Robson Raspberry Improvement District
Water System Asset Study Memo

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1.0 CONTENTS

2.0 INTRODUCTION

XenonCyber Dynamics (XCD) was engaged to produce a water system electrical/ OT asset inventory with Urban Systems Ltd (USL) engaged as a sub-consultant to evaluate/ document the civil infrastructure for the Robson Raspberry Improvement District water system.

The Xenon team visited the Water Treatment Plant, and PRV station to collect an asset inventory and document observations. The H20 Innovations Design report/ drawings was used as a starting point for the asset list. The following report is design to be read in parallel with the corresponding asset inventory.

The asset study is largely an asset inventory and condition assessment to complete an informed life-cycle analysis of the RRID's water utility. The intention is that this information will support RRID's rate study for implementing water rates to customers. This is following the implementation of universal water metering that RRID in currently underway, supported through grant funding.

3.0 ASSET INVENTORY

3.1 WATER TREATMENT PLANT

USL completed an asset inventory based on the USL site walk through July 15, 2025, and the O&M manuals, P&ID drawings, and process drawings provided by H2O Innovations. An Excel copy of the asset inventory has been provided separately to the RRID.

XC completed their walk through on July 2nd and 3rd, 2025.

3.2 DISTRIBUTION SYSTEM

USL completed a desktop asset inventory based on provided GIS data, record drawings, and data provided by the RRID operations staff. Chris Popoff was also contacted as his company, Dirty Diggers, has been repairing and upgrading RRID's water distribution system for 15+ years. All distribution system attributes were added to an ArcGIS file that will be provided to the RRID. Figures have been provided in **Appendix A** which shows the overview of the distribution system.

4.0 CONDITION ASSESSMENT

USL completed a condition assessment of the RRID water system, applying a condition rating to each of the inventoried assets. The Asset Evaluation spreadsheet documents the collected assets and their corresponding information from the sites visited. Asset ID's were provided for each asset, with corresponding labels applied to the field devices where possible to simplify cross referencing the report and field. Years in services estimates were primarily based on discussions with the Operations team that escorted the Xenon staff on site.

Assets were evaluated by the Xenon team on a 1-5 scale, see below. This was used to produce a condition-based assessment that could be reviewed in parallel to a straight-line approach to depreciation.

The straight-line approach column within the asset evaluation spreadsheet calculates the yearly depreciation over the original estimated service life, to equally reduce the value over time per year.

The condition assessment was primarily a visual inspection and did not include any physical testing. Condition ratings were selected based on the condition's effect on service life, outlined in the table below.

TABLE 1: CONDITION RATING

Condition	Service Life	Description
1	0%	Very poor: The asset is unfit for sustained service. It is near or beyond its expected service life and shows widespread signs of advanced deterioration. Some assets may be unusable.
2	20%	Poor: There is an increasing potential for its condition to affect the service it provides. The asset is approaching the end of its service life, the condition is below standard, and a large portion of the system exhibits significant deterioration.
3	45%	Fair: The asset requires attention. The asset shows signs of deterioration, and some elements exhibit deficiencies.
4	75%	Good: The asset is adequate. It is acceptable and generally within the mid-stage of its expected service life.
5	100%	Very Good: The asset is fit for the future. It is well maintained, in good condition, new or recently rehabilitated.
N/A		Unknown: Not enough data exists to respond

The condition assessment of the distribution system, largely comprised of water main, isolation valves, air release valves, and water services, was completed based on age, material, and replacement life of the asset. This helps to estimate the estimated remaining service life of each of the assets. A similar approach was used to evaluate estimated service life for the assets within the water treatment plant. However, the remaining estimated service life of each asset was scaled based on the visual condition assessment completed and discussions with RRID operators during the July 15th USL site visit.

4.1 Water Treatment Plant Unit Processes

Operators noted that there was a major chemical spill of hydrochloric acid shortly after the facility was commissioned that went undetected for over a week before it was cleaned. It is expected that this chemical spill is the cause of the severe corrosion observed on the process equipment. This section will speak only of the process

equipment, not the condition of other equipment. Note that electrical equipment is much more susceptible to damage and failure from a chemical spill than the treatment process equipment. **Figure 1** below shows the process flow diagram of the RRID water treatment plant.

