EDMONTON WATERWORKS

ANNUAL REPORT TO ENVIRONMENT AND PARKS

Approval Number 638-04-00

2022

2022 ANNUAL REPORT

TABLE OF CONTENTS **PAGE**

1.0 Overview

2.0 Raw Pumpage, Treated Pumpage and Distribution System

3.0 Water Quality

4.0 Chemicals

1.1 Overview

Through 2022, EPCOR Water Services Inc. (EWSI) continued to satisfy all water demand requirements while meeting our strict water quality criteria. Total demand in 2022 was similar to 2021, 373 ML/d average versus 376 ML/d in 2021, and higher than the previous 10-year average.

Rossdale WTP converted from DF on March 17 and E.L. Smith on March 18 in advance of runoff. Upstream creeks began flowing at various times between March 18 and 26 and both plants started to feed carbon to control taste and odour. After peaking at approximately 45 TCU on March 26, raw water color continued to decrease through early April and returned to winter-like levels by mid-month. Both plants stopped feeding carbon on April 4. The river broke-up in stages through the month and raw water turbidity peaked at 1200 NTU on April 23 as the last of the ice flowed through the city. The 2022 Home Sniffing Program concluded on May 21. The average score was 92.9% satisfied over the 90-day period, slightly below the 94.4% PBR target. This is similar to results last seen in 2018.

Rains in June and early July resulted in increased raw water color and turbidity, and decreased demands. Demands increased in late July with the onset of warm, dry conditions and remained higher than average through September, and raw conditions remained generally favorable late summer through fall.

E.L. Smith converted to Direct Filtration (DF) on October 11 and Rossdale followed on October 24. In 2022, the WTPs were able to achieve an average of 151 days in DF. The internal target of 120 days for DF operations was exceeded. DF operation resulted in a reduction of total solids discharged to the NSR by 50.4% during the months of January, February, November, and December compared to baseline conventional operation. In 2022, both plants operated several days in DF in March, and October. During this Extended DF period, the total solids reduction was 29.7% compared to baseline conventional operation.

EPCOR continued to assess the impacts of residuals to the NSR by generating better estimates of loads of TSS, dissolved aluminum and total metals from the WTPs, and

determining the extent and duration of the exceedances of instream guidelines through a mass balance approach. To improve the ability to calculate loads, EPCOR developed a Waste Stream Monitoring Program, which was approved by AEPA in December 2022, which will include installing flow monitoring equipment and autosamplers on select waste streams. The monitoring equipment, along with the results from the Waste Stream Monitoring Program, will assist in the calculation of loads and the assessment of both near-field and far-field impacts of WTP discharges on the NSR.

There was one notification to AEPA from the WTPs in 2022, involving a chlorinated release to the stormwater system at the Roslyn Reservoir site. The release occurred June 20 and 21st, and was reported on June 21. Given the distance from the river and the diversion of most of the release through a stormwater management facility, it is unlikely that there was any measurable chlorine residual at the point of discharge to the river.

The WTPs continue to improve the integrated safety and environmental management system in accordance with the ISO 14001:2015 and 45001:2018 standard. In 2022, an external auditor completed a surveillance audit of the WTPs and reservoirs to both of these standards. There were no nonconformances identified.

EWSI continued to upgrade the water treatment plants and the reservoir assets. Total expenditures in 2022 were approximately $38.5 M. Some of the major projects are as follows:

- kīsikāw pīsim Solar Farm – construction of the solar farm was substantially completed and the 13.6MW solar farm adjacent to the E.L. Smith WTP was placed into service in fall 2022.
- E.L. Smith Filter Structural Rehabilitation was completed on Stage 1, Filter 1 and Filter 2 in 2022. This structural rehabilitation program on all of the Stage 1 and Stage 2 filters is necessary for future deep bed filtration implementation.
- E.L. Smith Bypass main project was largely completed in 2021 and was placed in service in early 2022. This new pipe provides additional supply heading north from ELS.

- Phosphoric Injection for Lead Control construction continued through 2022 for the facilities at both WTPs and will be in service in Q1 2023.
- Plants Flood Protection work progressed in 2022 on this multi-year project. Work completed in 2022 included initial public and Indigenous consultation, groundwater transient modeling analysis, preliminary design work for permanent flood barriers, installation of demountable flood barriers at select locations, and detailed risk assessments of all WTP assets to define the detailed scope of the flood mitigation project.
- Rehabilitation of Clareview Reservoir was completed in early 2022.

In 2022, Water Distribution and Transmission repaired 277 water main breaks on the distribution system in Edmonton, with the majority of main breaks occurring on cast iron pipes. EPCOR generally experiences a higher volume of breaks in the first quarter of the year attributed to deeper frost penetration as we incurred 93 in this time frame. The overall reliability of the water distribution system can be attributed to the water main replacement and cathodic protection programs as well as the use of more reliable pipe materials in both replacement and new water main construction.

In 2022, the Uni-Directional Flushing program completed flushing and valve exercising in about 32% of Edmonton (2225 runs).This program is now a six-year cycle with area prioritization emphasis placed on water quality parameters, percentage of Cast Iron Mains, and the relative success of the previous flush.

