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.

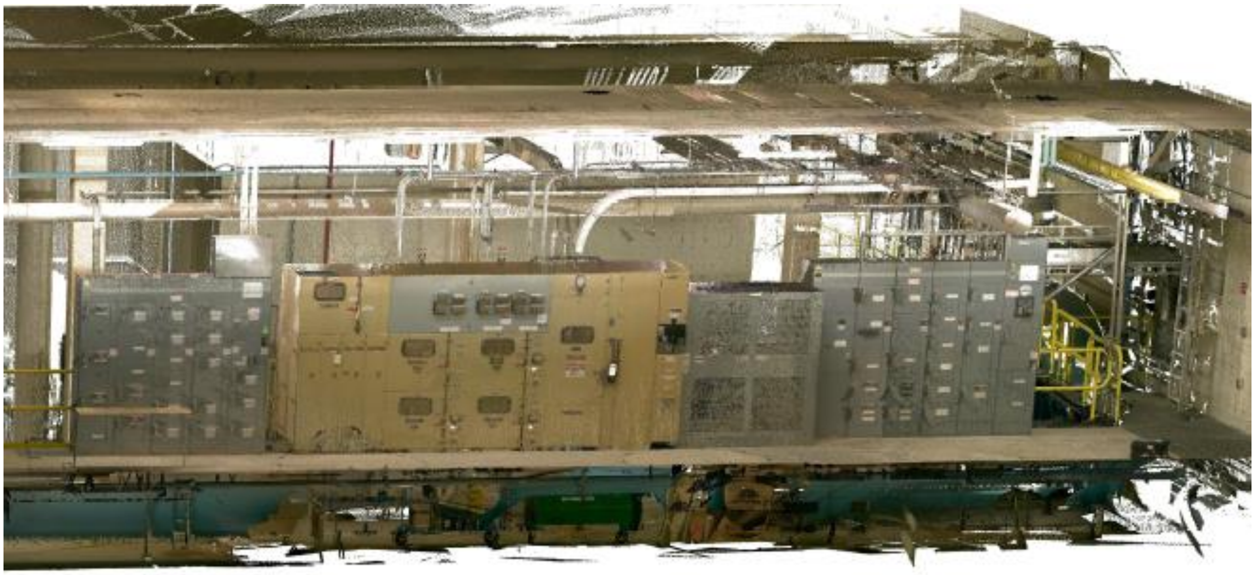
2. The 5 kV Upgrades Project is included in the reliability / life cycle category. EWSI has forecast total program capital expenditures during 2022-2026 at $5.04 million, in addition to the $1.22 million projected to have been spent within the 2017-2021 PBR term. Construction is planned for 2022, which 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.

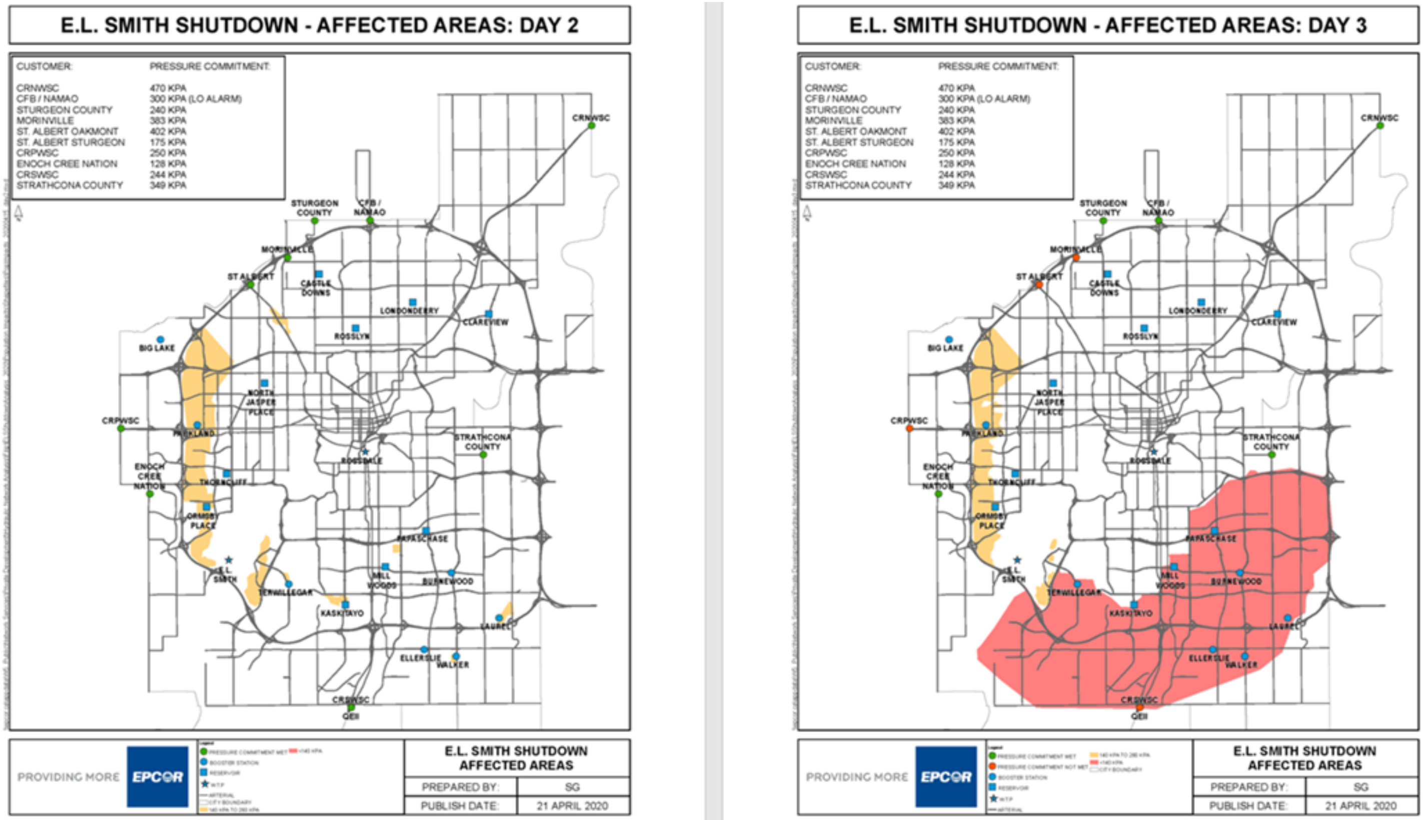
2.2 Project Justification

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)

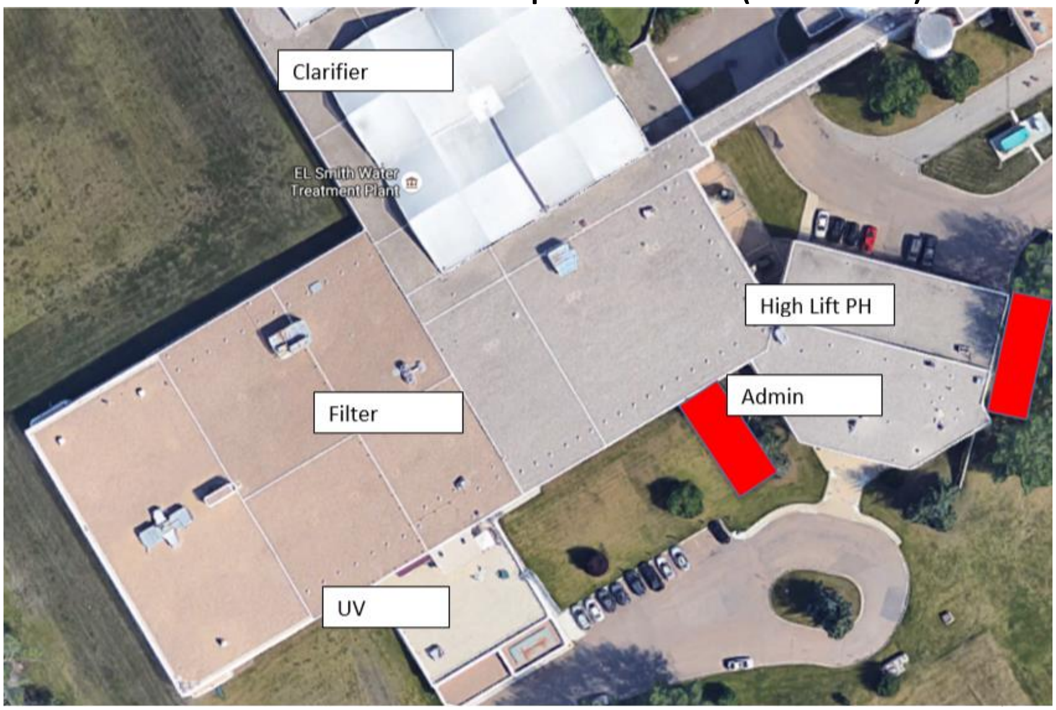
3.0 PROJECT DESCRIPTION

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	B	C	D	E	F	G	H	I	J	K	L	M
		2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**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	B	C	D	E	F	G	H	I	J	K	L	M
		2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**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)

	AMI	A 2022	B 2023	C 2024	D 2025	E 2026	F 2027-2031	G 2032-2042	H 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)

	AMR	A **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **2027-2031**	G **2032-2042**	H **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

Table of Contents

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.

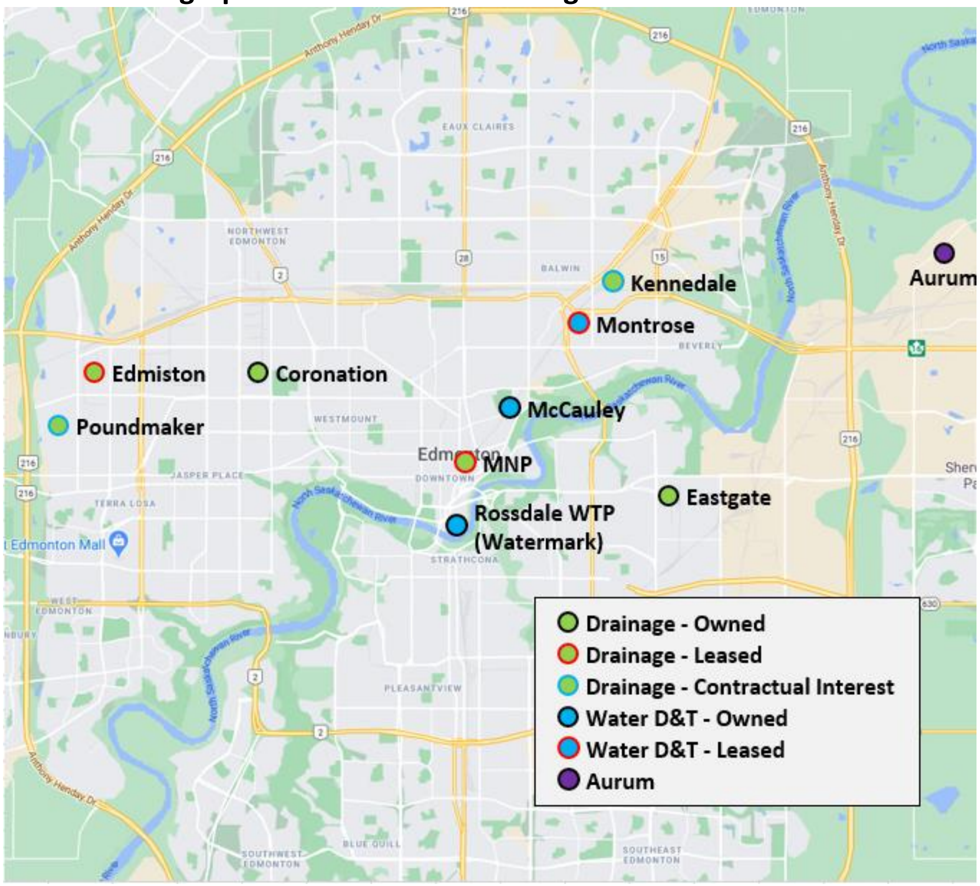
5. The transfer of Drainage Services was not anticipated at the time of the request for $16.00 million in the 2017-2021 Water PBR Application. However, once the transfer was approved, EWSI made the decision to refocus its work on the Water D&T Facilities Expansion Project in favour of

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. Upfront Capital Expenditures – *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.

