City of Lloydminster

Water Treatment Assessment

Final Report

February 2025

ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

At ISL, your identity is part of our identity. Diversity, Equity, and Inclusion (DEI) speaks to our core values and provides space for our teams to bring their authentic selves to work. ISL believes DEI creates the best outcomes for our clients while sustaining a happy and thriving work environment that allows for career development opportunities for all staff. ISL is committed to a focused effort on continuous improvement and development of a respectful and safe workplace.

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February 21, 2025

Our Reference: 28160

City of Lloydminster
4420 50 Avenue
Lloydminster, AB/SK
T9V 0W2

Attention: James Rogers, P.Eng., Senior Manager, Capital Infrastructure

Dear Sir:

Reference: City of Lloydminster – Water Treatment Assessment Final Report

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Please find enclosed for your review the Final Water Treatment Assessment Report for the City of Lloydminster. The key objective of this assessment is to evaluate the City's current water treatment infrastructure in terms of its condition and treatment capacity, and to determine the requirements for future replacement, refurbishment and expansions.

The Water Treatment Assessment will provide the City of Lloydminster with direction on the implementation of water supply / treatment projects to meet the future potable water demands up to 2042. With associated timelines and costs provided, this information will aid the City in making informed decisions on capital and operational projects, and will provide solutions for efficient, economic, and sustainable municipal services to residents and businesses.

We sincerely appreciate the opportunity to undertake this project on behalf of the City of Lloydminster. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 403.254.5044.

Sincerely,

Geoffrey Schulmeister, P.Eng., SCPM
General Manager, Water and Environment

Corporate Authorization

This document entitled “Water Treatment Assessment Final Report” has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of City of Lloydminster. The information and data provided herein represent ISL’s professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.

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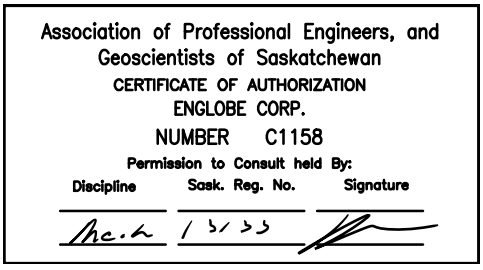
Process



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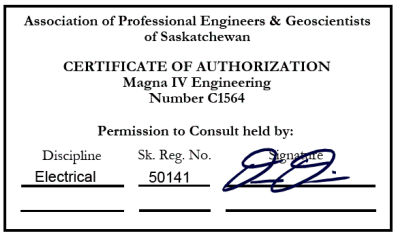

Darin Drisner P.Eng.
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Territory Acknowledgement

City of Lloydminster

The City of Lloydminster acknowledges that we are located on Treaty 6 Territory, and the City of Lloydminster respects the histories, languages, and cultures of First Nations, Metis, Inuit, and all First Peoples of Canada, whose presence continues to enrich our vibrant community.

ISL Engineering and Land Services Ltd.

ISL Engineering and Land Services Ltd. acknowledges that our Calgary office and work takes place on the ancestral, traditional, and present-day territory of the Treaty 7 Nations of Southern Alberta. The confluence of the Bow and Elbow Rivers has been an important meeting place for Indigenous peoples since time immemorial, and we honour the Siksika, Piikani, and Kainai Nations of the Blackfoot Confederacy, the Bearspaw, Chiniki, and Goodstoney First Nations of the Stoney Nakoda Nations, and the Tsuut'ina Nation. We also acknowledge that this is the homeland of the Métis Nation of Alberta, Region 3.

Executive Summary

ISL Engineering and Land Services Ltd. (ISL) was retained by the City of Lloydminster (City) to evaluate the potable water treatment system in terms of its condition and treatment capacity, and to identify any upcoming upgrades and significant maintenance. The results of this work will allow the City to plan for future upgrades and formulate a financial plan. This will also allow the reassessment of their water rates in advance of commencing any of the upgrades or changes identified within this report.

Potable Water Treatment

The City's water treatment plant (WTP) is located at 4701 – 67 Street in the Province of Saskatchewan. The treatment facility was commissioned in March of 1984 and designed to provide treatment for a raw water flowrate of 30,000 m^3/d. Subsequent assessments and experience downrated the treatment capacity of the WTP to 20,168 m^3/d, which was due to the performance of the clarifier. The water treatment process is comprised of the following stages:

- Coagulation
- Flocculation and clarification
- Media filtration
- Ultra-violet disinfection
- Chlorine disinfection

In addition to providing potable water to the City, the WTP also provides potable water to the ACE Regional Waterline and the Prairie North Regional Potable Water Supply System. In 2023 the maximum daily volume of potable water provided by the WTP was 16,545 m^3, which was achieved by operating the WTP for a total of 18.3 hours.

Future Potable Water Demands

Historical potable water usage provided by the City's advanced metering infrastructure (AMI) system, allowed the consumption rates for specific categories of the City's residents and land-uses to be established. An average day to maximum day peaking factor of 1.4 was similarly selected from the historical operational data from the WTP.

By utilizing the 2.2% average residential growth rate from the 2019 Joint Regional Growth Study in conjunction with the planned growth within the City's service areas, the future average day demands (ADD) and maximum day demands (MDD) for potable water were established. At the City's request two scenarios were developed for the WTP MMD to provide a high and low-demand forecast.

Under the "high-demand" scenario the future potable water demands projected based upon the City's growth were combined with the contractual MDD values for the ACE Regional Waterline and the Prairie North Regional Potable Water Supply System. For the "low-demand" scenario the City's projected growth (as before) was combined with the historical MDD values for the ACE Regional Waterline and the Prairie North Regional Potable Water Supply System.

Table 1 Future Potable Water Demands

Year	Average Day Demand (ADD) (m^3/d)	High-Demand Maximum Day Demand (MDD) (m^3/d)	Low -Demand Maximum Day Demand (MDD) (m^3/d)
2022	10,332	14,892	14,892
2025	11,878	19,419	17,107
2027	12,727	20,608	18,295
2032	14,454	23,026	20,712
2042	17,903	28,609	25,235

Condition and Capacity Assessment Summary / Conclusions

Based upon the information collected from the condition assessment visits and the analysis undertaken as part of the capacity assessment, a summary of the findings / conclusions have been provided below based upon the projected average and maximum day demands for potable water up to 2042. Further specifics and details are included within the main report and the condition assessment tables provided as Appendices A to F.

RIVER PUMPHOUSE AND RAW WATER PIPELINE

Historical investment in maintaining the pumping equipment, and the recent upgrades to the electrical equipment, has resulted in a raw water pumphouse whose condition is understood and is reliable. After 40 years of service, there are still aspects that require addressing which is to be expected with equipment and structures that have been in service for this length of time (i.e. travelling water screen replacement, limited HVAC cooling capacity, roof investigation, etc.).

As water demands increase moving towards 2042, previous pumping equipment that was used as an online stand-by in case of failure, will now have to operate as part of normal operations to meet peak demand. This will require a change to the operation and maintenance of the river pumphouse.

The condition of the raw water pipeline is a significant unknown, and in 2042 it is expected to operate at 95% of its design capacity under the high-demand scenario, and 70% of its design capacity under the low-demand scenario. While all indications are that the pipeline is operating as expected and the only identified issue is flooded valved chambers, this is a critical part of the water supply infrastructure. Its replacement would be a significant undertaking for the City in terms of effort and costs.

CENOVUS RAW WATER PUMPHOUSE

As with the river pump house, the pumping and electrical equipment within the Cenovus raw water pump house is maintained and overhauled on a regular basis. The pumphouse was constructed in 1999 and no significant concerns were noted as part of the condition assessment.

From an operational perspective the two raw water pumps were installed to be operated in a duty / standby configuration, but now both operate together to meet Cenovus's demand. However, this arrangement does not incorporate an on-line standby pump to allow the pumping capacity to be maintained in the event that one of the current pumps fail.

RAW WATER RESERVOIR

On going efforts by the City's teams maintains the condition of the accessible parts of the raw water reservoir, with no issues noted from this assessment. However, the amount of solids deposition within the reservoir and its condition below the water level is undetermined and would require the reservoir to be removed from service and drained for further information to be gathered.

As the demands for water increase, a "full" raw water reservoir would provide approximately five (5) to seven (7) days of raw water storage in 2042, depending upon the MDD demand scenario applied. While there is no regulatory driver to provide additional raw water storage capacity, the expansion of the reservoir becomes a risk assessment exercise as to whether this is sufficient time to address any upstream issues that arise.

WATER TREATMENT PLANT

Over the 40 years in which the WTP has been in service, the maintenance and upkeep efforts with regards to this facility have been focused on the water treatment equipment, with the clarifier being the last major item to be assessed for a refurbishment / upgrade since construction. Except for the clarifier, the identified items to be address moving forwards mainly focus on the ancillary systems such as building mechanical, electrical equipment and the building envelope.

Tasks identified around the building structure and envelope are mostly maintenance items and projects which can be addressed on an individual basis. However, due to the age of the equipment and additional factors, an overall HVAC and electrical upgrade is required. Subject to further investigations a new roof to the WTP building may also be necessary.

Based upon the projections for average day and maximum day demands, the treatment capacity of the WTP is expected to be exceeded in 2026 under the high-demand scenario, and 2031 when applying the low-demand scenario. To clarify, it is estimated that on peak demand days of the identified year, the WTP will not be able to make sufficient water in a 24-hour period to match that which has been used. As such the water stored within the water distribution system will be depleted. The expansion of the WTP will need to include the addition of a second clarifier and the expansion of the media filtration and UV disinfection stages to ideally match the new clarifier's treatment capacity.

Figure 1 Lloydminster Water Treatment Plant

The West End Reservoir was constructed in 2006, and no major issues were identified as part of this work. Issues that have arisen in the past eighteen (18) years have been addressed and improvements made to optimize the pumping operation. Several important maintenance type tasks were identified around the building envelope aspects.

The City of Lloydminster Water Master Plan (ISL 2024) concluded that the potable water storage capacity within the water distribution system should be increased in approximately 2032 to meet regulatory requirements. However, with the recommended demolition of the 1974 circular reservoir in the next five (5) to ten (10) years, this expansion may need to be brought forward.

Recommendations

Based upon the above conclusions and the contents of this report, the following **key recommendations are made**. Each condition assessment table should be reviewed in detail, and the recommended actions should be incorporated into an overall plan / schedule.

At the river pumphouse:

- Replace the failed travelling water screen as soon as possible.
- Proceed with the procurement of a new low lift and high lift pump by 2030, such that a complete pump is available in storage as the number of pumps required to run increases.
- Replace the main air handling unit by 2027 to provide the required ventilation rates and sufficient cooling in summer.
- Complete an assessment / intrusive investigation of the pumphouse roof within the next five (5) years, which could lead to its replacement.
- Monitor the roof assemblies in the meter house building, which may lead to the building's replacement in the future.
- Complete a structural inspection of the wet well walls and floors using divers within the next five (5) years.
- Continue with current maintenance and overhaul practices of all pumping equipment.

With regards to the raw water pipeline:

- Continue to explore and select a method to complete an in-depth assessment of the raw water pipeline within the next five (5) years to determine its remaining service life.
- Within the next five (5) years, establish the basis for the supply of raw water to both the City and Cenovus for the next 50 years, which could influence how future capital projects are undertaken.
- Start to plan and budget for the replacement / twinning of the existing raw water pipeline at a time beyond the next fifteen (15) years.
- Commence a program over the next fifteen (15) years to refurbish the concrete vaults along the length of the raw water main, which contain isolation and air release valves. A number of these vaults are either flooded or need concrete repair / refurbishment.

At the Cenovus raw water pumphouse:

- Review the pipework / wall penetration arrangement to mitigate possible loading of the wall within the next five (5) years.
- Consider with Cenovus the installation of a third raw water pump to provide an online standby in the event one of the existing raw water pumps fails.

- Continue with current maintenance and overhaul practices of all pumping equipment.

With regards to the raw water reservoir:

- Within the next five (5) years drain and inspect the condition and amount of solids deposition below the water level. This may lead to future projects and costs.

At the water treatment plant:

- Complete the clarifier assessment within the next twelve (12) months and plan to complete any remedial work identified in a timely manner.
- Replace both the raw water and distribution flowmeters within then next five years (5) and record the daily volumes / instantaneous flows such that the flow projections and timing for the WTP upgrade can be updated.
- Within the next five (5) years, undertake trials to operate the clarifier and WTP at higher flows under varying raw water quality, such that its potential for producing more potable water per day can be updated.
- Within the next five (5) years, adjust the access to the chlorine gas storage and feed room, which is currently via the WTP, and does not meet the SWSA requirements for exterior access only.
- Address access limitations and water ingress into Vaults 1 and 5, by extending the below grade walls and adding a new above grade structure within the next five (5) years.
- Investigate the condition of the WTP's roof within the next five (5) years, which will likely lead to the replacement of the WTP roof.
- Replace the curtain wall at the front entry area within the next five years (5).
- Complete an upgrade of the HVAC system and electrical equipment within the next five (5) to ten (10) years.
    - These upgrades are integrated and linked with the roof replacement.

With regards to the expansion of the treatment capacity at the WTP:

- Complete the design and contract document preparation within the next five (5) years, such that the project is ready to tender at short notice.
- Plan / budget to construct the WTP expansion in the next five (5) to (10) years, on the basis that the project could be pushed back based upon the actual water demands that occur moving forward.

At the West End Reservoir:

- Decommission and demolish the 1974 circular reservoir within the next five (5) to ten (10) years.
- Complete a structural inspection of the interior of the reservoir cells around 2031, when the reservoir has been in service for 25 years.
- Plan to expand the potable water storage capacity within the water distribution system as per the City of Lloydminster Water Master Plan (ISL 2024). Adjustments may be required based upon the demolition of the circular reservoir.

Cost Estimate and Expenditure Forecast

Based upon the tasks / actions identified within the condition and capacity assessments, the table below provides a summary of the cost estimates and forecast of future expenditure for the water treatment system. This table does not include the expansion of water storage within the water distribution system, which is covered within the City of Lloydminster Water Master Plan (ISL 2024).

Table 2 Overall Cost Estimate and Expenditure Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Mnths	< 5 Years	5 to 10 Years	10 to 15 Years	None
Process	$1,016,000	$3,202,100	$3,040,000	$445,000	$40,000,000
Building Mechanical	$107,550	$1,388,800	$340,400	$326,000	$0
Structural	$25,500	$642,000	$470,000	$30,000	$0
Building Enclosure	$7,600	$574,900	$33,000	$0	$0
Electrical	$0	$400,000	$370,000	$0	$112,000
Instrumentation and Controls	$33,000	$66,000	$125,000	$0	$0
Condit. Assess. Totals	$1,189,650	$6,273,800	$4,378,400	$801,000	$40,112,000
Building Mechanical Items Removal		-$981,000	-$195,500	-$308,000	
Electrical Items Removal		-$400,000	-$184,000		
Electrical Upgrade		$300,000	$2,700,000		
Building Mechanical Upgrade		$300,000	$2,700,000		
WTP Roof Replacement			$860,000		
Revised Totals from Project Consolidation	$1,189,650	$5,492,800	$10,258,900	$493,000	$40,112,000
River Pumphouse Low Lift Pump		$275,000			
River Pumphouse High Lift Pump		$450,000			
WTP Capacity Expansion		$3,000,000	$27,000,000		
Overall Total	$1,189,650	$9,217,800	$37,258,900	$493,000	$40,112,000

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APPENDICES

TABLES

FIGURES

ACRONYMS

Acronyms	Description
AC	asbestos cement
ACE	Alberta Central East Water Corporation
ADD	average day demand
AHU	air handling unit
BMS	building management system
CI	cast iron
City	City of Lloydminster
EPS	extended period simulation
FF	fire flow
GIS	geographic information system
HDPE	high-density polyethylene
HGL	hydraulic grade line
HLP	high lift pump
HVAC	heating, ventilation, and air conditioning
IR	infra-red
ISL	ISL Engineering and Land Services Ltd.
LED	light emitting diode
LiDAR	light detection and ranging
MCC	motor control center
MDD	maximum day demand
NBC	National Building Code
PE	polyethylene
PHD	peak hour demand
PLC	process logic controller
PRV	pressure reducing valve
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
SME	Saskatchewan Ministry of Environment
STL	steel
SCADA	supervisory control and data acquisition
SWSA	Saskatchewan Water Security Agency
UFW	unaccounted for water
UPS	uninterruptable power supply
UVT	ultraviolet transmissivity
WER	West End Reservoir
WMP	Water Master Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

UNITS

Unit	Meaning
$	dollars
%	percentage
ADD	average day demand
AMI	advanced metering infrastructure
ft	feet
ft^2	square feet
ft^2/unit	square feet per unit
ha	hectares
Kg/d	kilograms per day
km	kilometre
kPa	kilopascals
L/p/d	litres per person per day
L/sec	litres per second
L/min	litres per minute
L/s/ha	litres per second per hectare
MDD	maximum day demand
m	metres
mg/L	milligrams per litre
mg-min/L	milligrams minutes per litre
m/h	meters per hour
m/sec	metres per second
m^2	square meters
m^3	cubic metres
m^3/hr	cubic metres per hour
m^3/d	cubic metres per day
m^3/m^2/h	cubic meters per square meters per hour
mm	millimetres
kPa	kilopascal
psi	pounds per square inch

1.0 Introduction

1.1 Authorization

The City of Lloydminster (City) retained ISL Engineering and Land Services Ltd. (ISL) to complete a review of its current raw water intake, treatment, and storage systems and assess their capacity to meet the current and future growth water demands effectively culminating in an updated Water Master Plan (WMP). This document contains the review of the City's water treatment system; the part of the study considering the water distribution system is included under a separate cover titled City of Lloydminster, Water Master Plan.

1.2 Objective

As part of the workflow to determine future capital projects, the condition of the City's key infrastructure and its ability to meet future growth demands is a key part of the planning exercise. The potable water treatment system for the City can be divided into three (3) categories as follows:

- raw water supply and storage,
- potable water treatment, and
- potable water storage and distribution.

The objective of this assessment is to evaluate the potable water treatment system in terms of condition and treatment capacity and to identify any upcoming upgrades and maintenance requirements to provide high quality potable water to the City's consumers which complies with the Saskatchewan standards and regulations. Planning for future upgrades will allow the City to formulate a financial plan and reassess their water rates in advance of commencing any of the upgrades or changes identified within this report.

1.3 References

- Guidelines for Chlorine Gas Use in Water and Wastewater Treatment, EPB 265, Government of Saskatchewan, 2004
- A Guide to Waterworks Design EPB 201, Saskatchewan Water Security Agency 2012.
- Waterworks Design Standard, EPB 501, Saskatchewan Water Security Agency, 2012
- City of Lloydminster Waterworks System Assessment, Associated Engineering, 2006
- City of Lloydminster Waterworks System Assessment and Capital Plan, Worley Parsons, 2010
- Permit to Operate a Waterworks, Water Security Agency, 2011
- Waterworks Master Plan and System Assessment, ISL Engineering and Land Services, 2016
- City of Lloydminster and County of Vermillion River Joint Regional Growth Study, 2019
- WTP – UV Disinfection System Upgrade Design Basis Memorandum, MPE Engineering Ltd., 2022
- City of Lloydminster Water Master Plan, ISL Engineering and Land Services ISL, 2024

2.0 Water Treatment Overview

2.1 System Description

The City's existing water treatment system consists of the following three (3) main components,

- raw water supply and storage,
- potable water treatment, and
- potable water storage and distribution.

The following subsections will provide a description of each of the sub-components within the three systems listed above. A Process Flow Diagram (PFD) highlighting all of the components described in this section is provided below in Figure 2.1.

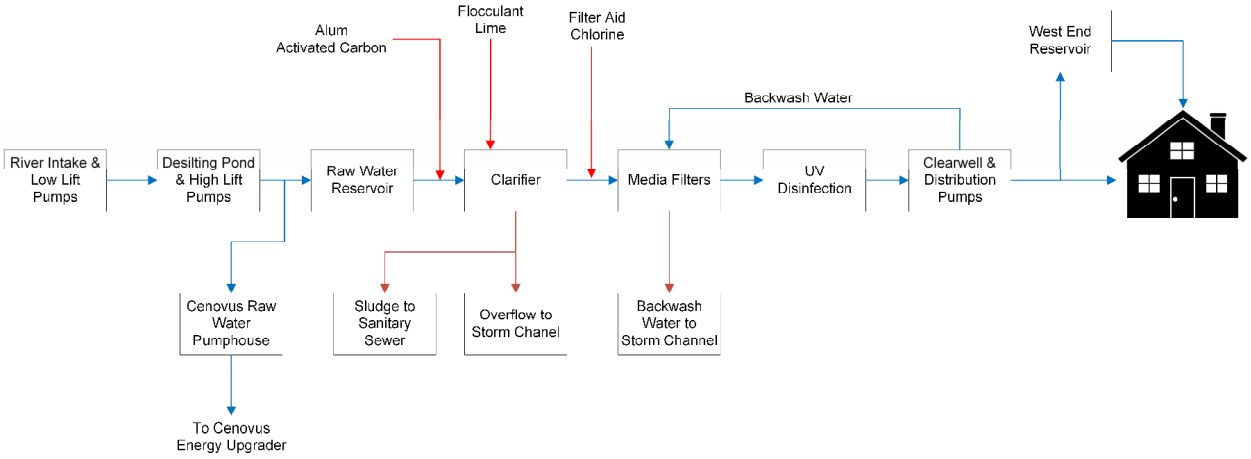


Figure 2.1 Process Flow Diagram

2.2 Raw Water Supply and Storage

The raw water supply and storage system provides raw water to both the City and the Cenovus Energy Upgrader (Cenovus). Constructed in the summer of 1983 and placed into service during the spring of 1984, the system was upgraded first in 1991 and finally in 1999 to address Cenovus' increasing raw water demand. The major elements of this system include the:

- River intake structure
- River intake pump station
- Desilting pond
- High lift pump station
- Raw water supply pipeline
- Cenovus raw water pumphouse
- Raw water reservoir

River Intake Structure

The river intake structure is positioned in the main flow channel of the North Saskatchewan River north of Lloydminster. This concrete rectangular structure is responsible for drawing and directing water from the river into the river intake pump station. The intake structure draws in raw water from the North Saskatchewan River using four (4) intake ports, two (2) on each side of the intake structure. Following entry into the intake structure, raw water is directed to the river intake pump station via a 1,050 mm diameter high-density polyethylene (HDPE) pipe. The intake structure, as well as the transfer pipe, has a design capacity of 1,042 L/sec (90,000 m^3/d).

In 2020 the intake structure within the North Saskatchewan River was upgraded through the installation of rock and sheet piles to protect the intake from high flows and ice, while narrowing the channel to increase the water velocity at the intake structure and mitigate settlement of sand and gravel.

River Intake Pump Station

The river intake pump station is comprised of three (3) components.

- A 10 mm mesh size travelling water screen with a rated capacity of 1,040 L/sec (89,856 m^3/d), which screens out and prevents larger debris from entering the rest of the downstream raw water system.
- Two (2) VFD-driven low-lift pumps, each with a rated capacity of 451 L/sec (38,976 m^3/d) at a discharge pressure of 39 ft. (11.8 m) of water, which pump the raw water influent to the desilting pond. Provisions to direct raw water from the low lift pump wet well directly to the high lift pump wet well are provided in the event the desilting pond is undergoing maintenance.
- Three (3) fixed speed high lift pumps, each with a capacity of 231 L/sec (19,923 m^3/d) at a discharge pressure of 607 ft. (185 m) of water. These units pump the screened and de-silted river water to the raw water reservoir adjacent to the Water Treatment Plant (WTP) via a 750 mm diameter raw water supply pipeline.

Desilting Pond

The single U-shaped desilting pond is designed to remove particulate matter such as sediment and silt from the raw water, prior to the raw water being pumped to the raw water reservoir by the high lift pumps. Following desilting, the outlet from the pond flows by gravity into the high lift pump wet well. The volumetric capacity of the desilting pond is 122,000 m^3, and a working volume of 90,000 m^3. The desilting pond was last dredged in 2007.

Raw Water Supply Pipeline

The high lift pumps have the capability to move river water from the high lift pump wet well to the raw water reservoir via a 36 km long, 750 mm diameter yellow jacketed, cement lined steel pipe with a design capacity of 694 L/sec (60,000 m^3/d). At this capacity, the velocity of the flow within the pipe would be approximately 1.6 m/s. A provision is provided to bypass the raw water reservoir and directly feed the WTP in the event the raw water reservoir is undergoing maintenance.

In addition to supplying raw water to the City and the Cenovus Energy Upgrader, raw water is drawn directly off the raw water supply pipeline and supplied for agricultural operations to the following establishments:

- Don Whiting Farm
- Jack Whiting Farm
- Manley Farms Ltd.
- L&A Farms

- Five L Farms Ltd.

Quantock Cattle Co. is an additional agricultural establishment that holds an account to draw raw water directly off the raw water supply pipeline; however historical data supplied by the City suggests that Quantock Cattle Co. has not drawn any raw water from the raw water supply pipeline since 2011. The average volume of raw water supplied for agricultural operations from 2020- 2024 is 1,081 m^3 per year

Cenovus Raw Water Pump House

The Cenovus Raw Water Pump House is located adjacent to both the WTP and the raw water reservoir. This pump house is used to supply raw water to Cenovus and is comprised of two (2) horizontal split case pumps, each with a capacity of 91 L/sec (7,865 m^3/d) at a discharge pressure of 188 ft (57 m) of water. Since the 1999 upgrade, the raw water supply for Cenovus is no longer taken from the raw water reservoir but instead supplied directly to the suction pipework of this pump house. The split case pumps direct raw water from the raw water supply pipeline to Cenovus via a 9 km long 350 mm diameter PVC pipeline. The Cenovus supply pipeline is rated for a maximum flow rate of 15,720 m^3/d. At this flow rate, the velocity of the flow within the pipe will be approximately 1.9 m/s. Two (2) additional users, the Driven Energy Legion Ball Park and the City's golf course, also draw raw water from the Cenovus raw water pipeline.

Figure 2.2 Cenovus Raw Water Pumps

Raw Water Reservoir

Constructed and commissioned in 1974, the raw water reservoir is located directly west of the City's WTP. The volumetric capacity of the raw water reservoir is approximately 204,000 m^3, of which the lower 2 m cannot be used due to allowances for solids accumulation and position of the outlet pipework. In accounting for 1 m of ice cover this results in a working raw water storage capacity of 155,000 m^3 in winter, and 188,000 m^3 in summer.

Copper sulfate is added periodically to the raw water reservoir to control algae growth within the raw water, typically during the spring and summer seasons. The City usually adds one (1) 25 kg bag of copper sulfate to the raw water reservoir during each application, which translates to a dose of 2.2 mg/L. Depending upon algae growth around two or three applications are made per year.

2.3 Potable Water Treatment

The City's WTP is located at 4701 – 67 Street in the Province of Saskatchewan. Construction of the WTP began in late 1981 and the process was commissioned in March of 1984. The WTP was designed to treat a flow of 30,000 m^3/d, when it was commissioned.

As per the assessment completed in July 2003 by Associated Engineering, the rated net production capacity of the WTP was established as 21,800 m^3/d. The net production capacity was reduced further to 20,125 m^3/d as a result of the assessment performed by Worley Parsons in 2010, which was supported in 2016 by ISL's assessment. In all cases the treatment capacity of the clarifier was the limiting factor.

Based upon the available data between 2009 and 2024, the highest potable water volume produced by the WTP was 18,241 m^3/d in 2015. The WTP is typically operated for about sixteen (16) hours a day at a fixed flowrate, with the number of hours of operation per day adjusted to account for variations in daily demands until the West End Reservoir is "full".

Originally the raw water from the raw water reservoir was pumped into the WTP using combinations of three (3) vertical inline centrifugal pumps, each with the capacity to provide 173.5 L/sec of flow (14,990 m3/d). However, due to the presence of significant head (elevation difference) between the raw water reservoir and the WTP, the City Operations' staff replaced one of the raw water pumps with a section of pipework. During normal operation, raw water now flows by gravity from the raw water reservoir into the WTP. Should the City experience high demands, the remaining two raw water pumps can be used to provide additional flow.

The WTP accomplishes the treatment of raw water by subjecting it to the following treatment stages:

- Coagulation
- Flocculation and clarification
- Media filtration
- Disinfection

Coagulation, Hydrated Lime and Powder Activated Carbon

As a first step, aluminum sulphate (alum) is added to the water to neutralize the charge of particles and compounds within the raw water, which results in the formation of pin-floc. This is followed by the addition of hydrated lime (Lime), which assists with the downstream flocculation process and adjusts the raw water's pH. Powdered activated carbon (PAC) can also be added to assist in this process.

The WTP is equipped with a maximum alum storage capacity of 65,000 kg, of which only about 40,000 kg is stored on site. The two alum dosing pumps (which were installed in 1984) each have the capacity to add up to 13 L/min of alum.

The Lime silo at the WTP is capable of storing a maximum of 27,750 kg of Lime. As Lime is typically only used between spring and fall of each year, the silo is typically filled at the start of each season. In 2024 a new Lime makeup and feed system was installed, which has the capacity to provide a maximum feed rate

of 25 kg/d. In 2023 a new PAC makeup and feed system was installed, which utilizes bulk bags of PAC and an eductor system for mixing and conveyance. The system has a maximum feed rate of 17 kg/d.

All three systems have the option to apply chemicals to more than one location as summarized below.

- Alum is normally applied at the raw water inlet and can be also applied at the flash mixer upstream of the clarifier.
- PAC is normally applied at the flash mixer and can also be applied at the raw water inlet and at the mixing zone within the clarifier.
- Lime is normally applied at the mixing zone within the clarifier but can also be applied at the flash mixer.

Flocculation and Clarification

Following coagulation, the partially treated water enters a single, solids contact clarifier where flocculation and clarification (settlement) occurs. The water enters the central feed well. (mixing zone) where an anionic polymer and Lime are added to the water. Within the mixing zone the chemicals are mixed, and the pin-floc is encouraged to grow into larger macro-floc (flocculation). The water then exits at the bottom of the mixing zone (aka flocculation zone) and enters a large quiescent volume when the large macro-floc (solids) settles to the bottom of the clarifier and the clear, clarified water is decanted at the top of the clarifier.

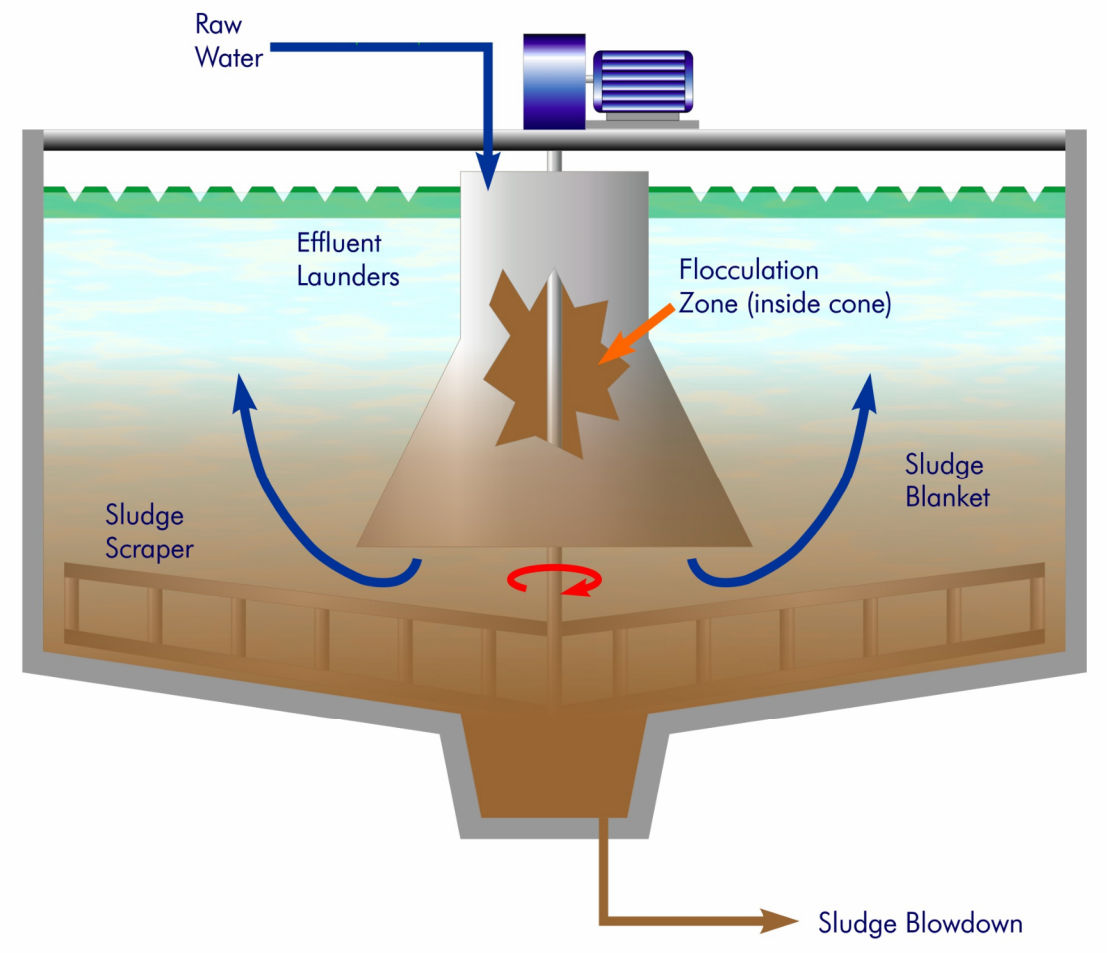


Figure 2.3 Typical Solids Contact Clarifier Arrangement

The clarifier at the WTP is installed with inclined tube settlers, which are positioned between the settled sludge at the bottom of the clarifier and the effluent launders at the top. Tube settlers consist of multiple inclined tubes that create a larger effective settling area. This approach reduces the vertical distance that the floc must travel to remove itself from the main water flow allowing for quicker and more efficient solids removal.

At the manufacturer's recommended maximum loading rate of 4.2 m/h (which includes the tube settlers) and with an effective surface area of 210 m^2, the clarifier is currently rated to treat up to 21,168 m^3/d, based upon 24/7 continuous operation. If the clarifier has to be taken off-line for maintenance, it can be bypassed and a direct filtration approach used to treat the raw water. Once isolated, the two sludge pumps that are used to waste excess sludge from the clarifier to the sanitary sewer system are used to completely drain the clarifier.

An anionic polymer (Clearfloc AE3055) is used to aid the formation of macro-floc within the mixing zone. Stored on site in the form of a liquid, the polymer is made into a solution on an as-needed basis and added to the central feed well / mixing zone of the clarifier. The maximum polymer dose that can be applied is 1.0 mg/L.

Filtration

During normal operation, the clarified water is directed to a set of four (4) dual media filters that operate in parallel. Any solids that are not removed via the solids contact clarifier are removed during this stage. At the manufacturer's recommended maximum loading rate of 11.2 m/h and with an effective filtration area of 27.0 m^2, all four filters have a combined capacity of 28,995 m^3/d based upon 24 hours of operation. With only three filters online this reduces to 21,747 m^3/d.

The four media filters are backwashed using a separate air and water backwash cycle. Once isolated, a single air blower is used to agitate the media and solids. Once the media is agitated, the blower is switched off and a single backwash pump (rated at 1,070 m^3/h) is used to reverse the flow of water through the filter and lift / flush the collected solids out of the filter. Once the upwash phase of the cleaning cycle is completed the filter is filtered-to-waste and returned to service.

The need to clean a media filter is based upon the head (pressure) loss across the filter or the length of time the filter has been in service. Typically, any filter that has been in service for more than 8 days is backwashed.

As the water leaves the solids contact clarifier, a filter aid (CTI CL2410) is added at a dose of 0.05 to 0.2 mg/L to help promote the filtration process. Currently, the filter aid is withdrawn directly from a 210 Litre (55 Gallon) drum using a small Grundfos DDA dosing pump. According to NSF/ANSI Standard 60, the maximum dose of CTI CL2410 is 50 mg/L, which is significantly more than the doses applied.

Figure 2.4 Dual Media Filters

Ultra-Violet (UV) Disinfection

Commissioned in 2024, the purpose of the UV disinfection stage was to maintain the quality and disinfection of the potable water while the solids contact clarifier is removed from service for inspection and maintenance. Trojan UV Swift reactors were installed on the outlet of each media filter to provide a 3-log reduction in both Cryptosporidium and Giardia. The UV reactors are integrated with the normal operation of the WTP and disinfect the filtered water prior to it entering the downstream clearwell.

Figure 2.5 UV Reactor & Filter Outlet Pipework

Chlorine Disinfection

Gaseous chlorine is used to achieve the required reduction in viruses prior to the water entering the water distribution system. Chlorine can be added to the water at the outlet of the solids contact clarifier or the inlet of the clearwell. Each dosing point has a dedicated chlorinator, each with a capacity of 90 kg/d which are interconnected to provide stand-by capacity if required. Liquified chlorine is stored within chlorine drums (tonners), each holding 907 kg of liquified chlorine. Only three tonners are currently stored at the facility, with two drums always online. Both online drums are located on weigh scales to allow monitoring of the amount of chlorine used and both are connected to vacuum regulators in a duty / stand-by configuration.

Under normal operating conditions, chlorine is added to the water as it leaves the clarifier, in proportion to the total filter outlet flowrate (i.e. flow paced). The chlorine dose is set such that the water passing through the media filters and the downstream clearwell achieves a specific free chlorine residual on leaving the clearwell. Should the free chlorine residual drop through the filters and clearwell, additional chlorine can be added at the outlet of the clearwell.

Disposal of Wastewater

The water treatment process has two (2) main sources of waste; settled sludge from the clarifier and backwash water from the media filters.

The settled sludge from the clarifier is discharged to the sanitary sewer system, which mixes with the wastewater and flows to the City's Wastewater Treatment Facility.

The wastewater generated from backwashing the filters is pumped, collected in a tank, and discharged to a storm channel adjacent to the WTP. As the source water for the backwash water is chlorinated, a downstream impact assessment study was completed by the City in 2005 which determined that there was no free chlorine residual within the natural stream downstream as a result of the backwash water. At this time the discharge of backwash water to the storm channel has been permitted to continue.

2.4 Potable Water Storage and Distribution

The clearwell located at the WTP has no capacity for storage and does not contribute to the overall potable water storage volume. Its primary purpose is as a source of filter backwash water and to provide a volume of water from which the distribution pumps can draw.

Water is distributed to the City through the water distribution system by three (3) vertical turbine pumps which operate in a two duty / one standby configuration. All three (3) vertical turbine pumps were modified in 2003 and their capacity increased, such that their **current performance does not match the duty stated on the pump nameplates.** Two of the three pumps operate using constant speed drives and are rated to operate at a duty flow of 16,353 m^3/d at 598 kPa. The third pump operates using a variable frequency drive (VFD) and is rated at a duty flow of 13,355 m^3/d at 592 kPa.

Potable water from the WTP is pumped into the water distribution system to meet the potable water demands of the City's residents and commercial users, with any unused water diverted to refill the West End Reservoir. The West End Reservoir stores and redistributes potable water to supply high pressure zones, meet fire flow demands, and provide potable water to the City when the WTP is shutdown overnight (typically between 11:00 pm and 6:00 am).

Figure 2.6 West End Reservoir Pumping Equipment

The West End Reservoir has a total storage capacity of 24,795 m^3. An above ground concrete structure constructed in 1974 provides 4,545 m^3 of storage, with an additional 20,250 m^3 of storage provided within two below ground reservoirs which were installed in 2006. Potable water from the West End Reservoir can be supplied to the water distribution system using combinations of the four pumps installed adjacent to the reservoir. Each pump has a capacity of 103 L/sec (371 m^3/h) at 43.2 m. Originally the system was commissioned with two of the pumps operated using variable frequency drives (VFDs) and two using constant speed drives. This has been recently upgraded such that all the distribution pumps operate using VFDs.

During periods of high demand (i.e. during the day), potable water is primarily supplied to the water distribution system from the WTP, with the distribution pumps at the West End Reservoir making up any shortfall. As the demand declines towards the end of the day, the excess potable water from the WTP is used to replace the potable water that has been provided by the West End Reservoir during the day. Typically, the WTP shuts down at approximately 11:00 pm each night, with the overnight demands of the City met by the West End Reservoir only, until 6:00 am the following morning when the WTP restarts. If necessary, it is possible to operate the WTP for longer hours to meet higher than typical demands.

3.0 Potable Water Demands

The first step to assessing a water treatment system is to understand the historical demands and establish the future water demands over a specified time. Using the estimated growth within the City's service areas, this section will summarize the population and flow projections which will be used to complete a capacity assessment of the City's WTP components, including the river intake, the raw water supply pipeline, and the West End Reservoir.

During preliminary discussions with the City, it was agreed to separate the residential growth from the non-residential growth with the intent of producing more realistic projections and to avoid a "blanket approach" of predicting future water demands.

3.1 Residential Growth

To predict the residential growth within Lloydminster, the following four (4) options were reviewed and discussed with the City's team.

- **Option #1** - Continuation of the application of population projections within the 2019 Joint Regional Growth Study, which would result in a very conservative estimate as to when upgrades will be needed. This has occurred historically with reports stating the WTP was overdue for an upgrade, however the WTP was not running 24-hours a day in the peak summer months, thus contradicting the requirement for an upgrade.
- **Option #2** - Application of the 2021 Lloydminster Population Centre census value of 31,582 persons. (Statistics Canada) and the recalculation of the future population projections with a 2.2% growth rate, determined within the 2019 Joint Regional Growth Study.
- **Option #3** - Application of the 2021 Lloydminster Population Centre census value of 31,582 persons and adjusting the growth rate to achieve the Joint Regional Growth Study's population for 2051 of 67,489 persons.
- **Option #4** - Application of the 2021 Lloydminster Population Centre census value of 31,582 persons and recalculation of the future population projections with an alternate / lower growth rate to reflect the actual growth rate being observed within the City.

Through discussions with the City, Option #2 was selected on the following basis:

- Option #1 does not meet the objectives of the project in terms of providing realistic and practical input into the City's capital program.
- Option #4 diverges too significantly from the 2019 Joint Regional Growth Study and is likely to cause contradictions with other work and initiatives ongoing within the City.
- Although Option #3 will eventually align with the longer-term 35-year plan, it results in a higher growth rate, which may be unrealistic / unsustainable.

Table 3.1 below provides the 20-year residential population projections for the City using the method summarized for Option 2.

Table 3.1 City of Lloydminster Residential Population Projections

Base Year	Horizon	Historical Population (persons)
2021	-	31,582
Year	**Horizon**	**Projected Population (persons)**
2022	0	32,277
2025	3	34,454
2027	5	35,987
2032	10	40,124
2042	20	49,878

3.2 Non-Residential Growth

The City provided ISL with documents summarizing the non-residential staging projections for the City based on the current Municipal Development Plan (MDP) as well as the Off-Site Levy Project, which are listed in order of precedence informed by the City below:

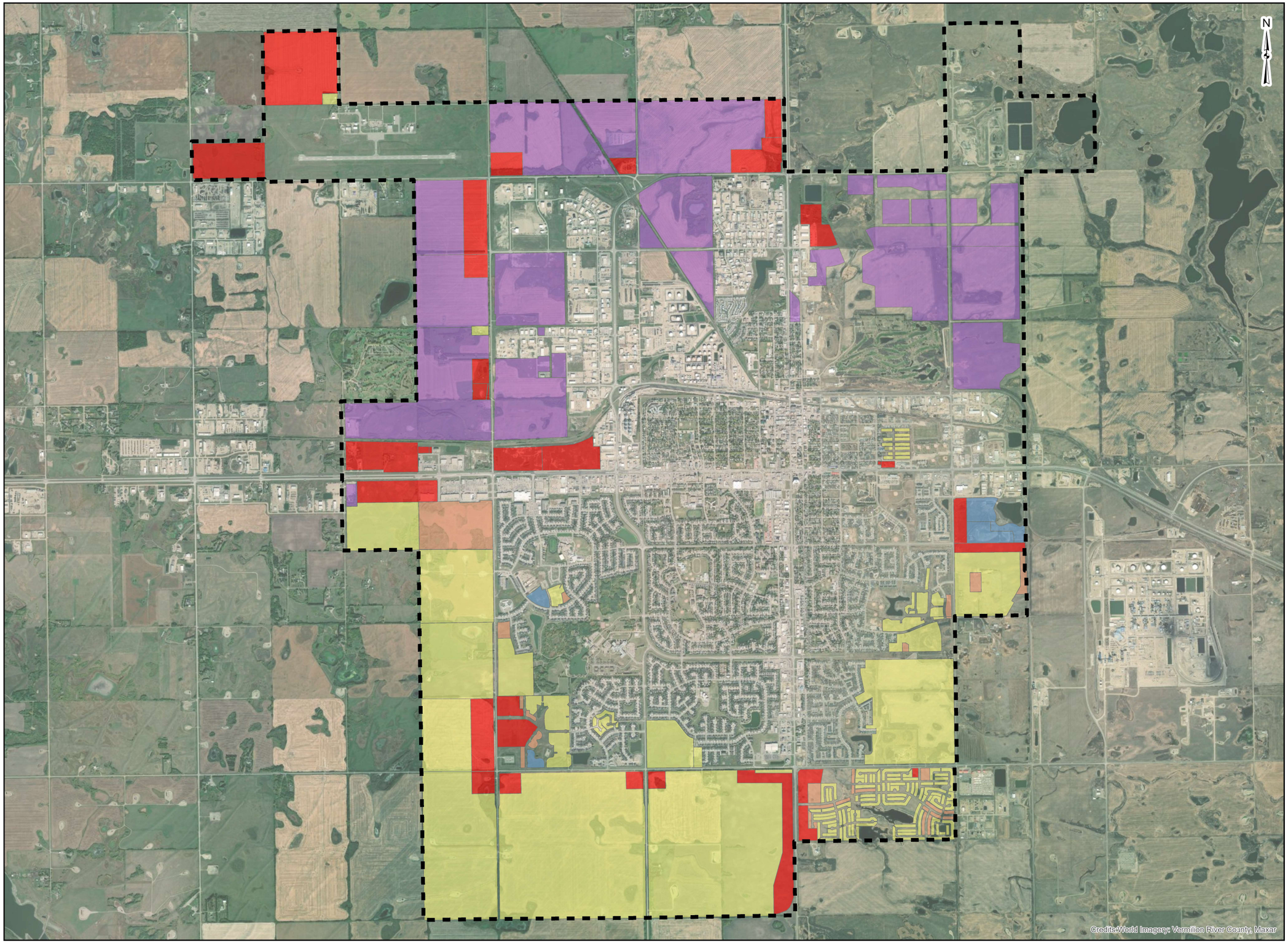
- Project #2241118 – 2023-01-12 Developable Land Timeframes and Projects (City Revisions), which is the City's most up to date understanding of growth projections from discussions with Developers and Consultants
- Project #2241118 – 2022-11 Consolidated Future Growth DRAFT, which summarizes the expected future growth prior to the Developable lands plan. This document has timelines for some areas that are not defined in the first document. Outcomes of discussions between the City and ISL's water distribution team have been included within this memorandum.
- Project #2241118 – Capital Projects and Growth Phasing, which summarizes the Capital Projects from the last Master Plans and their expected timelines.
- Project #2241118 – Lloydminster Revised Maps 18.01023 – From MDP, which summarizes the updated MDP plans that are suspected to be 95% complete and summarizes the expected land uses of various areas.