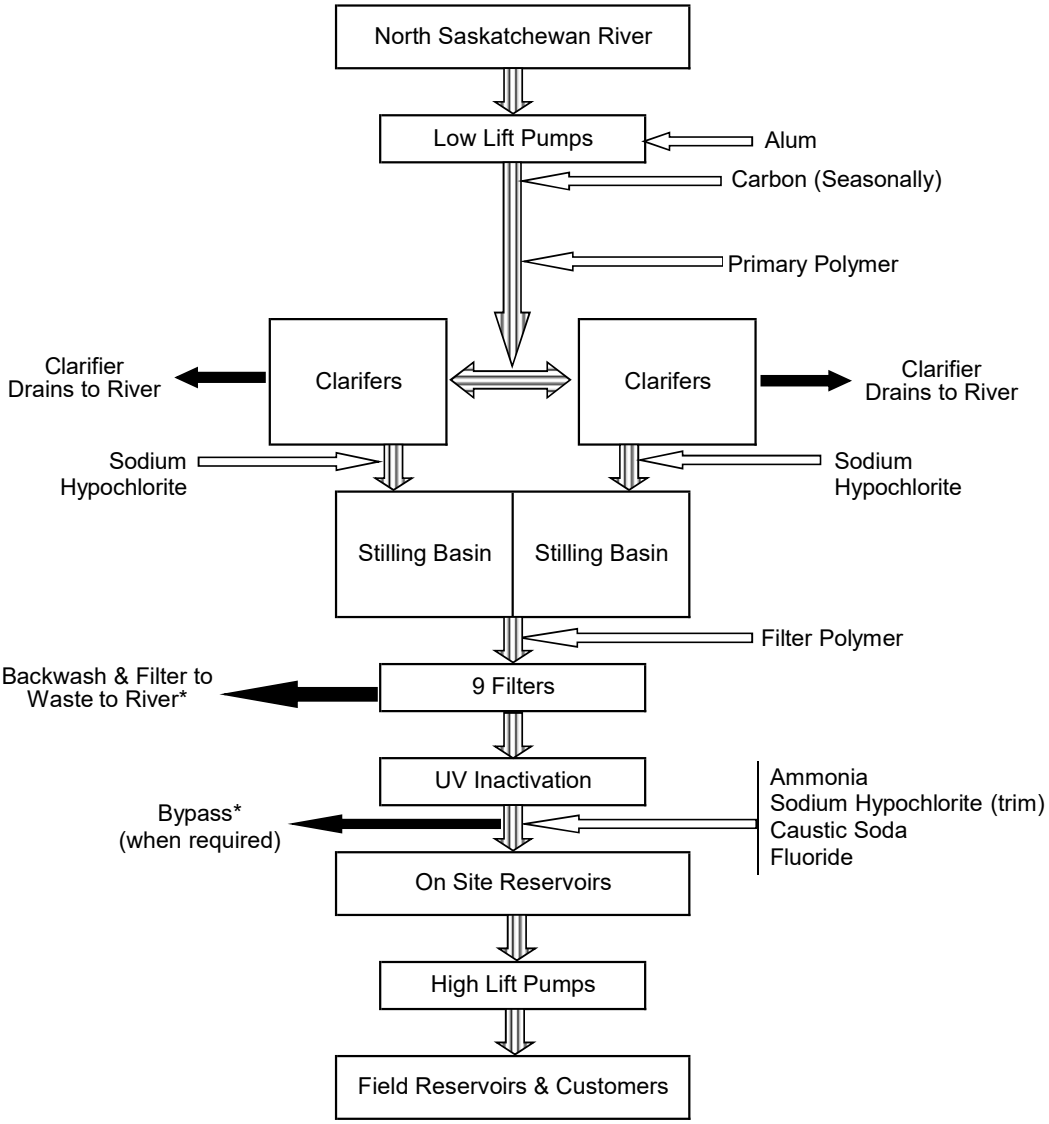
There was one AEPA approval contraventions within WDT in 2022 concerning TC+ samples. All samples were determined to be from contaminated hydrants. Issues were addressed by super-chlorinating hydrant barrel and resampling. There were 101 main breaks reported to AEPA due to the proximity of release to the storm system and the North Saskatchewan River

EWSI continues to provide water and wastewater services and expertise to numerous communities in Alberta, British Columbia, Saskatchewan, as well as industrial sites in Fort McMurray.

As we move into 2023, we will continue to focus our efforts on the production of and distribution of high quality water, customer satisfaction, protection of the environment, workplace safety and cost effectiveness. We will continue to ensure our customers receive best value for the services we provide them.