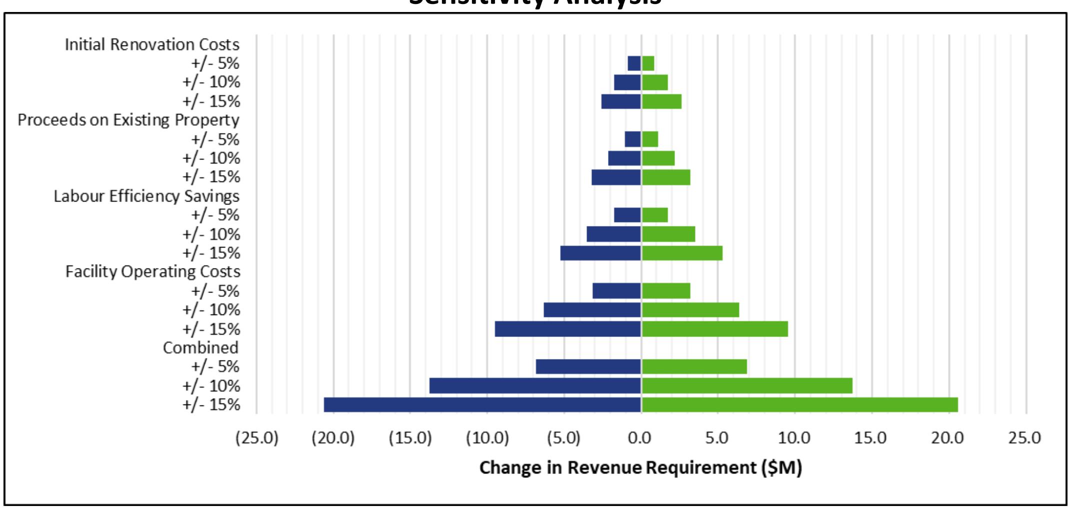
- The CMAR firm will be contracted early in the design phase, maximizing potential for cost certainty by allowing the Construction Manager to assist with value engineering, cost estimating and constructability reviews.
- Because the CMAR has begun working as part of a collaborative team with EPCOR and 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.

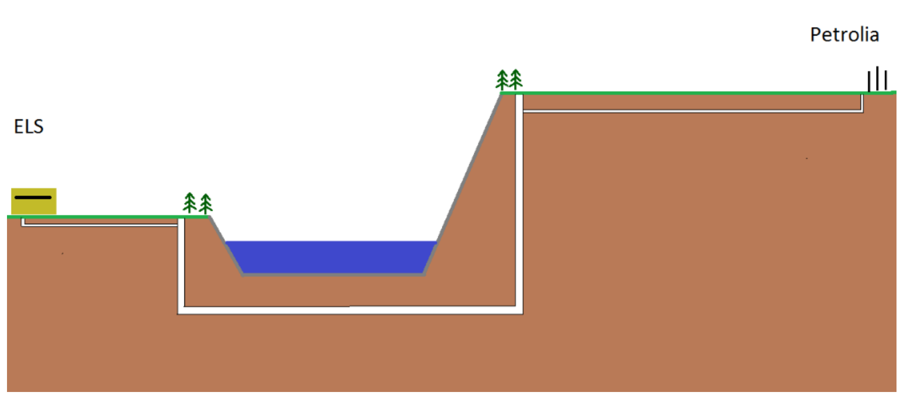
2. The E. L. Smith New Power Feed Project is included in the reliability / life cycle category and EWSI has forecast the total cost at $5.94 million, with $1.09 million forecast to be spent within the 2022-2026 PBR term. The in-service date is scheduled for 2028.

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

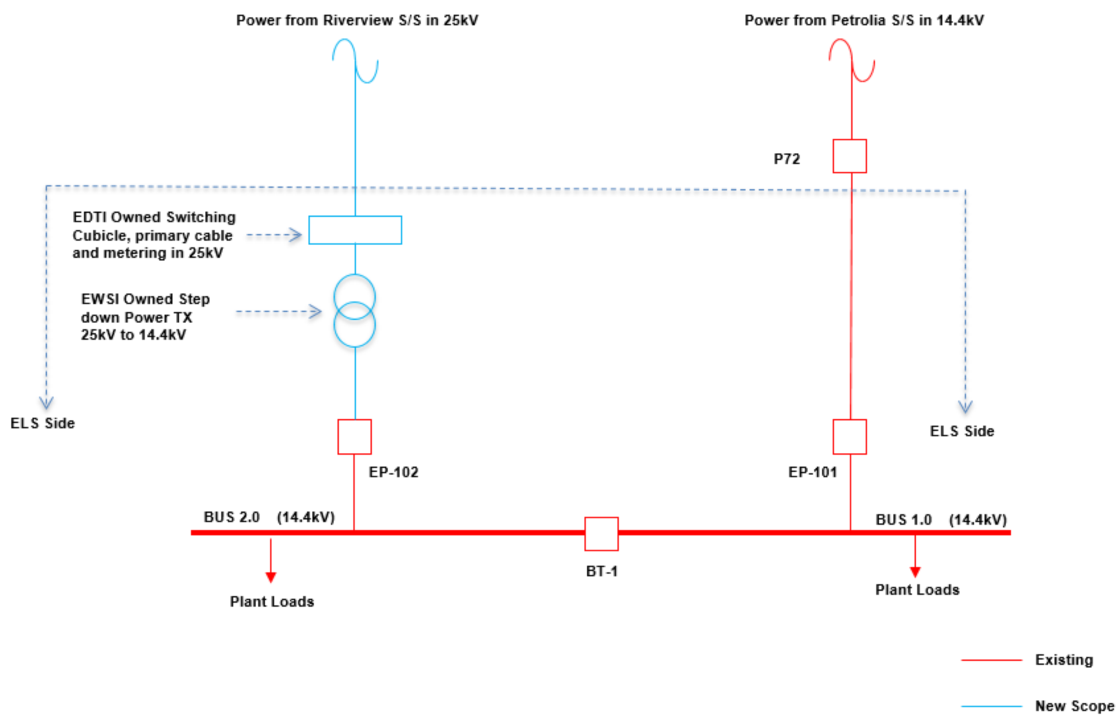
6. The scope of this project is set to include building a new electrical feeder to E. L. Smith from Riverview Substation; and abandon in place existing feeder P12 from Petrolia Substation after new feeder is fully commissioned and in service.

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:

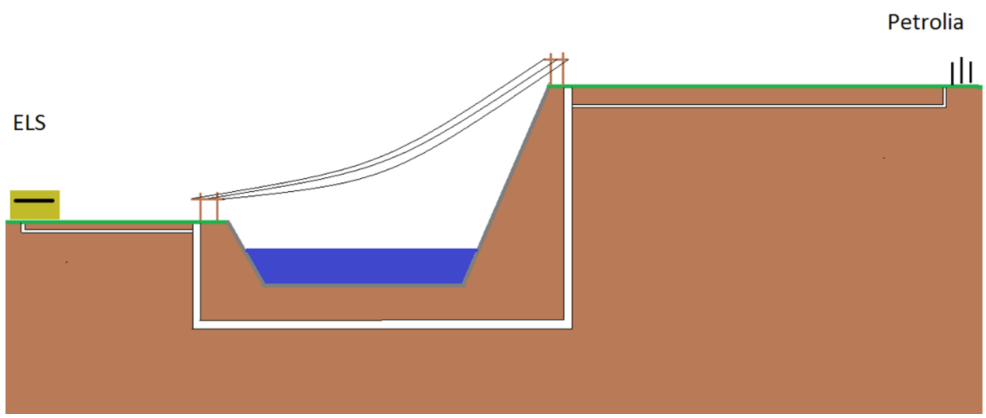
4.1 Alternative 1: Install New Power Feed from Riverview Substation (Selected)

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

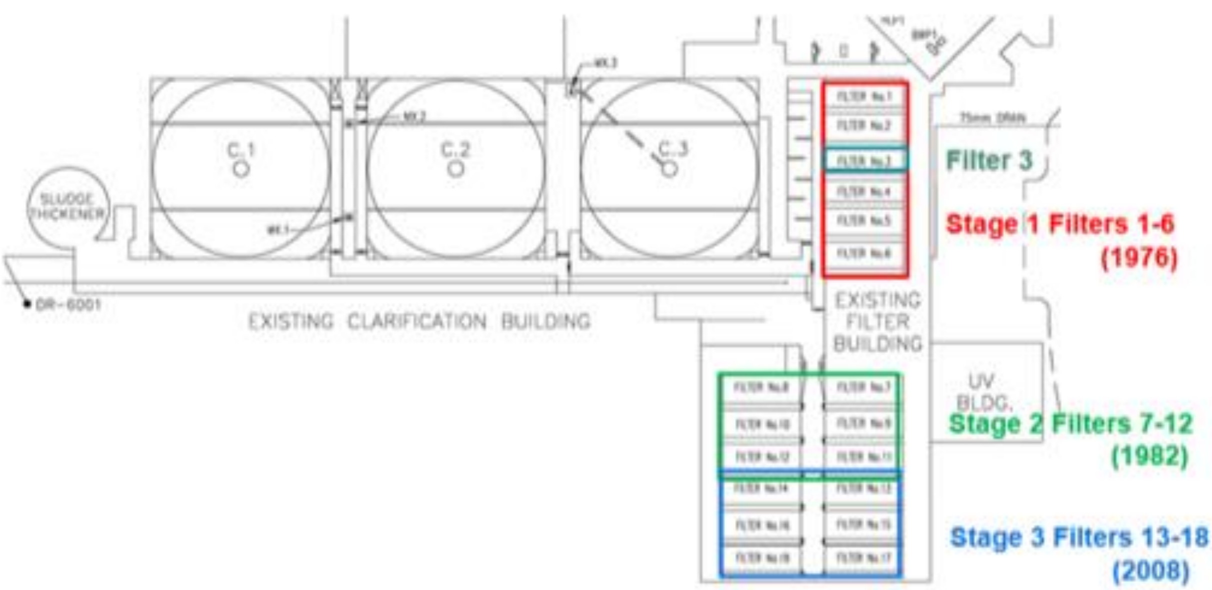
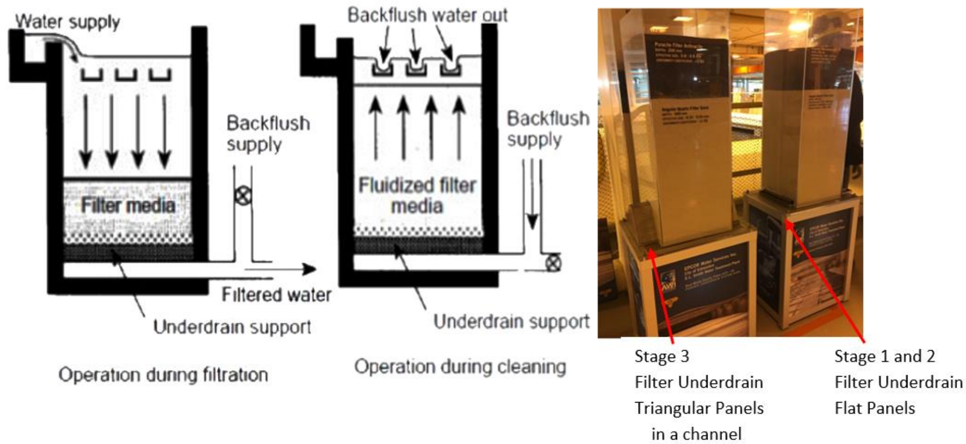


Figure 2.2-2
Filter Underdrain Flat vs. Triangular Panels



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

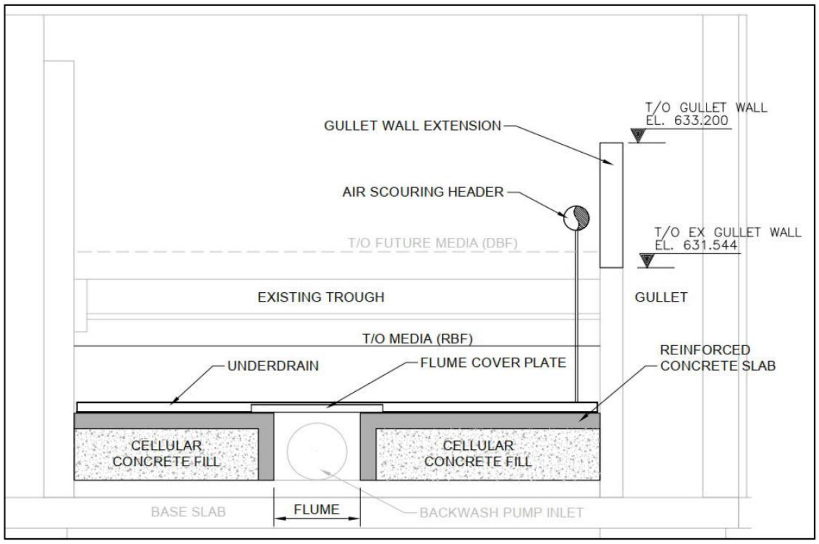
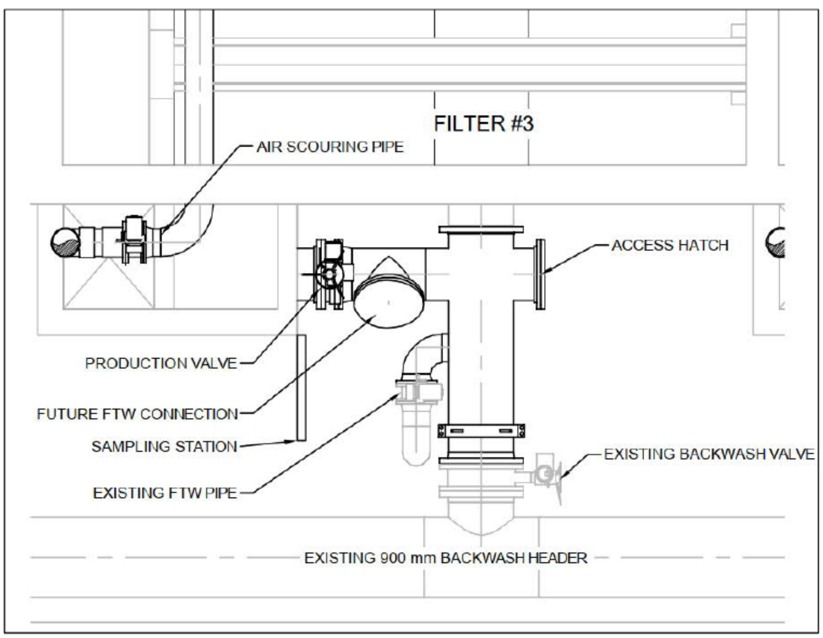


Figure 2.4-2
Filter 3 New Piping Layout



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.