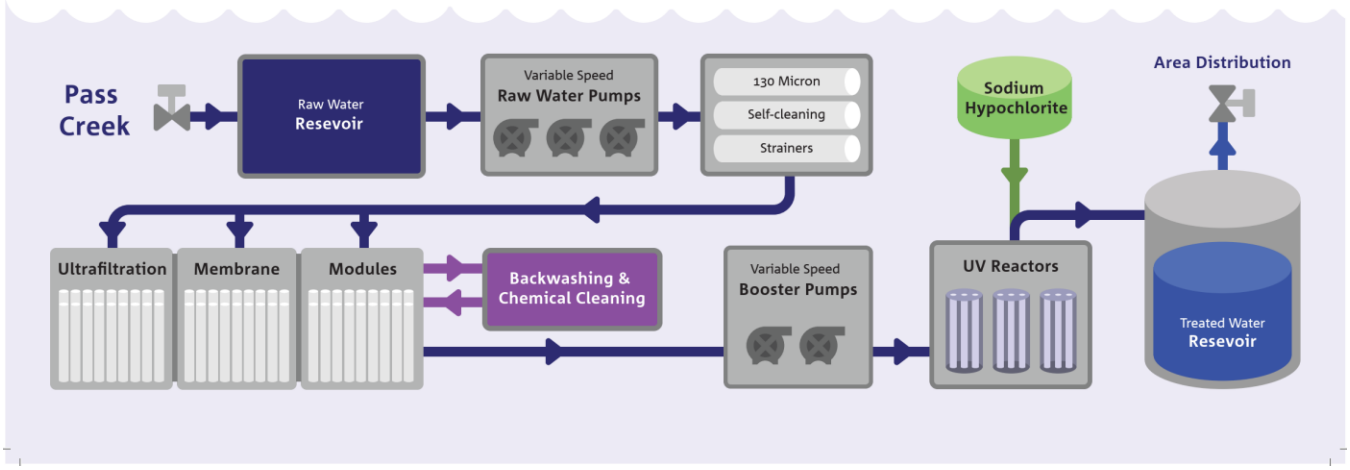


FIGURE 1: RRID PROCESS FLOW DIAGRAM

4.1.1 Raw Water System

The raw water system includes the intake structure from Pass Creek, settling pond, and raw water pumps.

The intake structure (screen and sluice) appears to be in good condition. Routine maintenance is recommended to ensure that the screen is clear of debris (pictures show sticks getting stuck).

The settling pond is in poor condition. The pond is overrun with vegetation and suspected wildlife living in/adjacent to raw water storage. Vegetation and roots are also a culprit for puncturing holes in the liner, compromising its integrity. The settling pond drain valve currently does not function and the condition of the drain line and outlet is unknown. Also, there have been historical algae blooms during summer heat.

Recommend rehabilitating the water storage include:

- Clearing vegetation around the perimeter of the pond
- Dredging gravels/sands that have deposited
    - The pond is cleaned annually by operators – a large effort. This is still recommended during the replacement of the liner.
    - Replacing the liner
    - Adding a surface agitator (e.g., SolarBee) to mitigate future algae blooms
    - Repair/replace drain line and valve

All 3 variable speed raw water pumps are in very poor shape. Pumps and motors are heavily corroded. The packing gland between the drive shaft and pump is visibly leaking on Pump 1. These are recommended for replacement.

4.1.2 PRESCREENING

Prescreening is completed by Amiad filters, which appear to be in good condition. The shafts and seals of these filters were refurbished in 2024. Minor corrosion on fastener bolts and motor housing. With regular maintenance, these are expected to last their service life.

4.1.3 UF TREATMENT

UF treatment includes the UF filter trains, cleaning systems, and booster pumps. The RRID operates three UF treatment trains of 18 filter membranes per train. While the label on the filters indicate they are produced by DOW, DuPont has purchased this product and provides ongoing customer support. RRID engaged in discussions with DuPont in 2025 and indicated that the membrane has a 12-year nominal lifespan. RRID has evaluated the condition of these membranes through a permeability test under mid-summer water quality conditions. Results showed that the membranes are operating at approximately $1/10^{th}$ of the nominal permeability. This is limiting the treatment capacity of the facility. RRID has purchased a replacement train of filter membranes, with the intention of replacing it in the near future.

The UF booster pumps were observed to be in good condition. There was major surface rust observed, but nothing to suggest that this rust was penetrating through the pump casing or otherwise impeding performance. We suggest that these are continuously monitored (as they currently are) to see if the rusting gets any worse.

4.1.4 UV TREATMENT

The RRID WTP disinfects water with UV treatment through the means of a UV disinfection skid, which includes UV reactors, process piping, valves, and appurtenances in the system. These were observed to be in good working condition. As discussed in XCD's review, the control panels have lost their CSA certification and the manufacturing of the UV reactors has been discontinued. Ongoing support from suppliers is non-existent. The risk of not being able to maintain these with replacement parts is too high. For those reasons we have noted the condition to be poor to recommend and plan for replacement in the near future.

4.1.5 CHEMICAL DOSING SYSTEM

The chemical dosing system includes the chemical dosing skids, sodium hypochlorite, citric acid, sodium bisulfite, coagulant, and sodium hydroxide chemical tanks. Dosing skids and chemical tanks wear appeared to normal for being 10 years old. Nothing unusual was observed or noted about their condition. This equipment is expected to reach the service life of 25 years.

Typically, during the spring freshet, raw water quality drops below the allowable UVT and RRID is required to issue a Water Quality Advisory. Testing completed by RRID revealed this is due to dissolved colourless natural organic matter (NOM) which sneaks past the UF membranes and depresses UVT. RRID employed the help of Alumichem to test methods of removing NOM during freshet. The results were satisfactory, with the addition of ACH, dissolved NOM's were reduced and UVT increased from approximately 83% to 95%. This was verified and allowed RRID to rescind the Advisory.

Using ACH results in some adverse effects though, namely it requires extensive and onerous cleaning of the UF membranes. As such, RRID will not be pursing the use of ACH coagulant unless a coagulant pre-treatment system is upgraded. This could include any of the following:

- Pressure sand filter or conventional settling, to remove particular and dissolved NOM before UF
- Jar testing to optimize ACH (or alternative coagulant) dosage, to prevent overdosing and adverse fouling of the UF membranes

4.1.6 Waste Management System and WTP Drains

The RRID WTP operates several waste management systems, backwash waste, UF skid drain, raw strainer waste, neutralized chemical waste, miscellaneous floor drains and overflow drains in the WTP, and the reservoir drain line. All items were noted in okay condition, save for the backwash waste drain system. The backwash waste currently discharges to an obsolete and silted reservoir located between the WTP and treated water reservoir. This does not meet current Ministry of Environment regulations for discharge. A further investigation and upgrades are recommended to ensure this backwash waste disposal system upgraded to meet modern regulations and adequate treatment is maintained.