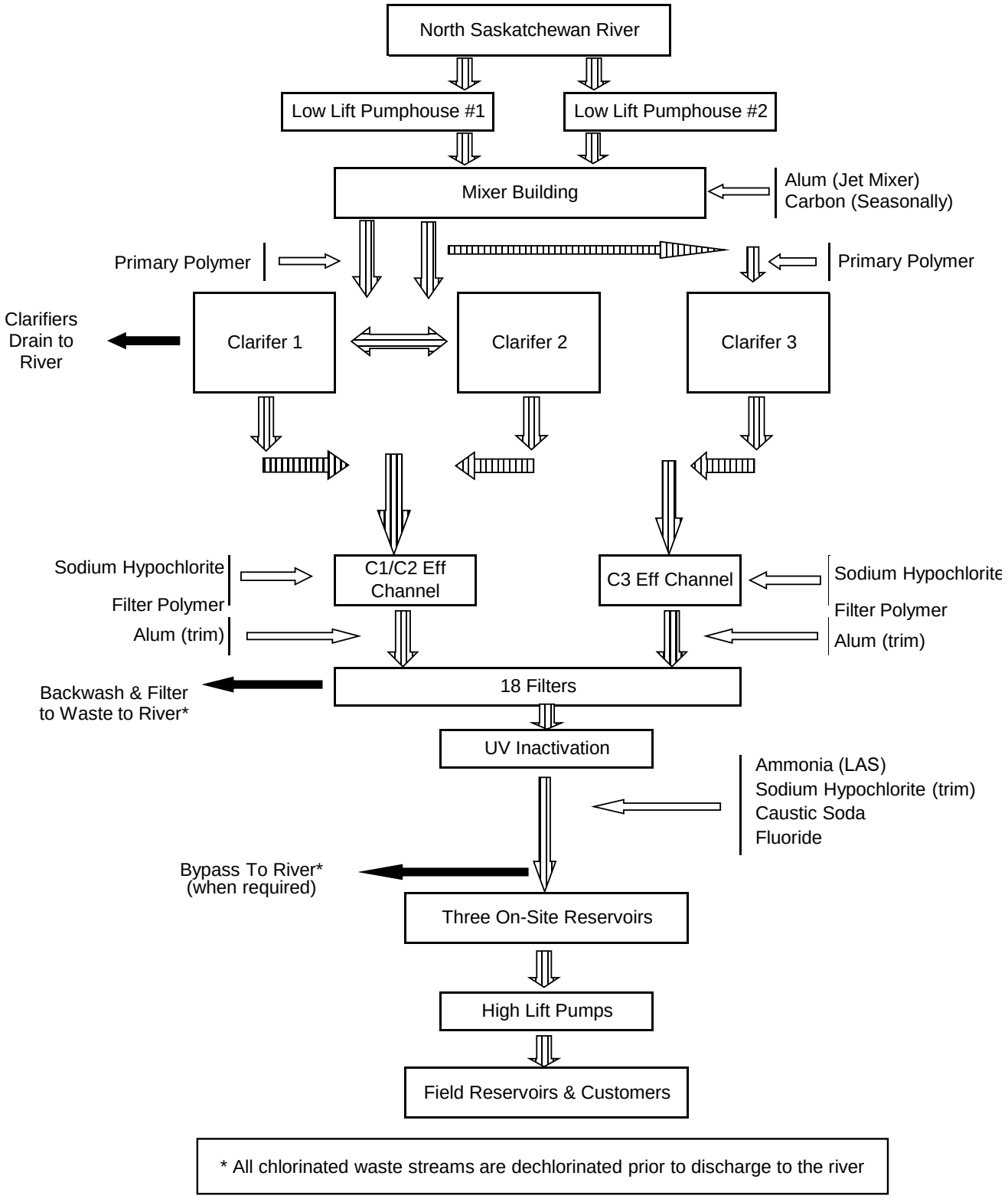
(End of Section)

1.2 Process Schematic - Rossdale (Plants 1 & 2)



* All chlorinated waste streams are dechlorinated prior to discharge to the river

1.3 Process Schematic - E. L. Smith (Plant 4)



1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220117-327057	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 17, 2022	387091
ENV-20220114-845037	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 14, 2022	387119
ENV-20220114-840972	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 14, 2022	387118
ENV-20220116-521847	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 16, 2022	387142
ENV-20220117-964909	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 17, 2022	387149
ENV-20220119-882446	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 19, 2022	387210
ENV-20220120-595121	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 20, 2022	387228
ENV-20220120-714275	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 20, 2022	387244
ENV-20220120-614893	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 20, 2022	387230
ENV-20220121-779624	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 21, 2022	387299

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220122-399545	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 22, 2022	387309
ENV-20220123-767891	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 23, 2022	387330
ENV-20220126-715055	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 26, 2022	387394
ENV-20220126-574096	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 26, 2022	387393
ENV-20220128-881763	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 28, 2022	387506
ENV-20220129-757935	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 29, 2022	387515
ENV-20220129-424597	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 29, 2022	387512
ENV-20220130-597801	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 30, 2022	387523
ENV-20220130-361862	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 30, 2022	387518
ENV-20220131-363414	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 31, 2022	387546

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220131-220479	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Jan 31, 2022	387537
ENV-20220201-304503	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 1, 2022	387578
ENV-20220201-976561	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 1, 2022	387556
ENV-20220202-003007	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 1, 2022	387603
ENV-20220202-851022	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 2, 2022	387586
ENV-20220202-827962	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 2, 2022	387584
ENV-20220204-446633	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 3, 2022	387647
ENV-20220201-559853	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 1,2022	387581
ENV-20220202-851022	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 2, 2022	387586
ENV-20220203-869615	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 3, 23022	387638

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220203-683188	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 3, 2022	387623
ENV-20220204-550741	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 4, 2022	387651
ENV-20220204-543238	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 3, 2022	387650
ENV-20220206-383337	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 6, 2022	387689
ENV-20220208-255462	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 8, 2022	387753
ENV-20220209-004659	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 9, 2022	387774
ENV-20220211-059814	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 11, 2022	387846
ENV-20220211-873864	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 11, 2022	387840
ENV-20220211-818939	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 11, 2022	387837
ENV-20220211-796731	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 11, 2022	387835

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220211-359519	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 10, 2022	387823
ENV-20220212-579920	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 12,2022	387855
ENV-20220212-416922	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 12, 2022	387850
ENV-20220216-747709	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387931
ENV-20220216-264237	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387955
ENV-20220216-268423	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387956
ENV-20220216-430940	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387963
ENV-20220216-268423	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387956
ENV-20220216-264237	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387955
ENV-20220216-747709	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 16, 2022	387931

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220223-062952	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 23, 2022	388144
ENV-20220224-035874	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	Feb 24, 2022	388186
ENV-20220301-552874	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 1, 2022	388336
ENV-20220301-053638	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 1, 2022	388303
ENV-20220311-079783	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 11, 2022	388560
ENV-20220312-803626	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 12, 2022	388586
ENV-20220315-355887	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 15, 2022	388649
ENV-20220321-597639	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 21, 2022	388836
ENV-20220325-768717	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 25, 2022	388966
ENV-20220326-833130	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 26, 2022	388999