Using the documentation listed above and through clarifications with the City, ISL defined the non-residential growth (in hectares) expected for the next 20 years, which has been summarized in Table 3.2 and Figure 3.1 below. Through discussions with the City, the non-residential areas were classified into the following categories:

- Public Services (PS)
- Local Commercial (LC)
- Commercial Business District (CBD)
- Industrial (IND)
- Irrigation (IRRIG)

Table 3.2 City of Lloydminster Non-Residential Cumulative Growth

Year	Horizon	PS Projected Area	LC Projected Area	CBD Projected Area	IND Projected Area	IRRIG Projected Area
		ha	ha	ha	ha	ha
2022	0	159	37	169	478	10
2025	3	167	37	195	615	10
2027	5	189	37	239	660	10
2032	10	192	37	293	809	10
2042	20	192	37	363	1056	10



Legend

Study Area

Future Land Use

- Commercial Business District
- Industrial
- Public Service
- Medium Density Residential
- Low Density Residential

Note: Parcels shown are those to be serviced.

0 500 1,000 2,000 Meters

1:40,000 NAD 1983 UTM Zone 12N

FIGURE 3.1
FUTURE LAND USE
LLOYDMINSTER WATER MASTER PLAN

ISL

LLOYDMINSTER

Integrated Expertise. Locally Delivered.

Date: 9/17/2024 Document: Z:\Shared\GIS\Projects\28160_Lloyd_Water_Master_Plan\251_Figures\3_Reporting\28160_Lloyd WMP\Lloyd WMP.aprx

3.3 Historical Potable Water Demands

The City's WTP supplies potable water to three (3) service areas:

- Alberta Central East (ACE) Regional Waterline,
- Prairie North Regional Potable Water Supply System, and
- City of Lloydminster.

The following sub-sections summarize the historical demands related to each of the service areas.

3.3.1 ACE Regional Waterline

The ACE Regional Waterline supplies potable water to seven (7) communities to the west of the City in Alberta. This regional system has been in operation since October of 2018, with all communities online as of December 2023. There are currently no plans to add more communities to this regional waterline.

Historical daily volumes of potable water supplied to the ACE Regional Waterline from October of 2018 to February 2024 were provided by the City. Table 3.3 summarizes the minimum, average, maximum, 99th percentile and 95th percentile of the annual potable volumes supplied to the ACE Regional Waterline for 2019 to 2023 (i.e. whole years only).

Table 3.3 Historical ACE Regional Waterline Demands

Year	Minimum Daily Volume	Average Daily Volume	Maximum Daily Volume	99th Percentile Daily Volume	95th Percentile Daily Volume
	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
2019	0	447	1,993	976	750
2020	0	475	1,600	961	754
2021	173	477	1,069	957	725
2022	116	528	1,136	941	782
2023	170	539	1,106	1,024	792

Within the agreement with the City, the ACE Regional Waterline is entitled to draw the following flows / volumes.

- 2020 to 2024 – 2,471 m^3/day
- 2025 to 2034 – 2,842 m^3/day
- 2035 to 2039 – 3,464 m^3/day
- 2040 to 2041 – 3,824 m^3/day

Based upon the last three years of data (during which the daily maximum flow stabilized), the ratio of the allowable daily maximum volume to the actual daily volume is 4.83. This peaking factor will be applied to the future flow projections.

3.3.2 Prairie North Regional Potable Water Supply System

Through the Prairie North Regional Potable Water Supply System (Prairie North) the City supplies potable water from its WTP to the communities of Marshall and Lashburn, located in the Province of Saskatchewan. This regional system was commissioned in December 2022 and minimum, average, maximum, 99th percentile and 95th percentile of the potable water volumes supplied in 2023 are shown in Table 3.4 below.

Table 3.4 Historical Prairie North Regional Waterline Demands

Year	Minimum Daily Volume	Average Daily Volume	Maximum Daily Volume	99th Percentile Daily Volume	95th Percentile Daily Volume
	m^3/day	m^3/day	m^3/day	m^3/day	m^3/day
2023	206	311	564	482	405

As per the agreement with the Prairie North Regional Potable Water Supply System, the City is expected to provide a maximum daily volume of 800 m^3/day with an allowance to provide flows up to 1,000 m^3/day for ten days per year. The agreement currently in place is for 20 years, with the possibility to review the maximum daily flows supplied in the first five years of operation and adjust the agreement accordingly.

Based upon the 2023 data, the ratio of the allowable daily maximum flow to actual average daily volume is 3.22. This peaking factor will be applied to the future flow projections.

3.3.3 City of Lloydminster

In 2017 the City implemented an advanced metering infrastructure (AMI) system to allow for the collection of actual/real-time water usage data and the implementation of advanced leak detection on the basis that all parcels serviced by the City are metered. The City provided AMI data from January 2021 to December 2023 as well as the daily volume of potable water supplied by the City WTP from 2018 to 2023.

In working with the City, the users from the AMI data were classified into the following categories:

- Residential, which were further categorized into:
  - Single Family (RES-SF)
  - Multi Family (RES-MF)
  - High Density (RES-HD)
- Public Services (PS)
- Local Commercial (LC)
- Commercial Business District (CBD)
- Industrial (IND)
- Irrigation (IRRIG)

Table 3.5 below provides a summary of the AMI data and a comparison of the AMI data to the WTP data from January 2021 to December 2023.

Table 3.5 Summary of AMI Data (January 2021 to December 2023)

Summary	Total Volume from January 2021 to December 2023	Average Flowrate[1]	Percent of Total Volume Consumed	Percent of Total Volume Produced From WTP
	m^3	L/s	%	%
RES - SF	4,214,630	44.5	42.5	39.1
RES - MF	363,936	3.8	3.7	3.4
RES - HD	1,325,345	14.0	13.4	12.3
PS	627,286	6.6	6.3	5.8
LC	238,706	2.5	2.4	2.2
CBD	1,217,062	12.9	12.3	11.3
IND	1,936,284	20.5	19.5	18.0
IRRIG	7,915	0.1	0.1	0.1
Potable Water Volume Consumed (from AMI Data)	9,923,250	104.8	100.0	92.0
Potable Water Volume Produced (from WTP data)	10,780,821	113.9	-	100.0
Unaccounted Water	857,571	9.1	-	8.0

Notes
1. Based on the average of monthly volumes

ISL compared the AMI data to the volumes supplied from the WTP (to the City only). From the comparison, an average difference of 8% was observed between the two sets of data. This may be attributed to unaccounted water due to losses/leakage throughout the water distribution system, thus aligning with understanding that all parcels serviced by the City are metered and retaining confidence in the AMI data.

From the data summarized in Table 3.5 it is also seen that single family residences use the largest volume of potable water within the City, followed by industrial, high density residential, and commercial business district categories, respectively. Irrigation users utilized the least volume of potable water.

Using the total water usage data for the residential users summarized in Table 3.5 above (RES-SF, RES-MF and RES-HD) and a residential population of 32,277 persons (2022 population noted in Table 3.1), the average per person per day for **residential users** was determined to be **167 L/p/d.**

In the Waterworks Master Plan and System Assessment, ISL 2016, an average day demand (ADD) to maximum day demand (MDD) peaking factor of 1.5 based upon a 5-day rolling average of historical data was selected. Using the same approach and reviewing the historical data from 2016 to 2023, the steps and measures taken by the City to improve flow monitoring and address leakage support the revision of the ADD to MDD peaking factor to 1.4, as shown in Figure 3.2 below.

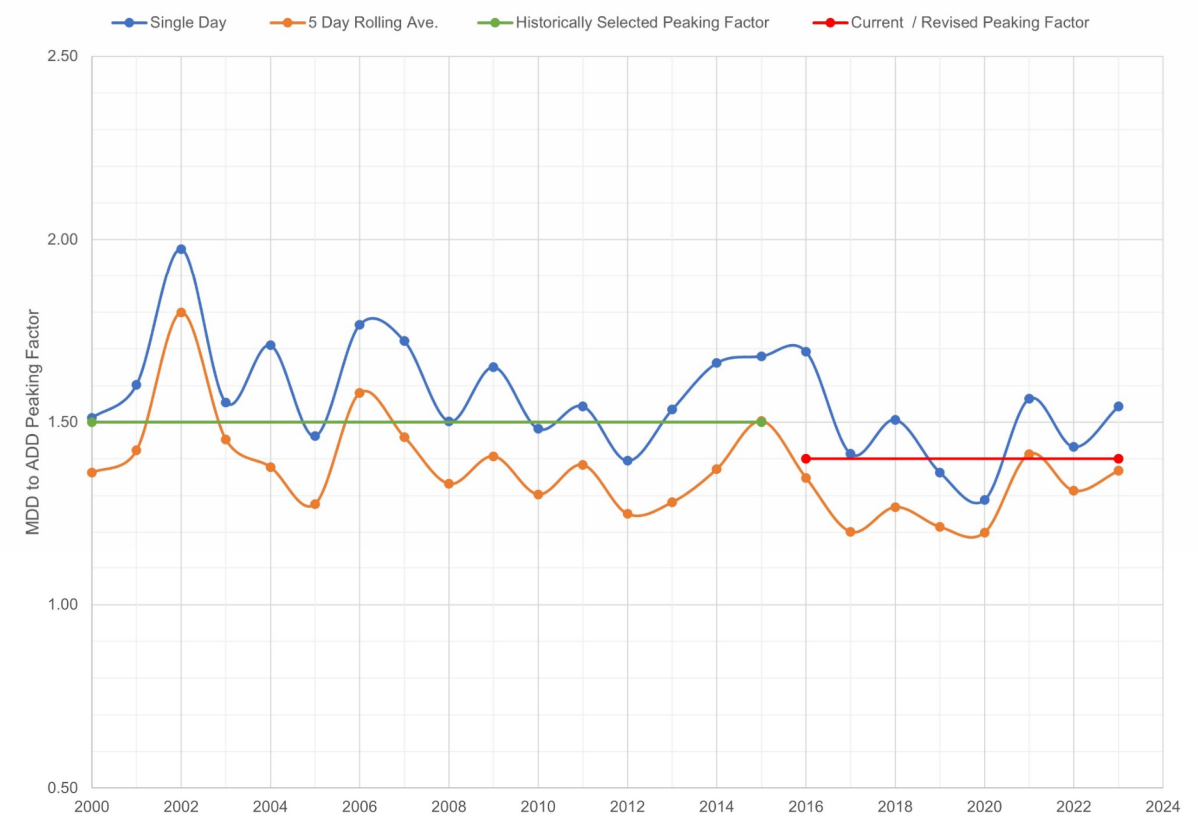


Figure 3.2 ADD to MDD Peaking Factors for WTP Daily Volume.

Based upon the historical areas and water usage (AMI) data, volume per hectare rates and peaking factors were developed for the non-residential areas as listed below.

- Average per hectare rate of **3.6 m^3/ha/day** for **PS** with a MDD to ADD peaking factor of **1.4**.
- Average per hectare rate of **5.8 m^3/ha/day** for **LC** with a MDD to ADD peaking factor of **1.4**.
- Average per hectare rate of **6.5 m^3/ha/day** for **CBD** with a MDD to ADD peaking factor of **1.4**.
- Average per hectare rate of **3.6 m^3/ha/day** for **IND** with a MDD to ADD peaking factor of **1.4**.
- Average per hectare rate of **0.7 m^3/ha/day** for **IRRIG** with a MDD to ADD peaking factor of **1.4**.

3.4 Potable Water Demand Projections

Table 3.6 and Table 3.7 summarizes the ADD and MDD potable water projections, respectively, which will be utilized to complete the capacity assessment for the City's raw water supply, water treatment, and water storage infrastructure using the average per capita/per hectare rates and peaking factors summarized in Section 3.3.

Table 3.6 WTP Cumulative ADD Projections

Horizon	Year	Residential ADD	Non-Residential ADD					ACE Regional Waterline ADD	Prairie Nth Regional System ADD	Total ADD (including 8% losses)
			PS	LC	CBD	IND	IRRIG			
		m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day
0	2022	5,392	568	216	1,102	1,753	7	528	0	10,332
3	2025	5,755	597	216	1,269	2,255	7	588	311	11,878
5	2027	6,011	675	216	1,556	2,420	7	588	311	12,727
10	2032	6,702	686	216	1,907	2,966	7	588	311	14,454
20	2042	8,332	686	216	2,363	3,871	7	791	311	17,903

Notes

1. Future ADD based upon the agreed MDD and the historical ACE ADD to MDD Peaking Factor. Schedule D of the Agreement between ACE and the City includes a memorandum from Nichols Applied Management Inc that notes the expected ADD to be roughly 1,050 m3/d until 2036.
2. Future ADD based upon the agreed MDD, and the historical Prairie North ADD to MDD Peaking Factor

Table 3.7 WTP Cumulative MDD Projections

Horizon	Year	Residential MDD	Non-Residential MDD					ACE Regional Waterline MDD	Prairie Nth Regional System MDD	Total MDD. (including 8% losses)
			PS	LC	CBD	IND	IRRIG			
		m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day	m³/day
0	2022	7,548	795	303	1,543	2,454	10	1,136	0	14,892
3	2025	8,058	835	303	1,777	3,157	10	2,842	1,000	19,419
5	2027	8,416	945	303	2,178	3,388	10	2,842	1,000	20,608
10	2032	9,383	960	303	2,670	4,152	10	2,842	1,000	23,026
20	2042	11,665	960	303	3,308	5,420	10	3,824	1,000	28,609

Table 3.7 above provides a high-demand scenario in terms of MDD as it includes the contractual volumes of potable water the City is required to provide. These values could artificially advance the need to upgrade the WTP based upon the required treatment capacity, whether the potable water is truly required or not. Therefore, as discussed with the City, a future MDD based upon maintaining the historical MDD values for the regional system will be used as a low-demand scenario to provide a contrasting / operational based perspective as to when a WTP upgrade will be required. Using a historical MDD of 1,100 m³/d for the ACE Regional Water Line, 600 m³/d for the Prairie North Regional System, and the projected MDD for the City, the contrasting potable water MDDs are provided within Table 3.8.

Table 3.8 Projected Low-Demand MDD Based Upon Historical Values

Horizon	Year	Potable Water MDD (m³/d)
0	2022	14,982
3	2025	17,107
5	2027	18,295
10	2032	20,712
20	2042	25,235

4.0 Condition Assessment

4.1 Approach and Methodology

The objective of the condition assessment is to complete a visual review of the water treatment infrastructure and to assess its condition and performance with a goal of providing recommendations for maintenance or replacement programs. To achieve this objective, representatives from each of the disciplines listed below visited the City's facilities and completed the review and assessment:

- process
- building mechanical
- structural
- building enclosure
- electrical

Due to the completion of a recent upgrade, the instrumentation and controls infrastructure were assessed via a desktop review using information provided by the City and photographs collected by the electrical representative during the site review.

To establish a common assessment criterion prior to the site visits, all parties including the City agreed on an assessment approach that assessed the condition of the infrastructure (likelihood / probability) and the consequence if the infrastructure failed (severity). These two factors were then combined to result in the risk for the infrastructure. To achieve consistency in the assessment across the disciplines, reference tables were developed, which are provided in the tables on the subsequent pages.

Figure 4.1 Lloydminster Water Treatment Plant

Table 4.1 Infrastructure Condition Assessment Guide

	General Notes	Spare Parts	Process	Structural	Buildings Envelope	Building Services	Electrical	Controls
Good (Green)	Good condition, no issues identified	No difficulty in obtaining spare parts when needed	No signs of rust / corrosion. Stops / starts with no issues. Operates to meet operational needs. Well Maintained.	No signs of significant deterioration, distress or deflection. Structure is protected from environmental damage.	Building component is in serviceable condition and performing the intended function. Little to no repair is required in the near future.	Equipment is maintained and in good working order. Meets performance requirements. Little or no repair required in the near future.	Equipment is maintained properly with no signs of deterioration. Meets all applicable requirements for safe operation. Readily available spare components. Has capacity for expansion.	Equipment is maintained properly with no signs of deterioration. Meets all applicable requirements for safe operation. Readily available spare components. Has capacity for expansion.
Requires Attention (Amber)	Operational / Functional, but requires some maintenance or attention	Can obtain spare parts by reverse engineering / custom manufacturing to repair or rebuild.	Showing some age. Needs minor maintenance. Usually stops / starts / operates as needed. Fails regularly or once in a while.	Structure is still performing adequately but evidence of on-going deterioration or risk of environmental damage. Serviceability concerns from deflection or vibration.	Building component does not necessarily require immediate replacement but either: - Is nearing the end of its serviceable life and replacement should be planned for. - Requires maintenance or repair in order to continue to perform the intended function. - Further invasive investigation is recommended to understand the condition of the building component	Showing signs of age. Needs minor repair in the near future. Operates as required but does fail on occasion. Minor repair to get back into operation. Parts can be obtained easily or can be custom built easily.	Equipment has known upcoming or current obsolescence but has obtainable spares. Equipment has spare components that are not in-hand and are long-lead. Equipment is aged. Equipment should receive maintenance but has no major deficiencies. Equipment has limited expansion capacity.	Equipment has known upcoming or current obsolescence but has obtainable spares. Equipment has spare components that are not in-hand and are long-lead. Equipment is aged. Equipment should receive maintenance but has no major deficiencies. Equipment has limited expansion capacity.
Poor (Red)	Continued operation presents risk to availability. Needs major work / replacement	Cannot obtain any spare parts, in any form. Needs to be replaced in its entirety with new item.	In need to rebuild / major maintenance. Unsure it will start or operate for a prolonged period when called for.	Significant signs of deterioration or damage. Structure has previously failed, or risk of failure will limit operations or present life safety concerns.	Building component is at or past the end of its serviceable life and/or is no longer performing the intended function. Replacement is strongly recommended in the immediate or near future. Consequences such as ongoing damage to other building envelope or structural components may be expected.	Equipment has failed. Requires significant repair. If it fails not easy to repair and get back operational. On failure unit cause safety concerns. Parts are hard to obtain and requires prolonged down time of the equipment. The equipment is at the end of its service life.	Equipment is aged, has not received proper maintenance. Equipment has obsolete components with unavailable spares. Equipment has safety deficiencies or operational deficiencies. Equipment has no expansion capacity.	Equipment is aged, has not received proper maintenance. Equipment has obsolete components with unavailable spares. Equipment has safety deficiencies or operational deficiencies. Equipment has no expansion capacity.

Table 4.2 Consequence of Failure Guide

	Production of Water	Health and Safety	To Customers	Redundancy
Minor (Green)	Using Standby Equipment as per design	Continued deterioration of asset through use. No risk to operators or public	Affects just a lot / street	Online redundancy / standby available with good separation between run hours
Reasonable (Amber)	Partial reduction in output, but meets WQ objectives	Deterioration in the near future leading potential risk of incident / accident which involves operators or public	Affects Subdivision	Online redundancy / standby available, with the same / similar run hours.
Significant (Red)	Unable to produce any water or not meeting WQ objectives	Immediate risk of incident / accident which involves operators or public	Affects Whole System	No online redundancy / standby or spare "boxed" units

As noted previously these two factors were then used to assign a risk for the infrastructure using Table 4.3 below. Once the risk was assigned, an action to address the risk was defined in addition to a cost estimate to complete and a priority rating which defined the time in which the action should be completed, see Table 4.4 below.

Table 4.3 Condition Assessment Risk Matrix

		Consequence (Severity)		
		Minor	**Reasonable**	**Significant**
Condition (Likelihood / Probability)	**Good**	Low	Low	Medium
	Requires Attention	Low	Medium	High
	Poor	Medium	High	High

Table 4.4 Condition Assessment Priority Rating

Priority	Definition
1	To be completed within twelve (12) months
2	To be completed within five (5) years
3	To be completed in five (5) to ten (10) years
4	To be completed in ten (10) to fifteen (15) years
5	No Priority.

4.2 Assessment Findings

The details from the review and assessment have been provided within detailed tables for each discipline, which are attached as appendices. The format and the expected content of the detailed assessment tables were agreed upon with the City prior to completing the site review. Due to the large amount of data collected and presented within the assessment tables, the key findings of each discipline are summarized below for each infrastructure facility.

4.2.1 Process

Within this section, key aspects with regards to the process (water treatment) systems have been summarized. As a rule, process equipment that includes rotating and moving parts has a service life between 20 to 25 years. Subject to the level of proactive maintenance applied to the components and the repairs undertaken, the service life can be extended.

River Pumphouse and Raw Water Pipeline

1. The river intake arrangement was adjusted in 2020 with the addition of a sheet pile spur. The adjustments are working as intended and no actions were identified.
2. The river intake travelling water screen is beyond the end of its service life and is a critical part of the intake system with no backup or redundancy. The screen was planned to be inspected within twelve (12) months of the site review and possibly refurbished / replaced within five (5) years. However, the screen has recently failed and should therefore be replaced within the next twelve (12) months. (High)
3. Both low lift pumps and their associated motors are regularly overhauled and rebuilt. No concerns were raised with regards to LLP-101, and it is scheduled to be rebuilt in 2024. LLP-102 is also operating with no apparent issues, and the pump and motor are scheduled to be overhauled and rebuilt in the next five (5) to ten (10) years. (Low)
4. The pipework associated with the low lift pumps appears to be in good condition. However, while the isolation and check valves are exercised on a regular basis, the City's operators are not confident that they will function / isolate when required. The valves should be tested and replaced as required within the next five (5) to ten (10) years. (Medium)
5. The desilting pond was last cleaned in 2005 and will be cleaned again when required. Further cleaning of the desilting pond is believed to be unlikely as the recent addition of the sheet pile spur has significantly reduced the infiltration of sand from the river.
6. The three (3) high lift pumps and their associated motors are regularly overhauled and rebuilt. All pumps are missing guards around the rotating shaft between the pump and motor. (Medium)
   a. HLP-101 appears to be operating with no issues. The pump was last overhauled in 2017 and is overdue its next motor overhaul, with the whole pump due to be refurbished in the next five (5) to ten (10) years. (Low)
   b. HLP-102 is operating with no issues reported but it was showing signs of previous minor leakage. This pump was overhauled and upsized to a capacity of 19,923 m^3/d at discharge pressure of 185 m of water in September 2024. (Low)
   c. HLP-103 is operating with no issues reported but was also showing some signs of minor leakage. The pump was last overhauled in 2015 and the motor in April 2023. The exposed motor shaft is missing a guard and the pump / motor is due to be refurbished in the next five (5) to ten (10) years. (Low)
7. Pressure relief and surge protection valves are installed on the high lift pump discharge headers due to the high pressures involved in conveying water to the raw water reservoir, and the long raw water

pipework length. These valves are serviced / maintained on a regular basis and appear to be in good working condition. This practice should be continued in the future. (Medium)

8. The pipework associated with the high lift pumps is generally in good condition, but there are areas where surface corrosion was noted. This corrosion should be addressed and the pipe suitably prepared and recoated within the next five (5) years. (Low)
9. The isolation and check valves for the high lift pumps are exercised on a regular basis, however the operators are not confident that they will function / isolate when required. The valves should be tested and replaced as required within the next five (5) to ten (10) years. (Medium)
10. Raw water is conveyed from the raw water pumphouse to the raw water reservoir via a single 30" cement lined steel pipe which was installed in 1984. The raw water pipeline has been in service for 40 years and its condition / remaining service life is unknown. In discussions with the City the following actions have been identified.
    a. Within the next five (5) to ten (10) years undertake non-destructive physical testing / assessment of the raw water pipeline to ascertain its remaining service life. (High)
11. Undertake a desktop assessment to consider and evaluate the longer-term raw water supply / sources for the City for the next 50+ years. (Medium).
    - Upon consultation with and the establishment of future demands with all potential parties, the above study should confirm:
        - How the effluent from the new wastewater treatment facility can be leveraged.
        - Possible alternative water sources to the North Saskatchewan River and their potential to supply the required raw water volumes,
        - If a second river intake should be built at the North Saskatchewan River, or the existing arrangements intake increased in capacity?
        - How the raw water supply pipeline should be maintained and adjusted to meet the future raw water demands.
12. Start to budget / plan to replace or twin the raw water line. No timeline has been placed on this task, however the budget for such an undertaking is significant. (High)

Figure 4.2 Flooded Raw Water Pipeline Vault

13. Multiple concrete vaults containing isolation and air release valves exist along the raw water line. A number of these vaults are either flooded or need of concrete repair / refurbishment. In discussions with the City a phased refurbishment program of the vaults should be completed over the next fifteen (15) years. (High)
14. While the pressure control / surge valves within Vault 1 appear to be in good condition and operating, the following specific items were noted.
    a. The pipework and isolation valves were showing signs of their age based upon the missing coating and surface corrosion. Excessive scale was noted in the south-west corner where water intrusion is occurring around a pipework penetration (which is isolated). Within the next five (5) years the missing coating / corrosion on the pipework should be addressed and section of isolated pipework removed such that the scale build up can be mitigated. (Medium)
    b. There is significant water ingress to the vault, which is below grade. The installed sump pump is removing the accumulated water, but the installed electrical equipment is at risk from flooding and the elevated moisture in the environment could increase the rate of corrosion of metallic equipment. Access to the vault is also restricted. (via ladder) and it is a challenge to complete regular maintenance and replace large valves in the future.
    c. Within the next five (5) years the concrete roof should be removed, the walls extended above grade and additional waterproofing applied to address the water ingress. A single storey structure with mezzanine, ships ladder access and hatches to access and remove valves / equipment should be provided. (Medium)

Cenovus Raw Water Pumphouse

1. Cenovus raw water pump 1 appears to be operating with no issues reported. The pump was last overhauled in 2023 and is due for its next scheduled pump and motor overhaul within the next five (5) years (Medium). Some exposed metal was noted on the pump casing which should addressed within the next five (5) years before it starts to corrode. (Low)
2. Cenovus raw water pump 2 is in a similar condition to pump 1 and was also last overhauled in 2023. The pump is due for its next scheduled pump and motor overhaul within the next five (5) years. (Medium). Some exposed metal was noted on the pump coating which should be addressed within the next five (5) years before it starts to corrode. (Low)
3. The two raw water pumps were installed to be operated as duty / standby, but now both operate together to meet the demand. There is space to install a third pump, and the City should consider its installation within the next five (5) years to provide an on-line standby / redundancy. (Medium)
4. The pipework within the pumphouse is generally in good condition, but there are areas where surface corrosion was noted. This corrosion should be addressed and the pipe suitably prepared and recoated within the next five (5) years. (Low)
5. The isolation and check valves associated with the pumps are exercised on a regular basis, however the City's operators are not confident that they will function / isolate when required. The valves should be tested and replaced as required within the next five (5) to ten (10) years. (Medium)
6. Pressure relief and surge protection valves are installed on the headers. The valves are serviced / maintained on a regular basis and appear to be in good working condition. This practice should be continued in the future. (Low)
7. The raw water connection to Cenovus is a 350 mm buried PVC pipeline. The pipeline is operating with no reported issues and is meeting its design basis.

Raw Water Reservoir

1. The raw water reservoir was constructed in 1974 and has a working capacity of 188,000 m³ in summer and 155,000 m³ in winter. No signs of major berm / bank deterioration were noted, and the City's grounds crew manage the trees and vegetation around the reservoir. Any issues are addressed when identified. The City's operators wish to lower the water levels within the reservoirs within the next five (5) years and complete an inspection to determine if any remedial work is needed. (Low)

Water Treatment Plant

Due to the size and complexity of the WTP, the summary below follows the sequence by which water flows through / is treated by the process.

2. Raw water can be moved into the WTP either by using gravity or pumps, depending upon how much water is required and the water levels within the upstream raw water reservoir. With regards to this system the following specific items were noted.
   a. Both raw water pumps. (RWP-101 and RWP-103) are rarely used. They are "bump tested" regularly to confirm availability, their mechanical seals are replaced as needed, and no issues were reported. Some surface corrosion / exposed metal on pump case body where coating has been chipped away was noted, and the pumps did not have any guards installed to protect operators from rotating parts. To ensure further operations both units. (pumps and motors) should be overhauled within the next five (5) years (Medium).
   b. RWP-102 was removed and used to supply raw water via gravity instead. No issues were noted with this system.
   c. The isolation and check valves associated with the raw water system are exercised on a regular basis, however the City's operators are not confident that they will function / isolate when required. These valves should be tested and replaced as required within the next five (5) to ten (10) years. (Medium)
3. The equipment in Vault 5 appears to be in similar condition to Vault 1. (i.e. a good operating condition). The following specific items were noted within Vault 5.
   a. The pipework and isolation valves were showing signs of their age based upon the missing coating and surface corrosion. Within the next five (5) years the missing coating / corrosion on the pipework should be addressed. (Medium)
   b. There is significant water ingress to the vault, which is below grade. The installed sump pump is removing the accumulated water, but the installed electrical equipment is at risk from flooding and the elevated moisture in the environment could increase the rate of corrosion of metallic equipment. Access to the vault is also restricted. (via ladder) and it is a challenge to complete regular maintenance and replace large valves in the future. Within the next five (5) years the concrete roof should be removed, the walls extended above grade and additional waterproofing applied to address the water ingress. A single storey structure with mezzanine, ships ladder access and hatches to access and remove valves / equipment should be provided. (Medium).
4. The section of the process where the raw water re-enters the WTP and enters the clarifier is referred to as pre-clarification. Within this section the following items were noted.
   a. The original raw water magnetic flowmeter failed in 2005 and was replaced with a clamp on ultrasonic flowmeter which is at the end of its service life and discontinued, resulting in no spare parts being available. A new magnetic flowmeter should be installed within the next five (5) years. (Medium)

Figure 4.3 Vault 5 Hydraulic / Pressure Control Valve

b. At the time of the review temporary hoses were used as dosing lines for the addition of PAC and lime. These were replaced with PVC pipework in 2023 and 2024. The dosing connection to the raw water pipeline is leaking at the old flash mixer and should be repaired within the next twelve (12) months. (Medium)
c. The sample sink is missing a sign to indicate that the water from the taps is non-potable. This should be added within the next twelve (12) months. (Low)

5. Aluminium sulphate (alum) is added to the raw water as a coagulant. With regards to the storage and dosing equipment associated with this system, the following items were noted.
   a. There is no safety shower in proximity to the tanker unloading point for use by the supplier's staff in the event of a spill or leak. It is recommended that a safety shower with tempered water should be installed in proximity to the chemical unloading point within the next five (5) years. This safety shower would also serve for the unloading of lime. (Medium)
   b. Both alum dosing pumps were part of the original installation and have been rebuilt several times. They are now excessively beyond their service life and should be replaced within the next five (5) years. (High)
   c. No issues were noted with the dosing pipework; however, parts of the system are made up of flexible PVC hose. The dosing pipework should be replaced with PVC pipework within the next five (5) years. (Low)
   d. Alum is primarily added on the gravity raw water pipeline where RWP-102 used to be installed. There are no indications of leaks or issues at the dosing point, but the chemical mixing is dependent upon the carrier water or the operation of the two raw water pumps (which is rare). All raw water chemical dosing points should be relocated to common point on the header after raw water pumps within the next five (5) years and the dosing pipework rerouted. For the alum the application of a jet mixer to improve the performance /efficiency of the coagulation stage should be considered. (Low)

6. Following the review, the PAC makeup and dosing equipment was upgraded in 2023. However, the ventilation rates for both PAC rooms are low, and the replacement of the HVAC that serves is discussed within the building mechanical condition assessment. (Medium)
7. Lime is added to the raw water to adjust the pH of the treated water leaving the WTP. With regards to the lime storage, makeup and dosing system the following specific items were noted.
    a. There is no safety shower in proximity to the tanker unloading point for use by the supplier's staff in the event of a spill or leak. It is recommended that a safety shower with tempered water should be installed in proximity to the chemical unloading point within the next five (5) years. This safety shower would also serve for the unloading of alum. (Medium)
    b. The lime is stored in a steel hopper which is painted internally and externally. No issues were noted with the silo, but the upper sections of the outside of the silo should be painted in line with the lower sections (completed 2024) within the next five (5) to ten (10) years. (Medium)
    c. Following the review, the Lime makeup and dosing equipment was upgraded in 2024. However, the ventilation rates for the three Lime rooms are low, and the replacement of the HVAC that serves them has been discussed within the building mechanical condition assessment. (Medium)
8. Polymer is applied at the clarifier mixing zone to build macro-floc for gravity settlement. The following items were noted with regards to the polymer makeup and dosing system.
    a. The polymer makeup unit is an Envirochem custom makeup unit, installed in 1984. The system is beyond its service life and uses old technology. The company that supplied the custom-built unit no longer exists and spare parts are fabricated / reverse engineered by the City as needed. The makeup system should be replaced with a new system that uses current technology and is supported within the next five (5) years. (Medium)
    b. Both polymer dosing pumps were part of the original installation and are leaking oil (regardless of several overhauls and rebuilds). The pumps are now excessively beyond their service life and should be replaced within the next five (5) years. (High)
    c. The magnetic flowmeter installed on suction pipework to monitor Polymer flowrates / volumes is restricting flow of polymer to the dosing pumps and is currently bypassed. Flowmeter should be relocated to the common dosing pump discharge pipework within the next twelve (12) months. (Medium)
9. The solid contact clarifier is used to settle material / solids from the raw water following the addition of the chemicals. The clarifier was installed in 1984 and has never been thoroughly inspected. From what could be observed during the review, there were no signs of concrete spalling or significant corrosion of troughs, however the following items were identified and developed with the City.
    a. The clarifier is showing signs of its age, and the cleaning and detailed inspection of the clarifier is a priority for the City's operators. This is planned to be completed within the next twelve (12) months. (High)
    b. The settling tubes within the clarifier are also part of the original installation and collapsed in 1999 when the clarifier was drained. The supports had corroded due to lack of cathodic protection, which was subsequently installed. The tubes will be inspected as part of the clarifier inspection scheduled within the next twelve (12) months. (High)
    c. The drive / rake mechanism has been upgraded in stages of the years of service. (i.e. VFD and drive mechanism). The condition of the rake at the bottom of the clarifier is unknown and will be determined as part of the clarifier inspection scheduled within the next twelve (12) months. (High)
    d. Two sludge pumps are used to withdraw the settled sludge from the bottom of the clarifier and discharge it to the sanitary sewer. Both pumps. (P-123 and P-124) are showing no indications of any issues, but both are beyond their service life. As such the pump / motor should be replaced within the next five (5) years. (Medium)

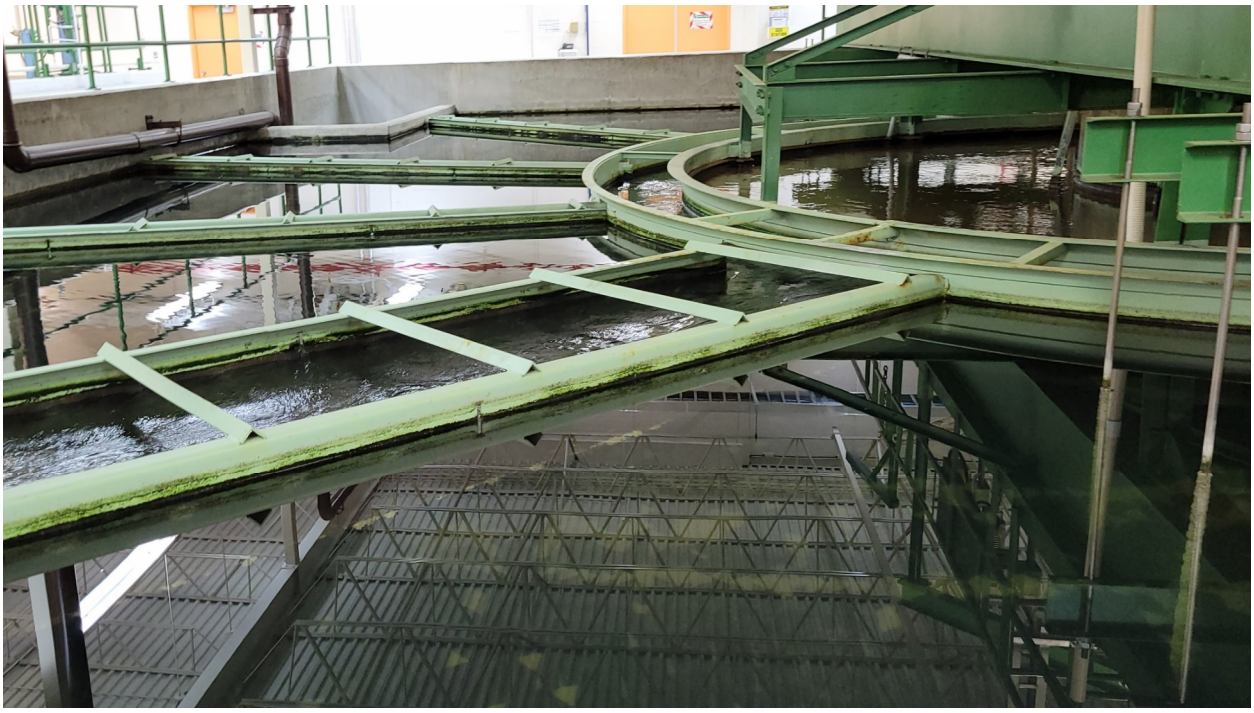


Figure 4.4 Solids Contact Clarifier

e. The sludge pipework is generally in good condition with some corrosion and sections of exposed metal. Within the next five (5) years, the corrosion should be removed on all the pipework and supports, and the sections prepared and repainted. (Low)

f. A temporary actuator is currently installed on main desludging valve. This valve should be replaced with a new permanent actuator within the next five (5) years. (Low)

g. The insertion flowmeter installed on the sludge pipework is designed for indication only with water lines where the flow is uniform over the pipe cross-section. As such its accuracy is limited and it should be replaced with an inline mass flowmeter and sludge density meter, specific for the purpose, within the next five (5) years. This will allow optimization of sludge blowdown and mitigate water losses. (Low)

10. Filter aid is added to the water leaving the clarifier to improve the performance of the media filters. The following items were noted with regards to this system.

a. No chemical containment was in place for drum storage such that any spills will be washed to the sanitary system via drains in the room, and no monitoring of product use is available. A containment tray and weigh scales for drums should be provided within the next five (5) years. (Low)

b. The tubing used to convey the filter aid from the pump to the dosing pump degrades over time. Within the next five (5) years conduit should be installed to support the tube and aid its easy replacement. (Low)

11. The media filtration system removes any material from the water which is carried over from the clarifier. It involves several sub-systems, within which the following items were noted.

a. A contact chamber exists between the outlet of the clarifier and the inlets to the media filters. The access ladder into the chamber for maintenance / inspection is severely corroded and needs to be replaced with an FRP version within the next twelve (12) months. (High) In addition, some of the wooden baffles within the channel have moved and need to be removed from the chamber. They do not need to be replaced as they are not needed. (Low)

b. The media filters appear to be in good working order and no issues were raised during the 2019 inspection by AWI. Monitoring of corrosion on the trough supports and the condition of coating / paintwork within the filter should continue, and issues addressed as identified. (Low)
c. The filter inlet and backwash outlet gates / actuators are maintained and continue to operate well beyond their typical service life. Several of the actuators are only partially working and require intervention from the City's operators when moving position. It is also unclear how much longer spares will be available for the gates / actuators due to their age. The gate supplier recommends a complete gate replacement as these are old style gates which are difficult to adjust / seal. Furthermore, electrical actuators should be used instead of pneumatic to reduce dependence on the compressed air system and regular maintenance tasks. This task should be completed within the next five (5) years. (High)
d. A single air blower was installed in 2004 to provide an air scour to the media filters when backwashing. There is no redundancy / backup for the blower should it fail. The City should investigate the addition of a standby blower and costs implications. A boxed spare is an option. (Medium)
e. No issues were noted with regards to the backwash supply pump. (BSP-101). If this pump fails, backwash water can be provided from distribution pump PWP-103. The valves associated with BSP-101 appear to be in good condition, but the City's operators are not confident that they will function / isolate when they are required to use PWP-103. As these valves are critical to provide redundancy to BSP-101 they should be replaced within the next five (5) years. (High)
f. The backwash waste pumps (BWP-101 and BWP-102) were installed in 1984 and have never been refurbished or overhauled. No major issues were noted or reported with the pumps or motors, but they are monitored, and issues will be addressed when they are identified. There is some corrosion on the pump which should be removed and the exposed metal prepared and repainted. (Medium)
g. All backwash and filter outlet valves / pipework downstream of the filters were replaced as part of the UV upgrade in 2023. No issues noted or reported with the valves.

12. A UV disinfection stage was installed in 2023 using Trojan UV swift reactors. The reactors were sized to provide a 3-log inactivation of both Cryptosporidium and Giardia. No issues were noted or reported with the UV system.
13. Following UV disinfection, chlorine is added to the partially treated water to provide virus log reduction and a residual disinfectant. Using chlorine gas, the following specific items were noted with the chlorination system.
    a. Both chlorinators operate with no issues and are serviced annually. Chlorinators are rotated and rebuilt with a third unit, which then becomes the standby unit. Motive water for the ejector comes from process water supply which can be back fed from water distribution system. All chlorine solution pipework is in good condition, with no signs of any leakage.
    b. The access to the chlorine gas storage and feed rooms does not meet SWSA EPB 265 which does not permit interior access. Within the next five (5) years the City should modify access to facilitate regular exterior entry / exit under all weather conditions. The interior access is to be subsequently removed. (Medium)
    c. The ventilation applied to the chlorine gas storage and feed rooms does not meet SWSA EPB 265, which states that the ventilation system is to be separate from the main WTP's system. Within the next five (5) years the City to modify / separate the ventilation system in accordance with OH&S and EPB 265. (High)
14. Water is lifted from the clearwell by the distribution pumps and conveyed to the water distribution system. The distribution pumps and motors are monitored, and issues are addressed when identified. The following items were noted with regards to this system.

a. Distribution pump PWP-101 was running during site visit and no abnormal / unusual sounds were noted while operating. Pump and motor were last refurbished in April 2003. No actions required.
b. The motor for distribution pump PWP-102 was last refurbished in October 2019 and the pump itself was overhauled in 2003.
    i. Some corrosion was noted at pump base, which should be removed, and the exposed metal prepared and recoated within the next five (5) years. (Low)
    ii. The City's operators have noted an increase in demand which is resulting in more reliance / increased operation of VFD distribution pump which fine tunes / adjusts the flow of water, of which there is one. City should replace existing fixed speed starter for PWP-102 with a VFD within the next five (5) years to provide redundancy. (High)
    iii. Distribution pump (PWP-103) was running during site visit and no abnormal / unusual sounds were noted while operating. Pump and motor were last refurbished in 2002. Some corrosion was noted on pump base, which should be removed, and the exposed metal prepared and recoated within the next five (5) years. (Low)
c. The pipework associated with the distribution pumps is generally in good condition, but there are areas where surface corrosion was noted (especially on the header next to the pressure relief valve). This corrosion should be addressed and the pipe suitably prepared and recoated within the next five (5) years. (Low)
d. The isolation and check valves associated with the distribution pumps are exercised on a regular basis, however the City's operators are not confident that they will function / isolate when required. The valves should be tested and replaced as required within the next five (5) to ten (10) years. (Medium)
e. The original distribution magnetic flowmeter failed and was replaced with a clamp on ultrasonic flowmeter which is at the end of its service life and discontinued, resulting in no spare parts being available. A new magnetic flowmeter should be installed within the next five (5) years. (Medium).

West End Reservoir

1. All distribution pumps are in service and monitored on an ongoing basis. No regular refurbishment / overhaul schedule is in place, but issues are addressed when identified. The following specific items were noted with regards to the pumps.
2. Distribution pump 1 (DP-1) is operating but there is a history of issues with the pump motor (possible fluting and arcing). Motor overhauled and an insulated bearing installed in 2016. The motor oil for DP-1 is discoloured, but the pump is operating as required (Low)
3. The pump seal was replaced and corrosion within the pump was addressed with regards to distribution pump 1 (DP-1) and 2 (DP-2) in 2023.
4. No issues reported or noted with regards to distribution pump 3 (DP-3). Pump and motor were both overhauled in 2002, and the starter was changed to a VFD following the review in 2023. . (Low)
5. No issues reported or noted with regards to distribution pump 4 (DP-4). Pump starter changed to a VFD in 2023 following the review.
6. Distribution pipework within the pumphouse is comprised of 304 stainless steel of various sizes. Most welds on the pipework are corroded and a significant amount of surface corrosion is present. Integrity of pipework does not appear to be affected at this time. The corrosion is being caused by chlorine fumes collecting in the pump room. The City has already modified the storage of sodium hypochlorite within the space to mitigate the presence of these fumes. To further mitigate this issue.
    a. The vents from the pump well should be redirected outside the pumphouse within the next five (5) years. (Low)

b. Once ventilation issues addressed, clean, prepare, pickle and passivate all external areas of corrosion (inc. welds). ISL recommend that an initial test is completed within the next five (5) years and if successful a program is set up to complete a specific area per year until complete. (Low)

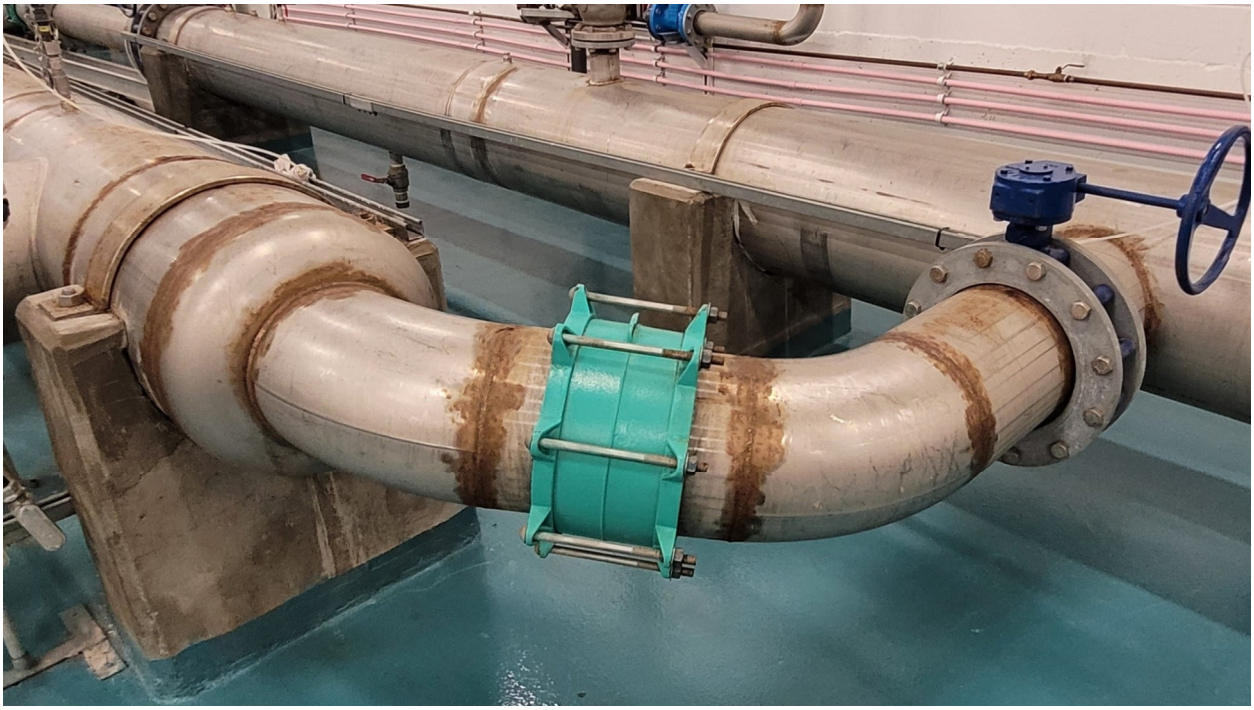


Figure 4.5 Corroded Pipework Welds

7. Pressure control / hydraulically operated valves are installed on the inlet and outlet headers. Valves appear to be in good operating condition, but the coating is flaking off and starting to corrode valve bodies. Within the next five (5) years remove corrosion, prepare and recoat the exposed metal on the valves. (Low)
8. Sodium hypochlorite dosing system recently upgraded using original dosing pumps. No issues raised with the dosing system; however, drums are stored without chemical containment. Within the next twelve (12) months, provide chemical containment trays for drums. (Low)
9. To access the reservoir compartments, hatches and ladders are provided. The ladders are starting to corrode where they are exposed to chlorinated atmosphere (i.e. reservoir freeboard).
   A similar issue exists at WTP. City to trial FRP ladder at WTP and then undertake replacement of ladders at the Reservoir (5 in total) in the next five (5) to ten (10) years if trial is successful. (Medium)

4.2.2 Building Mechanical

Within this section, key aspects with regards to the building mechanical systems have been summarized. As a rule, building mechanical equipment that includes rotating and moving parts has a service life between 20 to 25 years. Subject to the level of proactive maintenance applied to the components and the repairs undertaken, the service life can be extended.