Added benefits:

- 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 **2022**	B **2023**	C **2024**	D **2025**	E **2026**	F **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

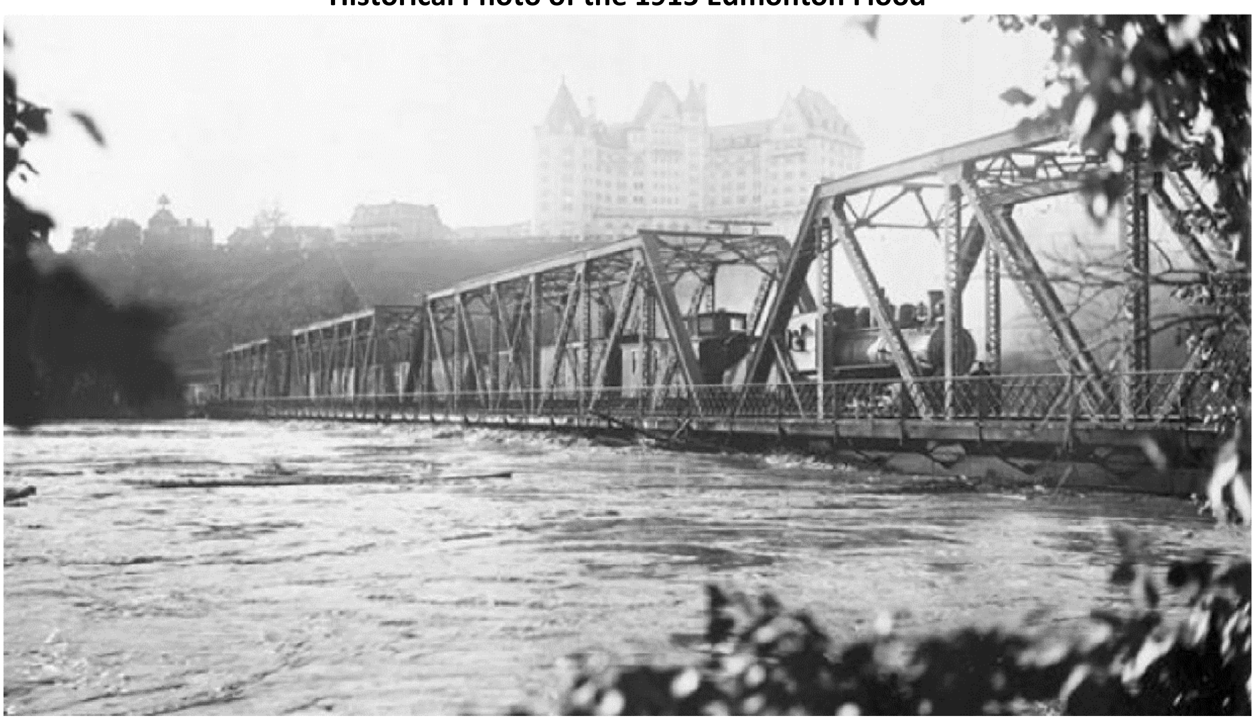


Image Credit: https://www.cbc.ca/news/canada/edmonton/flood-of-1915-the-worst-in-edmonton-history-1.3737170

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

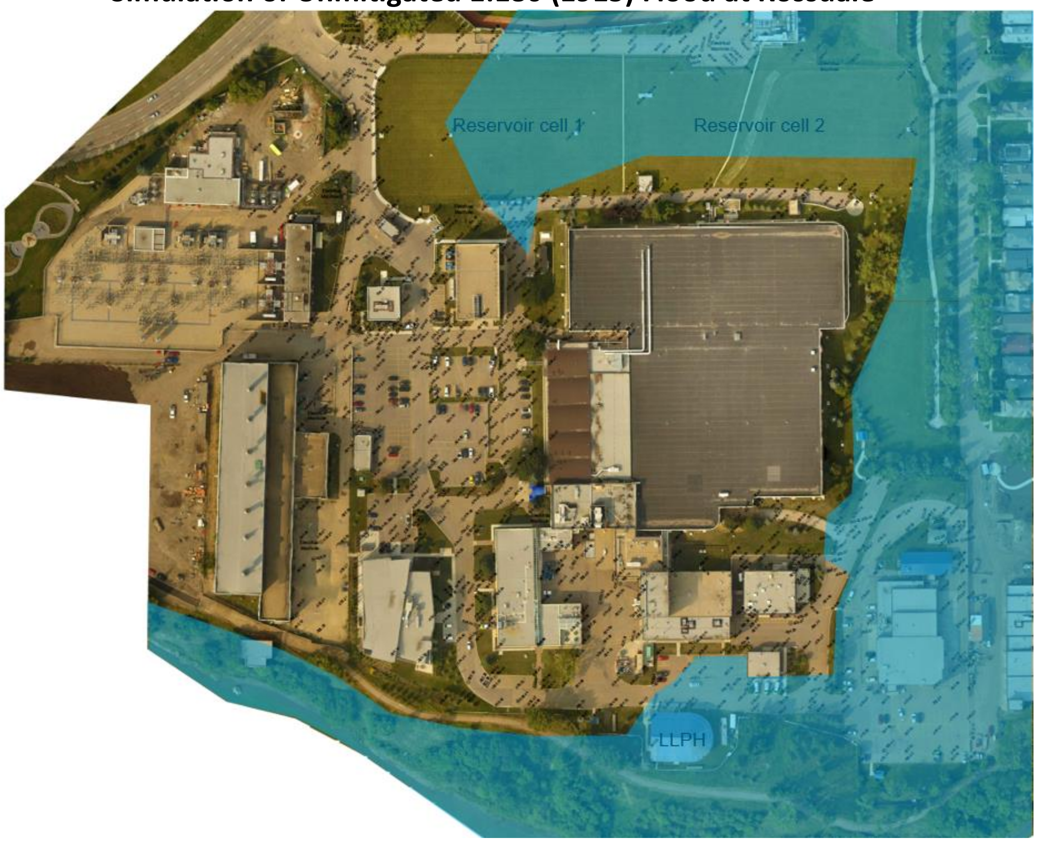
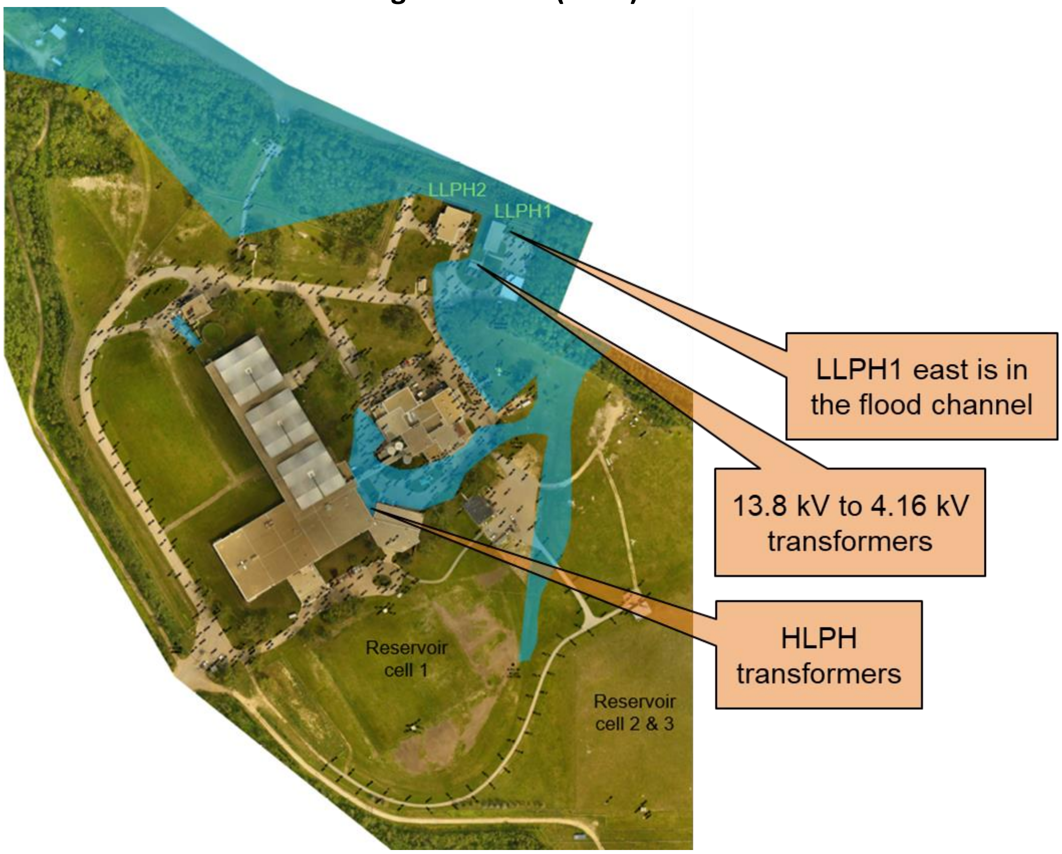


Figure 2.1-3
Simulation of Unmitigated 1:180 (1915) Flood at E. L. Smith



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.

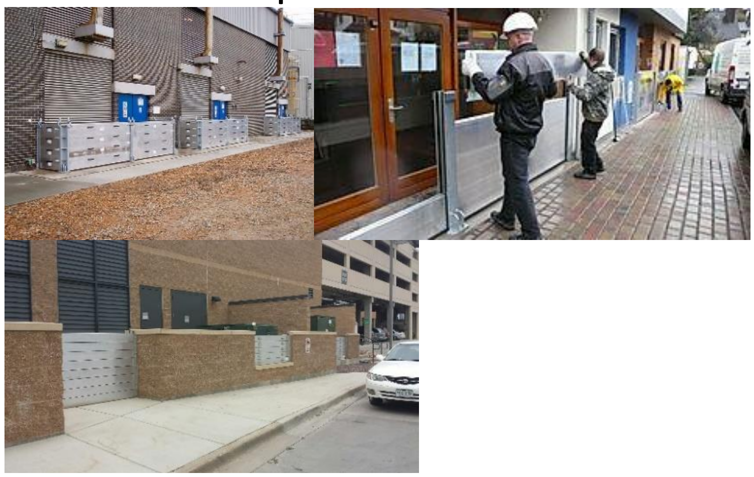
33. Each project's contribution toward mitigating the city-wide flood risk has been evaluated by integrating them with EPCOR's SIRP, which consists of a dynamic multi-dimensional city-wide risk assessment modelling platform. The proposed project selection is optimized to reduce the social, financial, 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.

