5.75%	620	11	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
25	11724 A	5.75%	533	9	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
26	11664 B	5.75%	62	1	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.0%	0.0
27	11724 B	5.75%	800	15	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.0%	0.0
28				**34,671**							**100.0%**	**16.8**

Table 6.2-2
Long Term Debt Lag (Lead) – 2018

					Payment Dates			Payment Lags				
		A	B	C	D	E	F	G	H	I	J	K
	Description	Interest Rate	Face Value	Interest Expense	First	Second	Mid-Year	First	Second	Average	Weight	Weighted Total Lag
1	IC-EUI-80-0012				3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	8.0%	2.6
2	IC-EUI-80-0013	6.06%	50,400	3,054	2-May	2-Nov	1-Jul	(60.5)	123.5	31.5	9.1%	2.9
3	IC-EUI-80-0014	5.60%	40,000	1,195	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	3.6%	(0.0)
4	IC-EUI-80-0016	5.60%	15,000	448	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	1.3%	(0.0)
5	IC-EUI-80-0017	5.38%	30,000	910	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	2.7%	1.7
6	IC-EUI-80-0032	5.96%	100,000	3,613	1-Jan	1-Jul	1-Jul	(181.5)	(0.5)	(91.0)	10.8%	(9.8)
7	IC-EUI-80-0036	6.75%	30,000	1,336	1-Apr	1-Oct	1-Jul	(91.5)	91.5	-	4.0%	-
8	IC-EUI-80-0042	5.85%	30,000	1,255	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	3.7%	2.3
9	IC-EUI-80-0046	5.20%	30,000	1,156	1-May	1-Nov	1-Jul	(61.5)	122.5	30.5	3.5%	1.1
10	IC-EUI-80-0047	4.88%	30,000	1,142	2-Jun	1-Dec	1-Jul	(29.5)	152.5	61.5	3.4%	2.1
11	IC-EUI-80-0070	4.62%	110,000	5,077	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	15.2%	(9.1)
12	IC-EUI-80-0075	4.73%	60,000	2,838	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	8.5%	5.2
13	IC-EUI-80-0076	4.12%	40,000	1,647	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	4.9%	3.0
14	IC-EUI-80-0082	4.41%	45,000	1,985	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.9%	3.6
15	IC-EUIC-80-2016	4.01%	45,000	1,805	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.4%	3.3
16	IC-EUIC-80-2017	3.72%	65,000	2,418	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	7.2%	4.4
17	IC-EUIC-80-2018	4.16%	55,000	191		31-Dec	1-Jul		182.5	182.5	0.6%	1.0
18	11247 A	7.25%	10,000	216	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	0.6%	(0.5)
19	11317 A	7.25%	16,000	346	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	1.0%	(0.8)
20	11247 B	6.38%	429	9	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.0%	0.0
21	11496 A	6.38%	4,866	102	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.3%	0.1
22	11317 B	5.75%	261	5	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
23	11664 A	5.75%	620	13	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
24	11724 A	5.75%	533	11	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
25	11664 B	5.75%	62	1	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.0%	0.0
26	11724 B	5.75%	800	17	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.1%	0.0
27				33,477							100.0%	12.9

Table 6.2-3
Long Term Debt Lag (Lead) – 2017

				Payment Dates			Payment Lags				
	A	B	C	D	E	F	G	H	I	J	K
Description	Interest Rate	Face Value	Interest Expense	First	Second	Mid-Year	First	Second	Average	Weight	Weighted Total Lag
1 IC-EUI-80-0012				3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	8.4%	2.7
2 IC-EUI-80-0013	6.06%	50,400	3,054	2-May	2-Nov	1-Jul	(60.5)	123.5	31.5	9.5%	3.0
3 IC-EUI-80-0014	5.60%	40,000	1,311	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	4.1%	(0.0)
4 IC-EUI-80-0016	5.60%	15,000	492	31-Mar	30-Sep	1-Jul	(92.5)	90.5	(1.0)	1.5%	(0.0)
5 IC-EUI-80-0017	5.38%	30,000	990	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	3.1%	1.9
6 IC-EUI-80-0032	5.96%	100,000	3,899	1-Jan	1-Jul	1-Jul	(181.5)	(0.5)	(91.0)	12.2%	(11.1)
7 IC-EUI-80-0036	6.75%	30,000	1,427	1-Apr	1-Oct	1-Jul	(91.5)	91.5	-	4.5%	-
8 IC-EUI-80-0042	5.85%	30,000	1,329	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	4.1%	2.5
9 IC-EUI-80-0046	5.20%	30,000	1,220	1-May	1-Nov	1-Jul	(61.5)	122.5	30.5	3.8%	1.2
10 IC-EUI-80-0047	4.88%	30,000	1,199	3-Jun	2-Dec	1-Jul	(28.5)	153.5	62.5	3.7%	2.3
11 IC-EUI-80-0070	4.62%	110,000	5,077	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	15.9%	(9.5)
12 IC-EUI-80-0075	4.73%	60,000	2,838	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	8.9%	5.4
13 IC-EUI-80-0076	4.12%	40,000	1,647	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.1%	3.1
14 IC-EUI-80-0082	4.41%	45,000	1,985	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	6.2%	3.8
15 IC-EUIC-80-2016	4.01%	45,000	1,805	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.6%	3.4
16 IC-EUIC-80-2017	3.72%	65,000	202		31-Dec	1-Jul		182.5	182.5	0.6%	1.1
17 11247 A	7.25%	10,000	260	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	0.8%	(0.6)
18 11317 A	7.25%	16,000	416	15-Jan	15-Jul	1-Jul	(167.5)	13.5	(77.0)	1.3%	(1.0)
19 11247 B	6.38%	429	11	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.0%	0.0
20 11496 A	6.38%	4,866	119	3-May	3-Nov	1-Jul	(59.5)	124.5	32.5	0.4%	0.1
21 11317 B	5.75%	261	6	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
22 11664 A	5.75%	620	14	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
23 11724 A	5.75%	533	12	2-Feb	2-Aug	1-Jul	(149.5)	31.5	(59.0)	0.0%	(0.0)
24 11664 B	5.75%	62	2	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.0%	0.0
25 11724 B	5.75%	800	20	15-Jun	15-Dec	1-Jul	(16.5)	166.5	75.0	0.1%	0.0
26			32,021							100.0%	8.4

Table 6.2-4
Long Term Debt Lag (Lead) – 2016

Description	A Interest Rate	B Face Value	C Interest Expense	Payment Dates D First	 E Second	 F Mid-Year	Payment Lags G First	 H Second	 I Average	J Weight	K Weighted Total Lag
1 IC-EUI-80-0012	6.72%	40,000	2,688	3-May	3-Nov	1-Jul	(59.0)	125.0	33.0	8.7%	2.9
2 IC-EUI-80-0013	6.06%	50,400	3,054	2-May	2-Nov	1-Jul	(60.0)	124.0	32.0	9.8%	3.1
3 IC-EUI-80-0014	5.60%	40,000	1,421	31-Mar	30-Sep	1-Jul	(92.0)	91.0	(0.5)	4.6%	(0.0)
4 IC-EUI-80-0016	5.60%	15,000	533	31-Mar	30-Sep	1-Jul	(92.0)	91.0	(0.5)	1.7%	(0.0)
5 IC-EUI-80-0017	5.38%	30,000	1,066	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	3.4%	2.1
6 IC-EUI-80-0032	5.96%	100,000	4,169	1-Jan	1-Jul	1-Jul	(182.0)	-	(91.0)	13.4%	(12.2)
7 IC-EUI-80-0036	6.75%	30,000	1,513	1-Apr	1-Oct	1-Jul	(91.0)	92.0	0.5	4.9%	0.0
8 IC-EUI-80-0042	5.85%	30,000	1,398	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	4.5%	2.8
9 IC-EUI-80-0046	5.20%	30,000	1,281	1-May	1-Nov	1-Jul	(61.0)	123.0	31.0	4.1%	1.3
10 IC-EUI-80-0047	4.88%	30,000	1,254	1-Jun	3-Dec	1-Jul	(30.0)	155.0	62.5	4.0%	2.5
11 IC-EUI-80-0070	4.62%	110,000	5,077	1-Feb	1-Aug	1-Jul	(151.0)	31.0	(60.0)	16.3%	(9.8)
12 IC-EUI-80-0075	4.73%	60,000	2,838	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	9.1%	5.6
13 IC-EUI-80-0076	4.12%	40,000	1,647	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	5.3%	3.3
14 IC-EUI-80-0082	4.41%	45,000	1,985	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	6.4%	3.9
15 IC-EUIC-80-2016	4.01%	45,000	150		31-Dec	1-Jul		183.0	183.0	0.5%	0.9
16 11247 A	7.25%	10,000	303	15-Jan	15-Jul	1-Jul	(168.0)	14.0	(77.0)	1.0%	(0.8)
17 11317 A	7.25%	16,000	485	15-Jan	15-Jul	1-Jul	(168.0)	14.0	(77.0)	1.6%	(1.2)
18 11247 B	6.38%	429	12	3-May	3-Nov	1-Jul	(59.0)	125.0	33.0	0.0%	0.0
19 11496 A	6.38%	4,866	136	3-May	3-Nov	1-Jul	(59.0)	125.0	33.0	0.4%	0.1
20 11317 B	5.75%	261	7	2-Feb	2-Aug	1-Jul	(150.0)	32.0	(59.0)	0.0%	(0.0)
21 11664 A	5.75%	620	16	2-Feb	2-Aug	1-Jul	(150.0)	32.0	(59.0)	0.1%	(0.0)
22 11724 A	5.75%	533	14	2-Feb	2-Aug	1-Jul	(150.0)	32.0	(59.0)	0.0%	(0.0)
23 11664 B	5.75%	62	2	15-Jun	15-Dec	1-Jul	(16.0)	167.0	75.5	0.0%	0.0
24 11724 B	5.75%	800	22	15-Jun	15-Dec	1-Jul	(16.0)	167.0	75.5	0.1%	0.1
25			31,070							100.0%	4.5

6.3 Common Dividends

36. EWSI issues common dividends on December 31 for the current fiscal year, at the end of the consumption period. Accordingly, the common dividend lag is 182.5 days (365/2) for 2016, 2017, 2018, and 2019.

7.0 STUDY RESULTS

37. For the 2022-2026 PBR Term EWSI is proposing the lead lag ratios and days provided in Table 7.0-1 (columns E and F).

Table 7.0-1
Summary of 2016-2019
Lead Lag Ratios

		A **2019**	B **2018**	C **2017**	D **2016**	E **Average**	F **Lead/(Lag) Days**
1	Water Service Expenses	5.0 %	4.9 %	5.5 %	5.0 %	**5.1 %**	**18.6**
2	Depreciation	13.9 %	13.6 %	14.3 %	14.1 %	**14.0 %**	**51.1**
3	Retained Earnings	13.9 %	13.6 %	14.3 %	14.1 %	**14.0 %**	**51.1**
4	Dividend	(50.0 %)	(50.0 %)	(50.0 %)	(50.1 %)	**(50.0 %)**	**(182.5)**
5	Interest Expense	9.3 %	10.0 %	12.0 %	12.9 %	**11.1 %**	**40.5**
6	GST Collection	1.4 %	1.1 %	1.8 %	1.6 %	**1.5 %**	**5.5**
7	GST Input Tax Credit	5.8 %	5.8 %	5.8 %	5.8 %	**5.8 %**	**21.0**

38. Comparison of EWSI's Lead Lag Study with those of other Canadian regulated entities shows that both the items included in the lead lag study and the resulting working capital ratios are consistent with those of other Canadian regulated entities.

39. Table 7.0-2 compares working capital ratios among other regulated entities. Review of the calculation of these ratios shows a high degree of consistency in study methodology among regulated entities.

Table 7.0-2
Comparative Study Working Capital Ratios

		Comparative Studies					Range			EWSI
		A	B	C	D	E	F	G	H	I
		EDTI Tran[1]	**ATCO Gas[2]**	**Enmax Tran[3]**	**AltaLink[4]**	**Hydro One[5]**	**Low**	**High**	**Avg**	**Avg**
1	O&M Expenses	3.8 %	1.5 %	0.8 %	9.5 %	7.3 %	0.8 %	9.5 %	4.6 %	**5.1 %**
2	Income Tax Installments	N/A	4.8 %	N/A	(0.1)%	10.5 %	(0.1)%	10.5 %	5.0 %	**N/A**
3	Other Taxes	-	(6.7)%	(8.2)%	(4.4)%	9.4 %	(8.2)%	9.4 %	(2.0)%	**7.2 %**
4	Long Term Debt Interest	(37.8)%	4.1 %	8.2 %	(12.7)%	14.7 %	(37.8)%	14.7 %	(4.7)%	**11.1 %**
5	Common Dividends	(0.2)%	(15.0)%	-	-	N/A	(15.0)%	-	(3.8)%	**(50.0)%**
6	Retained Earnings	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**14.0 %**
7	Depreciation Expense	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**14.0 %**

40. Comparison of EWSI's working capital ratios to those of the other companies included in Table 7.0-2 shows the following:

- EWSI's working capital ratios for O&M Expenses and Other Taxes are well within the range of the other companies included in the comparison;
- Since EWSI is not subject to income taxes this category does not apply to it;
- EWSI's working capital ratios for retained earnings and depreciation are higher than those of the other companies included in Table 7.0-2. These ratios are based on revenue lag days. Since all of EWSI's revenues are derived from retail customers, rather than settlement with AESO or other system operators, EWSI's collection periods are longer than those of the other companies in the comparison. Accordingly, EWSI's ratios are reasonable;
- EWSI's long term debt interest ratios are slightly higher than those of the other companies in Table 7.0-2. These ratios are based on the difference between revenue lag days and interest expense lag days. EWSI based its calculation of interest expense lag days on the actual dates of interest paid during the year, a methodology also used by ENMAX, HydroOne, and AltaLink. This methodology provides a representative view of actual cash flows throughout the year. Accordingly, EWSI's long term debt interest ratio is reasonable;

[1] EDTI 2020-2022 TFO Tariff Application, MFR Schedules, Schedule 11-3.
[2] ATCO Gas GRA Filing 2011-2012, December 2010.
[3] EPC 2018-2020 Transmission General Tariff Application, Appendix Q - EPC Lead Lag Study (Chymko).
[4] AltaLink Management Ltd. 2019 - 2021 General Tariff Application, Table 11.2-1.
[5] Hydro 1 EB-2017-0049, GTA Exhibit D1, Tab 1, Schedule 3, 2018 Test Year, March 03, 2017.

41. The differences in the ratios between EWSI and these companies are primarily caused by the timing of interest payments, with EWSI making interest payments towards the end of the year because of November and December debt issues, rather than towards mid-year. EWSI's higher revenue lag days also serve to increase its long term debt interest ratio, but to a lesser extent.

42. EDTI and EWSI have significantly different long term debt interest ratios. EDTI used a simplified methodology to calculate interest expense lag days. EDTI assumed that interest is paid twice annually, resulting in a consumption period of 182.5 days (365/2). Subtracting this lag from EDTI's revenue lag of 44.5 days, yields an interest expense lag 138 days (37.8%).

7.1 Appendix 1: Salary, Overtime and Wage Lag details

Table A1-1
Salary Lag
Year Ending December 31, 2019
(days)

	Period start date	A Mid Period	B Period End	C Processing	D Payment Date	E Consumption Lag	F Processing Lag	G Payment Lag	H Total Lag
1	23-Dec-18	29-Dec-18	05-Jan-19	07-Jan-19	11-Jan-19	7.00	2.00	4.00	13.00
2	06-Jan-19	12-Jan-19	19-Jan-19	21-Jan-19	25-Jan-19	7.00	2.00	4.00	13.00
3	20-Jan-19	26-Jan-19	02-Feb-19	04-Feb-19	08-Feb-19	7.00	2.00	4.00	13.00
4	03-Feb-19	09-Feb-19	16-Feb-19	18-Feb-19	22-Feb-19	7.00	2.00	4.00	13.00
5	17-Feb-19	23-Feb-19	02-Mar-19	04-Mar-19	08-Mar-19	7.00	2.00	4.00	13.00
6	03-Mar-19	09-Mar-19	16-Mar-19	18-Mar-19	22-Mar-19	7.00	2.00	4.00	13.00
7	17-Mar-19	23-Mar-19	30-Mar-19	01-Apr-19	05-Apr-19	7.00	2.00	4.00	13.00
8	31-Mar-19	06-Apr-19	13-Apr-19	15-Apr-19	18-Apr-19	7.00	2.00	3.00	12.00
9	14-Apr-19	20-Apr-19	27-Apr-19	29-Apr-19	03-May-19	7.00	2.00	4.00	13.00
10	28-Apr-19	04-May-19	11-May-19	13-May-19	17-May-19	7.00	2.00	4.00	13.00
11	12-May-19	18-May-19	25-May-19	27-May-19	31-May-19	7.00	2.00	4.00	13.00
12	26-May-19	01-Jun-19	08-Jun-19	10-Jun-19	14-Jun-19	7.00	2.00	4.00	13.00
13	09-Jun-19	15-Jun-19	22-Jun-19	24-Jun-19	28-Jun-19	7.00	2.00	4.00	13.00
14	23-Jun-19	29-Jun-19	06-Jul-19	08-Jul-19	12-Jul-19	7.00	2.00	4.00	13.00
15	07-Jul-19	13-Jul-19	20-Jul-19	22-Jul-19	26-Jul-19	7.00	2.00	4.00	13.00
16	21-Jul-19	27-Jul-19	03-Aug-19	05-Aug-19	09-Aug-19	7.00	2.00	4.00	13.00
17	04-Aug-19	10-Aug-19	17-Aug-19	19-Aug-19	23-Aug-19	7.00	2.00	4.00	13.00
18	18-Aug-19	24-Aug-19	31-Aug-19	02-Sep-19	06-Sep-19	7.00	2.00	4.00	13.00
19	01-Sep-19	07-Sep-19	14-Sep-19	16-Sep-19	20-Sep-19	7.00	2.00	4.00	13.00
20	15-Sep-19	21-Sep-19	28-Sep-19	30-Sep-19	04-Oct-19	7.00	2.00	4.00	13.00
21	29-Sep-19	05-Oct-19	12-Oct-19	14-Oct-19	18-Oct-19	7.00	2.00	4.00	13.00
22	13-Oct-19	19-Oct-19	26-Oct-19	28-Oct-19	01-Nov-19	7.00	2.00	4.00	13.00
23	27-Oct-19	02-Nov-19	09-Nov-19	11-Nov-19	15-Nov-19	7.00	2.00	4.00	13.00
24	10-Nov-19	16-Nov-19	23-Nov-19	25-Nov-19	29-Nov-19	7.00	2.00	4.00	13.00
25	24-Nov-19	30-Nov-19	07-Dec-19	09-Dec-19	13-Dec-19	7.00	2.00	4.00	13.00
26	08-Dec-19	14-Dec-19	21-Dec-19	23-Dec-19	27-Dec-19	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**3.96**	**12.96**

Table A1-2
Salary Lag
Year Ending December 31, 2018
(days)

		A	B	C	D	E	F	G	H
	Period start date	**Mid Period**	**Period End**	**Processing**	**Payment Date**	**Consumption Lag**	**Processing Lag**	**Payment Lag**	**Total Lag**
1	24-Dec-17	30-Dec-17	06-Jan-18	08-Jan-18	12-Jan-18	7.00	2.00	4.00	13.00
2	07-Jan-18	13-Jan-18	20-Jan-18	22-Jan-18	26-Jan-18	7.00	2.00	4.00	13.00
3	21-Jan-18	27-Jan-18	03-Feb-18	05-Feb-18	09-Feb-18	7.00	2.00	4.00	13.00
4	04-Feb-18	10-Feb-18	17-Feb-18	19-Feb-18	23-Feb-18	7.00	2.00	4.00	13.00
5	18-Feb-18	24-Feb-18	03-Mar-18	05-Mar-18	09-Mar-18	7.00	2.00	4.00	13.00
6	04-Mar-18	10-Mar-18	17-Mar-18	19-Mar-18	23-Mar-18	7.00	2.00	4.00	13.00
7	18-Mar-18	24-Mar-18	31-Mar-18	02-Apr-18	06-Apr-18	7.00	2.00	4.00	13.00
8	01-Apr-18	07-Apr-18	14-Apr-18	16-Apr-18	20-Apr-18	7.00	2.00	4.00	13.00
9	15-Apr-18	21-Apr-18	28-Apr-18	30-Apr-18	04-May-18	7.00	2.00	4.00	13.00
10	29-Apr-18	05-May-18	12-May-18	14-May-18	18-May-18	7.00	2.00	4.00	13.00
11	13-May-18	19-May-18	26-May-18	28-May-18	01-Jun-18	7.00	2.00	4.00	13.00
12	27-May-18	02-Jun-18	09-Jun-18	11-Jun-18	15-Jun-18	7.00	2.00	4.00	13.00
13	10-Jun-18	16-Jun-18	23-Jun-18	25-Jun-18	29-Jun-18	7.00	2.00	4.00	13.00
14	24-Jun-18	30-Jun-18	07-Jul-18	09-Jul-18	13-Jul-18	7.00	2.00	4.00	13.00
15	08-Jul-18	14-Jul-18	21-Jul-18	23-Jul-18	27-Jul-18	7.00	2.00	4.00	13.00
16	22-Jul-18	28-Jul-18	04-Aug-18	06-Aug-18	10-Aug-18	7.00	2.00	4.00	13.00
17	05-Aug-18	11-Aug-18	18-Aug-18	20-Aug-18	24-Aug-18	7.00	2.00	4.00	13.00
18	19-Aug-18	25-Aug-18	01-Sep-18	03-Sep-18	07-Sep-18	7.00	2.00	4.00	13.00
19	02-Sep-18	08-Sep-18	15-Sep-18	17-Sep-18	21-Sep-18	7.00	2.00	4.00	13.00
20	16-Sep-18	22-Sep-18	29-Sep-18	01-Oct-18	05-Oct-18	7.00	2.00	4.00	13.00
21	30-Sep-18	06-Oct-18	13-Oct-18	15-Oct-18	19-Oct-18	7.00	2.00	4.00	13.00
22	14-Oct-18	20-Oct-18	27-Oct-18	29-Oct-18	02-Nov-18	7.00	2.00	4.00	13.00
23	28-Oct-18	03-Nov-18	10-Nov-18	12-Nov-18	16-Nov-18	7.00	2.00	4.00	13.00
24	11-Nov-18	17-Nov-18	24-Nov-18	26-Nov-18	30-Nov-18	7.00	2.00	4.00	13.00
25	25-Nov-18	01-Dec-18	08-Dec-18	10-Dec-18	14-Dec-18	7.00	2.00	4.00	13.00
26	09-Dec-18	15-Dec-18	22-Dec-18	24-Dec-18	28-Dec-18	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**4.00**	**13.00**