River Pumphouse and Raw Water Supply Pipeline

1. Majority of HVAC components within the river pump house appear to be in good working order and operating as required. The exception is AHU-101 which is adjusted manually and is challenged to

keep the electrical equipment cool in summer. Within the next five (5) years, this unit should be replaced and updated with heat recovery system for winter conditions and more importantly a cooling system sized for electrical equipment in summer. (Medium)

2. The building service water pipework is showing signs of corrosion which is evident at the fittings and the insulation is removed / damaged in some locations. The corroded fittings should be replaced, and the insulation repaired / reinstated in the next five (5) to ten (10) years. Note that the insulation contains asbestos which will need to be abated. (Low)
3. The penetration of the gas line through the exterior wall is damaged. (concrete broken). Reseal the penetration in the next twelve (12) months. (Medium)
4. The HVAC components within the metering vault / building appear to be in good working order and no actions were identified.
5. The HVAC and plumbing equipment in Vault 1 are in good working order. The only action is to replace the support rods and isolation springs on supply fans SAF-109 within the next five (5) to ten (10) years as they are corroded. (Medium)

Cenovus Raw Water Pumphouse

1. The majority of building mechanical components within the pump house appear to be in good working order and operating as required. Items including unit heaters are replaced on an ongoing basis as they reach the end of their service lives or when necessary.
2. The discharge damper appears to be in good working order, but there is heat loss occurring due to the style installed. A more efficient insulated version should be installed within the next ten (10) to fifteen (15) years. (Low)
3. The outside air. (O/A) damper appears to be in good working order, but there is heat loss occurring due to the style installed. A more efficient insulated version should be installed within the next ten (10) to fifteen (15) years. (Low)

Raw Water Reservoir

1. There are no building mechanical aspects at the raw water reservoir.

Water Treatment Plant

1. The hot water supply, (HWS), hot water return, (HWR), glycol hot supply, (GHS) and glycol hot return, (GHR) pipework all appear to be in good working order but are showing signs of age in terms of corrosion on the exterior services. All lines should be replaced in the next ten (10) to fifteen (15) years. (Low)
2. All plant service water pipework appears to be in good working order and no issues / actions were noted.
3. The gas lines through out the WTP appear to be in good condition. These are high pressure gas lines and are not labelled with their contents or pressure. These lines should be labelled within the next twelve (12) months. (High)
4. Most of the building mechanical components within the boiler room. (main floor) were found to be in good working order with the exception of the following items.
   a. Several of the isolation valves were observed to be leaking via the packing. They are all reaching the end of their service life and should be replaced within the next five (5) years. (Medium)
   b. All the pumps which convey hot water or glycol are operating but missing guards around their shafts and are showing signs of corrosion. Guards should be installed on all pumps within the next 12 months (High).

c. All hot water and glycol pumps appear to be nearing the end of their service lives and should be replaced within the next five (5) years. (Low)
d. Heat exchanger. (HEX-101) appears to be in good working order, but the equipment is reaching the end of its service life and should be replaced in the next five (5) to ten (10) years. (Low)
e. Hot water expansion tank. (ET-101) and Glycol Expansion Tank. (ET-102) are due for inspection within the next five (5) years. (Low)
f. The chimney on Boiler #101 is leaking and the flange joint needs to be remade within the next five (5) years. (Medium)
g. Air handling unit. (AHU-101) is in working order but is at the end of its service life. This unit should be replaced in the next five (5) to ten (10) years. (Medium)
h. Temperature control valves TCV-37 & TCV-38 are leaking, and TCV-39 is leaking and damaged at the time of the assessment. The City has repaired the leaks as required and due to their importance in the system, these valves should all be replaced within the next five (5) years. (High)

5. Within the mechanical room located on the main floor the following items were identified.
   a. Air conditioning unit AHU-101 is in good working order. However, the unit utilizes an excessive amount of water which is then wasted. As such its replacement in the next ten (10) to fifteen (15) years should be planned for. (Low) The drain lines for this unit are also highly corroded and need to be replaced in the next twelve (12) months. (Medium)
   b. Make-up air unit MAU_101 which servers the clarifier area is a direct fired unit which is nearing the end of its service life and is interlocked with the exhaust fan for this area. With the exhaust fans at end of their life and their possible failure, there is a risk of the combustion gasses being released into the clarifier area. This make-up air unit should be replaced with a more suitable unit that vents directly outside within the next five (5) years and the pipework which supplies gas to the unit needs to be labelled. (High)
   c. Heating coil GC-103 is in good working order. The glycol isolation and control valves associated with the unit are nearing the end of their service life and should be replaced in the next five (5) to ten (10) years. (Low)
   d. Supply air fan SAF-107 supplies air to the laboratory but is not used as it negatively affects the operation of the fume hood. This fan should be reviewed, resized and replaced within the next twelve (12) months. (High)
   e. Supply air fan SAF-103 and return air fan. (RAF-103) are both nearing the end of their service life and should be replaced in the next five (5) to ten (10) years. (Low)
6. Within the fan room on the upper floor, the following items were noted.
   a. Unit heaters HC-114 and HC-116 are in good working order and no actions are needed.
   b. All the supply and exhaust fans which serve various parts of the WTP are nearing the end of their service lives and spare parts cannot be obtained. (they must be custom made). As such all the fans should be replaced in the next five (5) years. The importance of replacement is based upon the areas to which each fan supplies air. (Medium / Low)
   c. Glycol pump P-210 is showing signs of leakage and is nearing the end of its service life. It should be replaced in the next five (5) years. (Medium)
   d. Temperature control valve TCV-35 is showing signs of leakage and is nearing the end of its service life. It should be replaced in the next five (5) years. (High)

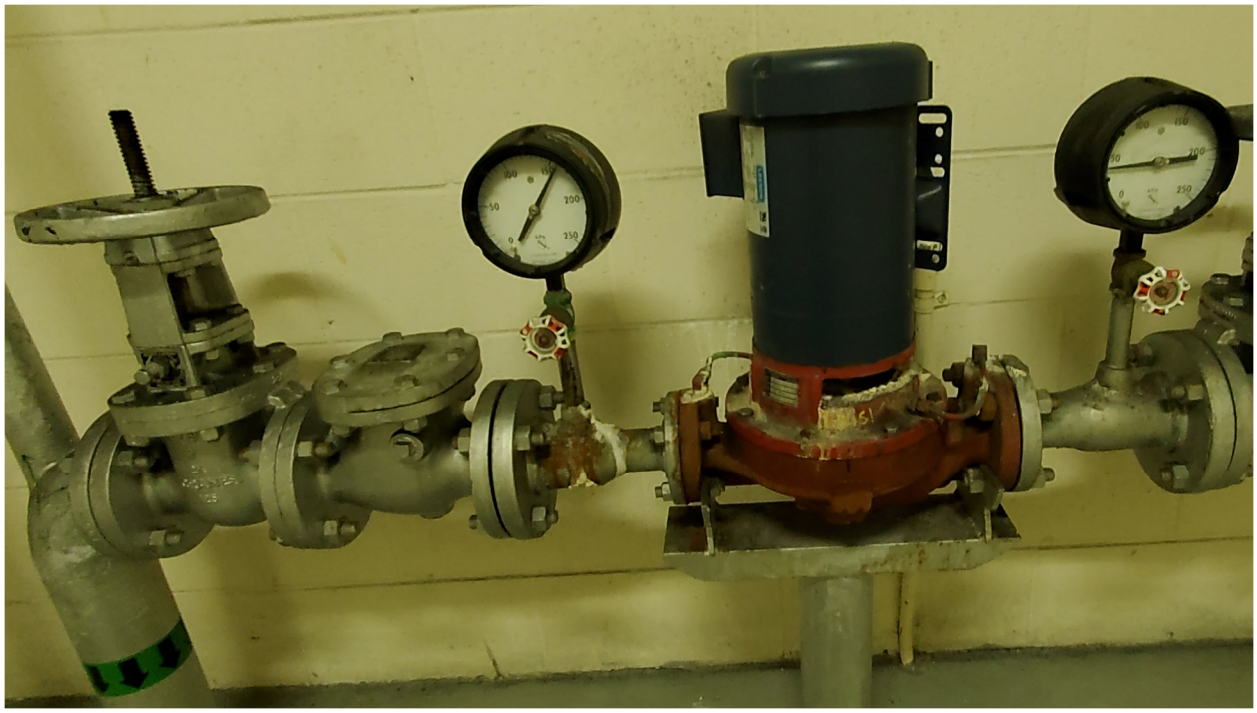


Figure 4.6 Glycol Pump P-210

7. Within the pump area in the basement the following components require attention.
   a. All the air operated control valves and the isolation gate valves on the hot water system / unit heaters are old and showing signs of corrosion. To avoid leaking hot water on equipment and individuals these valves should be replaced within the next five (5) years. (Low)
   b. Unit heater UH-111 was making excessive noise while operating at the time of assessment, but the City has changed the motor mounts and the unit is now reported to operate quite. This unit also appears to be nearing the end of its service life and should be replaced within the next twelve (12) months. (Medium)
   c. Pressure reducing valve PRV70 is used for fire protection and is in good working order. However, it requires the installation of pressure gauges upstream and downstream as per the NFPA standards. This work needs to be completed in the next twelve (12) months. (Medium)
8. The compressed air system within the basement serves various items of equipment around the WTP. The system was found to be in good working condition, but the larger key components are over 30 years old. As such plans should be made to replace the compressed air equipment in the next five (5) to ten (10) years. (Low)
9. The building mechanical equipment within the basement's open area and where the raw water pipework runs are mostly in good working order, apart from air operated control valve TCV20 and the isolation valves for the hot water system. These valves are showing signs of corrosion and require attention due to age. They should all be replaced in the next five (5) to ten (10) years. (Low)
10. All gas supply equipment in the gas meter room appears to be in good working order. However, the gas pipework requires labelling with content and pressure within the next twelve (12) months. (Medium)
11. No issues or items were identified with regards to the building mechanical aspects in the front entry, hallway or WTP Managers office.
12. Within the washrooms and locker room, the following items were found to be in need of attention.

a. One of the sink's drainpipes is showing signs of leakage and the pipework should be sealed / replaced within the next five (5) to ten (10) years. (Low)
b. Sections of the water supply pipework were highly corroded, which could lead to a pipe burst and flooding overtime. The pipework and valves should be replaced in the next five (5) to ten (10) years. (Low)
c. Both the supply and return air ducts within the locker room were showing signs of dust / particle build up. Ducts should be cleaned out and grills replaced in the next five (5) to ten (10) years. (Low)

13. No issues or items were identified with regards to building mechanical aspects in the kitchen, workshop mezzanine, or the workshop itself.
14. The building mechanical equipment within the laboratory are mostly in good working order apart from the following items
    a. The faucet and drain pipework on the sinks on the north side and within the island of the laboratory are showing signs of leakage and should be replaced within the next five (5) years. (Low)
    b. Exhaust fan EF-113 which serves the "chemical area" is noisy, indicating that it is nearing the end of its service life. It should be replaced within the next twelve (12) months. (Medium)
15. All the HVAC and plumbing equipment within the powdered activated carbon. (PAC) rooms on the main floor and in the basement is in good working order. However, the ventilation rates within these rooms are low and a dedicated system should be installed within the next five (5) years(High)
    a. Within the lower PAC room it was noted that the hot water isolation valves were nearing the end of their service life and showing signs of corrosion. These should be replaced in the next twelve (12) months. (Low)
16. All the HVAC and plumbing equipment within the lime room in the basement and on the main and upper floors are in good working order. However, the ventilation rates within these room are low and a dedicated system should be installed within the next five (5) years. This system needs to be larger as it serves three floors and the alum storage area. (High)
17. All the HVAC and plumbing equipment within the Polymer makeup and dosing room is in good working order. However, the ventilation rates within the room may be under capacity and should be assessed and upgraded within the next five (5) years in conjunction with the PAC and Lime HVAC systems. (Medium)
18. No issues or items were identified with regards to HVAC and plumbing aspects in the storage room on the main floor.
19. The HVAC and plumbing equipment within the chlorine storage and feed room are in good working order. However, the HVAC system is part of the system that serves the whole WTP building, which contravenes the current regulations. As chlorine gas is a hazardous chemical this has been flagged by the SWSA and an action has been assigned to the City to install a separate HVAC system for the chlorine storage and feed room as per EPB 265. No schedule has been set by SWSA, but this work should be completed within the next five (5) years. (High)
20. With regards to the eyewash room, adjacent to chlorine storage and feed rooms, the only item noted was that the safety shower is not provided with tempered water. As soon as possible a tempering valve and hot water tank with sufficient volume to supply the required flow of tempered water should be added. (High)

21. All the building mechanical equipment within the alum dosing room is in good working order. However, the ventilation rates within the room may be under capacity and should be assessed and possibly upgraded within the next five (5) years in conjunction with the PAC and Lime HVAC systems. (Medium)

22. Within the basement sump room, the only item noted was highly corroded sections of the discharge pipework. This can lead to failure of the pipework and potential flooding, and as such the pipework should be replaced within the next twelve (12) months. (High)
23. While the HVAC equipment within the electrical room on the main floor is in good working order, the room regularly overheats, putting the electrical equipment and water production at risk. As such the room needs to be supplemented with additional cooling equipment for summer months. This addition should be completed a soon as possible. (High)
24. No issues were noted within the electrical room on the upper floor. However, the unused generator should be removed and the remaining connections terminated / sealed within the next five (5) years. (Medium)
25. No issues or items were identified with regards to HVAC and plumbing aspects in the parts room, the interconnecting hallways or the north hallway / stairwell on the main floor.
26. Within the stairwell to the basement near the electrical room, it was noted that the hot water isolation valves to the cabinet heater were nearing the end of their service life and showing signs of corrosion. These valves should be replaced in the next five (5) years. (Medium)
27. All the HVAC and plumbing equipment in Vault 5 is in good working order. The only actions is to replace the support rods and isolation springs on supply fan SAF-110 within the next five (5) to ten (10) years as they are corroded. (Medium)

West End Reservoir

1. Unit heaters UH-1 and UH-2 appear to be in good working order but are nearing the end of their service lives. These unit heaters should be replaced with new equipment within the next five (5) years. (Low)
2. Furnace FUR-1 appears to be in good working order but is nearing the end of its service life. The furnace should be replaced with a new unit within the next five (5) years. (Low)
3. Eye wash station and shower EW-1 is not supplied with tempered water, which is a requirement of the ANSI Standard Z358.1. Non tempered water can cause a worker using this station to become hypothermic or to not rinse/wash for a long enough time. As soon as possible a tempering valve and hot water supply with sufficient volume to meet the required flow of tempered water should be added. (High)

Figure 4.7 Safety Shower and Eye Wash Station

4.2.3 Structural

Within this section, key aspects with regards to the structural review have been summarized. Generally, water retaining structures and structural components of buildings have a service life between 40 to 50 years. Subject to the level of proactive maintenance applied to the components and the repairs undertaken, the service life can be extended further.

River Pumphouse and Raw Water Supply Pipeline

1. The roof structure is in good condition and loading should be reviewed / confirmed within the next five (5) year for the future re-roofing project due to possible application of excess gravel. (Low)
2. Roof access and fall protection are all in good condition but requires attention in terms of ladder replacement and the addition of fall arrest posts within the next five (5) years. (Low)
3. Above grade wall structures and the main floor slab are all in a good condition and no significant issues noted.
4. Concrete fountains and wet well walls could not be reviewed due to access restrictions. Due to age, a full engineering review should be completed with divers within the next five (5) years. (High)
5. Some pipe supports are showing signs of paint failure and corrosion. Supports should be prepared and recoated as corrosion decreases cross-section area of steel members. This work should be completed within the next five (5) years. (Medium)
6. Mezzanine structure is not showing any signs of deterioration or stress. However, the access ladder requires safety chains at the top where there is an opening in the guard rail. This must be addressed within the next twelve (12) months. (Low)
7. With regards to Vault 1 at the WTP, the access ladder into the vault is corroding. Steel components should be prepared and repainted within the next five (5) years. (Low)

Cenovus Raw Water Pumphouse

1. The roof structure, main floor slab and foundation are all in good condition and no issues were noted.
2. There is no permanent roof access or fall protection in place which places responsibility on the user for temporary fall protection.
3. The wall structure is performing adequately with no signs of significant deterioration or distress, apart from the section where there is a 500 mm pipe penetration. Cracking was observed and it appears that the pipe is loading the wall. A review of pipe supports required to determine if and how the pipe can be restrained. (Low)

Raw Water Reservoir

1. There are no structural aspects at the raw water reservoir

Water Treatment Plant

1. The roof structure is performing adequately with no signs of significant deterioration or distress. Due to changes in NBC, the roof loading should be reviewed / confirmed within the next five (5) years in preparation for a future re-roofing project. (Low). It was noted that paint was peeling on underside of the roof deck. No action is needed to address this item, but it should be monitored and investigated if the deterioration of the paint increases. (Low)
2. No permanent fall protection is installed for the roof areas. Within the next five (5) years, control zone markings and permanent fall arrest posts should be installed for any permanent equipment that requires regular maintenance. (Low)

3. The concrete floors in all areas of the WTP are performing adequately with no signs of significant deterioration or distress. No actions were identified.
4. The pump support on the 600 mm diameter pipework in the basement is cracked and may no longer be supporting / restraining the pipework. New pipework supports should be installed within the next five (5) years. (Medium)
5. The sub-basement tanks could not be reviewed due to access restrictions. Due to age, a full review with divers should be completed in the next five (5) years. (Medium)
6. Where accessible, cracks were observed in the clarifier walls. Within the next five (5) years the clarifier should be removed from service and reviewed in detail. (Medium)
7. The chlorine storage and feed rooms are performing adequately with no signs of significant deterioration or distress. The room configuration does not meet SWSA EPB 265 for access, which should be addressed within the next five (5) years. (Medium)
8. With regards to the exterior structures
    a. Protective boxes around PVC water stops need to be replaced and fastened to the foundation walls within the next five (5) years. (Low)
    b. Two of the exterior stairs on the south side of the building are not code compliant and deteriorating. They require replacement within the next five (5) to ten (10) years. (Low)
    c. Steel components of loading dock are corroding and if the corrosion continues, the components could fail. All steel components should be prepared and repainted within the next five (5) years. (Low)
    d. The access ladders into Vault 5 is corroding. Steel components should be prepared and repainted within the next five (5) years. (Low)
9. The WTP was originally built from 1983 to 1984, and code deficiencies were noted / suspected as per the 2022 Kasian Report. As significant renovations could require upgrades to current NBC, a code review by a specialist to confirm a list of non-compliant Building Code requirements should be completed within the next five (5) years. (Medium)
10. As noted within the 2022 Kasian Report, the architectural finishes are generally serviceable but are at or beyond their service life. The finishes are primarily aesthetic but do provide protection to the structure and ensure the health, safety and security of occupants. Over the next ten (10) years the finishes should be renewed as budget is available. (Low)

West End Reservoir

1. Roof and wall structures of building are performing adequately with no signs of significant deterioration or distress. No actions identified. (Low)
2. There is no permanent access or fall protection in place. As such City and/or contractors are responsible for temporary fall protection measures when access is required. (Low)
3. The main floor slab is performing adequately with no signs of significant deterioration or distress. A full engineering review of the reservoir interior is recommended around 2031 when the reservoir has been in service for 25 years. (Low)
4. Purpose and functions of mezzanine above office and generator unclear, as is requirements for fire protection measures in place with regards to the generator. Within the next five (5) years a desktop code review should be completed to confirm requirements for generator room and office. (Medium)
5. Surface deterioration is present across the slab of the exterior loading dock from heavy salting and freeze thaw damage. Damage was also observed to corner grade beam from a vehicle impact repaired. Life cycle of dock will be limited due to corrosion of rebar and freeze thaw damage. Remedial work on the dock and stairs is required within the next five (5) years. (Medium)

6. The masonry wall alongside the access road is in poor condition with numerous blocks toppled. The wall should be rebuilt to specifications and coordinated with new access stairs / ramp within the next five (5) to ten (10) years. (Medium)
7. The West End Reservoir includes a circular concrete reservoir which was constructed in 1974. A previous assessment in 2010 stated the reservoir was in a poor to fair condition at that time. The reservoir is now beyond the high end of a typical service life range. (i.e. 50 years) and in conjunction with its current condition, the City should plan for its removal from service and demolition in the next five (5) to ten (10) years. (High)

Figure 4.8 Circular Reservoir at the West End Reservoir

4.2.4 Building Enclosure

Within this section, key aspects with regards to the building enclosure / envelope have been summarized. Generally, building enclosures have a service life between 15 to 25 years. Subject to the level of proactive maintenance applied to the components and the repairs undertaken, the service life can be extended further.

River Pumphouse and Raw Water Supply Pipeline

1. Roof assembly requires attention due to its time in service. An invasive investigation of the roof should be completed within the next five (5) years, so that the membrane can be visually reviewed. Depending on the condition of the membrane, the subsequent recommendation could be to leave the roof in place for an extended period of time and make minor repairs or replace the roof entirely. (Low)
2. Due to their poor condition, re-seal roof penetrations within the next twelve (12) months. (Medium)
3. Due to current condition, install new flashing around the perimeter of the roof within the next five (5) years. Replacement of the flashing should be completed after the roof assembly investigation is performed to confirm if other work is required. (Medium)

4. Some mortar joints on the wall are cracked. Re-point mortar and replace or repair any blocks which have significantly cracked within the next five (5) years. (Low)
5. Several poorly detailed or failed sealant joints were identified on the exterior of the building and should be addressed to mitigate moisture or pest entry within the next five (5) years. (Medium)
6. Rigid insulation board was observed on the interior of the large vent on the west elevation. City should investigate and address. (Low)
7. The roof assemblies of the meter vault building are in poor condition. Building is not negatively affected currently. Roof assembly condition should be monitored and the City should plan to replace the building. (due to small size) within the next five (5) to ten (10) years. (High)
8. While the river pumphouse building does not meet current National Energy Code of Canada for Buildings with regards to thermal performance. (i.e., R values), it is providing a reasonable level of performance for its age. If the building is to be re-roofed or re-clad, then insulation upgrades can be considered at that time. (Low)

Cenovus Raw Water Pumphouse

1. Roof assembly is in good condition and has performed positively to date. Downspouts at the three downspout locations should be extended to help direct water further away from the building. (Low)
2. Failed or poorly detailed sealants at penetrations observed. Sealant replacement exercise should be completed on the exterior of the building within the next five (5) years. (Medium)
3. Main doors are serviceable but there is a sizeable gap where ingress of pest and moisture can occur. This minor issue can be addressed by the installation of robust door sweeps within the next five (5) years. (Low)
4. Several poorly detailed or failed sealant joints were identified on the exterior of the building and need to be addressed to mitigate moisture or pest entry within the next five (5) years. (Medium)
5. Insulation installed with a plyboard cover noted at grade around the perimeter of the building. Plywood is not a suitable material to be in contact with the ground. While showing signs of deterioration, the performance of the system does not seem to be affected. If significant further deterioration is noted, then the foundation insulation should be replaced. (Medium)
6. While the building does not meet current National Energy Code of Canada for Buildings with regards to thermal performance. (i.e., R values), it is providing a reasonable level of performance for its age. If the building is to be re-roofed or re-clad, then insulation upgrades can be considered at that time. (Low)

Raw Water Reservoir

1. There are no building enclosure aspects at the raw water reservoir.

Water Treatment Plant

1. Overall, the entire roof assembly requires attention due to age. Complete an invasive investigation of the roof within the next five (5) years, so that the membrane can be visually reviewed, and a detailing plan / scope of work can be developed. The section above the office / boardroom which was previously leaking was completely replaced in September 2024. (High / Medium)
2. Roofing sealant and flashing was observed to be in poor condition and some flashing was damaged in some locations. As these issues promote the risk of where water can enter the roof assembly, the penetrations should be resealed, and the damaged flashing replaced within the next five (5) years. (Medium)

3. With regards to the exterior block wall, some of the mortar joints have cracked and the weep holes above doors on the east face have been sealed. Any cracked mortar should be re-pointed within the next five (5) years and City should also consider removing the sealant from the weeping holes. (Low)
4. Metal cladding is installed on the top portion of the building, which appears to be an architectural feature. The metal flashings located at the bottom of the metal cladding around the entire building is poorly sloped and unsealed at laps. This has resulted in water draining onto the masonry wall at flashing joints and staining the masonry. Some locations were observed where the flashing was missing altogether. Situation should be investigated, and flashing replaced around the perimeter within the next five (5) years. A new metal soffit is also required near the front entry where it is damaged/missing. (Low)
5. Several poorly detailed or failed sealant joints were identified on the exterior of the building and need to be addressed to mitigate moisture or pest entry within the next five (5) years. (Medium)
6. The curtain wall around the front entry area is in poor condition, with cracked and failed sealant, damage to beauty caps, openings at joints in the beauty caps, and deformed and broken beauty caps. No weep holes were observed in the beauty caps, and it is unclear how the system is drained. The curtain wall either needs to be refurbished or replaced. (preferred) within the next five (5) years. (High)

Figure 4.9 Curtain Wall Damage

7. While the building does not meet current National Energy Code of Canada for Buildings with regards to thermal performance. (i.e., R values), it is providing a reasonable level of performance for its age. If the building is to be re-roofed or re-clad, then insulation upgrades can be considered at that time. (Low)

West End Reservoir

1. The roofing assembly requires attention and is in reasonable condition. Significant degranulation of the roof was noted, which can lead to UV related degradation of the membrane and an increased risk of

water ingress. The options are to do nothing, apply an overcoat or completely replace the roof. ISL's recommendation would be to apply an overcoat within the next five (5) years. (Medium)

2. The sealant on roofing penetrations was observed to be in poor condition, which increases the likelihood of water entering the roof assembly. All penetrations should be resealed within the next five (5) years. (Medium)
3. Some mortar joints on the exterior concrete blocks have cracked. Re-point mortar and replace or repair any blocks which have significantly cracked within the next five (5) years. (Low)
4. Several poorly detailed or failed sealant joints were identified on the exterior of the building and need to be addressed to mitigate moisture or pest entry within the next five (5) years. (Medium)
5. Exterior foundation assembly noted to be a combination of exterior metal flashing, plywood, insulation, bituminous waterproofing or damp proofing, which was installed on the concrete foundation wall. Flashing, insulation and plywood are in poor condition. (with some areas damaged) and plywood is generally not a suitable material to be installed at grade. While showing signs of deterioration, performance does not seem to be affected. If significant further deterioration is noted, then the foundation insulation should be replaced. (Medium)
6. While the building does not meet current National Energy Code of Canada for Buildings with regards to thermal performance. (i.e., R values), it is providing a reasonable level of performance for its age. If the building is to be re-roofed or re-clad, then insulation upgrades can be considered at that time. (Low)

4.2.5 Electrical

Within this section, key aspects with regards to the electrical systems have been summarized. Major electrical equipment is typically serviced at five (5) year intervals. Typical lifespans of properly serviced and operated electrical equipment will be in the 30-to-50-year range.

River Pumphouse and Raw Water Supply Pipeline

1. There are no major actions required.
2. Within the 4160V switchgear, the 469 protection relay is obsolete, but still supported and widely available. While the City has a shelf spare relay, consideration should be given to procuring more spare relays (as three (3) are in use) or upgrading to a Multilin 869 relay prior to this relay becoming difficult to procure. (~ five (5) to ten (10) year timeframe) (Low)
3. All remaining major equipment within the river pumphouse is relatively new and in good visual condition and working order. The recommended action is to continue IR monitoring and maintenance testing on five (5) year intervals.

Cenovus Raw Water Pumphouse

1. There is no redundancy for critical pumping process. Electrical equipment is well maintained and in working order, but additional redundancy is recommended due to process impact if failure occurs. (Low) Note: this rating is reflective of electrical requirements but may be deemed higher urgency from a process perspective.
2. Equipment within the pumphouse is in good condition and well maintained. There are no immediate requirements for electrical equipment replacements due to age or end-of-life.
3. General building services are in good condition, however there is no fire panel or annunciation equipment located within this building. This is allowed by code given the building classification; however it could be a future upgrade consideration. (Low)

Figure 4.10 River Pumphouse 4160v Switchgear and 600v Motor Control Centre

Raw Water Reservoir

1. There are no electrical aspects at the raw water reservoir

Water Treatment Plant

1. MCC Equipment within the main electrical room is approaching end-of-life. (~40 years) This equipment is in good working order but has major operational considerations. (plant outage) if failure occurs. (High)
2. This electrical room also experiences high ambient temperatures that can diminish equipment lifespans. (High) The HVAC system for electrical room 1 is not providing adequate ventilation. A large amount of electrical equipment creates high ambient temperatures that can degrade the lifespan of this critical electrical equipment. Additional ventilation and/or a larger HVAC system should be under strong consideration for this location.
3. MCC Equipment within the upper electrical room is approaching end-of-life. (~40 years) This equipment is in good working order but has significant operational considerations. (plant outage) if failure occurs. (High)
4. Continue IR monitoring and consider more frequent maintenance intervals for aged equipment in both electrical rooms. (Medium)
5. Fire detection is not present throughout many parts of the water treatment building. (Medium) Although water treatment has generally low risk of fire, this system would not meet current code requirements for detector locations. If modifications are made to the fire system, code compliance would require upgrading this system.
6. Lighting – Existing lighting is fluorescent fixtures which are obsolete and should be upgraded to LED with occupational sensors in the next five (5) to ten (10) years. (Low)

West End Reservoir

1. There are no major actions required. Continue ongoing electrical maintenance.

2. VFD VSP1 was noted to have occasional saturation alarms. This alarm can be associated with electrical noise or inadequate grounding. If encountered in the future, it is recommended to perform continuity checks and visual inspections on ground connections as a preliminary diagnosis. (Low)
3. IR windows could optionally be added to MCC equipment. This can provide a more efficient and safe means of infrared testing but may limit visibility. (Low)

4.2.6 Instrumentation and Controls

Within this section, key aspects with regards to instrumentation and controls has been summarized. Instrumentation and Controls equipment is in generally good working order across the water treatment facilities. Several locations have been recently upgraded, including each building's process control PLC cabinet. In general, instrumentation can be replaced individually and does not constitute any major or urgent budgetary, process, or maintenance concerns if handled individually.

River Pumphouse and Raw Water Supply Pipeline

1. All instruments look modern, well maintained and are operating with no issues. The instrumentation should provide additional ten (10) + years of useful life. (Low)
2. The PLC and communication system are newly installed in 2021, no damage, cabinet is clean, all equipment operating with no issues, and spare parts available on site for replacement if needed. The PLC and communication system should have 20+ years of useful life remaining. (Low)
3. The control systems for both AHU and gas unit heater are very robust and look to be in good condition with no issues noted. The controls for these systems should provide 20+ years of useful life. (Low)
4. Magna IV recommends:
    a. Continuing manufacturer recommended maintenance on all equipment and testing all instruments regularly.
    b. Performing routine firmware and software updates to all PLCs, PCs, switches, and routers to ensure cybersecurity and functionality.
    c. Ensuring there are backups of both PLC and SCADA programs on city network.
    d. Testing control panel UPS yearly and replacing batteries at most every 5 years to ensure UPS runtime on power failure.

Cenovus Raw Water Pumphouse

1. All instruments look well maintained and are operating with no issues. Last inspection on all instruments was done in 2021. The pressure transmitters and pressure control valve solenoids age are undetermined but based on visual inspection they should provide an additional ten (10) years of useful life.
2. The flowmeter has exceeded its life expectancy as of 2004 when manufacturers deemed the model to be obsoleted. With no spare parts available this flowmeter, the City is planning to replace the flowmeter in late 2024. (Low)
3. The PLC and communication system was replaced recently in 2021, no visible damage, cabinet is clean, all equipment operating with no issues, and spare parts available on site for replacement if needed. The PLC and communication system should have 20+ years of useful life remaining. (Low)
4. The control systems for both AHU and gas unit heater are very robust and look to be in good condition with no issues noted. The controls for these systems should provide 20+ years of useful life. (Low)
5. Magna IV recommends:
    a. Continuing manufacturer recommended maintenance on all equipment and testing all instruments regularly.

b. Beginning the process of getting a replacement flowmeter in the next five (5) to ten (10) years and monitoring flow values more closely as unit's readings may start to drift more frequently as it nears end of life.
c. Performing routine firmware and software updates to PLC, PC, and switch to ensure cybersecurity and functionality.
d. Ensuring there are backups of both PLC and SCADA programs on city network.
e. Testing control panel UPS yearly and replacing batteries at most every five (5) years to ensure UPS runtime on power failure.

Raw Water Reservoir

1. There are no instrumentation or control aspects at the raw water reservoir.

Water Treatment Plant

1. All instruments look well maintained. Last inspection on instruments was done in 2021. The age of the instruments is undetermined but based on visual inspection they should provide additional ten (10) years of useful life. (Low)
2. The ultrasonic flowmeters on the raw water influent pipework and the distribution effluent pipework have exceeded their life expectancy. As they were discontinued in 2009 with no spare parts available, these flowmeters should be replaced in the next five (5) to ten (10) years. (Low)
3. The PLC, SCADA and communication systems were all replaced recently in 2021, no visible damage, cabinets are all clean, all equipment operating with no issues, and spare parts available on site for replacement if needed. The PLC and communication system should have 20+ years of useful life remaining. (Low)
4. The BMS control cabinets have no visible damage, cabinets are all clean, all equipment operating with no issues, SCADA looks to be running with no issues. The Schneider TAC Xenta product line has been discontinued as of Oct. 2018 and Support & Services stopped as of Dec. 2022. The BMS system should have ten (10) years of useful life remaining and should be replaced as part of any future building mechanical upgrade. (Medium)
5. Magna IV recommends:
   a. Continuing manufacturer recommended maintenance on all equipment and testing all instruments regularly.
   b. Beginning process of getting a replacement flowmeter in the next five (5) to ten (10) years and monitoring flow values more closely as unit's readings may start to drift more frequently as it nears end of life.
   c. Upgrading the BMS controllers to newer model that is supported by manufacturer which would include updating SCADA and PC to prevent failure of HVAC/heating system and increased cybersecurity risk from the unit no longer being supported.
   d. Perform routine firmware and software updates to PLC, PC, and switch to ensure cybersecurity and functionality.
   e. Ensure there are backups of Process PLC & SCADA programs and BMS controllers and SCADA program on city network.
   f. Test UPS units yearly and replace batteries at most every five (5) years to ensure UPS runtime on power failure.

West End Reservoir

1. All instruments look well maintained and in working order. The age of the instruments is undetermined but based on visual inspection they should provide additional ten (10)+ years of useful life. (Low)
2. The electromagnetic flowmeters on the inlet and outlet lines have exceeded their life expectancy and have been discontinued. With no spare parts available these flowmeters, the City is planning to replace both flowmeters in the next five (5) years. (Low)
3. The PLC and communication system was replaced recently in 2021, no visible damage, cabinet is clean, all equipment operating with no issues, and spare parts available on site for replacement if needed. The PLC and communication system should have 20+ years of useful life remaining. (Low)
4. The control systems for both AHU and gas unit heater are very robust and look to be in good condition with no issues noted. The controls for these systems should provide 20+ years of useful life. (Low)
5. Magna IV recommends:
   a. Continuing manufacturer recommended maintenance on all equipment and testing all instruments regularly.
   b. Replace flowmeters in five (5) to ten (10) years and monitor flow values more closely as unit's readings may start to drift more frequently as it nears end of life.
   c. Performing routine firmware and software updates to PLC, PC, and switches to ensure cybersecurity and functionality.
   d. Ensuring there are backups of both PLC and SCADA programs on city network.
   e. Testing UPS's yearly and replacing batteries at most every five (5) years to ensure UPS runtime on power failure.

4.3 Cost Estimates and Forecasts

As noted previously, each one of the identified actions resulting from the condition assessment was assigned a cost estimate to complete and a time period in which the action would be completed. Within Appendix G is provided a detailed table for each discipline where the cost estimates are shown by facility location, risk and priority ratings. Tables 4.5 to 4.9 below provide the estimated costs for each facility by discipline and priority rating. Table 4.10 provides the overall total forecast for each facility with the priority rating.

Table 4.5 River Pumphouse and Raw Water Supply Pipeline Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$837,000	$850,000	$2,490,000	$445,000	$40,000,000
Building Mechanical	$500	$350,000	$17,500	$1,500	$0
Structural	$1,000	$85,000	$0	$0	$0
Building Enclosure	$3,300	$72,600	$33,000	$0	$0
Electrical	$0	$0	$3,000	$0	$10,000
Instrumentation and Controls	$0	$0	$0	$0	$0
Total	$841,800	$1,357,600	$2,543,500	$446,500	$40,010,000

Table 4.6 Cenovus Raw Water Pumphouse Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$0	$274,100	$125,000	$0	$0
Building Mechanical	$0	$0	$0	$10,000	$0
Structural	$0	$15,000	$0	$0	$0
Building Enclosure	$0	$7,300	$0	$0	$0
Electrical	$0	$0	$20,000	$0	$80,000
Instrumentation and Controls	$33,000	$0	$0	$0	$0
Total	$33,000	$296,400	$145,000	$10,000	$80,000

Table 4.7 Raw Water Reservoir Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$0	$150,000	$0	$0	$0
Total	$0	$150,000	$0	$0	$0

Table 4.8 Water Treatment Plant Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$178,500	$1,913,000	$375,000	$0	$0
Building Mechanical	$92,050	$1,021,800	$321,400	$314,500	$0
Structural	$24,000	$512,000	$305,000	$0	$0
Building Enclosure	$1,000	$429,000	$0	$0	$0
Electrical	$0	$400,000	$346,000	$0	$10,000
Instrumentation and Controls	$0	$0	$125,000	$0	$0
Total	$295,550	$4,275,800	$1,472,400	$314,500	$10,000

Table 4.9 West End Reservoir Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$1,000	$15,000	$50,000	$0	$0
Building Mechanical	$15,000	$17,000	$0	$0	$0
Structural	$500	$30,000	$165,000	$30,000	$0
Building Enclosure	$3,300	$66,000	$0	$0	$0
Electrical	$0	$0	$1,000	$0	$12,000
Instrumentation and Controls	$0	$66,000	$0	$0	$0
Total	$19,800	$194,000	$216,000	$30,000	$12,000

Table 4.10 Overall Cost Estimate / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 yrs	5 to 10 yrs	10 to 15 yrs	None
Process	$1,016,000	$3,202,100	$3,040,000	$445,000	$40,000,000
Building Mechanical	$107,550	$1,388,800	$340,400	$326,000	$0
Structural	$25,500	$642,000	$470,000	$30,000	$0
Building Enclosure	$7,600	$574,900	$33,000	$0	$0
Electrical	$0	$400,000	$370,000	$0	$112,000
Instrumentation and Controls	$33,000	$66,000	$125,000	$0	$0
Total	$1,189,650	$6,273,800	$4,378,400	$801,000	$40,112,000
Budget per year	$1,186,150	$1,568,450	$875,680	$160,200	N/A

4.4 Condition Assessment Summary

At each one of the infrastructure facilities that are used to supply potable water to the City a conditions assessment was completed which considered the condition of the equipment associated with each discipline / trade. While this provided a significant amount of information, an overall summary is required for each facility.

River Pumphouse and Raw Water Supply Pipeline

Commissioned in 1984, the river pumphouse and raw water supply pipeline are critical to the continued supply of raw water to the City, Cenovus, and other users through potable water sales agreements. The pumping equipment is regularly maintained and overhauled, and while the recent travelling water screen failure was unfortunate, it was on the task list to be addressed. Recent upgrades / adjustments to both the intake, electrical system and controls have improved both the performance of the system and its reliability.

While there is still work to be completed on the pumping system (i.e. continued pump overhauls and valve replacements), this condition assessment identified more tasks around the building enclosure and building mechanical aspects. Except for the replacement of the air handling unit to address electrical overheating in summer, most of the items are maintenance projects such as re-sealing roof penetrations, addressing corrosion on pipework and pipe supports etc. However, there are some follow-up tasks which could lead to larger scopes of work, including:

- the assessment / intrusive investigation of the pump house roof which could lead to its replacement,
- further monitoring roof assemblies in the meter house building which may lead to its replacement, and
- the structural inspection of the wet well walls and floors by divers.

The condition and status of the raw water supply pipeline is a significant concern. As a single pipeline that supplies raw water to the City and Cenovus, it is a critical part of the water supply infrastructure with no redundancy or backup if it were to fail. Through the execution of this project, enquiries have been made to identify a means and method by which to complete physical testing and inspection of the raw water pipeline. However, the limited opportunity to remove the pipeline from service and its overall length with no connections to remove equipment partway along the pipeline, present significant challenges and result in significant costs. As such it is recommended that the City:

- continue to explore methods to complete an in-depth assessment of the raw water supply pipeline to determine its remaining service life,
- establish the basis for the supply of raw water to both the City and Cenovus for the next 50 years, which could influence how future capital projects are undertaken, and
- start to plan and establish a budget to replace / twin the existing raw water supply pipeline.

Furthermore, there are a series of concrete vaults along the length of the raw water supply pipeline which contain isolation and air valves. A number of these vaults are either flooded or need concrete repair / refurbishment. In discussions with the City a phased refurbishment program of the vaults should be completed over the next fifteen (15) years.

Cenovus Raw Water Pumphouse

As with the river pump house, the pumping and electrical equipment within the Cenovus raw water pump house is maintained and overhauled on a regular basis. The pumphouse was constructed in 1999 and no significant concerns were noted as part of the condition assessment.

Items such as valve replacement, damper replacement, and building enclosure maintenance are noted, along with the recommendation that a review of 500 mm pipework penetration be undertaken as it appears to be placing a “load / thrust” on the building’s wall which has resulted in some cracking. The addition of further pipe supports / restraints may be required.

From an operational perspective it was noted that the two raw water pumps were installed to be operated as duty / standby, but now both run together to meet Cenovus’s demand. There is space to install a third pump, and the City should consider its installation to provide on-line standby / redundancy.

Raw Water Reservoir

Originally constructed and filled with water in 1974, the raw water reservoir has never been drained or reviewed internally below the normal water level since being commissioned. Divers entered the reservoir to isolate pipework in 2019 and reported that from the limited area that they were working in, they did not observe any issues. From the exterior of the reservoir, there are no indications of any major concerns.

To determine if any remedial work is needed, or if the solids deposition is impacting on the storage capacity of the raw water reservoir, the City should lower the water level within the reservoir and complete further assessment in the near future. Based upon the results of the assessment, further scopes of work can then be defined and planned for.

Water Treatment Plant

Commissioned in 1984, the maintenance and upkeep efforts with regards to the WTP have been focused on the main treatment equipment, with the clarifier being the last piece of major process equipment to receive an upgrade since construction. Upgrades and adjustments over the past few years have put measures in place such that an inspection of the clarifier can be completed in the fall of 2024, and an action plan established.

Pumping and ancillary equipment is maintained and monitored, with issues addressed and equipment replaced as issues are identified. From a process perspective, the assessment highlighted tasks mostly around the continuation of regular maintenance and valve replacements, including the original gates and actuators which are part of the media filters.

From a structural perspective, no major issues were identified, but there are unknowns around the condition of the clarifier and the tanks in the basement which could not be accessed. While the structure appears in general to be performing adequately with no signs of significant deterioration or distress, specific issues were identified with regards to,

- the access to the chlorine gas storage and feed room which is currently via the WTP and does not meet the SWSA requirements for exterior access only, and
- access limitations and water ingress into Vaults 1 and 5, for which extension of the below grade wall and a new structure are proposed.

Most of the issues noted around the WTP building enclosure were with regards to maintenance and upkeep (i.e. resealing of penetrations, repair to cladding, failed exterior joints, etc.). Two significant items that were identified include the,

- investigation and possible replacement of the WTP roof, and
- replacement of the curtain wall at the front entry area, which is in poor condition.

The assessment of the building mechanical systems identified that most of the key equipment was close to the end of its service life and plans should be made to replace this equipment. Some equipment and valves were identified as critical and should be replaced as soon as possible. Furthermore, ventilation rates within some of the building key areas (i.e. chemical rooms) were identified to be low and are part of the main HVAC system that serves the whole building. The current best practice is to separate the HVAC systems for chemical areas, and SWSA specify that the ventilation for the chlorine gas storage and feed rooms must be independent from any other system.