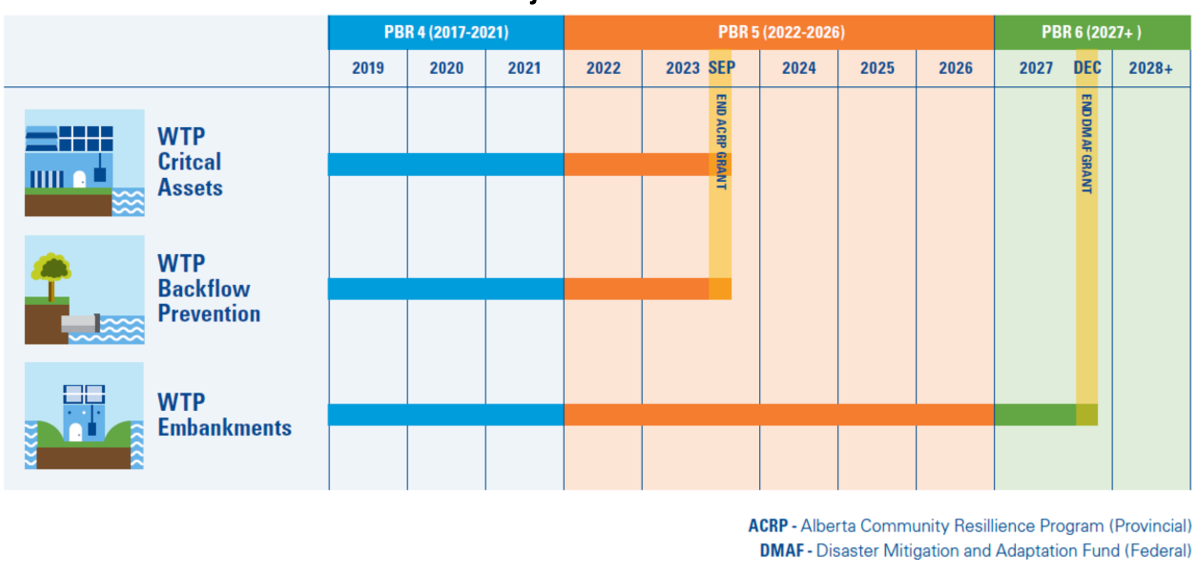
2.3.2 Exclusions

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	B	C	D	E	F	G
		2022	**2023**	**2024**	**2025**	**2026**	**2022-2026 Total**	**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

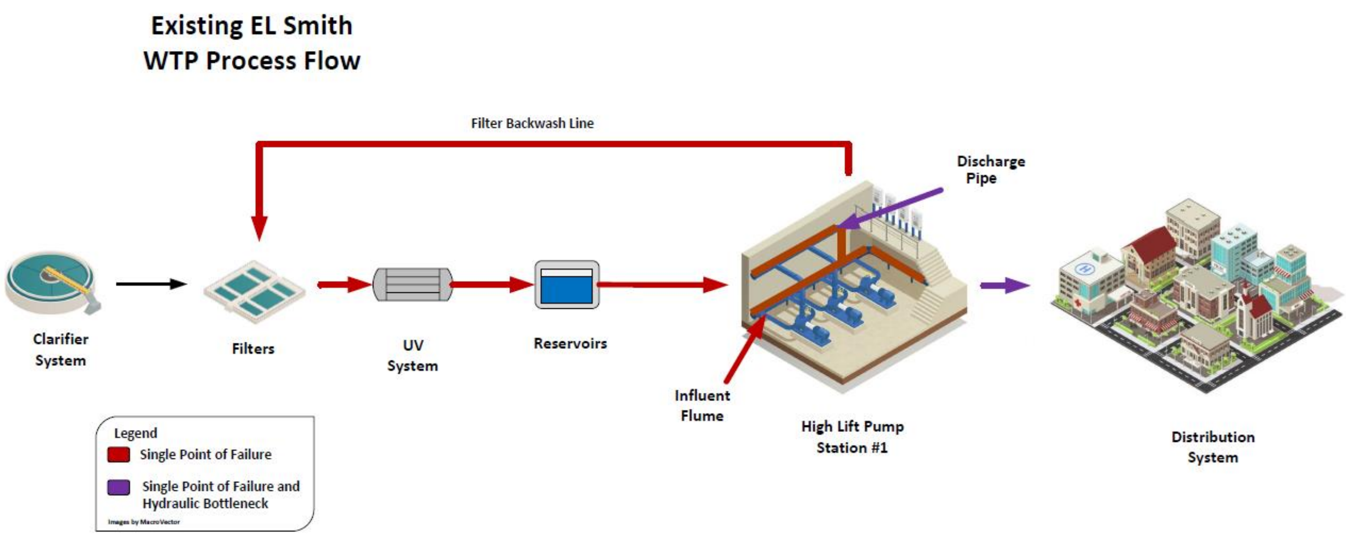
8. This project addresses three main risks at the E. L. Smith water treatment plant.

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)

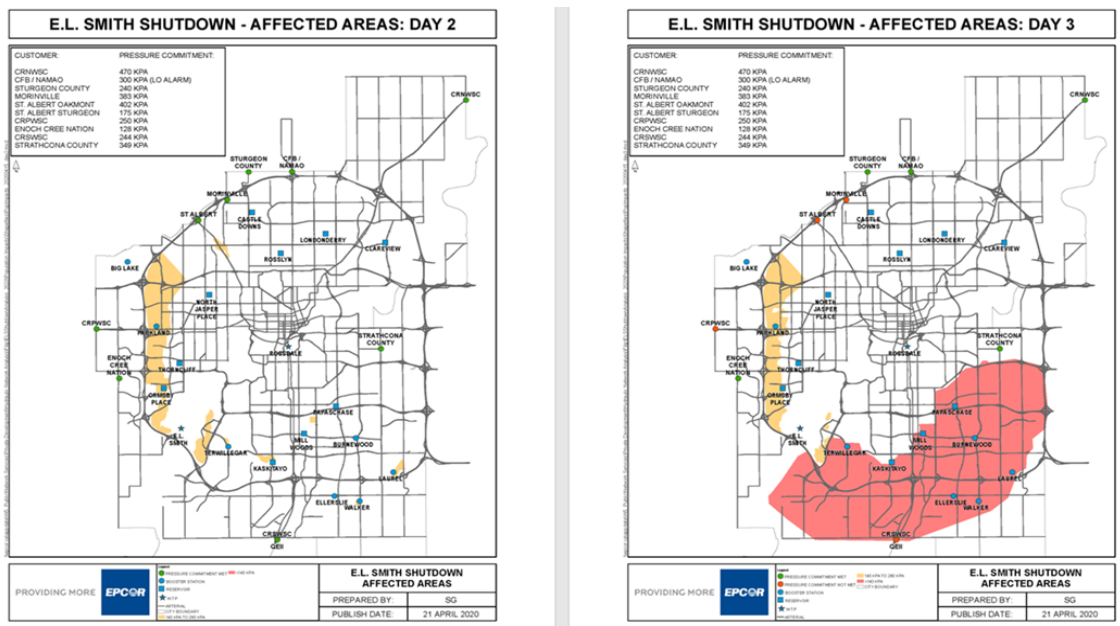
10. Due to the configuration of the existing HLPH, equipment is susceptible to damage from flooding as it is all 9 meters below grade in a dry pump pit. If there was a failure of the flume feeding the pumps or, of the discharge pipe downstream of the pumps, the volume of water would quickly inundate 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.

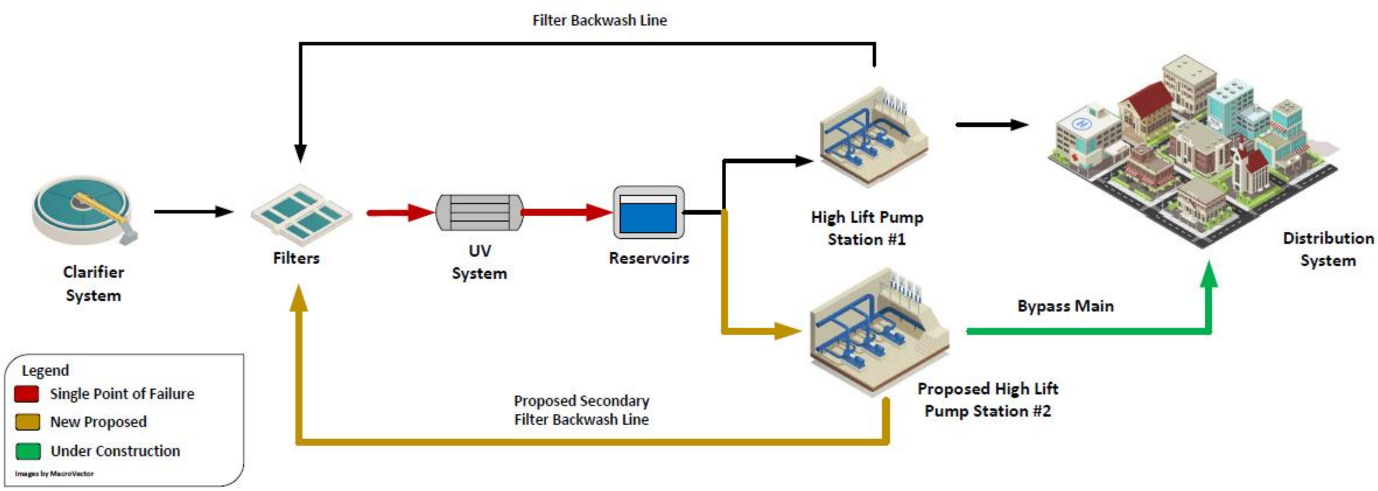
18. New Pumps - New high lift pumps (likely two) with a capacity of 150 ML/d will be installed initially to meet redundancy requirements. The pumphouse will also include a new backwash pump to feed the proposed redundant filter backwash pipe that enters the Filter Building on the southwest side. Interconnections 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

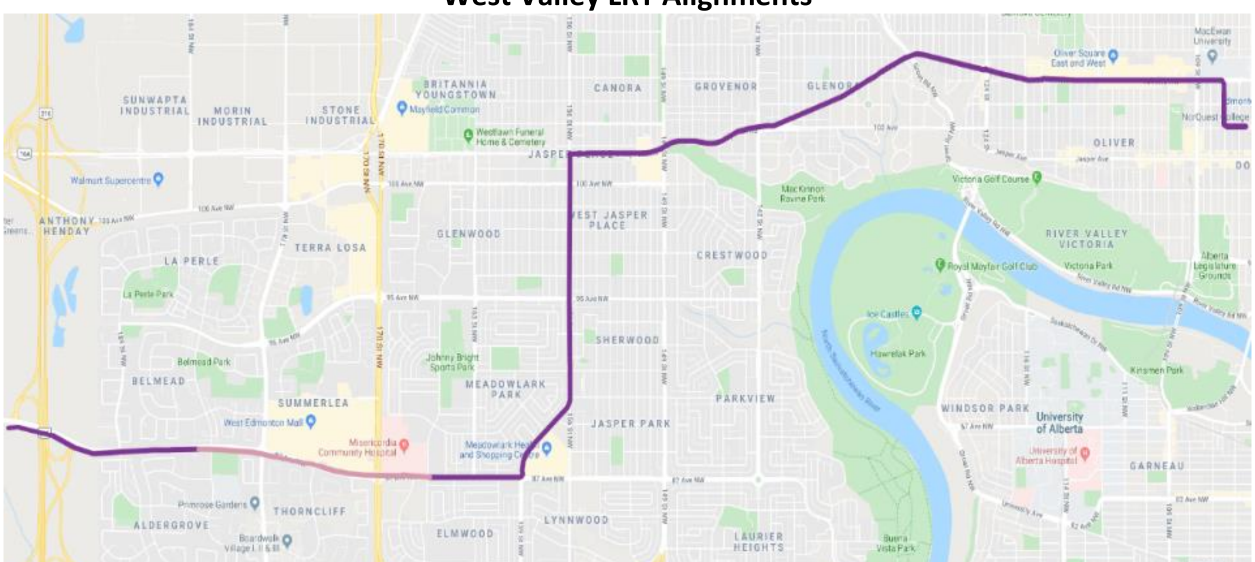
9. The purpose of this program is to enable EWSI to meet its commitments under the Franchise Agreement within the 2022-2026 PBR period by relocating existing water infrastructure as required for LRT construction. Water relocates are completed based on EWSI's commitments under the Franchise Agreement 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

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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.

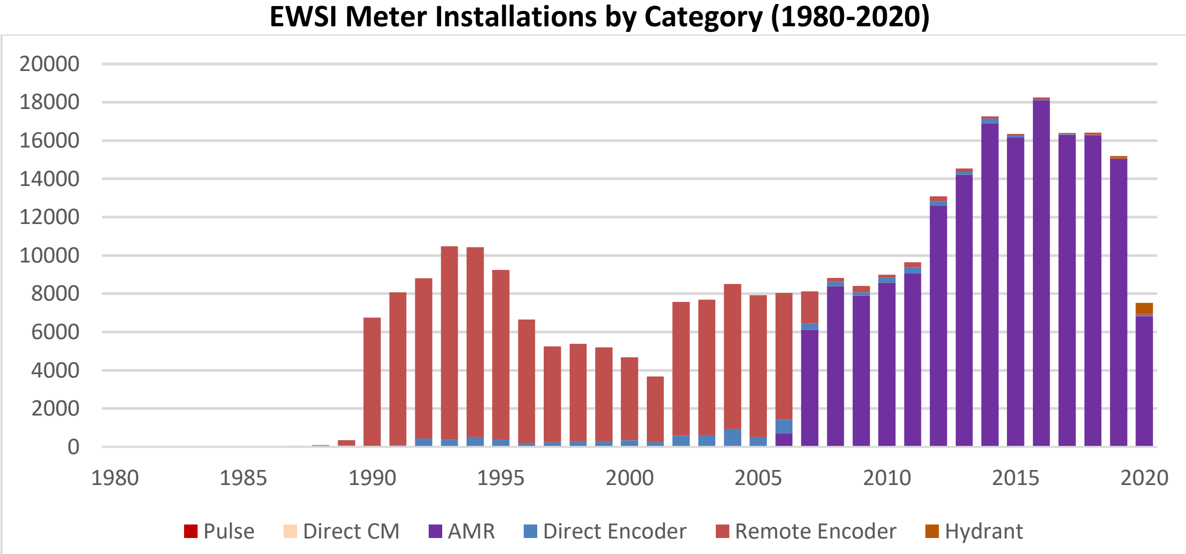
13. There are five categories of meter replacements described below.

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

	Meter Size	A Replacement \Testing Target	B 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.