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220330-589891	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 30, 2022	389138
ENV-20220330-478985	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	March 30, 2022	389126
ENV-20220407-463315	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	April 7, 2022	389399
ENV-20220408-434474	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	April 8, 2022	389452
ENV-20220413-334029	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	April 13, 2022	389558
ENV-20220414-696862	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water. The leak was isolated until the repair was completed.	April 14, 2022	389618
ENV-20220501-116468	EPCOR crew took a water sample from H1248 following a main break repair that resulted in a high turbidity. AEP was notified. Further flushing was performed and resampling done. The turbidity sample result was acceptable.	April 30,2022	390067
ENV-20220520-619368	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	May 20, 2022	390807
ENV-20220530-229804	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	May 30, 2022	391114

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220602-663454	Failure of a Quarterly toxicity testing (rainbow trout 96-hour acute lethality test) of the clarifier blowdown waste stream at the EL Smith WTP with a result of the LC50 of 70.7%. Results are typically non-toxic (i.e. LC50 >100%). Sampling and testing of the waste streams released to the North Saskatchewan River is not a requirement under the Approval to Operate but is done voluntarily as part of the residuals management program. Alberta Environment was notified of the result on June 1 (AEP Reference No. 391211).	June 1, 2022	391211
ENV-20220603-571575	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	June 3, 2022	391301
ENV-20220611-579117	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	June 11, 2022	400101
ENV-20220613-234316	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	June 13,2022	400139
ENV-20220615-050277	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	June 15,2022	400425
ENV-20220618-657319	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	June 18,2022	400285

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220621-120370	Rosslyn Reservoir Cell 2 was taken out of service May 25 for cleaning and inspection. Operations began to fill the reservoir with potable water at 13:40h in June 20 and stopped at 06:11h on June 21. Shortly after filling stopped on June 21, operating staff noted the level in the reservoir dropping slowly. In troubleshooting, they found the drain valve partially open 4 turns (of 30 required to open fully) and flow from the reservoir to the storm collection system. The drain valve was closed and the leak confirmed stopped at 09:22h on June 21. The storm collection system discharges to the NSR more than 10 km away at Outfall 74. The release was reported to Alberta Environment at approximately 15:00h on June 21 (Reference No. 400509).	June 21, 2022	400509
ENV-20220706-227489	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 6, 2022	401055
ENV-20220711-281585	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 11, 2022	401184
ENV-20220713-198229	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 13, 2022	401326
ENV-20220718-474037	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage combined sewer catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 18,2022	401522
ENV-20220713-916680	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 31,2022	402123

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220713-859924	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 31,2022	402122
ENV-20220731-505210	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	July 31,2022	402109
ENV-20220729-049470	On July 28, 2022, Hydrant #4547 was replaced. A water sample was collected and marked "in use" on the sample form but the control valve was left closed. In-field samples for chlorine and turbidity levels were within normal operating ranges. The sample failed with a positive result for Total Coliforms. The lab results were reported on July 29, 2022 at 14:27 hrs. Immediately following the notification from the lab of the failed sample, an EPCOR crew was arranged to collect three (3) additional samples for lab testing on July 29, 2022. All additional samples had acceptable results for all parameters.	July 29,2022	402048
ENV-20220725-455432	After a major fail and repair of a motor on the Watermark Chiller it was noticed that the unit was no longer able to maintain set points. A leak check was performed and a leak was found. The refrigerant (R22) was removed and weighed, 22 lbs of a possible 47 lbs was recovered. This resulted in a 25 lbs loss from the system. Called into AEP Reference Number 401853. 7 Day letter is required. The remaining R-22 refrigerant was removed from the unit and was replaced with R-407C. The Chiller was repaired.	July 24, 2022	401853
ENV-20220805-865237	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the combined catch basin infrastructure e to dechlorinate the water. The water was not released though an outfall. The leak was isolated until the repair was completed.	August 5, 2022	402298
ENV-20220819-095493	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	August 19, 2022	402921

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220825-297968	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	August 25, 2022	403235
ENV-20220805-082253	On August 4, 2022 at 10:15 hrs, EPCOR Rossdale Lab sampler collected two weekly reservoir samples from Thorncliff Reservoir and submitted one to Provincial Lab at 10:57 hrs and the other to EPCOR Lab for in-house analysis. On August 5, 2022 at 13:37 hrs, the laboratory received a notification from Provincial Lab, indicating the sample tested positive for total coliform. AEP was notified of the lab results on August 5, 2022 at 15:20 hrs. Lab staff subsequently collected one sample from Thorncliff Reservoir at 16:00 hrs. Water Trouble crew collected three samples from near-by hydrants (H6748, H6741, and H6532). All these samples were submitted to the lab by the end of Friday, August 5, 2022. All sample were tested negative for total coliform.	August 4, 2022	402328
ENV-20220823-509644	On August 17, 2022 at 9:53 hrs, EPCOR Rossdale Lab sampler collected two monthly fire station samples from Fire Station #4 and submitted one to Provincial Lab at 10:59 hrs and the other to EPCOR Lab for in-house analysis. On August 19, 2022 at 12:30 hrs, the laboratory received a notification from Provincial Lab, indicating the sample tested positive for total coliforms. AEP as well as AHS were notified of the lab results on August 19, 2022 at 14:30 hrs. A Water Trouble crew was dispatched to collect four samples at 15:17hrs on August 19, 2022 (one from the utility tap in Fire Station #4, one from the bathroom tap in Fire Station #4, two from near-by hydrants H15749 and H12930). All these samples were submitted to the lab by the end of Friday, August 19, 2022. All re-samples tested negative for total coliforms.	August 17, 2022	402863