4.1.7 Storage

Treated water storage is provided with an above ground bolted steel tank reservoir. The reservoir was constructed in 2014 at the same time the new treatment plant was installed. The reservoir appears to be in great condition.

4.1.8 Miscellaneous Items

Miscellaneous metal items within the WTP room had severe corrosion and replacement is recommended. These include the lab/sampling equipment and storage.

4.2 Distribution System

4.2.1 Distribution

The distribution system contains a mix of pipe materials with asbestos cement pipe being the most common which was installed in the 1960's. Over time, the distribution system has been expanded, with more recent expansions including PVC and HDPE piping. Anecdotal evidence from the District and Chris Popoff states that much of the older piping is in poor shape.

Note that it appears that large portions of the distribution mains are located on private property without the proper easements or ROWs.

4.2.2 Servicing

Anecdotally, most service laterals are HDPE, but it has been noted by RRID operations staff that HDPE piping intended for irrigation piping is common. Irrigation piping has been a common material repaired by Chris Popoff as it is not rated for domestic water pressures. The extent of the use of this irrigation grade piping is unknow but

we recommend the service lateral sizes and material types are recorded during the upcoming water meter installation.

4.2.3 PRV Station

The PRV station building was in fair shape. The two PRV's within the building are in good shape but require an internal rebuild kit to ensure they can continue to operate as designed. Currently, it does not appear that the PRVs are functioning and are assumed to be stuck in the wide-open position. Aside from this, they should meet their service life.

4.2.4 Air Relief Valves

There are several air relief valves located throughout the distribution system at local high points. The age and condition/functionality of these air relief valves are unknown.

4.2.5 Hydrants and Standpipes

There are 18 hydrants and 16 standpipes throughout the distribution system which provide fire protection, flushing points, and sampling locations. The install dates of these are largely unknown. Hydrants are operated twice a year by District staff.

4.3 Electrical/ OT Condition Assessment Breakdown

Comments here have been expanded upon based on notes within the asset registry and condition assessment spreadsheet. Condition ratings have been applied to all electrical assets. The items listed here are key recommendations to address in terms of deficient installations, equipment in need of repair, or upgrades. For estimates related to replacement of equipment due to end of service life, see the asset registry spreadsheet.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.0	SCADA Computer - Software	Electrical - Process	Ignition SCADA Software	Ignition SCADA is running with version v7.6.7	Software out of support (released 2017-03-30) No modern security patches available, additional programming time required for outdated and undocumented software versions. Possible to experience software performance/reliability issues with underlying operating system when significantly out of date.	Upgrade to current version of Ignition SCADA (v8.1+). Ignition will require programmer compatibility efforts post-upgrade to ensure the same level of service SCADA provides today is realized. Newer software includes vendor support for security and software updates, opportunities exist to maintain current (but upgraded) "vision" module for SCADA display rather than migrating to Ignitions latest perspective module. This will eliminate the need to rebuild the SCADA system from scratch.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.1	SCADA Computer - Software	Electrical - Process	RSLogix 5000 PLC Programming Software	RSLogix 5000 is version v20.05	RA considers v20.05 "retired": -Not available for download - May be available through technical support -Anomalies and Windows OS Support behaviors will not be addressed -Phone / self-assist support available Operationally, we see the anomalies present between the modern Windows 11 OS and RSLogix 5000. The program does not open reliably and may delay troubleshooting/repair efforts. Currently addressing in an ad-hoc capacity when it doesn't launch properly.	Update the firmware on the plant PLC and install corresponding RSLogix 5000 software version on SCADA Computer or Engineering Workstation (EWS). Implications for upgrade require planning and a back-out-plan to ensure plant reliability remains unaffected.
5.2	SCADA Computer - CompactLogix PLC - Firmware	Electrical - Process	Compactlogix PLC Firmware	v20.13	Consistent with PLC programming software, the PLC is running outdated firmware revisions with	See above

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.3	SCADA Computer - CompactLogix PLC - OEM PLC Program	Electrical - Process	Compactlogix 1769-L36ERM PLC Program	Closed-source add-on instructions, portions of program not fully commissioned. Efforts to eliminate lack of functionality or visibility attributed to closed-source AOIs have been ongoing and are considered "workarounds" rather than program optimizations.	Some components from OEM equipment packages include closed-source add-on instruction blocks (AOIs). Many systems or subsystems have non-finalized programming, IE limit switches not implemented with valves. Historically this has been a larger issue. While recent efforts have improved the maintainability/reliability of the program, some issues are associated with limited program visibility and limit troubleshooting capacity for programmers and operators.	Program could be rewritten. Iterative changes can continue to be made.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.4	Panelview Plus - Plant HMI	Electrical - Process	Undocumented HMI Program	No development program available	HMI program would not be recoverable if hardware failed. HMI program changes or updates are not feasible without programming software or saved copy of HMI program. Difficult to source alarm and process signals present on the	Request HMI IDE program from H2O Innovations if they have a record. Alternatively, retrieve the runtime program with Factorytalk View programming software and reverse-engineer to full IDE program. Going forward, either eliminate the HMI and replace with ignition HMI instance or carry annual license for Factorytalk View HMI program software.
5.5	Panelview Plus - Plant HMI	Electrical - Process	HMI Firmware out-of-date	Firmware revision is outdated	Update Panelview Plus firmware to more recent version	Update Panelview Plus firmware to more recent version
5.6	Fortigate-30D - Plant Security Gateway	ICS Network	Hardware considered End-of-Life	Router hardware is considered obsolete and no longer being supported	Multiple vulnerabilities have been identified for older versions of the FortiOS software/firmware running on the appliance. The hardware is considered End-of-Life by the manufacturer and updates have not been feasible for some time.	Upgrade to modern security appliance and maintain security updates. An updated router would provide RRID with an opportunity to deploy remote access to the WTP SCADA interface for the purposes of operational supervision without the need to log on to the SCADA server directly. This is recommended to limit