Table A1-3
Salary Lag
Year Ending December 31, 2017
(days)

		A	B	C	D	E	F	G	H
	Period start date	**Mid Period**	**Period End**	**Processing**	**Payment Date**	**Consumption Lag**	**Processing Lag**	**Payment Lag**	**Total Lag**
1	25-Dec-16	31-Dec-16	07-Jan-17	09-Jan-17	13-Jan-17	7.00	2.00	4.00	13.00
2	08-Jan-17	14-Jan-17	21-Jan-17	23-Jan-17	27-Jan-17	7.00	2.00	4.00	13.00
3	22-Jan-17	28-Jan-17	04-Feb-17	06-Feb-17	10-Feb-17	7.00	2.00	4.00	13.00
4	05-Feb-17	11-Feb-17	18-Feb-17	20-Feb-17	24-Feb-17	7.00	2.00	4.00	13.00
5	19-Feb-17	25-Feb-17	04-Mar-17	06-Mar-17	10-Mar-17	7.00	2.00	4.00	13.00
6	05-Mar-17	11-Mar-17	18-Mar-17	20-Mar-17	24-Mar-17	7.00	2.00	4.00	13.00
7	19-Mar-17	25-Mar-17	01-Apr-17	03-Apr-17	07-Apr-17	7.00	2.00	4.00	13.00
8	02-Apr-17	08-Apr-17	15-Apr-17	17-Apr-17	21-Apr-17	7.00	2.00	4.00	13.00
9	16-Apr-17	22-Apr-17	29-Apr-17	01-May-17	05-May-17	7.00	2.00	4.00	13.00
10	30-Apr-17	06-May-17	13-May-17	15-May-17	19-May-17	7.00	2.00	4.00	13.00
11	14-May-17	20-May-17	27-May-17	29-May-17	02-Jun-17	7.00	2.00	4.00	13.00
12	28-May-17	03-Jun-17	10-Jun-17	12-Jun-17	16-Jun-17	7.00	2.00	4.00	13.00
13	11-Jun-17	17-Jun-17	24-Jun-17	26-Jun-17	30-Jun-17	7.00	2.00	4.00	13.00
14	25-Jun-17	01-Jul-17	08-Jul-17	10-Jul-17	14-Jul-17	7.00	2.00	4.00	13.00
15	09-Jul-17	15-Jul-17	22-Jul-17	24-Jul-17	28-Jul-17	7.00	2.00	4.00	13.00
16	23-Jul-17	29-Jul-17	05-Aug-17	07-Aug-17	11-Aug-17	7.00	2.00	4.00	13.00
17	06-Aug-17	12-Aug-17	19-Aug-17	21-Aug-17	25-Aug-17	7.00	2.00	4.00	13.00
18	20-Aug-17	26-Aug-17	02-Sep-17	04-Sep-17	08-Sep-17	7.00	2.00	4.00	13.00
19	03-Sep-17	09-Sep-17	16-Sep-17	18-Sep-17	22-Sep-17	7.00	2.00	4.00	13.00
20	17-Sep-17	23-Sep-17	30-Sep-17	02-Oct-17	06-Oct-17	7.00	2.00	4.00	13.00
21	01-Oct-17	07-Oct-17	14-Oct-17	16-Oct-17	20-Oct-17	7.00	2.00	4.00	13.00
22	15-Oct-17	21-Oct-17	28-Oct-17	30-Oct-17	03-Nov-17	7.00	2.00	4.00	13.00
23	29-Oct-17	04-Nov-17	11-Nov-17	13-Nov-17	17-Nov-17	7.00	2.00	4.00	13.00
24	12-Nov-17	18-Nov-17	25-Nov-17	27-Nov-17	01-Dec-17	7.00	2.00	4.00	13.00
25	26-Nov-17	02-Dec-17	09-Dec-17	11-Dec-17	15-Dec-17	7.00	2.00	4.00	13.00
26	10-Dec-17	16-Dec-17	23-Dec-17	25-Dec-17	29-Dec-17	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**4.00**	**13.00**

Table A1-4
Salary Lag
Year Ending December 31, 2016
(days)

		A	B	C	D	E	F	G	H
	Period start date	**Mid Period**	**Period End**	**Processing**	**Payment Date**	**Consumption Lag**	**Processing Lag**	**Payment Lag**	**Total Lag**
1	27-Dec-15	02-Jan-16	09-Jan-16	11-Jan-16	15-Jan-16	7.00	2.00	4.00	13.00
2	10-Jan-16	16-Jan-16	23-Jan-16	25-Jan-16	29-Jan-16	7.00	2.00	4.00	13.00
3	24-Jan-16	30-Jan-16	06-Feb-16	08-Feb-16	12-Feb-16	7.00	2.00	4.00	13.00
4	07-Feb-16	13-Feb-16	20-Feb-16	22-Feb-16	26-Feb-16	7.00	2.00	4.00	13.00
5	21-Feb-16	27-Feb-16	05-Mar-16	07-Mar-16	11-Mar-16	7.00	2.00	4.00	13.00
6	06-Mar-16	12-Mar-16	19-Mar-16	21-Mar-16	24-Mar-16	7.00	2.00	3.00	12.00
7	20-Mar-16	26-Mar-16	02-Apr-16	04-Apr-16	08-Apr-16	7.00	2.00	4.00	13.00
8	03-Apr-16	09-Apr-16	16-Apr-16	18-Apr-16	22-Apr-16	7.00	2.00	4.00	13.00
9	17-Apr-16	23-Apr-16	30-Apr-16	02-May-16	06-May-16	7.00	2.00	4.00	13.00
10	01-May-16	07-May-16	14-May-16	16-May-16	20-May-16	7.00	2.00	4.00	13.00
11	15-May-16	21-May-16	28-May-16	30-May-16	03-Jun-16	7.00	2.00	4.00	13.00
12	29-May-16	04-Jun-16	11-Jun-16	13-Jun-16	17-Jun-16	7.00	2.00	4.00	13.00
13	12-Jun-16	18-Jun-16	25-Jun-16	27-Jun-16	30-Jun-16	7.00	2.00	3.00	12.00
14	26-Jun-16	02-Jul-16	09-Jul-16	11-Jul-16	15-Jul-16	7.00	2.00	4.00	13.00
15	10-Jul-16	16-Jul-16	23-Jul-16	25-Jul-16	29-Jul-16	7.00	2.00	4.00	13.00
16	24-Jul-16	30-Jul-16	06-Aug-16	08-Aug-16	12-Aug-16	7.00	2.00	4.00	13.00
17	07-Aug-16	13-Aug-16	20-Aug-16	22-Aug-16	26-Aug-16	7.00	2.00	4.00	13.00
18	21-Aug-16	27-Aug-16	03-Sep-16	05-Sep-16	09-Sep-16	7.00	2.00	4.00	13.00
19	04-Sep-16	10-Sep-16	17-Sep-16	19-Sep-16	23-Sep-16	7.00	2.00	4.00	13.00
20	18-Sep-16	24-Sep-16	01-Oct-16	03-Oct-16	07-Oct-16	7.00	2.00	4.00	13.00
21	02-Oct-16	08-Oct-16	15-Oct-16	17-Oct-16	21-Oct-16	7.00	2.00	4.00	13.00
22	16-Oct-16	22-Oct-16	29-Oct-16	31-Oct-16	04-Nov-16	7.00	2.00	4.00	13.00
23	30-Oct-16	05-Nov-16	12-Nov-16	14-Nov-16	18-Nov-16	7.00	2.00	4.00	13.00
24	13-Nov-16	19-Nov-16	26-Nov-16	28-Nov-16	02-Dec-16	7.00	2.00	4.00	13.00
25	27-Nov-16	03-Dec-16	10-Dec-16	12-Dec-16	16-Dec-16	7.00	2.00	4.00	13.00
26	11-Dec-16	17-Dec-16	24-Dec-16	26-Dec-16	30-Dec-16	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**3.92**	**12.92**

7.2 Appendix 2: Labour and Benefit Summary Lag details

Table A2-1
Salary and Benefit Lag
Year ending December 31, 2019
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	28,512	62.74%	8.1
2	CRA	7.0	6.0	7.6	20.6	8,503	18.71%	3.9
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,609	3.54%	0.6
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	64	0.14%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	5,219	11.48%	3.2
6	Union Dues	7.0	6.0	3.0	16.0	194	0.43%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	44	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	6	0.01%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	875	1.93%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	66	0.14%	0.0
11	Health Services			45.6	45.6	209	0.46%	0.2
12	WCB			45.6	45.6	147	0.32%	0.1
13	**Average Withholding Lag**						100.00%	**16.6**

Table A2-2
Salary and Benefit Lag
Year ending December 31, 2018
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	28,467	62.64%	8.1
2	CRA	7.0	6.0	7.6	20.6	8,310	18.29%	3.8
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,554	3.42%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	76	0.17%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	5,529	12.17%	3.4
6	Union Dues	7.0	6.0	3.0	16.0	199	0.44%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	44	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	9	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	867	1.91%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	72	0.16%	0.0
11	Health Services			45.6	45.6	171	0.38%	0.2
12	WCB			45.6	45.6	148	0.33%	0.1
13	**Average Withholding Lag**						100.00%	**16.7**

[6] $ thousands.

Table A2-3
Salary and Benefit Lag
Year ending December 31, 2017
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	27,799	62.46%	8.1
2	CRA	7.0	6.0	7.6	20.6	7,988	17.95%	3.7
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,424	3.20%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	68	0.15%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	5,770	12.96%	3.6
6	Union Dues	7.0	6.0	3.0	16.0	188	0.42%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	43	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	9	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	839	1.89%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	56	0.13%	0.0
11	Health Services			45.6	45.6	169	0.38%	0.2
12	WCB			45.6	45.6	155	0.35%	0.2
13	**Average Withholding Lag**						100.00%	**16.7**

Table A2-4
Salary and Benefit Lag
Year ending December 31, 2018
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	3.9	12.9	23,927	62.43%	8.1
2	CRA	7.0	6.0	7.6	20.6	7,129	18.60%	3.8
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,114	2.91%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	68	0.18%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	4,871	12.71%	3.6
6	Union Dues	7.0	6.0	3.0	16.0	153	0.40%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	34	0.09%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	6	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	716	1.87%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	54	0.14%	0.0
11	Health Services			45.6	45.6	130	0.34%	0.2
12	WCB			45.8	45.8	123	0.32%	0.1
13	**Average Withholding Lag**						100.00%	**16.7**

7.3 Appendix 3: General Expense Lag details

Table A3-1
Operating Expense Lag
Years ended December 31, 2017, 2018, and 2019
(days)

	Period Start	A Midpoint	B Period End	C Payment Date	D Consumption Lag Days	E Payment Lag Days	F Total Lag Days
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5
13	**Total Operating Expenses Remittance Lag**						**45.6**

Table A3-2
Operating Expense Lag
Year ended December 31, 2016
(days)

	Period Start	A Midpoint	B Period End	C Payment Date	D Consumption Lag Days	E Payment Lag Days	F Total Lag Days
1	1-Jan	16-Jan	31-Jan	29-Feb	15.5	29.0	44.5
2	1-Feb	15-Feb	29-Feb	31-Mar	14.0	30.0	44.5
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5
13	**Total Operating Expenses Remittance Lag**						**45.8**

7.4 Appendix 4: GST Lag calculations

Table A4-1
GST Lag
Years ended December 31, 2017, 2018, and 2019
(days)

	Period Start	A Midpoint	B Period End	C Filing Date	D Consumption Lag	E Remittance Lag	F GST Filing Lag	G Payment Lag	H Total Lag Days
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5	64.5	108.0
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0	66.0	111.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5	66.5	112.0
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0	67.0	113.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5	66.5	112.0
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0	67.0	113.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5	67.5	114.0
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5	66.5	112.0
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0	67.0	113.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5	66.5	112.0
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0	67.0	113.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5	67.5	114.0
13	**Total GST Lag**						**45.6**	**66.6**	**112.3**

Table A4-2
GST Lag
Years ended December 31, 2016
(days)

	Period Start	A Midpoint	B Period End	C Filing Date	D Consumption Lag	E Remittance Lag	F GST Filing Lag	G Payment Lag	H Total Lag Days
1	1-Jan	16-Jan	31-Jan	29-Feb	15.5	29.0	44.5	65.5	110.0
2	1-Feb	15-Feb	29-Feb	31-Mar	14.5	30.0	44.5	66.5	112.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5	66.5	112.0
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0	67.0	113.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5	66.5	112.0
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0	67.0	113.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5	67.5	114.0
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5	66.5	112.0
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0	67.0	113.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5	66.5	112.0
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0	67.0	113.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	32.0	47.5	67.5	114.0
13	**Total GST Lag**						**45.8**	**66.8**	**112.5**

Appendix O2

EPCOR WATER SERVICES INC.

Wastewater Treatment
Lead Lag Study

February 16, 2021

Table of Contents

1.0 INTRODUCTION

1. This lead-lag study has been undertaken to support the necessary working capital allowance for EPCOR Water Services Inc. (EWSI) for the 2022 to 2024 PBR filing with the City of Edmonton. A lead-lag study recognizes the timing differences between EWSI's provision of a service and payment, (revenue lag), and the timing differences between when an expense is incurred and subsequently paid, (expense lag). The net lag for an expense category is the difference between the associated revenue lag and the expense lag.

2. Lags are derived from analysis of each revenue and expenses stream and are broken down into their individual components in order to more precisely determine the total lag. EWSI's revenues are derived from fixed and metered charges for residential, multi-residential, commercial customers, and other sources. Since revenue cycles and the lead periods for each are not significantly different, they are considered together. Operating expenses are broken down into labour, salary and benefits, incentives, general expenses, property taxes, parent charges and franchise fees. An overall operating expense lag is then calculated on a weighted average and netted against the appropriate revenues. Net lags are also calculated for GST and individual capital expenses including debt interest, retained earnings, dividends, and depreciation.

3. The working capital ratio (net lag/365) is then applied against the corresponding expense amount in order to determine the portion of necessary working capital related to each component.

4. Lags are made up of two general components: consumption and payment.

- Consumption lag is the lag between when a service is provided or good consumed and the end of a consumption period. For example, if a service is billed on a weekly basis, the consumption period is a week and the consumption lag would vary between zero and seven days, depending on when the service was provided. As it is generally assumed that consumption occurs evenly over the consumption period, the mid-point of a consumption period is used to determine the consumption lag. In a weekly consumption period, the consumption lag would be 3.5 days (7/2) or in a monthly consumption period with 30 days the consumption lag would be 15 days (30/2).
- Payment lag is the time between the end of the consumption period and the receipt of cash. The payment lag sometimes includes a processing lag, which is time required to receive, process, and issue the order to proceed, however this is not always

considered separately from the payment lag. The payment lag is also measured in days and is the length between the last day of the consumption period and payment issue.

5. The lead-lag methodology used in this report is consistent with public lead-lag studies done for Hydro One Networks Inc., AltaLink, and Atco Gas among others. In addition, despite some changes in the assumptions, the underlying methodology is consistent with the principles applied in EDTI's 2020-2022 Transmission General Tariff Application with respect to necessary working capital. See further discussion in the Study Results section.

2.0 EXECUTIVE SUMMARY

6. The overall impact of the lead-lag study using 2019, 2018, 2017 and 2016 actual financial results are shown in Table 2.0-1.

Table 2.0-1
Summary of Necessary Working Capital
($ thousands)

		A	B	C	D	E	F	G	H	I	J	K	L
		2019			**2018**			**2017**			**2016**		
		Actual	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**
1	Operating Expense, net of revenue offsets	43,709	4.3 %	1,870	43,045	4.6 %	1,996	41,187	5.8 %	2,382	41,845	4.9 %	2,043
2	Depreciation	18,033	13.4 %	2,411	16,436	13.5 %	2,219	14,404	14.7 %	2,119	13,053	14.0 %	1,831
3	Retained Earnings	20,871	13.4 %	2,790	21,192	13.5 %	2,861	20,586	14.7 %	3,029	15,575	14.0 %	2,184
4	Dividends	10,000	(50.0 %)	(5,000)	10,000	(50.0 %)	(5,000)	-	(50.0 %)	-	-	(50.1 %)	-
5	Interest Expense	10,692	(2.7 %)	(290)	9,971	(2.7 %)	(270)	9,187	(1.7 %)	(157)	8,510	(2.8 %)	(236)
6	GST Collection	130	0.9 %	1	96	1.0 %	1	89	2.2 %	2	74	1.5 %	1
7	GST Input Tax Credit	2,852	5.8 %	164	3,054	5.8 %	176	2,878	5.8 %	166	2,869	5.8 %	165
8	**Necessary Working Capital**			**1,945**			**1,982**			**7,540**			**5,989**

7. The ratios used to determine EWSI's necessary working capital requirements reflect the revenue and expense lags as shown in Tables 2.0-2 to 2.0-5.

Table 2.0-2
Summary of Lags and Working Capital Ratio – 2019
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	48.8	33.2	15.6	4.3 %
2	Fixed	48.8	33.2	15.6	4.3 %
3	Miscellaneous	48.8	33.2	15.6	4.3 %
4	GST Collection	48.8	45.6	3.2	0.9 %
5	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	48.8	58.7	(9.9)	(2.7 %)
7	Retained Earnings	48.8	-	48.8	13.4 %
8	Dividends	-	182.5	(182.5)	(50.0 %)
9	Depreciation	48.8	-	48.8	13.4 %

Table 2.0-3
Summary of Lags and Working Capital Ratio – 2018
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	49.3	32.3	16.9	4.6 %
2	Fixed	49.3	32.3	16.9	4.6 %
3	Miscellaneous	49.3	32.3	16.9	4.6 %
4	GST Collection	49.3	45.6	3.6	1.0 %
5	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	49.3	59.2	(9.9)	(2.7 %)
7	Retained Earnings	49.3	-	49.3	13.5 %
8	Dividends	-	182.5	(182.5)	(50.0 %)
9	Depreciation	49.3	-	49.3	13.5 %

Table 2.0-4
Summary of Lags and Working Capital Ratio – 2017
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	53.7	32.6	21.1	5.8 %
2	Fixed	53.7	32.6	21.1	5.8 %
3	Miscellaneous	53.7	32.6	21.1	5.8 %
4	GST Collection	53.7	45.6	8.1	2.2 %
5	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	53.7	59.9	(6.2)	(1.7 %)
7	Retained Earnings	53.7	-	53.7	14.7 %
8	Dividends	-	182.5	(182.5)	(50.0 %)
9	Depreciation	53.7	-	53.7	14.7 %

Table 2.0-5
Summary of Lags and Working Capital Ratio – 2016
(days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	51.2	33.4	17.8	4.9 %
2	Fixed	51.2	33.4	17.8	4.9 %
3	Miscellaneous	51.2	33.4	17.8	4.9 %
4	GST Collection	51.2	45.8	5.4	1.5 %
5	GST Input Tax Credit	66.8	45.8	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	51.2	61.3	(10.1)	(2.8 %)
7	Retained Earnings	51.2	-	51.2	14.0 %
8	Dividends	-	183.0	(183.0)	(50.1 %)
9	Depreciation	51.2	-	51.2	14.0 %

8. Working capital lags between 2016 and 2019 have remained relatively consistent, with the changes in revenue lags attributable to changes in customer payment lag (account receivable balance). While changes in expense lags are primarily attributable to changes in the levels of incentives, which are paid annually in arrears, and decreases in the net lag for debt interest, reflecting debt issuances in the latter part of each year, and interest payments shifting to mid-year, decreasing the overall debt interest expense lag.

3.0 REVENUE

9. The revenue lag is the measure of time from consumption or provision of a service by EWSI to the receipt of payment from the customer. All of EWSI's revenue streams, including: metered, fixed, overstrength surcharges, and miscellaneous revenues, are subject to similar billing and payment cycles. Therefore, since these revenues are all billed in the same manner and are based on the same payment and consumption schedules, the lag period is similar for each revenue function and will not be considered separately for purposes of this report.

10. The revenue lag calculation considers several key components. Each has been broken down for clarity in understanding.

3.1 Average Consumption Period Lag

11. In order to determine the average lag for each consumption period, an average consumption period between meter readings must be determined. Each site is billed once per month, or 12 times per year. Given 365 days in 1 year, the average consumption period billed is calculated to be 30.42 days (365 divided by 12). EWSI has used the mid-point of the average consumption period billed as the consumption period lag. (30.4 days divided by 2 = 15.2 days).

3.2 Average Tariff Bill File Publish Lag and Invoice Lag

12. EWSI publishes each billing cycle exactly 6 business days after the scheduled reading date. This is in accordance with performance requirements as specified in section 2.14 of the Tariff Billing Code. Due to the fact that meter reading operations and billing cycles are performed on a business day schedule, the actual calendar day lag is 8 days for 4 (Tuesday – Friday) of the 5 cycles billed in a week and 10 days for the tariff files published on Mondays due to an extra weekend coming into play. These dates are summarized in Table 3.2-1.