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220817-190664	Original samples collected on August 15, 2022 at 01:20 hrs. Original lab results reported on August 16, 2022 at 15:46 hrs. The sample from the original hydrant tested positive for total coliform. Flushing and resampling was completed at the original hydrant plus two (2) hydrants upstream and downstream of the original hydrant on August 16, 2022 at 20:00 hrs and the hydrant control valve was closed to isolate the hydrant from the distribution system. Lab results for the resamples were reported on August 18, 2022 at 15:22 hrs. The resample from the original hydrant tested positive for total coliform. All other samples passed. Further flushing and resampling was not repeated as the hydrant was then isolated from the distribution system and the original hydrant was super chlorinated on August 18, 2022 at 16:45 hrs. The original hydrant was flushed and resampling was completed at original hydrant from two (2) ports, plus two (2) hydrants upstream and downstream of the original hydrant on August 19, 2022 at 15:00 hrs. Lab results for these resamples were reported on August 21, 2022 at 11:08 hrs and passed for all parameters. Hydrant was put back into service on August 21, 2022 at 13:24 hrs.	August 15, 2022	402772
ENV-20220907-380515	About 68 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into a catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Sept 7, 2022	403999
ENV-20220912-568785	About 111 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Sept 12, 2022	404219
ENV-20220915-784949	About 0.1 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Water was pooling nearby. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. This was a very low volume leak. The leak was isolated until the repair was completed.	Sept 15, 2022	404439

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20220916-141998	About 195 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Sept 16, 2022	404449
ENV-20220924-513937	About 142 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into a nearby catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Sept 24, 2022	404781
ENV-20221008-296513	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into a catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	October 8, 2022	405363
ENV-20221008-304361	Potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	October 8, 2022	405372
ENV-20221013-590033	Potable chlorinated water was released due to a suspected leak within the water distribution system. Water was pooling nearby. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. This was a very low volume leak. The leak was isolated until the repair was completed.	October 13, 2022	405545
ENV-20221014-719010	About 38 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed. The water then travelled 1.7 km into a storm drain where it exited into Millcreek ravine.	October 14, 2022	405628
ENV-20221104-832428	About 84 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into a storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 4, 2022	406486

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20221106-281902	About 73 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 6, 2022	406509
ENV-20221113-337510	About 43 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 13, 2022	406705
ENV-20221114-346764	About 18 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 14, 2022	406737
ENV-20221120-448315	About 37 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the combined storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 20, 2022	406930
ENV-20221124-103053	About 227 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 24, 2022	407086
ENV-20221127-827994	About 103 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 27, 2022	407140
ENV-20221130-101945	About 49 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Nov 30, 2022	407255

1.4 Summary of Violations and Notifications for 2022

EPCOR Incident Number	Description	Date of Incident	AESRD Report File Number
ENV-20221206-139039	About 58 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into a storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Dec 6, 2022	407422
ENV-20221207-354745	About 73 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Dec 7, 2022	407494
ENV-20221225-428939	About 36 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Dec 25, 2022	408034
ENV-20221228-399106	About 36 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the drainage storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Dec 28, 2022	408097
ENV-20221231-788595	About 70 cubic metres of potable chlorinated water was released due to a suspected leak within the water distribution system. Dechlorination pucks were placed in the path of water and the water entry point into the combined storm catch basin infrastructure to dechlorinate the water. The leak was isolated until the repair was completed.	Dec 31, 2022	408173

(End of Section)

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

ROSSDALE WATER TREATMENT PLANT (LEVEL IV)		
	Director, Edmonton Water Treatment Plants	
	Senior Manager, Operations	**WT II**
Employee Name	Title	Alberta Environment Certification Level
	Operations Engineer	WT I
	Manager, Operations	WT III, WWT III
	Manager, Transmission Operations	WT III
	Day Foreman	WT III
	Operations Foreman	WT IV
	HEI Foreman	WT IV
	Operations Foreman	WT IV
	Operations Foreman	WT IV
	Operations Foreman	WT IV
	Operations Foreman	WT IV
	Transmission Foreman	WT III
	Training Operator Foreman	WT III
	Lead Hand, Operator	WT II
	Operator I	WT III
	Operator I	WT II
	Lead Hand, Operator	WT II
	Lead Hand, Operator	WT III
	Operator I	WT II
	Operator I	WT III
	Lead Hand, Operator	WT IV, WD III, WWT II, WWC III
	Operator I	WT II
	Lead Hand, Operator	WT II
	Operator I	WT II
	Operator I	WT II, WD II, WWT II, WWC II
	Operator I	WT II, WWT II
	Operator I	WT II
	Operator I	WT II
	Operator I	WT III, WWT III
	Operator I	WT I
	Operator I (temp)	WT II, WD II, WWT II, WWC II
	Operator I (temp)	Non-Certified

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

E.L. SMITH TREATMENT PLANT (LEVEL IV)

	Director, Edmonton Water Treatment Plants	
	Senior Manager, Operations	**WT II**
Employee Name	Title	Alberta Environment Certification Level
	Director, Edmonton Water Treatment Plants	
	Senior Manager, Operations	WT II
	Operations Engineer	
	Manager, Operations	WT III, WWT III
	Day Foreman	WT IV
	HEI Foreman	WT IV
	Training Operator Foreman	WT III
	Operations Foreman	WT IV
	Operations Foreman	WT IV
	Operations Foreman	WT III
	Operations Foreman	WT IV
	Operations Foreman	WT III
	Lead Hand, Operator	WT III
	Lead Hand, Operator	WT II
	Lead Hand, Operator	WT IV
	Lead Hand, Operator	WT II
	Lead Hand, Operator	WT II, WD II, WWT I, WWC I
	Operator I	WT III, WWT II,
	Operator I	WT IV
	Operator I	WT II
	Operator I	WT III
	Operator I	WT II
	Operator I	WT III, WWT III
	Operator I	WT II, WD II, WWT I

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

DISTRIBUTION SYSTEM (LEVEL IV FACILITY)

WATER DISTRIBUTION (WD) - NETWORK MAINTENANCE

Senior Manager, Maintenance and Construction
Manager, Maintenance and Construction
Manager, Dist. Maint Schedule