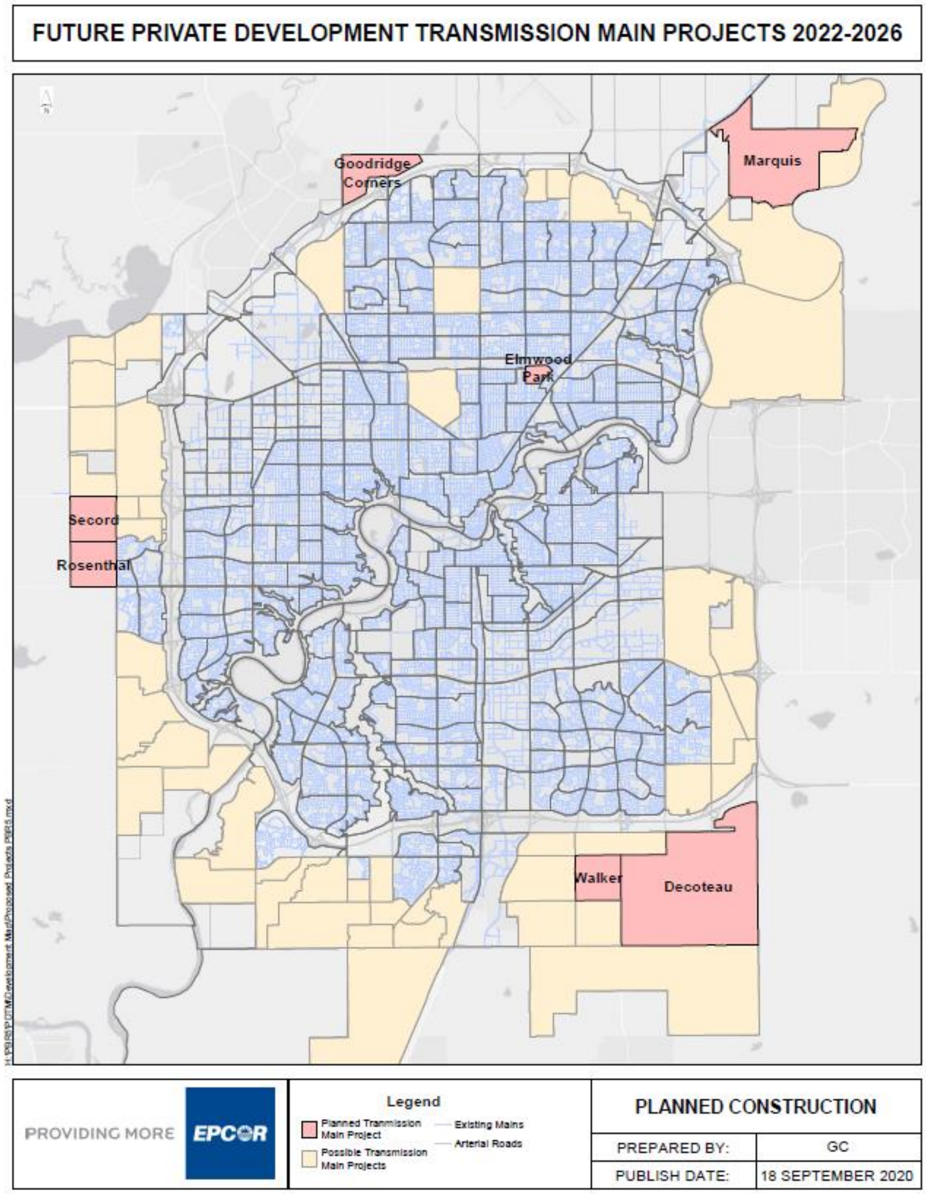
3.0 PROGRAM DESCRIPTION

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	B	C	D	E	F	G
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**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.

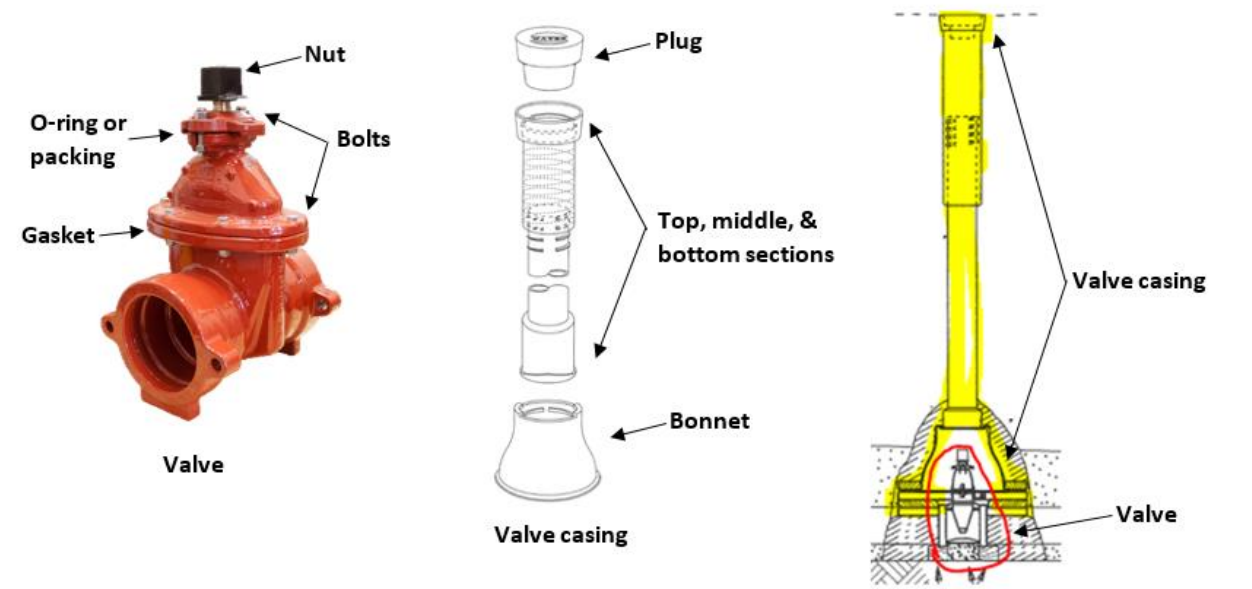
5. The increase of $7.48 million over the cost forecast for the 2017-2021 PBR Application is the result of three factors: (1) actual per-valve costs higher than previously forecast (2) number of valve replacements higher than previously forecast and (3) broadened program scope to include replacement 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.

- Cost per Valve: 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

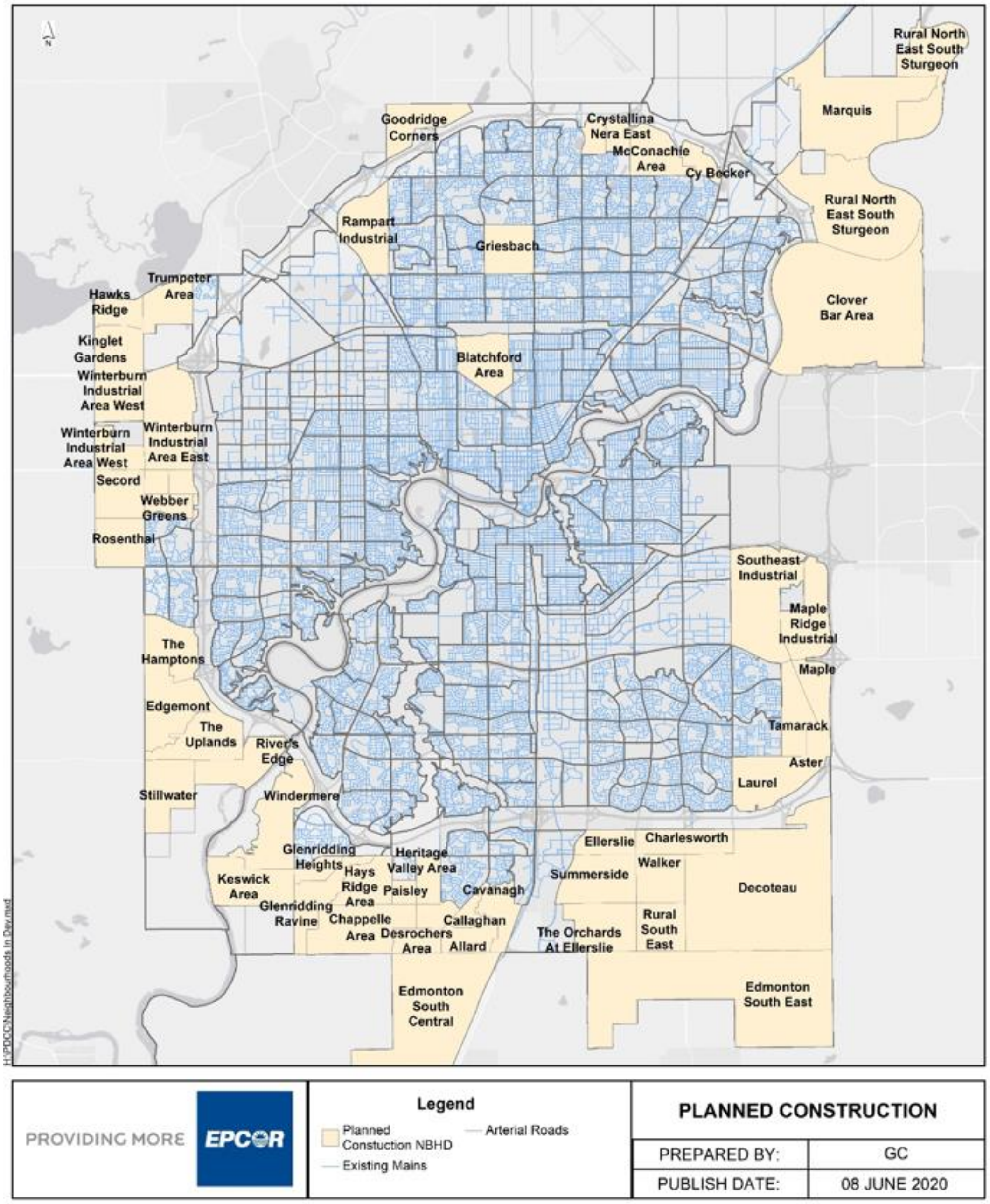
2.1 Program Background

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:

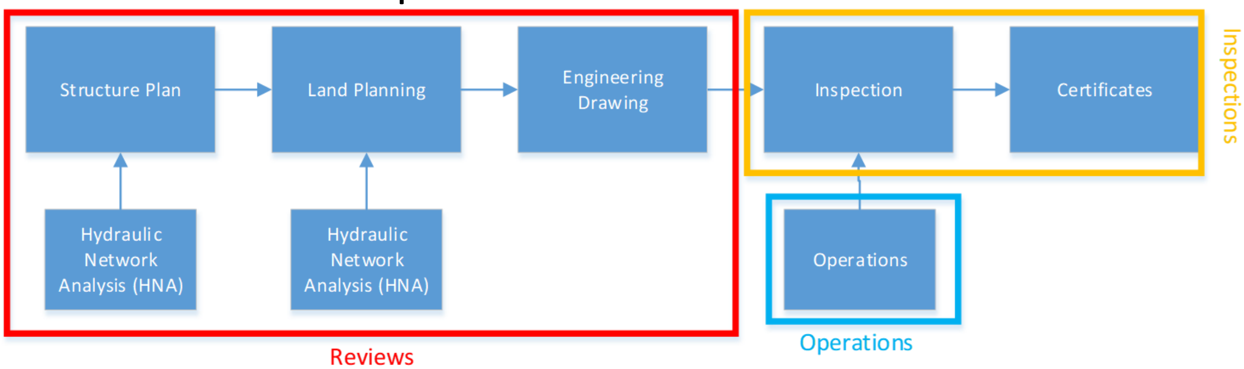
- Providing any consulting or contracting services for a project including the completion of planning, design, and construction, and all other items associated with a development to the satisfaction of the City of Edmonton and its various departments.
- Providing any project management services for a 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.