Table 3.2-1
Tariff Bill File Publish Lag and Invoice Lag
(days)

	Bill Cycle	A Meter Reading	B Tariff Bill File Publish	C Billing	D TBF Lag	E Invoice Lag
1	1	Friday	Monday	Wednesday	10.0	2.0
2	2	Monday	Tuesday	Thursday	8.0	2.0
3	3	Tuesday	Wednesday	Friday	8.0	2.0
4	4	Wednesday	Thursday	Monday	8.0	4.0
5	5	Thursday	Friday	Tuesday	8.0	4.0
6				**Average**	**8.4**	**2.8**

13. These lags are unchanged from EWSI's 2016 Lead-Lag Study, which is as expected since the billing schedule is also unchanged.

3.3 Customer Payment Lags

14. Payment is due from customer 21 days after the invoice date. Analysis of year end accounts receivable showed collections lags of 24.7 days in 2016, 27.3 days in 2017, 22.9 days in 2018 and 22.4 days in 2019.

15. The overall revenue lags for EWSI revenues are summarized in Table 3.3-1.

Table 3.3-1
Revenue Lag Summary
(days)

		A 2019	B 2018	C 2017	D 2016
1	Consumption period mid-point	15.21	15.21	15.21	15.25
2	TBF Publish lag	8.40	8.40	8.40	8.40
3	Invoicing lag	2.80	2.80	2.80	2.80
4	Customer payment	22.39	22.86	27.29	24.74
5	**Total**	**48.80**	**49.27**	**53.70**	**51.19**

16. As most expense lags are netted against these revenue lags to determine the corresponding working capital ratios and requirements, revenue lags play a significant role in the determination of EWSI's overall working capital requirement.

4.0 EXPENSES

17. EWSI examined operating expenses by breaking them down into the categories of labour, salary and benefits, incentive, property taxes, franchise fees, parent charges (inter-company

allocations) and general operating expenses. The total operating expense lag is calculated by taking the weighted average of these components on a yearly basis.

4.1 Labour, Salary and Benefits

18. Labour expense is comprised of salary and benefits, including remittances to CRA, Sun Life and other employee benefit and withholding categories. The total labour and benefits lag is calculated using the weighted average of all expenses types (incentive is calculated separately). Contractor fees are included in general operating expense as they are paid through the general accounts payable cheque runs.

19. The individual labour and benefit lag for EWSI was essentially unchanged between 2016 and 2019, which is as expected. The overall lag remained relatively flat from the 2016 lead lag study.

20. Components of the labour lag other than salaries, overtime and wages are based on lag times and weightings calculated by EUI's Payroll department for EPCOR as a whole. These weighting reflect the fact that these payments are processed centrally for all EPCOR subsidiaries, so the lag times will not differ between the various EPCOR subsidiaries, including EWSI. In addition, the weighting of categories within labour and benefits is comparable between areas.

4.2 Incentive Payments

21. Employee incentives are categorized separately from other operating costs as they have a longer payment lag of approximately 290 days compared to 46 days for other operating costs and only 16-17 days for other labour costs. Employee incentives are paid annual in the second pay period of April for the previous fiscal year, resulting in a consumption lag of 182 days and a payment lag of 111 days in 2016, 110 days in 2017, and 108 days in 2018, and 2019. Total lags for incentives were 293.5 days in 2016, 292 days in 2017 and 290 days for 2018 and 2019.

4.3 Property and Business Taxes

22. Property taxes are due June 30 for the current fiscal year, halfway through the consumption period. Accordingly, the property tax lead is 1 day for 2016 and 1.5 days for 2017 to 2019. Business taxes are paid March 31, so the expense lag for business taxes is 92.0 days for 2016 and 92.5 days for 2017 to 2019. Total weighted lead for property and business taxes are 1.0 days 2016, 1.5 days in 2017, 2018, and 2019

4.4 Franchise Fees

23. Franchise fees are paid monthly to municipalities; EPCOR pays these bills in the same fashion as the general operating expenses discussed below. It is therefore assumed that the lag period is the same as general operating expenses of 45.8 days in 2016 and 45.6 days in 2017, 2018, and 2019.

4.5 Parent Charges

24. EPCOR Corporate or "Parent" charges are categorized separately from other operating costs such as material costs and contractor costs as they have a shorter payment lag. Parent charges are allocated from corporate on a monthly basis therefore the lag is the average monthly consumption period of 15.0 days compared to 45.6 days for other operating costs.

4.6 General Operating Expenses

25. A majority of EPCOR's general operating expenses are paid within 30 days of receiving the invoice; therefore, assuming expenses are incurred evenly over a month, the average consumption period is approximately 15 days. Assuming all expenses incurred in the month are paid at the end of the next month, the total lag for general operating expenses is 45.8 days in 2016, and 45.6 days in each of 2017, 2018, and 2019.

26. Net lags for revenues and expenses are summarized in Tables 4.6-1 to 4.6-4.

Table 4.6-1
Net Lag (Lead) for Revenues and Expenses – 2019
($ thousands)

		A **Amount**	B **Percentage**	C **Lag Days**	D **Weighted Days**
	REVENUE				
1	Metered	76,815	77.5%	48.8	37.8
2	Fixed	15,459	15.6%	48.8	7.6
3	Miscellaneous	6,871	6.9%	48.8	3.4
4	**Subtotal**	99,145	100%		48.8
5	**NET REVENUE LAG**				**48.8**
	EXPENDITURES				
6	Labour, salaries & benefits	16,605	32.8%	16.6	5.4
7	Incentive	949	1.9%	290.0	5.4
8	Other operating expenses	20,919	41.4%	45.6	18.9
9	Parent charges	4,301	8.5%	15.0	1.3
10	Property tax	588	1.2%	(1.5)	(0.0)
11	Franchise fees	7,219	14.3%	15.2	2.2
12	**Subtotal**	50,580	100%		33.2
13	**NET EXPENSE LAG**				**33.2**
14	**Net Lag (Lead) For Receipts & Payments 2019**				**15.6**

Table 4.6-2
Net Lag (Lead) for Revenues and Expenses – 2018
($ thousands)

		A	B	C	D
		Amount	**Percentage**	**Lag Days**	**Weighted Days**
	REVENUE				
1	Metered	75,236	78.4%	49.3	38.6
2	Fixed	14,583	15.2%	49.3	7.5
3	Miscellaneous	6,195	6.5%	49.3	3.2
4	**Subtotal**	96,014	100%		49.3
5	**NET REVENUE LAG**				**49.3**
	EXPENDITURES				
6	Labour, salaries & benefits	17,274	35.1%	16.7	5.8
7	Incentive	868	1.8%	290.0	5.1
8	Other operating expenses	19,429	39.5%	45.6	18.0
9	Parent charges	4,079	8.3%	15.0	1.2
10	Property tax	587	1.2%	(1.5)	(0.0)
11	Franchise fees	7,002	14.2%	15.2	2.2
12	**Subtotal**	49,240	100%		32.3
13	**NET EXPENSE LAG**				**32.3**
14	**Net Lag (Lead) For Receipts & Payments 2018**				**16.9**

Table 4.6-3
Net Lag (Lead) for Revenues and Expenses – 2017
($ thousands)

		A	B	C	D
		Amount	**Percentage**	**Lag Days**	**Weighted Days**
	REVENUE				
1	Metered	70,297	77.4%	53.7	41.6
2	Fixed	14,310	15.8%	53.7	8.5
3	Miscellaneous	6,193	6.8%	53.7	3.7
4	**Subtotal**	90,800	100%		53.7
5	**NET REVENUE LAG**				**53.7**
	EXPENDITURES				
6	Labour, salaries & benefits	16,506	34.8%	16.7	5.8
7	Incentive	910	1.9%	292.0	5.6
8	Other operating expenses	18,308	38.6%	45.6	17.6
9	Parent charges	4,454	9.4%	15.0	1.4
10	Property tax	581	1.2%	(1.5)	(0.0)
11	Franchise fees	6,620	14.0%	15.2	2.1
12	**Subtotal**	47,380	100%		32.6
13	**NET EXPENSE LAG**				**32.6**
14	**Net Lag (Lead) For Receipts & Payments 2017**				**21.1**

Table 4.6-4
Net Lag (Lead) for Revenues and Expenses – 2016
($ thousands)

		A	B	C	D
		Amount	**Percentage**	**Lag Days**	**Weighted Days**
	REVENUE				
1	Metered	64,993	77.7%	51.2	39.8
2	Fixed	13,258	15.8%	51.2	8.1
3	Miscellaneous	5,424	6.5%	51.2	3.3
4	**Subtotal**	83,674	100%		51.2
5	**NET REVENUE LAG**				**51.2**
	EXPENDITURES				
6	Labour, salaries & benefits	15,985	33.8%	16.7	5.6
7	Incentive	953	2.0%	293.5	5.9
8	Other operating expenses	18,956	40.1%	45.8	18.3
9	Parent charges	4,736	10.0%	15.0	1.5
10	Property tax	521	1.1%	(1.0)	(0.0)
11	Franchise fees	6,119	12.9%	15.3	2.0
12	**Subtotal**	47,269	100%		33.4
13	**NET EXPENSE LAG**				**33.4**
14	**Net Lag (Lead) For Receipts & Payments 2016**				**17.8**

27. Overall for EWSI, the net lags for receipts and payments are 17.8 days in 2016, 21.1 days in 2017, 16.9 days in 2018, and 15.6 days in 2019. The changes in net lag times between 2016 and 2019 are primarily due to changes in customer payment lag each year. These values are based on actual costs for 2016, 2017, 2018, and 2019. The working capital ratios of 4.9% in 2016, 5.8% in 2017, 4.6% in 2018, and 4.3% in 2019 are calculated from the expense net lags (17.8/365, 21.1/365 and 16.9/365, 15.6/365) are then applied to the overall operating expense, net of revenue offsets, to provide the appropriate necessary working capital for this component (see Table 2.0-1).

5.0 GST

28. GST is not applicable to water sales, so EWSI only collects GST on a small proportion of its revenues, mainly for surplus sales, facility revenues and miscellaneous fees. Accordingly, EWSI is always in a refund position with the CRA. GST returns are filed monthly (usually on the last business day of the following month). Per discussions with EPCOR tax group, input credits are normally received from the CRA within 2-4 week of filing. Calculation of the GST remittance lag is shown in Appendix 5.

Table 5.0-1
GST Impact on Working Capital
($ thousands)

		A	B **2019**	C **2018**	D **2017**	E **2016**
	REVENUE					
1	Net Receipts applicable to GST		2,598	1,914	1,784	1,486
2	GST rate		5.00%	5.00%	5.00%	5.00%
3	GST collected	(a)	130	96	89	74
4	Day factor - revenue lag		48.8	49.3	53.7	51.2
5	Day factor - GST remittance		45.6	45.6	45.6	45.8
6	Net	(b)	3.2	3.6	8.1	5.4
7	Impact on Working Capital	(a)*(b)/365	1	1	2	1
	EXPENDITURES					
8	Other operating costs		20,919	19,429	18,308	18,956
9	Capital expenditures excluding labour		36,127	41,652	39,261	38,429
10	Net costs applicable to GST		57,046	61,081	57,569	57,385
11	GST rate		5.00%	5.00%	5.00%	5.00%
12	GST remitted	(d)	2,852	3,054	2,878	2,869
13	Day factor- GST refund lag		66.6	66.6	66.6	66.8
14	Day factor - GST applicable expense lag		45.6	45.6	45.6	45.8
15	Net	(e)	21.0	21.0	21.0	21.0
16	Impact on Working Capital	(d)*(e)/365	164	176	166	165
17	**Net GST impact on Working Capital**		**165**	**177**	**168**	**166**

29. GST collected by EWSI is based on analysis of 2016-2019 revenues, with input tax credits based on total operating expenses less labour, salaries, benefits and incentives and property taxes plus capital expenditures excluding labour components.

30. The day factor on GST applicable expenses is based on lead-lag days for general operating expenses, since capital expenditures (excluding labour) are assumed to be on the same payment schedule as all other operating costs.

31. As shown in Table 5.0-1, the impact of GST on working capital is negligible; resulting in an increase to necessary working capital of $0.17 million in 2016, $0.17 million in 2017, $0.18 million in 2018, and $0.17 million in 2019.

6.0 CAPITAL EXPENSES

32. Capital expenses include four categories: interest, retained earnings, common dividends and depreciation. As EWSI had not consistently issued a common dividend in the past, dividends

were not included in the 2016 lead lag study. However, EWSI has issued a dividend annually in 2018 and 2019 is forecast to continue annual dividends over the 2022 to 2024 period. As result, common dividends have been included in the current lead lag study. Table 6.0-1 provides the capital expense lags for 2016 to 2019.

Table 6.0-1
Capital Expense Lags for 2016, 2017, 2018, and 2019
($ thousands)

		A	B	C	D	E	F	G	H
		2019		**2018**		**2017**		**2016**	
	Expense	**Lag Days**	**Expense**	**Lag Days**	**Expense**	**Lag Days**	**Expense**	**Lag Days**	**Expense**
1	Interest	58.7	10,692	59.2	9,971	59.9	9,187	61.3	8,510
2	Retained Earnings	-	20,871	-	21,192	-	20,586	-	15,575
3	Dividends	182.5	10,000	182.5	10,000	182.5	-	182.5	-
4	Depreciation	-	18,033	-	16,436	-	14,404	-	13,053

6.1 Retained Earnings and Depreciation

33. Consistent with accepted practice for lead-lag studies, retained earnings and depreciation both have expense lags equivalent to zero days.

6.2 Interest on Long Term Debt

34. EWSI pays interest on inter-company long term debt issued by EPCOR Utilities Inc. (EUI) as well as interest on the City of Edmonton Debentures (COE debt). Both the COE debt and inter-company notes are paid at various times throughout the year. All interest is paid on a semi-annual basis. The midpoint of the consumption period for long term interest is 182.5 days, or July 2. The overall lag (lead) for interest expense is calculated as the weighted average lag (lead) of each individual debt issue.

35. Tables 6.2-1 to 6.2-4 show the calculation of long term debt lag (lead) days. The interest expense lag was 61.3 days in 2016, the lag decreased to 59.9 days in 2017, 59.2 days in 2018, and 58.7 days in 2019. The change in the net lag for long term debt are attributable to new debt issuances in the latter part of each year, with interest payments shifting back to mid-year, decreasing the overall long term debt expense lag.

Table 6.2-1
Long Term Debt Lag (Lead) – 2019

	Description	A Interest Rate	B Face Value	C Interest Expense	Payment Dates D First	 E Second	 F Mid-Year	Payment Lags G First	 H Second	 I Average	J Weight	K Weighted Total Lag
1	IC-EUI-8B-0048	4.88%	20,000	721	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	6.7%	4.1
2	IC-EUI-8B-0071	4.62%	20,000	923	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	8.6%	(5.2)
3	IC-EUI-8B-0076	4.73%	35,000	1,656	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	15.5%	9.4
4	IC-EUI-8B-0078	4.12%	20,000	824	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	7.7%	4.7
5	IC-EUI-8B-0081	4.41%	12,000	529	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	4.9%	3.0
6	IC-EUI-8B-2016	4.01%	25,000	1,003	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	9.4%	5.7
7	IC-EUI-8B-2017	3.72%	30,000	1,116	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	10.4%	6.4
8	IC-EUI-8B-2018	4.16%	25,000	1,040	3-Jun	3-Dec	1-Jul	(28.5)	154.5	63.0	9.7%	6.1
9	IC-EUI-8B-2019	3.23%	40,000	108		31-Dec	1-Jul		182.5	91.3	1.0%	0.9
10	COE - Debt	5.00%	53,194	2,773	30-Jun	31-Dec	1-Jul	(1.5)	182.5	90.5	25.9%	23.5
11				**10,692**							**74.1%**	**58.7**

Table 6.2-2
Long Term Debt Lag (Lead) – 2018

	Description	A Interest Rate	B Face Value	C Interest Expense	Payment Dates D First	 E Second	 F Mid-Year	Payment Lags G First	 H Second	 I Average	J Weight	K Weighted Total Lag
1	IC-EUI-8B-0048	4.88%	20,000	761	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	7.6%	4.7
2	IC-EUI-8B-0071	4.62%	20,000	923	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	9.3%	(5.6)
3	IC-EUI-8B-0076	4.73%	35,000	1,656	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	16.6%	10.1
4	IC-EUI-8B-0078	4.12%	20,000	824	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	8.3%	5.0
5	IC-EUI-8B-0081	4.41%	12,000	529	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.3%	3.2
6	IC-EUI-8B-2016	4.01%	25,000	1,003	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	10.1%	6.1
7	IC-EUI-8B-2017	3.72%	30,000	1,116	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	11.2%	6.8
8	IC-EUI-8B-2018	4.16%	25,000	87		31-Dec	1-Jul		182.5	91.3	0.9%	0.8
10	COE - Debt	5.00%	53,194	3,073	30-Jun	31-Dec	1-Jul	(1.5)	182.5	90.5	30.8%	27.9
11				**9,971**							**100.0%**	**59.2**

Table 6.2-3
Long Term Debt Lag (Lead) – 2017

	Description	A Interest Rate	B Face Value	C Interest Expense	Payment Dates D First	E Second	F Mid-Year	Payment Lags G First	H Second	I Average	J Weight	K Weighted Total Lag
1	IC-EUI-8B-0048	4.88%	20,000	800	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	8.7%	5.3
2	IC-EUI-8B-0071	4.62%	20,000	923	1-Feb	1-Aug	1-Jul	(150.5)	30.5	(60.0)	10.0%	(6.0)
3	IC-EUI-8B-0076	4.73%	35,000	1,656	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	18.0%	11.0
4	IC-EUI-8B-0078	4.12%	20,000	824	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	9.0%	5.5
5	IC-EUI-8B-0081	4.41%	12,000	529	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	5.8%	3.5
6	IC-EUI-8B-2016	4.01%	25,000	1,003	1-Jun	1-Dec	1-Jul	(30.5)	152.5	61.0	10.9%	6.7
7	IC-EUI-8B-2017	3.72%	30,000	93		31-Dec	1-Jul		182.5	91.3	1.0%	0.9
10	COE - Debt	5.00%	53,194	3,361	30-Jun	31-Dec	1-Jul	(1.5)	182.5	90.5	36.6%	33.1
11				**9,187**							**100.0%**	**59.9**

Table 6.2-4
Long Term Debt Lag (Lead) – 2016

	Description	A Interest Rate	B Face Value	C Interest Expense	Payment Dates D First	E Second	F Mid-Year	Payment Lags G First	H Second	I Average	J Weight	K Weighted Total Lag
1	IC-EUI-8B-0048	4.88%	20,000	836	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	9.8%	6.0
2	IC-EUI-8B-0071	4.62%	20,000	923	1-Feb	1-Aug	1-Jul	(151.0)	31.0	(60.0)	10.8%	(6.5)
3	IC-EUI-8B-0076	4.73%	35,000	1,656	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	19.5%	12.0
4	IC-EUI-8B-0078	4.12%	20,000	824	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	9.7%	6.0
5	IC-EUI-8B-0081	4.41%	12,000	529	1-Jun	1-Dec	1-Jul	(30.0)	153.0	61.5	6.2%	3.8
6	IC-EUI-8B-2016	4.01%	25,000	84		31-Dec	1-Jul		183.0	91.5	1.0%	0.9
10	COE - Debt	5.00%	53,194	3,659	30-Jun	31-Dec	1-Jul	(1.0)	183.0	91.0	43.0%	39.1
11				**8,510**							**100.0%**	**61.3**

6.3 Common Dividends

36. EWSI issues common dividends on December 31 for the current fiscal year, at the end of the consumption period. Accordingly, the common dividend lag is 182.5 days (365/2) for 2016, 2017, 2018, and 2019.

7.0 STUDY RESULTS

37. For the 2022-2024 PBR Term EWSI is proposing the lead lag ratios and days provided in Table 7.0-1 (columns E and F).

Table 7.0-1
Summary of 2016-2019
Lead Lag Ratios

		A	B	C	D	E	F
		2019	**2018**	**2017**	**2016**	**Average**	**Lead/(Lag) Days**
1	Operating Expenses	4.3 %	4.6 %	5.8 %	4.9 %	**4.9 %**	**17.9**
2	Depreciation	13.4 %	13.5 %	14.7 %	14.0 %	**13.9 %**	**50.7**
3	Retained Earnings	13.4 %	13.5 %	14.7 %	14.0 %	**13.9 %**	**50.7**
4	Dividend	(50.0 %)	(50.0 %)	(50.0 %)	(50.1 %)	**(50.0 %)**	**(182.5)**
5	Interest Expense	(2.7 %)	(2.7 %)	(1.7 %)	(2.8 %)	**(2.5 %)**	**(9.1)**
6	GST Collection	0.9 %	1.0 %	2.2 %	1.5 %	**1.4 %**	**5.1**
7	GST Input Tax Credit	5.8 %	5.8 %	5.8 %	5.8 %	**5.8 %**	**21.0**

38. Comparison of EWSI’s Lead Lag Study with those of other Canadian regulated entities shows that both the items included in the lead lag study and the resulting working capital ratios are consistent with those of other Canadian regulated entities.

39. Table 7.0-2 compares working capital ratios among other regulated entities. Review of the calculation of these ratios shows a high degree of consistency in study methodology among regulated entities.