Employee Name	Title	Alberta Environment Certification Level
	Water Network Operator	WD IV WWC I
	Water Network Operator	WD IV
	Foreman III	WD III
	Foreman III	WD III
	Foreman III	WD III
	Foreman III	WD III
	Foreman I	WD III WWC I
	Foreman I	WD II
	Foreman I	WD III
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD III
	Foreman I	WD II
	Foreman I	WD II
	Foreman I	WD IV
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Equipment Operator III	WD I
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Equipment Operator III	WD I
	Equipment Operator III	WD I
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Equipment Operator III	WD I
	Equipment Operator III	WD II
	Equipment Operator III	WD II
	Labourer II	WD II
	Labourer II	WD II
	Labourer II	WD I
	Labourer II	WD I
	Labourer II	WD I
	Labourer III	WD III
	Labourer II	WD I
	Labourer III	WD I
	Labourer II	WD I
	Labourer II	WD I

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

DISTRIBUTION SYSTEM (LEVEL IV FACILITY)

WATER DISTRIBUTION (WD) - NETWORK MAINTENANCE

Senior Manager, Maintenance and Construction

Manager, Maintenance and Construction

Manager, Dist. Maint Scheduling

Employee Name	Title	Alberta Environment Certification Level
	Labourer II	WD I
	Labourer II	WD II
	Labourer II	WD I
	Labourer II	WD I
	Labourer II	WD I
	Labourer II	WD II
	Labourer II	
	Labourer II	WD II
	Labourer II	WD II
	Truck Driver III	WD II
	Truck Driver III	WD II
	Truck Driver III	WD I
	Truck Driver III	WD I
	Foreman III	WD III
	Welder	WD II
	Maintenance Repairman I	WD II
	Maintenance Repairman I	WD I
	Maintenance Repairman I	WD I
	Labourer III	WD I
	Labourer II	WD I
	Foreman I	WD I
	Water Sys Tech Support Specialist	WD II
	Water Sys Tech Support Specialist	WD IV

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

DISTRIBUTION SYSTEM (LEVEL IV FACILITY)

WATER DISTRIBUTION (WD) - FIELD OPERATIONS

	Senior Manager, Distribution Operations	
	Manager, Field Operations	
	Manager, Metering and Preventative Maintenance	WD I
	Manager, Water Trouble	WD III
Employee Name	Title	Alberta Environment Certification Level
	Foreman III	WD IV
	Foreman III	WD IV
	Foreman I	WD II
	Foreman I	WD II
	Labourer III	WD II
	Labourer III	WD II
	Labourer III	WD I
	Labourer III	WD I
	Labourer III	WD III
	Labourer II	WD I
	Labourer II	WD II
	Labourer II	WD I
	Labourer II	WD I
	Labourer III	WD I
	Labourer II	WD II
	Labourer II	WD I
	Labourer III	WD I
	Labourer II	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD III
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD III
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD II
	Water Systems Serviceman	WD I
	Water Systems Serviceman	WD II

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

DISTRIBUTION SYSTEM (LEVEL IV FACILITY)

WATER DISTRIBUTION (WD) - CUSTOMER SERVICE

Senior Manager, Customer Service

Manager, Dispatch

Manager, Inspections and Customer Service

Employee Name	Title	Alberta Environment Certification Level
	Team Lead, Dispatch	
	Dispatcher Coordinator	WD I
	Inspector – Water Metering	WD II
	Inspector – Water Metering	WD I
	Foreman III	WD III
	Manager, Cross Connections	WD II
	Inspector – Cross Connections	WD I

1.5 Alberta Environment Operator Certifications

Operator Contact Number: EPCOR Water Services Dispatch (24 hr) (780) 412-4500

DISTRIBUTION SYSTEM (LEVEL IV FACILITY)

WATER METERING (WD)

D. Cooper	**Manager, Metering Operations**	**WD I**
Employee Name	Title	Alberta Environment Certification Level
	Foreman III	WD II
	Meter Installer II	WD II
	Meter Mechanic II	WD II
	Meter Installer II	WD III
	Meter Installer I	WD II
	Meter Installer I	WD II
	Meter Installer I	WD II
	Meter Installer I	WD I
	Meter Installer I	WD III
	Meter Installer I	WD I
	Meter Installer I	WD I

1.6 Demand/Production Statistics (Estimated HLP Flow)

2022

Month	ROSSDALE ZONE			E.L.SMITH ZONE			SYSTEM TOTAL			RESERVOIR PUMPAGE		
	Monthly Prod'n (ML)	Max Daily Prod'n (ML)	Peak Daily Demand (ML)	Monthly Prod'n (ML)	Max Daily Prod'n (ML)	Peak Daily Demand (ML)	Monthly Prod'n (ML)	Max Daily Prod'n (ML)	Peak Daily Demand (ML)	Rossdale Zone (ML)	E.L.Smith Zone (ML)	Total (ML)
JANUARY	4,254	144	154	6,512	226	233	10,766	366	359	760	2,430	3,190
FEBRUARY	4,024	165	240	5,668	227	273	9,692	381	361	720	2,197	2,916
MARCH	4,650	170	194	6,043	217	225	10,693	377	358	933	2,316	3,249
APRIL	4,647	174	210	5,848	214	263	10,494	379	358	1,190	2,375	3,565
MAY	4,619	187	228	6,874	266	318	11,493	442	414	1,344	2,927	4,272
JUNE	4,496	187	189	7,459	290	273	11,955	476	455	1,117	2,929	4,046
JULY	4,999	230	223	7,932	316	297	12,931	546	513	1,553	3,225	4,778
AUGUST	5,800	236	263	7,873	315	292	13,672	524	509	1,710	3,541	5,251
SEPTEMBER	5,026	214	232	7,033	293	274	12,058	501	484	1,402	3,044	4,446
OCTOBER	4,039	208	178	7,150	286	295	11,189	472	379	1,197	2,924	4,122
NOVEMBER	3,989	163	225	6,506	253	288	10,495	416	372	1,128	2,594	3,722
DECEMBER	4,149	163	195	6,723	257	269	10,872	400	364	1,142	2,728	3,870