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
						exposure of critical system components to threat actors or inadvertent misconfiguration. A new plant router would also allow for remote support teams to directly access components within the network utilizing engineering workstations with additional troubleshooting tools and software. Additionally, this configuration would ensure the SCADA server remains free for operator use while they're in the plant, as remote support users would not be required to utilize the SCADA PC to support RRID for the majority of support issues.
5.7	ICS Security - Best Practices	ICS Network	Remote Access Methodology	Direct Remote Access to SCADA Server	Remote user's access to critical operational resources is not limited. No ICS-DMZ is utilized and MFA is not implemented.	Ignition provides a java-based SCADA client which can be utilized by remote operations personnel for the purposes of supervisory control. While the ignition client is utilized on the SCADA server itself, it

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
						could be deployed to additional remote RRID users with minimal effort. Users would log in to a VPN, and be provided with access to only the ports and protocols necessary for full SCADA functionality. This would limit the exposure of critical plant components to unauthorized threat actors or inadvertent misconfiguration. It is recommended that plant ICS network architecture is defined according to the Purdue Enterprise Reference Architecture and informed by ISA 62443 or other applicable industrial cybersecurtity standards. A properly implemented industrial control network will include an ICS-DMZ to facilitate appropriate levels of access for external systems and users.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.8	SCADA, PLCs, Embedded Devices	Electrical - Process	Backup and Disaster Recovery	Limited internet bandwidth has resulted in few opportunities to migrate backup data to systems external to the plant.	Reliable back ups may not be available when required.	Follow the 3-2-1 rule for backups* as a minimum requirement. Backups may be automated to minimize efforts, however robust verification of backup and recovery mechanisms are recommended in any context. A disaster recovery plan could formalize recovery requirements and highlight additional opportunities for RRID to promote systems resiliency.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.9	n/a	Electrical and Instrumentation	Critical Spares	Spares for some equipment which is critical for WTP operations do not exist	Unplanned downtime, potential for extended delivery times for legacy components could further exacerbate downtime.	Implement a formal critical spare management program. Critical spares can be defined informally to facilitate initiation of a critical spare management program, however the development of a formal Disaster Recovery Plan (DRP) would define critical spares based on organizational priorities and plant criticality, providing formalized and comprehensive context to the critical spare plan.

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.10	Plant Wiring	Electrical - Process	Loose and/or corroded wiring	Plant reliability issues arise from time-to-time related to loose or corroded wiring, terminals, and components. Recent efforts to move network hardware and SCADA system have mitigated the likelihood for significant corrosion on these systems. Vibration is present in many plant areas.	Unanticipated downtime during high-demand scenarios could result in operational reliability challenges or the inability to keep reservoir filled.	Establish a preventative maintenance routine which supports the inspection and service of plant wiring and associated components. An electrician could service plant areas on a periodic, cyclical basis. Frequency and scope of efforts may be reviewed on an ongoing basis based on extent of electricians findings/efforts to resolve. Look for opportunities to minimize effort/hours for checks once a baseline for service requirements is established.
5.11	BW FESTO	Backwash - Electrical	Corrosion	Exposed metal parts have corroded	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7
5.12	BW-DISCONNECT	Backwash - Electrical	Corrosion	corrosion on outside of disconnect and on fuses	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.13	BST-DISCONNECT	Booster Pumps-Electrical	Corrosion	corrosion on outside of disconnect and on fuses	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7
5.14	FAL-80100A FAL-80100B FAL-83500A FAL-83500B FAL-83700A FAL-83700B FAL-84100A FAL-84100B FAL-84300A FAL-84300B	Chemical Dosing – Instrumentation	Incorrect wiring	Some floats are not working, some mapped to wrong pumps in PLC logic	Plant not operating as expected	Verify wiring, and rectify in program or field.
5.15	AE-37205	CIP - Instrumentation	Inaccurate	operator indicates values reported are very inaccurate	Plant not operating as expected. Incorrect recorded data	Replace with new instrument.
5.16	AE-37208	CIP - Instrumentation	Inaccurate	operator indicates values reported are very inaccurate	Plant not operating as expected. Incorrect recorded data	Replace with new instrument
5.17	CIP-DISCONNECT	CIP – Electrical	Corrosion	corrosion on outside of disconnect and on fuses	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7

Item No.	Asset / System ID	Asset / System Type	Topic	Description of Current State	Identified Risks	Opportunities or Recommendations
5.18	AIT-11209	Pre-screening Electrical	Failed unit	Operator indicates unit is failed		Replace with new instrument
5.19	SCR-DISCONNECT	Pre-screening Instrumentation	Corrosion	corrosion on outside of disconnect and on fuses	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7
	VFD-10200A VFD-10200B VFD-10200C	Raw water feed	Network loss	intermittent ethernet comms loss, requires fault reset at VFD	Unexpected downtime	Investigate cause of comm loss. Consider configuration changes for auto fault reset, or PLC controlled reset.
	AIT-31089-1 AIT-31089-2 AIT-31089-3	UF	Failed	Unit has failed, will not accept calibration		Replace with new instrument
	P-91000A P-91000B P-91000C	UV	Corrosion	Corrosion on all metal surfaces within control cabinet	Unexpected downtime, intermittent electrical connections	See maintenance plan description under section 7
	EM-WTR-HTR	WTP	Failed	Leaking, not heating water	Emergency shower not providing tempered water when required	Repair or replace

4.4 Additional Notes and/or Considerations

Notes listed below are general in nature and summarize the deficiencies listed above, or are deficiencies not linked to any specific asset.