Table 7.0-2
Comparative Study Working Capital Ratios

		A	B	C	D	E	F	G	H	I
		Comparative Studies					**Range**			**EWSI**
		EDTI Tran[1]	**ATCO Gas[2]**	**Enmax Tran[3]**	**AltaLink[4]**	**Hydro One[5]**	**Low**	**High**	**Avg**	**Avg**
1	O&M Expenses	3.8 %	1.5 %	0.8 %	9.5 %	7.3 %	0.8 %	9.5 %	4.6 %	**4.9 %**
2	Income Tax Installments	N/A	4.8 %	N/A	(0.1)%	10.5 %	(0.1)%	10.5 %	5.0 %	**N/A**
3	Other Taxes	-	(6.7)%	(8.2)%	(4.4)%	9.4 %	(8.2)%	9.4 %	(2.0)%	**7.1 %**
4	Long Term Debt Interest	(37.8)%	4.1 %	8.2 %	(12.7)%	14.7 %	(37.8)%	14.7 %	(4.7)%	**(2.5)%**
5	Common Dividends	(0.2)%	(15.0)%	-	-	N/A	(15.0)%	-	(3.8)%	**(50.0)%**
6	Retained Earnings	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**13.9 %**
7	Depreciation Expense	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**13.9 %**

40. Comparison of EWSI's working capital ratios to those of the other companies included in Table 7.0-2 shows the following:

- EWSI's working capital ratios for O&M Expenses and Other Taxes are well within the range of the other companies included in the comparison;
- Since EWSI is not subject to income taxes this category does not apply to it;
- EWSI's working capital ratio for Dividends are higher than the other companies. The other companies included in the comparison issue dividends either quarterly or mid-year. EWSI issue its dividend at the end of the year, resulting in a higher working capital lag;
- EWSI's working capital ratios for retained earnings and depreciation are higher than those of the other companies included in Table 7.0-2. These ratios are based on revenue lag days. Since all of EWSI's revenues are derived from retail customers, rather than settlement with AESO or other system operators, EWSI's collection periods are longer than those of the other companies in the comparison. Accordingly, EWSI's ratios are reasonable;
- EWSI's long term debt interest ratios are slightly lower than those of the other companies in Table 7.0-2. These ratios are based on the difference between revenue lag days and interest expense lag days. EWSI based its calculation of interest expense lag days on the actual dates of interest paid during the year, a methodology also used by ENMAX, HydroOne, and AltaLink. This methodology provides a representative

[1] EDTI 2020-2022 TFO Tariff Application, MFR Schedules, Schedule 11-3.
[2] ATCO Gas GRA Filing 2011-2012, December 2010.
[3] EPC 2018-2020 Transmission General Tariff Application, Appendix Q - EPC Lead Lag Study (Chymko).
[4] AltaLink Management Ltd. 2019 - 2021 General Tariff Application, Table 11.2-1.
[5] Hydro 1 EB-2017-0049, GTA Exhibit D1, Tab 1, Schedule 3, 2018 Test Year, March 03, 2017.

view of actual cash flows throughout the year. Accordingly, EWSI's long term debt interest ratio is reasonable;

41. EDTI and EWSI have significantly different long term debt interest ratios. EDTI used a simplified methodology to calculate interest expense lag days. EDTI assumed that interest is paid twice annually, resulting in a consumption period of 182.5 days (365/2). Subtracting this lag from EDTI's revenue lag of 44.50 days, yields an interest expense lag 138 days (37.8%).

7.1 Appendix 1: Salary, Overtime and Wage Lag details

Table A1-1
Salary Lag
Year Ending December 31, 2019
(days)

		A	B	C	D	E	F	G	H
	Period Start Date	**Mid Period**	**Period End**	**Processing**	**Payment Date**	**Consumption Lag**	**Processing Lag**	**Payment Lag**	**Total Lag**
1	23-Dec-18	29-Dec-18	05-Jan-19	07-Jan-19	11-Jan-19	7.00	2.00	4.00	13.00
2	06-Jan-19	12-Jan-19	19-Jan-19	21-Jan-19	25-Jan-19	7.00	2.00	4.00	13.00
3	20-Jan-19	26-Jan-19	02-Feb-19	04-Feb-19	08-Feb-19	7.00	2.00	4.00	13.00
4	03-Feb-19	09-Feb-19	16-Feb-19	18-Feb-19	22-Feb-19	7.00	2.00	4.00	13.00
5	17-Feb-19	23-Feb-19	02-Mar-19	04-Mar-19	08-Mar-19	7.00	2.00	4.00	13.00
6	03-Mar-19	09-Mar-19	16-Mar-19	18-Mar-19	22-Mar-19	7.00	2.00	4.00	13.00
7	17-Mar-19	23-Mar-19	30-Mar-19	01-Apr-19	05-Apr-19	7.00	2.00	4.00	13.00
8	31-Mar-19	06-Apr-19	13-Apr-19	15-Apr-19	18-Apr-19	7.00	2.00	3.00	12.00
9	14-Apr-19	20-Apr-19	27-Apr-19	29-Apr-19	03-May-19	7.00	2.00	4.00	13.00
10	28-Apr-19	04-May-19	11-May-19	13-May-19	17-May-19	7.00	2.00	4.00	13.00
11	12-May-19	18-May-19	25-May-19	27-May-19	31-May-19	7.00	2.00	4.00	13.00
12	26-May-19	01-Jun-19	08-Jun-19	10-Jun-19	14-Jun-19	7.00	2.00	4.00	13.00
13	09-Jun-19	15-Jun-19	22-Jun-19	24-Jun-19	28-Jun-19	7.00	2.00	4.00	13.00
14	23-Jun-19	29-Jun-19	06-Jul-19	08-Jul-19	12-Jul-19	7.00	2.00	4.00	13.00
15	07-Jul-19	13-Jul-19	20-Jul-19	22-Jul-19	26-Jul-19	7.00	2.00	4.00	13.00
16	21-Jul-19	27-Jul-19	03-Aug-19	05-Aug-19	09-Aug-19	7.00	2.00	4.00	13.00
17	04-Aug-19	10-Aug-19	17-Aug-19	19-Aug-19	23-Aug-19	7.00	2.00	4.00	13.00
18	18-Aug-19	24-Aug-19	31-Aug-19	02-Sep-19	06-Sep-19	7.00	2.00	4.00	13.00
19	01-Sep-19	07-Sep-19	14-Sep-19	16-Sep-19	20-Sep-19	7.00	2.00	4.00	13.00
20	15-Sep-19	21-Sep-19	28-Sep-19	30-Sep-19	04-Oct-19	7.00	2.00	4.00	13.00
21	29-Sep-19	05-Oct-19	12-Oct-19	14-Oct-19	18-Oct-19	7.00	2.00	4.00	13.00
22	13-Oct-19	19-Oct-19	26-Oct-19	28-Oct-19	01-Nov-19	7.00	2.00	4.00	13.00
23	27-Oct-19	02-Nov-19	09-Nov-19	11-Nov-19	15-Nov-19	7.00	2.00	4.00	13.00
24	10-Nov-19	16-Nov-19	23-Nov-19	25-Nov-19	29-Nov-19	7.00	2.00	4.00	13.00
25	24-Nov-19	30-Nov-19	07-Dec-19	09-Dec-19	13-Dec-19	7.00	2.00	4.00	13.00
26	08-Dec-19	14-Dec-19	21-Dec-19	23-Dec-19	27-Dec-19	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**3.96**	**12.96**

Table A1-2
Salary Lag
Year Ending December 31, 2018
(days)

		A	B	C	D	E	F	G	H
	Period Start Date	Mid Period	Period End	Processing	Payment Date	Consumption Lag	Processing Lag	Payment Lag	Total Lag
1	24-Dec-17	30-Dec-17	06-Jan-18	08-Jan-18	12-Jan-18	7.00	2.00	4.00	13.00
2	07-Jan-18	13-Jan-18	20-Jan-18	22-Jan-18	26-Jan-18	7.00	2.00	4.00	13.00
3	21-Jan-18	27-Jan-18	03-Feb-18	05-Feb-18	09-Feb-18	7.00	2.00	4.00	13.00
4	04-Feb-18	10-Feb-18	17-Feb-18	19-Feb-18	23-Feb-18	7.00	2.00	4.00	13.00
5	18-Feb-18	24-Feb-18	03-Mar-18	05-Mar-18	09-Mar-18	7.00	2.00	4.00	13.00
6	04-Mar-18	10-Mar-18	17-Mar-18	19-Mar-18	23-Mar-18	7.00	2.00	4.00	13.00
7	18-Mar-18	24-Mar-18	31-Mar-18	02-Apr-18	06-Apr-18	7.00	2.00	4.00	13.00
8	01-Apr-18	07-Apr-18	14-Apr-18	16-Apr-18	20-Apr-18	7.00	2.00	4.00	13.00
9	15-Apr-18	21-Apr-18	28-Apr-18	30-Apr-18	04-May-18	7.00	2.00	4.00	13.00
10	29-Apr-18	05-May-18	12-May-18	14-May-18	18-May-18	7.00	2.00	4.00	13.00
11	13-May-18	19-May-18	26-May-18	28-May-18	01-Jun-18	7.00	2.00	4.00	13.00
12	27-May-18	02-Jun-18	09-Jun-18	11-Jun-18	15-Jun-18	7.00	2.00	4.00	13.00
13	10-Jun-18	16-Jun-18	23-Jun-18	25-Jun-18	29-Jun-18	7.00	2.00	4.00	13.00
14	24-Jun-18	30-Jun-18	07-Jul-18	09-Jul-18	13-Jul-18	7.00	2.00	4.00	13.00
15	08-Jul-18	14-Jul-18	21-Jul-18	23-Jul-18	27-Jul-18	7.00	2.00	4.00	13.00
16	22-Jul-18	28-Jul-18	04-Aug-18	06-Aug-18	10-Aug-18	7.00	2.00	4.00	13.00
17	05-Aug-18	11-Aug-18	18-Aug-18	20-Aug-18	24-Aug-18	7.00	2.00	4.00	13.00
18	19-Aug-18	25-Aug-18	01-Sep-18	03-Sep-18	07-Sep-18	7.00	2.00	4.00	13.00
19	02-Sep-18	08-Sep-18	15-Sep-18	17-Sep-18	21-Sep-18	7.00	2.00	4.00	13.00
20	16-Sep-18	22-Sep-18	29-Sep-18	01-Oct-18	05-Oct-18	7.00	2.00	4.00	13.00
21	30-Sep-18	06-Oct-18	13-Oct-18	15-Oct-18	19-Oct-18	7.00	2.00	4.00	13.00
22	14-Oct-18	20-Oct-18	27-Oct-18	29-Oct-18	02-Nov-18	7.00	2.00	4.00	13.00
23	28-Oct-18	03-Nov-18	10-Nov-18	12-Nov-18	16-Nov-18	7.00	2.00	4.00	13.00
24	11-Nov-18	17-Nov-18	24-Nov-18	26-Nov-18	30-Nov-18	7.00	2.00	4.00	13.00
25	25-Nov-18	01-Dec-18	08-Dec-18	10-Dec-18	14-Dec-18	7.00	2.00	4.00	13.00
26	09-Dec-18	15-Dec-18	22-Dec-18	24-Dec-18	28-Dec-18	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**4.00**	**13.00**

Table A1-3
Salary Lag
Year Ending December 31, 2017
(days)

	Period start date	A Mid Period	B Period End	C Processing	D Payment Date	E Consumption Lag	F Processing Lag	G Payment Lag	H Total Lag
1	25-Dec-16	31-Dec-16	07-Jan-17	09-Jan-17	13-Jan-17	7.00	2.00	4.00	13.00
2	08-Jan-17	14-Jan-17	21-Jan-17	23-Jan-17	27-Jan-17	7.00	2.00	4.00	13.00
3	22-Jan-17	28-Jan-17	04-Feb-17	06-Feb-17	10-Feb-17	7.00	2.00	4.00	13.00
4	05-Feb-17	11-Feb-17	18-Feb-17	20-Feb-17	24-Feb-17	7.00	2.00	4.00	13.00
5	19-Feb-17	25-Feb-17	04-Mar-17	06-Mar-17	10-Mar-17	7.00	2.00	4.00	13.00
6	05-Mar-17	11-Mar-17	18-Mar-17	20-Mar-17	24-Mar-17	7.00	2.00	4.00	13.00
7	19-Mar-17	25-Mar-17	01-Apr-17	03-Apr-17	07-Apr-17	7.00	2.00	4.00	13.00
8	02-Apr-17	08-Apr-17	15-Apr-17	17-Apr-17	21-Apr-17	7.00	2.00	4.00	13.00
9	16-Apr-17	22-Apr-17	29-Apr-17	01-May-17	05-May-17	7.00	2.00	4.00	13.00
10	30-Apr-17	06-May-17	13-May-17	15-May-17	19-May-17	7.00	2.00	4.00	13.00
11	14-May-17	20-May-17	27-May-17	29-May-17	02-Jun-17	7.00	2.00	4.00	13.00
12	28-May-17	03-Jun-17	10-Jun-17	12-Jun-17	16-Jun-17	7.00	2.00	4.00	13.00
13	11-Jun-17	17-Jun-17	24-Jun-17	26-Jun-17	30-Jun-17	7.00	2.00	4.00	13.00
14	25-Jun-17	01-Jul-17	08-Jul-17	10-Jul-17	14-Jul-17	7.00	2.00	4.00	13.00
15	09-Jul-17	15-Jul-17	22-Jul-17	24-Jul-17	28-Jul-17	7.00	2.00	4.00	13.00
16	23-Jul-17	29-Jul-17	05-Aug-17	07-Aug-17	11-Aug-17	7.00	2.00	4.00	13.00
17	06-Aug-17	12-Aug-17	19-Aug-17	21-Aug-17	25-Aug-17	7.00	2.00	4.00	13.00
18	20-Aug-17	26-Aug-17	02-Sep-17	04-Sep-17	08-Sep-17	7.00	2.00	4.00	13.00
19	03-Sep-17	09-Sep-17	16-Sep-17	18-Sep-17	22-Sep-17	7.00	2.00	4.00	13.00
20	17-Sep-17	23-Sep-17	30-Sep-17	02-Oct-17	06-Oct-17	7.00	2.00	4.00	13.00
21	01-Oct-17	07-Oct-17	14-Oct-17	16-Oct-17	20-Oct-17	7.00	2.00	4.00	13.00
22	15-Oct-17	21-Oct-17	28-Oct-17	30-Oct-17	03-Nov-17	7.00	2.00	4.00	13.00
23	29-Oct-17	04-Nov-17	11-Nov-17	13-Nov-17	17-Nov-17	7.00	2.00	4.00	13.00
24	12-Nov-17	18-Nov-17	25-Nov-17	27-Nov-17	01-Dec-17	7.00	2.00	4.00	13.00
25	26-Nov-17	02-Dec-17	09-Dec-17	11-Dec-17	15-Dec-17	7.00	2.00	4.00	13.00
26	10-Dec-17	16-Dec-17	23-Dec-17	25-Dec-17	29-Dec-17	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**4.00**	**13.00**

Table A1-4
Salary Lag
Year Ending December 31, 2016
(days)

		A	B	C	D	E	F	G	H
	Period start date	**Mid Period**	**Period End**	**Processing**	**Payment Date**	**Consumption Lag**	**Processing Lag**	**Payment Lag**	**Total Lag**
1	27-Dec-15	02-Jan-16	09-Jan-16	11-Jan-16	15-Jan-16	7.00	2.00	4.00	13.00
2	10-Jan-16	16-Jan-16	23-Jan-16	25-Jan-16	29-Jan-16	7.00	2.00	4.00	13.00
3	24-Jan-16	30-Jan-16	06-Feb-16	08-Feb-16	12-Feb-16	7.00	2.00	4.00	13.00
4	07-Feb-16	13-Feb-16	20-Feb-16	22-Feb-16	26-Feb-16	7.00	2.00	4.00	13.00
5	21-Feb-16	27-Feb-16	05-Mar-16	07-Mar-16	11-Mar-16	7.00	2.00	4.00	13.00
6	06-Mar-16	12-Mar-16	19-Mar-16	21-Mar-16	24-Mar-16	7.00	2.00	3.00	12.00
7	20-Mar-16	26-Mar-16	02-Apr-16	04-Apr-16	08-Apr-16	7.00	2.00	4.00	13.00
8	03-Apr-16	09-Apr-16	16-Apr-16	18-Apr-16	22-Apr-16	7.00	2.00	4.00	13.00
9	17-Apr-16	23-Apr-16	30-Apr-16	02-May-16	06-May-16	7.00	2.00	4.00	13.00
10	01-May-16	07-May-16	14-May-16	16-May-16	20-May-16	7.00	2.00	4.00	13.00
11	15-May-16	21-May-16	28-May-16	30-May-16	03-Jun-16	7.00	2.00	4.00	13.00
12	29-May-16	04-Jun-16	11-Jun-16	13-Jun-16	17-Jun-16	7.00	2.00	4.00	13.00
13	12-Jun-16	18-Jun-16	25-Jun-16	27-Jun-16	30-Jun-16	7.00	2.00	3.00	12.00
14	26-Jun-16	02-Jul-16	09-Jul-16	11-Jul-16	15-Jul-16	7.00	2.00	4.00	13.00
15	10-Jul-16	16-Jul-16	23-Jul-16	25-Jul-16	29-Jul-16	7.00	2.00	4.00	13.00
16	24-Jul-16	30-Jul-16	06-Aug-16	08-Aug-16	12-Aug-16	7.00	2.00	4.00	13.00
17	07-Aug-16	13-Aug-16	20-Aug-16	22-Aug-16	26-Aug-16	7.00	2.00	4.00	13.00
18	21-Aug-16	27-Aug-16	03-Sep-16	05-Sep-16	09-Sep-16	7.00	2.00	4.00	13.00
19	04-Sep-16	10-Sep-16	17-Sep-16	19-Sep-16	23-Sep-16	7.00	2.00	4.00	13.00
20	18-Sep-16	24-Sep-16	01-Oct-16	03-Oct-16	07-Oct-16	7.00	2.00	4.00	13.00
21	02-Oct-16	08-Oct-16	15-Oct-16	17-Oct-16	21-Oct-16	7.00	2.00	4.00	13.00
22	16-Oct-16	22-Oct-16	29-Oct-16	31-Oct-16	04-Nov-16	7.00	2.00	4.00	13.00
23	30-Oct-16	05-Nov-16	12-Nov-16	14-Nov-16	18-Nov-16	7.00	2.00	4.00	13.00
24	13-Nov-16	19-Nov-16	26-Nov-16	28-Nov-16	02-Dec-16	7.00	2.00	4.00	13.00
25	27-Nov-16	03-Dec-16	10-Dec-16	12-Dec-16	16-Dec-16	7.00	2.00	4.00	13.00
26	11-Dec-16	17-Dec-16	24-Dec-16	26-Dec-16	30-Dec-16	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**3.92**	**12.92**

7.2 Appendix 2: Labour and Benefit Summary Lag details

Table A2-1
Salary and Benefit Lag
Year ending December 31, 2019
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	10,417	62.74%	8.1
2	CRA	7.0	6.0	7.6	20.6	3,107	18.71%	3.9
3	Sun Life Benefits	7.0	6.0	3.0	16.0	588	3.54%	0.6
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	23	0.14%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	1,907	11.48%	3.2
6	Union Dues	7.0	6.0	3.0	16.0	71	0.43%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	16	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	2	0.01%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	320	1.93%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	24	0.14%	0.0
11	Health Services			45.6	45.6	76	0.46%	0.2
12	WCB			45.6	45.6	54	0.32%	0.1
13	**Average Withholding Lag**						100.00%	**16.6**

Table A2-2
Salary and Benefit Lag
Year ending December 31, 2018
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	10,820	62.64%	8.1
2	CRA	7.0	6.0	7.6	20.6	3,159	18.29%	3.8
3	Sun Life Benefits	7.0	6.0	3.0	16.0	591	3.42%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	29	0.17%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	2,102	12.17%	3.4
6	Union Dues	7.0	6.0	3.0	16.0	76	0.44%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	17	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	3	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	330	1.91%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	27	0.16%	0.0
11	Health Services	0.0	0.0	45.6	45.6	65	0.38%	0.2
12	WCB			45.6	45.6	56	0.33%	0.1
13	**Average Withholding Lag**						100.00%	**16.7**

[6] $ thousands.

Table A2-3
Salary and Benefit Lag
Year ending December 31, 2017
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	10,310	62.46%	8.1
2	CRA	7.0	6.0	7.6	20.6	2,962	17.95%	3.7
3	Sun Life Benefits	7.0	6.0	3.0	16.0	528	3.20%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	25	0.15%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	2,140	12.96%	3.6
6	Union Dues	7.0	6.0	3.0	16.0	70	0.42%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	16	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	3	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	311	1.89%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	21	0.13%	0.0
11	Health Services	0.0	0.0	45.6	45.6	63	0.38%	0.2
12	WCB			45.6	45.6	58	0.35%	0.2
13	**Average Withholding Lag**						100.00%	**16.7**

Table A2-4
Salary and Benefit Lag
Year ending December 31, 2018
(days)

	Component	A Period Midpoint	B Processing Lag	C Payment Lag	D Total	E Actual Payroll[6]	F Weight	G Weighted Days
1	Salaries, Overtime & Wages	7.0	2.0	3.9	12.9	9,980	62.43%	8.1
2	CRA	7.0	6.0	7.6	20.6	2,973	18.60%	3.8
3	Sun Life Benefits	7.0	6.0	3.0	16.0	464	2.91%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	28	0.18%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	2,032	12.71%	3.6
6	Union Dues	7.0	6.0	3.0	16.0	64	0.40%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	14	0.09%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	3	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	299	1.87%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	23	0.14%	0.0
11	Health Services	0.0	0.0	45.6	45.6	54	0.34%	0.2
12	WCB			45.8	45.8	51	0.32%	0.1
13	**Average Withholding Lag**						100.00%	**16.7**

7.3 Appendix 3: General Expense Lag details

Table A3-1
Operating Expense Lag
Years ended December 31, 2017, 2018, and 2019
(days)

	Period Start	A Midpoint	B Period End	C Payment Date	D Consumption Lag Days	E Payment Lag Days	F Total Lag Days
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5
13	**Total Operating Expenses Remittance Lag**						**45.6**

Table A3-2
Operating Expense Lag
Year ended December 31, 2016
(days)

	Period Start	A Midpoint	B Period End	C Payment Date	D Consumption Lag Days	E Payment Lag Days	F Total Lag Days
1	1-Jan	16-Jan	31-Jan	29-Feb	15.5	29.0	44.5
2	1-Feb	15-Feb	29-Feb	31-Mar	14.5	30.0	45.5
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5
13	**Total Operating Expenses Remittance Lag**						**45.8**

7.4 Appendix 4: GST Lag calculations

Table A4-1
GST Lag
Years ended December 31, 2017, 2018, and 2019
(days)

	Period Start	A Midpoint	B Period End	C Filing Date	D Consumption Lag	E Remittance Lag	F GST Filing Lag	G Payment Lag	H Total Lag Days
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5	64.5	108.0
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0	66.0	111.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5	66.5	112.0
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0	67.0	113.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5	66.5	112.0
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0	67.0	113.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5	67.5	114.0
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5	66.5	112.0
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0	67.0	113.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5	66.5	112.0
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0	67.0	113.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5	67.5	114.0
13	**Total GST Lag**						**45.6**	**66.6**	**112.3**

Table A4-2
GST Lag
Years ended December 31, 2016
(days)

	Period Start	A Midpoint	B Period End	C Filing Date	D Consumption Lag	E Remittance Lag	F GST Filing Lag	G Payment Lag	H Total Lag Days
1	1-Jan	16-Jan	31-Jan	29-Feb	15.5	29.0	44.5	65.5	110.0
2	1-Feb	15-Feb	29-Feb	31-Mar	14.5	31.0	45.5	66.5	112.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5	66.5	112.0
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0	67.0	113.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5	66.5	112.0
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0	67.0	113.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5	67.5	114.0
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5	66.5	112.0
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0	67.0	113.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5	66.5	112.0
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0	67.0	113.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5	67.5	114.0
13	**Total GST Lag**						**45.8**	**66.8**	**112.5**

Appendix O3

EPCOR WATER SERVICES INC.