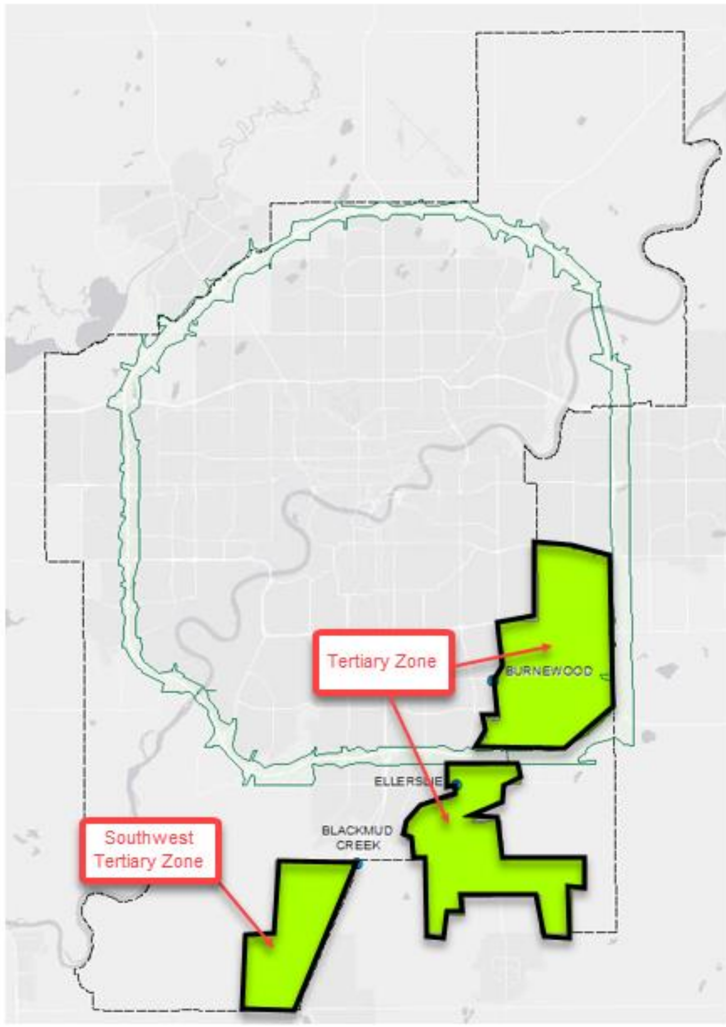
3. The recommended option of installing a 900 mm transmission main from the Blackmud Booster Station to Ellerslie Industrial has an estimated total project capital expenditures during 2022-2026 at $14.14 million. Construction will begin in 2024 and the assets will be placed into service the same year.

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

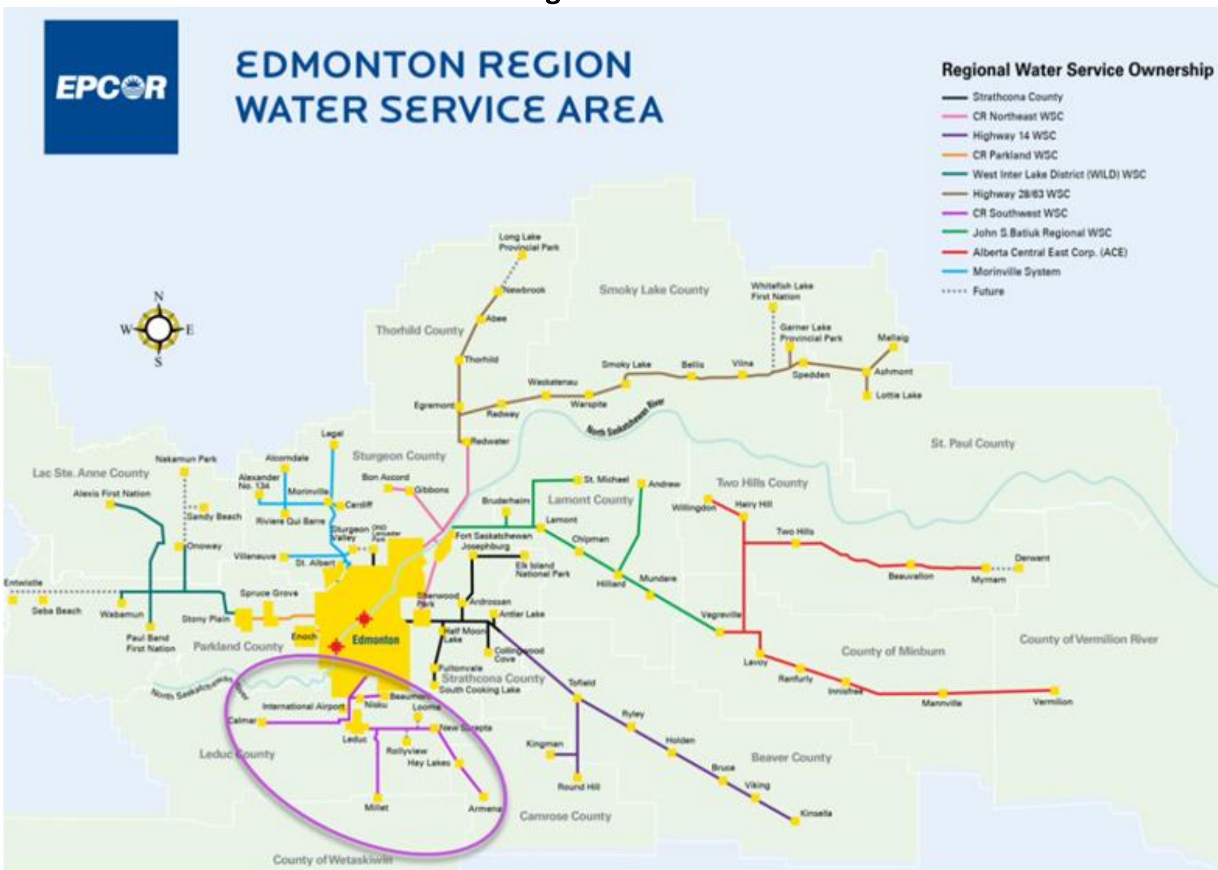
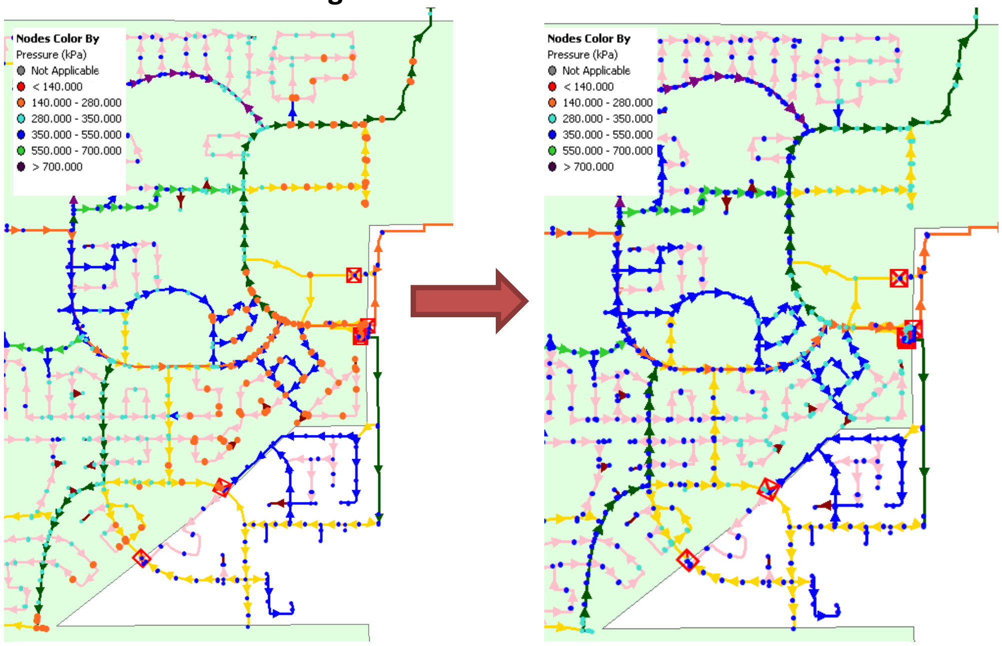


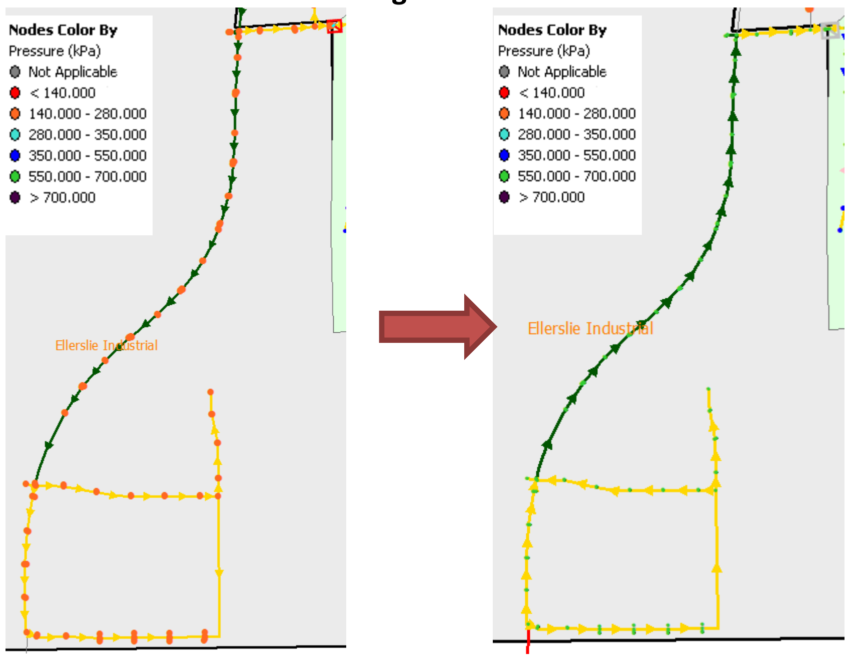
Figure 2.2-2
Increase in Servicing Pressures due to Addition of 900 mm Main



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

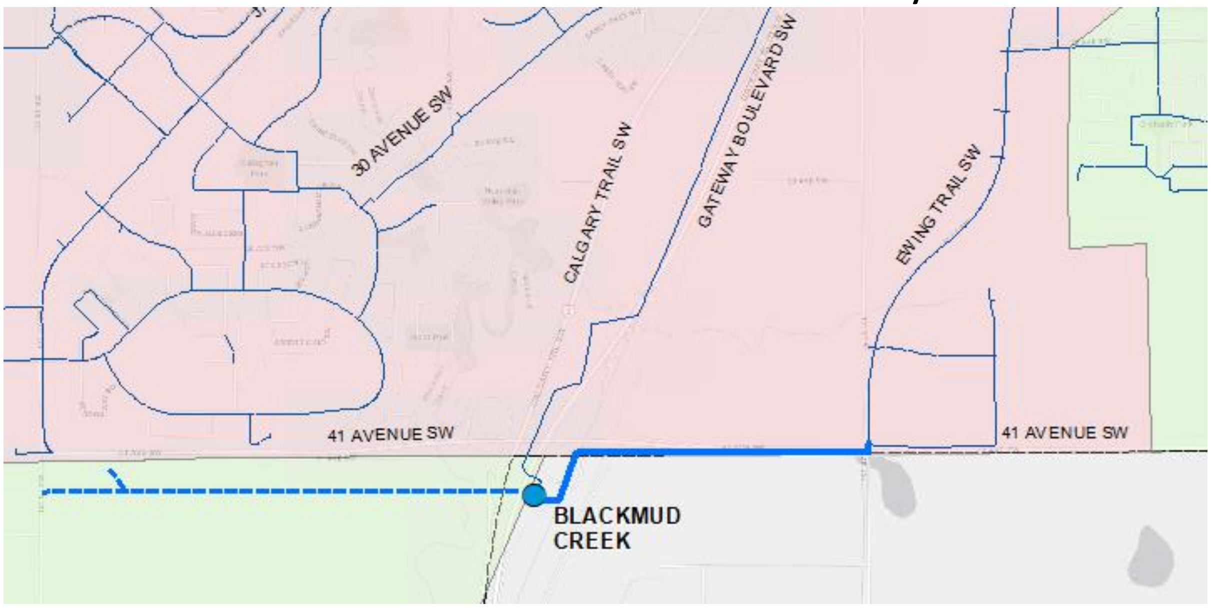


Without 900 mm Transmission *With 900 mm Transmission*

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

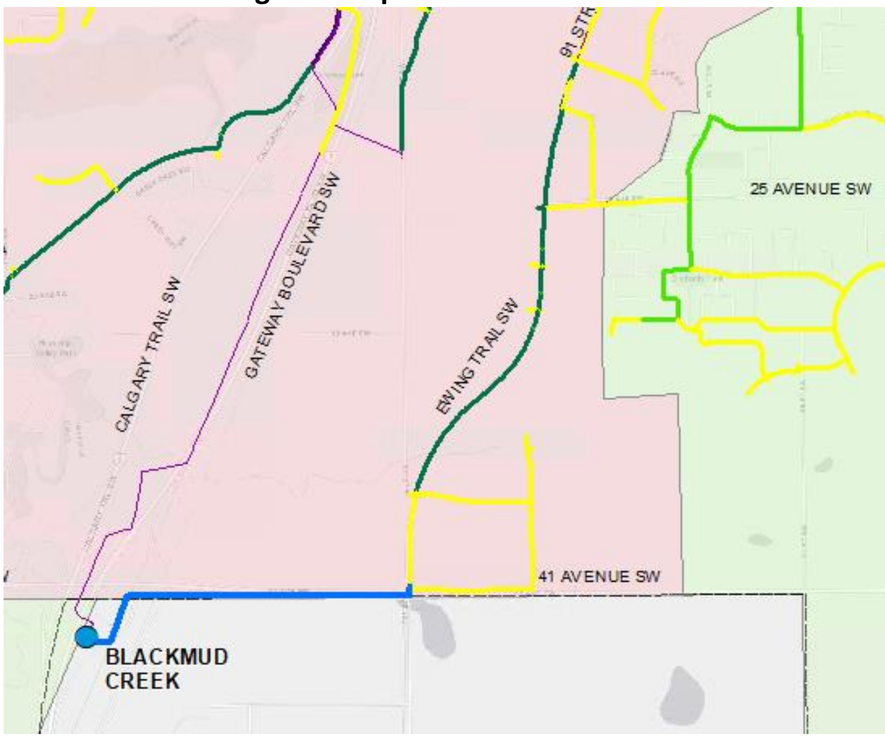
13. The scope of the project is to construct a 900 mm main, approximately 1.2 km in length, to connect Blackmud Creek Booster Station to a 300 mm PVC main, near-to the intersection of 41st Avenue Southwest and Ewing Trail Southwest.