The electrical equipment within the WTP is also approaching the end of its service life and planning should be undertaken to complete its replacement in the next few years. Overlapping with the building mechanical systems, the electrical rooms are unable to be sufficiently cooled in summer, increasing the risk of overheating and the possibility of limiting water production in peak demand periods. Furthermore, there is limited space to expand and complete the electrical upgrades / replacement which would have to be phased-in to allow the continued production of water.

A recent upgrade to the controls system places the treatment process in a good position for automation and monitoring. Several instruments including large diameter flowmeters require replacement, and the building management system (BMS) is no longer supported by the supplier. The upgrade of this system should be included within a larger building mechanical upgrade so that the BMS stays relevant with the new building mechanical modifications and does not reduce the functionality of the system.

West End Reservoir

Since commissioning in 2006, the equipment within the West End Reservoir has been monitored and any issues addressed as they have been identified. The electrical system was recently modified such that all the pumps now operate with VFDs, which provides greater flexibility and redundancy, and the chemical dosing system has been updated to mitigate the release of fumes which was resulting in surface corrosion of the pipework (further actions identified in the condition assessment).

No major issues were identified with regards to the building mechanical, electrical or control system, and regular maintenance tasks are being completed. This includes the replacement of instrumentation and small equipment as they reach the end of their service life. Replacement of the two magnetic flowmeters is one example which was identified.

Several tasks were identified with regards to the building enclosure including resealing of wall / roof penetrations, repairs to damaged flashing around the foundation wall, and the investigation / overcoat of the roof to address degranulation. From a structural perspective two future projects were identified,

- the decommissioning and demolition of the circular reservoir, which was constructed around 1974, and
- the inspection of the interior of the reservoir cells around 2031 when the reservoir has been in service for 25 years.

Consolidation of Tasks / Larger Projects

Actions, tasks, and potential projects which were identified for the river pumphouse, raw water supply pipeline, Cenovus raw water pumphouse, and the West End Reservoir can be executed as smaller individual projects to match the allocated budget in any year or period. However, the WTP is larger, more complex and the systems contained within it are significantly more integrated.

From the summary provided above it can be concluded that the current water treatment process is in a good position, with the clarifier the last major item of equipment to be addressed. However, the ancillary systems (building mechanical, electrical, and building enclosure) need attention due to their age and changes in requirements. While some actions and tasks identified within the condition assessment for the WTP can be conducted as individual smaller projects, there are some common aspects which should be combined into larger projects. These include:

- The clarifier upgrade / refurbishment.
- A building mechanical upgrade to replace old HVAC equipment and address
  - low ventilation rates in key areas
  - system separation requirements for chemical areas, and
  - overheating of electrical rooms
- An electrical upgrade to replace old equipment and increase reliability.
- The refurbishment / replacement of the WTP roof.

In considering these projects, ISL recommends that the following approach is undertaken:

1. The clarifier is assessed, and the identified remedial actions be completed first as the removal / replacement of the large clarifier components could require,
   a. removal of roof sections
   b. disassembly and removal of HVAC equipment and ductwork
2. The design of the building mechanical and electrical upgrade is completed together and integrated on the basis that the current electrical room on the main floor is doubled in size by,
   a. expanding it to the west of the WTP and consolidating / including the electrical equipment on the upper floor and allowing for future expansion, and
   b. provided with its own system for cooling of the electrical equipment.
3. New electrical equipment capable of powering critical loading is installed into the new electrical area, and critical equipment refed. Existing electrical equipment in the main floor and upper electrical rooms can then be replaced in an approach that allows the continued production of water.
4. The electrical upgrade is completed and the equipment to be retained is moved onto the new electrical equipment in a phased approach that allows the continued production of water.
5. With the electrical upgrade completed, the building mechanical upgrade is completed and serviced by the new electrical equipment.
6. With the work on the clarifier completed and the upgrades finished for the electrical and building mechanical systems, the roof can be replaced in whole or part on the basis that there are no further requirements to add new penetrations or remove / replace sections of the roof.

While the costs of refurbishment for the clarifier are unknown at this time, the above approach does require some adjustments to the cost estimates / forecast presented in Section 4.3 for both the building enclosure and mechanical systems. Table 4.11 below summarizes the revised cost estimates / forecast on the basis that

- Duplicate costs within the original condition assessment are removed,
- The electrical and building mechanical upgrades are combined into larger projects that address the whole WTP building, not just the specific items listed within the condition assessment.
- The entire roof of the WTP is replaced in one project.

Table 4.11 Revised Cost Estimate / Forecast with Consolidated Projects

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
Process	$1,016,000	$3,202,100	$3,040,000	$445,000	$40,000,000
Building Mechanical	$107,550	$1,388,800	$340,400	$326,000	$0
Structural	$25,500	$642,000	$470,000	$30,000	$0
Building Enclosure	$7,600	$574,900	$33,000	$0	$0
Electrical	$0	$400,000	$370,000	$0	$112,000
Instrumentation and Controls	$33,000	$66,000	$125,000	$0	$0
Condit. Assess. Totals	$1,189,650	$6,273,800	$4,378,400	$801,000	$40,112,000
Building Mechanical Items Removal		-$981,000	-$195,500	-$308,000	
Electrical Items Removal		-$400,000	-$184,000		
Electrical Upgrade		$300,000	$2,700,000		
Building Mechanical Upgrade		$300,000	$2,700,000		
WTP Roof Replacement			$860,000		
Revised Totals	$1,189,650	$5,492,800	$10,258,900	$493,000	$40,112,000

5.0 Capacity Assessment

The previous section of this report addressed the condition of the infrastructure that is used to supply potable water to the City as well as ACE Regional Waterline and the Prairie North Regional Potable Water Supply System. However, the installed equipment and systems are limited to how much water they were designed / fabricated to treat (i.e. capacity). Within this section the projections developed in Section 3.0 will be compared against the capacity of the currently installed infrastructure with a view to determining when a capacity expansion will be required and what items need to be included within the scope of work.

5.1 Potable and Raw Water Demand Projections

When designing water treatment systems two key values must be defined. The potable water average day demand (ADD) and the maximum day demand (MDD). The primary value used in establishing the design capacity of a WTP is the MDD, which is the maximum amount of potable water a WTP must be able to produce in a 24-hour period. This statement is made on the basis that peak hour demands are met by the storage capacity and pumping systems within the water distribution system. In the case of the City, the future MDDs were established using an ADD to MDD peaking factor that is based upon a 5-day rolling average of historical values. This mitigates exceptionally high demand days that could be due to abnormal factors such as pipe breaks within the water distribution system, maintenance, and recovery following infrastructure shutdowns.

The ADD and MDD are the volumes for potable water and when considering the requirements for treatment capacity, the losses or waste streams within the treatment process must be accounted for. This results in the raw water average and maximum flowrates. In looking at the historical data from 2017 to 2023, the average amount of waste / losses across the WTP was 4.5%.

As noted in Section 3.4, the City asked for two scenarios to be considered when assessing the treatment capacity of the WTP. The first would be a “high-demand” scenario which is based upon future potable water demands that include the City’s projected growth and the contractual MDD values for the ACE Regional Waterline and the Prairie North Regional Potable Water Supply System. In applying the established waste / losses across the WTP, the high-demand average and maximum day demands established for the City for both the potable and raw waters are shown below in Table 5.1.

Table 5.1 Projected High-Demand Potable and Raw Water Average and Max Day Flows for the WTP

Horizon	Year	Potable Water ADD	Potable Water MDD	Raw Water ADD	Raw Water MDD
0	2022	10,332	14,892	10,797	15,563
3	2025	11,878	19,419	12,412	20,293
5	2027	12,727	20,608	13,299	21,535
10	2032	14,454	23,026	15,105	24,062
20	2042	17,903	28,609	18,709	29,896

The second scenario to be considered is a “low-demand” scenario which is based upon the potable water demands that include the City’s projected growth (as before), but with the historical MDD values for the ACE Regional Waterline and the Prairie North Regional Potable Water Supply System as defined within

Section 3.4. The resulting average and maximum day demands for both potable and raw waters with regards to the WTP under the low-demand scenario are shown Table 5.2.

Table 5.2 Projected Low-Demand Potable and Raw Water Average and Max Day Flows for the WTP

Horizon	Year	Potable Water ADD	Potable Water MDD	Raw Water ADD	Raw Water MDD
0	2022	10,332	14,892	10,797	15,562
3	2025	11,878	17,107	12,412	17,877
5	2027	12,727	18,295	13,299	19,118
10	2032	14,454	20,712	15,105	21,644
20	2042	17,903	25,235	18,709	26,371

5.2 Historical Potable Water Production / Demands

The City's WTP operates in what is referred to as a "batch mode". Around 6:00 am every morning the WTP starts at a constant flow rate and provides potable water throughout the day to meet the water demands of the City's residents and businesses. Any unused water that is supplied to the water distribution system is directed to the West End Reservoir. As the demand for water reduces later in the day, the level in the West End Reservoir starts to increase until it is determined to be "full" by the control system, at which point the WTP is shut down for the day.

In assessing the historical performance of the WTP which operates in this manner, two factors can be considered. The volume of potable water provided each day, and the hours the WTP has been operated for in a day. Figures 5.1, 5.2 and 5.3 summarize this data for the WTP from 2017 to 2023 and show that while the average daily volumes remain constant initially, they do appear to increase from 2021 onwards. This may be due to the startup of the regional systems or an increase in the overall demand for potable water. The breakdown between the City and the regional systems is shown in Table 5.3 below, which shows that the City's ADD and MDD have remained relatively stable for the past seven (7) years. It appears that the addition of the regional systems may be the contributing factor to the recent overall increases. This upward trend is also evident in the hours operated values from 2021 onwards, especially with the number of cumulative days the WTP has operated over sixteen (16) hours.

Table 5.3 Breakdown of **POTABLE WATER** ADD and MDD for City and Regional Systems

Year	City		ACE		Prairie North		WTP Production	
	ADD	MDD	ADD	MDD	ADD	MDD	ADD	MDD
2017	9,897	13,996					9,897	13,996
2018	9,878	14,889	603	1,876			9,939	14,889
2019	9,669	13,204	447	1,993			10,116	13,563
2020	9,587	15,979	475	1,600			10,062	16,966
2021	9,742	15,280	477	1,069			10,242	16,278
2022	9,674	13,948	521	1,136	295	337	10,211	14,620
2023	9,868	15,438	539	1,106	311	564	10,718	16,545
Average	9,759	14,676	510	1,463	303	451	10,169	15,265

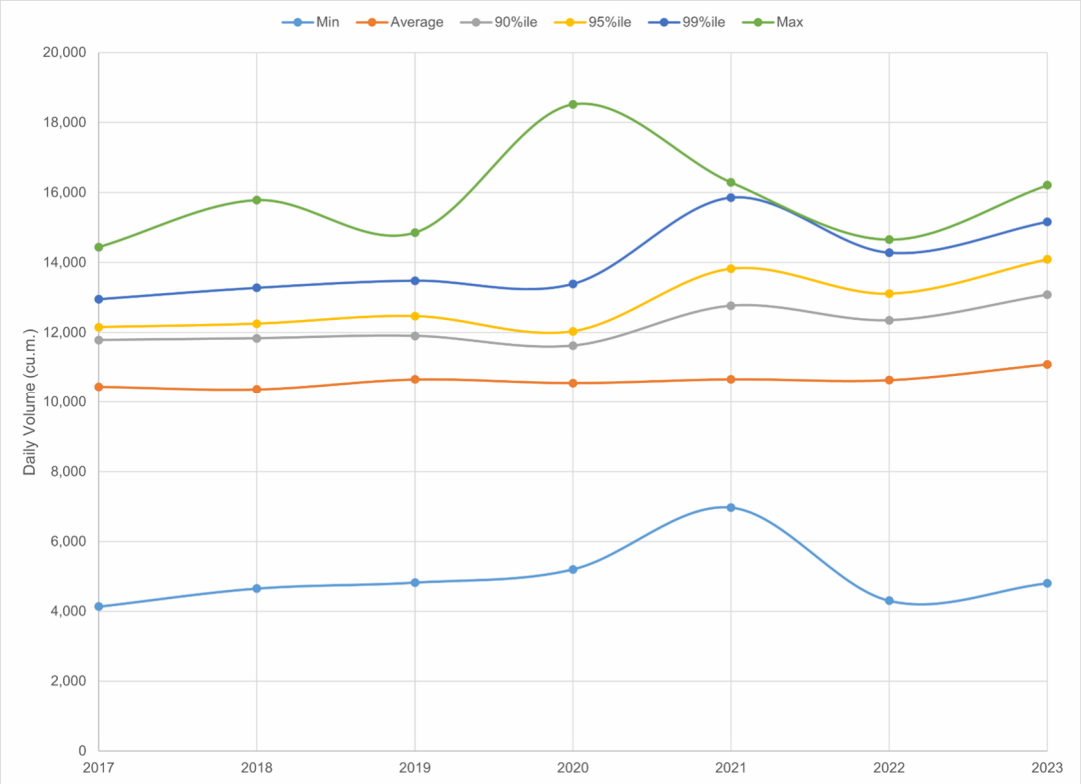


Figure 5.1 WTP Daily Volumes of **RAW WATER**

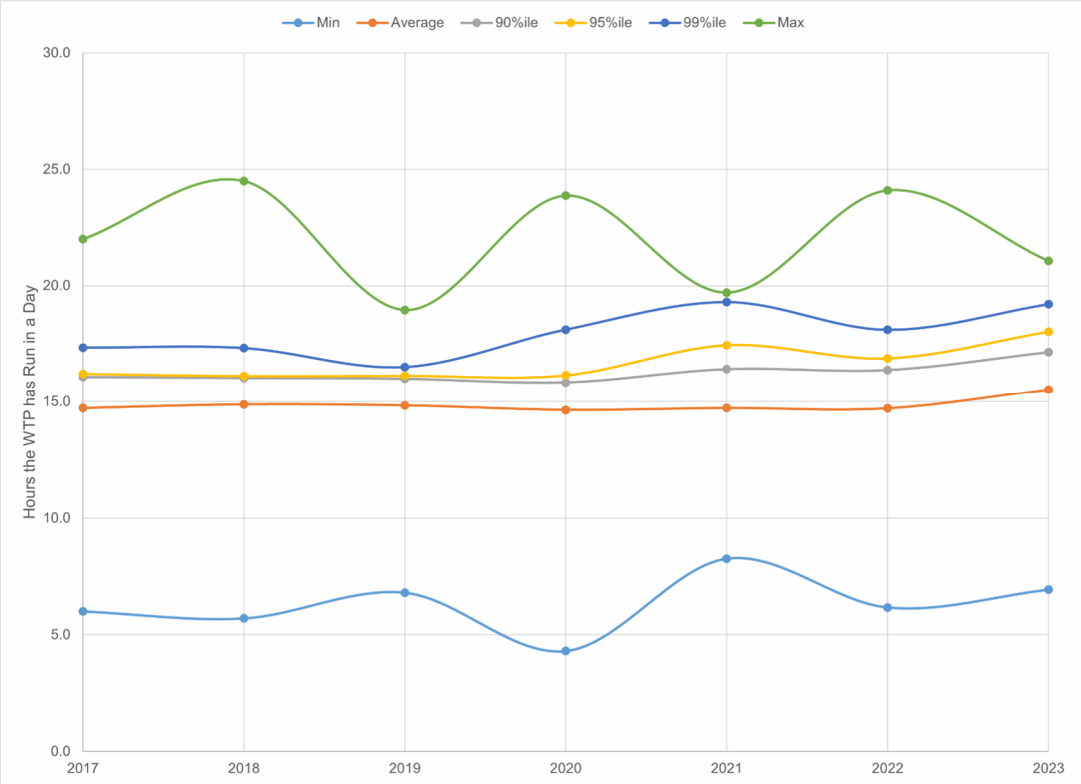


Figure 5.2 WTP Hours Run per Day

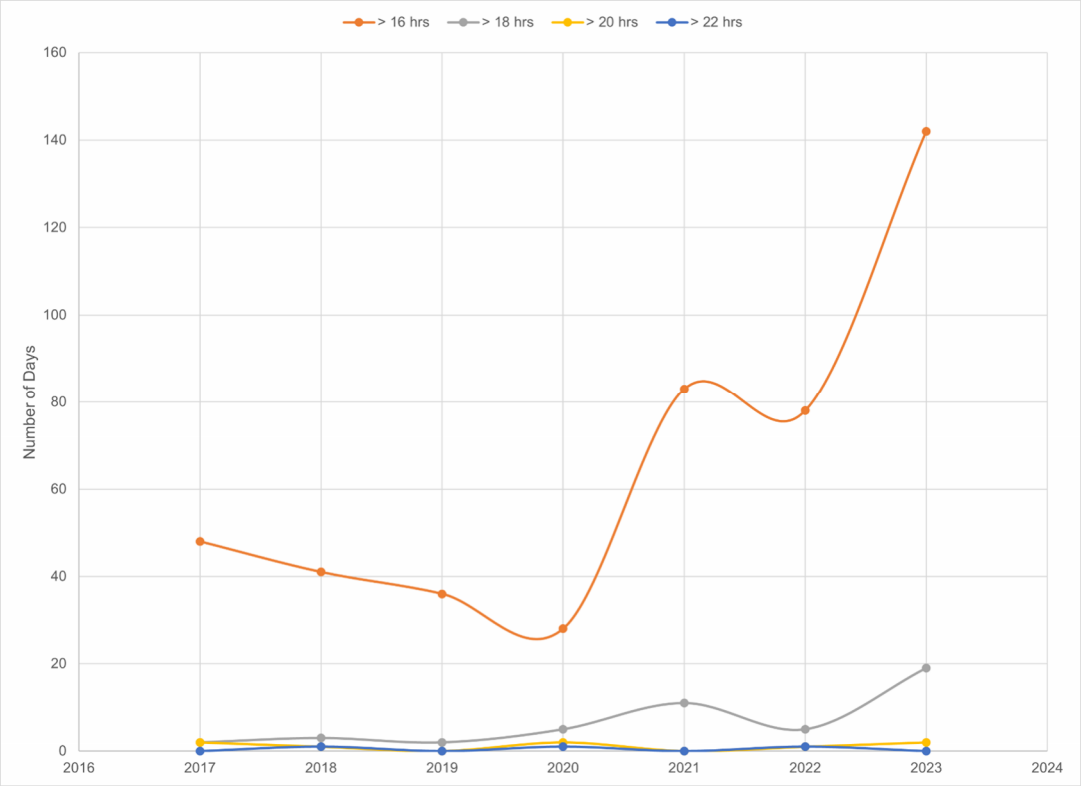


Figure 5.3 WTP Number of Cumulative Days at Elevated Run Hours

At a high level this data can be used to estimate the maximum daily volume the WTP could provide if it were to operate 24 hours a day every day of the week. Focusing on the information for 2023, data was collected for days where the WTP had operated for more than 16 hours. As shown in Figure 5.4 below, the high daily volumes occurred between April and September and by using the data for May 15, 2023, it is estimated that if the WTP were to operate 24 hours continuously, it could provide 21,710 m^3/d of potable water (905 m^3/h). The daily raw water volume for the same day based upon 24 hours of operation is 21,264 m^3/d, which is based on the provided raw water data and derived a flow of 886 m^3/h.

However, this is theoretical and the performance of the WTP is dependent upon the raw water quality that enters the process. While there are several parameters which dictate the adjustments needed to the water treatment process, raw water turbidity is a primary parameter which impacts the performance of the solids contact clarifier most. As shown in Figure 5.5 below, incoming raw water turbidity was not abnormally high during the higher flow events in May, and even when the turbidity did increase in late June 2023, the WTP was able to maintain an elevated flowrate.

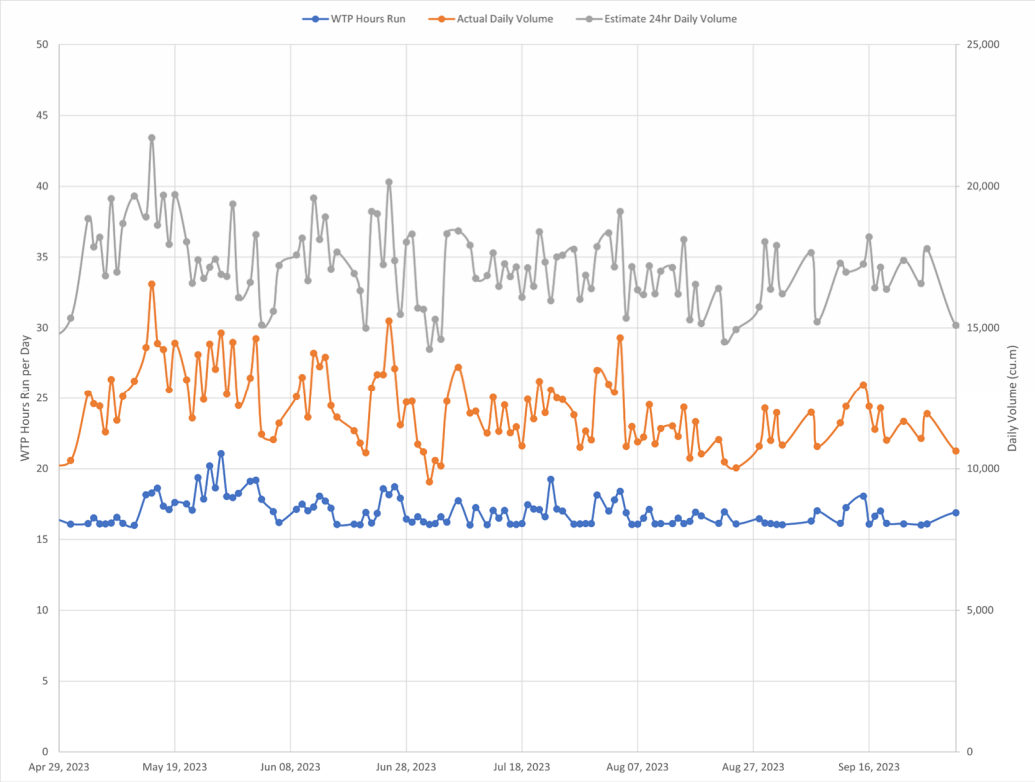


Figure 5.4 Estimated Maximum Daily Volume

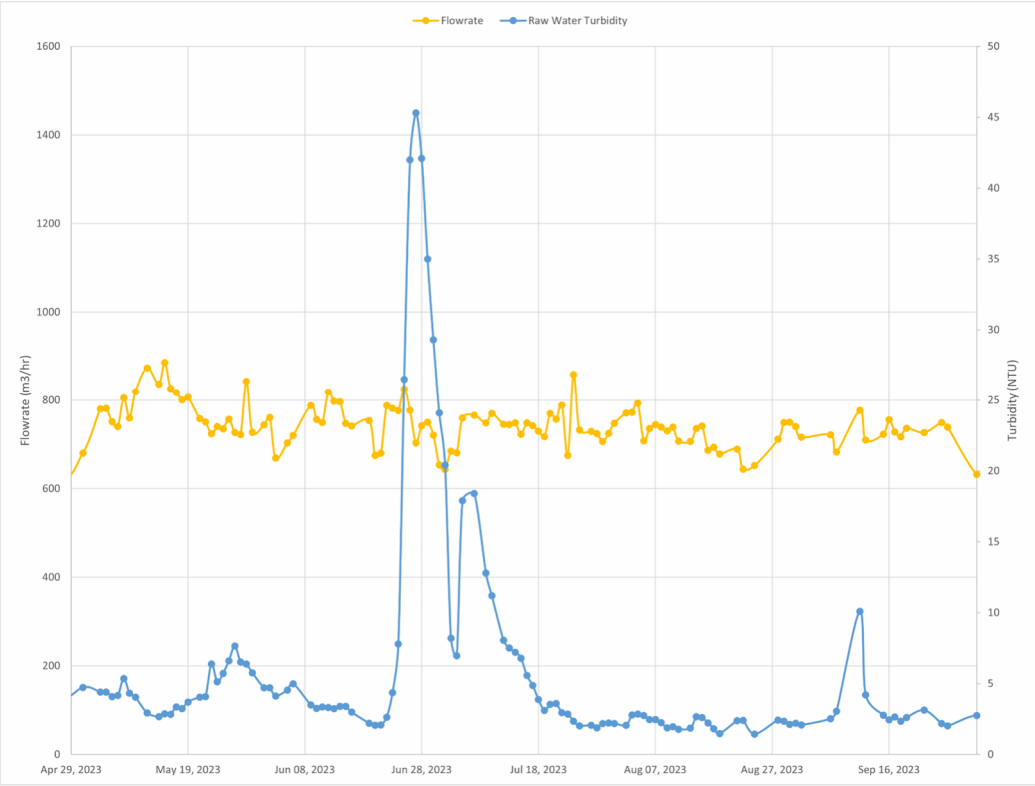


Figure 5.5 WTP Flowrate vs. Raw Water Turbidity

Therefore, if the WTP were to operate 24 hours per day, then based upon the May 15, 2023, data, the clarifier should be able to treat an incoming flow of 886 m^3/h (21,264 m^3/d). Using this raw water flow and applying raw water MDD values from the high and low-demand scenarios established within Section 5.1, then as shown in Table 5.4 below, under

- the high-demand raw water MDD scenario, the treatment capacity of the WTP will be exceeded in 2026,
- the low-demand raw water MDD scenario, the treatment capacity of the WTP will be exceeded in 2031, and
- both scenarios, the raw water ADD will continue to be met until after 2042.

Table 5.4 WTP Raw Water Maximum Day Demands

Horizon	Year	Raw Water High-Demand MDD (m^3/d)	Raw Water Low-Demand MDD (m^3/d)
0	2022	15,563	15,562
3	2025	20,293	17,877
5	2027	21,535	19,118
10	2032	24,062	21,644
20	2042	29,896	26,371

The above analysis and statements are based upon historical data, and it may be possible to operate the WTP at a higher constant flowrate. However, there have been no requirements to do so.

With an approximate timeline established for the WTP upgrade, the next step in this capacity assessment is to consider each stage within the water supply process and to identify where the limitations are.

5.3 River Pumphouse and Raw Water Supply Pipeline

To assess the capacity of the river pumphouse and the raw water supply pipeline, the daily volumes / flows for the supply of raw water to Cenovus must be added to provide the future combined demands for the raw water system. As stated within the Husky (Cenovus) Raw Water Supply Agreement with the City (1999), the City will provide Cenovus with

- a maximum annual average daily volume of 25,000 m^3/d, and
- a maximum daily volume of 27,273 m^3/d.

From a historical perspective, Cenovus draws approximately 15,700 m^3/d of raw water, which is consistent and does not vary significantly from day-to-day. Therefore, applying the same approach of a high-demand and low-demand scenario to the raw water system, a combined raw water demand can be established as shown in Table 5.5, where a Cenovus volume of

- 27,273 m^3/d is added to the WTP raw water MMD for the high-demand scenario, and
- 15,700 m^3/d is added to the WTP raw water ADD and WTP raw water MDD for the low-demand scenarios.

Table 5.5 Projected Combined Raw Water Demands

Horizon	Year	Combined Raw Water ADD (m^3/d)	Combined Raw Water High-Demand MDD (m^3/d)	Combined Raw Water Low-Demand MDD (m^3/d)
0	2022	26,497	42,836	31,262
3	2025	28,112	47,566	33,577
5	2027	28,999	48,808	34,818
10	2032	30,805	51,335	37,344
20	2042	34,409	57,169	42,071

Intake

The intake structure was constructed to allow both the City and Cenovus to withdraw up to 90,000 m^3/d of water from the North Saskatchewan River. Based upon the available Alberta diversion licences:

- Cenovus is permitted to withdraw an annual volume of 6,752,500 m^3/year (i.e., an average of 18,000 m^3/d) up to a peak flowrate of 60,048 m^3/d.
- the City is permitted to withdraw an annual volume of 11,101,337 m^3/year (i.e., an average of 30,415 m^3/d) up to a peak flowrate of 59,941 m^3/d.

While it is not possible for both the City and Cenovus to withdraw their maximum flowrates at the same time (i.e., 119,989 m^3/d), the intake is sufficiently sized to meet all the established flows within Table 5.5 up to 2042. Under the high-demand scenario in 2042 a maximum flow of 57,169 m^3/d will be withdrawn (i.e., 64% of the intake design capacity). Under the low-demand scenario 42,093 m^3/d will be withdrawn (47% of the intake design capacity).

Travelling Water Screen

The original screen was hydraulically sized to match the capacity of the intake structure (i.e., 89,856 m^3/d). The new screen should be similarly sized to match the design capacity of the intake, which will be sufficient to meet the raw water demands beyond 2042.

Low Lift Pumps & Desilting Pond

Two (2) low lift pumps were originally installed with a stated capacity of 29,980 m^3/d at a discharge pressure of 11.8 m of water, which is shown on the pump's nameplate. In 2009 both pump motors were upgraded to 150 hp motors which would operate at 1,190 rpm instead of 880 rpm. This increased the quoted capacity of each pump to 38,976 m^3/d at a discharge pressure of 11.8 m of water.

Both low lift pumps are operated with variable speed drives (VFDs) and when both are running together they should provide a total flow of approximately 77,952 m^3/d. While doubling the flow for two pumps provides an approximate flow, the exact value is dependent upon the pump's performance curves, condition, and the hydraulic losses within the system.

In 2042, the City's raw water ADD plus Cenovus's current demands result in an estimated flowrate of 34,409 m^3/d, which is within the capacity of a single low lift pump. For the high-demand scenario in 2042 a flow of 57,169 m^3/d is estimated, which will require two (2) low lift pumps to operate together. It is interesting to note that the high-demand MDD forecast for 2023 is 42,836 m^3/d, which would also require two low lift pumps to operate together. To date the City has not needed to operate two (2) low lift pumps together to meet the historical water demands.

In 2042, the low-demand scenario estimates a combined raw water flow of 42,071 m^3/d. This will require the operation of two (2) low lift pumps, which based upon the raw water demand projections should start to occur around 2035.

From a low lift pumping perspective, the removal, maintenance and overhaul of the low lift pumps is going to become more challenging as it becomes necessary to operate both low lift pumps to meet the MDD. As such the maintenance approach could be adjusted such it planned for periods of low water demand (i.e., winter). Alternatively, the City could have the components for a complete low lift pump and motor in storage which can be quickly assembled and swapped out with an online low lift pump, as and when maintenance is required. This approach would also address sudden low lift pump failures, and this same approach is currently used with the chlorinators at the WTP.

Recent improvements to the intake have reduced the river sand / silt infiltration into the river pumphouse. No issues were raised with regards to the solids removal performance of the desilting pond during the site review, therefore no expansion or improvements are anticipated.

The pipework associated with the low lift pumps was considered in terms of water velocity. For the 2042 ADD and MDD combined raw water flows (both scenarios), the resulting velocity was within an acceptable range in the pipework headers, which is positive. For the pump discharges, the velocity at the stated pump duty flowrate is very high at 3.6 m/sec. However, the pipe length is very short which mitigates a significant impact on the total dynamic head exerted on each pump.

High Lift Pumps

With the capacity of the smaller high lift pump (HLP-102) increased in September 2024 to 19,923 m^3/d at a discharge pressure of 185 m of water, to match the existing two large pumps, the three (3) high lift pumps now have a total capacity of approximately 59,769 m^3/d. While tripling the flow for three pumps provides an approximate value for the combined discharge flowrate, the exact value is dependent upon the pump's performance curves, condition, and the hydraulic losses within the system.

Currently the City's ADD and Cenovus's actual ADD result in a combined raw water flow of 26,497 m^3/d which requires at least two high lift pumps to operate together. In 2042 the combined raw water ADD is 34,409, which is still within the capacity of two high lift pumps.

Under the high demand scenario, the current combined raw water MDD is 42,836 m^3/d, which would require three (3) high lift pumps to operate together. The City has not needed to run three (3) high lift pumps together to meet the current water demands. In 2042, the combined raw water MDD for the high-demand scenario is estimated to be 57,169 m^3/d, which should just be within the capacity of the current three (3) high lift pumps.

For the low-demand scenario, the current combined raw water MDD only requires two (2) high lift pumps to operate together. By 2042 the "low-demand" combined raw water MDD is estimated to increase to 42,071 m^3/d, which would require the operation of three (3) high lift pumps together. It is anticipated that the move from needing two (2) to three (3) high lift pumps will occur around 2037.

As with the low lift pumps, it is going to become more challenging to remove a high lift pump for maintenance / overhaul as the demands for raw water will require multiple pumps to operate together for longer periods. The proposed maintenance approach for the low-lift pumps can also be applied to the high lift pumps where the components for a complete high lift pump and motor is kept in storage. A pump

can then be quickly assembled and swapped out with an online high lift pump, as and when maintenance is required, or a failure occurs.

The pipework associated with the high lift pumps was reviewed and found to be within acceptable velocity ranges for all the flowrate scenarios to 2042.

Raw Water Supply Pipeline

Installed in 1984, the 750 mm (30") diameter yellow jacketed, cement lined steel pipe has a design capacity of 60,000 m³/day. Based upon the combined raw water high-demand MMD in 2042, the estimated flowrate is 57,169 m³/d which is 95% of the design capacity of the pipeline. The combined raw water low-demand MDD in 2042 is 42,071 m3/d which is 70% of the pipeline's design capacity.

The raw water supply pipeline has the capacity to meet the estimated flows to 2042, however the spare design capacity in the future in conjunction with the raw water supply pipeline's age and unknown condition highlights the need for the City to start planning for the long-term conveyance of raw water from the river to the City, as noted within Section 4.4.

5.4 Cenovus Raw Water Pumphouse

While Cenovus is noted to request as much raw water as can be spared at peak times of the year, no indication that Cenovus intends to increase the pumping capacity at the raw water pumphouse has been provided to the City. Based upon the current demands, the City / Cenovus agreement, and the Cenovus diversion licence, Table 5.6 below summarizes the flows under each condition and the number of pumps of the same size currently installed that would be required to meet each condition requirement.

Table 5.6 Cenovus Raw Water Pump Requirements

	Raw Water Flow (m³/d)	No. of Current Pumps Required
Current Demands	15,270	2
City / Cenovus Agreement Annual Average Flow	25,000	4
City / Cenovus Agreement Maximum Day Flow	27,273	4
Diversion Licence Annual Average Flow	18,500	3
Diversion Licence Maximum Day Flow	60,048	8

Based upon the capacity of the currently installed pumps, both pumps are required to run to meet the current Cenovus demands. Any requirements to increase the flow to achieve the agreement values would require as a minimum the same pump capacity installed in the remaining open positions, such that four (4) pumps would be available. This would also meet the conditions for the annual average flow allowed under the diversion licence. A review of the pipework within the raw water pump station under the first four (4) flow conditions up to the annual average flow, shows that the water velocity to be within an acceptable range within the pipework. However, the 350 mm diameter PVC pipeline, which is owned by Cenovus, is only sufficient to meet the current demands and any increase in flow to Cenovus would require it to be twinned or upsized.

The maximum day flow under the diversion licence is very high and based upon the number of pumps required (which match those currently installed), and the resulting water velocity within the pipework, it is evident that the pumphouse was not designed to meet this flow condition.

As noted within the condition assessment, it is recommended that a third raw water pump is installed in the Cenovus raw water pumphouse as an online standby. The intent would not be for this pump to increase the capacity or flowrates currently provided to Cenovus, but to provide pump redundancy.

5.5 Raw Water Reservoir

The raw water reservoir has a design capacity of 204,000 m^3, a summer working volume of 188,000 m^3 and a winter working volume of 155,000 m^3. As water demands in winter are typically closer to the ADD and the MMD in summer, Figure 5.6 below shows the days of raw water storage for the design, summer and winter working capacities at these estimated demands.

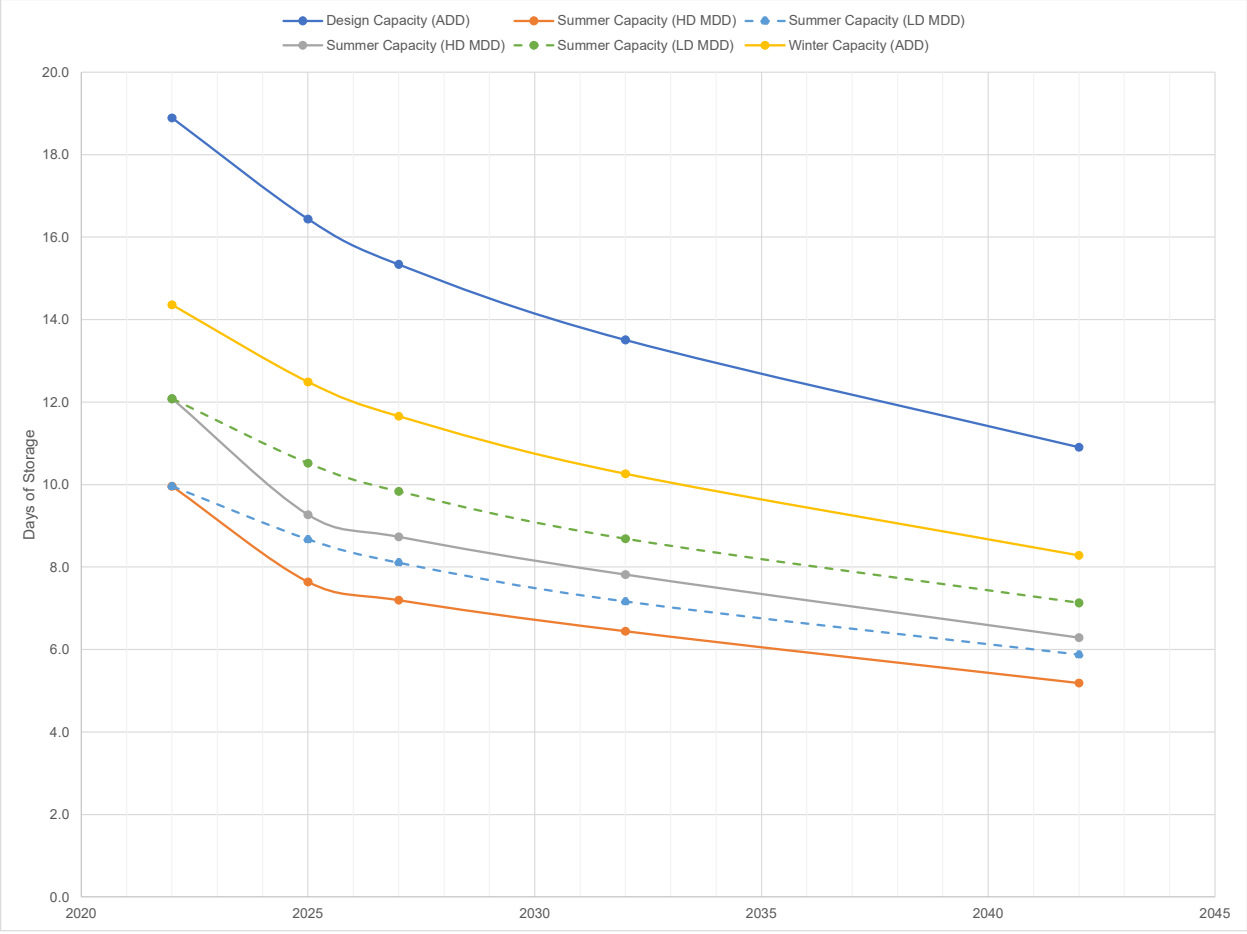


Figure 5.6 Raw Water Reservoir Days of Storage

By 2042 the raw water reservoir will provide five (5) to seven (7) days of raw water storage based upon either the summer or winter working capacities, and whether the high or low-demand raw water MDD is applied. Approximately half a day of storage can be gained under the MDD scenarios, if the working volume is increased to the design capacity.

If the WTP operates at the estimated raw water ADD in 2042, eight (8) days of raw water storage can be provided if the reservoir starts at the winter working capacity. Ten (10) days of storage can be provided if the starting volume is equal to the summer working volume.

The water supply requirements for Saskatchewan make no specific mention of the number of days of off-stream raw water storage that is required, other than to state that off-stream storage should be based on the hydrological and quality characteristics of the primary supply. Whilst the North Saskatchewan River is a large river with sufficient volume at this time, these values illustrate the number of days the City has to address any issues or problems that would prevent raw water from being moved from the river to the reservoir.

5.6 Water Treatment Plant

Raw Water Pumps / System

While raw water pumps were installed in 1984, the water has historically moved from the raw water reservoir to the WTP by gravity, with the raw water pumps only used rarely when the raw water reservoir level is low. At this time two of the three originally installed raw water pumps remain available, each with a duty point of 14,990 m^3/d at a discharge pressure of 9.2 m of water.

If the raw water reservoir is low and the raw water pumps are required, the current ADD flowrates can be met with one pump, with a second pump required to run around 2032. For both the high and low-demand MDD conditions both raw water pumps would need to run from now until 2042, at which point the pumps discharge flowrate would be comparable to the estimated MDD flowrate. While doubling the flow for two pumps provides an approximate flowrate, the exact value is dependent upon the pump's performance curves, condition, and the hydraulic losses within the system.

Should the need to operate the raw water pumps become a normal event, the City should consider the procurement of a third raw water pump for installation or as an off-line spare. The two existing raw water pumps have been included within the condition assessment for an overhaul of both the pumps and the motors within the next five (5) years.

The pipework associated with the raw water pumps was considered in terms of water velocity. For the 2042 ADD and MDD flowrates (both scenarios), the pipework from the raw water reservoir, through the vaults and the raw water system was found to be in the typical ranges for this application.

Solids Contact Clarifier

The capacity of the single solids contact clarifier has been the focus of attention for several previous assessments undertaken by the City. Originally rated for a surface loading rate of 5.95 m/h ($m^3/m^2/h$), which is equivalent to 30,000 m^3/d, the clarifier was subsequently downrated by the supplier to 4.2 m/h which is equivalent to a treatment capacity of 21,168 m^3/d.

In terms of typical design values, the Water Treatment Plant Design Handbook (McGraw – Hill 4th Edition) states that for a clarifier with settlement tubes, a loading rate between 2.4 and 7.3 m/h may be used depending upon the settlement characteristics of the floc. This puts the clarifier at the City's WTP just below the midpoint of this range. The 2023 historical data shows that the clarifier has operated with a raw water (inlet) flowrate of 886 m^3/h (i.e., 21,264 m^3/d), which is equivalent to a surface loading rate of 4.22 m/h, validating the suppliers' adjustments. As historical water demands have been met by this flowrate, the clarifier has not been operated at a higher surface loading rate. This does mean that the clarifier may be able to treat more water under favorable raw water quality conditions.

Using the established flow projections, the treatment capacity of the clarifier would be exceeded in 2026 using the raw water high-demand MDD, and 2031 when applying the raw water low-demand MDD.

Media Filtration

The original media filters would have been designed and installed to match the treatment capacity of the clarifier. The media filters installed at the WTP are comprised of sand and anthracite layers and would normally operate in the range of 2 to 9 m/h ($m^3/m^2/h$). The SWSA requirements for Waterworks Design (EPB 501) recommends that in general "*filters should not exceed 12.5 m/h*" and that "*production capacity shall be equal to or greater than the maximum plant capacity with the largest filter removed from service.*" The supplier of the filter's internal equipment noted on their drawings that the filters are designed for 11.2 m/h. While these numbers are useful, the true limiting factor is the quality of the filtered water (filtrate), specifically its turbidity which must remain below 0.3 NTU. If exceedances occur then either the upstream pre-treatment needs to be improved / optimized, the flow of water through the filters needs to be reduced, or the filter needs to be cleaned by backwashing. All of which can affect the daily volume produced by the WTP.

Historically, the quality of the water leaving the filter has been high with no challenges reported with maintaining the turbidity below 0.3 NTU. Tables 5.7 to 5.9 shows the filtration rates at the projected future flows and with filters out of service. While it is acknowledged that some of the raw water daily volume will be removed due to blow-down of the settled sludge from the clarifier, the estimated raw water demands have been applied to the media filters for continuity

In order to provide some context, the following colours have been applied to the filtration rates within the tables.

- Green applies to the values less than the supplier's design filtration rate (i.e., 11.2 m/h).
- Black applies to the values between the supplier's design filtration rate and what is considered appropriate by the Regulator (i.e., 11.2 to 12.5 m/h)
  - While the filters can operate in this condition, the quality of the water entering the filters becomes more critical and production of filtrate at these rates would be a challenge to maintain for a prolonged period.
- Red applies to values above what is considered not appropriate by the Regulator (i.e., 12.5 m/h)
  - While some facilities can operate at these high filtration rates, the media filters are usually modified (i.e. deep bed media filters) or they have a robust pretreatment stage.

Table 5.7 Filtration Rates at Future Raw Water ADD with No. of Filters in Service

			No of Filters in Service			
			4	3	2	1
Year	Raw Water ADD (m^3/d)	ADD (m^3/h)	Filtration Rate (m/h)			
2025	12,412	517	4.79	6.39	9.59	19.18
2027	13,299	554	5.14	6.85	10.27	20.55
2032	15,105	629	5.83	7.78	11.67	23.34
2042	18,709	780	7.23	9.64	14.45	28.91

Table 5.8 Filtration Rates at Future Raw Water High Demand MDD with No. of Filters in Service

			No of Filters in Service			
			4	3	2	1
Year	Raw Water MDD (m^3/d)	MDD (m^3/h)	Filtration Rate (m/h)			
2025	20,293	846	7.84	10.45	15.68	31.35
2027	21,535	897	8.32	11.09	16.64	33.27
2032	24,062	1,003	9.29	12.39	18.59	37.18
2042	29,896	1,246	11.55	15.40	23.10	46.19

Table 5.9 Filtration Rates at Future Raw Water Low Demand MDD with No. of Filters in Service

			No of Filters in Service			
			4	3	2	1
Year	Raw Water MDD (m^3/d)	MDD (m^3/h)	Filtration Rate (m/h)			
2025	17,877	745	6.91	9.21	13.81	27.62
2027	19,118	797	7.38	9.85	14.77	29.54
2032	21,644	902	8.36	11.15	16.72	33.44
2042	26,371	1,099	10.19	13.58	20.37	40.74

Based upon the tables above, it is evident that the treatment capacity of the media filters matches that of the clarifier. While the filtration rates vary depending upon the number of filters in service, to meet the requirements of the Regulator (i.e., the filtration rate must be less than 12.5 m/h when one filter is not in service), then based upon:

- The raw water high-demand MDD, additional filters are needed around 2032.
- The raw water low-demand MDD, additional filters are needed around 2038.
- The raw water ADD, the filters will meet these requirements beyond 2042.

This analysis shows that any future project to add a second clarifier should also include the addition of media filters with provisions to match the treatment capacity of the second clarifier as their combined treatment capacity is linked.

Ultra-Violet (UV) Disinfection

Commissioned in 2024, a single UV reactor was installed on the outlet of each media filter to provide a 3-log reduction in both Cryptosporidium and Giardia. From the design basis memorandum, each reactor was designed to provide treatment to the filtered water at a flowrate of 315 m^3/h at a UV Transmissivity (UVT) of 78%. In the unlikelihood that the UVT drops below 78%, the flow of water through the reactors would need to be lowered to maintain a 3-log reduction in Cryptosporidium and Giardia.