Drainage Services
Lead Lag Study

February 16, 2021

Table of Contents

1.0 INTRODUCTION

1. This lead-lag study has been undertaken to support the necessary working capital allowance for EPCOR Water Services Inc. (EWSI) for the 2022 to 2024 PBR filing with the City of Edmonton. A lead-lag study recognizes the timing differences between EWSI's provision of a service and payment, (revenue lag), and the timing differences between when an expense is incurred and subsequently paid, (expense lag). The net lag for an expense category is the difference between the associated revenue lag and the expense lag.

2. Lags are derived from analysis of each revenue and expenses stream and are broken down into their individual components in order to more precisely determine the total lag. EWSI's revenues are derived from fixed and metered charges for residential, multi-residential, commercial customers, and other sources. Since revenue cycles and the lead periods for each are not significantly different, they are considered together. Operating expenses are broken down into labour, salary and benefits, incentives, general expenses, property taxes, parent charges and franchise fees. An overall operating expense lag is then calculated on a weighted average and netted against the appropriate revenues. Net lags are also calculated for GST and individual capital expenses including debt interest, retained earnings, dividends, and depreciation.

3. The working capital ratio (net lag/365) is then applied against the corresponding expense amount in order to determine the portion of necessary working capital related to each component.

4. Lags are made up of two general components: consumption and payment:

- Consumption lag is the lag between when a service is provided or good consumed and the end of a consumption period. For example, if a service is billed on a weekly basis, the consumption period is a week and the consumption lag would vary between zero and seven days, depending on when the service was provided. As it is generally assumed that consumption occurs evenly over the consumption period, the mid-point of a consumption period is used to determine the consumption lag. In a weekly consumption period, the consumption lag would be 3.5 days (7/2) or in a monthly consumption period with 30 days the consumption lag would be 15 days (30/2).
- Payment lag is the time between the end of the consumption period and the receipt of cash. The payment lag sometimes includes a processing lag, which is time required to receive, process, and issue the order to proceed, however this is not always considered separately from the payment lag. The payment lag is also measured in

days and is the length between the last day of the consumption period and payment issue.

5. The lead-lag methodology used in this report is consistent with public lead-lag studies done for Hydro One Networks Inc., AltaLink, and Atco Gas among others. In addition, despite some changes in the assumptions, the underlying methodology is consistent with the principles applied in EDTI's 2020-2022 Transmission General Tariff Application with respect to necessary working capital. See further discussion in the Study Results section.

2.0 EXECUTIVE SUMMARY

6. The overall impact of the lead-lag study using 2019, and 2018 actual financial results are shown in Table 2.0-1.

Table 2.0-1
Summary of Necessary Working Capital
($ thousands)

		A	B	C	D	E	F
		2019			**2018**		
		Actual	**Ratio**	**Working Cap**	**Actual**	**Ratio**	**Working Cap**
1	Operating Expenses, net of revenue offsets	106,471	4.0 %	4,220	98,693	3.9 %	3,881
2	Depreciation	32,854	13.3 %	4,353	32,811	13.6 %	4,457
3	Retained Earnings	29,710	13.3 %	3,937	31,680	13.6 %	4,303
4	Dividends	-	(50.0 %)	-	-	(50.0 %)	-
5	Interest Expense	20,156	(5.7 %)	(1,140)	19,789	(5.5 %)	(1,094)
6	GST Collection	372	0.8 %	3	480	1.1 %	5
7	GST Input Tax Credit	5,268	5.8 %	303	7,568	5.8 %	435
8	**Necessary Working Capital**			**11,677**			**11,987**

7. The ratios used to determine EWSI's necessary working capital requirements reflect the revenue and expense lags as shown in Tables 2.0-2 and 2.0-3.

Table 2.0-2
Summary of Lags and Working Capital Ratio – 2019
(Days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	48.4	33.9	14.5	4.0 %
2	Fixed	48.4	33.9	14.5	4.0 %
3	Miscellaneous	48.4	33.9	14.5	4.0 %
4	GST Collection	48.4	45.6	2.7	0.8 %
5	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	48.4	69.0	(20.6)	(5.7 %)
7	Retained Earnings	48.4	-	48.4	13.3 %
8	Dividends	-	182.5	(182.5)	(50.0%)
9	Depreciation	48.4	-	48.4	13.3 %

Table 2.0-3
Summary of Lags and Working Capital Ratio – 2018
Number of Days
(Days)

		A **Revenue**	B **Expense**	C **Net**	D **Ratio**
1	Metered	49.6	35.2	14.4	3.9 %
2	Fixed	49.6	35.2	14.4	3.9 %
3	Miscellaneous	49.6	35.2	14.4	3.9 %
4	GST Collection	49.6	45.6	4.0	1.1 %
5	GST Input Tax Credit	66.6	45.6	21.0	5.8 %
	Capital Expenses	**Revenue**	**Expense**	**Net**	**Ratio**
6	Debt interest	49.6	69.8	(20.2)	(5.5 %)
7	Retained Earnings	49.6	-	49.6	13.6 %
8	Dividends	-	182.5	(182.5)	(50.0%)
9	Depreciation	49.6	-	49.6	13.6 %

8. Working capital lags between 2018 and 2019 have remained relatively consistent, with the changes in revenue lags attributable to changes in customer payment lag (account receivable balance). While changes in expense lags are primarily attributable to a reduction in operating expenses between 2018 and 2019, and decreases in the net lag for debt interest, reflecting debt issuances in the latter part of each year, with interest payments shifting back to mid-year, decreasing the overall debt interest expense lag.

3.0 REVENUE

9. The revenue lag is the measure of time from consumption or provision of a service by EWSI to the receipt of payment from the customer. All of EWSI's revenue streams, including: metered, fixed, and miscellaneous revenues, are subject to similar billing and payment cycles. Therefore, since these revenues are all billed in the same manner and are based on the same payment and consumption schedules, the lag period is similar for each revenue function and will not be considered separately for purposes of this report.

10. The revenue lag calculation considers several key components. Each has been broken down for clarity in understanding.

3.1 Average Consumption Period Lag

11. In order to determine the average lag for each consumption period, an average consumption period between meter readings must be determined. Each site is billed once per month, or 12 times per year. Given 365 days in 1 year, the average consumption period billed is calculated to be 30.42 days (365 divided by 12). EWSI has used the mid-point of the average consumption period billed as the consumption period lag. (30.4 days divided by 2 = 15.2 days).

3.2 Average Tariff Bill File Publish Lag and Invoice Lag

12. EWSI publishes each billing cycle exactly 6 business days after the scheduled reading date. This is in accordance with performance requirements as specified in section 2.14 of the Tariff Billing Code. Due to the fact that meter reading operations and billing cycles are performed on a business day schedule, the actual calendar day lag is 8 days for 4 (Tuesday – Friday) of the 5 cycles billed in a week and 10 days for the tariff files published on Mondays due to an extra weekend coming into play. These dates are summarized in Table 3.2-1.

Table 3.2-1
Tariff Bill File Publish Lag and Invoice Lag
(Days)

	Bill Cycle	A Meter Reading	B Tariff Bill File Publish	C Billing	D TBF Lag	E Invoice Lag
1	1	Friday	Monday	Wednesday	10.0	2.0
2	2	Monday	Tuesday	Thursday	8.0	2.0
3	3	Tuesday	Wednesday	Friday	8.0	2.0
4	4	Wednesday	Thursday	Monday	8.0	4.0
5	5	Thursday	Friday	Tuesday	8.0	4.0
6				**Average**	**8.4**	**2.8**

13. These lags are unchanged from EWSI's 2016 Lead-Lag Study, which is as expected since the billing schedule is also unchanged.

3.3 Customer Payment Lags

14. Payment is due from customer 21 days after the invoice date. Analysis of year end accounts receivable showed collections lags of 23.2 days in 2018, and 22.0 days in 2019.

15. The overall revenue lags for EWSI revenues are summarized in Table 3.3-1.

Table 3.3-1
Revenue Lag Summary
(Days)

		A **2019**	B **2018**
1	Consumption period mid-point	15.21	15.21
2	TBF Publish lag	8.40	8.40
3	Invoicing lag	2.80	2.80
4	Customer payment	21.96	23.17
5	**Total**	**48.36**	**49.58**

16. As most expense lags are netted against these revenue lags to determine the corresponding working capital ratios and requirements, revenue lags play a significant role in the determination of EWSI's overall working capital requirement.

4.0 EXPENSES

17. EWSI examined operating expenses by breaking them down into the categories of labour, salary and benefits, incentive, property taxes, franchise fees, parent charges (inter-company

allocations) and general operating expenses. The total operating expense lag is calculated by taking the weighted average of these components on a yearly basis.

4.1 Labour, Salary and Benefits

18. Labour expense is comprised of salary and benefits, including remittances to CRA, Sun Life and other employee benefit and withholding categories. The total labour and benefits lag is calculated using the weighted average of all expenses types (incentive is calculated separately). Contractor fees are included in general operating expense as they are paid through the general accounts payable cheque runs.

19. The individual labour and benefit lag for EWSI was essentially unchanged between 2018 and 2019, which is as expected.

20. Components of the labour lag other than salaries, overtime and wages are based on lag times and weightings calculated by EUI's Payroll department for EPCOR as a whole. These weighting reflect the fact that these payments are processed centrally for all EPCOR subsidiaries, so the lag times will not differ between the various EPCOR subsidiaries, including EWSI. In addition, the weighting of categories within labour and benefits is comparable between areas.

4.2 Incentive Payments

21. Employee incentives are categorized separately from other operating costs as they have a longer payment lag of approximately 290 days compared to 46 days for other operating costs and only 16-17 days for other labour costs. Employee incentives are paid annual in the second pay period of April for the previous fiscal year, resulting in a consumption lag of 182 days and a payment lag of 108 days in 2018 and 2019. Total lags for incentives were 290 days for 2018 and 2019.

4.3 Property and Business Taxes

22. Property taxes are due June 30 for the current fiscal year, halfway through the consumption period. Accordingly, the property tax lead is 1.5 days for 2018 and 2019. Business taxes are paid March 31, so the expense lag for business taxes is 92.5 days for 2018 and 2019. Total weighted lead for property and business taxes are 1.6 days for 2018, and 1.7 days for 2019.

4.4 Franchise Fees

23. Franchise fees are paid monthly to municipalities; EPCOR pays these bills in the same fashion as the general operating expenses discussed below. It is therefore assumed that the lag period is the same as general operating expenses of 45.6 days in 2018, and 2019.

4.5 Parent Charges

24. EPCOR Corporate or "Parent" charges are categorized separately from other operating costs such as material costs and contractor costs as they have a shorter payment lag. Parent charges are allocated from corporate on a monthly basis therefore the lag is the average monthly consumption period of 15.0 days compared to 45.6 days for other operating costs.

4.6 General Operating Expenses

25. A majority of EPCOR's general operating expenses are paid within 30 days of receiving the invoice; therefore, assuming expenses are incurred evenly over a month, the average consumption period is approximately 15 days. Assuming all expenses incurred in the month are paid at the end of the next month, the total lag for general operating expenses is 45.6 days in each of 2018, and 2019.

26. Net lags for revenues and expenses are summarized in Tables 4.6-1 and 4.6-2.

Table 4.6-1
Net Lag (Lead) for Revenues and Expenses – 2019
($ thousands)

		A **Amount**	B **Percentage**	C **Lag days**	D **Weighted Days**
	REVENUE				
1	Metered	150,363	75.7%	48.4	36.6
2	Fixed	40,019	20.2%	48.4	9.7
3	Miscellaneous	8,197	4.1%	48.4	2.0
4	**Subtotal**	198,578	100%		48.4
5	**NET REVENUE LAG**				**48.4**
	EXPENDITURES				
6	Labour, salaries & benefits	45,216	39.4%	16.6	6.5
7	Incentive	3,355	2.9%	290.0	8.5
8	Other operating expenses	38,639	33.7%	45.6	15.4
9	Parent charges	17,436	15.2%	15.0	2.3
10	Property tax	773	0.7%	(1.7)	(0.0)
11	Franchise fees	9,248	8.1%	15.2	1.2
12	**Subtotal**	114,668	100%		33.9
13	**NET EXPENSE LAG**				**33.9**
14	**Net Lag (Lead) For Receipts & Payments 2019**				**14.5**

Table 4.6-2
Net Lag (Lead) for Revenues and Expenses – 2018
($ thousands)

		A **Amount**	B **Percentage**	C **Lag days**	D **Weighted Days**
	REVENUE				
1	Metered	146,024	75.0%	49.6	37.2
2	Fixed	38,522	19.8%	49.6	9.8
3	Miscellaneous	10,102	5.2%	49.6	2.6
4	**Subtotal**	194,648	100%		49.6
5	**NET REVENUE LAG**				**49.6**
	EXPENDITURES				
6	Labour, salaries & benefits	36,837	33.9%	16.7	5.6
7	Incentive	3,120	2.9%	290.0	8.3
8	Other operating expenses	42,262	38.8%	45.6	17.7
9	Parent charges	16,750	15.4%	15.0	2.3
10	Property tax	901	0.8%	(1.6)	(0.0)
11	Franchise fees	8,925	8.2%	15.2	1.2
12	**Subtotal**	108,795	100%		35.2
13	**NET EXPENSE LAG**				**35.2**
14	**Net Lag (Lead) For Receipts & Payments 2018**				**14.4**

27. Overall for EWSI, the net lags for receipts and payments are 14.4 days in 2018, and 14.5 days in 2019. The changes in net lag times between 2018 and 2019 are primarily due to changes in customer payment lag each year, offset by a reduction in operating expense in 2019. These values are based on actual costs for 2018 and 2019. The working capital ratios of 3.9% in 2018, and 4.0% in 2019 are calculated from the expense net lags (14.4/365 and 14.5/365) are then applied to the overall operating expenses, net of revenue offsets, to provide the appropriate necessary working capital for this component (see Table 2.0-1).

5.0 GST

28. GST is not applicable to water sales, so EWSI only collects GST on a small proportion of its revenues, mainly for surplus sales, facility revenues and miscellaneous fees. Accordingly, EWSI is always in a refund position with the CRA. GST returns are filed monthly (usually on the last business day of the following month). Per discussions with EPCOR tax group, input credits are normally received from the CRA within 2-4 weeks of filing. Calculation of the GST remittance lag is shown in Appendix 5.

Table 5.0-1
GST Impact on Working Capital
($ thousands)

		A	B **2019**	C **2018**
	REVENUE			
1	Net Receipts applicable to GST		7,437	9,593
2	GST rate		5.00%	5.00%
3	GST collected	(a)	372	480
4	Day factor - revenue lag		48.4	49.6
5	Day factor - GST remittance		45.6	45.6
6	Net	(b)	2.7	4.0
7	Impact on Working Capital	(a)*(b)/365	3	5
	EXPENDITURES			
8	Other operating costs		38,639	42,262
9	Capital expenditures excluding labour		66,723	109,094
10	Net costs applicable to GST		105,362	151,356
11	GST rate		5.00%	5.00%
12	GST remitted	(d)	5,268	7,568
13	Day factor- GST refund lag		66.6	66.6
14	Day factor - GST applicable expense lag		45.6	45.6
15	Net	(e)	21.0	21.0
16	Impact on Working Capital	(d)*(e)/365	303	435
17	**Net GST impact on Working Capital**		**306**	**441**

29. GST collected by EWSI is based on analysis of 2018-2019 revenues, with input tax credits based on total operating expenses less labour, salaries, benefits and incentives and property taxes plus capital expenditures excluding labour components.

30. The day factor on GST applicable expenses is based on lead-lag days for general operating expenses, since capital expenditures (excluding labour) are assumed to be on the same payment schedule as all other operating costs.

31. As shown in Table 5.0-1, the impact of GST on working capital is negligible; resulting in an increase to necessary working capital of $0.44 million in 2018, and $0.31 million in 2019.

6.0 CAPITAL EXPENSES

32. Capital expenses include four categories: interest, retained earnings, common dividends and depreciation. Drainage Services did not issue a common dividend in 2018 or 2019 and is not forecast to issue a dividend over the 2022 to 2024 period. However, common dividends have

been included in the current lead lag study using the same assumption as EWSI's Water and Wastewater Treatment business units. Table 6.0-1 provides the capital expense lags for 2018 to 2019.

Table 6.0-1
Capital Expense Lags for 2018 and 2019
($ thousands)

		A	B	C	D
		2019		**2018**	
	Expense	**Lag Days**	**Expense**	**Lag Days**	**Expense**
1	Interest	69.0	20,156	69.8	19,789
2	Retained Earnings	-	29,710	-	31,680
3	Dividends	182.5	-	182.5	-
4	Depreciation	-	32,854	-	32,811

6.1 Retained Earnings and Depreciation

33. Consistent with accepted practice for lead-lag studies, retained earnings and depreciation both have expense lags equivalent to zero days.

6.2 Interest on Long Term Debt

34. EWSI pays interest on inter-company long term debt issued by EPCOR Utilities Inc. (EUI) as well as interest on the City of Edmonton Debentures (COE debt). Both the COE debt and inter-company notes are paid at various times throughout the year. Interest on inter-company long term debt is paid on a semi-annual basis, while interest on COE debt is paid annually. The midpoint of the consumption period for long term interest is 182.5 days, or July 2. The overall lag (lead) for interest expense is calculated as the weighted average lag (lead) of each individual debt issue.

35. Tables 6.2-1 and 6.2-2 show the calculation of long term debt lag (lead) days. The interest expense lag was 69.8 days in 2018, and 69.0 days in 2019. The change in the net lag for long term debt are attributable to new debt issuances in the latter part of each year, with interest payments shifting back to mid-year, decreasing the overall long term debt expense lag.

Table 6.2-1
Long Term Debt Lag (Lead) – 2019

				Payment Dates			Payment Lags				
Description	A Interest Rate	B Principal	C Interest Expense	D First	E Second	F Mid-Year	G First	H Second	I Average	J Weight	K Weighted Total Lag
1 IC-EUI-9K-2018	2.31%	30,000	652	17-Mar	17-Sep	1-Jul	(106.5)	77.5	(14.5)	3.2%	(0.5)
2 IC-EUI-9K-2019	2.31%	80,000	500	31-Dec		1-Jul	182.5		182.5	2.5%	4.5
3 COE-Sanitary-03	3.58%	50,953	1,685	31-Jul		1-Jul	29.5		29.5	8.4%	2.5
4 COE-Sanitary-04	4.15%	5,902	222	15-Apr		1-Jul	(77.5)		(77.5)	1.1%	(0.9)
5 COE-Sanitary-06	3.70%	107,598	3,812	15-Jun		1-Jul	(16.5)		(16.5)	18.9%	(3.1)
6 COE-Sanitary-07	6.04%	730	44	15-Jul		1-Jul	13.5		13.5	0.2%	0.0
7 COE-Sanitary-09	3.36%	50,492	1,686	15-Sep		1-Jul	75.5		75.5	8.4%	6.3
8 COE-Sanitary-10	3.73%	6,017	222	15-Oct		1-Jul	105.5		105.5	1.1%	1.2
9 COE-Sanitary-11	6.14%	5,358	342	15-Nov		1-Jul	136.5		136.5	1.7%	2.3
10 COE-Sanitary-12	3.83%	123,521	4,855	15-Dec		1-Jul	166.5		166.5	24.1%	40.1
11 COE-Storm-03	3.34%	21,677	670	15-Mar		1-Jul	(108.5)		(108.5)	3.3%	(3.6)
12 COE-Storm-04	4.15%	2,951	111	15-Apr		1-Jul	(77.5)		(77.5)	0.6%	(0.4)
13 COE-Storm-06	3.64%	64,479	2,238	15-Jun		1-Jul	(16.5)		(16.5)	11.1%	(1.8)
14 COE-Storm-09	3.07%	21,788	671	15-Sep		1-Jul	75.5		75.5	3.3%	2.5
15 COE-Storm-10	3.73%	3,009	111	15-Oct		1-Jul	105.5		105.5	0.6%	0.6
16 COE-Storm-12	3.59%	66,399	2,336	15-Dec		1-Jul	166.5		166.5	11.6%	19.3
17			**20,156**							**100.0%**	**69.0**

Table 6.2-2
Long Term Debt Lag (Lead) – 2018

				Payment Dates			Payment Lags				
Description	A Interest Rate	B Principal	C Interest Expense	D First	E Second	F Mid-Year	G First	H Second	I Average	J Weight	K Weighted Total Lag
1 IC-EUI-9K-2018	2.31%	30,000	28	31-Dec		1-Jul	182.5		182.5	0.1%	0.3
2 COE-Sanitary-03	3.58%	53,162	1,733	31-Jul		1-Jul	29.5		29.5	8.8%	2.6
3 COE-Sanitary-04	4.15%	6,163	230	15-Apr		1-Jul	(77.5)		(77.5)	1.2%	(0.9)
4 COE-Sanitary-06	3.70%	111,980	3,935	15-Jun		1-Jul	(16.5)		(16.5)	19.9%	(3.3)
5 COE-Sanitary-07	6.04%	888	53	15-Jul		1-Jul	13.5		13.5	0.3%	0.0
6 COE-Sanitary-09	3.36%	52,398	1,738	15-Sep		1-Jul	75.5		75.5	8.8%	6.6
7 COE-Sanitary-10	3.73%	6,283	231	15-Oct		1-Jul	105.5		105.5	1.2%	1.2
8 COE-Sanitary-11	6.14%	6,052	381	15-Nov		1-Jul	136.5		136.5	1.9%	2.6
9 COE-Sanitary-12	3.83%	130,417	5,124	15-Dec		1-Jul	166.5		166.5	25.9%	43.1
10 COE-Storm-03	3.34%	22,475	689	15-Mar		1-Jul	(108.5)		(108.5)	3.5%	(3.8)
11 COE-Storm-04	4.15%	3,081	115	15-Apr		1-Jul	(77.5)		(77.5)	0.6%	(0.4)
12 COE-Storm-06	3.64%	67,055	2,308	15-Jun		1-Jul	(16.5)		(16.5)	11.7%	(1.9)
13 COE-Storm-09	3.07%	22,600	692	15-Sep		1-Jul	75.5		75.5	3.5%	2.6
14 COE-Storm-10	3.73%	3,142	115	15-Oct		1-Jul	105.5		105.5	0.6%	0.6
15 COE-Storm-12	3.59%	69,154	2,418	15-Dec		1-Jul	166.5		166.5	12.2%	20.3
16			**19,789**							**100.0%**	**69.8**

6.3 Common Dividends

36. EWSI issues common dividends on December 31 for the current fiscal year, at the end of the consumption period. Accordingly, the common dividend lag is 182.5 days (365/2).