2022 - HIGH 5-DAY DEMAND

	PLANTS PROD (ML/d)	RES. GAIN / LOSS (%)	RES. GAIN / LOSS (ML)	TOTAL DEMAND (ML)
22-Aug-2022	461	-3.4	-21.2	482
23-Aug-2022	322	-25.1	-158.1	480
24-Aug-2022	506	3.6	22.6	483
25-Aug-2022	497	0.2	1.0	496
26-Aug-2022	524	5.7	35.9	488
			AVERAGE:	486

Year to Date Data	2022	2021	% CHANGE
TOTAL PRODUCTION TO DATE (ML)	136,309	137,214	(0.7)
AVG. DAILY DEMAND TO DATE (ML)	373	376	(0.7)
PEAK DAILY DEMAND TO DATE (ML)	513	608	(15.7)
PEAK HOURLY DEMAND TO DATE (ML)	716	865	(17.2)
HIGH 5-DAY AVERAGE TO DATE (ML)	486	591	(17.8)

Peak daily demand of 513 ML/d occurred on July 28, 2022

Peak hourly demand of 716 ML/d occurred on August 31st at 20:00 to 21:00

1.7 Energy Consumption and Usage

Energy Consumption

Power Consumption (kWh):

	2022	2021	Change %
Rossdale WTP	32,298,100	30,231,847	6.83%
E.L Smith WTP.	43,911,766	44,602,862	-1.55%
Field Pump Stations	15,910,792	15,083,368	5.49%
TOTAL	92,120,658	89,918,078	2.45%

Gas Consumption (GJ):

	2022	2021	Change %
Plants	93,903	96,754	-2.95%
Pumping Stations	4,362	4,309	1.23%
TOTAL	98,265	101,062	-2.77%

Water Production/Pumpage(ML):

	2022	2021	Change %
Rossdale WTP	54,690	51,847	5.48%
E.L Smith WTP.	81,621	85,368	-4.39%
Field Pump Stations	43,743	43,972	-0.52%
TOTAL	136,310	137,215	-0.66%

Note: The reservoirs and booster stations are not included into these totals.

Energy Usage

	2022	2021
Energy Consumption for Treatment and Pumpage (kWh)	92,120,658	89,918,078
Energy in kW.h per ML pumped	676	655
Gas Consumption – All Facilities (GJ)	98,265	101,062
Gas Consumption – All Field Pump Stations (GJ)	4,362	4,309

(End of Section)

1.8 Summary of Changes to the Operations Program

A summary of the significant changes to the 2023 Operations Program document from the previous year is as follows:

1. References to Alberta Environment & Parks (AEP) have been removed, and throughout the document now references Alberta Environment & Protected Areas (AEPA), with the excepting of to historical documents that were authored by AEP.
2. The EWTPiMS is now registered under the Health and Safety Standard ISO 45001, replacing OHSAS 18000.
3. Section 1, reference to North Saskatchewan River Science and Knowledge Mobilization Committee which EPCOR staff are leading.
4. Section 1, updated to reflect new PBR cycle for WaterSHED program to 2026.
5. Section 1.1.3, reference to Residuals Monitoring Plan that was submitted to AEPA in 2022 that was accepted and is now implemented.
6. Section 1.2 EWSI staff has incorporated the Integrated Watershed Management Strategy into a an updated Total Loading Management Plan that was provided to AEPA in 2022
7. Section 1.3, updates to research programs that are scheduled/occurring.
8. Section 3.1.1 update to the existing distribution and transmission system length from 4,122 km to more than 4,337 km and an updated Table 3.1.
9. Section 3.1.1 Updated Table 3.2 showing reservoir storage volumes.
10. Section 3.2, as of June 2021, the Water, Drainage, and Power standards are now hosted on the EPCOR website rather than the City of Edmonton website.
11. Section 3.2.4, reference to EWSI only testing CCs as part of the Final Acceptance Process. CCs are confirmed off during commissioning activities and left as such as homes have not been built to confirm their successful operation. CCs found to be inoperable during home construction are repaired under warranty – by the developer if there isn't a depressurization needed (i.e. a bent casing or missing rod) or by EWSI if a depressurization of the distribution system is needed.
12. Section 3.2.5.2, added that in development areas where a high risk of long-term stagnation is identified, developers are required to enter into a flushing agreement with EPCOR where EPCOR will report to site on a regular basis to sample the mains and will flush as needed to ensure that chlorine and turbidity are within a set range of parameters. If the testing shows that the water within the main is outside of the specified parameters, flushing is completed until the line is returned to being within range. Developers may be permitted to do the flushing themselves to minimize costs, but EPCOR retains a monitoring program and will act immediately if the water is found to be outside of specification.
13. Section 3.3.1, updated reference to bylaw 19626 and EPCOR requirement for registration of a caveat for Check Valve installation on title for any new development or

redevelopment that has more than one service entering the property. The wording of the caveat requires the installation of a check valve on the service line within 1m of each service entry onto private property if the lines become interconnected. This is to prevent water from entering a site, becoming contaminated, and exiting the site back into the distribution system. These check valves are owned/maintained by the site owner.