Noted on site:

- Chemical storage
    - Barrel with no top containing unknown chemical
    - Tank containing chemical different from label
- All Pneumatic Sharpe branded control valves considered as original and end of life due to contamination from old air system causing internal seal failures
- Corrosion on all exposed metal surfaces, consider thermal scan of all electrical components to identify connections overheating due to corrosion
- Potential energy savings:
    - Fix leaks in airlines
    - Replace light fixtures with LEDs
- Many small air leaks observed, consider plant wide air audit for energy savings and to extend equipment longevity

5.0 Capacity Assessment

RRID currently maintains approximately 520 connections. The vast majority of these are residential, with a school, the Lions Head Pub, and the RRID office. RRID currently estimates people per unit at 2.5, which is in line with BC Rural Estimates provided by BC Stats. The City of Cranbrook recently completed their Official Community Plan and estimated their residential occupancy density at 2.3 people per unit. For this reason, we have assumed to proceed with the 2.5 people per unit estimate for estimating growth.

RRID fields approximately 3-4 subdivision requests per year. For the purposes of evaluating growth, we will assume 3 subdivision requests are converted into new residential units per year.

RRID has provided flow data from the WTP over the past five years. These are summarized in **Figure 2** below.

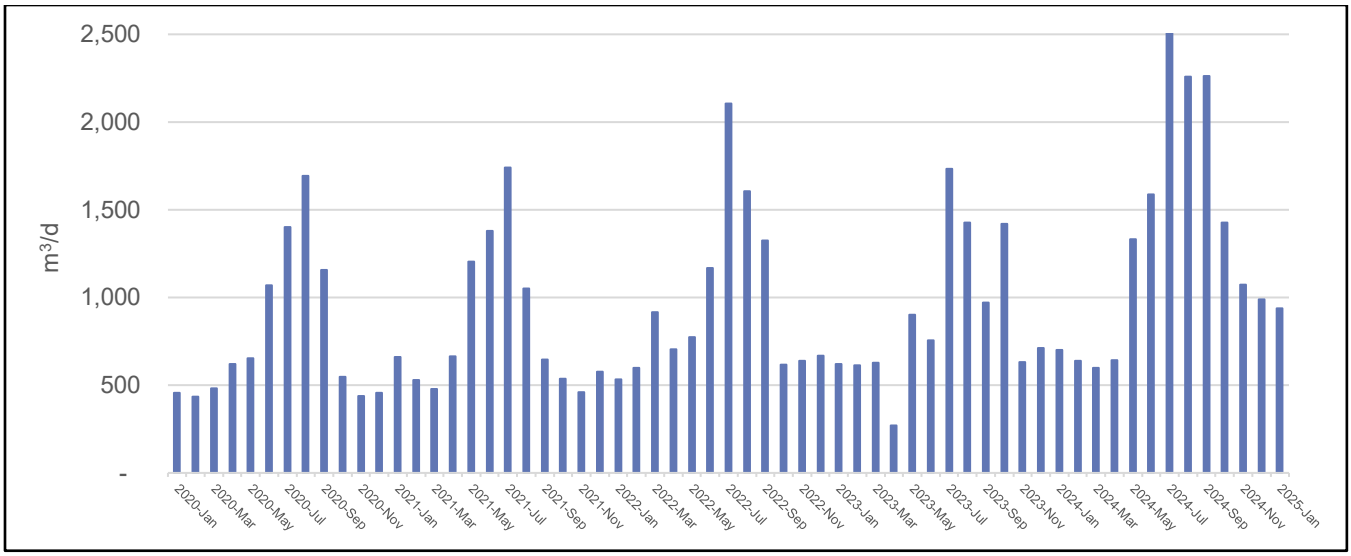


FIGURE 2: RRID WTP AVERAGE DAILY DEMAND

As shown in **Figure 2**, there is significant seasonal variation in the flows throughout the distribution system. As such, we evaluated seasonal flows across each year, with summer flows extending from April-September and winter flows extending from January-March and October-December.

TABLE 2: EXISITING FLOW RATES

Item	Unit	ADD (Summer)	ADD (Winter)
Average Daily Demand	m^3/d	1,254	669
Max Daily Demand[1]		2,507	1,337
Average per capita flow rates	L/capita/d	964	514

1. Max Daily Demand (MDD) was estimated at 2x ADD, per the 2022 MMCD Design Guidelines

Per capita flow rates are quite high for a community of this size. The 2022 MMCD Design Guidelines recommends estimating 300 L/capita/d for new water systems that are metered. While this is a large discrepancy from what the existing per capital rates are showing, the implementation of universal metering will help RRID reduce demands and target the MMCD estimates.

Figure 3 below provides an estimate of ADD growth for summer and winter flow rates. We have also included an ADD growth projection based on the MMCD 2022 Design Guidelines, for comparative sake of a target for what's typical of a new system that's metered.