7.0 STUDY RESULTS

37. For the 2022-2024 PBR Term EWSI is proposing the lead lag ratios and days provided in Table 7.0-1 (columns C and D).

Table 7.0-1
Summary of 2018-2019
Lead Lag Ratios

		A	B	C	D
		2019	**2018**	**Average**	**Lead/(Lag) Days**
1	Operating Expenses	4.0 %	3.9 %	**3.9 %**	**14.4**
2	Depreciation	13.3 %	13.6 %	**13.4 %**	**49.0**
3	Retained Earnings	13.3 %	13.6 %	**13.4 %**	**49.0**
4	Dividend	(50.0 %)	(50.0 %)	**(50.0 %)**	**(182.5)**
5	Interest Expense	(5.7 %)	(5.5 %)	**(5.6 %)**	**(20.4)**
6	GST Collection	0.8 %	1.1 %	**0.9 %**	**3.3**
7	GST Input Tax Credit	5.8 %	5.8 %	**5.8 %**	**21.0**

38. Comparison of EWSI's Lead Lag Study with those of other Canadian regulated entities shows that both the items included in the lead lag study and the resulting working capital ratios are consistent with those of other Canadian regulated entities.

39. Table 7.0-2 compares working capital ratios among other regulated entities. Review of the calculation of these ratios shows a high degree of consistency in study methodology among regulated entities.

Table 7.0-2
Comparative Study Working Capital Ratios

		A	B	C	D	E	F	G	H	I
		Comparative Studies					**Range**			**EWSI**
		EDTI Tran[1]	**ATCO Gas[2]**	**Enmax Tran[3]**	**AltaLink[4]**	**Hydro One[5]**	**Low**	**High**	**Avg**	**Avg**
1	O&M Expenses	3.8 %	1.5 %	0.8 %	9.5 %	7.3 %	0.8 %	9.5 %	4.6 %	**3.9 %**
2	Income Tax Installments	N/A	4.8 %	N/A	(0.1)%	10.5 %	(0.1)%	10.5 %	5.0 %	**N/A**
3	Other Taxes	-	(6.7)%	(8.2)%	(4.4)%	9.4 %	(8.2)%	9.4 %	(2.0)%	**6.7 %**
4	Long Term Debt Interest	(37.8)%	4.1 %	8.2 %	(12.7)%	14.7 %	(37.8)%	14.7 %	(4.7)%	**(5.6)%**
5	Common Dividends	(0.2)%	(15.0)%	-	-	N/A	(15.0)%	-	(3.8)%	**(50.0)%**
6	Retained Earnings	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**13.4 %**
7	Depreciation Expense	12.2 %	8.5 %	12.4 %	12.1 %	N/A	8.5 %	12.4 %	11.3 %	**13.4 %**

40. Comparison of EWSI's working capital ratios to those of the other companies included in Table 7.0-2 shows the following:

- EWSI's working capital ratios for O&M Expenses and Other Taxes are well within the range of the other companies included in the comparison;
- Since EWSI is not subject to income taxes this category does not apply to it;
- EWSI's working capital ratio for Dividends are higher than the other companies. The other companies included in the comparison issue dividends either quarterly or mid-year. EWSI issues its dividend at the end of the year, resulting in a higher working capital lag;
- EWSI's working capital ratios for retained earnings and depreciation are higher than those of the other companies included in Table 7.0-2. These ratios are based on revenue lag days. Since all of EWSI's revenues are derived from retail customers, rather than settlement with AESO or other system operators, EWSI's collection periods are longer than those of the other companies in the comparison. Accordingly, EWSI's ratios are reasonable;
- EWSI's long term debt interest ratios are slightly lower than those of the other companies in Table 7.0-2. These ratios are based on the difference between revenue lag days and interest expense lag days. EWSI based its calculation of interest expense lag days on the actual dates of interest paid during the year, a methodology also used by ENMAX, HydroOne, and AltaLink. This methodology provides a representative

[1] EDTI 2020-2022 TFO Tariff Application, MFR Schedules, Schedule 11-3.
[2] ATCO Gas GRA Filing 2011-2012, December 2010.
[3] EPC 2018-2020 Transmission General Tariff Application, Appendix Q - EPC Lead Lag Study (Chymko).
[4] AltaLink Management Ltd. 2019 - 2021 General Tariff Application, Table 11.2-1.
[5] Hydro 1 EB-2017-0049, GTA Exhibit D1, Tab 1, Schedule 3, 2018 Test Year, March 03, 2017.

view of actual cash flows throughout the year. Accordingly, EWSI's long term debt interest ratio is reasonable;

41. EDTI and EWSI have significantly different long term debt interest ratios. EDTI used a simplified methodology to calculate interest expense lag days. EDTI assumed that interest is paid twice annually, resulting in a consumption period of 182.5 days (365/2). Subtracting this lag from EDTI's revenue lag of 44.50 days, yields an interest expense lag 138 days (37.8%).

7.1 Appendix 1: Salary, Overtime and Wage Lag details

Table A1-1
Salary Lag
Year Ending December 31, 2019
(days)

	Period start date	A Mid Period	B Period End	C Processing	D Payment Date	E Consumption Lag	F Processing Lag	G Payment Lag	H Total Lag
1	23-Dec-18	29-Dec-18	05-Jan-19	07-Jan-19	11-Jan-19	7.00	2.00	4.00	13.00
2	06-Jan-19	12-Jan-19	19-Jan-19	21-Jan-19	25-Jan-19	7.00	2.00	4.00	13.00
3	20-Jan-19	26-Jan-19	02-Feb-19	04-Feb-19	08-Feb-19	7.00	2.00	4.00	13.00
4	03-Feb-19	09-Feb-19	16-Feb-19	18-Feb-19	22-Feb-19	7.00	2.00	4.00	13.00
5	17-Feb-19	23-Feb-19	02-Mar-19	04-Mar-19	08-Mar-19	7.00	2.00	4.00	13.00
6	03-Mar-19	09-Mar-19	16-Mar-19	18-Mar-19	22-Mar-19	7.00	2.00	4.00	13.00
7	17-Mar-19	23-Mar-19	30-Mar-19	01-Apr-19	05-Apr-19	7.00	2.00	4.00	13.00
8	31-Mar-19	06-Apr-19	13-Apr-19	15-Apr-19	18-Apr-19	7.00	2.00	3.00	12.00
9	14-Apr-19	20-Apr-19	27-Apr-19	29-Apr-19	03-May-19	7.00	2.00	4.00	13.00
10	28-Apr-19	04-May-19	11-May-19	13-May-19	17-May-19	7.00	2.00	4.00	13.00
11	12-May-19	18-May-19	25-May-19	27-May-19	31-May-19	7.00	2.00	4.00	13.00
12	26-May-19	01-Jun-19	08-Jun-19	10-Jun-19	14-Jun-19	7.00	2.00	4.00	13.00
13	09-Jun-19	15-Jun-19	22-Jun-19	24-Jun-19	28-Jun-19	7.00	2.00	4.00	13.00
14	23-Jun-19	29-Jun-19	06-Jul-19	08-Jul-19	12-Jul-19	7.00	2.00	4.00	13.00
15	07-Jul-19	13-Jul-19	20-Jul-19	22-Jul-19	26-Jul-19	7.00	2.00	4.00	13.00
16	21-Jul-19	27-Jul-19	03-Aug-19	05-Aug-19	09-Aug-19	7.00	2.00	4.00	13.00
17	04-Aug-19	10-Aug-19	17-Aug-19	19-Aug-19	23-Aug-19	7.00	2.00	4.00	13.00
18	18-Aug-19	24-Aug-19	31-Aug-19	02-Sep-19	06-Sep-19	7.00	2.00	4.00	13.00
19	01-Sep-19	07-Sep-19	14-Sep-19	16-Sep-19	20-Sep-19	7.00	2.00	4.00	13.00
20	15-Sep-19	21-Sep-19	28-Sep-19	30-Sep-19	04-Oct-19	7.00	2.00	4.00	13.00
21	29-Sep-19	05-Oct-19	12-Oct-19	14-Oct-19	18-Oct-19	7.00	2.00	4.00	13.00
22	13-Oct-19	19-Oct-19	26-Oct-19	28-Oct-19	01-Nov-19	7.00	2.00	4.00	13.00
23	27-Oct-19	02-Nov-19	09-Nov-19	11-Nov-19	15-Nov-19	7.00	2.00	4.00	13.00
24	10-Nov-19	16-Nov-19	23-Nov-19	25-Nov-19	29-Nov-19	7.00	2.00	4.00	13.00
25	24-Nov-19	30-Nov-19	07-Dec-19	09-Dec-19	13-Dec-19	7.00	2.00	4.00	13.00
26	08-Dec-19	14-Dec-19	21-Dec-19	23-Dec-19	27-Dec-19	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**3.96**	**12.96**

Table A1-2
Salary Lag
Year Ending December 31, 2018
(days)

		A	B	C	D	E	F	G	H
	Period start date	Mid Period	Period End	Processing	Payment Date	Consumption Lag	Processing Lag	Payment Lag	Total Lag
1	24-Dec-17	30-Dec-17	06-Jan-18	08-Jan-18	12-Jan-18	7.00	2.00	4.00	13.00
2	07-Jan-18	13-Jan-18	20-Jan-18	22-Jan-18	26-Jan-18	7.00	2.00	4.00	13.00
3	21-Jan-18	27-Jan-18	03-Feb-18	05-Feb-18	09-Feb-18	7.00	2.00	4.00	13.00
4	04-Feb-18	10-Feb-18	17-Feb-18	19-Feb-18	23-Feb-18	7.00	2.00	4.00	13.00
5	18-Feb-18	24-Feb-18	03-Mar-18	05-Mar-18	09-Mar-18	7.00	2.00	4.00	13.00
6	04-Mar-18	10-Mar-18	17-Mar-18	19-Mar-18	23-Mar-18	7.00	2.00	4.00	13.00
7	18-Mar-18	24-Mar-18	31-Mar-18	02-Apr-18	06-Apr-18	7.00	2.00	4.00	13.00
8	01-Apr-18	07-Apr-18	14-Apr-18	16-Apr-18	20-Apr-18	7.00	2.00	4.00	13.00
9	15-Apr-18	21-Apr-18	28-Apr-18	30-Apr-18	04-May-18	7.00	2.00	4.00	13.00
10	29-Apr-18	05-May-18	12-May-18	14-May-18	18-May-18	7.00	2.00	4.00	13.00
11	13-May-18	19-May-18	26-May-18	28-May-18	01-Jun-18	7.00	2.00	4.00	13.00
12	27-May-18	02-Jun-18	09-Jun-18	11-Jun-18	15-Jun-18	7.00	2.00	4.00	13.00
13	10-Jun-18	16-Jun-18	23-Jun-18	25-Jun-18	29-Jun-18	7.00	2.00	4.00	13.00
14	24-Jun-18	30-Jun-18	07-Jul-18	09-Jul-18	13-Jul-18	7.00	2.00	4.00	13.00
15	08-Jul-18	14-Jul-18	21-Jul-18	23-Jul-18	27-Jul-18	7.00	2.00	4.00	13.00
16	22-Jul-18	28-Jul-18	04-Aug-18	06-Aug-18	10-Aug-18	7.00	2.00	4.00	13.00
17	05-Aug-18	11-Aug-18	18-Aug-18	20-Aug-18	24-Aug-18	7.00	2.00	4.00	13.00
18	19-Aug-18	25-Aug-18	01-Sep-18	03-Sep-18	07-Sep-18	7.00	2.00	4.00	13.00
19	02-Sep-18	08-Sep-18	15-Sep-18	17-Sep-18	21-Sep-18	7.00	2.00	4.00	13.00
20	16-Sep-18	22-Sep-18	29-Sep-18	01-Oct-18	05-Oct-18	7.00	2.00	4.00	13.00
21	30-Sep-18	06-Oct-18	13-Oct-18	15-Oct-18	19-Oct-18	7.00	2.00	4.00	13.00
22	14-Oct-18	20-Oct-18	27-Oct-18	29-Oct-18	02-Nov-18	7.00	2.00	4.00	13.00
23	28-Oct-18	03-Nov-18	10-Nov-18	12-Nov-18	16-Nov-18	7.00	2.00	4.00	13.00
24	11-Nov-18	17-Nov-18	24-Nov-18	26-Nov-18	30-Nov-18	7.00	2.00	4.00	13.00
25	25-Nov-18	01-Dec-18	08-Dec-18	10-Dec-18	14-Dec-18	7.00	2.00	4.00	13.00
26	09-Dec-18	15-Dec-18	22-Dec-18	24-Dec-18	28-Dec-18	7.00	2.00	4.00	13.00
27	**Average Salary Lag**					**7.00**	**2.00**	**4.00**	**13.00**

7.2 Appendix 2: Labour and Benefit Summary Lag details

Table A2-1
Salary and Benefit Lag
Year ending December 31, 2019
(days)

		A	B	C	D	E	F	G
	Component	**Period Midpoint**	**Processing Lag**	**Payment Lag**	**Total**	**Actual Payroll[6]**	**Weight**	**Weighted Days**
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	28,367	62.74%	8.1
2	CRA	7.0	6.0	7.6	20.6	8,459	18.71%	3.9
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,601	3.54%	0.6
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	64	0.14%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	5,192	11.48%	3.2
6	Union Dues	7.0	6.0	3.0	16.0	193	0.43%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	44	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	6	0.01%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	871	1.93%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	65	0.14%	0.0
11	Health Services			45.6	45.6	208	0.46%	0.2
12	WCB			45.6	45.6	147	0.32%	0.1
13	**Average Withholding Lag**						100.00%	**16.6**

Table A2-2
Salary and Benefit Lag
Year ending December 31, 2018
(days)

		A	B	C	D	E	F	G
	Component	**Period Midpoint**	**Processing Lag**	**Payment Lag**	**Total**	**Actual Payroll[6]**	**Weight**	**Weighted Days**
1	Salaries, Overtime & Wages	7.0	2.0	4.0	13.0	23,074	62.64%	8.1
2	CRA	7.0	6.0	7.6	20.6	6,736	18.29%	3.8
3	Sun Life Benefits	7.0	6.0	3.0	16.0	1,259	3.42%	0.5
4	Sun Life Savings Plan	7.0	6.0	3.0	16.0	62	0.17%	0.0
5	Local Authorities Pension	7.0	6.0	15.0	28.0	4,482	12.17%	3.4
6	Union Dues	7.0	6.0	3.0	16.0	162	0.44%	0.1
7	EPCOR Social Club & Donations	7.0	6.0	3.0	16.0	36	0.10%	0.0
8	Employee Garnishes	7.0	6.0	3.0	16.0	7	0.02%	0.0
9	Employee Savings Plan	7.0	6.0	3.0	16.0	703	1.91%	0.3
10	Wellness Personal Spending Account	15.0	0.0	15.0	30.0	59	0.16%	0.0
11	Health Services	0.0	0.0	45.6	45.6	138	0.38%	0.2
12	WCB			45.6	45.6	120	0.33%	0.1
13	**Average Withholding Lag**						100.00%	**16.7**

[6] $ thousands.

7.3 Appendix 3: General Expense Lag details

Table A3-1
Operating Expense Lag
Years ended December 31, 2018, and 2019
(days)

	Period Start	A Midpoint	B Period End	C Payment Date	D Consumption Lag Days	E Payment Lag Days	F Total Lag Days
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5
13	**Total Operating Expenses Remittance Lag**						**45.6**

7.4 Appendix 4: GST Lag calculations

Table A4-1
GST Lag
Years ended December 31, 2018, and 2019
(days)

		A	B	C	D	E	F	G	H
	Period Start	**Midpoint**	**Period End**	**Filing Date**	**Consumption Lag**	**Remittance Lag**	**GST Filing Lag**	**Payment Lag**	**Total Lag Days**
1	1-Jan	16-Jan	31-Jan	28-Feb	15.5	28.0	43.5	64.5	108.0
2	1-Feb	14-Feb	28-Feb	31-Mar	14.0	31.0	45.0	66.0	111.0
3	1-Mar	16-Mar	31-Mar	30-Apr	15.5	30.0	45.5	66.5	112.0
4	1-Apr	15-Apr	30-Apr	31-May	15.0	31.0	46.0	67.0	113.0
5	1-May	16-May	31-May	30-Jun	15.5	30.0	45.5	66.5	112.0
6	1-Jun	15-Jun	30-Jun	31-Jul	15.0	31.0	46.0	67.0	113.0
7	1-Jul	16-Jul	31-Jul	31-Aug	15.5	31.0	46.5	67.5	114.0
8	1-Aug	16-Aug	31-Aug	30-Sep	15.5	30.0	45.5	66.5	112.0
9	1-Sep	15-Sep	30-Sep	31-Oct	15.0	31.0	46.0	67.0	113.0
10	1-Oct	16-Oct	31-Oct	30-Nov	15.5	30.0	45.5	66.5	112.0
11	1-Nov	15-Nov	30-Nov	31-Dec	15.0	31.0	46.0	67.0	113.0
12	1-Dec	16-Dec	31-Dec	31-Jan	15.5	31.0	46.5	67.5	114.0
13	**Total GST Lag**						**45.6**	**66.6**	**112.3**

Appendix P

EPCOR WATER SERVICES INC.

Performance Based Regulation Background

February 16, 2021

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1.0 INTRODUCTION

1. This is a companion document to Schedule 3 of the Water Services Bylaw and the Drainage Services and Wastewater Treatment Bylaw. It is intended to provide an in-depth explanation of the various components of the performance based regulation to enhance the understanding of City Council, the City's Utility Committee and the public.

2. Under EWSI's Performance Based Regulation (PBR), EWSI typically submits an application every five years to its regulator, Edmonton City Council, to extend the PBR methodology for a subsequent five year period. With each five year application, EWSI applies the same general performance based regulation methodology and principles which underpin the Waterworks Bylaw originally developed in 2002. The PBR model was initially approved by Edmonton City Council in 2001 and has been utilized to determine water rates charged to City of Edmonton customers since January, 2002.

3. Beginning with the 2012-2016 PBR term, EWSI incorporated the wastewater treatment operations provided at the Gold Bar Wastewater Treatment Plant into the PBR structure. Drainage Services transferred to EPCOR in 2017 and this PBR Application is its first. Water, wastewater treatment and drainage services are each provided to customers under separate rate structures.

4. EWSI has submitted applications to set rates over the years 2022-2026 for Water Services and 2022-2024 for Drainage and Wastewater Treatment Services. A three year PBR term is proposed for Drainage and Wastewater Treatment in order to establish a staggered schedule for future five-year PBR terms.

5. Section 2.0 of this document presents the principles upon which the PBR Applications have been designed. Section 3.0 provides a high level overview of the operations being funded through the PBR Applications. Section 4.0 describes the rate structure, Section 5.0 describes performance measures and penalties, and Section 6.0 contains the reporting requirements of the PBR.

2.0 RATE CALCULATION PRINCIPLES

6. Water rate standards set by the AWWA and WEF are based upon a number of common principles. The purpose of these principles is to balance the interests of the customers with the

utility. EWSI has set its water wastewater treatment and drainage rates in accordance with these principles.

- Rates are based upon the cost of service.
- No cross-subsidization of rates between customer classes.
- No cross-subsidization of rates between generations of customers.
- Equity of rates to customers who are within a single customer class.
- Rate stability and predictability.

3.0 PERFORMANCE-BASED REGULATION METHODOLOGY

7. EWSI's PBR methodology reflects several key components described below.

3.1 Cost of Service

8. The cost allocation process is based on a Cost of Service Study (COSS). Costs reflects the total amount that must be collected in rates for the utility to recover its prudently incurred costs for maintaining, operating and investing in the utility system plus a fair return on investment.