With four (4) filters in service, the UV system can provide treatment up to 30,240 m^3/d, and 22,680 m^3/d with three (3) filters in service. This approximately aligns with the treatment capacities established for the

clarifier and media filters. Therefore, should a second clarifier and additional media filters be added to the WTP, then additional UV disinfection must also be included in the project. The only variation the City may wish to consider from the current installation is to create a UV stage with a lower number of larger duty / standby reactors, rather than installing UV reactors on the outlet of each filter. Then should a UV reactor fail, the associated filter does not need to be removed from service.

Chlorine Disinfection

The introduction of the UV stage has made a significant difference, as prior to its application the chlorine disinfection stage was required to provide a 0.5 log reduction in Giardia. This required a longer contact time, which resulted in part of the water distribution system being used for potable water treatment. Now with the chlorine disinfection stage only focusing on virus reduction, the contact time has significantly reduced.

Each WTP that uses a surface water source must provide treatment to achieve a 4-log reduction in viruses. SWSA EPB 501 states that for a WTP that incorporates:

- conventional sedimentation and filtration, a 2-log reduction virus credit is assigned for the clarifier and filter, and
- direct filtration, a 1-log reduction virus credit is assigned for the filters.

When the clarifier is in service the City's WTP operates as a conventional filtration and sedimentation process, and as such the chlorine disinfection stage must provide a 2-log reduction in viruses. When the clarifier is out of service and the WTP operates as a direct filtration process, the chlorine disinfection stage must then provide a 3-log reduction in viruses.

When assessing virus log reduction, multiple variables and factors need to be established. Table 5.10 provides the required free chlorine concentration to achieve a 2-log reduction in viruses for varying water flowrates when the;

- water temperature is at 0.5 DegC, which sets the CT value at 6 mg-min/L,
- baffling factor is 0.3, and
- clearwell is full to a water depth of 3.1m.

With the clearwell also used as a source of backwash water for the media filters, the operation of the backwash water supply pump must be incorporated into the outlet flowrate which must be used in the CT calculation. Table 5.10 uses the high-demand potable water MDD, as this is the worst case and by the disinfection stage all the accounted losses (i.e. waste streams) have been removed from the flow.

Table 5.10 Required Free Chlorine Concentration in a Full Clearwell for 2-log Virus Reduction

Year	High Demand Potable Water MMD (m^3/d)	Backwash Pump (m^3/d)	Total Outlet Flow (L/min)	Residence Time (min)	T_{10} (min)	Req. Chlorine Conc (mg/L)
2025	19,419	25,920	31,486	34.7	10.4	0.58
2027	20,608	25,920	32,311	33.8	10.1	0.59
2032	23,026	25,920	33,990	32.1	9.6	0.62
2042	28,609	25,920	37,867	28.9	8.7	0.69

Table 5.10 shows that under normal operating conditions, a full clearwell can provide the required 2-log virus reduction up to the 2042 high-demand MDD potable water flowrates (worst case scenario) with a free chlorine residual at the outlet of 0.69 mg/L. When the clarifier is removed from service and a 3-log virus reduction is required, the CT value increases to 9 mg-min/L with a water temperature of 0.5 DegC, which requires the free chlorine residual to be increased in 2042 to 1.04 mg/L.

As the clearwell is used to draw water for the distribution pumps, it will be challenging to always maintain a full clearwell. Historical data shows that the free chlorine residual is maintained about 1.0 mg/l in winter and 1.5 mg/L in summer. By using these values as a basis, the outlet flowrates applied from Table 5.10 for 2042, and a baffling factor of 0.3, the water depth above which the clearwell must be maintained under each different scenario when the clarifier is in service is summarized in Table 5.11.

Table 5.11 Minimum Clearwell Levels to Achieve 2-Log Reduction in Viruses

Flow Condition	Outlet Flow (L/min)	Virus Log Reduction	Water Temp. (DegC)	CT Value (mg-min/L)	Free Chlorine Residual (mg/L)	Minimum Water Depth (m)	Clearwell Level
2042 HD MDD Plus Backwash Pump (Winter)	37,867	2	0.5	6	1.0	2.15	69%
2042 LD MDD Plus Backwash Pump (Winter)	35,525	2	0.5	6	1.0	2.02	65%
2042 HD MDD Plus Backwash Pump (Summer)	37,867	2	20	1	1.5	0.24	8%
2042 LD MDD Plus Backwash Pump (Summer)	35,525	2	20	1	1.5	0.22	7%

In situations where the clarifier is removed from service, a 3-log reduction in viruses is required which increases the CT values. While the required operation for each situation will need to be determined on a case-by-case basis, removing the clarifier under the high demand 2042 MDD for potable water, in winter conditions, while maintaining a minimum clearwell level of 69% will required the free chorine residual to be maintain at or above 1.5 mg/L.

The above summary illustrates that should a treatment capacity expansion occur at the WTP, then the current arrangements for chlorine disinfection are sufficient to meet the required log reductions for viruses up to the 2042 flowrate projections, subject to the conditions mentioned above. However, as the addition of a second clarifier would provide a total treatment capacity through the clarifier, media filters and UV

stages of approximately 42,528 m^3/d, provision should be made to increase the size of the clearwell in the future to provide additional chlorine disinfection and distribution pumping at the same capacity.

Distribution Pumps

The distribution pumping equipment conveys potable water from the WTP into the water distribution system. Historically there has been confusion as to the capacity of the distribution pumps. The data listed on the pump's nameplates are incorrect and the City has confirmed that in 2003 the pumps were modified such that the following duty points apply.

- PWP-101 has a duty point of 3,000 USGPM (16,353 m^3/d) at a discharge pressure of 200 ft (598 kPa).
- PWP-102 has a duty point of 3,000 USGPM (16,353 m^3/d) at a discharge pressure of 200 ft (598 kPa).
- PWP-103 has a duty point of 2,000 USGPM (13,355 m^3/d) at a discharge pressure of 198 ft (592 kPa).

The two larger pumps are operated using fixed speed starters, whereas the smaller pump operates using a VFD and can be used to backwash the media filters should the backwash supply pump fail. In supplying water to the water distribution system, the pumping equipment can be used in various combinations as shown below. While adding flowrates for multiple pumps provides an approximate flow, the exact value is dependent upon the pump's performance curves, condition, and the hydraulic losses within the system.

Table 5.12 Distribution Pump Flowrates

Pump Combinations	Flowrate
One (1) large pump	16,353 m^3/d
One (1) large and one (1) small pump	29,708 m^3/d
Two (2) large pumps	32,706 m^3/d
Three (3) pumps	46,061 m^3/d

Based upon the values provided within Table 5.12 and the estimated potable flows for current and future demands.

- The current potable water ADD requires one large pump to run for part of the day.
- In 2042 the potable water ADD is estimated to be 17,903 m^3/d, which would require one large and one small distribution pump to operate together continuously around 2038.
- The current potable water MDD requires one large and one small distribution pump to operate together for part of the day.
- Under the 2042 high-demand potable water MDD of 28,609 m^3/d, this demand can be met by one small and one large pump.
- Under the 2042 low-demand potable water MDD of 25,235 m^3/d, this demand can be met by one small and one large pump.

The above summary shows that the projected demands up to 2042 under all conditions can be met by one small pump and one large pump. However, as the water demands increase and PWP-103 needs to run more often, this pump become more critical in the supply of potable water to the distribution system.

It is important to note that there is no equivalent standby pump for PWP-103, and both PWP-101 and PWP-102 operate on fixed speed starters. In the event that PWP-103 fails or is unavailable due to maintenance, potable water demands will have to be met using the two larger fixed speed pumps, which could be an operational challenge.

To allow for the possible loss of PWP-103, it is recommended that PWP-101 and PWP-102 are modified such that they are operated using variable speed drives. Installation of VFDs on both pumps was identified and included within condition assessment. Pre-work and confirmation would be required to ensure that PWP-101 and PWP-102 are able to,

- operate such that they can meet all the demands developed within this report, and
- provide standby capabilities for the backwash water supply pump (BSP-101) which is currently provided by PWP-103.

The pipework associated with the distribution pumps was considered in terms of water velocity. For the estimated 2042 ADD, high-demand MDD, and low-demand MMD flowrates, the pipework was found to be in the typical ranges for this application.

5.7 West End Reservoir

The requirements for potable water storage were evaluated and discussed within the City of Lloydminster Water Master Plan (ISL 2024). The Water Master Plan (ISL 2024) concluded that extra storage capacity would be required at the ten (10) year scenario, and additional pumping capacity would be required at the twenty (20) year scenario. While options exist to add a third and fourth cell, as well as additional pumping capacity at the West End Reservoir, a further option was provided in the Water Master Plan (ISL 2024) to construct a new reservoir in the north-west of the City, where larger pipework is available to convey the required volumes.

The capacity assessment undertaken as part of this report aligns with the values and conclusions of the Water Master Plan (ISL 2024). However, both assessments include the storage volume provided by the circular reservoir at the West End Reservoir which was built in 1974. The condition assessment completed and reported within this document recommends that the circular reservoir is removed from service and demolished within the next five (5) to ten (10) years due to its age and condition.

This would remove 4,545 m^3 of storage capacity from the water distribution system, leaving a maximum potable water storage capacity of 20,250 m^3 within the below grade cells constructed at the West End Reservoir in 2006. The removal of this volume does not appear to impact the supply of water to the City, but it does challenges the water supply system to meet the requirement of SWSA EPB 501. The requirement calls for water supply systems that include fire protection to provide potable water storage that is equal to or greater than twice the ADD.

Table 5.13 SWSA Minimum Potable Water Storage Requirements

	Year	ADD (m^3/d)	2 x ADD (m^3)
Historical ADD	2020	10,062	20,124
	2021	10,242	20,484
	2022	10,211	20,422
	2023	10,718	21,436
Projected Estimates of ADD	2025	11,878	23,756
	2027	12,727	25,453
	2032	14,454	28,908
	2042	17,903	35,807

In moving forward with the demolition of the circular reservoir, the timing for the addition of further potable water storage should be such that the minimum requirements as required by the SWSA are maintained.

5.8 WTP Capacity Assessment Summary

In evaluating the capacity at each location of the City's water supply infrastructure, the following summary can be provided.

River Pumphouse and Raw Water Supply Pipeline

The river pumphouse and raw water supply pipeline were designed to convey more water than is needed to meet the City's 2042 raw water high-demand MDD and the water volumes that can be provided to Cenovus under their agreement with the City. While it is not possible for both the City and Cenovus to withdraw their maximum flowrates under their respective diversion licenses at the same time (i.e., 119,989 m^3/d), the intake and travelling screen are sufficiently sized to meet the,

- 2042 high-demand maximum combined raw water flow of 57,169 m^3/d (i.e., 64% of the intake and travelling screen's design capacity), and
- 2042 low-demand maximum combined raw water flow of 42,093 m^3/d (i.e., 47% of the intake and travelling screen's design capacity).

In terms of pumping equipment, the duration of time in which multiple pumps are required to run will increase. While a single low lift pump can meet the 2042 City raw water ADD and Cenovus's current demands, it is anticipated that both low lift pumps will need to operate continuously to meet the combined raw water maximum flows under both the demand scenarios in 2042. Under the high-demand maximum combined raw water flow scenario, both low lift pumps should be operating together at this time (which they are not). For the low-demand combined raw water maximum flow scenario, both low lift pumps are expected to be required to operate together in 2035.

With the smaller high lift pump recently upsized to result in three (3) high lift pumps of the same size, it is estimated that by 2032 two (2) of the high lift pumps will need to run together continuously to meet the estimated City raw water ADD and Cenovus's current demands. Under the high-demand scenario for combined raw water, all three (3) high lift pumps should be currently running to meet the maximum flows (which they are not). Under the low-demand scenario, the City should be currently operating two (2) high lift pumps to meet the maximum combined raw water flows, which they are. By 2037 all three (3) high lift pumps will need to operate together to meet the estimated low-demand scenario for the maximum combined raw water flows, which will then be sufficient to meet the same scenario's maximum combined raw water flows estimated for 2042.

While the infrastructure is designed to convey these volumes of river water, the maintenance and overhaul of the pumping equipment will need to be adjusted. As there will be limited time available to allow for a pump to be off-line, a complete pump and motor for each of the low lift and high lift pumps will need to be kept in storage. This will allow pumping equipment to be rotated and overhauled without losing pumping capacity. A similar approach is currently undertaken on a smaller scale with the chlorinators at the WTP. It is estimated that a new low lift pump / motor will approximately cost $275,000 and a new high lift pump / motor will cost approximately $450,000.

Cenovus Raw Water Pumphouse

The amount of water conveyed to Cenovus is not driven by growth, but instead by the plans to expand and optimize the upgrader facility. As no indication that an increase in pumping capacity is necessary at

the raw water pumphouse, the current demands for water are met by the two installed pumps. However, this arrangement does not incorporate an on-line standby pump to allow the pumping capacity to be maintained in the event that one of the current pumps fail.

Should Cenovus wish to increase the capacity of the pumphouse to match the volumes stated in their agreement with the City, then two additional pumps will need to be installed within the open spaces that are currently available and the PVC pipeline to the upgrader will need to be either twinned or upsized.

Raw Water Reservoir

As SWSA has no regulatory requirements for raw water storage, the available storage capacity of the raw water reservoir provides time for the City to address issues within the upstream infrastructure should a failure occur that prevents water from being conveyed from the river. This occurred previously in 2020 when a repair was completed on the raw water pipeline.

Based upon the 2042 ADD, the raw water reservoir would provide between eight (8) to ten (10) days of raw water storage depending upon the initial volume held. Under the maximum flow conditions, the raw water reservoir will provide five (5) to seven (7) days of raw water storage based upon either the summer or winter working capacities, and whether the 2042 high or low-demand raw water MDD is applied. While there is no driver to provide additional raw water storage capacity, it becomes a risk assessment exercise as to whether the time provided by raw water storage is sufficient time to address any issues that arise upstream.

It is also important to note that the raw water reservoir provides a secondary function, it terms of mitigating spikes in the raw water quality (primarily solids), thus reducing dramatic changes at the inlet to the WTP which subsequently required adjustment to the treatment process.

Figure 5.7 Raw Water Pipeline Repair 2020

Water Treatment Plant

The demonstrated capacity of the single solids contact clarifier at the City's WTP is 21,264 m^3/d, which aligns with the treatment capacity of both the media filtration and UV disinfection. To maintain the operability of the WTP and to maximize cost efficiency, a project to install a second clarifier will also

therefore require as a minimum the inclusion of media filtration and UV disinfection to ideally match the new clarifier's treatment capacity. This will result in a parallel treatment process (cross connected at key points) which will double the treatment capacity of the WTP to 42,528 m^3/d.

While options exist for new technology such as high-rate sedimentation (i.e. Actiflo) and membrane filtration, it is recommended that the same process, equipment, size and configuration is applied. The reasons for this approach are:

- The technology and its application are proven with regards to the City's water source.
- The same size / capacity reduces the challenges with regards to adjustment of chemical dosing / flow splitting and provides additional treatment capacity / redundancy should a clarifier and / or multiple filters be removed from service.
- The City's operators are knowledgeable and experienced with the operation and maintenance of this process and equipment with the WTP's water source.
- The operational costs of the process and equipment are defined and known.
- The "process design" is complete, allowing an accelerated design phase.
- To economically apply the new technology, the existing concrete tanks would need to be modified and retrofitted. The current WTP does not have multiple basins or clarifiers which can be taken offline for prolonged periods, while new equipment is installed. In addition, construction in this manner typically results in a higher construction cost due to unknown construction risks and a higher degree of complexity.
- High-rate sedimentation and membrane technologies are typically required where the source water is directly extract from the river, which also experiences quick and significant changes in water quality (i.e. Red Deer River and Peace River). With the desilting pond and raw water reservoir in place, the City is not faced with these challenges.
- The original design and construction anticipated and allowed for the mirroring of the treatment process in the future.

Based upon the estimated future demands projections, the treatment capacity of the WTP would be exceeded in 2026 using the high-demand raw water MDD, and 2031 when applying the low-demand raw water MDD.

The cost to add a second clarifier with additional media filtration and UV disinfection is in the order of $30 million. With the recommended upgrade to the existing WTP HVAC and electrical equipment in the next five (5) to ten (10) years, it is recommended that:

1. The City completes the design and contract documents preparation for the expansion of the WTP in the next five (5) years, such that the project is ready to tender at short notice.
2. The City budgets to construct the WTP expansion in the next five (5) to (10) years, on the basis that the project could be pushed back based upon the actual water demands that occur moving forward.

West End Reservoir

Based upon the work undertaken with regards to the Water Master Plan (ISL 2024) and this assessment, the current potable water storage and pump capacity at the West End Reservoir is sufficient to meet the current demands. Following the regulatory requirements, expansion of potable water storage with the water distribution system will be required in about the next five (5) to ten (10) years. This expansion can be phased as outlined in the Water Master Plan (ISL 2024). However, the addition of new potable water storage capacity may need to be brought forward based upon the potential demolition of the 1974 circulate reservoir at the West End Reservoir in the next five (5) to (10) ten years.

6.0 Conclusions and Recommendaitons

ISL was retained by the City to evaluate the potable water treatment system in terms of its condition and treatment capacity and to identify any upcoming upgrades and maintenance. The findings of this work will allow the City to plan for future upgrades and formulate a financial plan. This will also allow the reassessment of their water rates in advance of commencing any of the upgrades or changes identified within this report.

6.1 Conclusions

Further details for each infrastructure facility, summarizing the findings of the condition and capacity assessments, are located within Sections 4.4 and 5.8 respectively. Based upon these findings the following conclusions can be drawn, using the projected average and maximum day demands for potable water up to 2042.

River Pumphouse and Raw Water Supply Pipeline

Historical investment in maintaining the pumping equipment, and the recent upgrades to the electrical equipment, has resulted in a raw water pumphouse whose condition is understood and is reliable. After 40 years of service, there are still aspects that require addressing which is to be expected with equipment and structures that have been in service for this length of time (i.e. travelling water screen replacement, limited HVAC cooling capacity, roof investigation, etc.).

As water demands increase moving towards 2042, previous pumping equipment that was used as an online stand-by in case of failure, will now have to operate as part of normal operations to meet peak demand. This will require a change to the operation and maintenance of the river pumphouse.

The condition of the raw water supply pipeline is a significant unknown. Depending upon which demand scenario is applied, the raw water pipeline could be operating at 95% of its design capacity when the high-demand combined raw water maximum day demand is applied, or 70% of its design capacity when the low-demand combined raw water maximum day demand is applied. While all indications are that the pipeline is operating as expected, and the only identified issue is flooded valved chambers, it is noted that the pipeline is a critical part of the water supply infrastructure. Its replacement would be a significant undertaking in terms of effort and costs.

Cenovus Raw Water Pumphouse

As with the river pump house, the pumping and electrical equipment within the Cenovus raw water pump house is maintained and overhauled on a regular basis. The pumphouse was constructed in 1999 and no significant concerns were noted as part of the condition assessment.

From an operational perspective the two raw water pumps were installed to be operated in a duty / standby configuration, but now both run together to meet Cenovus's demand. However, this arrangement does not incorporate an on-line standby pump to allow the pumping capacity to be maintained in the event that one of the current pumps fail.

Raw Water Reservoir

Ongoing efforts by the City's teams maintains the condition of the accessible parts of the raw water reservoir, with no issues noted from this assessment. However, the amount of solids deposition within

the reservoir and its condition below the water level is undetermined and would require the reservoir to be removed from service and drained for further information to be gathered.

As the demands for water increase, a “full” raw water reservoir would provide approximately five (5) to seven (7) days of raw water storage in 2042, depending upon the MDD demand scenario applied. While there is no regulatory driver to provide additional raw water storage capacity, the expansion of the reservoir becomes a risk assessment exercise as to whether this is sufficient time to address any upstream issues that arise.

Water Treatment Plant

Over the 40 years in which the WTP has been in service, the maintenance and upkeep efforts with regards to this facility have been focused on the water treatment equipment, with the clarifier being the last major item to be assessed for a refurbishment / upgrade since construction. Except for the clarifier, the identified items to be address moving forwards mainly focus on the ancillary systems such as building mechanical, electrical equipment and building envelope.

Tasks identified around the building structure and envelope are mostly maintenance items and projects which can be addressed on an individual basis. However, due to the age of the equipment and additional factors, an overall HVAC and electrical upgrade is required. Subject to further investigations a new roof to the WTP building may also be necessary.

Based upon the projections for average day and maximum day demands, the treatment capacity of the WTP is expected to be exceeded in 2026 using the raw water high-demand scenario MDD, and 2031 when applying the raw water low-demand scenario MDD.

To clarify, it is estimated that on the summer high demand days of the noted year, the WTP will not be able to make sufficient water in a 24-hour period to match that which has been used. As such the water stored within the water distribution system will be depleted. The expansion of the WTP will need to include the addition of a second clarifier and the expansion of the media filtration and UV disinfection stages to ideally match the new clarifier’s treatment capacity.

West End Reservoir

The West End Reservoir was constructed in 2006, and no major issues were identified as part of this work. Issues that have arisen in the past eighteen (18) years have been addressed and improvements have been made to optimize the pumping operation. Several important maintenance type tasks were identified around the building envelope aspects.

The Water Master Plan (ISL 2024) concluded that the potable water storage capacity within the water distribution system should be increased in approximately 2032 to meet regulatory requirements. However, with the recommended demolition of the 1974 circular reservoir in the next five (5) to ten (10) years, this expansion may need to be brought forward.

6.2 Recommendations

Based upon the above conclusions and the contents of this report, the following **key recommendations are made**. Each condition assessment table should be reviewed in detail, and the recommended actions should be incorporated into an overall plan.

At the river pumphouse:

- Replace the failed travelling water screen as soon as possible.
- Proceed with the procurement of a new low lift and high lift pump by 2035, such that a complete pump is available in storage as the number of pumps required to run increases.
- Replace the main air handling unit by 2027 to provide the required ventilation rates and sufficient cooling in summer.
- Complete an assessment / intrusive investigation of the pumphouse roof within the next five (5) years, which could lead to its replacement.
- Monitor the roof assemblies in the meter house building, which may lead to the building's replacement in the future.
- Complete a structural inspection of the wet well walls and floors using divers within the next five (5) years.
- Continue with current maintenance and overhaul practices of all pumping equipment.

With regards to the raw water supply pipeline:

- Continue to explore and select a method to complete an in-depth assessment of the raw water supply pipeline within the next five (5) years to determine its remaining service life.
- Within the next five (5) years, establish the basis for the supply of raw water to both the City and Cenovus for the next 50 years, which could influence how future capital projects are undertaken.
- Start to plan and budget for the replacement / twinning of the existing raw water supply pipeline at a time beyond the next fifteen (15) years.
- Commence a program over the next fifteen (15) years to refurbish the concrete vaults along the length of the raw water main, which contain isolation and air release valves. A number of these vaults are either flooded or need concrete repair / refurbishment.

At the Cenovus raw water pumphouse:

- Review the pipework / wall penetration arrangement to mitigate possible loading of the wall within the next five (5) years.
- Consider with Cenovus the installation of a third raw water pump to provide an online standby in the event one of the existing raw water pumps fails.
- Continue with current maintenance and overhaul practices of all pumping equipment.

With regards to the raw water reservoir:

- Within the next five (5) years drain and inspect the condition and amount of solids deposition below the water level. This may lead to future projects and costs.

At the water treatment plant:

- Complete the clarifier assessment within the next twelve (12) months and plan to complete any remedial work identified in a timely manner.
- Replace both the raw water and distribution flowmeters within then next five years (5) and record the daily volumes / instantaneous flows such that the flow projections and timing for the WTP upgrade can be updated.
- Within the next five (5) years, undertake trials to operate the clarifier and WTP at higher flows under varying raw water quality, such that its potential for producing more potable water per day can be updated.

- Within the next five (5) years, adjust the access to the chlorine gas storage and feed room, which is currently via the WTP, and does not meet the SWSA requirements for exterior access only.
- Address access limitations and water ingress into Vaults 1 and 5, by extending the below grade walls and adding a new above grade structure within the next five (5) years.
- Investigate the condition of the WTP's roof within the next five (5) years, which will likely lead to the replacement of the WTP roof.
- Replace the curtain wall at the front entry area within the next five years (5).
- Complete an upgrade of the HVAC system and electrical equipment within the next five (5) to ten (10) years.
  - These upgrades are integrated and linked with the roof replacement. Further details and a sequence for implementation is provided under "Consolidation of Tasks / Larger Projects" within Section 4.4.
- With regards to the expansion of the treatment capacity at the WTP:
  - Complete the design and contract document preparation within the next five (5) years, such that the project is ready to tender at short notice.
  - Plan / budget to construct the WTP expansion in the next five (5) to (10) years, on the basis that the project could be pushed back based upon the actual water demands that occur moving forward.

At the West End Reservoir:

- Decommission and demolish the circular reservoir within the next five (5) to ten (10) years.
- Complete a structural inspection of the interior of the reservoir cells around 2031, when the reservoir has been in service for 25 years.
- Plan to expand the potable water storage capacity within the water distribution system as per the City of Lloydminster Water Master Plan (ISL 2024). Adjustments may be required based upon the demolition of the circular reservoir.

Figure 6.1 Raw Water Reservoir

6.3 Cost Estimate and Forecast

Building upon the cost estimate / forecast provided in Section 4.4, the additional costs associated with the upgrades with regards to the capacity assessment have been added and provided below to show an overall cost estimate / forecast. The table below does not include the expansion of water storage within the water distribution system, which is covered within the City of Lloydminster Water Master Plan (ISL 2024).

Table 6.1 Overall Cost Estimate and Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
Process	$1,016,000	$3,202,100	$3,040,000	$445,000	$40,000,000
Building Mechanical	$107,550	$1,388,800	$340,400	$326,000	$0
Structural	$25,500	$642,000	$470,000	$30,000	$0
Building Enclosure	$7,600	$574,900	$33,000	$0	$0
Electrical	$0	$400,000	$370,000	$0	$112,000
Instrumentation and Controls	$33,000	$66,000	$125,000	$0	$0
Condit. Assess. Totals	$1,189,650	$6,273,800	$4,378,400	$801,000	$40,112,000
Building Mechanical Items Removal		-$981,000	-$195,500	-$308,000	
Electrical Items Removal		-$400,000	-$184,000		
Electrical Upgrade		$300,000	$2,700,000		
Building Mechanical Upgrade		$300,000	$2,700,000		
WTP Roof Replacement			$860,000		
Revised Totals from Project Consolidation	$1,189,650	$5,492,800	$10,258,900	$493,000	$40,112,000
River Pumphouse Low Lift Pump		$275,000			
River Pumphouse High Lift Pump		$450,000			
WTP Capacity Expansion		$3,000,000	$27,000,000		
Overall Total	$1,189,650	$9,217,800	$37,258,900	$493,000	$40,112,000

APPENDIX A
Process
Condition Assessment Tables

Discipline : Process
Assessment Date : Site Visit - October 2022 / Updated April 2024
Assessment Complete by : Elizabeth Calvin & Richard Tombs (ISL)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw Water Pipeline									
Intake Pipework	1,050 mm diameter HDPE 1,042 L/sec capacity 900,000 m³/day	Intake in a good condition. Rock and sheet pile installed in 2020 to protect the intake. Sheet pile is 55 m wide and intake has three windows. Structure narrows the channel to increase velocity and mitigate settlement.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
River Intake Screen	Rexnord traveling screen. Mesh size 10 mm. Hydraulic capacity 89,856 m³/day. Installed in 1984.	Operations noted that the screen is running well with no maintenance issues. Silt builds-up in the screening collection channel each Summer	No issues noted. Screen is used beyond its service life and condition of components below water level are unknown. **Screen failed in early 2024 and is going to be replaced ASAP.**	Poor	Reasonable	Replaced screen ASAP.	High	$810,000	1
Low Lift Pump LLP-101	Verti-line Aurora Pump with a duty point of 7,150 USGPM @ 39 ft (38,976 m³/day @ 11.8 m). 150 Hp US Motors which operate on VFDs. Pump duty does not match nameplate. Motors upgrade in 2009 from 75 Hp / 880 RPM to 150 Hp / 1190 RPM. Pumps (wet end) installed in 1984.	Pump in operation during site visit. No concerns noted with regards to sound or visual operation of the pump. Pump overhauled in 2010. Pumps refurbished / overhauled every 10 years and motor every 5 years.	Pump missing guard and is overdue an overhaul.	Requires Attention	Reasonable	Budgeted for completion in 2024	Medium	N/A	5
Low Lift Pump LLP-102	Verti-line Aurora Pump with a duty point of 7,150 USGPM @ 39 ft (38,976 m³/day @ 11.8 m). 150 Hp US Motors which operate on VFDs. Pump duty does not match nameplate. Motors upgrade in 2009 from 75 Hp / 880 RPM to 150 Hp / 1190 RPM. Pumps (wet end) installed in 1984.	Pump and motor refurbished in 2020. Pump not in operation during inspection. Pumps refurbished / overhauled every 10 years and motor every 5 years.	Pump missing guard.	Good	Reasonable	Pump and motor due for regular overhaul in 5 to 10 years. Add guard for safety.	Low	$65,000	3
Low Lift Pumps Pipework & Valves	Various diameters of steel pipework. Epoxy coated internally, painted externally.	Pipework is in good condition. A few areas require touch up of exposed metal. Discharge air valves have surface corrosion at flanges joints. Original isolation and check valves in used. While valves are exercised, there is little confidence that they will hold / isolate.	Surface corrosion. Water pooling noted on site between low lift pumps and travelling water screen, source was unclear.	Good	Minor	None at this time.	Low	N/A	5
			While isolation valves are exercised, Operators are not confident that valves will hold / seal when required.	Requires Attention	Reasonable	Valves isolate the pumps from the desilting pond. Valve should be tested and then replaced if needed prior to the low lift pumps being removed / refurbished.	Medium	$150,000	3

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
De-silting Pond	122,000 m³ capacity. Installed in 1984.	Operations Team has noted sand at the outlet of the pond which feeds the high lift pumps. Pond was last cleaned in 2005. Evidence of wildlife geese and gophers. No major bank structure concerns.	No issues noted.	Good	Reasonable	None at this time. Pond will be desilted when needed by unlikely to happen as recent changes to the intake have significantly reduce sand infiltration.	Low	N/A	5
High Lift Pump HLP-101	Verti-line Aurora Pump with a duty point of 3,655 GPM @ 607 ft (19,923 m^3/day @ 185 m). 700 hp US motors which operate on soft starters. Pumps installed in 1984.	Pump is in good condition. Pump tag indicates refurbishment of pump and motor completed in Dec 2017. Pumps refurbished / overhauled every 10 years and motor every 5 years.	Pump missing guard. Motor due an overhaul in 2022	Good	Reasonable	Complete motor overhaul ($25,000) Add guard for safety ($1,000)	Low	$26,000	1
				Good	Reasonable	Schedule Pump and Motor Overhaul in 2027 ($65,000)	Low	$65,000	3
High Lift Pump HLP-102	Verti-line Aurora Pump with a duty point of 3,655 GPM @ 607 ft (19,923 m3/day @ 185 m). 700 hp US motors which operate on soft starters. Original pump installed in 1984.	Pump is showing scale and silt buildup, with corrosion on pump base from past leakage. Pump was in operation during visit, no noted concerns with sound or visual operation of the pump. Pumps refurbished / overhauled every 10 years and motor every 5 years.	Pump missing guard. Pump and motor budgeted and scheduled for 2022 for refurbishment but it could not be pulled due to the Cenovus demands. Pump inspected in 2023 and damage found to wet end of the pump. City is installing spare wet end and increase pumping capacity.	Good	Minor	Pump upsizing and motor overhaul to completed in September 2024. Pump capacity is now 19,923 m3/day @ 185 m Budget already allocated under separate budget. Include pump / motor in normal overhaul cycle when completed	Low	N/A	5
				Good	Minor	Motor is due for overhaul in 2029	Low	$25,000	3
				Good	Minor	Pump and Motor would be due an overhaul in 2034	Low	$65,000	4
High Lift Pump HLP-103	Verti-line Aurora Pump with a duty point of 3,655 GPM @ 607 ft (19,923 m3/day @ 185 m). 700 hp US motors which operate on a soft starter. Installed in 1984.	Evidence of some leakage. Pump Last refurbished in 2015. Motor was last overhauled in April 2023. Pumps refurbished / overhauled every 10 years and motor every 5 years.	Pump missing guard.	Requires Attention	Reasonable	Add guard for safety ($1,000).	Medium	$1,000	1
				Requires Attention	Reasonable	Pump due an overhaul in 2028	Medium	$65,000	3

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
High Lift Pump Pressure Relief / Surge Control Valves	Various sizes and applications.	South surge release valve rebuilt in 1996 and rebuilt in 2018. North surge release valve replaced in 2002. Pressure relief valves on high lift pumps replaced in 2017. Valves are tested three times a week as there are critical valves. Valves will be refurbished / maintained when issues are found	No issues noted.	Good	Significant	Continue with current practices due to the criticality of the surge release valves.	Medium	N/A	5
High Lift Pump Pipework & Isolation Valves	Various diameters of steel pipework, epoxy coated internally, painted externally. Installed in 1984.	Pipework appears to be in good condition. Few areas of pipework surface require a touch up and the start of corrosion was noted. Pipework is stained from water leaking from valves and fittings. Original isolation and check valves still in use. Valves are exercised on a regular basis.	Corrosion should be addressed before it increases.	Good	Minor	Remove corrosion, prepare and repaint / coat pipework .	Low	$5,000	2
			While isolation valves are exercised, WTP Operators are not confident that valves will hold / seal when required.	Requires Attention	Reasonable	Valves isolate the pumps from the raw water pipeline. Significant pressure is placed on these valve when equipment is isolated. Valve should be tested prior to each pump removal / overhaul and replaced if necessary.	Medium	$240,000	3
Raw Water Pipeline	750 mm (30") yellow jacketed, cement lined steel pipe with a wall thickness of 0.25 inches. Pipework Grade 290 in accordance with CSA Z 245.1 and 245.4 Design Capacity 694 L/sec (60,000 m³/day) Installed in 1984	Max flow currently 50,000 m^3/day due to high Cenovus demands. Capacity limited by pumping equipment installed at the river pumphouse. Will be able to pump 60,000 m^3/day once HLP-102 is upsized	Pipeline is almost at design capacity. The pipework is a single point of failure (i.e. no redundancy). Pipeline has been in service for 40 years. There are also questions about long term water sources / drought conditions / reclaimed water etc.	Requires Attention	Significant	Complete assessment of raw water pipework. Options included Internal assessment via smart pig (PICA) and external via holiday testing. Allowance included based upon discussion with supplier.	High	$1,500,000	3
				Requires Attention	Reasonable	Undertake an assessment to consider and evaluate the longer term raw water supply / sources for the City (i.e. 50 years plus)	Medium	$50,000	2
				Requires Attention	Significant	The age of infrastructure and criticality of the raw water pipeline, raises the identification and development of a plan it possible duplication / replacement.	High	$40,000,000	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Raw Water Pipeline Vaults	Thirty eight concrete vaults containing isolation and air / vacuum release valves. Installed in 1984	Raw water vaults in need of concrete repair / sealing. Most of the vaults that were visited during the site review were full of water and it was not possible visually inspect them. Raw water pipeline has eight (8) supply connections along its length. Only one or two are in use. Some connections may be leaking.	Vaults accumulating water and their condition of contents of the vaults is expected to be poor. Operation of air release valves is expected to unreliable.	Poor	Significant	Vaults need to be refurbished and operation of air valves confirmed. Local contractor quoted $35,000 to $25,000 per vault to seal and cost internal concrete of the vault. Phase repair to vaults over 15 years	High	$380,000	2
								$380,000	3
								$380,000	4
Vault 1 Pressure Control / Relief on Reservoir Supply									
Pressure Control Valves	Ductile Iron Hydraulic Operated Valves. Epoxy coated various sizes. Installed in 1984.	Valves look to be in good condition and well maintained. Confined space entry needed for inspection / maintenance. Valves are tested regularly and will be serviced / maintained when issues are found	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Pipework and Isolation Valves	Various diameters of steel pipework, epoxy coated internally and painted externally.	Age of pipework is showing as pipework coating is missing and surface corrosion is present in some areas on the pipework surface. Valves exercised on a regular basis.	Pipework penetration in SW corner which is the connection to the old Cenovus Pump House is scaled up / corroded. Scale is due to water infiltration (link seal failed) Connection is currently isolated and scheduled to be removed / capped when the old Cenovus Pump House is demolished. Ability of valves to isolate pipework is unknown.	Requires Attention	Reasonable	WTP Operators to continue to remove scale on pipework. Remove corrosion and make spot repairs to pipework exterior as needed. Penetration to old Cenovus Pumphouse will be removed when it is demolished.	Medium	$5,000	2
Concrete Vault	Buried, cast in place concrete vault	Evidence of significant leakage / water seepage on walls and floors Sump pump appears to be managing the ingress of water.	There is electrical equipment within the vault which is at risk of flooding. Increased moisture in the air, increasing the risk of corrosion	Requires Attention	Reasonable	Seal concrete joints from inside and apply water proofing from outside	Medium	Inc below.	2
Access to Vault	Access via wooden shack and ladder.	Ladder and access are serviceable.	Access is a restricted space entry with limited space to move. This is not ideal to review / inspect contents of vault on a regular basis and complete maintenance.	Requires Attention	Reasonable	Remove concrete roof and extend walls upwards above grade. Add single storey structure with mezzanine and ships ladder access. Provide hatches to remove valves / equipment.	Medium	$410,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Cenovus Raw Water Pumphouse									
Cenovus Raw Water Pump 1	Split-case Horizontal Pumps with a duty point of 1,443 USGPM @ 188 ft (7,866 m³/day @ 562 kPa). Crane Weinman Pumps, which were installed in 1999 200 hp Baldor Motors using soft starters which were installed in 2020.	Pump was operating during site visit. Pumps were planned to operate as duty/standby and now both operate together at max flow to meet the Cenovus demand. Pump and motor was overhauled in 2023.	No issues with operation or condition noted. Bare metals exposed on pulp casing / motor due to impacts or paint flaking off. No signs of serious corrosion. There is no redundancy or standby available	Good	Minor	Address exposed metal.	Low	$5,000	2
				Good	Significant	Pump and Motor Overhaul due in 2028	Medium	$40,000	2
				Good	Significant	Consider addition of third pump for redundancy and cover when pumps are being overhauled.	Medium	$182,100	2
Cenovus Raw Water Pump 2	Split-case Horizontal Pumps with a duty point of 1,443 USGPM @ 188 ft (7,866 m³/day @ 562 kPa). Crane Weinman Pumps, which were installed in 1999 200 hp Baldor Motors using soft starters which were installed in 2020.	Pump was operating during site visit. Pumps were planned to operate as duty/standby and now both operate together at max flow to meet the Cenovus demand. Pump and motor was overhauled in 2023.	No issues with operation or condition noted. Bare metals exposed on pulp casing / motor due to impacts or paint flaking off. No signs of serious corrosion. There is no redundancy or standby available	Good	Minor	Address exposed metal.	Low	$5,000	2
				Good	Significant	Pump and Motor Overhaul due in 2028	Medium	$40,000	2
Pipework and Isolation Valves	Various diameters of steel pipework, epoxy coated internally and painted externally.	Piping appears in good condition. Noted sections / patches where paint was missing. Valves are exercised on a regular basis	Exposed steel pipework may start to corrode. WTP Operators are not confident that valves will hold / seal when required.	Good	Minor	Remove corrosion, prepare and repaint / coat pipework .	Low	$2,000	2
				Good	Significant	Replace isolation on pumps. No Check valve, uses hydraulically operated valve	Medium	$125,000	3
Pressure Control / Pump Start up Valves	Ductile Iron Hydraulic Operated Valves. Epoxy coated various sizes.	Values look to be in good condition and well maintained. Valves are tested regularly and will be serviced / maintained when issues are found	No issues noted.	Good	Minor	Continue with regular testing and maintenance.	Low	N/A	5
Raw Water Pipeline to Cenovus	350 mm PVC Pipework	Condition is unknown. Raw water pipeline is running at maximum pumping capacity. Cenovus would like to receive more raw water.	Space is available for third and forth pumps. Supply of more raw water volume to Cenovus is dependant upon increased pumping capacity at the river pump house	Good	Reasonable	Current system operating with no issues and achieving the design basis. Increasing the raw water volume provided to Cenovus is a separate expansion project	Low	N/A	5

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Raw Water Reservoir									
Raw Reservoir	Volumetric design capacity of 204,000 m³. Working capacity of 188,000 m³ in summer and 155,000 m³ in winter. Installed in 1974.	No signs of major berm / bank deterioration. WTP Operators complete regular walk arounds looking for issues. City's grounds crew keep trees and vegetation under control. Issues are addressed when identified Algae blooms are a known to an issue for which copper sulphate is added seasonally.	Condition and situation below water level is unknown. Reservoir has never been emptied, desludged and inspected. Dive team noted no issues when completed pipeline isolation / capping work in 2019.	Good	Minor	City to continue with regular inspections from the banks and address issues as the arise. City would like to drain and complete a more through inspection of the reservoir. City to plan to lower water levels during normal operation and then drain remainder to storm ditch to allow visual inspection of banks and solids . sludge deposition. Remedial work to be planned / budgeted for once inspection completed	Low	$150,000	2
Water Treatment Plant									
Raw Water Pumps / Gravity Pipework									
Jockey Pump JSP-101	Aurora Pump with a duty point of 60 USGPM @ 229 ft (327 m3/day @ 684 kPa). 15 hp motor which uses at fixed speed starter. Installed in 1984	Use to back feed water to the raw water pipeline when the raw water high lift pumps stop, such that consumers on the pipeline and supplied with water. This also keeps the raw water pipeline full of water, making restarts a less of a risk. Only one pump of this size is installed. No issues noted.	No redundancy, but the pump hardly runs. Pump monitored and issues addressed when identified.	Good	Significant	None at this time.	Medium	N/A	5
Raw Water Pump (RWP-101)	Aurora Pump with a duty point of 2,750 USGPM @ 30 ft (14,990 m³/day @ 90 kPa) . 30 hp motor which uses a fixed speed starter. Installed in 1984.	No indication of water leakage from the pump. Pump runs very rarely and only when raw water reservoir is low. Pump is bump tested regularly and issued will be addressed when identified. Some surface corrosion / exposed metal on pump case/ body where coating has been chipped away. All original pumps, mechanical seals are replaced as needed.	No guards on pump to protect operators from rotating parts. Pump have not run for a significant period of time and require an overhaul such that they are available when needed.	Good	Significant	Complete Pump & Motor overhaul to ensure operation.	Medium	$40,000	2
Raw Water Pump (RWP-103)	Aurora Pump with a duty point of 2,750 USGPM @ 30 ft (14,990 m³/day @ 90 kPa) . 30 hp motor which uses a fixed speed starter. Installed in 1984.	No indication of water leakage from the pump. Pump runs very rarely and only when raw water reservoir is low. Pump is bump tested regularly and issued will be addressed when identified. Some surface corrosion / exposed metal on pump case/ body where coating has been chipped away. All original pumps, mechanical seals are replaced as needed.	No guards on pump to protect operators from rotating parts. Pump have not run for a significant period of time and require an overhaul such that they are available when needed.	Good	Significant	Complete Pump & Motor overhaul to ensure operation.	Medium	$40,000	2

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WTP Raw Water Gravity Pipework. (Raw Water Pump RWP-102)	Various diameters of steel pipework, epoxy coated internally and painted externally. RWP-102 removed to allow gravity flow from raw water reservoir into WTP as pumped flow was too high.	Raw water in clarifier is controlled by the pressure control valve in Vault #5. Historical water demands have been met by gravity flow, except in 2023 when Cenovus demands prevented the reservoir form refilling quickly enough.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Associated Pipework and Valves	Various diameters of steel pipework, epoxy coated internally and painted externally.	Pipe and valves coated or painted. No exposed metal work or corrosion noted. Exposed bolts are rusted. Valves are exercised regularly.	While isolation valves are exercised regularly, WTP Operators have little confidence that the valves will hold / isolate when needed	Requires Attention	Reasonable	Undertake program to replace isolation and check valves around raw water pumps. Complete Valve Replacement with Raw Water Pump Overhauls	Medium	$225,000	2
Associated Instrumentation	Various pressure gauges. Water quality instruments on gravity pipework for Turbidity, pH and Temperature.	All instruments appeared to be in good working order. All water quality instruments are checked / calibrated annually by supplier.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Vault 5 Pressure Control to WTP									
Pressure Control Valves	600 mm diameter specialist pressure control valve. Ductile iron, epoxy coated. Installed in 1984.	Minor water leaks from covers / flanges. Multi-year rebuild of valve completed in 2023.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Pipework and Isolation Valves	Various diameters of steel pipework, epoxy coated internally, painted externally.	Pipework is in good condition. Corrosion noted on pipe supports, pipework and metalwork at floor level (likely due to water infiltration). Valves exercised on a regular basis.	Corrosion will continue to spread and put metal work integrity at risk. No concerns noted regarding valves isolating pipework when required.	Requires Attention	Minor	Remove corrosion, prepare and repaint pipework support, pipework and metal work.	Low	$5,000	2
Concrete Vault	Buried, cast in place concrete vault	Evidence of minor leakage / water seepage on walls and floors Sump pump appears to be managing the ingress of water.	Increased moisture in the air, increasing the risk of corrosion	Good	Minor	Seal concrete joints from inside and apply water proofing from outside	Low	Inc below.	2
Access to Vault	Access via wooden shack and ladder.	Ladder and access are serviceable.	Access is a restricted space entry with limited space to move. This is not ideal to review / inspect contents of vault on a regular basis and complete maintenance.	Requires Attention	Reasonable	Remove concrete roof and extend walls upwards above grade. Add single storey structure with mezzanine and ships ladder access. Provide hatches to remove valves / equipment.	Medium	$410,000	2
Pre-Clarification									
Raw Water Flowmeter	Magnetic flowmeter failed in 2005 and replaced with clamp on ultrasonic flowmeter	Flowmeter is working and providing a value. Ultrasonic flowmeter checked and calibrated on a regular basis	Ultrasonic flowmeter is at the end of its service life and no spare parts can be obtained.	Poor	Minor	Install new magnetic flowmeter	Medium	$40,000	2