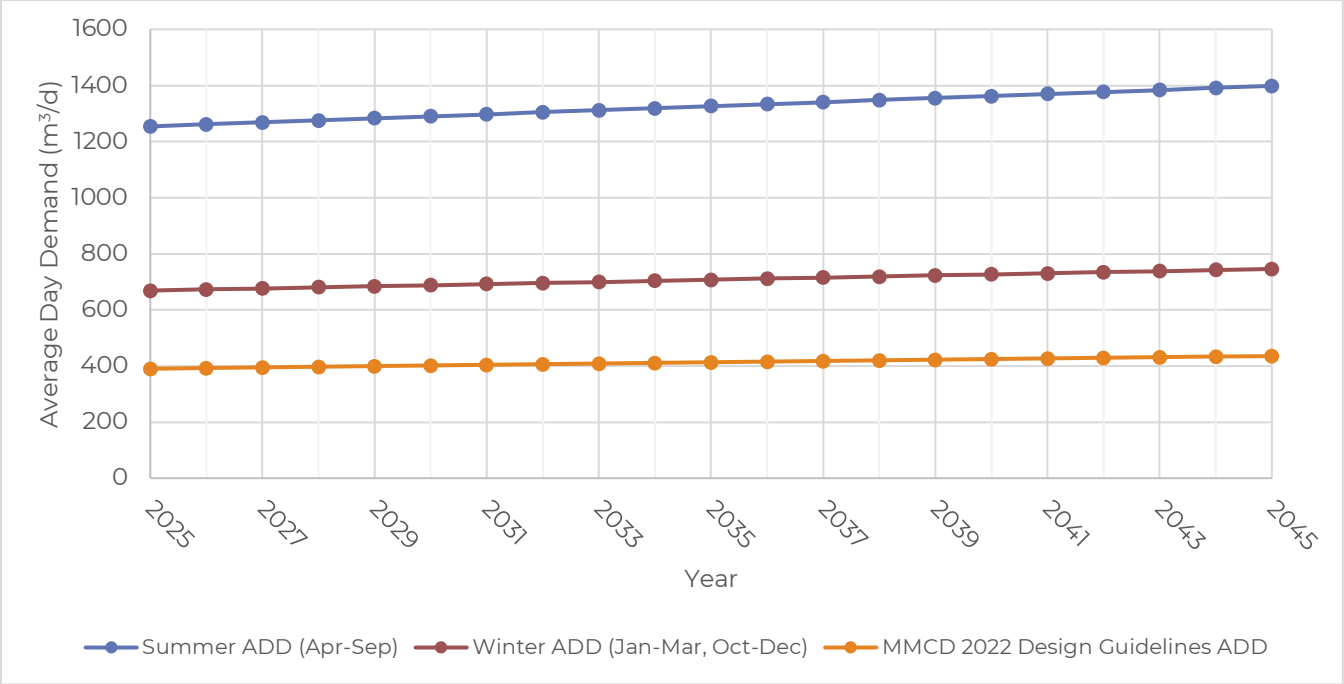


FIGURE 3: ADD GROWTH PROJECTION BASED ON 3 NEW CONNECTIONS PER YEAR

We reviewed the existing treated water storage against the 20-year projected flows to confirm if expanding treated water storage is required. The RRID currently maintains a bolted steel tank with 2,096 m^3 of storage capacity. The required treated storage was evaluated following the 2022 MMCD Design Guidelines:

Required Storage = A + B + C

where,

A is FF storage

B is 25% max day demand (MDD) (accounting for peak hour demand)

C is 25% of A+B (accounting for emergency storage

A) RRID did not publish an SDS bylaw that stipulates required fire flow. Lions Head Pub is the largest commercial building within the community; an FF of 150 L/s was assumed (per the MMCD Design Guidelines). The Fire Underwriters Survey (FUS) stipulates that for a 150 L/s fire flow required, this must be maintained for 2 hours. This requires a storage of **1,080 m^3**.

B) Future MDD was estimated as 2x the future ADD. Peak hour demands typically occur in the morning or evening for ~3 hours. Our calculations allowed for 6 hours of Peak Hour Demand storage (i.e., 25% of MDD).

C) MMCD Design Guidelines states that emergency storage must be required. This storage can be reduced by a number of factors, including dependability of water source, reliability of the supply system, presence of more than one supply source, redundancy of treatment components, etc. For our calculations, we evaluated storage requirements with both including and excluding emergency storage.

TABLE 3: REQUIRED STORAGE (M^3) (ASSUMING NO EMERGENCY STORAGE NEEDED)

	A	B	C	Required	Available	Expansion
Existing Conditions (summer flows)	1,080	625	0	1,705	2,096	*Not required*
Growth to 2045 (~20 yrs) (summer flows)	1,080	700	0	1,780	2,096	*Not required*

TABLE 4: REQUIRED STORAGE (M3) (ASSUMING EMERGENCY STORAGE IS NEEDED)

	A	B	C	Required	Available	Expansion
Existing Conditions (summer flows)	1,080	625	425	2,130	2,096	**34**
Growth to 2045 (~20 yrs) (summer flows)	1,080	700	445	2,225	2,096	**129**
Growth to 2045 (~20 yrs) with winter flows	1,080	375	365	1,820	2,096	*Not required*

Assuming no emergency storage is required, no treated reservoir storage expansion is required under the 20-year horizon. Assuming emergency storage is needed under existing and 20-year growth scenarios for summer flows, between 34 to 129 m^3 of additional storage is required. When evaluating 20-year growth under the winter flows scenario, no storage expansion is required.