3.2 Revenue Requirement

9. The components of the revenue requirement are listed in Table 3.2-1.

Table 3.2-1
Components of the Revenue Requirement

Item	A **Description**
1 Operating Costs	Costs broken down by operating cost categories (salaries and benefits, contractors and consultants, power and chemicals, materials and supplies, etc.) and by the different functional areas within Water Services, Wastewater Treatment Services and Drainage Services.
2 Revenue Offsets	Includes revenues for various service charges and fees, penalties and miscellaneous revenues.
3 Taxes and Franchise Fees	Taxes payable by EWSI (property taxes, linear taxes and business taxes) and franchise fees payable to the City of Edmonton
4 Depreciation	Capital assets are depreciated over the shortest of the assets' physical, technological, commercial or legal life. Depreciation expense is a non-cash expense reflecting the portion of a tangible capital asset that is deemed to have been consumed or expired.
5 Interest	The cost for EWSI to service its existing debt and to finance new debt requirements. EWSI's cost of new debt is based on its credit rating of A (low) as assessed by the DBRS credit rating agency.
6 Return on Equity	New capital projects are financed by a combination of debt and equity. Just as debt attracts an interest cost for borrowing, equity investment attracts a cost as well. The regulator determines the fair rate of return that the utility is allowed to earn on their investment in utility assets (rate base). A cost of capital experts recommends the appropriate return on equity for EWSI based on its business and financial risk.

3.3 Routine Adjustment

10. The annual rate adjustment is applied to each class of customer contained in Section 1 of the Water Services Bylaw 17698 and the Drainage Services and Wastewater Treatment Bylaw. Each year, certain components appear as an adjustment to the fixed monthly service charge and/or consumption charge. The categories falling under this heading are inflation, the efficiency factor and special rate adjustments.

3.4 Inflation

11. As set out in Sections 1 and 2 of Schedule 3 to the PBR Bylaw, consumption charges and fixed monthly service charges are adjusted annually by the forecast rate of inflation for the upcoming year plus an adjustment for the difference between actual and forecast inflation rate for the prior year.

3.5 Efficiency Factor

12. As set out in Sections 1 and 2 of Schedule 3 to the PBR Bylaw, the efficiency factor is a reduction to the inflation factor applied to the rates on an annual basis. The efficiency factor reduces the increase in rates to customers. It recognizes that as a business grow, it should become more efficient and the efficiency factor therefore represents the minimum amount by which EWSI must improve operational efficiency to maintain its net income.

13. For 2022-2026, EWSI proposes to maintain the 0.25% efficiency factor as the underlying industry parameters have not changed since its calculation.

3.6 Special Rate Adjustments

14. The special rate adjustments are outlined in Section 2.3 of Schedule 3 of the PBR Bylaw. The special rate adjustments are added to the consumption charge and/or fixed monthly service charge for both water rates, wastewater treatment rates, sanitary rates and stormwater rates. Special rate adjustments are required for increases to rates above inflation and includes a special rate adjustment for re-basing which his required to recover the difference between EWSI's revenue requirement forecast for the PBR term and the revenue that would be realized if annual rate increases were limited to PBR inflation. Other special rate adjustments may be required for programs or initiatives that are in addition to EWSI's core utility operations.

3.7 Non-Routine Adjustments

15. EWSI assumes the risk on all operating and capital related costs. However, there are cost factors that are beyond the control of EWSI. In the rare or unlikely situations where these factors result in a significant impact to EWSI, these costs can be passed through to customers based on city of Edmonton Council or City Manager approval. If EWSI anticipates making a request for one or more non-routine adjustments, EWSI will submit its request for non-routine adjustments to the City Manager, and will include with such request sufficient information to enable the City Manager / City Council to evaluate and approve the request, if appropriate.

16. Where a non-routine adjustment is very significant in size, it may be charged to Adjustment Deferral Account. The purpose of this is to minimize the financial impact that this could have on customers or EWSI and promote rate stability over time. The Adjustment Deferral Account balance will be treated as a working capital item.

17. EWSI will recover/credit that cost over a reasonable time frame through an adjustment to the fixed monthly meter charge in Schedule 1 of the Water Services Bylaw and the Drainage Services and Wastewater Treatment Bylaw.

3.8 Off-ramps

18. In the event that this performance-based regulation does not work in the way EWSI and its regulator intended, then the performance-based regulation can be terminated with the mutual consent and agreement of both parties prior to the expiration of its term.

19. In the event of termination of the performance-based regulation, it is necessary to wind-down the plan. Any balance of the Adjustment Deferral Account must be cleared within a one-year period from the date of termination.

4.0 PBR RATE STRUCTURE

20. EWSI's in-city customers pay both a consumption charge and a fixed monthly service charge. The fixed charge recovers costs that are directly attributable to a customer including the cost of the water meter, customer service and billing. The consumption charge captures all the costs of operations, maintenance, administration and capital investment associated with operating the water, wastewater or drainage utility.

21. **Water Services** includes the production, treatment and supply of potable water to a customer, for which EWSI charges water rates. **Wastewater Treatment Services** includes the treatment of wastewater and the storage, pumping and disposal of treated wastewater, for which EWSI charges wastewater treatment rates. **Drainage Services** includes operation of the sanitary, stormwater and combined sewer systems.

22. Customers are categorized into three rate classes for the purpose of determining which specific water rate applies to each customer. The water rate classes include: Residential, Multi-residential and Commercial.

23. Table 4.0-1 provides an overview of the rate structure for Water Services, Wastewater Treatment Services and Drainage Services.

Table 4.0-1
EWSI Rate Components

	A **Water**	B **Wastewater**	C **Stormwater**	**Sanitary**
1	Consumption Charges	Consumption Charges	Consumption Charges	
2	Fixed Monthly Service Charges	Fixed Monthly Service Charges	Fixed Monthly Service Charges	Fixed Monthly Service Charges based on Stormwater Equivalent
3	Rate Riders	Wastewater Overstrength Surcharges		
4	Miscellaneous Service Charges			

5.0 PERFORMANCE MEASURES AND PENALTIES

24. The water system service quality measures, wastewater treatment service quality measures and drainage service quality measures reflect the results of EWSI's operational performance. These measures ensure that EWSI does not compromise customer service levels as it seeks to identify cost saving opportunities during the PBR period.

25. Drainage, Water and Wastewater individually have a 100 point benchmark. Total points are determined by the summation of points available for each performance measure. In the event that service or quality drops below a benchmarked standard, EWSI is financially penalized and that penalty amount is refunded to customers through a rebate on their water, wastewater treatment or drainage bill.

6.0 ANNUAL REPORTING AND FILING REQUIREMENTS

26. **Annual Rate Filing** - On March 1st of the year following the reporting year, EWSI will file with its regulator, the City of Edmonton, an *Annual Water, Wastewater Treatment and Drainage Rate Filing*. The filing will contain five parts:

- An audit report - An accountant will review the Annual Water, Wastewater Treatment and Drainage Rate Filing, conduct an audit and prepare an audit report in accordance with the recommendations contained within Section 5805 of the Canadian Institute of Chartered Accountants Handbook, as amended from time to time.
- Rates Sheets - The water rate and wastewater treatment rate forecast for each customer class of service for the period following the reporting period; and,
- Water System Service Quality Results - The results of each of the components of the water system service quality indices.

- Wastewater Treatment Service Quality Results - The results of each of the components of the wastewater treatment service quality indices.
- Drainage Services System Quality Results – The results of each of the components of the drainage system service quality indices.

27. **Annual Operating Plan** – An Operating Plan is presented to Utility Committee early each year. The intent of the plan to provide Utility Committee, City Council and stakeholders an understanding of the major operational initiatives being undertaken by the Utilities.

28. **Annual Progress Reports -** A PBR Progress Report to City Council, outlining in detail EWSI's performance in the prior year with regards to its operational performance against its service quality standards, its financial results for the year compared to the PBR plan, and opportunities and challenges expected in the upcoming year. An update of progress on initiatives from the Annual Operating Plan is also included.

29. **Minimum Filing Requirements -** In March 2013, City Council approved EWSI's proposed Minimum Filing Requirements (MFR) to be used for the next PBR application. The MFR includes both financial and non-financial filing requirements and takes guidance from the Alberta Utilities Commission MFR. The intent of EWSI's MFR is to provide: (i) greater visibility and transparency; (ii) improved consistency and comparability in terms of structure and format of application consistent with filings by other regulated entities in Alberta; and (iii) better functionality in terms of decision-useful information in a readily extractable form.

Appendix Q

EPCOR WATER SERVICES INC.

Bill Comparison Report

February 16, 2021

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1.0 DOCUMENT PURPOSE

1. This document will discuss the components of EPCOR Water Services Inc. (EWSI) water rates, wastewater treatment rates, sanitary rates and stormwater rates and provide a comparison to those of surrounding communities and other regions based on monthly water, wastewater and drainage bills.

2.0 OVERVIEW

2.1 Water Rate Comparison

2. For purposes of preparing this document, EWSI compared its rates with the water utilities of Calgary, Regina, Saskatoon, Vancouver and Winnipeg as well as a representative selection of communities surrounding Edmonton. These communities are collectively referred to in this document as the Alberta Capital Region communities and are comprised of St. Albert, Sherwood Park, Sturgeon County and Spruce Grove.

3. Based on its review of water rates in the Alberta Capital Region and the other major cities noted above, EWSI concludes the following with respect to its proposed water rates for 2022:

- When comparing EWSI's water rates with those of other communities, there are a few notable factors related to the level of services provided and the costs incurred by the utility which cause variation in the level of rates. These factors include:
    - **quality of raw water** – the raw water quality treated by EWSI is relatively poor compared to some other communities, requiring additional treatment processes;
    - **franchise fees** – EWSI and water utilities in certain other communities pay franchise fees, whereas some others do not; and
    - **age of the system** – EWSI's distribution system is relatively old compared to other communities (particularly Alberta Capital Region) which requires higher costs to maintain and replace aging infrastructure.
- Even with these upward pressures on rates, the results show that EWSI's water rates are competitive with the other sample utilities surrounding Edmonton and in other jurisdictions.
- The sections below provide a comparison of the monthly water bills of EWSI with the other communities sampled for various customer classes and consumption

levels. The results show that water bills of EWSI's customers generally rank in the middle or low range within the communities sampled.

2.2 Total Wastewater Rate Comparison

4. It is not possible to conduct a direct comparison of EWSI's wastewater treatment rates or EWSI's sanitary and stormwater rates with those of other communities because all other communities combine the wastewater treatment and the operation of the wastewater collection system. In order to provide a meaningful comparison with other communities, EWSI has combined its wastewater treatment rates with its sanitary and stormwater rates for the collection system.

5. The combination of wastewater treatment rates and sanitary and stormwater rates (which collectively comprise the drainage bill for EWSI) is herein referred to as " total wastewater". In order to provide a meaningful comparison with other communities, the comparison is presented on a total wastewater basis.

6. Based on this comparison of EWSI's total wastewater rates with those in other communities, EWSI concludes the following with respect to its proposed rates for 2022:

- Similar to the water rate comparison, when comparing wastewater rates with those of other communities, there are a few key factors which lead to differences in rates including:
  - **franchise fees** – EWSI and certain wastewater utilities in other communities pay franchise fees, whereas some others do not;
  - **investments in resilience** – EWSI's stormwater rates include significant investment in flood protection to ensure Edmonton's resilience. In a February 2021 Report from Intact Centre on Climate Change Adaptation[1], Edmonton received a B+ score for flood preparedness, tied with Regina and Toronto for the top rank of the 16 major Canadian cities included in the report;
  - **ageing Infrastructure** – the drainage system in Edmonton is older than in surrounding communities, requiring a higher level of maintenance and renewal including corrosion and odour reduction (CORe);

[1] https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2021/02/16-Cities-Flood-Preparedness.pdf

  - **extent of treatment** – while some municipalities apply similar treatment processes as EWSI, others are able to treat wastewater to a less extent; and
  - **full cost recovery approach** – while EWSI's wastewater rates are based on full cost recovery, it is not clear if other communities take this same approach in determining their rates.
- Even with these upward pressures on rates, the results show that the wastewater rates are competitive with the other sampled utilities surrounding Edmonton and in other jurisdictions.

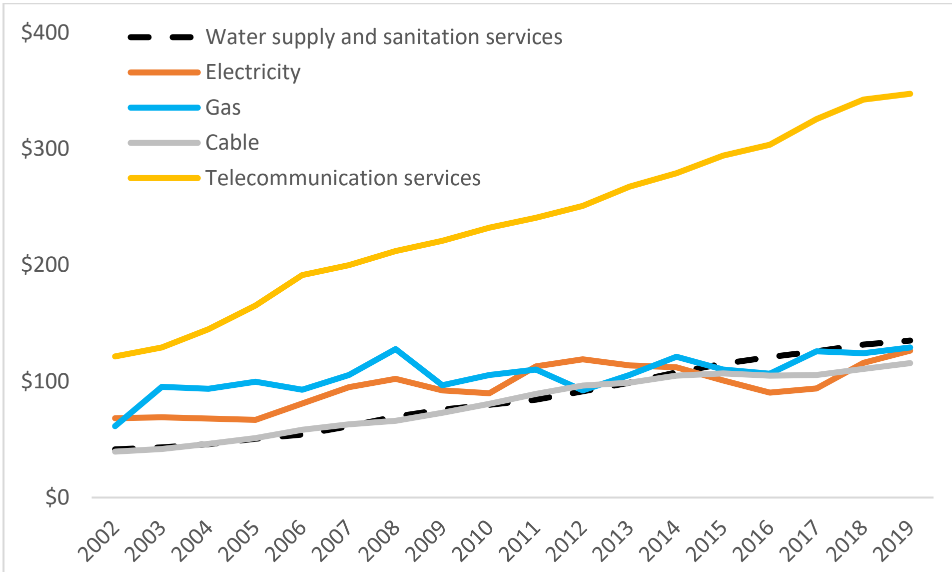
3.0 COMPARISON OF EWSI'S WATER RATES WITH OTHER UTILITY SERVICES

7. Figure 3.0-1 below, taken from Statistics Canada Detailed Household Final Consumption Expenditures in Alberta shows the average residential spending in the following categories since 2002:

- Water supply and sanitation services;
- Electricity;
- Gas;
- Telecommunication services; and
- Cable, satellite and other program distribution services.

8. The graph illustrates that, by comparison, water supply and sanitation rates, which include EWSI's water and total wastewater rates, have increased at a faster rate than electricity and gas rates, due to the significant investments required to maintain the waterworks system.

Figure 3.0-1
Household Consumption Expenditures, Alberta[2]
Average Monthly Spending
2002-2019



4.0 WATER BILL COMPARISONS

9. Surrounding communities and other regions' water rates will be compared to EWSI's based on calculated monthly water bills. While a rate comparison of this nature provides a good overview, it has inherent limitations, as discussed in the Canadian Municipal Water Consortium's "2015 Canadian Municipal Water Priorities Report":

> ... these types of comparisons don't often highlight more complex and variable structures being used to support full cost recovery... When comparing costs between municipalities, there are disparities and local realities for each system. Each municipality has chosen a different way of covering costs and has a unique combination of level of service, treatment processes, maintenance and upgrade requirements, fire protection, average consumption, population size, energy for distribution and collection, type and quality of source water and receiving water.[3]

[2] Statistics Canada. Table 36-10-0225-01 Detailed household final consumption expenditure, provincial and territorial, annual (x 1,000,000).

[3] Canadian Municipal Water Consortium. "2015 Canadian Municipal Water Priorities Report: Towards Sustainable and Resilient Water Management," page 23.

4.1 Approaches to Water Bill Comparisons

10. The comparative 2022 water bill information is based on the other utilities' water rates as of 2021, escalated by the I factor (2.31%) to determine a 2022 rate. EWSI is generally unable to find published 2022 rates for the utilities used for the comparison and therefore used 2021 rates escalated by the I factor as a conservative measure. The bill comparisons generally reflect 2022 water rates for comparable communities and are based on the total cost to the customer including fixed charges, consumption charges plus any surcharges. The proposed 2022 EWSI rates are utilized as EWSI rates for this comparison.

11. Comparisons of a residential water bill are provided for three levels of water consumption:

- Low use residential consumer (10 m3/month);
- Average use residential consumer (15 m3/month) based on the average consumption for an Edmonton household; and
- High use residential consumer (40 m3/month).

12. Comparisons are not made for the multi-residential customer class because many jurisdictions do not have a similar rate class.

13. Comparisons are made for three sizes of commercial customers:

- A small commercial business representative of a typical car wash (325 m3/month).
- A medium commercial business representative of a large hotel or large shopping center (6,000 m3/month).
- A large commercial business representative of a large-scale commercial enterprise, like a brewery or food processing plant (20,000 m3/month).

4.2 Residential Water Bill Comparison

Figure 4.2-1
Low Use Monthly Residential Water Bill
(10 m^3/month)

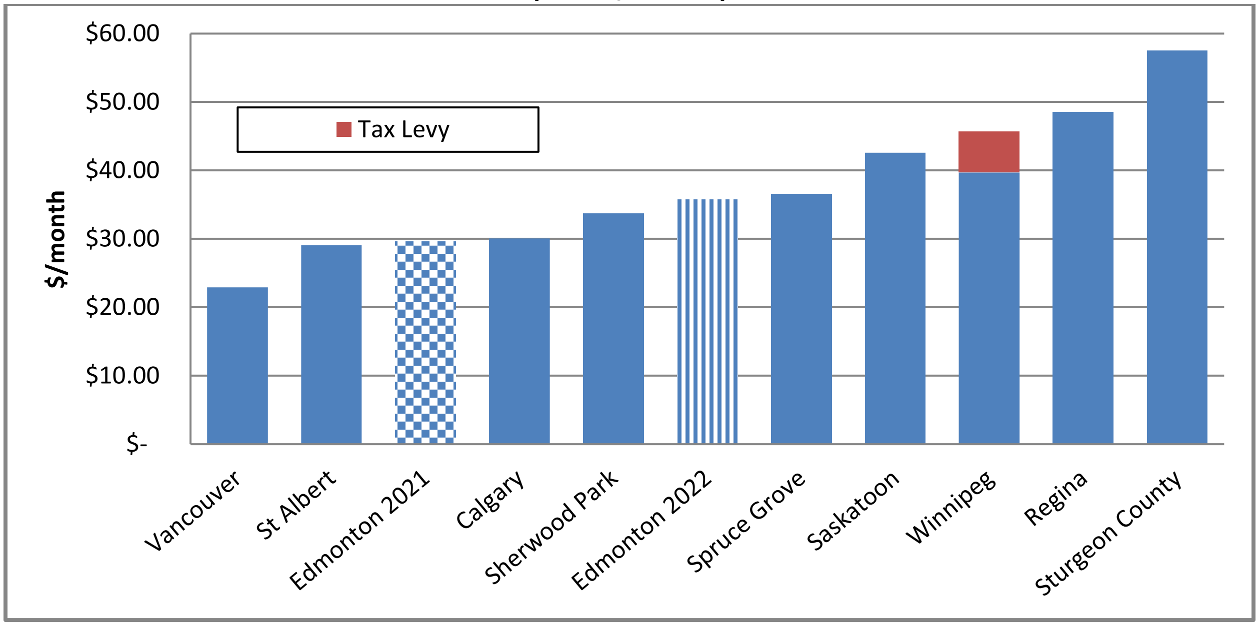


Figure 4.2-2
Average Edmonton Monthly Residential Water Bill
(15 m^3/month)

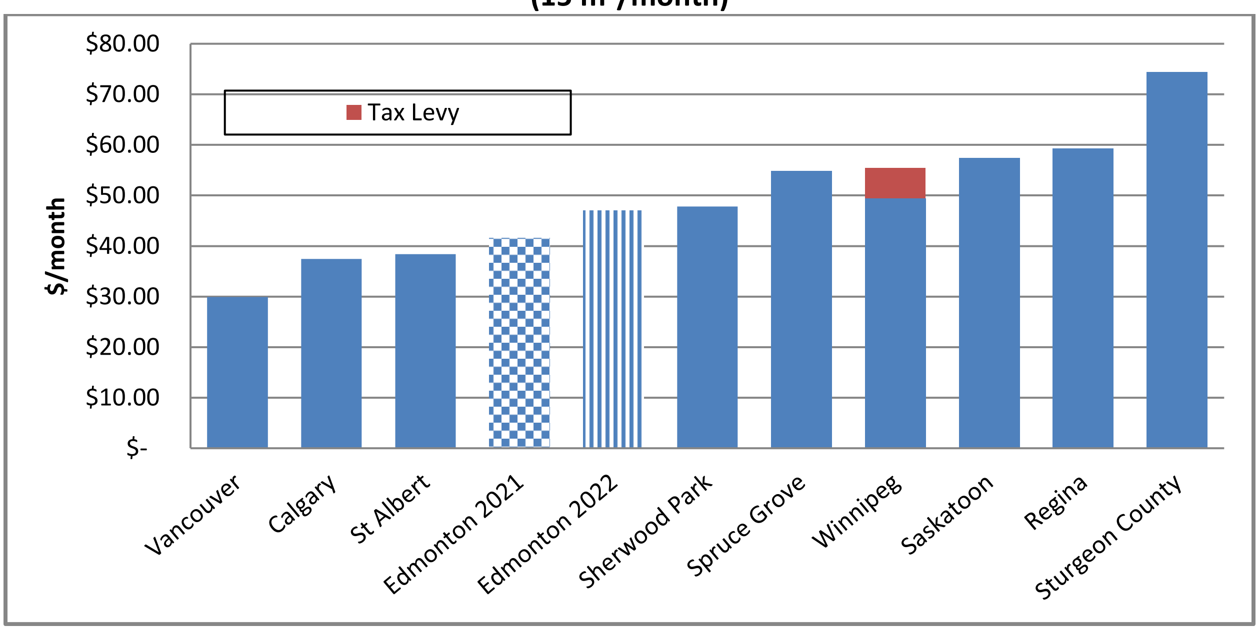
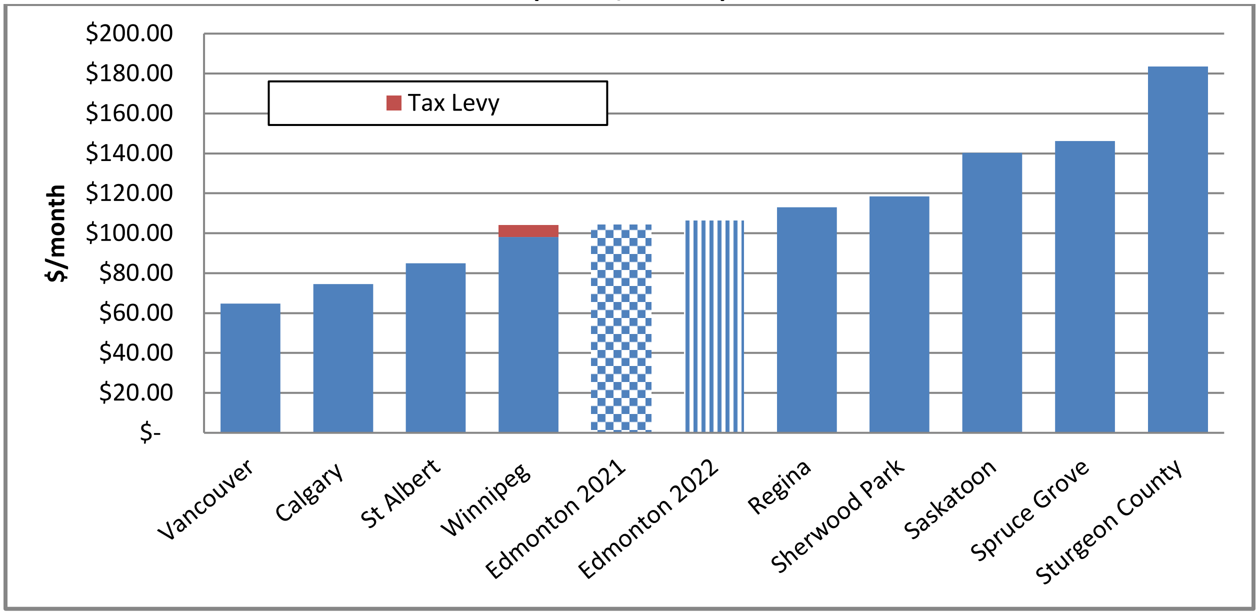