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Flash Mixer FM-101	N/A	Flash mixer was remove several years ago. No issues reported with chemical mixing.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Chemical Dosing Point	Multiple connections for multiple chemicals.	Temporary hose dosing lines used for PAC and Lime, which were replace in 2023 & 2024.	Pipework connection leaking at first connection point.	Requires Attention	Reasonable	Repair leak to pipe connection.	Medium	$2,000	1
Associated Pipework and Valves	Large (24") and small diameter steel pipework, epoxy coated internally and painted externally. Valves are exercised on a regular basis	Some discoloration on sections of pipe. Generally pipework is in a very good condition aside from section around chemical dosing point.	City to continue with spot repairs as identified. Valves have been used recently to successfully isolate pipe.	Good	Minor	None at this time.	Low	N/A	5
Sampling Sink	Stainless steel sink where various samples are brought to one location.	Sink in a condition suitable for its purpose.	Non-potable water signage needed at sink.	Requires Attention	Minor	Add safety sign to the sink.	Low	$1,000	1
Alum Storage and Dosing									
Alum Unloading Point	Labelled exterior connection point for Alum, pneumatically unloaded from tankers. Single connection point. Local indication provided to alert driver when Alum storage tank is high.	Spills from hose disconnection are captured by a "half barrel". No safety shower in proximity to unloading point. Difference sizes of connections for difference chemicals. Loading point has been reviewed by supplier on more than one occasion and SOP is in place to address safety concerns.	No safety shower in proximity to unloading point.	Good	Significant	Install safety shower in proximity to chemical unloading point.	Medium	$20,000	2
Alum Storage Tank	Wood stave tank with liner with a capacity to hold 65,000 kg of Alum. Tank located in room within the WTP that has spill containment incorporated. Installed in 1984.	Overflow goes to sanitary system not environment. No leaks or damage to the tank noted. There is a secondary smaller tank available that is used when the liner is replaced or should the main storage tank fails. Alum floor drain in containment area goes to sanitary system	No issues noted. Floor drains are prone to blockages and are flushed regularly.	Good	Reasonable	None at this time.	Low	N/A	5
Alum Dosing Pump P-109	Wallace and Tiernan pumps (Series 44-125). Pumps operated with VFDs to match variations in flow. Installed in 1984.	Pump are well maintained and there are no signs of any chemical leaks. Pump is working and some parts are still available at this time. No issues reported by Operations.	Pumps are excessively beyond their service life.	Poor	Reasonable	Alum pumps are scheduled to be replaced when upgrades to Lime, PAC, and UV upgrades are completed.	High	$20,000	2
Alum Dosing Pump P-110	Wallace and Tiernan pumps (Series 44-125). Pumps operated with VFDs to match variations in flow. Installed in 1984.	Pump is old and is working, Some parts are still available. Pump 110 was running during site visit.	Pumps are excessively beyond their service life.	Poor	Reasonable	Alum pumps are scheduled to be replaced when upgrades to Lime, PAC, and UV upgrades are completed.	High	$20,000	2

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Associated Pipework and Valves	Small diameter PVC pipework. Pipework is colour coded to indicted pipework contents. Carrier water used to move the Alum from dosing pumps to the point of application?	No indications of chemical spills / leakage. Alum floor drain in pump room goes to sanitary system.	No issues noted with dosing system. Floor drains are prone to blockages and are flushed regularly. Parts of the dosing pipework are sagging and some sections are made up of flexible PVC hose	Requires Attention	Minor	Replace dosing pipe with rigid PVC pipework and valves.	Low	$50,000	2
Alum Dosing Point	Primary dosing point is at the on the gravity raw water pipework where RWP-102 used to be. There are also options to add Alum at the flash mixer.	No indication of leaks or issues at the dosing point.	No dosing point on pumped raw water pipework. Chemical addition relying on diffusion of chemical when raw water pump runs (which is very rare).	Requires Attention	Reasonable	Relocate all chemical dosing points to common header after raw water pumps. Modify / weld new connection point and reroute pipework Consider application of Jet Mixer (not included in estimate).	Low	$25,000	2
Alum Instrumentation	ABB flow meter installed on suction line to monitor Alum flowrates / volumes. Pressure gauges are also installed.	System well maintained and no indication of any issues. Installation of flowmeter on suction is unusual, but it works.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Powdered Activated Carbon Makeup & Dosing									
Carbon Make-up and Feed Equipment	Originally installed in 1984. System comprised of manual loading (for 25 kg bags), hopper, slurry tank and dosing pumps / pipework.	System is beyond service life and has been repaired numerous times. Manual loading of 25 kg bags creates a lot of dust which is hazardous to Operators.		Good	Minor	System replaced in 2023 with eductor system that uses tote bags. Manual loading eliminated.	Low	N/A	5
PAC Upper and Lower Rooms	Refer to Building Mechanical Assessment for equipment specific details.	Refer to Building Mechanical Assessment for equipment specific details.	System identified is under capacity based upon best practice of 12 air changes per hour. Refer to and review ISL Memorandum "Lime and PAC Assessment and Recommended Upgrades" dated March 2, 2021	Requires Attention	Reasonable	New separate HVAC system should be installed for both PAC areas and sized accordingly. May be possible to combine with Alum and Lime rooms.	Medium	Inc in Building Mechanical Condition Assessment	2
Hydrated Lime Makeup & Dosing									
Lime Unloading Point	Labelled exterior connection point for Lime, pneumatically unloaded from tanker. Single connection point. Local indication provided to alert driver when Lime Silo is high.	Spills from hose disconnection are captured by a "half barrel". No safety shower in proximity to unloading point. Difference sizes of connections used for difference chemicals. Loading point has been reviewed by supplier on more than one occasion and SOP is in place to address safety concerns.	No safety shower in proximity to unloading point.	Good	Significant	Install safety shower in proximity to chemical unloading point.	Medium	Included under Alum Storage and Dosing Section	2

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Lime Storage Silo	Steel Hopper, which is coated / painted internally and externally. Silo capacity is 27,750 kg. Silo installed with bin filter and pressure relief hatch. Installed in 1984.	Paint work degrading and missing in places. No indication of corrosion. Top of tank pressure relief hatch is weighted down such that only excessively high pressures are relieved. Air exhaust have bags / filters has not been changed since installation.	No issues noted.	Requires Attention	Reasonable	Lower section of silo to be painted and silo outlet valve to be replaced in 2024 as part of makeup system upgrade. Undertake review and maintenance of equipment at the top of the silo. Remove failing paintwork, prepare and repaint exterior of silo where applicable.	Medium	$15,000	3
Lime Make-up and Feed Equipment	Originally Installed in 1984. System comprised of slurry tank, dosing pumps and pipework.	System is beyond service life. Dosing pipework is flushed with acid on a regular basis to removal scale. Multiple repairs have been made over the years.	System at the end of life and needed to be replaced.	Good	Minor	System replaced in 2024 with high density lime system.	Low	N/A	5
Lime Room Ventilation	Refer to Building Mechanical Assessment for equipment specific details.	Refer to Building Mechanical Assessment for equipment specific details.	System identified is under capacity based upon best practice of 12 air changes per hour. Refer to and review ISL Memorandum "Lime and PAC Assessment and Recommended Upgrades" dated March 2, 2021	Requires Attention	Reasonable	New separate HVAC system should be installed for both PAC rooms and sized accordingly. May be possible to combine with Alum and PAC rooms.	Medium	Inc in Building Mechanical Condition Assessment	2
Polymer Makeup & Dosing									
Make-up Unit	Envirochem custom makeup unit, installed in 1984. Liquid Polymer (ClearFloc AE3055) is applied with dilution (1.25 L of polymer to 300 L of water)	Makeup unit is well maintained with no signed of leakage. Concentration is maintained and dose rate adjusted. Any spills will go to the sanitary system. No issues noted with performance.	System beyond service life that uses old technology. Custom built by company which no longer exists. Spare parts are reverse engineered as needed	Requires Attention	Reasonable	Update with new system that uses current technology and which is supported.	Medium	$75,000	2
			No containment in place for drum storage.	Requires Attention	Reasonable	Provide containment tray for drum storage.	Medium	$500	1
Polyelectrolyte Dosing Pump P-120	Wallace and Tiernan pumps installed in 1984 (Model U-26660) Pumps operated with VFDs to match variations in flow.	Original Pumps still working using VFDs. Pumps are maintained and spares can be obtained. Pump leaking oil regardless of rebuilds.	Pump showing age. Pump continues to leak oil	Poor	Reasonable	Schedule replacement of dosing pumps (Recommend Blue White M Series with integral VFDs supplied as skid)	High	$15,000	2
Polyelectrolyte Dosing Pump P-121	Wallace and Tiernan pumps installed in 1984 (Model U-26660) Pumps operated with VFDs to match variations in flow.	Original Pumps still working using VFDs. Pumps are maintained and spares can be obtained. Pump leaking oil.	Pump showing age. Pump leaking oil	Poor	Reasonable	Programme replacement of dosing pumps (Recommend Blue White M Series with integral VFDs supplied as skid)	High	$15,000	2
Associated Pipework and Valves	Small diameter PVC pipework. Pipework is colour coded to indicted pipework contents.	No indications of chemical spills / leakage.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Polymer Dosing Point	Polymer added to clarifier feedwell via a free discharge.	Polymer and carrier water observed flowing.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Polymer Dosing Flowmeter	ABB flowmeter installed on suction pipework to monitor Polymer flowrates / volumes.	Not functioning.	Restricting flow to dosing pumps. Currently bypassed.	Poor	Minor	Flowmeter to be relocated to dosing pump discharges.	Medium	$5,000	1

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Clarification									
Solids Contact Clarifier / Basin	Originally installed in 1984. Originally rated with settling tubes to 30,000 m_3/day, the clarifier has been subsequently downrated to 21,100 m^3/day by the Supplier.	From walkways no sign of concrete spalling or significant corrosion of troughs. Clarifier showing signs of its age.	Clarifier cleanout and detailed inspection is a priority for the Operations Team. Clarifier catholic protection needs to be assessment and addressed. Anodes need to be replaced.	Requires Attention	Significant	City a planning to take clarifier offline in the Fall of 2024 and drain, clean and inspect. Estimate is for inspection only.	High	$50,000	1
Settling Tubes	Part of the original 1984 installation. Used to enhance solid / liquid separation within the clarifier.	Tubes collapsed in 1999 when clarifier drained. Supports corroded due to lack of cathodic protection (which was subsequently installed).	Condition unknown. Tubes and supports may require replacement.	Requires Attention	Significant	City planning to draining Clarifier and complete inspection in the Fall of 2024. Tubes to be replaced and repair as necessary. Estimate is for inspection only.	High	$30,000	1
Drive / Rake Mechanism	Part of the original 1984 installation. Mixer used to mix incoming water with chemicals. Rake used to drawing sludge to central collection sump.	Mixer has been replaced since last assessment and new unit was installed with a new VFD. City wishes to undertake an assessment of the mechanism, which would require the clarifier to be taken offline. Clarifier drive is leaking oil, bearing was replaced in 2005, which was the last time the clarifier was drained.	Oil leak needs to be addressed. Condition of system below the water level is unknown.	Requires Attention	Significant	Rake and Mixer to be inspected when the Clarifier is drained in the fall of 2024. Items to be replaced / repaired as necessary. Estimate is for inspection only.	High	$30,000	1
Chemical Dosing Points	PVC dosing pipework and conduits used for PAC and Lime.	PAC dosing pipework was upgraded in 2023. Lime dosing pipework was upgraded in 2024.	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Clarifier Outlet Instrumentation	Online Water Quality instruments installed for pH, Turbidity and Chlorine	Instruments are operational and maintained. Turbidity instrument is new.	Chlorine instrument due to be replaced in 2024. Beyond its service life.	Good	Minor	Replace Chlorine Instrument. Included below under Disinfection - Chlorination Section.	Low	N/A	5
Sludge Pump P-123	Smart Turner pump with a duty point of 11 L/s @ 10.7 m. Installed with new 3.0 hp Westinghouse motor.	No leaks on pump, new motor was been installed in 2016.	No immediate issues noted, but pump is significantly beyond its service life.	Good	Reasonable	Replace pump due to age	Low	$10,000	2
Sludge Pump P-124	Smart Turner pump with a duty point of 11 L/s @ 10.7 m. Installed with original 3.0 hp Brook Crompton Parkinson motor.	No leaks on pump. Some surface corrosion on the pump body observed.	No immediate issues noted, but pump is significantly beyond its service life.	Requires Attention	Reasonable	Replace pump due to age	Medium	$10,000	2
Sludge Pipework and Valves	Various diameters of steel pipework (painted) with butterfly isolation valves (some air actuated)	Pipework generally in a good condition with some corrosion and sections of exposed bare metal. Temporary actuator on main desludging valve, which needs replacing.	No major issues noted. Address areas of corrosion and exposed metal.	Requires Attention	Minor	Remove corrosion, prepare and repaint pipework support, pipework and metal work. Replace existing actuator valve with new Rotork actuated valve.	Low	$10,000	2

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Sludge Instrumentation	Insertion Flowmeter installed on main sludge line.	Retrofitted instrument that provides an indication of flow.	Instrument is for indication of flow and suited to water lines where the flow is uniform over the pipe cross-section. Accuracy is limited.	Good	Minor	Install inline mass flowmeter and sludge density meter, specific for the purpose. This will allow optimization of sludge blowdown and mitigate water losses	Low	$30,000	3
Filter Aid									
Filter Aid Storage	Filter Aid stored and withdrawn from 55 gallon drums (CTI CL2410).	No containment in place for drums. Any spills will go to the sanitary system via drains in the room. No monitoring of product use available.	No issues noted.	Good	Minor	Provide containment tray and weigh scales for drums.	Low	$15,000	2
Filter Aid Dosing Pump P-109	Single Grundfos DDA Pump (7.5 - 16). Adds chemical based upon the filter flow (about 55 mL/hr).	No indication of any leaks or issues. System uses two drums per year. No online stand-by. Repair kit on site and pump can be replaced quickly if needed	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Associated Pipework and Valves	Due to small volume used, tubing is routed through the WTP to outlet of clarifier. Isolation valves provided on pump discharge.	No issues notes. Single length of tube running to dosing point which can be quickly replaced if needed.	Tubing has to be replaced regularly as it degrades over time	Good	Minor	Tubing to be installed within conduit to aid easy replacement.	Low	$5,000	2
Filter Aid Dosing Point	Tubing drip feeding chemical into clarifier outlet by fish screen.	Mixing is provided by downstream channel ahead of the media filters.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Media Filtration									
Contact Chamber Referred to Future Recarbonation Chamber on Drawings.	Concrete channel / chamber between clarifier outlet and filter inlet. Includes up and over wooden baffles.	Final section can only be flushed. Section containing baffles and ladder cannot be drained unless clarifier is also drained. Up and over baffles make access difficult to clean.	Severe corrosion on ladder that is used to access the chamber. Possible issue with material used in fabrication and chlorinated water within the chamber.	Poor	Significant	Replace with ladder / supports with material which is compatible with chlorinated water. Recommend application of FRP ladder to resist chlorine.	High	$15,000	1
			Baffles moved / slipped.	Requires Attention	Minor	Moved baffles to be removed during next inspection. No replacement needed as they are not required.	Low	$0	2
Media Filters	Four dual media rapid gravity filters, each with a filtration area of 27 m^2. Filter floor replaced / refurbished in 2004 with AWI Phoenix underdrain system. Sand depth is 18" and Anthracite depth is 24". Filter backwash cycle comprised of separate air and water cycles.	Surface corrosion on main beam which is supporting the backwash troughs. Some of the coating / paintwork on concrete is pitting / flaking. AWI assessment completed in 2019, with no issues noted. Mild acid wash applied to the walls yearly to remove staining.	Nothing significant noted. Address corrosion on supporting metalwork.	Good	Reasonable	Monitor corrosion of supports and condition of coating / paintwork. Address as needed.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Inlet Gates & Actuators	500 x 500 mm Gates with pneumatic actuators (rising stem). Installed in 1984.	Gates and actuators are maintained and continue to operate beyond a typical service life. Several actuators are partially working and require Operator intervention when moving position. Unclear how much longer spares will be available due to age of valves / actuators.	Actuators are beyond their service life and should be replaced as Operator intervention is needed. Actual condition of gates and the need to replace then is unknown.	Poor	Reasonable	Suppliers recommend complete replacement are old style gates are difficult to adjust. Plan to replace all gates with electric actuators.	High	$220,000	2
Backwash Outlet Gates & Actuators	750 x 750 mm Gates with pneumatic actuators. Installed in 1984.	Gates and actuators are maintained and continue to operate beyond a typical service life. Several actuators are partially working and require Operator intervention when moving position. Unclear how much longer spares will be available due to age of valves / actuators.	Actuators are beyond their service life and should be replaced as Operator intervention is needed. Actual condition of gates and the need to replace then is unknown.	Poor	Reasonable	Suppliers recommend complete replacement are old style gates are difficult to adjust. Plan to replace all gates with electric actuators.	High	$230,000	2
Filter Outlet Pipework and Valves	Various diameters of steel pipework, epoxy coated internally and painted externally. Both actuated and manual butterfly isolation valves in use.	Filter outlet pipework was mostly replaced as part of the UV disinfection upgrade in 2024 with stainless steel. Valve actuators on each filter outlet were also changed from pneumatic to electric.	No issues noted	Good	Minor	None at this time	Low	N/A	5
Filter Air Scour Blowers	Single blower installed in 2004. Blower capacity unknown and installed with a 4 hp motor.	No redundant blower installed. Filter can backwash without air scour, but the loss of the blower will reduce the cleaning efficiency of the backwash cycle (i.e. a second wash may be needed). Blower discharge pressure transmitters added in 2006 for monitoring.	Single blower, no redundancy.	Good	Significant	City should investigate addition of standby blower and costs implications. Boxed spare is an option.	Medium	N/A	5
Backwash Supply Pump BSP-101	Verti-Line Aurora vertical turbine pump with a duty point of 4,755 USGPM @ 43 ft (25,920 m³/day @ 140 kPa). 75 hp US motor which uses a new VFD (Installed in 2024). Pump and motor installed in 1984.	No indication of water leakage or corrosion on the pump. Pump and motor have not been overhauled since installation. Backwash flow controlled via VFD and magnetic flowmeter. Backup provide by distribution pump PWP-103 which is powered via VFD. Supply to water distribution system has to be stopped when PWP-103 is used for filter washing.	No issues noted. Pump and motor are monitored and issues will be addressed when identified.	Good	Minor	None at this time	Low	N/A	5
Backwash Waste Pump BWP-101	Verti-Line Aurora vertical turbine pump with a duty point of 4,755 USGPM @ 43 ft (25,920 m³/day @ 140 kPa). 75 hp US motor which uses a fixed speed starter and pumps startup valve. Pump and motor installed in 1984.	Some corrosion and scaling noted. Pump and motor have not been overhauled since installation.	No major issues noted or reported. Pump and motor are monitored and issues will be addressed when identified.	Requires Attention	Reasonable	Remove corrosion, prepare and repaint exposed metal	Medium	$2,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Backwash Waste Pump BWP-102	Verti-Line Aurora vertical turbine pump with a duty point of 4,755 USGPM @ 43 ft (25,920 m³/day @ 140 kPa). 75 hp US motor which uses a fixed speed starter and pumps startup valve. Pump and motor installed in 1984.	Some corrosion and scaling noted. Pump and motor have not been overhauled since installation.	No major issues noted or reported. Some water around base that requires investigation and addressing. Pump and motor are monitored and issues will be addressed when identified.	Requires Attention	Reasonable	Remove corrosion, prepare and repaint exposed metal	Medium	$2,000	2
Backwash System Pipework and Isolation Valves	Various diameters of steel pipework, epoxy coated internally and painted externally.	Pipework and valves in good condition. Unlikely that isolation and check valves will hold when needed.	No issues noted.	Requires Attention	Significant	Replace check valve and isolation valve on backwash water supply pump. These will be needed if the backwash pump fails and water has to be drawn from the water distribution system header.	High	$190,000	2
Backwash Supply Pressure Control Valve	450 mm diameter pressure / flow control valve.	Valves appear in a good condition. No issues reported with regards to its operation. UPDATE - Valve was removed following site visit as part of the UV upgrade on early 2024. Supply pump now uses VFD and flowmeter.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Filter Instrumentation	Hach Turbidity meters installed on all filter outlets for continuous monitoring.	Instrument in good condition and well maintained. In Summer the backwashes are triggered by filter headloss. At a headloss of 2.6m the turbidity meter fails due to loss of sample. Insufficient driving head push water flow through analyzer.	WTP Operators monitor the instrument flow throughout the day. When sample flow is too low, the filter is scheduled for a backwash. City has not basis to change this approach.	Good	Minor	None at this time.	Low	N/A	5
Disinfection - Ultra Violet									
UV Reactors	Trojan UV Swift Reactors. Provides 3-log inactivation of both Cryptosporidium and Giardia	One reactor installed on each filter outlet, with filter to waste option. Commissioned in February 2024	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
UV Pipework and Valves	Stainless Steel Pipework of various diameters. Both manual and Rotork actuated installed on butterfly valves.	Commissioned in February 2024	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
UV Instrumentation	Trojan UVT Instruments installed on each filter outlet, which provided measured UVT values to the UV Reactor's PLCs.	Commissioned in February 2024	No issues noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Disinfection - Chlorination									
Chlorine Gas Storage & Feed Rooms	Self-contained room with chlorine gas detection system. Space available for twelve 1-tonne drums of chorine gas Only three on site at any time. Overhead crane available for moving drums.	Access via both interior and exterior doors (interior access through vestibule). System regularly reviewed and inspected. No issues raised with operation	Interior access not permitted under the Saskatchewan Requirements (EPB 265).	Requires Attention	Reasonable	Access to be modified to facilitate regular exterior entry / exit under all weather conditions. Interior access to be subsequently removed.	Medium	Refer to Structural Assessment Tables	2
			Ventilation separate from the main WTP is required under the Saskatchewan Requirements (EPB 265).	Requires Attention	Significant	Separate ventilation system required that meets OH&S and EPB 265.	High	Refer to Building Mechanical Assessment Tables	2
Chlorinator CFD-101	Walace & Tiernan V10K Chlorinators with Vacuum Regulators (5 to 90 kg/day)	Chlorinator operates with no issues and has never reached maximum flow. CFD-101 is serviced annually. Chlorinators are rotated and rebuilt with a third unit regularly. Motive water for ejector comes from process water supply which can be backflowed from the water distribution system.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Chlorinator CFD-102	Walace & Tiernan V10K Chlorinators with Vacuum Regulators (5 to 90 kg/day)	Chlorinator operates with no issues and has never reached maximum flow. CFD-102 is serviced annually. Chlorinators are rotated and rebuilt with a third unit regularly. Motive water for ejector comes from process water supply which can be backflowed from the water distribution system.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Chlorination Pipework and Valves	Various sizes of PVC Pipework. All painted / colour coded to identify contents.	Pipework in good condition, with no signs of any leaks.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Chlorine Dosing and Locations	Primary dosing point is at the outlet of the clarifier with a secondary alternative dosing point after the media filters.	Single dosing line to each location (hard PVC). Both chlorinators can add chlorine to both locations, but only one at a time.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Clearwell	Concrete wet well where the filtered water is discharged and from where the distribution pumps withdraw water.	Last cleaned in 2015. Unable to observe condition as clearwell cannot be removed from service due to water demand. WTP Operators reported no issues.	Inspection / Cleaning overdue	Good	Minor	Complete Remote Vehicle Inspection of clearwell. The intent is to complete removed inspection of both Westend Reservoir and WTP Clearwell.	Low	N/A	5
Clearwell Access Hatches	Steel Access Hatch installed in roof of clearwell / floor of blower room.	Hatch is installed within curbs to prevent water intrusion from spills.	Hatch is not water tight which has been an ongoing point of discussion with SWSA, as it does not address a flood condition. Hatch was replaced shortly after review.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Chlorination Instrumentation	ATI Free chlorine Instruments (Model Q45H) & 1984 Wallace and Tiernan Instrument	Instruments located on filter inlet, filter outlet and distribution supply.	Chlorine instrument due to be replaced in 2024. Beyond service life.	Good	Minor	Replace Chlorine Instrument	Low	$45,000	1
WTP Distribution									
Distribution Pump PWP-101	Verti-line Aurora pump with a duty point of 3,000 USGPM @ 200 ft (16,353 m³/day @ 598 kPa). Installed with 200 hp US motor which uses a fixed speed starter. Pump and motor installed in 1984	Pump running during site visit. No abnormal / unusual sounds while operating Pump and Motor refurbished & modified in April 2003. Pump nameplates incorrect Some discolouring and corrosion noted around gasket.	No issues noted. Pump and motor are monitored and issued will be addressed when identified.	Good	Minor	None at this time.	Low	N/A	5
			Increasing water demand is resulting in more reliance / increased operation of VFD distribution pump, of which there is one	Good	Significant	Replace existing fixed speed starter with a VFD. Installed motor is inverter rated.	Medium	$85,000	2
Distribution Pump PWP-102	Verti-line Aurora pump with a duty point of 3,000 USGPM @ 200 ft (16,353 m³/day @ 598 kPa) . Installed with 200 hp US motor which uses a fixed speed starter. Pump and motor installed in 1984	Motor refurbished in October 2019. Pump and Motor refurbished & modified in April 2003. Pump nameplates incorrect Some corrosion noted at pump base.	No major issues noted. Pump and motor are monitored and issued will be addressed when identified.	Good	Minor	Remove corrosion, prepare and repaint exposed metals work.	Low	$2,000	2
			Pump was taken offline during site visit due to control valve leak, which was replaced shortly after the review.	Good	Minor	None at this time.	Low	N/A	5
			Increasing water demand is resulting in more reliance / increased operation of VFD distribution pump, of which there is one	Good	Significant	Replace existing fixed speed starter with a VFD. Installed motor is inverter rated.	Medium	$85,000	2
Distribution Pump PWP-103	Verti-line Aurora pump with a duty point of 2,000 USGPM @ 198 ft (13,355 m³/day @ 592 kPa). Installed with 200 hp US motor which uses VFD which was installed in 2018. Pump and motor installed in 1984.	Pump running during site visit. No abnormal / unusual sounds while operating. Pump and Motor refurbished & modified in April 2003. Pump nameplates incorrect Corrosion around pump sole plate.	No major issues noted. Pump and motor are monitored and issued will be addressed when identified.	Good	Minor	Remove corrosion, prepare and repaint exposed metal work.	Low	$2,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Associated Pipework and Valves	Various diameters of steel pipework, epoxy coated internally, painted externally. Manually operated butterfly valves for isolation.	Some of the coating flaking away from the pipework to leave exposed metal. No major pitting noted. Isolation valves are exercised regularly	Damaged / missing paint which exposes metal to atmosphere. Significant corrosion note don header next to pressure relief valve	Requires Attention	Minor	Remove corrosion, prepare and repaint exposed metal work.	Low	$5,000	2
			While isolation valves are exercised regularly, WTP Operators have little confidence that the valves will hold / isolate when needed	Requires Attention	Reasonable	Undertake program to replace isolation and check valves around distribution pumps.	Medium	$330,000	3
Associated Instrumentation	Chlorine, pH and Turbidity WQ Instruments. Effluent / Distribution Flowmeter	WQ Instrument well maintained and in good working order. Ultrasonic flowmeter used to replace previously failed magnetic flowmeter. Flowmeter is checked and calibrated on a regular basis.	Chlorine instrument due to be replaced in 2024. Beyond service life.	Good	Minor	Replace Chlorine Instrument. Included below under Disinfection - Chlorination	Low	N/A	5
			Ultrasonic flowmeter at the end of its service lift and no spare parts can be obtained.	Poor	Minor	Install new magnetic flowmeter.	Medium	$40,000	2
Compressed / Instrument Air System									
Refer to Building Mechanical Assessment									
West End Reservoir									
Distribution Pump (DP-1)	Deming pump with a duty point of 1,625 USGPM @ 142.5ft head, (8,858m³/day @ 426 kPa) . Installed with 75 hp US motor which uses a VFD. Pump Installed in 2005	Pump is leaking water onto pump bases / sole plate causing scaling and corrosion. Operations suspect issues with pump bearings that need to be investigated. Pump motor was overhauled in 2016.	Motor overhauled and pump bearing was replaced with an insulated bearing to prevent fluting and arcing. Oil is discoloured, but pump is operating ok UPDATE - Following the site assessment the pump seal was replaced and the pump base / sole plate was prepared and painted.	Good	Minor	None at this time	Low	N/A	5
Distribution Pump (DP-2)	Deming pump with a duty point of 1,625 USGPM @ 142.5ft head, (8,858m³/day @ 426 kPa) . Installed with 75 hp US motor which uses a VFD. Pump Installed in 2005	Significant amount of corrosion on pump base and sole plate. Pump seal was replaced in 2023 and corrosion issues addressed	No issues reported with regards to performance. Pump and motor are monitored and issues will be addressed when identified. Corrosion on pump to be addressed. UPDATE - Following the site assessment the pump base / sole plate was prepared and painted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Distribution Pump (DP-3)	Deming pump with a duty point of 1,625 USGPM @ 142.5ft head, (8,858m³/day @ 426 kPa) . Installed with 75 hp US motor. Starter changed to VFD in 2023. Pump and motor installed in 2005	No significant issues noted. Pump 3 missing guard on one side. Pump and motor overhauled in 2023.	No issues reported with regards to performance. Pump and motor are monitored and issues will be addressed when identified. UPDATE - Following the site assessment a guard was installed on the pump.	Good	Minor	None at this time	Low	N/A	5
Distribution Pump (DP-4)	Deming pump with a duty point of 1,625 USGPM @ 142.5ft head, (8,858m³/day @ 426 kPa) . Installed with 75 hp US motor. Starter changed to VFD in 2023. Pump and motor installed in 2005	Pump in good condition. No problems noted or reported.	Pump and motor are monitored and issues will be addressed when identified.	Good	Minor	None at this time	Low	N/A	5
Distribution Pipework	Stainless Steel Type 304 pipework of various sizes	Majority of welds are corroded and a significant amount of surface corrosion is present on the pipework, especially where welding / connections have been made. Integrity of pipework does not appear to be affected at this time.	Fumes from the sodium hypochlorite storage combined with the sweating pipes have corrode the welds / splatter. Storage modified such that drum now degas through a container of water, which has reduced the odour significantly	Good	Minor	None at this time	Low	N/A	5
			Chlorine fumes / vapours are entering pump room via reservoir a single vent.	Requires Attention	Minor	Modify reservoir vent, such that it draws / discharge air from outside the building.	Low	$5,000	2
			Pipework and welds are corroded. Appears to be surface corrosion on more of an aesthetic issue.	Requires Attention	Minor	Once ventilation issues addressed, the next option would be to clean, prepared, pickle and passivate all external areas of corrosion (inc. welds). Recommend a test are is completed first before moving forward with an ongoing program.	Low	$5,000	2
Distribution Valves	Manual butterfly valves used for isolation. Silent check valves on all pumps. Some isolation valves are actuated.	Pipework / dead legs flushed once a month. Reservoir inlet valve (FCV-1) was seized and has been repaired. It was allowing water to recirculate back into the reservoir when the Westend pumps were running.	No issues noted	Good	Minor	None at this time	Low	N/A	5
Pressure Control / Hydraulically Operated Valves	Singer Flow Control Valve on inlet pipework Cla-Val Pressure Relief Valve on discharge header.	Valves operating. Coating is flaking off and starting to corrode valve bodies. Cla-Val pump start up valves that were used on pumps 3 & 4 have been removed with the change to VFDs.	Pressure control valves are monitored and issued will be addressed when identified. Spare solenoids and repair kits are available on site.	Requires Attention	Minor	Remove corrosion, prepare and recoat the exposed metal on the valves.	Low	$5,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Actuated Valves and Gates	Rotork Actuators with butterfly valves for reservoir fill options. EIM actuators on gates for reservoir compartment isolation.	Valves, gates and actuators operating as intended. No signs of corrosion or damage.	No issues noted	Good	Minor	None at this time	Low	N/A	5
Instrumentation	Siemens Multirange 100 Level Instruments. Khrone Flowmeters on inlet and outlet pipework.	All instruments are in good condition / good working order.	No issues noted with regards to the level instruments. Flowmeter are obsolete and are not longer supported. Spare parts are not available.	Good	Minor	None at this time for the level instruments. Refer to instrumentation and controls assessment for actions on the flowmeters.	Low	N/A	5
Sodium Hypochlorite (Chlorine) Dosing System	Two Prominent Gamma L Dosing Pumps (2006), installed with new skid. System incudes dosing pumps, drum weigh scale, containment and actuated valves. System is capable of adding sodium hypochlorite to four (4) locations.	No issues noted with system operation / performance. Safety shower close to chemical use.	No containment provided for spare drums.	Good	Reasonable	Provide containment tray for drums.	Low	$500	1
Reservoir Access	Multiple locations with hatches to reservoir compartments, with ladder access.	Ladders are starting to corrode where they are exposed to chlorinated atmosphere (i.e. reservoir freeboard).	As ladders continue to corrode they will eventually become unsafe.	Requires Attention	Reasonable	Similar issue at WTP. Recommend trialing FRP ladder at WTP and then undertake replacement of ladders at the Reservoir (5 in total).	Medium	$50,000	3
Reservoir Hatches	Aluminium Hatch (four in total of various sizes)	Hatches are installed within curbs to prevent water intrusion from spills.	Hatches are not water tight which has been an ongoing point of discussion with SWSA as it does not address a flood condition. All hatches were replaced soon after the review	Good	Minor	None at this time	Low	N/A	5

APPENDIX B
Building Mechanica
Condition Assessment Tables

Discipline : Building Mechanical
Assessment Date : October 2022
Assessment Complete by : David Benke (ISL)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw Water Pipeline									
AHU-101	Trane/Cabinet Fan/Unit #63LPFTH/Serial #721521 Motor- 15hp/575V/3PH/1775rpm VFD controlled	Original unit outdoor air damper is manual and needs to be set in the spring and winter. Appears to be set to minimal outdoor air therefore minimal air changes	Building will not meet the air change requirements during occupancy, nor the cooling in the summer as this is using outdoor air to cool. The electrical equipment is running near the max operating temperatures which is very hard on this equipment and can shorten it's lifespan	Requires Attention	Reasonable	The unit should be replaced with a new unit that has a heat section along with heat recovery to ensure adequate air changes. Cooling should be added to the system to ensure that the interior building temperature can be maintained at a reasonable equipment operating temperature during the hot summer periods when most of the equipment is running at the maximum.	Medium	$350,000	2
AHU discharge diffusers	6@1700x400/2830CFM	All appear to be in good condition	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
AHU Return air	2800x1300	All appear to be in good condition	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
TC-101	Not Available	AHU room temperature controller appears to be working and in good condition	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
TC-102	Not Available	AHU in duct air temperature controller appears to be working and in good condition	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
DM-101	This has been removed	The Outside air damper is manually opened	Part of the AHU-101 System, the damper is manually adjusted for summer and winter operation	Good	Minor	None at this time.	Low	N/A	5
DM-102	Belimo AFB24-MFT	Replaced recently and in new condition	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
Duct work	Various sizes	All duct work appears to be in good condition, no issues	Part of the AHU-101 System	Good	Minor	None at this time.	Low	N/A	5
EUH-101	Unknown make or model/7500W	Older unit but appears to be in good working order, integrated thermostat	No issues noted. Reviewed EUH was replaced in 2023	Good	Minor	None at this time. Equipment replaced in 2023	Low	N/A	5
EUH-102	Unknown make or model/7500W	Older unit but appears to be in good working order, integrated thermostat	No issues noted. Reviewed EUH was replaced in 2023	Good	Minor	None at this time. Equipment replaced in 2023	Low	N/A	5
EUH-103	Unknown make or model/7500W	Appears to be recently replaced and in good working order, integrated thermostat	No issues noted. Reviewed EUH was replaced in 2023	Good	Minor	None at this time. Equipment replaced in 2023	Low	N/A	5
EH-101	Unknown make and model	Electric baseboard heater in the storage room	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
EH-102	Unknown make and model	Electric baseboard heater in the washroom	No issues noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
UH-101	DM Olsen/Model #KAS-200H/Serial #08515KAEP/180,000BTU	Natural gas unit heater converted from propane, rust showing on the burner section and heat exchanger	Very old natural gas unit heater and requires replacement as this is one the main heat source in the winter months. Reviewed UH was replaced in 2023	Good	Minor	None at this time. Equipment replaced in 2023	Low	N/A	1
F-101	Overhead Fan/unknown make/model/fractional horsepower	Original and appears to be in good working order, no issues	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
F-102	Overhead Fan/unknown make/model/fractional horsepower	Original and appears to be in good working order, no issues	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
RH-101	Relief Air hood and damper/1676x1524	Original and appears to be in good working order, no issues	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
RH-102	Relief Air hood and damper/1676x1524	Original and appears to be in good working order, no issues	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
WT-101	Fiberglass multi-piece holding tank	Building service water holding tank	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
WH-101	Bradford White/M12/12 USG/1500W/120V	Water heater, old but appears to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	$2,500	3
EF-101	Unknown Make and model/ 120V	Washroom exhaust fan	No issues noted.	Good	Minor	None at this time.	Low	$500	4
PT-101	Red Lion/Model #RL-4/Serial #604453	Building services pressure tank replaced approximately 10 years. ago	No issues noted.	Good	Minor	None at this time.	Low	$500	4
P-101	Mastercraft/Model #S48C03C09/ 0.5Hp/115V/1Ph/3450rpm Pump model #312222	Building services pressure pump replaced in the last 5 years	No issues noted.	Good	Minor	None at this time.	Low	$500	4
Roof drains	Not available	Drops in raw water channel	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
HT-101	Fiberglass sewage holding tank estimated volume $15m^3$	Sewage Holding tank, no comments or observations	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Water Closet	Unknown Make and model	Replaced within the last 5 years and in good working condition	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Lavatory	Unknown Make and model	Replaced within the last 5 years and in good working condition	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Drainage piping	PVC	Good condition	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Building services water piping	Mix of copper, black iron and galvanized	Showing signs of leakage at black iron fittings and connections to brass and copper. Insulation has been damaged or removed on some portions of the piping	Carbon steel will corrode and leak over time, there will be some galvanic corrosion with the dissimilar metals	Requires Attention	Minor	Replace carbon steel with copper/brass pipe and fittings. Note that asbestos is present in insulation which will need to be abated.	Low	$15,000	3
Natural Gas piping	Carbon steel painted	Concrete is broken out at the wall penetration	Piping needs to be sealed at the wall penetration location on both the interior and exterior	Requires Attention	Reasonable	Seal around penetrations	Medium	$500	1

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Raw Water Metering Vault / Building (Installed in 1991)									
Electric Heater for drywell area	Thermolec/ model Control Panel/ Serial #38406-00/ 1.6kW/ 240V/ 1pH/ 4 stage	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Inlet Damper motor	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Outlet Damper motor	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Drywell electric unit heater	No information available, unable to enter confined space	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Electric wall heater for at grade building area	No information available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Sump pump	No information available, unable to enter confined space	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Louvers	Not Available	Appear to be in good condition	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Vault #1									
SAF-109 Supply fan	531 L/s	Appeared to be in good working order	Support rods and isolation springs are corroded	Requires Attention	Reasonable	Fan support rod need to be changed out to SS rods, and new springs are also required	Medium	$1,500	3
Ducting (Return and Supply)	Galvanized steel, Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Electric heating elements (EDH-101)	Not available	Not observable.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
manual dampers	Not available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sump pump (P-140)	1/3 Hp 120V/1pH/60hz c/w piggyback switch	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sump discharge piping	galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Electric unit heater	Not available	Appears to be relatively new and in good working condition	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Cenovus Pump House									
Discharge Louvers	800x800 1298 L/s Max and 130 L/s Min	Appear to be in good condition	No issues at this time	Good	Minor	None at this time.	Low	N/A	5
Discharge Dampers	Non-Insulated	Appeared to be in good working order	There is heat loss due to the dampers being non-insulated and having no edge seals	Good	Reasonable	Replace existing damper with new efficient insulated damper.	Low	$5,000	4
Damper Motor - DM-503	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
DM-504	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
AHU-501	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Intake Louver	1000x1000 2596 L/s Max and 260 L/s Min	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
O/A DM-501	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
R/A DM-502	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
O/A Damper	1000x1000 (non-insulated)	Appeared to be in good working order	There is heat loss due to the dampers being non-insulated and having no edge seals	Good	Reasonable	Replace existing damper with new efficient insulated damper	Low	$5,000	4
R/A Damper	1000x1000	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
UH-501	Reznor/ Model #FE100-H/ Serial # AYD66W7N53653X/90,000BTU/120 V/60Hz/1pH/4Amps	Installed in 1999 and is scheduled for replacement in 2023	Needs to be replaced as it has reached end of service life. Reviewed UH was replaced in 2023	Good	Minor	None at this time. Equipment replaced in 2023	Low	N/A	3
UH-502	Advanced Distributor Products/ Model #SEP-100A-6/ Serial #5619C13425/ 100,000BTU/ 120V/60Hz/1pH/6Amps	new just replaced in 2020	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Water Treatment Plant									
Piping (HWS, HWR,GHS,GHR)	Carbon steel	Appeared to be in good working order, but where visible the piping is showing signs of corrosion on the exterior. The fasteners are also showing signs of corrosion.	No issues at this time, but the piping will be nearing the end of life. Within the next 10 years there will likely be pinhole leaks developing.	Requires Attention	Minor	All hot water and glycol pipework should replaced throughout the WTP within the next ten 10 to 15 year.	Low	$250,000	4
Plant service water piping and valves	Pipe: Copper, Valves: Brass	The plant service water piping and valves appear to be in good condition	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Gas line	Carbon steel painted orange	Gas lines appear to be in good condition	Most of the gas lines in the plant are high pressure but there is no labelling to indicate that these lines are high pressure	Requires Attention	Significant	All high pressure gas lines are to be labelled as "High Pressure Natural Gas X psi"	High	$3,500	1
Boiler Room									
Isolation Valves	Gate valve, rising stem	Some have leaks and packing has been tightened	valve packings need to be adjusted as required, valves are reaching end of service life.	Requires Attention	Reasonable	Recommend replacement in the next 5 years	Medium	$65,000	3
Building Mechanical Pump Guards	All glycol and hot water pumps (see below)	Guards around rotating elements of each pumps are missing.	Operators not protected from safety hazard.	Requires Attention	Significant	Install guards around all rotating element of all building mechanical pumps within the next 12 months	High	$4,000	1
P-204 HWS Pump, hot water heating supply pump for Glycol heater exchanger	Motor: Lero-Somer - Mod# 90, V575 - 1740RPM - 1.5Hp TEFC Pump -Armstrong Mod# 2D 1035, serial# 66703 A, impeller BF 5.875, capacity 104GPM @25ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor and pump are showing signs of corrosion	The motor and pump appears to be nearing end of life	Requires Attention	Minor	Look into replacement in the next 5 years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
P-205 HWS Pump, hot water heating supply pump for Glycol heater exchanger	Motor: Lero-Somer - Mod# 90, V575 - 1740RPM - 1.5Hp TEFC Pump -Armstrong Mod# 2D 1035, serial# 66703 A, impeller BF 5.875, capacity 104GPM @25ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor and pump are showing signs of corrosion	The motor and Pump appears to be nearing end of life	Good	Minor	Look into replacement in the next 5 years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
P-206 HWS Pump	Motor: LEESON - Mod# C143T17FB4A V575 - 1740RPM - 1Hp TEFC Pump - Armstrong, impeller BF 5.750, capacity 32GPM @35ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor and pump are showing signs of corrosion	The motor and pump appears to be nearing end of life	Good	Minor	look into replacement in the next 5 years	Low	$4,500	3
Strainer	50mm Keckley strainer	Appeared to be in good working order	No issues noted.	Good	Minor	The basket needs to be checked to ensure that it is still intact	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-600 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
P-207 HWS Pump	Motor: Bauldor - Mod# M3546T-5, Spec# 35A001T094H1, V575 - 1740RPM - 1Hp TEFC, Serial # F0407024621 Pump - Armstrong, impeller BF 5.750, capacity 32GPM @35ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor is new but the pump is showing signs of corrosion	The pump appears to be nearing end of life	Good	Minor	The pump will require replacement in the next five years	Low	$4,500	3
Strainer	50mm Keckley strainer	Appeared to be in good working order	No issues noted.	Good	Minor	The basket needs to be checked to ensure that it is still intact	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Missing	The pressure gauge needs to be replaced	Good	Minor	Replace pressure gauge	Low	$500	1
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-600 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
P-208 HWS Pump	Motor: Bauldor - Mod# EM3611T-5, Spec# 36Q570S582G11, V575 - 1760RPM - 3Hp TEFC, Serial # F1807033465 Pump - Armstrong, impeller BF 5.750, capacity 100GPM @35ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor is new but the pump is showing signs of corrosion	The pump appears to be nearing end of life	Good	Minor	The pump will require replacement in the next five years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time.	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
P-209 HWS Pump	Motor: Teco Westinghouse - Mod# EPACT-HPE, V575, 1755RPM, 3Hp, TEFC, Ser # FQ356S410034 Pump - Armstrong, capacity 100GPM @35ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor is new but the pump is showing signs of corrosion	The pump appears to be nearing end of life	Good	Minor	The pump will require replacement in the next five years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time.	Low	$1,000	4
Suction Pressure Gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Discharge Pressure Gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Check Valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
P-212 GHS Pump, Glycol water supply pump	Motor: US Electric - Mod# CT TE, V575, 1728RPM, 3Hp, TEFC, Ser # M-073528829 Pump - Armstrong, Model# 2E 4035, Ser# 66770, Impeller BF 7.5in, capacity 111GPM @50ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor is new but the pump is showing signs of corrosion	The pump appears to be nearing end of life	Good	Minor	The pump will require replacement in the next five years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time.	Low	$1,000	4
Suction Pressure gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Discharge pressure gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Check valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
P-213 GHS Pump	Motor: Leeson - Mod#C182T17FB2B, V575, 1740RPM, 3Hp, TEFC, Pump - Armstrong, Model# 2E 4035, Ser# 66769, Impeller BF 7.5in, capacity 111GPM @50ft	Appeared to be in good working order. There are no guards in place on the pump shaft (addressed above). The motor and the pump is showing signs of corrosion	The motor and pump appears to be nearing end of life	Good	Minor	The pump will require replacement in the next five years	Low	$6,500	3
Strainer	100mm Keckley flanged strainer	Appeared to be in good working order	As a maintenance item the basket needs to be checked to ensure that it is still intact	Good	Minor	None at this time.	Low	$1,000	4
Suction Pressure gauge	100mm dia gauge, 0-250 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Discharge pressure gauge	Ashcroft (Duragauge) 100mm dia gauge, 0-400 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Check valve	Silent check	Appears to have been recently replaced and appeared to be in good working order	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Heat Exchanger (HEX-101)	Taco, Shell and tube heat exchanger, Manufactured 1982/01/01, CRN# E4162.5.3, Ser # R11355-612506 Shell dia 0.23m, Shell Length 2.23m,	Appeared to be in good working order	The last inspection appears to have taken place in 2013, the equipment is reaching end of life and should look at replacement.	Good	Minor	Recommend replacement in the next 5 years to 10 years	Low	$50,000	3
Hot water Expansion Tank (ET-101)	Westeel Rosco, manufactured 1982, 30-Expansion tank, Ser # 54242-7	Last inspected in 2019 (External Re-inspection	No issues noted.	Good	Minor	Due for a reinspection within the next 5 years	Low	$2,500	2
Glycol Expansion Tank (ET-102)	Westeel Rosco, manufactured 1982, 30-Expansion tank, Ser # 54348	Last inspected in 2019 (External Re-inspection	No issues noted.	Good	Minor	Due for a reinspection soon within the next 5 years	Low	$2,500	2
Boiler #101	Cleaver Brooks Model 5 Watertube Boiler, Mod # M5W-3000 series 700, Ser # 05871-1-1, Max Output 2,400,000 BTU, Max gas Input 3,000,000 BTU, Min gas Input 1,000,000 BTU, 7.8 inWC max input pressure to manifold, Max Gas supply press. 3psi.	Appeared to be in good working order overall, but the chimney appears to be leaking from one of the flanged joints	Separate and remake the chimney joint to be gas tight	Requires Attention	Reasonable	Recommend fixing the chimney joint to be gas tight	Medium	$3,500	1
Boiler #102	Cleaver Brooks Model 5 Watertube Boiler, Mod # M5W-3000 series 700, Ser # 05640-1-1, Max Output 2,400,000 BTU, Max gas Input 3,000,000 BTU, Min gas Input 1,000,000 BTU, 7.8 inWC max input pressure to manifold, Max Gas supply press. 3psi.	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Air Handling Unit (AHU-101)	Trane, Torrivent, Unit # T61PHFTH, Ser # 719565	Appears to be in working order	this unit is old and at the end of service life	Requires Attention	Minor	Recommend replacement in the next 5 years to 10 years	Low	$15,000	3
Ducts	Galvanized steel, Painted	Appears to be in working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Temperature Control Valve (TCV-37)	100 mm dia Honeywell	Working but there is evidence of leakage in the recent past UPDATE - Valve leaks have been repaired since site visit.	Valve is nearing end of service life	Requires Attention	Reasonable	Plan for valve replacement	Medium	$4,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Temperature Control Valve (TCV-38)	50 mm dia unknown model, brass threaded	Working but there is evidence of leakage in the recent past UPDATE - Valve leaks have been repaired since site visit.	Valve in very near end of service life	Requires Attention	Reasonable	Plan for valve replacement	Medium	$1,500	2
Temperature Control Valve (TCV-39)	65mm Three way mixing valve, air operated	Valve is leaking and has damaged the insulation on the piping below it UPDATE - Valve leaks have been repaired since site visit.	Valve needs to be replaced	Requires Attention	Reasonable	Plan for valve replacement	Medium	$3,500	2
PRV 68, pressure reducing valve (on make up water line)	Unknown make	Appears to be in good working condition	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Make up water line backflow preventer	Unknown make	Appears to be in good working condition	Run drain line to the sink securely fastened to the wall	Good	Minor	Fasten the drain line securely to the wall. This may require a new run of pipe	Low	$500	1
Mechanical Room (Main Floor)									
Unit Heater - HC-106	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Water Heater / WH-10	A.O Smith / Model# BT80300 / 74 gal	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Natural Gas Pressure Reducing Valve / PRV78	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Backflow Preventer	Not Available	Appears that the drain line is not permanently mounted to dump port.	Splashing water if dump port opens.	Good	Minor	Replace drain line with 75mm PVC pipe to nearest drain	Low	$500	1
Air Conditioning Unit / AC-101	Trane / Model# SCWJ10053A01010	Appeared to be in good working order. Installed in July 2014	This unit uses an excessive amount of water which is then wasted down the drain	Good	Minor	Although the unit works well the excessive use of water is substantial. And would recommend replacement with a condenser and coil.	Low	$50,000	4
Supply Duct	Galvanized Steel / 600x550	Appeared to be in good working order. Insulation poorly installed near AC unit.	Insulation is exposed	Good	Minor	Replacement of insulation with proper installation.	Low	$300	1
Return Ducts	Galvanized Steel	Appeared to be in good working order. Insulation poorly installed near AC unit.	Insulation is exposed	Good	Minor	Replacement of insulation with proper installation.	Low	$300	1
Drain lines	PVC and copper	Appears the copper drain line (pipe to control valve) is highly corroded	Pipe may soon start to leak. Although line is not pressurized and may not damage equipment above, water on floor is unwanted.	Poor	Minor	Replacement of copper line	Medium	$250	1
Make-Up Air Unit / MAU-101 for Clarifier area	Not Available, Centrifugal Fan, 4032 L/s	Direct Fired, no direct venting. Operating is interlocked with exhaust fans	The access to this unit is very difficult as the operator is required to crawl over the unit to perform some of the service tasks. The gases from combustion end up in the air stream and then go into the Clarifier Room. Unit is nearing end of service life.	Requires Attention	Significant	Recommend that this unit be replaced with a unit that is more suitable for operation (i.e. vents outside).	High	$100,000	2
Natural Gas Line	Steel / 25mm	Appeared to be in good working order.	There is no indication on the high pressure side	Requires Attention	Significant	Recommend line labels to indicate line commodity and pressures	High	$3,500	1