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

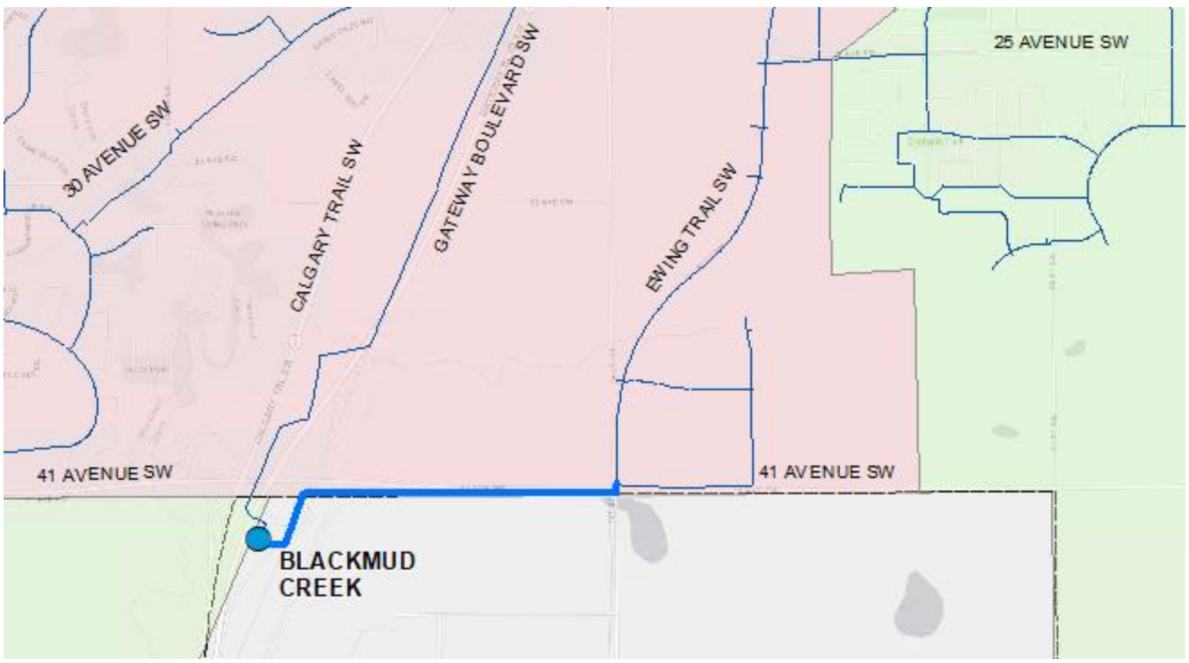
23. In this option, there is the ability to stage flow upgrades as demand in the tertiary zone increases, and there are no building constraints limiting the sizing of infrastructure. This option also increases pumping capacity to improve peak hour demands and fire flows.

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

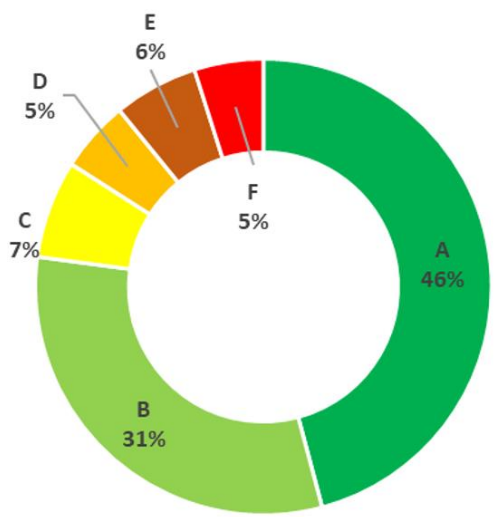


Table 2.1-2
Condition Grade by Material for Distribution System

		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

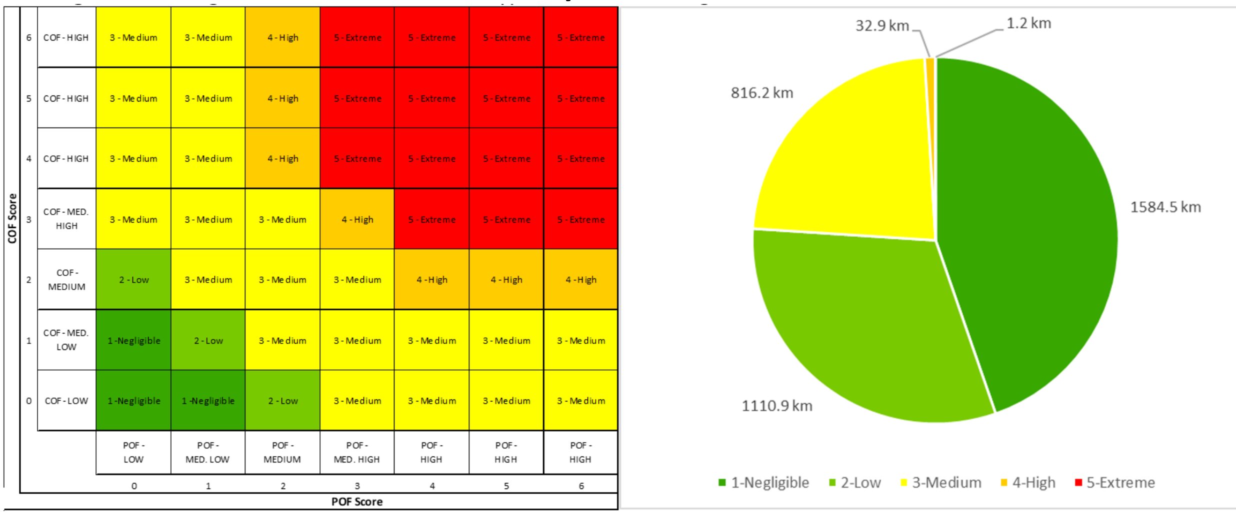
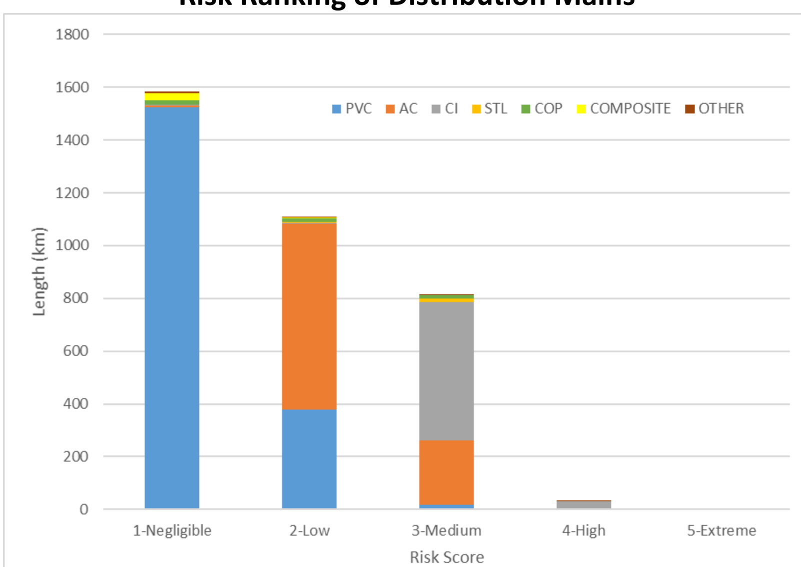


Figure 3.0-2
Risk Ranking of Distribution Mains



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

	Scope Item	A **Anticipated Year in Service**	B **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

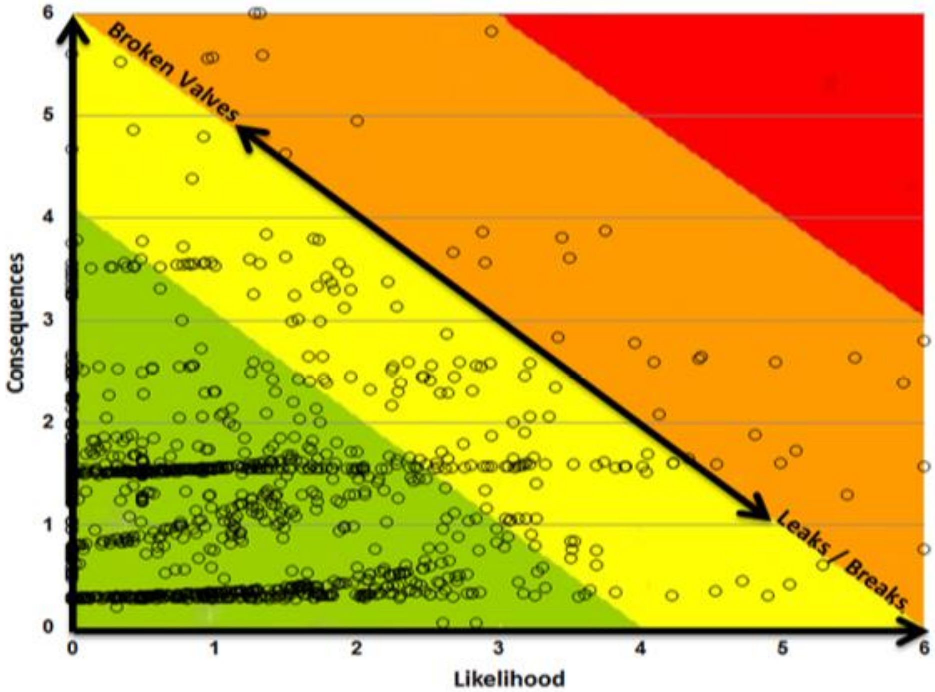
18. The Scope of this program includes the rehabilitation of high risk Transmission mains, 350mm in diameter or greater, that show signs of deterioration, are made of a highly susceptible material (certain vintages of cast iron), or have a history of breaks but do not yet qualify for the reactive renewal 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

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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.

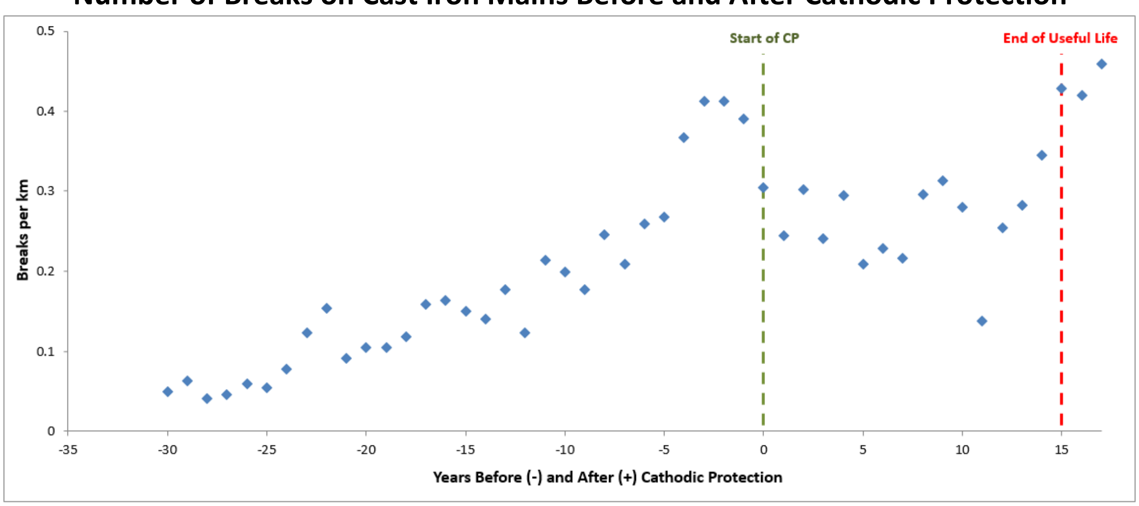
5. In 1997, EWSI commenced the CP program for cast iron water mains in an effort to extend their useful life. The sacrificial anodes are installed from the surface utilizing a minimally-invasive hydrovac excavation methodology (augernode) that does not require extensive open cut – therefore pavement 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