It is recommended that RRID work to reduce the ADD and MDD throughout the summer. With the implementation of universal water metering and a revised rate study planned in the near future, there are means to reduce these demands. Should the RRID be able to reduce the summer flows to be in line with their winter flows, the existing configuration of approximately 2,096 m^3 of storage will be sufficient for the 20-year horizon.

6.0 LIFE-CYCLE RENEWAL COSTS

6.1 SUMMARY OF ASSET VALUES

Table 5 shows the current dollar replacement estimate of all process and linear water infrastructure.

TABLE 5: PROCESS AND LINEAR INFRASTRUCTURE REPLACEMENT VALUE (CURRENT DAY DOLLARS)

Item	Cost
Treatment	$2,420,000
Distribution	$14,107,000
Total	**$16,527,000**

Table 6 shows the current dollar replacement estimate of all electrical infrastructure

TABLE 6: ELECTRICAL INFRASTRUCTURE REPLACEMENT VALUE (CURRENT DAY DOLLARS)

Item	Cost
Electrical	**$3,415,950**

Note: the above cost estimate has been prepared using aggregate unit prices. Further investigation and engineering is recommended to obtain more detailed cost estimates prior to proceeding with upgrade or replacement of specific sections, areas, or components of the system.

6.2 Asset Renewal Forecast (20 Year)

Table 7 shows the asset renewal forecast for all process and linear infrastructure (excludes electrical).

TABLE 7: PROCESS AND LINEAR INFRASTRUCTURE ASSET RENEWAL FORECAST (20-YEAR)

Year	Investment	Year	Investment	Year	Investment	Year	Investment
2025	$380,000	2026	$0	2027	$0	2028	$250,000
2029	$659,800	2030	$0	2031	$0	2032	$0
2033	$0	2034	$83,400	2035	$13,102,200	2036	$103,900
2037	$0	2038	$0	2039	$0	2040	$110,700
2041	$0	2042	$0	2043	$735,600	2044	$244,400
2045	$0						

Table 8 shows the asset renewal forecast for all electrical infrastructure that was excluded in Table 7 above.

TABLE 8: ELECTRICAL INFRASTRUCTURE ASSET RENEWAL FORECAST (20-YEAR)

Year	Investment	Year	Investment	Year	Investment	Year	Investment
2025	$100,500.00	2026	$0	2027	$18,612.22	2028	$986,500.30
2029	$39,032.66	2030	$587,663.46	2031	$0	2032	$38,959.52
2033	$147,791.18	2034	$54,469.36	2035	$175,569.61	2036	$1,467,472.90
2037	$23,593.80	2038	$0	2039	$8,014.33	2040	$894,456.13
2041	$0	2042	$4,489.73	2043	$1,595,327.86	2044	$54,140.00
2045	$228,586.94						

Note: the above tables utilize the values presented in **Table 5** and **Table 6** respectively. A 2.4% value was included per year for inflation.

7.0 RECOMMENDED NEXT STEPS:

7.1 RECOMMENDED WATER TREATMENT PLANT NEXT STEPS

- Prioritize modernization of depreciated equipment. Consider risk introduced by the various equipment, supportability, and manufacturer recommendations.
- Prepare an electrical maintenance plan for regular items that should be performed (yearly, monthly, etc) including but not limited to:
    - Thermal scanning electrical equipment
    - Cleaning corrosion on connectors to minimize heat build up and intermittent connections
    - Re-torque lugs/ screws
    - Additional recommendations as outlined within CSA Z463:24 Standard - Electrical Systems Maintenance
- Upgrade raw water settling pond, including replacing the pond liner, removing vegetation around the perimeter, and adding a water agitator (e.g., SolarBee) to mitigate algae blooms.
- Upgrade the three raw water pumps.
- Replace the UF filter membrane trains to improve permeability.
- Upgrade and replace the UV reactors and retrofit the UV skid to suit. UV replacement with a reactor model that is still manufactured and retains customer support.
- Review the coagulation dosing system to address the freshet NOM affect on UVT. Consider options like adding an upstream pressure sand filter or optimizing the ACH dosing with benchtop jar testing.
- Reconfigure the backwash waste drainage system to meet current regulatory requirements.
- Energy savings – It is unlikely that the identified energy savings will qualify for a detailed energy efficiency study through Fortis BC, however their may still be funding through direct incentives to help resolve these items.

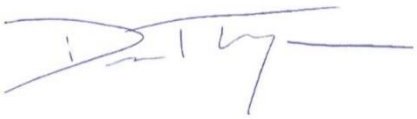
7.2 RECOMMENDED DISTRIBUTION SYSTEM NEXT STEPS

- Take samples of the asbestos cement watermain to determine remaining life. During repairs in the asbestos cement watermain, samples of disused pipe should be saved. The following tests are available to be performed on the pipe sample coupons:
    - Hardness testing
    - Phenolphthalein dye testing
    - Elemental/petrographic testing
    - Mechanical testing (crushing, bursting, bending or splitting)
    - More information on testing is available here: https://nrc-publications.canada.ca/eng/view/accepted/?id=b126c138-6549-4bb8-a83d-240763b0f8ba
    - Levelton Engineering Solutions (now WSP) provides hydrostatic and phenolphthalein testing
- Rebuild the two PRVs with new internal components

- Inspect the air relief valves and rebuild or replace as required
- Continue scheduled operation and inspection of the hydrants and standpipes and rebuild or replace as required
- Record service lateral material and size during the upcoming water meter installation
- Utilize the provided ArcGIS file containing the linear assets to record water main breaks and repairs
- Obtain the proper ROWs or easements for the sections of the distribution main located on private property

Sincerely,

URBAN SYSTEMS LTD.