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Natural Gas Pressure Reducing Valve / PRV79	Fischer Controls	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Heating Coil / HC-103	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Glycol Isolation Valves	Cast Iron / Gate Type / Crane / 63mm	Appeared to be in good working order	Valve is nearing end of service life	Requires Attention	Reasonable	None at this time	Medium	$10,000	3
Glycol Control Valve	Not Available	Appeared to be in good working order	Valve is nearing end of service life	Requires Attention	Reasonable	Recommend replacement in the next 5 to 10 years	Medium	$3,500	3
Supply Air Fan (Lab) / SAF-107	Not Available	Operator noted that the fan is not run as this is too large for the system as it feeds the lab and affects operation of the fume hood.	Nearing end of service life	Poor	Significant	Review fan operation / sizing and replace unit.	High	$10,000	1
Heating Coil (Lab) / HC-101	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pneumatic Damper (Lab) / DM48	1219x508	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Air Fan (Pump Room) / SAF-103	Centrifugal Type / 5664 L/s	Not Available	Nearing end of service life	Requires Attention	Minor	None at this time	Low	$10,000	3
Return Air Fan (Pump Room) / RAF-103	Centrifugal Type / 5098 L/s	Not Available	Nearing end of service life	Requires Attention	Minor	None at this time	Low	$10,000	3
Silencer	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Dampers (Pump Room)	Not Available	Not Available		Good	Minor	None at this time	Low	N/A	5
Supply Ducts (Pump Room)	Galvanized Steel, various large sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts (Pump Room)	Galvanized Steel, various large sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Air Fan (Office) / RAF-104	Centrifugal Type / 1858 L/s	Not Available	Nearing end of service life	Good	Minor	None at this time	Low	$6,500	4
Silencer	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Steam Humidifier / HUM-101	Neptronic / SK310M	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Steam Hose	40mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Front Load Washers	LG	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fan Room (Upper Floor)									
Unit Heater / HC-114	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low		5
Unit Heater / UH-116	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low		5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Supply Air Fan (Chemical Rooms) / SAF-101	6832 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$10,000	2
Exhaust Fan (Chlorine Storage)/ EF-101	670 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$2,500	2
Exhaust Fan (Chlorine Storage / EF-102	670 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$2,500	2
Exhaust Fan (Chlorine Room)/ EF-103	189 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$2,500	2
Exhaust Fan (Chlorine Room)/ EF-104	1180 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$6,500	2
Exhaust Fan (Fluoride Room)/ EF-105	189 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$2,500	2
Exhaust Fan (PAC Room) / EF-107	510 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Significant	Recommend replacement within the next 5 years	Medium	$10,000	2
Exhaust Fan (Clarifier Area) / EF-109	1805 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$6,500	2
Exhaust Fan (Clarifier Area) / EF-110	1806 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$6,500	2
Exhaust Fan (Lime Room)/ EF-111	326 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$2,500	2
Exhaust Fan / EF-117	195 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$2,500	2
Exhaust Fan / EF-118	132 L/s (Trane)	Appeared to be in good working order	Nearing end of service life, Parts are not available and need to be custom machined	Good	Reasonable	Recommend replacement within the next 5 years	Low	$2,500	2
Heating Coil / HC-103	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
P-210 (Glycol circulation pump)	Motor: Leeson, 1.5Hp, 575V, model # C145T17FK30D. Pump: Armstrong, model# 1.5D 4380, 42 gpm @45.5 ft, 1800 rpm.	Evidence of leakage from the seals	Does not appear to be leaking at the moment but the pump and associated parts are nearing end of service life	Requires Attention	Reasonable	Recommend replacement in the next 5 years	Medium	$7,500	2
Temperature control Valve (TCV 35)	Unknown	Has evidence of leakage	Near end of service life. This supplies the heat to the air that supplies the chemical rooms	Requires Attention	Significant	Recommend replacement in the next 5 years	High	$2,500	2
Expansion tank (ET - 103)	Unknown	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Clarifier Area									
UH-115 / Unit Heater	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
UH-113 / Unit Heater	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
UH-103/ Unit Heater	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
UH-104 / Unit Heater	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
UH-109 / Unit Heater	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
FHR-106 / Fire Hose Reel	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
FHR-105 / Fire Hose Reel	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
FHR-104 / Fire Hose Reel	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
FHR-102 / Fire Hose Reel	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguishers	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Roof Drains	PVC / 150mm	Signs of leaks at 90 degree elbow is from water prior to the remediation work.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pump Area (Basement)									
Unit Heater / UH-107	Trane	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Air Operated Control Valve / TCV54	Not Available	Appears to be show signs of leak and corrosion is visible on valve body	Leaking hot water to below.	Requires Attention	Minor	Replacement of valve	Low	$1,500	2
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of 3 valves	Low	$2,000	2
Unit Heater / UH-108	Trane	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of 3 valves	Low	$2,000	2
Unit Heater / UH-110	Trane	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low		5
Air Operated Control Valve / TCV55	Not Available	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of valve	Low	$1,500	3
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of 3 valves	Low	$2,000	3
Unit Heater / UH-111	Trane	Appeared be noisy while operating	Loud noise sign of end of life for the fan.	Requires Attention	Reasonable	Replacement of unit heater	Medium	$2,000	1
Air Operated Control Valve / TCV47	Not Available	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of valve	Low	$1,500	2
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion. A temporary pan placed under valves to catch leaks	Leaking hot water to below.	Requires Attention	Minor	Replacement of 3 valves	Low	$2,000	2
Supply Ducts (west wall)	Galvanized steel / various large sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Supply Grills (west wall)	Metal / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts (north wall)	Galvanized steel / various large sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grills (north wall)	Metal / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Backflow Preventer / BFP-87	Not Available	Not Available	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves (upstream and downstream of PRV) / V1	Various sizes and types	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Reducing Valve (DCW) / PRV71	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Reducing Valve (fire protection) / PRV70	100mm, not available	Appeared to be in good working order	This valve requires pressure gauges on each side of the valve	Requires Attention	Reasonable	Add pressure gauges as required by NFPA standards for fire protection systems	Medium	$2,500	1
Isolation Valve (upstream of PRV)	Gate type / 100mm, not available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Plant Service Water Meter	Sensus OMNImeter	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drain Pipes	Cast Iron and ABS / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Hose Reels	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguishers	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Compressed Air system (Basement)									
Air Compressor / CP-101	Lesson / Model# N256T17DH2 / 1740 RPM / 20HP / 575 V 60Hz 3Ph	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years)	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$25,000	3
Air Tank (19652)	Steel / Steel Fabrication & Welding Co. / Yr. 1982 / SN# 5579346 / 200 psi	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years). Last certification in 2019 -12	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$10,000	3
Air Compressor / CP-102	Lesson / Model# N256T17DH2 / 1740 RPM / 20HP / 575 V 60Hz 3Ph	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years)	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$25,000	3
Air Tank (19653)	Steel / Steel Fabrication & Welding Co. / Yr: 1982 / SN# 5622587 / 200 psi	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years). Last certification in 2019 -12	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$10,000	3
Air Compressor / CP-103	Lesson / Model# C184T17DB2A / 1740 RPM / 5HP / 575 V 60Hz 1Ph	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years)	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$10,000	3
Air Dryer / RD-101	KelAir / DSA / 150 SCFM @ 100 psi	Appeared to be in good working order	No issues at this time. Unit appears old (over 30 years)	Good	Minor	Recommend replace of unit between 5 to 10 years	Low	$10,000	3
Pressure Guage	DuraGuage / 1-1000 kPa	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Switches	Custom Control Sensors / Model: 604GJ11	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Condensate Separators	HiRoss / Model S02CB0	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Solenoid Valves	Asco / Serial# T884676	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Raw Water Pipework / Open Space (Basement)									
Variable Air Volume (VAV) Box / RCB-122	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-120	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-115	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-119	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Air Operated Control Valve / TCV20	Not Available	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of valves	Low	$1,500	3
Variable Air Volume (VAV) Box / RCB-113	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-114	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion. A temporary pan placed under valves to catch leaks	Leaking hot water to below.	Requires Attention	Minor	Replacement of all (approx. 18) valves in the Raw Water Meter Room	Low	$12,000	3
Supply Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	Metal / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grills	Metal / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drain Pipes	PVC	Appeared to be in good working order. No leaks noticed.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Piping (Fire protection)	Carbon steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Hose Reels	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguishers	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Large Floor Mounted Sink (single)	Stainless Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Gas Meter Room									
Gas Meter	Galvanic / GasMicro / EVC	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Relief Valves / PRV74	Canadian Meter / SSV / 50mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Relief Valves / PRV75	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Pressure Reducing Valves / PRV84	Not Available / 50mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Pressure Reducing Valves / PRV85	Fischer / 50mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Interior Isolation Valves	Various models / 65mm, 50mm, 30mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Piping	Steel	Appeared to be in good working order	There is no labelling of the piping or of the pressures in the piping	Good	Significant	Piping requires labels and pressure indication	Medium	$1,500	1
Ducts	Insulated / Rectangular	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Front Entry and Hallway									
Cabinet Heater / FC-101	Wall mounted	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Heating Coil / HC-105	Above ceiling, Not Available	Not Available	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Heating Coil / HC-107	Above ceiling, Not Available	Not Available	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Diffuser (entrance)	Ceiling Type / 305x250 / 143 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill (end of Hallway)	Ceiling type / 356x254 / 129 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Water Cooler	Wall mounted / Elkay	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Hose	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguishers	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
WTP Manager's Office									
Supply Diffusers	Suspended Ceiling type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Janitorial Room									
Floor Tub	Plastic	Appears the walls are not leaking but old stains are visible	No issues noted.	Good	Minor	Replacement of tub within the next 5 years	Low	$500	3
Drain at Tub	Bronze nickel/cast iron	Appears that the drain cover is not seated and able to be removed from seat	Potential of large objects entering the drain pipe and cause blockage in system. UPDATE - Floor drain replaced following site assessment	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Door mounted type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	152x127 / 62 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Washrooms and Locker Room									
Single Bowl Sinks (washroom)	Ceramic / porcelain	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucets	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Sink Drain Pipes	ABS DWV / 63mm	Appears to show signs of leaks at pipes below at one of sinks.	Leaks and stains to be eliminated to provide clean and safe area	Requires Attention	Minor	Replacement of drain piping and seals	Low	$500	3
Water supply pipes	Copper / 12mm	Highly corroded copper pipe (hot and cold supply) from wall to hand valve	Highly corroded pipes can lead to pipe deterioration over time and lead to pipe burst	Requires Attention	Minor	Replacement of copper piping and valves	Low	$1,200	2
Single Bowl Sink (locker room)	Ceramic	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucet	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sink Drain Pipes	Not Available	Not Available	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill (washroom entrance)	Door mounted type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill (washroom)	Ceiling type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill (locker room)	Door mounted type	Appears to show build up of dust particles	Can potential build up and restrict air flow causing poor circulation	Requires Attention	Minor	Replacement of grill. Recommend cleaning of ducts within the system	Low	$200	3
Return Grill (locker room)	Ceiling type	Appears to show build up of dust particles	Can potential build up and restrict air flow causing poor circulation	Requires Attention	Minor	Replacement of grill. Recommend cleaning of ducts within the system	Low	$200	3
Floor Drains	Bronze nickel/cast iron	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Urinal and Water Closet	Porcelain	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Kitchen									
Double Bowl Sink	Stainless Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucet	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sink Drain Pipes	ABS DWV / 63mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Diffuser	Ceiling type / 203x203 / 68 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	Ceiling type / 254x152 / 62 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Heating Coil / HC-109	Above ceiling, Not Available	Not Available	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Workshop Mezzanine									
Heating Coil / HC-112 (mezzanine)	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Air Operated Control Valve / TCV86	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Gate type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	Metal / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Return Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grills	Metal / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Workshop									
Exhaust Fan w/ flexible hose and arm / EF-119	Endwalk Corporation / Not Available	Appeared t be in good working order.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ceiling Fans / F-101, F1-02	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Compressed Air Lines	Carbon steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Air Gauges	0-100psi range / Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Laboratory									
Double Bowl Sink (East)	Stainless Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucet (East)	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sink Drain Pipes (East)	ABS DWV / 63mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Double Bowl Sink (North)	Stainless Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucet (North)	Not Available	Appears to show signs of leaks at valve and spout	Leak may cause damage to surroundings. Leaks and stains to be eliminated to provide clean and safe area	Requires Attention	Minor	Replace faucet and spout	Low	$600	2
Sink Drain Pipes (North)	ABS DWV / 63mm	Appears to show signs of leaks at pipes below sink	Leak may cause damage to surroundings. Leaks and stains to be eliminated to provide clean and safe area	Requires Attention	Minor	Replace piping and seals under sink	Low	$500	2
Single Bowl Sink (East)	Plastic	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Faucet (East)	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sink Drain Pipes (East)	ABS DWV / 63mm	Appears to show signs of leaks at valve	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fume Hood	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Fan / EF-113 / Chemical Area	283 L/s	Noise level higher than normal for a fan	Loud noise sign of end of life for the fan	Requires Attention	Reasonable	Replacement of fan	Medium	$2,500	1
Single Bowl Sink (Island)	Stainless Steel. This sink is asbestos lined.	Appeared to be in good working order	When replaced / worked on the asbestos lining will need to be abated	Good	Minor	None at this time	Low		5
Sink Drain Pipes (Island)	ABS DWV / 63mm	Appears to show signs of leaks at trap below sink	Leak may cause damage to surroundings. Leaks and stains to be eliminated to provide clean and safe area	Requires Attention	Minor	Replace piping and seals under sink	Low	$500	2

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Eyewash Station (Island)	Faucet mounted type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Diffusers	Ceiling type / 356x356 / 216 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grills	Ceiling type / 457x457 / 389 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Heating Coil / HC-106	Above ceiling, Not Available	Not Available		Good	Minor	None at this time	Low	N/A	5
PAC Room (Main Floor)									
Variable Air Volume (VAV) Box / RCB-105	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply ducts	Galvanized steel	Appeared to be in good working order. Excessive amount of build up on top of ducts and visible inside ducts/grills	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	356x356 / 276 L/s	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel / 360x310	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	356x254 / 189 L/s	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Hopper duct thru upper level	Galvanized steel / round duct	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drain Pipes	PVC / Various sizes	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Sprinklers	Not Available	Originally a dry system which was upgrade to a wet system in 2023 as part of the PAC upgrade	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Pipes	Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Valves	Gate type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Hose Bibb	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	PAC upgrade project identified ventilation is under capacity for the PAC rooms.	Insufficient air changes per hour for chemical space.	Requires Attention	Significant	New separate HVAC system should be installed for both PAC areas and sized accordingly. May be possible to combine with Alum and Lime rooms.	High	$100,000	2
Lime Room (Main Floor)									
Variable Air Volume (VAV) Box / RCB-106	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Supply Grills	610x254 / 354 L/s	Appeared to be in good working order. Build up on surface visible	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	916x406 / 637L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drain Pipes	PVC / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Large Ducts Thru Room	Galvanized steel / 860x460	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	Lime upgrade project identified ventilation is under capacity for the lime rooms	Insufficient air changes per hour for chemical space.	Requires Attention	Significant	New separate HVAC system should be installed for both PAC rooms and sized accordingly. May be possible to combine with Alum and PAC rooms.	High	$400,000	2
Polymer Makeup & Dosing Room (Main Floor)									
Supply ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	356x254 / 89 L/s	Appeared to be in good working order. Build up on surface visible	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill / Above Double door	356x254 / 89 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drain	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Large Ducts Thru Room	Galvanized steel / Various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	PAC and Lime upgrade projects identified ventilation is under capacity. Likely to be the same for this space.	Possible insufficient air changes per hour for chemical space.	Requires Attention	Reasonable	Space should be assessed for ventilation rates and included with adjustments for Lime and PAC spaces.	Medium	Included in Lime Costs above	2
Storage Room (Main Floor)									
Variable Air Volume (VAV) Box / RCB-111	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	610x254 / 89 L/s	Appeared to be in good working order. Build up on surface visible	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	254x203 / 190 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Large Ducts Thru Room	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Chlorine Storage Room									
Variable Air Volume (VAV) Box / RCB-103	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply ducts	Galvanized steel	Appeared to be in good working order. Paint coming off duct but no signs of any corrosion.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	406x254 / 223/293 L/s	Appeared to be in good working order.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel / 1000x600	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Weatherproof Louver / Damper (Air operated)	Steel / 1800x900	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Configuration / Arrangement	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	SWSA EPB 265 call for ventilation system for chlorine gas storage and feed areas to be separate from other ventilation systems within the WTP.	Chlorine Storage Room does not meet current OH&S and SWSA requirements. This has been noted by the SWSA.	Requires Attention	Significant	Installed separate HVAC system to meet regulatory requirements	High	$300,000	2
Eyewash Room (Adjacent to Chlorine Storage and Feed Rooms)									
Variable Air Volume (VAV) Box / RCB-112	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	Not Available	Appeared to be in good working order.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drain	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Safety Eye Wash/shower Station / EW-101	Haws / Stainless Steel	Appeared to be in good working order	Tempered water not supplied to safety shower	Requires Attention	Significant	Add a tempering valve and hot water tank with sufficient volume to supply the required flow of tempered water to the shower/eyewash stn.	High	$15,000	1
Piping/valves	PVC	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Chlorine Feed Room									
Supply Ducts	Galvanized steel / 210x150	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	406x203 / 191 L/s	Appeared to be in good working order.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel / 500x400	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Weatherproof Louver / Damper (Air operated)	Steel / 1800x900	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drain	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
PAC Room (Basement)									
Variable Air Volume (VAV) Box / RCB-116	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Supply Ducts	Galvanized steel	Appeared to be in good working order. Excessive amount of build up on top of ducts and visible inside ducts/grills	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Not Available	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	Not Available	See above	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Sprinklers	Wet type	Originally a dry system which was upgrade to a wet system in 2023 as part of the PAC upgrade	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Pipes	Steel	Originally a dry system which was upgrade to a wet system in 2023 as part of the PAC upgrade	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Hot Water Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of 1 valves	Low	$700	1
Hose Bibb	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	PAC upgrade project identified ventilation is under capacity for the PAC rooms.	Insufficient air changes per hour for chemical space.	Requires Attention	Significant	New separate HVAC system should be installed for both PAC rooms and sized accordingly. May be possible to combine with Alum and Lime rooms.	High	Inc with Main Floor PAC Room Assessment	See Above
Lime Room (Basement)									
Variable Air Volume (VAV) Box / RCB-117	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Trench Drain	Steel grate	Appears that the grate is damaged in some sections and highly rusted. Grate not seated.	Tripping hazard Following the review the grating replaced as part of 2024 Lime Upgrade	Good	Minor	None at this time	Low	N/A	5
Plant Service Water Piping	PVC / 50mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Ball type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	Lime upgrade project identified ventila	Insufficient air changes per hour for chemical space.	Requires Attention	Significant	New separate HVAC system should be installed for both PAC rooms and sized accordingly. May be possible to combine with Alum and PAC rooms.	High	Inc with Main Floor PAC Room Assessment	See Above
Alum Dosing Room (Lower)									
Supply Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Plant Service Water Piping	PVC / 50mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Ball type	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Control Valves (for chemical system)	Electric operated	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Ventilation Capacity	One HVAC system installed when constructed that serves all of the whole WTP building. This was an acceptable practice when the WTP was constructed.	PAC and Lime upgrade projects identified ventilation is under capacity. Likely to be the same for this space.	Possible insufficient air changes per hour for chemical space.	Requires Attention	Reasonable	Space should be assessed for ventilation rates and included with adjustments for Lime and PAC spaces.	Medium	Included in Lime Costs above	2
Basement Sump Room									
P-217 Sump Pump	Motor: Gould - Cat.# C-665 / 3/4 HP / 1725 RPM / 230/115 V 1PH 60hz / Pump capacity - unknown	Appeared to be in good working order. There are no pump guards on the shaft.	The pump appears to be nearing end of life	Good	Minor	Recommend replacement in the next 5 years	Low	$3,500	2
P-218 Sump Pump	Motor: Gould - Cat.# C-665 / 3/4 HP / 1725 RPM / 230/115 V 1PH 60hz / Pump capacity - unknown	Appeared to be in good working order	The pump appears to be nearing end of life	Good	Minor	Recommend replacement in the next 5 years	Low	$3,500	2
Check Valves (sump pump discharge)	Brass / Ball check valve / 32mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves (sump pump discharge)	Brass / Gate valve / 32mm	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drainage Piping	PVC	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Discharge Piping	Steel / 32mm	Highly corroded pipe sections and union (at cover plate)	Highly corroded section can lead to failure	Poor	Reasonable	Requires replacement of piping from pump and up	High	$1,000	1
Variable Air Volume (VAV) Box / RCB-123	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Electrical Room #1 (Main Floor)									

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Circulation Fan / SAF-106	Aerofoil	Appeared to be in good working order,	The room is too hot, the electrical equipment is running and this is not enough cool air to remove the heat.	Requires Attention	Significant	Supply fan needs to be supplemented with air conditioning to lower the electrical room temperature. Recommend using heat pumps	High	$40,000	1
Supply Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel / various sizes	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grills	305x152 99 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grills	Unknown	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguisher	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Electrical Room #2 (Upper Floor)									
Emergency Generator	NGG-101	Not in operation	This unit has been not in use for some time	Poor	Minor	Remove generator and modify/cap all associated parts that go with this unit.	Medium	$20,000	2
Variable Air Volume (VAV) Box / RCB-124	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Parts Room (Main Floor)									
Variable Air Volume (VAV) Box / RCB-109	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-104	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Floor Drains	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Main Floor Hallway Chemical Rooms									
Variable Air Volume (VAV) Box / RCB-110	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Variable Air Volume (VAV) Box / RCB-103	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Supply Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Return Ducts	Galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Return Grill	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Hose Reel	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguisher	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Main Floor North Hallway and Stairwell									
Cabinet Heater (Stairs)/ FC-104	Wall mounted	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Cabinet Heater (Hallway)/ FC-105	Wall mounted	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Fire Extinguisher	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Stairwell to Basement near Electrical Room									
Cabinet Heater / FC-102	Wall mounted	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Isolation Valves	Gate type	Appears to be in old condition and starting to show corrosion	High chance of leaking hot water in future	Requires Attention	Minor	Replacement of 3 valves	Low	$2,000	2
Vault #5									
SAF-110 Supply fan	354 L/s	Appeared to be in good working order	Support rods are corroded	Requires Attention	Reasonable	Fan support rod need to be changed out to SS rods	Medium	$1,500	3
Electric heating elements (EDH-101)	20 amp disconnect	Not observable.	No issues noted.	Good	Minor	None at this time	Low	N/A	5
manual dampers	Not available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sump pump (P-141)	1/3 Hp 120V/1pH/60hz c/w piggyback switch	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Electric unit heater	15 Amp disconnect	Appears to be relatively new and in good working condition	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sump discharge piping	galvanized steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
West End Reservoir									
Intake Louver / Pumphouse / L-1	400x600 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper / Pumphouse / C-1	Belimo Fail-safe On/Off Actuator / NF120-S / 400x600 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Intake Louver / Pumphouse / L-1	400x600 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper / Pumphouse / C-1	Belimo Fail-safe On/Off Actuator / NF120-S / 400x600 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Intake Louver (Inlet) / Generator Room / L-1	1600x1800 / 4973 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper (Inlet) / Generator Room / C-1	1600x1800 / 4973 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Intake Louver (Inlet and Combustion) / Generator Room / L-1	1600x1800 / 4973 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper (Inlet and Combustion) / Generator Room / C-1	1600x1800 / 4973 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Motorized Damper / Generator Room / C-1	1600x1600 / 9346 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Louver / Generator Room / L-1	1600x1600 / 9346 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper (Recir.) / Generator Room / C-2	1200x1200 / 9346 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Standby Generator / Generator Room, GEN-1	Cummins Model DFCE-15741107, 400 kW. Installed in 2005	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Fan / Washroom / EF-2	No information available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Fan / Pumphouse / EF-1	Enertech	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Louver / Pumphouse / L-1	400x400 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper / Pumphouse / C-1	400x400 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Fan / Pumphouse / EF-2	Enertech	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Exhaust Louver / Pumphouse / L-1	400x400 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Motorized Damper / Pumphouse / C-1	400x400 / 283 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Unit Heater / Pumphouse / UH-1	Modine / / PDP 75AE0130 / 60000 BTU / 120V/60Hz/1pH/3.3Amps	Appeared to be in good working order	Reaching near the end of service life	Good	Minor	Replace with new unit	Low	$4,500	2
Unit Heater / Pumphouse / UH-2	Modine / / PDP 75AE0130 / 60000 BTU / 120V/60Hz/1pH/3.3Amps	Appeared to be in good working order	Reaching near the end of service life	Good	Minor	Replace with new unit	Low	$4,500	2
Furnace / Pumphouse / FUR-1	KeepRite	Appeared to be in good working order	Reaching near the end of service life	Good	Minor	Replace with new unit	Low	$5,500	2
Supply Diffusers / D-1	200Ø & 250Ø / 130 - 170 L/s	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Furnace Supply Ducts	Size Varies	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Water Closet / Washroom	Porciline	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Lavatory / Washroom	Porciline	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Water Heater / Office	Space Saver / 65L	Appeared to be in good working order	Reaching near the end of service life	Good	Minor	Replace with new unit	Low	$2,500	2
Double Bowl Sink / Office	Stainless Steel	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Mop Sink Basins / Pumphouse	Plastic	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Hose Bibbs / Pumphouse and Exterior	No model or serial numbers visible	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Eyewash Station / Pumphouse / EW-1	Haws	There is no tempered water that would be required with a safety shower	There are chemicals being used nearby and the safety shower requires tempered water to meeting the CSA standard.	Requires Attention	Significant	Add a tempering valve and hot water tank with sufficient volume to supply the required flow of tempered water to the shower/eyewash stn.	High	$15,000	1
Roof Drains / Pumphouse	Not Available	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Drainage piping	PVC	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Building services water piping	mix of copper, black iron and galvanized	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Natural Gas piping	Carbon steel painted	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Diesel Fuel Tank / Generator Room	Steel / Westeel / C-508024 / 1135 L	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5
Sample sink	Plastic	Appeared to be in good working order	No issues noted.	Good	Minor	None at this time	Low	N/A	5

APPENDIX C
Structural Condition Assessment Tables

Lloydminster Water Master Plan - Water Treatment Assessment
Appendix C - Structural Condition Assessment Table

Discipline : Structural
Assessment Date : October 2022
Assessment Complete by : Marc Bourassa (ISL)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw Water Pipeline									
Roof Structure	38mm Metal Roof Deck (Galvanized and Painted), Open Web Steel Joists. Steel channel framing at deck penetrations and equipment.	Structure is performing adequately with no signs of significant deterioration or distress.	Roofing is design from a Snow Load of 1.2kPa. Current NBC would require additional snow load and increased load factors (importance factor). High exposure and limited opportunity for drifting will limit snow accumulation.	Good	Minor	ISL recommends that loading should be reviewed in coordination with a future re-roofing project. Reduction in gravel ballast may result in excess capacity.	Low	$5,000	2
Roof access and Fall Protection	Painted steel ladder with cage. No fall protection in place on roof surface.	Ladder and cage structure in fair condition with some signs of minor rust and need to repainting soon.	While ladder has a cage, it travels 9.6m (31'-6") in a straight run with no fall protection in place. As installed was prior to 1986, this meets OH&S standards but not current best practice, which recommends platforms at intervals of at least 6m or be equipped with a personal fall arrest system (vertical traveller). No fall protection is present on the roof surface.	Requires Attention	Minor	ISL recommends that the ladder be replaced with a new galvanized steel ladder complete with vertical traveller for use with a fall arrest harness. Fall arrest posts should be placed to allow full travel of the roof surface for maintenance. This should be performed as part of a future re-roofing project.	Low	$20,000	2
Wall Structure	Cast-in-place 250mm concrete wall from main to roof structure. Includes corbel for bridge crane.	Structure is performing adequately with no signs of significant deterioration or distress.	Minor shrinkage cracking present but does not present structural concerns.	Good	Minor	None at this time.	Low	N/A	5
Main Floor Slab	Cast-in-place 400mm structural slab over wet wells and backfill beyond extent the extent of water retaining structures below.	Structure is performing adequately with no signs of significant deterioration or distress.	No significant issues or concerns. See comments in Building Envelope for coating recommendations.	Good	Minor	None at this time.	Low	N/A	5
Concrete Foundation and Wet Wells	Cast-in-place concrete raft footing and walls.	Interior of wet wells not reviewed. Operators present did not have concerns with current conditions.	Foundation concrete is currently 41 years old. While operators mention it is in good condition, given the critical nature of the facility a full engineering review of wet wells is recommended in the near future.	Requires Attention	Significant	ISL recommends that a full engineering review of wet wells is completed using divers.	High	$50,000	2
Misc. Steel Pipe Supports	Painted steel	Paint failure common on baseplates and wet areas.	Corrosion is decreasing cross sectional area of steel members.	Requires Attention	Reasonable	ISL recommends supports properly prepared and re-coated with replacement potential required at some locations.	Medium	$10,000	2
Mezzanine Structure	Cast-in-place concrete slab on steel structure.	Structure is performing adequately with no signs of significant deterioration or distress.	Access to mezzanine is via steel ladder to opening in perimeter guardrail.	Requires Attention	Minor	Safety chains with snap hooks should be present at the guardrail opening.	Low	$1,000	1
Cenovus Raw Water Pumphouse									
Roof Structure	38mm Metal Roof Deck, steel channel purlins and wide flange steel beams. Steel channel framing at deck penetrations and equipment.	Structure is performing adequately with no signs of significant deterioration or distress. Structural drawings indicate dead, snow and crane loads.	No issued noted.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Roof access and Fall Protection	No permanent access or fall protection in place.	Access to roof is with portable extension ladder.	City and/or contractors responsible for temporary fall protection measures when access required.	Requires Attention	Minor	None at this time.	Low	N/A	5
Wall Structure	Load bearing 190mm Concrete Unit Masonry walls.	Structure is performing adequately with no signs of significant deterioration or distress. Walls are detailed with control joints and sitting on concrete curb which provides protection from moisture at base.	Where the 500 dia pipe goes through the south wall, there is some mortar cracking in the wall. It appears some thrust in the pipe is loading the wall. While major failure is unlikely, the cracking will decrease durability and capacity of the wall. Block coursing and control joint detail at the doors is unusual and does not match drawings but appears to be performing adequately.	Requires Attention	Minor	ISL recommends that a full engineering review of the pipe supports in this area be completed to determine if and how the pipe can be restrained.	Low	$15,000	2
Main Floor Slab and Foundation	Cast-in-place slab on grade with an thickened edge	Structure is performing adequately with no signs of significant deterioration or distress. A thickened slab shallow foundation is unusual for a masonry structure due to potential of differential movement and cracking.	Minor cracking in slab present but is not impacting performance.	Good	Minor	None at this time.	Low	N/A	5
Exterior Structures - Vault #1	Cast-in-place buried vault with wood framed enclosure at surface.	Enclosure structure is serviceable. Concrete structure is performing adequately with no signs of significant deterioration or distress.	Miscellaneous steel access ladders and pipe supports are showing signs of rust. Condition and purpose of vaults assessed and discussed further in Process Assessment Tables.	Requires Attention	Minor	ISL recommends steel elements be prepared and painted.	Low	$5,000	2
Water Treatment Plant									
Roof Structure	38mm Metal Roof Deck (Galvanized / Painted), open web steel joists and steel beams. Steel channel framing at deck penetrations and equipment.	Structure is performing adequately with no signs of significant deterioration or distress.	Roofing is design from a Snow Load of 1.44kPa plus drifting. Current NBC would require additional snow load and increased load factors (importance factor).	Good	Minor	ISL recommends that loading should be reviewed in coordination with a future re-roofing project. Reduction in gravel ballast may result in excess capacity.	Low	$5,000	2
Roof Structure	Paint to underside of roof deck	Peeling paint at some deck located noted, specifically boiler room.	Paint failure likely due to compatibility issue between deck galvanized surface, coating and plat humidity.	Requires Attention	Minor	No action required. Interior condition presents little risk to exposed deck. Paint if desired for aesthetics.	Low	N/A	5
Roof access and Fall Protection	No fall protection in place.	Access to roof is from door on high roof or with portable extension ladder to lower levels.	City and/or contractors responsible for temporary fall protection measures when access required.	Requires Attention	Minor	ISL recommends that control zone markers be installed at 2m from the roof edge and fall arrest posts provided for any permanent equipment which requires maintenance inside this zone. This should be performed as part of a future re-roofing project.	Low	$100,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
2nd Floor (Grids H-J, 4-7)	200mm one-way concrete slab (conventionally reinforced) supported by concrete beams and columns	Structure is performing adequately with no signs of significant deterioration or distress.	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Main Floor	200 - 250mm one-way concrete slab (conventionally reinforced) supported by concrete beams and columns unless noted otherwise	Structure is performing adequately with no signs of significant deterioration or distress.	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Main Floor	Removable pre-cast floor panels over lower level pump room	Structure is performing adequately with no signs of significant deterioration or distress.	No issues identified. Underside not visible due to acoustic material.	Good	Minor	None at this time.	Low	N/A	5
Overhead Crane (Filters)	Electrically operated crane. 3 ton capacity	Crane performing as intended. Inspection are completed on an annuals basis	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Mezzanine (above Control / Electrical Room)	Space occupied by duct work, cable tray and crane	Space appears to be not constructed for occupancy. No permanent access or fall protection in place.	City and/or contractors responsible for temporary fall protection measures when access required.	Requires Attention	Minor	None at this time.	Low	N/A	5
Basement - Chemical Feed Area Floor	350mm two-way concrete slab (conventionally reinforced) supported by concrete piers and footings.	Structure is performing adequately with no signs of significant deterioration or distress.	No issues identified. Underside not visible due to acoustic material.	Good	Minor	None at this time.	Low	N/A	5
Basement - Lower Pump Room Floor	300mm one-way concrete slab (conventionally reinforced) supported by concrete beams and columns	Structure is performing adequately with no signs of significant deterioration or distress.	No issues identified. Underside not visible due to acoustic material.	Good	Minor	None at this time.	Low	N/A	5
Basement - Lower Pump Room 600 dia Header Concrete Pipe Supports	Concrete pipe supports under 600 dia header.	Concrete supports have cracked at two locations.	Supports may no longer be able to support thrust from pipe.	Requires Attention	Reasonable	Install additional or new pipe supports designed to resist loads.	Medium	$20,000	2
Basement - Lower Pump Room Clear Well Access Hatch	10mm steel cover	Original construction. Cover is heavy and difficult to operate (no lift aids)	No seal on cover, heater above which could leak contaminants into clear well. Hatch was replaced shortly after review.	Good	Minor	None at this time.	Low	N/A	5
Sub-basement Tanks	Concrete water retaining tanks (wet well/clearwell/backwash)	Not accessible	Unknown if construction has been review since construction.	Requires Attention	Reasonable	ISL recommends that structure be reviewed using divers to confirm condition.	Medium	$40,000	2
Sub-basement - Sludge Pump Room	Exposed Concrete Walls	Cracking visible in numerous locations including mineral deposits on the wall and ceiling.	This the backside of the clarifier structure.	Requires Attention	Reasonable	ISL recommends that entire clarifier concrete structure be reviewed when it can be taken off-line.	Medium	$10,000	2
Clarifier and Filter Pit	Concrete Tanks	Not accessible	Unknown if construction has been review since construction.	Requires Attention	Reasonable	ISL recommends that entire clarifier concrete structure be reviewed when it can be taken off-line.	Medium	$20,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Chlorine Storage/Feed Room	Concrete floor/ceiling with CMU walls. Access from corridor.	Structure is performing adequately with no signs of significant deterioration or distress.	Water security agency has flagged that chlorine rooms do not meeting EPB 265.	Requires Attention	Reasonable	Conduct code and engineering study to confirm Chlorine requirements. Likely will result in access addition (exterior corridor) and upgrades to interior wall systems and mechanical / electrical aspects.	Medium	$295,000	2
Overhead Crane (Chlorine Storage)	Monorail with 2 ton capacity. Used in conjunction with electrically operated winch.	Crane performing as intended. Inspection are completed on an annuals basis	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Exterior Structures	PVC Waterstops for future connection	Waterstops are exposed with wood boxes built around for protection.	Wood boxes are deteriorated and loose, PVC may deteriorate	Requires Attention	Minor	Rebuild protective boxes and fasten to foundation wall.	Low	$2,000	2
Exterior Structures	Exterior Concrete Stairs (2 locations) on south side of building	Landings appear short and no handrails are presents.at one location.	Non-code compliant. Nosing inserts are rusting.	Requires Attention	Minor	ISL recommends that stairs be removed and replaced as part of a future renovation.	Low	$20,000	3
Exterior Structures	Exterior Loading Dock Structure	Steel components (column baseplates, stair railings and nosings) are rusting.	Continued corrosion could lead to failure of components	Requires Attention	Minor	ISL recommends steel elements be prepared and painted.	Low	$10,000	2
Exterior Structures - Vault #5	Cast-in-place buried vault with wood framed enclosure at surface.	Enclosure structure is serviceable. Concrete structure is performing adequately with no signs of significant deterioration or distress.	Miscellaneous steel access ladders and pipe supports are showing signs of rust. Condition and purpose of vaults assessed and discussed further in Process Assessment Tables.	Requires Attention	Minor	ISL recommends steel elements be prepared and painted.	Low	$5,000	2
Code Compliance	Building originally construction to 1975 National Building Code of Canada.	Numerous egress, exiting, stair, fire ratings, fire separations and mezzanine Code deficiencies are suspected throughout the facility. Reference 2022 Kasian Report.	Significant renovations could require upgrades to current NBC. Code requirements based on safety and should be confirmed.	Requires Attention	Reasonable	ISL recommends a code review be completed to by a specialist to confirm a list of non-compliant Building Code requirements.	Medium	$24,000	1
Architectural Finishes	Painting, flooring, millwork, doors and hardware.	Materials are generally services but at or beyond life expectancy. Reference 2022 Kasian Report.	Finishes are primarily aesthetic; however, do provide protection to structure, ensure health, safety and security of occupants.	Requires Attention	Minor	ISL recommends that finishes be renewed as budgets permit and in coordination with upgrades to equipment and function. Refer to 2022 Kasian Report	Low	$285,000	3
Westend Reservoir									
Roof Structure	38mm Metal Roof Deck (Galvanized), open web steel joists. Steel channel framing at deck penetrations and equipment.	Structure is performing adequately with no signs of significant deterioration or distress. Design loads not indicated on the drawings.	Interior structural steel is only primed with red oxide primer. No paint. Suitable for interior conditions but important moisture and humidity continue to be managed appropriately.	Good	Minor	None at this time.	Low	N/A	5
Roof access and Fall Protection	No permanent access or fall protection in place.	Access to roof is with portable extension ladder.	City and/or contractors responsible for temporary fall protection measures when access required.	Requires Attention	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Wall Structure	Load bearing 190mm Concrete Unit Masonry walls.	Structure is performing adequately with no signs of significant deterioration or distress. Walls are detailed with control joints and sitting on concrete curb which provides protection from moisture at base.	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Main Floor Slab	Cast-in-place 250-350mm structural slab with dropped beams span over the reservoir below the pumphouse.	Structure is performing adequately with no signs of significant deterioration or distress. Design live loads are noted as 12.0kPa which is appropriate for a facility of this nature.	No significant issues or concerns. See comments in Building Envelope for coating recommendations.	Good	Minor	ISL recommends that a full engineering review reservoir interior take place around 25 years into the reservoir life-cycle (2031).	Low	$30,000	4
Floor Hatches	Bilco style (Type K) floor hatches exist at four locations.	While hatches are in good condition, operators noted that hatches are not water tight and have been noted by SWSA as deficient.	Hatches not water tight. Cast in curb which provides some surface protection. Hatch was replaced shortly after review.	Good	Minor	None at this time.	Low	N/A	5
Mezzanine Structure	2x6 Treated Wood Joists spanning to CMU walls over office and generator room	Structure is performing adequately with no signs of significant deterioration or distress. Design live loads are not noted on the drawings however area is not normally accessible.	Access may be required for mechanical maintenance. Temporary guardrails will be required. Unclear if a fire rating is required between the generator room and the balance of the pumphouse. Single layer of 16mm type X gypsum wall board provided on underside of joists.	Requires Attention	Reasonable	ISL recommends a desktop code review be completed to ensure generator room meets Building Code requirements.	Medium	$5,000	2
Overhead Crane	2 tonne capacity monorails with manually operated winch.	Crane performing as intended. Inspection are completed on an annuals basis	No issued noted.	Good	Minor	None at this time.	Low	N/A	5
Exterior loading dock slab	Cast-in-place 250mm structural slab on void supported by a perimeter grade beam on piles.	Surface deterioration present across the slab from heavy salting and freeze thaw damage. Damage to corner grade beam from vehicle impact repaired. No bumpers and vehicle stops present. Steel grating stairs appear to be installed after original construction as a concrete stair shown on the original drawings is not present.	Life cycle of structural slab will be limited due to corrosion of rebar and freeze thaw damage. Stairs do not appear to be engineered.	Requires Attention	Reasonable	ISL recommends the installation of vehicle bumpers and bollards at loading dock or ground mounted curbs to avoid impact with structure. Cracks and surface in existing slab should be sealed with a polyurethane membrane to extend life. Install code compliant steel stairs.	Medium	$25,000	2
Masonry retaining wall	"Allan block" style construction.	Wall is performing poor which numerous toppled blocks. Causing damage at building foundation cladding.	Causing damage at building foundation cladding. Continued deterioration likely. Suspect that wall was not building to specifications.	Poor	Minor	ISL recommends wall be re-built according to spec, or replaced with concrete retaining wall and coordination with new stair or ramp, or be remove and area re-graded.	Medium	$15,000	3
Office millwork countertops	Laminate Construction	Veneer strips loose.	Loose veneer, especially near sink can cause failure of the countertops.	Requires Attention	Minor	ISL recommends re-gluing veneer.	Low	$500	1