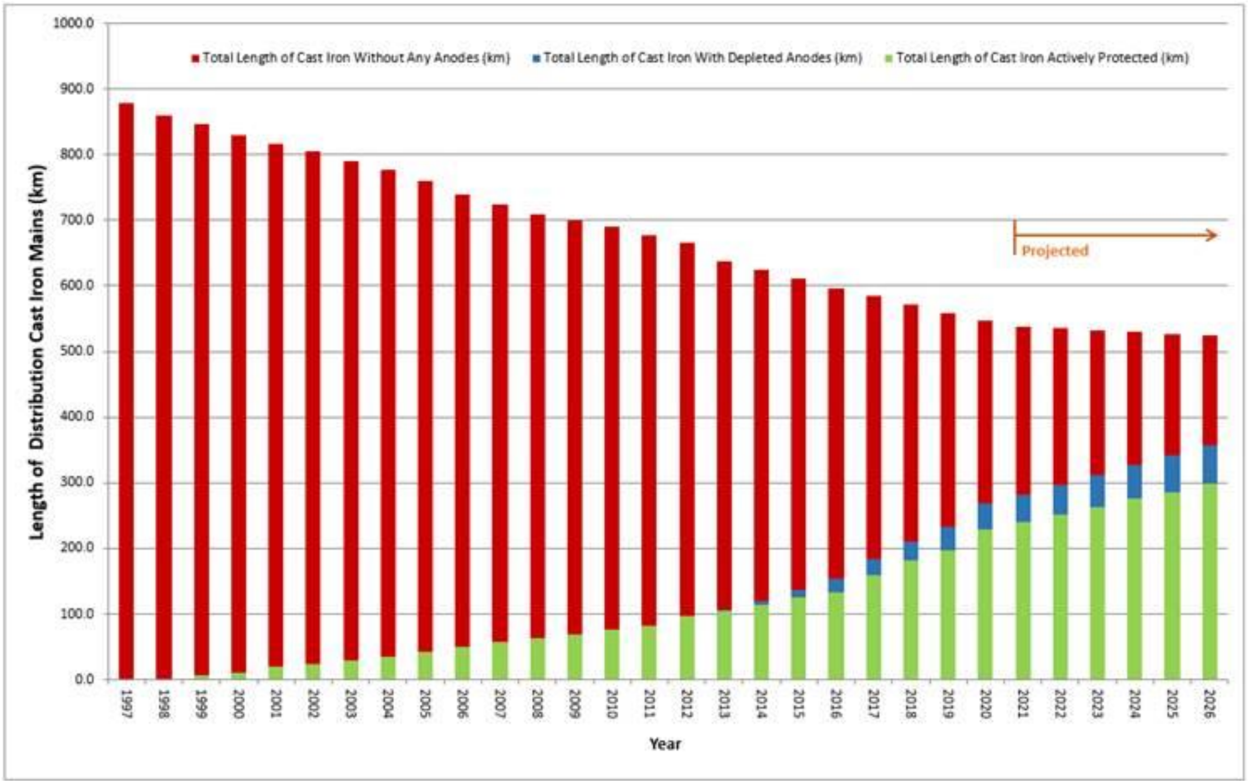
		A
1	Total Length of Pipe With Anodes [Active or Depleted] (km)	232.7
2	Total Length of Pipe Without Anodes (km)	325.3
3	Total Length of Pipe with Depleted Anodes (km)	35.8
4	% With Anodes	42%
5	% Actively Protected	35%

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.

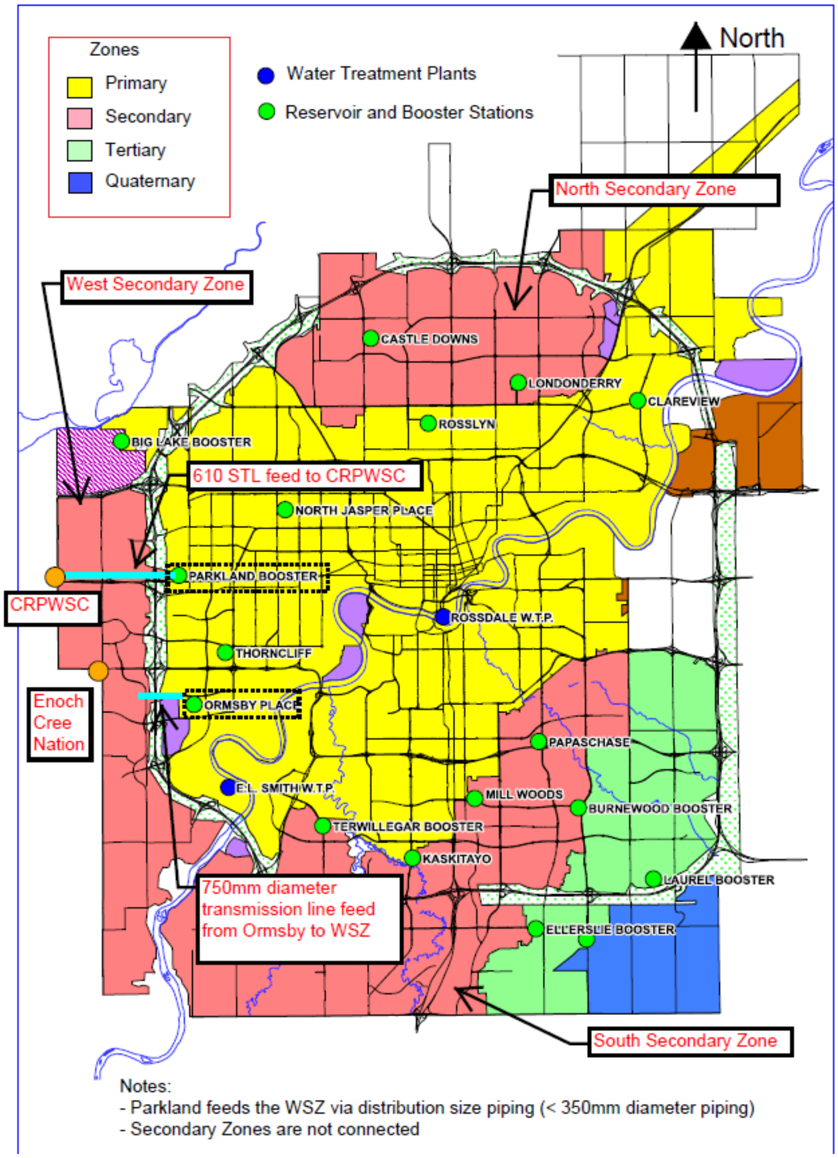
2.0 BACKGROUND AND JUSTIFICATION

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

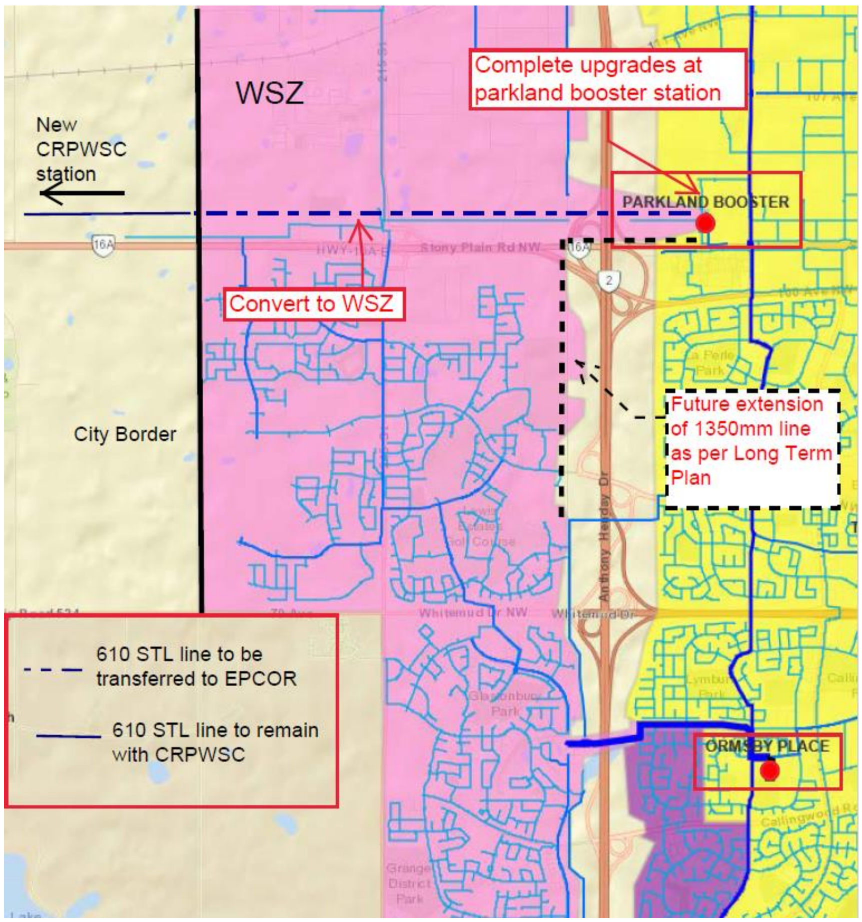
4.0 ALTERNATIVES ANALYSIS

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:

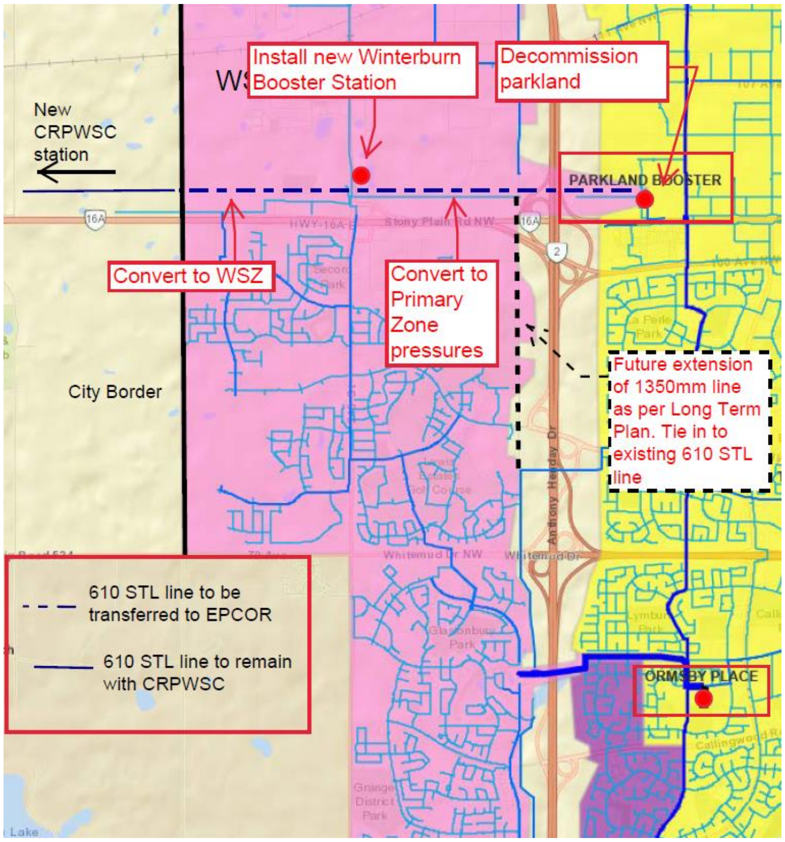
- This option is anticipated to be the most expensive over the long term, as it will require an additional estimated $6.77 million in construction costs for the 1350 mm transmission main to cross the Anthony Henday Drive when it is extended on 199 Street.

- 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%.

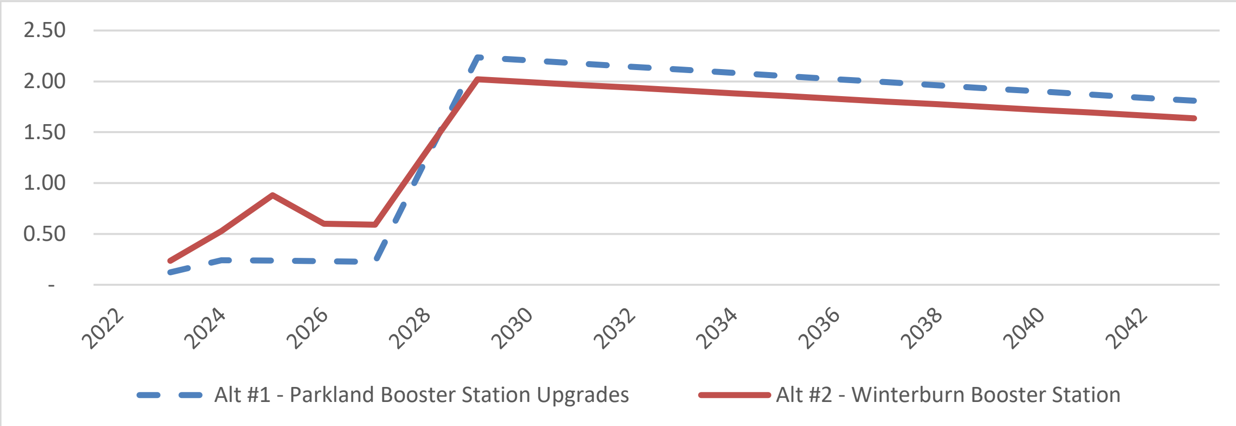
Table 4.3-2
Alternative 2: Winterburn Booster Station
Capital Expenditure Forecast by PBR
($ millions)

	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.