Dean Thompson, P.Eng.
Project Engineer

Shiloh Johnson, P.Eng.
Water & Wastewater Engineer

/SJ and DT

XenonCyber Dynamics Inc.

Jason Marchese, P.Eng, PMP

8.0 APPENDIX A - OVERVIEW OF THE DISTRIBUTION SYSTEM

Robson Raspberry Improvement District

Water Asset Study

Water Infrastructure Map Page 1 of 8

Legend

- Water Network Structure

Fitting Type
- Curb Stop
- Coupling
- Unknown
- Cap

- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
- Abandoned Water Main
- Water Lateral Line
- Pipe Jump
- Areas with Assumed Pipe Size, Material, and or Location.
- Parcel (PMBC)

0 50
Meters

N

Coordinate System:
NAD 1983 UTM Zone 11N

Scale:
1:6,000
(When plotted at 22"x34")

Data Sources:
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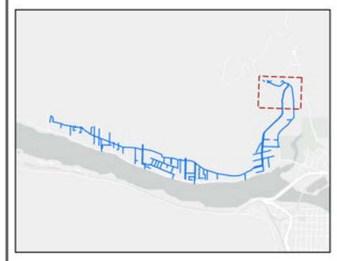
Water Asset Study

Water Infrastructure Map Page 2 of 8

Legend

- Water Network Structure

Fitting Type
- Curb Stop
- Unknown
- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
- Abandoned Water Main
- Water Lateral Line
- Pipe Jump
- Parcel (PMBC)



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Meters

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Coordinate System:
NAD 1983 UTM Zone 11N

Scale:
1:1,000
(When plotted at 22"x34")

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Water Asset Study

Water Infrastructure Map Page 3 of 8

Legend

- Water Network Structure

Fitting Type
- Curb Stop
- Coupling
- Cap
- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
- Abandoned Water Main
- Water Lateral Line
- Pipe Jump
- Parcel (PMBC)

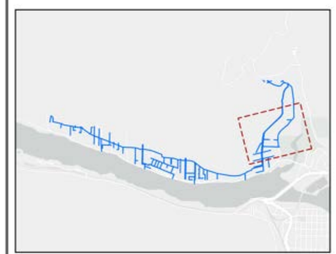

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FIGURE XX

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Water Asset Study

Water Infrastructure Map Page 4 of 8

Legend

- Water Network Structure
- Fitting Type
  - Curb Stop
  - Coupling
  - Cap
- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
- Abandoned Water Main
- Water Lateral Line
- Pipe Jump
- Areas with Assumed Pipe Size, Material, and or Location.
- Parcel (PMBC)

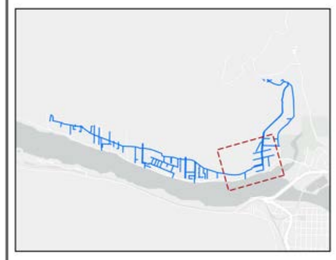

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FIGURE XX

Robson Raspberry Improvement District

Water Asset Study

Water Infrastructure Map Page 5 of 8

Legend

Fitting Type
- Curb Stop
- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe

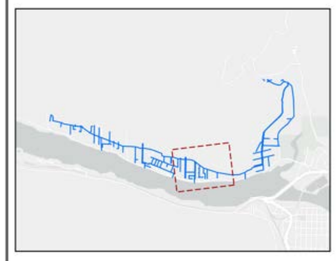
Active Water Main

Water Lateral Line

Pipe Jump

Areas with Assumed Pipe Size, Material, and or Location.

Parcel (PMBC)



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0 50 Meters

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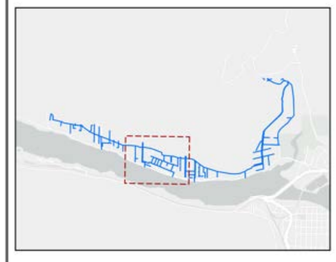
Water Asset Study

Water Infrastructure Map Page 6 of 8

Legend

Fitting Type
- Curb Stop
- Water Control Valve
- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
- Water Lateral Line
- Pipe Jump
- Areas with Assumed Pipe Size, Material, and or Location.
- Parcel (PMBC)



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Water Asset Study

Water Infrastructure Map Page 7 of 8

Legend

Fitting Type
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- Water System Valve
- Hydrant
- Standpipe
- Active Water Main
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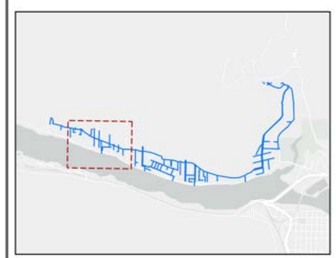

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Water Asset Study

Water Infrastructure Map Page 8 of 8

Legend

Fitting Type
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- Water Control Valve
- Water System Valve
- Hydrant
- Active Water Main
- Pipe Jump
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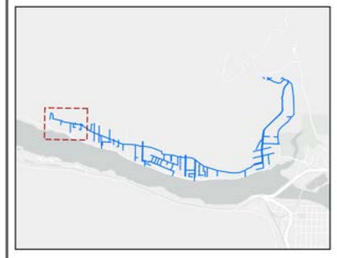

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