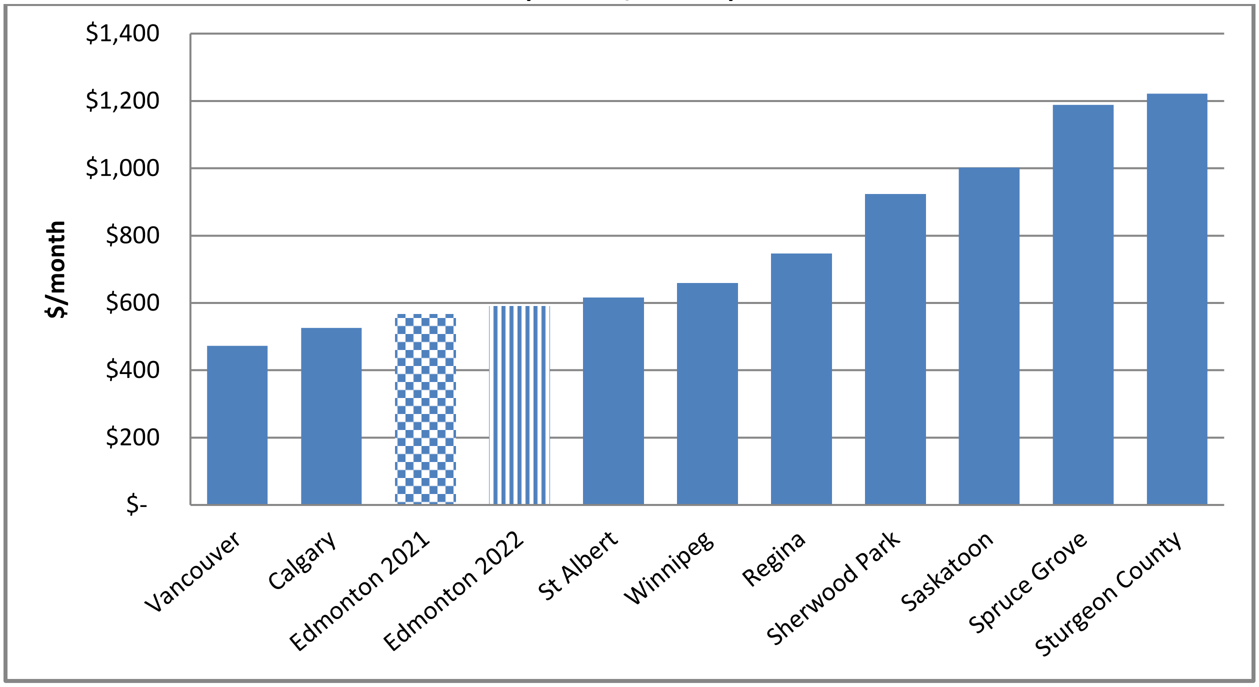
Figure 4.2-3
High Use Monthly Residential Water Bill
(40 m³/month)



14. Overall in the residential segment, EWSI's proposed rates are competitive compared to the other utilities.

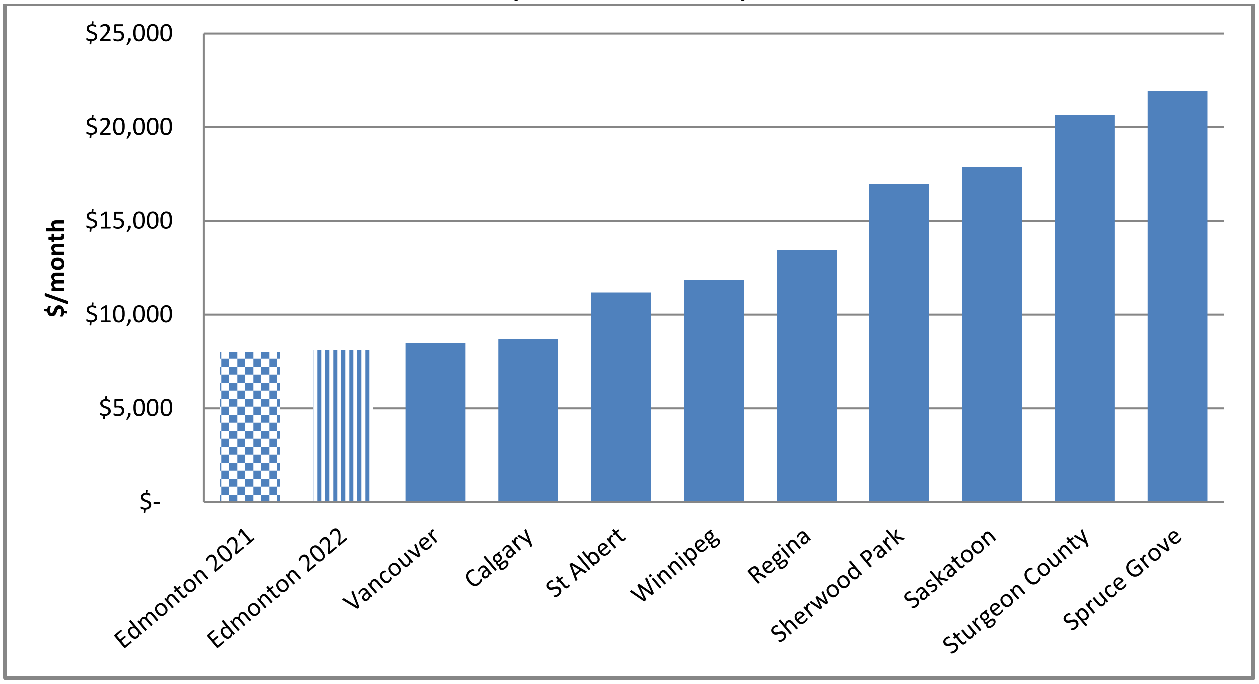
4.3 Commercial Water Bill Comparison

Figure 4.3-1
Small Commercial Monthly Water Bill
(325 m³/month)



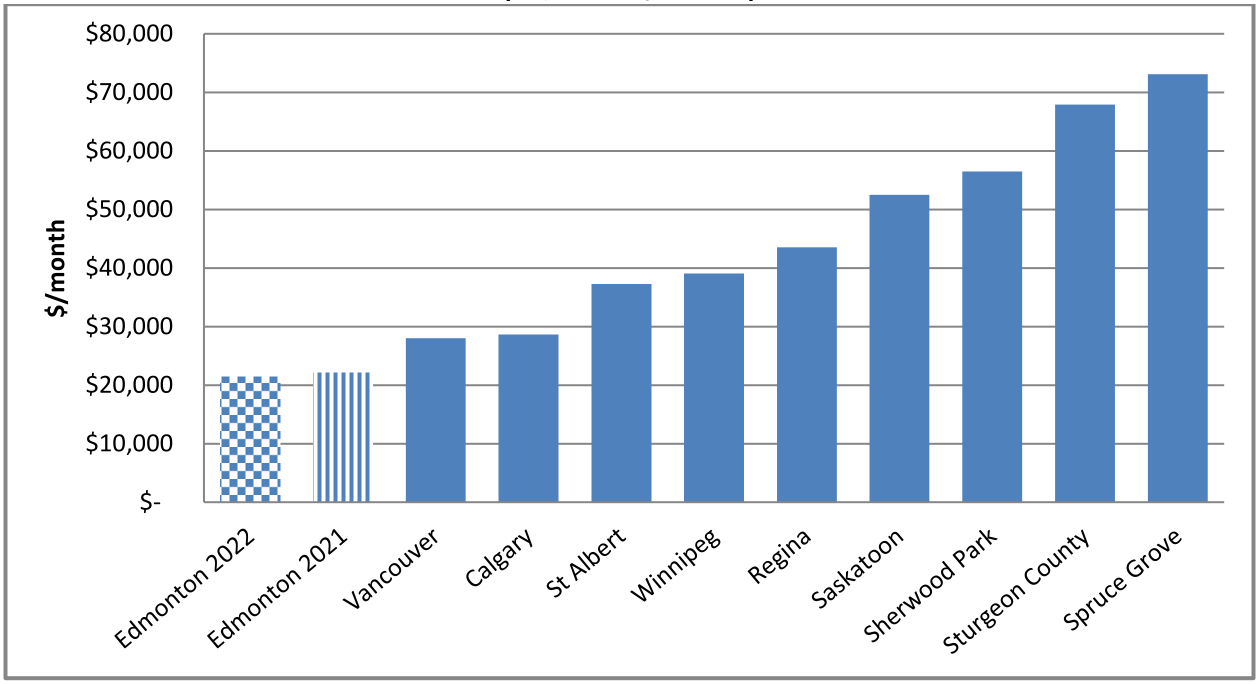
15. Figure 4.3-1 provides a comparison of the monthly water bill for small commercial customers consuming 325 m³ per month, which is representative of a typical car wash. In this category, the Edmonton 2022 water bill is one of the lowest when comparing with surrounding communities.

Figure 4.3-2
Medium Commercial Monthly Water Bill
(6,000 m³/month)



16. Figure 4.3-2 provides a comparison of the monthly water bill for medium commercial customers consuming 6,000 m³ per month, which is intended to represent a large hotel or large shopping center. In this category, the Edmonton 2022 water bill is the lowest when comparing with surrounding communities.

Figure 4.3-3
Large Commercial Monthly Water Bill
(20,000 m³/month)



17. Figure 4.3-3 provides the comparison of the monthly water bill for large commercial customers consuming 20,000 m³ per month, which is representative of a large scale commercial or industrial enterprise, like a brewery or food processing plant. In this category, the Edmonton 2022 water bill is the lowest cost when compared to all other communities.

18. Overall in the commercial segment EWSI's charges are one of the lowest when compared to the other utilities.

5.0 TOTAL WASTEWATER BILL COMPARISONS

5.1 Approach to Total Wastewater Bill Comparisons

19. Using the same approach as wased used for the water bill comparsion, comparative total wastewater bill information is based on the other utilities' wastewater collection and treatment rates as of the 2016, escalated by the I factor (2.31%) to determine a 2022 rate. The rate comparisons are based on the total cost to the customer and include fixed charges, consumption charges plus any surcharges.

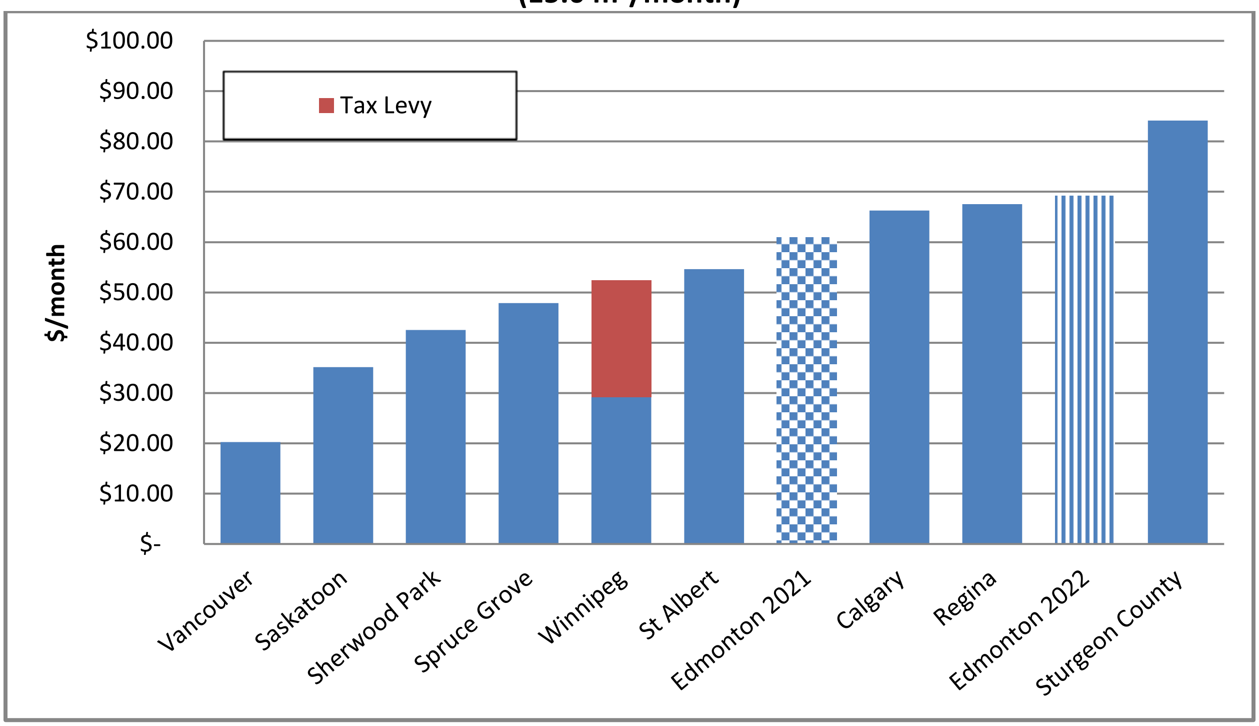
20. The residential wastewater bill comparisons are based on a residential customer consuming 15.0 m³ per month, reflecting an average Edmonton wastewater residential consumer.

21. Comparisons for commercial customers are provided for two sizes:

- A small commercial business representative of a typical car wash.
- A large commercial business representative of a large-scale commercial enterprise, like a brewery or food processing plant.

5.2 Residential Total Wastewater Bill Comparison

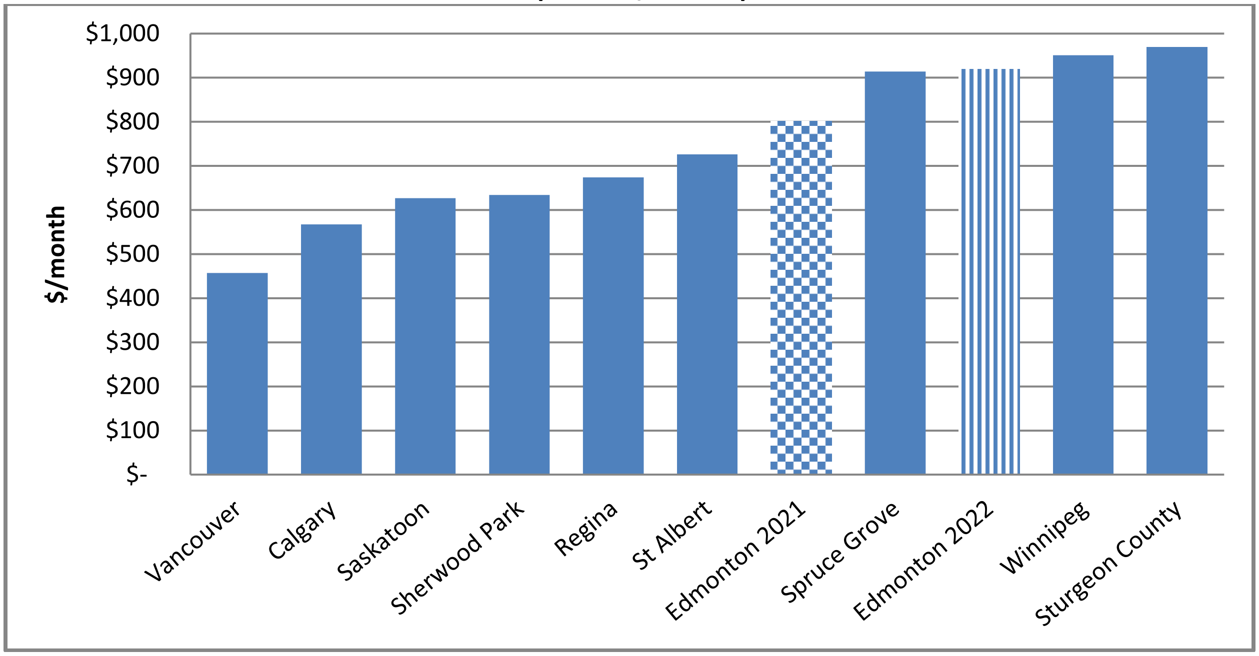
Figure 5.2-1
Average Edmonton Residential Monthly Wastewater Bill
(15.0 m^3/month)



22. Figure 5.2-1 provides a comparison of the monthly wastewater bill for residential customers consuming 15.0 m^3 per month, which is representative of an average Edmonton household. In this category, the Edmonton 2022 wastewater bill has increased relative to surrounding communities and other regions.

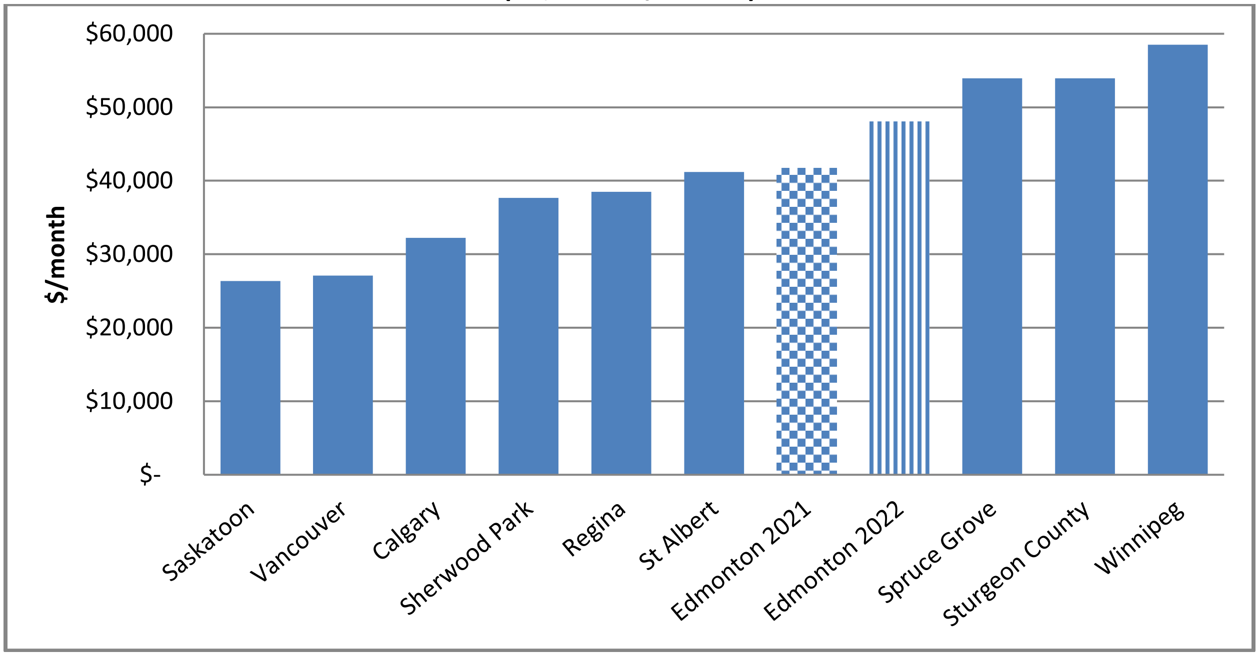
5.3 Commercial Total Wastewater Bill Comparison

Figure 5.3-1
Small Commercial Monthly Wastewater Bill
(325 m³/month)



23. Figure 5.3-1 provides a comparison of the monthly total wastewater bill for small commercial customers consuming 325 m³ per month, which is representative of a typical car wash. In this category, the Edmonton 2022 total wastewater bill is comparable with surrounding communities and other regions.

Figure 5.3-2
Large Commercial Monthly Wastewater Bill
(20,000 m³/month)



24. Figure 5.3-2 provides a comparison of the monthly total wastewater bill for large commercial customers consuming 20,000 m³ per month, which is representative of a large scale commercial or industrial enterprise, like a brewery or food processing plant.

25. The relative rankings of the wastewater utilities reflect the differences in costs associated with the differences identified in Section 2.2.

26. Overall in the commercial segment, Edmonton wastewater rates are competitive compared to the other sampled utilities.