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Old Reservoir	Cylindrical (40m dia x 7.5m deep) concrete reservoir. Constructed in 1970. Unknown if drawings exist. 2010 Evaluation report from Stantec reviewed.	Interior or roof not accessible. Visual review and sounding with concrete hammer from ground level.	Stantec report estimated 50 year life expectancy (2020) with structure in poor to fair condition. No known upgrades completed since 2010. Micro-cracking present and evidence of seepage/mineral deposits on exterior face. Stantec report noted poor concrete conditions in interior walls and roof slab.	Poor	Reasonable	Due to age and condition, plan to demolish the circular reservoir in the next 5 to 10 years	High	$150,000	3

APPENDIX D
Building Enclosure
Condition Assessment Tables

Discipline : Building Enclosure
Assessment Date : October 2022
Assessment Complete by : Ben Toornstra (ISL)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw Water Pipeline									
Roof Assembly	Built up roof assembly	ISL observed the building drawings to identify the roofing assembly, from top to bottom to be; Gravel, 75mm rigid Styrofoam insulation, 4 ply built-up roof, 75mm rigid fibreglass insulation, permastop vapour barrier, 38mm metal deck. Given this review was visual only, ISL was only able to visually observe the gravel ballast, and the rigid Styrofoam insulation on a small area where ISL cleared away the gravel ballast. The client noted that there have been no reported leaks.	Built-up roof assemblies that are protected by insulation and gravel are typically very robust roofs and can have long life spans. This roof is believed to be approximately 41 years old which is past most typically estimated life spans for built up roofs (20 - 40 years). Despite its age, there is no indication that this roofing assembly has failed.	Requires Attention	Minor	Given the age of the roof, ISL recommends that an invasive investigation be performed on the roof so that the membrane can be visually reviewed. Depending on the condition of the membrane, the subsequent recommendation will be to leave the roof in place for an extended period of time, or replace the roof in the near future. The cost estimate that ISL has provided is a placeholder for an investigation. ISL recommends that this investigation be performed simultaneously with the other roof investigations discussed within this assessment. **The displayed estimate is for the investigation only.**	Low	$8,250	2
Roofing Penetrations	Sealant and flashings at roofing penetrations	ISL observed a small number of roofing penetrations with deteriorated and failed sealant.	Failing penetrations are a common location where water may enter a roofing assembly.	Poor	Minor	ISL recommends that the penetrations be re-sealed. This is a low-cost item that can be performed to reduce the probability of water entering the roofing assembly.	Medium	$3,300	1
Parapet Flashing	Painted metal flashing that is installed over the roof parapet	ISL observed the metal parapet flashing to have the paint worn off at most locations. Multiple missing fasteners were also observed on the exterior of the flashing. The client reported to ISL that one piece of flashing had previously blown off of the building and had to be re-installed.	The flashing is aging and the attachment of the flashing to the building is suspect.	Poor	Minor	ISL recommends that a new flashing be installed around the perimeter of the roof. Replacing the flashing should be done after the roof assembly investigation is performed. If a roof replacement is occurring in the near future, the flashing replacement can be incorporated into that overall project.	Medium	$26,400	2
Exterior Concrete Block	Exterior wall assembly clad in concrete block	ISL observed the building drawings to identify the masonry wall assembly, from interior to exterior to be; 250mm concrete wall, adhesive vapour barrier, 75mm rigid insulation, air space, 100mm concrete block. ISL observed the masonry block cladding and noted it to be in reasonably good condition. Weeping holes were observed installed at every 3rd block at the base of wall. No control joints were observed in the masonry wall. Isolated locations were observed where a concrete block has cracked or mortar joints have cracked.	Isolated cracked blocks and mortar joints can be a source of moisture and pest entry and lead to further deterioration.	Requires Attention	Minor	ISL recommends the client re-point mortar joints which have cracked, as well as replace or repair any blocks which have significantly cracked.	Low	$13,200	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Exterior metal cladding	Exterior wall assembly clad in metal.	ISL observed the building drawings to identify the metal wall assembly to be similar to the masonry assembly, but with the masonry cladding replaced with metal vertical girts and 38mm metal cladding.	No concerns were observed with the metal cladding.	Good	Minor	None at this time.	Low	N/A	5
Sealant	Exterior sealant at various transitions and penetrations	ISL observed various failed or poorly detailed sealants at penetrations, fenestrations, and transitions from masonry to metal cladding.	Poorly detailed or failed sealant joints can be a source of moisture and pest entry and lead to further deterioration.	Poor	Minor	ISL recommends a sealant replacement project occur on the exterior of the building.	Medium	$16,500	2
Fenestrations	Two man doors and one large overhead door	ISL observed two man doors and one large overhead door. The doors appeared to be in reasonable condition. Small gaps around door perimeters were observed, which is expected for doors in buildings of this nature. ISL observed some minor damage and punctures on the interior of the metal panel of the overhead door.	The issues identified are relatively minor.	Good	Minor	No recommendations are made at this time. If an exterior remediation is performed where new doors are installed, robust metal doors with robust weatherproofing should be installed.	Low	N/A	5
Insulation In Vent	Insulation in vent	ISL observed some rigid insulation board on the interior of the large vent on the west elevation.	It is unclear where this insulation came from and should be investigated.	Requires Attention	Minor	ISL recommends the client investigates where this insulation came from and if building repairs are required. The cost estimate that ISL has provided is a placeholder for an investigation, but this task is something the client may wish to do internally.	Low	$8,250	2
Interior Slab Coating	Interior slab coating	ISL observed the remnants of an interior slab coating which has been mostly worn off. ISL also observed some small "troughs" adjacent to the concrete house keeping pads which may collect water and lead to deterioration.	The slab appears to be performing well even with a deteriorated coating.	Good	Minor	If a new coating is desired, the client should also address the upturn conditions and small "troughs" adjacent to house keeping pads.	Low	N/A	5
Small Building Adjacent to the Pumphouse (Metering Vault / Building)	Small Building Adjacent to the Pumphouse	ISL observed a small building adjacent the pumphouse. The building appears to be constructed of insulated metal panels, although an invasive investigation would have to be performed to confirm this. Various concerns were observed with the building including: - Poorly sealed penetrations. - Unsealed interior penetrations through the air barrier. - Deteriorated rigid insulation around the foundation of the building. - The base of wall flashing was observed to be back-sloped, directing water towards the building.	The building assemblies are in poor condition, although this does not appear to be negatively affecting the operation of the building at this time.	Poor	Reasonable	Given the small size of this building, maintaining and repairing the building may not prove to be cost effective. ISL recommends the client monitor the building, and if other concerns such as leaks or operation issues present themselves, then the entire building can be replaced.	High	$33,000	3

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Thermal Performance	Thermal performance	Based upon the provided drawings, the approximate R-value of the existing roof is R-30, and the approximate R-value of the typical wall assembly is R-15. Various factors that are currently unknown such as methods of fastening insulation can greatly affect the effective R-value. The provided approximate R-values are based solely on the expected R-value of the insulation present in the assemblies. For comparison sake, the prescriptive R-values provided in the NECB (National Energy Code of Canada) 2017 is R-41 for roofs, and R-27 for walls. These values are provided for comparison sake only as the existing building does not need to comply with the modern NECB requirements. Given the age and use of the building, it is ISL's opinion that the existing R-values provide a reasonable level of thermal performance.	N/A	Good	Minor	ISL recommends that if a re-roof or re-clad is planned for, then insulation upgrades be considered at that time.	Low	N/A	5
Cenovus Raw Water Pumphouse									
Roof Assembly	EPDM Roofing assembly	ISL observed the building drawings to identify the roofing assembly, from top to bottom to be; Gravel, separation sheet, 75mm rigid insulation, continuous waterproofing membrane, 13mm plywood sheathing, vapour barrier, 38mm metal deck. Given this review was solely visual, ISL was only able to visually observe the gravel ballast, and the separation sheet on a small area where ISL cleared away the gravel ballast. The client noted that there have been no reported leaks. ISL observed membrane upturns around the inside of the parapet to be EPDM membrane, implying that the primary roof membrane is also EPDM. The parapet cap flashings were observed to be correctly sloping towards the roof. The water was observed to drain through three scuppers at the rear of the building.	EPDM roof assemblies protected by insulation and gravel are typically robust as the ballast and insulation protects the membrane from punctures (which is a common cause of failure on EPDM roofs). This roof is believed to be approximately 23 year old which is within most typically estimated life spans for EPDM roofs (20 - 40 years). There is no indication that the roofing assembly has failed. Currently the downspouts will drain water from the scuppers drain adjacent to the building, onto splash pads, with some water appearing to drain onto the building.	Good	Minor	Given the positive performance to date, ISL does not recommend any repairs at this time. If a higher level of surety is desired, an invasive investigation could be performed along with the other roof invasive investigations recommended within this assessment. A minor item ISL recommends that the City add an additional piece of downspout at the three downspout locations to help direct water further away from the building. **The estimate displayed is for and inspection and the extension of the downspouts**	Low	$3,000	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Exterior metal cladding	Exterior wall assembly clad in metal.	ISL observed that the building drawings identify the metal wall assembly, from the interior to exterior to be; 190mm masonry blocks, 50mm thick rigid insulation with 50mm deep galvanized steel z-girts. ISL observed the metal cladding to be fastened with gasketed screws.	Other than typically expected aging and minor damage (such as the damaged base of wall flashing at one corner of the building), No concerns were observed with the metal cladding.	Good	Minor	None at this time.	Low	N/A	5
Sealant	Exterior sealant at various transitions and penetrations	ISL observed various failed or poorly detailed sealants at penetrations through the metal cladding. The sealant at the perimeter of doors appeared to be in good condition.	Poorly detailed or failed sealant joints can be a source of moisture and pest entry and lead to further deterioration.	Poor	Minor	ISL recommends a sealant replacement project occur on the exterior of the building.	Medium	$3,300	2
Fenestrations	A single swing and double swing man door	ISL observed two man doors. The doors appeared to be in serviceable condition. A significantly sized gap was observed at the base of one side of the double door which can be a source of water ingress or pests. It appeared a door sweep was once installed at this location, but may have been removed.	The issues identified are relatively minor.	Good	Minor	The client may consider installing robust door sweeps at the base of the doors.	Low	$1,000	2
Interior Slab Coating	Interior slab coating	The coating was observed to be in good condition with only small areas of damage.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Foundation Detailing	Plywood and insulation at the perimeter of the building	ISL observed rigid insulation installed around the perimeter of the building with plywood installed over the insulation. This insulation and plywood is partially above and partially below grade. The plywood appeared weathered. At isolated locations, the plywood was damaged which exposed the insulation. Where observed, the insulation also appeared weathered and damaged.	The insulation and plywood are in poor condition and plywood is generally not a suitable material to install in contact with the ground.	Poor	Minor	Although the plywood and insulation are in poor condition, it does not appear to be affecting the overall performance and usability of the building. ISL recommends that replacement only occur if significant further deterioration is observed or if the client is undertaking other significant exterior remediation projects. Replacing the foundation insulation can then be combined with other items as one large project to achieve some positive economies of scale.	Medium	N/A	3

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Thermal Performance	Thermal performance	Based upon the provided drawings, the approximate R-value of the existing roof is R-15, and the approximate R-value of the typical wall assembly is R-10. Various factors that are currently unknown such as methods of fastening insulation can greatly affect the effective R-value. The provided approximate R-values are based solely on the expected R-value of the insulation present in the assemblies. For comparison sake, the prescriptive R-values provided in the NECB (National Energy Code of Canada) 2017 is R-41 for roofs, and R-27 for walls. These values are provided for comparison sake only as the existing building does not need to comply with the modern NECB requirements. Given the age and use of the building, it is ISL's opinion that the existing R-values are lower than expected, but can provide an adequate level of thermal performance.	N/A	Good	Minor	ISL recommends that if a re-roof or re-clad is planned for, then insulation upgrades be considered at that time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Water Treatment Plant									
Roof Assembly	Built up roof assembly	ISL observed the building drawings to identify the roofing assembly, from top to bottom to be; Pea gravel, 75mm rigid Styrofoam insulation, 5 ply built-up roof, 75mm rigid fibreglass insulation, perm stop vapour barrier, 38mm metal deck. Given this review was solely visual, ISL was only able to visually observed the gravel ballast, and the rigid Styrofoam insulation on a small area where ISL cleared away the gravel ballast. ISL also observed the depth of the assembly at a drain location and the assembly appeared to generally match the architectural drawings. The client noted that there have been no reported leaks, with the exception of the one roof leak discussed below in its own section. ISL observed flashings covering building expansion joints. Parapet flashings were generally observed to be correctly sloped towards the roof. ISL observed the roof to generally slope to the interior roof drains. ISL observed one location where the roof parapet flashing was damaged and detached. ISL observed some exposed insulation where water may be pooling and observed the insulation to be deteriorating.	Built-up roof assemblies that are protected by insulation and gravel are typically robust roofs and can have long life spans. This roof is believed to be approximately 39 year old which is at or past most typically estimated life spans for built up roofs (20 - 40 years). Despite its age, there is no indication that this roofing assembly has failed.	Requires Attention	Minor	Given the age of the roof, ISL recommends that an invasive investigation be performed on the roof so that the membrane can be visually reviewed. Depending on the condition of the membrane, the subsequent recommendation will be to leave the roof in place for an extended period of time, or replace the roof in the near future. The cost estimate that ISL has provided is a placeholder for an investigation. ISL recommends that this investigation be performed simultaneously with the other roof investigations discussed within this assessment.	Low	$8,250	2
Roof Assembly	Roof leak	A single roof leak was reported by the client near the front entry in the office space/board room area. Efforts have been made to seal the leak by installing sealant and liquid applied membranes on the roof surface and flashings.	Attempting to "face seal" a roof leak on a roof assembly like this will rarely achieve a robust and long-term repair. UPDATE - This section of the roof was completely re-roofed in Septmeber 2024	Good	Minor	No recommendations are made at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Roofing Sealant and Flashings	Sealant and flashings at roofing penetrations	ISL observed the sealant at penetrations and flashings to be in variable conditions. Some appear to have been recently upgraded, whereas other sealant appears to be in poor condition.	Failing penetrations are a common location where water may enter a roofing assembly.	Poor	Minor	ISL recommends that the penetrations be re-sealed. This is a low-cost item that can be performed to reduce the probability of water entering the roofing assembly. ISL has also included repairing the damaged roof parapet flashing as part of this line item.	Medium	$8,250	2
Exterior Concrete Block	Exterior wall assembly clad in concrete block	ISL observed the building drawings to identify the masonry wall assembly, from interior to exterior to be; 150mm interior block, adhesive vapour barrier, 75mm rigid insulation, 25mm air space, 100mm concrete block. ISL observed the masonry block cladding and noted it to be in serviceable condition. Weeping holes were observed installed at every 32". ISL noted that some weep holes (as at the masonry cladding on the roof, and the weep holes above doors on the east face) have been sealed. Vertical control joints were observed in the masonry wall. Isolated locations were observed where mortar joints have cracked.	Isolated cracked blocks and mortar joints can be a source of moisture entry and lead to further deterioration. Blocked weeping holes can prevent the air space from acting as a pressure-equalized drained and vented cavity.	Requires Attention	Minor	ISL recommends the client re-point mortar joints which have cracked. The client should also consider removing the sealant which has been incorrectly installed over weep holes.	Low	$16,500	2
Exterior metal cladding	Exterior wall assembly clad in metal.	ISL observed the top portion of the wall to have metal cladding installed. It appears that the concrete block extends the full height of the wall and the metal cladding is just installed over the block as an architectural feature. The condition of metal cladding above the front entry was unclear, although it appears to solely be an architectural feature. ISL observed some damaged metal soffit near the building entry. ISL also noted the metal flashings located at the bottom of the metal cladding around the entire building to be poorly sloped and unsealed at laps. This has resulted in water draining onto the masonry wall at flashing joints, and staining the masonry. Some locations were observed where the flashing was missing altogether.	The staining on the masonry walls are unsightly and may lead to premature deterioration of the wall.	Requires Attention	Minor	Assuming replacement of the flashing is feasible without removing the metal cladding (This would be confirmed during the design development phase of a restoration project), ISL recommends that a new flashing is installed around the entire perimeter that is correctly sloped and sealed at joints. ISL also recommends new metal soffit is installed near the front entry where damaged/missing.	Low	$49,500	2
Sealant	Exterior sealant at various transitions and penetrations	ISL observed various failed or poorly detailed sealants at penetrations, fenestrations, and vertical masonry expansion joints.	Poorly detailed or failed sealant joints can be a source of moisture and pest entry and lead to further deterioration.	Poor	Minor	ISL recommends a sealant replacement project occur on the exterior of the building.	Medium	$16,500	2

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Drain Pipe	Drain pipe penetrating wall assembly	ISL observed a drain pipe extending through the wall assembly near the base of the wall. The drain pipe was observed only extending a small distance from the building face, causing wetting of the masonry veneer.	The ongoing wetting of the masonry veneer may lead to premature deterioration.	Requires Attention	Minor	ISL recommends the drain pipe be extended further from the wall to avoid ongoing wetting of the masonry veneer.	Low	$1,000	1
Fenestrations	Various man doors and an overhead door	ISL observed various man doors and an overhead door. The doors appeared to be in serviceable condition. Some doors were observed to have some peeling pink paint, whereas other doors appear to have been painted orange in recent years	The issues identified are relatively minor.	Good	Minor	No recommendations are made at this time.	Low	N/A	5
Curtain Wall	Curtain wall assembly around the front entry area	ISL observed curtain wall installed at the building. The curtain wall was observed to be in generally poor condition. ISL observed cracked and failed sealant, damage to beauty caps, openings at joints in the beauty caps, and deformed and broken beauty caps. No weep holes were observed in the beauty caps and it is unclear how the system is drained.	The curtain wall is in poor condition and is expected to be close to 40 years old.	Poor	Reasonable	ISL recommends the client do one of the following: 1 - Curtain wall renewal - The existing framing and IGU's would be maintained. The existing beauty caps and pressure plates would be removed and cleaned. New sealants, corner blocks, and butyl would be installed. Existing pressure plates would be re-installed with new thermal breaks and potentially new beauty caps. 2 - New curtain wall - A completely new curtain wall would be installed. This would be significantly more expensive than just a renewal, although would offer the opportunity to upgrade the thermal performance and aesthetic look of the curtain wall, as well as provide all new components as opposed to maintaining existing components. for the purpose of budgeting, ISL has provided a cost estimate for a completely new curtain wall. **The displayed estimate is for a new curtain wall**	High	$330,000	2
Interior Slab Coating	Interior slab coating	ISL observed the interior slab coating at various parts of the building to be in variable condition, with some areas worn off in high traffic locations.	The slab appears to be performing well without an interior coating.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Thermal Performance	Thermal performance	Based upon the provided drawings, the approximate R-value of the existing roof is R-30, and the approximate R-value of the typical wall assembly is R-15. Various factors that are currently unknown such as methods of fastening insulation can greatly affect the effective R-value. The provided approximate R-values are based solely on the expected R-value of the insulation present in the assemblies. For comparison sake, the prescriptive R-values provided in the NECB (National Energy Code of Canada) 2017 is R-41 for roofs, and R-27 for walls. These values are provided for comparison sake only as the existing building does not need to comply with the modern NECB requirements. Given the age and use of the building, it is ISL's opinion that the existing R-values provide a reasonable level of thermal performance.	N/A	Good	Minor	ISL recommends that if a re-roof or re-clad is planned for, then insulation upgrades be considered at that time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
West End Reservoir									
Roof Assembly	2-ply SBS roof assembly	ISL observed the building drawings to identify the roofing assembly, from top to bottom to be; Granular roof ballast, roof membrane, fibreboard, 100mm rigid insulation, air/vapour barrier membrane, 13mm gypsum leveling surface, 38mm metal roof decking. While on-site, ISL observed a conventional 2-ply SBS roofing membrane, with no granular roof ballast. The client noted that there have been no reported leaks. ISL observed significant amounts of degranulation on the roof, where the granules on the SBS cap sheet is wearing off of the roof. Degranulation will lead to the UV sensitive bituminous membrane becoming exposed. ISL also observed some ponding water on the roof at low points where the roof does not appear to adequately slope to drains. The roof has two interior roof drains which drain the water on the roof. The parapet cap flashings were observed to be correctly sloping towards the roof.	2-ply SBS roofing membranes are reasonably robust roofs. The roof assembly is believed to be approximately 16 years old. The lifespan for SBS roofing membranes are typically in the range of 25 - 35 years. The primary concern on this roof is the significant degranulation that has occurred. Eventually, the degranulation will lead to UV related degradation of the membrane and an increased risk of water ingress.	Requires Attention	Reasonable	ISL has split the possible actions into three options: 1 - "Do nothing" - Despite the degranulation, the roof is expected to still have a number of years of service life remaining. The client may choose to leave the roof as is and perform a complete replacement only once further issues (such as roof leaks or roof membrane damage) present themselves. 2 - "Overcoat" - The client may choose to overcoat the roofing surface with a liquid applied membrane to prevent future degranulation and protect the roof surface. This option will extend the expected life span of the roof. For budgeting purposes, this is the option that ISL used. 3 - "Complete replacement" - The client may choose to budget for a complete roof replacement in the future. Doing so will be the most expensive option but will prevent money from being spent on maintaining an aging asset. **The displayed estimate is for the application of an overcoat.**	Medium	$42,900	2
Roofing Penetrations	Sealant and flashings at roofing penetrations	ISL observed a small number of roofing penetrations with deteriorated and failed sealant. ISL also observed a "gum cup" penetration with missing sealer, allowing water to pool in the penetration.	Failing penetrations are a common location where water may enter a roofing assembly.	Poor	Minor	ISL recommends that the penetrations be re-sealed. This is a low-cost item that can be performed to reduce the probability of water entering the roofing assembly.	Medium	$3,300	1

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Exterior Concrete Block	Exterior wall assembly clad in concrete block	ISL observed the building drawings to identify the masonry wall assembly, from interior to exterior to be; core insulated concrete block, torch applied vapour barrier, 50mm rigid insulation, 12mm air space, 90mm split-faced concrete block. ISL observed the masonry block cladding and noted it to be in reasonably good condition. Weeping holes were observed installed at every 2nd block at the base of wall. At some locations, it appears a mortar joint was placed at the base of the wall which will partially block the weep holes. Vertical expansion joints were observed in the masonry wall. Isolated locations were observed where a concrete block has cracked or mortar joints have cracked. ISL observed isolated spots of corrosion on the split-faced block wall. This appears to be from small pieces of corroding metal within the block. The corrosion spots appear primarily aesthetic and do not appear to negatively affect the building's performance.	Isolated cracked blocks and mortar joints can be a source of moisture entry and lead to further deterioration.	Requires Attention	Minor	ISL recommends the client re-point mortar joints which have cracked, as well as replace or repair any blocks which have significantly cracked.	Low	$9,900	2
Exterior metal cladding	Exterior wall assembly clad in metal	ISL observed the top portion of the wall to have metal cladding installed. It appears that the split-faced concrete block extends the full height of the wall and the metal cladding is just installed over the block as an architectural feature.	No concerns were observed with the metal cladding.	Good	Minor	None at this time.	Low	N/A	5
Sealant	Exterior sealant at various transitions and penetrations	ISL observed various failed or poorly detailed sealants at penetrations, fenestrations, and vertical masonry expansion joints.	Poorly detailed or failed sealant joints can be a source of moisture and pest entry and lead to further deterioration.	Poor	Minor	ISL recommends a sealant replacement project occur on the exterior of the building.	Medium	$13,200	2
Fenestrations	A single swing and two double swing man doors	ISL observed three man doors. The doors appeared to be in serviceable condition.	No issues noted.	Good	Minor	None at this time.	Low	N/A	5
Interior Slab Coating	Interior slab coating	ISL observed the interior slab coating to be in mostly serviceable condition, with some isolated areas worn off in high traffic locations.	The slab appears to be performing well without an interior coating.	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Foundation Detailing	Flashing, plywood and insulation at the perimeter of the building	ISL observed the approximate exterior foundation assembly to be; exterior metal flashing, plywood, insulation, bituminous waterproofing or damp proofing installed on the concrete foundation wall. The foundation assembly is partially above and partially below grade. At isolated locations, the flashing and plywood was damaged which exposed the insulation.	The flashing, insulation and plywood are in poor condition and plywood is generally not a suitable material to install at grade.	Poor	Minor	Although the flashing, plywood and insulation are in poor condition, it does not appear to be affecting the overall performance and usability of the building. ISL recommends that replacement only occur if significant further deterioration is observed or if the client is undertaking other significant exterior remediation projects. Replacing the foundation assembly can then be combined with other items as one large project to achieve some positive economies of scale.	Medium	N/A	3
Thermal Performance	Thermal performance	Based upon the provided drawings, the approximate R-value of the existing roof is R-20, and the approximate R-value of the typical wall assembly is R-10. Various factors that are currently unknown such as methods of fastening insulation can greatly affect the effective R-value. The provided approximate R-values are based solely on the expected R-value of the insulation present in the assemblies. For comparison sake, the prescriptive R-values provided in the NECB (National Energy Code of Canada) 2017 is R-41 for roofs, and R-27 for walls. These values are provided for comparison sake only as the existing building does not need to comply with the modern NECB requirements. Given the age and use of the building, it is ISL's opinion that the existing R-values are lower than expected, but will provide an adequate level of thermal performance.	N/A	Good	Minor	ISL recommends that if a re-roof or re-clad is planned for, then insulation upgrades be considered at that time.	Low	N/A	5

APPENDIX E
Electrical
Condition Assessment Tables

Lloydminster Water Master Plan - Water Treatment Assessment
Appendix E - Electrical Condition Assessment Tables

Discipline : Electrical
Assessment Date : Site Visit - October 2022
Assessment Complete by : Ryan Kjorlien (MagnaIV)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw Water Pipeine									
4160V Switchgear	REV Engineering 4760V 1200A 3-phase Serial M200057-01.001 May 2017 install 5 Sections: Main incomer / Breaker Section 3x 750hp Starters 1x Load break to 600V MCC	Good visual condition Normal operation is < 200A on 1200A service Duty/Duty/Standby	Multilin 469 Relay obsolete, but still supported long-term. (motor protection relay for 3 sections). City has shelf spare relay at this time.	Good	Minor	Recommend performing offline electrical maintenance of main switchgear on ~5 year cycles. This generally includes functional checks of breaker, relays, internal testing. Continue current IR monitoring. In long term (~10+ years), consider obtaiining more spare Multin 469 relays, or upgrading to current equivalent (869)	Low	$3,000	3
Neutral Grounding Resistor	Hubbel PowerOHM 4160V (2400 L-N) 96ohm 25A continuous 375C SN# 23888583	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
4160V:600V Transformer	Hammond 221203 300kVA 3 phase Delta-Wye	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
600V MCC	Square D Model 6 MCC Type 1 600A Horizontal 3P 4W 38797479-001 ~2017 install 3 Sections: 2x 150hp Breakers Misc. building loads HVAC/crane	Good visual condition	No issues noted	Good	Minor	Continue IR monitoring. Recommend performing offline maintenance on ~5 year cycles.	Low	$10,000	5
VFD's LLP VFD 101 / 102	150hp Stand-alone VFD (2 units)	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
208V Distribution	Panel: Westinghouse type NBA 125A 120/208V 3P 4W 125A Main breaker Primarily wall-mount conduit	Panel in fair visual condition 3 Spaces available Signs of aging and minor corrosion on conduit, no notable concerns.	Aging and minor corrosion	Good	Minor	None at this time.	Low	N/A	5
208V Distribution	Above-grade conduit	Fair visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Fire System	Notifier CFP Series Conventional	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	3
Lighting	Various Fluorescent-style LEDs	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Cenovus Raw Water Pumphouse									
600V MCC "Raw Water Supply Upgrade"	Square D Model 6 MCC Type 1A 12471555-001 600V1200A Horizontal 3P 3W	Two 200hp pumps operate duty/duty to deliver raw water to Cenovus. No redundancy in pumping or electrical distribution.	No issues noted	Good	Minor	Consider procurement of spare soft starter due to lack of redundancy Consider addition of IR windows to front of MCC. Consider offline maintenance in ~5 year cycles. Post single-line drawing on MCC.	Low	$80,000	5
208V Distribution	Federal Pioneer NHLP30AB 204V 100A	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Fire System	Single detector connected to PLC No horn strobe or pull-stations	Location lacks functional fire system. Single detector is used for alarming to remote location. Building is unoccupied pumphouse with no workers present during normal operation.	No issues noted	Requires Attention	Minor	Consider installation of fire system. Simple install for this building consisting of ~2-3 detectors, pull stations, horn strobe.	Low	$20,000	3
Lighting	Various Fluorescent-style LEDs	Good visual condition	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Water Treatment Plant									
600V MCC #1 Main Breaker & ATS Sections (Main Electrical Room)	Cutler Hammer Cat#ATVIMGF32000ESC 2000A 347/600V 3P 4W 100kA 2010 install Eaton ATC-500 ATS Controller Eaton Breakers Main/Emergency (2 total) Magnum DS w/ Digitrip	Line-up is recently retrofitted, undergoes monthly ATS testing. System has spare capacity ATS is operated monthly	No issues HVAC is undersized for electrical room	Good	Minor	Continue ATS/generator operational maintenance and IR testing. Consider main breaker de-energization and maintenance testing (primarily breaker testing)on 5 year intervals. Post Single Line drawing on MCC	Low	$10,000	5
600V MCC #1 - Feeder Sections (Main Electrical Room)	Main pumping distribution + misc. loads	Line-up is clean and in good condition, but is original installation, approaching 40 years in age.	System operates in ~12h cycles. Maximum outage time available is ~12h before serious process consequences. Replacement has many operational considerations due to outage restrictions, temp power, available space, and cabling requirements (if relocated, existing cable is bottom-exit through conduit embedded in flooring).	Requires Attention	Significant	MCC line-up is 38 years old, limited redundancy, and critical to process. Continue IR testing and consider MCC offline maintenance testing on 2 year intervals. Recommend planning for replacement of original MCC components in near future.	High	$400,000	2
Stand-alone VFD PWP 103 VFD (Main Electrical Room)	Vacon 200hp Drive	No issues noted with VFD High temperatures / heating issues due to limited ventilation / cooling.	No issues with VFD *(Heat created by VFD is beyond capability of electrical room HVAC* *Potential overheating, nuisance tripping, and long term failures.* *This issue noted independently)*	Good	Minor	None at this time.	Low	N/A	5
Stand-alone VFD (Clarifier)	Powerflex 753 22 A Drive	No issues noted	No issues	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
600V MCC #2 (2 Adjacent line-ups in upstairs electrical room)	Part I: 5 Sections Cutler Hammer CB1 F500 SN#826010 600A Part II: 2 Sections Cutler Hammer Unitrol CB1 F500 SN# 026313 600A Horizontal Misc. process, HVAC loads	Line-ups are clean and in good condition, but are original installation, approaching 40 years in age.	System operates in ~12h cycles. Maximum outage time available is ~12h before serious process consequences. Replacement has many operational considerations due to outage restrictions, available space, and cabling requirements (if relocated, existing cable is bottom-exit through conduit embedded in flooring).	Requires Attention	Reasonable	MCC line-up is 38 years old, limited redundancy, and critical to process. Continue IR testing and consider MCC offline maintenance testing on 2 year intervals. Recommend planning for replacement of original MCC components in near future.	Medium	$184,000	3
208V Distribution	Various equipment	5 Panel Locations Spares available	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Fire System	Kiddie VS Series Panel c/w 16 zone indicator (13 zones used) Kiddie Annunciator (Ops room)	Smoke/heat detectors are tested annually.	Fire detection is not present in large portions of the building.	Poor	Minor	Maintain annual device testing. Consider upgrading existing system. If modifications are performed to existing system, code compliance requires upgrades	Medium	$67,000	3
Lighting	Indoor - Predominately 8' Fluorescents Outdoor - Wallpack Fluorescents	Lighting is wired in series in at least some locations. Single light failure will result in multiple lights de-powering (stairwells noted by operator). Fluorescent bulbs noted to require high degree of replacement versus modern LED installed in other locations	Lighting is obsolete. Occupational sensors not installed. Emergency wall-packing not installed for safe exit during emergency. However, emergency generator restores power within ~20-30s.	Requires Attention	Minor	Recommend upgrading indoor fluorescent lighting to LED. Consider upgrading outdoor fluorescent lighting to LED. Recommend consideration of occupational sensors in select locations. Lighting upgrades are low criticality, but are relatively straight-forward, and have long-term operational cost reductions for replacements and power usage.	Low	$95,000	3
Emergency Generator	Cummins Diesel DFGB-A029W985 SN#J090047822 Spec A Standby 600kW 750kA 721A 600/347V Outdoor Skintight enclosure ~24h tank	Unit is tested monthly with full transfer, and annually serviced and load-tested. No operational concerns. Sized for ~full capacity of site.	No issues noted	Good	Minor	None at this time.	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
Misc. Electrical	N/A	Additional stand-alone VFD installed in electrical room adds heat beyond original design.	HVAC system is undersized for electrical room leading to equipment temperature alarms	Requires Attention	Reasonable	Improve ventilation for electrical room to prevent long term nuisance tripping and over-temperature equipment damage	Medium	Refer to HVAC Section	2
West End Reservoir									
600V MCC #1	Eaton Cutler Hammer Freedom 2100 MCC 600V 3-phase 4-wire 800A Horizontal Bus 42kA Bracing, 25kA SC 2005 Bottom entry, bottom feed	Good Condition System has spare capacity. Metered at ~210A peak demand on	No issues noted	Good	Minor	Consider addition of IR windows to front of MCC. Consider offline maintenance in ~5 year cycles. Post single-line drawing on MCC.	Low	$1,000	3
ATS (installed in MCC #1)	Cutler Hammer ATHMM830600EKC 600A 600V 3-Phase 4-Wire 2005	Unit is operated monthly.	LCD Display is failed.	Good	Minor	Consider addition of IR windows to front of MCC. Consider offline maintenance in ~5 year cycles. Post single-line drawing on MCC.	Low	$10,000	5
VFD's / Starters (installed in MCC #1)	75hp VFD's (2 motors) 75hp starter (2 motors) + misc.	No current issues	VFD VSP1 was noted to occasionally give 'F7 Saturation Alarm' prior to recent replacement. Saturation is generally related to internal overvoltage of the VFD (VFD failure), but could also be associated with noise or inadequate grounding.	Good	Minor	Optional - check grounding connections/continuity on VFD VSP-1/2.	Low	$2,000	5
208V Distribution	Panel: Eaton Pow-R-Line 275A w/ 125A main breaker Transformer: 600:208V 45kVA 3-phase floor-mount	Panel in good condition, several available spare breakers. Transformer aged, but good condition.	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Fire System	ETS Fire Shield Conventional	No issues noted	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Lighting	Various Fluorescent-style LEDs	No issues noted	No issues noted	Good	Minor	None at this time.	Low	N/A	5
Emergency Generator	Cummins 400kW (500kVA) Diesel DFCE-5741107 Indoor	Unit is tested monthly with full transfer, and annually serviced and load-tested. No operational concerns. Sized for full capacity of site. Prior to current louvre air filter installation, issues with dust/grit.	No issues noted	Good	Minor	None at this time.	Low	N/A	5

APPENDIX F
Instrumentation and Controls
Condition Assessment Tables

Lloydminster Water Master Plan - Water Treatment Assessment
Appendix F - Instrumentation and Controls Condition Assessment Tables

Discipline : Instrumentation and Controls
Assessment Date : Desktop Review - October 2022
Assessment Complete by : Maximilian Basler (MagnaIV)

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
River Pumphouse and Raw WaterPipeline									
Level Transmitters	Emerson Rosemount 5300	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Pressure Transmitters	Emerson Rosemount 3051S	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
HVAC Controls	AHU (Honeywell controller) and Gas Unit Heater	Locally controlled and hardwired HVAC system, No BMS installed or required. Visually looks well maintained and is operating correctly.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
PLC-701B Cabinet	Schneider M580 PLC	Newly upgraded system (2021). Control Cabinet clean, Wires clearly labeled, no damage inside the cabinet, spare parts in stock at site.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
PCP-701B Cabinet	-	Newly upgraded system (2021). Control Cabinet clean, Wires clearly labeled, no damage inside the cabinet, spare parts in stock at site.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Cenovus Raw Water Pump House									
FIT-703 Transmitter	Emerson Rosemount 8712C	Well maintained and recently inspected in 2021	Instrument is obsolete since 2004 and no spare parts are readily available. This flow meter is located on the output pipe to Cenovus and provides to the PLC values for control of the pumps and important metering information for reporting.	Requires Attention	Minor	Ensure regular maintenance is performed on the metering unit and look into ordering new replacement option for future. City is planning to replace the flowmeter in late 2024.	Low	33,000	1
Pressure Transmitters	Emerson Rosemount 3051S	Well maintained and recently inspected in 2021	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Pressure control valves	-	Visually looks well maintained and is operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
HVAC Controls	AHU and Gas Unit Heater	Locally controlled and hardwired HVAC system, No BMS installed or required. Visually looks well maintained and is operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
PLC-701C Control Cabinet	Schneider M580 PLC	Newly upgraded system (2021). Control Cabinet clean, Wires clearly labeled, no damage inside the cabinet, spare parts in stock at site.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Water Treatment Plant									
Level Transmitters	Greyline LIT25 & VEGA level sensor	Visually looks good.	No Issues						
Flow Meters	Sensus OMNI, Rosemount 3051S, ABB ProccessMaster 630 & FE FUJI FLV	Visually looks good. Some devices recently tested in 2021.	The FE FUJI FLV influent & effluent flow meters have been discontinued since 2009 and no spare parts readily available. These flow meters provide values to the PLC for control of the pumps and important metering information for reporting.	Requires Attention	Minor	Process Assessment identified that flowmeter are unreliable and inaccurate. Action established to replaced influent and effluent flowmeters within the next five year	Low	Refer to Process Assessment Tables	2
Pressure Transmitters	ABB 2600T	Visually looks good.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Pressure Switches	misc.	Visually looks good.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Residual Chlorine Analyzer	ATI A15/79	Visually looks good.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Clarifier Sludge Level Transmitter	Hach SC1000	Visually looks good.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Process PLC & RIO Control Cabinets	Schneider M580 PLC with RIO racks	Newly upgraded system (2021). Control Cabinet clean, Wires clearly labeled, no damage inside the cabinet, spare parts in stock at site.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5

Component / Area / Tag # / Name	Material / Make / Model / Capacity / Size	Visual Inspection / WTP Operator Comments	Issues	Condition	Consequence Rating	Actions	Risk	Cost Estimate	Priority
HVAC Control Cabinets	1x Schneider TAC Xenta 281 4x Schneider TAC Xenta 282 1x Schneider TAC Xenta 301	Cabinets visually look well maintained and clean. SCADA software looks straight forward and is operating with no obvious issues.	The Schneider TAC Xenta PLC product line has been discontinued as of Oct. 2018 and support & services are to end at the end of Dec. 2022. If BMS systems are lost and no alarm goes out to the operators the building HVAC systems will not operate correctly and in the winter this could cause pipes to freeze and damage equipment.	Requires Attention	Reasonable	Short term: Ensure regular maintenance checks and perform a backup of the controller programs every 1-2 years. Long Term: We recommend upgrading the HVAC controllers to a more current system which would involve updating the SCADA and PC as well.	Medium	$125,000	3
West End Reservoir									
Level Transmitters	Siemens Multranger 100	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Flow Meters	Krohne IFC 010D & IFM 4010 KC	Visually looks well maintained and operating correctly	Instrument discontinued by the manufacturer and no spare parts readily available. These flow meters are located on the influent pipe and effluent pipe and provide important reporting information for the plant as well as some controls for the reservoir.	Requires Attention	Minor	Ensure regular maintenance is performed on the metering units. City is planning to repalce these flowmeters within the next 5 years.	Low	$66,000	2
Pressure Transmitters	ABB 2600T series	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Residual Chlorine Analyzer	ATI Q45H	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
Sluice Gate Actuators	Rotork IQ13 sized actuators	Visually looks well maintained and operating correctly	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
HVAC Controls	AHU and Gas Unit Heater	Locally controlled and hardwired HVAC system, No BMS installed or required.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5
PLC Control Cabinet	Schneider M580 PLC	Newly upgraded system (2021). Control Cabinet clean, Wires clearly labeled, no damage inside the cabinet, spare parts in stock at site.	No Issues	Good	Minor	No recommendations at this time	Low	N/A	5

APPENDIX G
Condition Assessment
Cost Estimate / Forecast Tables

Table 1: Process Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$26,000	$5,000	$155,000	$65,000	$0
Medium	$1,000	$465,000	$455,000	$0	$0
High	$810,000	$380,000	$1,880,000	$380,000	$40,000,000
Total	$837,000	$850,000	$2,490,000	$445,000	$40,000,000
Cenovus Raw Water Pumphouse					
Low	$0	$12,000	$0	$0	$0
Medium	$0	$262,100	$125,000	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$274,100	$125,000	$0	$0
Raw Water Reservoir					
Low	$0	$150,000	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$150,000	$0	$0	$0
Water Treatment Plant					
Low	$46,000	$129,000	$30,000	$0	$0
Medium	$7,500	$1,074,000	$345,000	$0	$0
High	$125,000	$710,000	$0	$0	$0
Total	$178,500	$1,913,000	$375,000	$0	$0
West End Reservoir					
Low	$500	$15,000	$0	$0	$0
Medium	$0	$0	$50,000	$0	$0
High	$0	$0	$0	$0	$0
Total	$1,000	$15,000	$50,000	$0	$0
Total Water Infrastructure					
Low	$72,500	$311,000	$185,000	$65,000	$0
Medium	$8,500	$1,801,100	$975,000	$0	$0
High	$935,500	$1,090,000	$1,880,000	$380,000	$40,000,000
Total	$1,016,000	$3,202,100	$3,040,000	$445,000	$40,000,000

Table 2: Building Mechanical Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$0	$0	$17,500	$1,500	$0
Medium	$500	$350,000	$1,500	$0	$0
High	$0	$0	$0	$0	$0
Total	$500	$350,000	$19,000	$1,500	$0
Cenovus Pump House					
Low	$0	$0	$0	$10,000	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$0	$10,000	$0
Water Treatment Plant					
Low	$2,800	$48,800	$241,400	$314,500	$0
Medium	$12,250	$70,500	$80,000	$0	$0
High	$77,000	$902,500	$0	$0	$0
Total	$92,050	$1,021,800	$321,400	$314,500	$0
West End Reservoir					
Low	$0	$17,000	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$15,000	$0	$0	$0	$0
Total	$15,000	$17,000	$0	$0	$0
Total Water Infrastructure					
Low	$2,800	$65,800	$258,900	$326,000	$0
Medium	$12,750	$420,500	$81,500	$0	$0
High	$92,000	$902,500	$0	$0	$0
Total	$107,550	$1,388,800	$340,400	$326,000	$0

Table 3: Structural Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$1,000	$25,000	$0	$0	$0
Medium	$0	$10,000	$0	$0	$0
High	$0	$50,000	$0	$0	$0
Total	$1,000	$85,000	$0	$0	$0
Cenovus Raw Water Pumphouse					
Low	$0	$20,000	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$20,000	$0	$0	$0
Water Treatment Plant					
Low	$0	$122,000	$305,000	$0	$0
Medium	$24,000	$385,000	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$24,000	$507,000	$305,000	$0	$0
Westend Reservoir					
Low	$500	$0	$0	$30,000	$0
Medium	$0	$30,000	$15,000	$0	$0
High	$0	$0	$150,000	$0	$0
Total	$500	$30,000	$165,000	$30,000	$0
Total Water Infrastructure					
Low	$1,500	$167,000	$305,000	$30,000	$0
Medium	$24,000	$425,000	$15,000	$0	$0
High	$0	$50,000	$150,000	$0	$0
Total	$25,500	$642,000	$470,000	$30,000	$0

Table 4: Building Enclosure Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$0	$29,700	$0	$0	$0
Medium	$3,300	$42,900	$0	$0	$0
High	$0	$0	$33,000	$0	$0
Total	$3,300	$72,600	$33,000	$0	$0
Cenovus Raw Water Pumphouse					
Low	$0	$4,000	$0	$0	$0
Medium	$0	$3,300	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$7,300	$0	$0	$0
Water Treatment Plant					
Low	$1,000	$74,250	$0	$0	$0
Medium	$0	$24,750	$0	$0	$0
High	$0	$330,000	$0	$0	$0
Total	$1,000	$429,000	$0	$0	$0
West End Reservoir					
Low	$0	$9,900	$0	$0	$0
Medium	$3,300	$56,100	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$3,300	$66,000	$0	$0	$0
Total Water Infrastructure					
Low	$1,000	$117,850	$0	$0	$0
Medium	$6,600	$127,050	$0	$0	$0
High	$0	$330,000	$33,000	$0	$0
Total	$7,600	$574,900	$33,000	$0	$0

Table 5: Electrical Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$0	$0	$3,000	$0	$10,000
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$3,000	$0	$10,000
Cenovus Raw Water Pumphouse					
Low	$0	$0	$20,000	$0	$80,000
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$20,000	$0	$80,000
Water Treatment Plant					
Low	$0	$0	$95,000	$0	$10,000
Medium	$0	$0	$251,000	$0	$0
High	$0	$400,000	$0	$0	$0
Total	$0	$400,000	$346,000	$0	$10,000
West End Reservoir					
Low	$0	$0	$1,000	$0	$12,000
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$1,000	$0	$12,000
Total Water Infrastructure					
Low	$0	$0	$119,000	$0	$112,000
Medium	$0	$0	$251,000	$0	$0
High	$0	$400,000	$0	$0	$0
Total	$0	$400,000	$370,000	$0	$112,000

Table 6: Instrumentation and Controls Detailed Cost Estimate Table / Forecast

Priority Rating	1	2	3	4	5
Timeframe	< 12 Months	< 5 Years	5 to 10 Years	10 to 15 Years	None
River Pumphouse and Raw Water Line					
Low	$0	$0	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$0	$0	$0
Cenovus Raw Water Pumphouse					
Low	$33,000	$0	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$33,000	$0	$0	$0	$0
Water Treatment Plant					
Low	$0	$0	$0	$0	$0
Medium	$0	$0	$125,000	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$0	$125,000	$0	$0
West End Reservoir					
Low	$0	$66,000	$0	$0	$0
Medium	$0	$0	$0	$0	$0
High	$0	$0	$0	$0	$0
Total	$0	$66,000	$0	$0	$0
Total Water Infrastructure					
Low	$33,000	$66,000	$0	$0	$0
Medium	$0	$0	$125,000	$0	$0
High	$0	$0	$0	$0	$0
Total	$33,000	$66,000	$125,000	$0	$0