14. Section 4.1.2 and 4.3, updated the Lab Quality Management System reference materials.
15. Section 4.2.3.2, updated census information and correlating number of required routine bacteriological samples required each month (195) and an updated Table 4.1.
16. Section 4.3.4, reference to the commencement of the RDT sampling to assess corrosion control and info that in 2022 there were 67 high priority LSL's and 68 maintenance/renewal LSL's, for a total of 135 LSL's removed from the distribution system. In 2023 the target is to complete the remaining < 27 high-priority-replacements.
17. Section 4.4, updated name from Home Sniffing Program to Spring Home Analysis Runoff Program (SHARP).
18. Section 4.4.2, the results of SHARP program and treatment decision reviewed annually and other relevant information considered includes temporal trends of raw water turbidity and colour as well as ammonia (NH3-N) and total kjeldahl nitrogen (TKN).
19. Section 6.1, update to the timing and method of reviewing Drinking Water Safety Plan (DWSP).
20. Sections 6.2 and 6.3 removed from the Operations Program as it is no longer required to be included. The DWSP and the requirements for it under the Approval are met by the individual DWSP document and its procedure along with its inclusion in the Environmental Aspect Identification component of the Integrated Health, Safety and Environmental Management System for the Edmonton Waterworks.
21. Section 7.2 updated the definitions for discrete capital projects and capital programs.
22. Table 10.1, removed Particle Counts as they are no longer listed in Schedule 3.
23. Table A-5, removed list of discretionary pharmaceutical sampling that not occurred in recent years.

2.1 Storage Capacities of Reservoirs

Reservoir Name	Available ML	Fire Storage (ML)	Operating Storage (ML)	Dead/ Emergency ML	Gross ML
Water Treatment Plant Reservoir Cells					
Rossdale Total	80.42	0.00	80.42	16.98	97.40
E.L. Smith Total	95.20	0.00	95.20	42.30	137.50
WTPs Sub Total	**175.62**	**0.00**	**175.62**	**59.28**	**234.90**
Field Reservoir Cells					
Rosslyn	97.54	12.56	110.10	12.93	123.04
Clareview	50.51	2.95	53.46	11.14	64.60
Papaschase	66.80	9.71	76.51	5.63	81.59
Londonderry	39.10	2.58	41.68	3.56	45.24
North Jasper Place	29.74	4.66	34.40	11.66	46.06
Ormsby	37.41	2.99	40.40	4.87	45.27
Thorncliff	37.10	2.93	40.03	3.40	43.43
Kaskitayo	21.78	3.96	25.74	3.20	28.94
Mill Woods	46.98	5.92	52.90	3.33	56.23
Castle Downs	22.70	2.41	25.11	8.93	34.04
Discovery Park	5.00	1.44	6.44	0.71	6.93
Field Sub Total	**454.65**	**52.11**	**506.77**	**69.36**	**575.37**
Grand Total	**630.27**	**52.11**	**682.39**	**128.64**	**810.27**

(End of Section)

2.2 Pumping Station Operating Pressure Ranges

		Current Alarms					
Treatment Plants Highlift Pump Stations	**Elevation, m**	**LOLO**	**LO**	**HI**	**HIHI**	**Low Pressure SD**	**High Pressure Setpoints**
ELS North	620.85	910	940	1080	1100		
ELS South	620.85	910	940	1080	1100		
Rossdale West	622.25	800	830	950	980		
Rossdale South	622.25	800	830	950	980		
Reservoir Pumping Stations	**Elevation, m**	**LOLO**	**LO**	**HI**	**HIHI**	**Low Pressure SD**	**High Pressure Setpoints**
Rosslyn 1 Discharge	669.87	295	345	475	595		
Rosslyn 2 Discharge	671.42	280	330	465	580		
Clareview Intake	649.73	365	410	640	670		
Clareview Discharge	648.95	430	480	620	640		
Papaschase 1 In/Disch	693.3	45	95	270	385		
Londonderry Intake	677.91	170	220	380	480		
Londonderry Discharge	670.21	400	450	500	525		535
Rosslyn 3 Discharge	669.14	510	540	630	700		610
Ormsby LE Discharge	679.38	525	575	680	710		
NJP Discharge	675.12	320	345	440	580		
Ormsby Primary Discharge	679.41	325	355	460	490		
Ormsby Intake	679.41	295	325	1000	1000		
Thorncliff Discharge	672.02	350	380	495	515		
Thorncliff Intake	672.02	310	340	480	500		
Castledowns Intake	678.96	230	260	400	430		
Castledowns Discharge	677.99	400	450	530	710		520
Kaskitayo Discharge	673.84	490	550	690	720		
Kaskitayo Intake	673.84	280	315	480	550		
Millwoods Discharge	678.83	490	520	620	650		
Millwoods Intake	678.82	220	250	400	430	60/140	
Papachase 2 Discharge	690.42	350	380	500	530		
Papachase 2 Intake	689.06	40	70	700	700		
Discovery Park Intake		350	400	460	510		
Discovery Park Discharge		280	330	470	520		
Booster Pumping Stations	**Elevation, m**	**LOLO**	**LO**	**HI**	**HIHI**	**Low Pressure SD**	**High Pressure Setpoints**
Parkland Intake	682.353	270	290	380	400		
Parkland Discharge 300mm	682.4	555	605	700			
Parkland Discharge 600mm	682.4	555	605	700			
Big Lake Intake	677.6					60/140	
Big Lake Discharge	677.6	315	365	475	625		
Terwillegar Discharge	683.00	440	480	650	690		
Terwillegar Intake	682.16	240	257	750	750	60/140	
Burnewood Discharge	695.05	520	550	610	640		
Burnewood Intake	695.05	210	240	700	700	60/140	
Laurel Intake		230	280	300	350	60/140	
Laurel Discharge		280	300	400	450		
Ellerslie Discharge	695.23	490	540	580	600		
Ellerslie Intake	695.2	250	280	500	540	60/140	
Walker Intake	723.6					60/140	
Walker Discharge	723.6	360	410	500	650		
Blackmud Creek Intake	690.104						
Blackmud Creek Discharge		630	680	830	880		

(End of Section)

2.3 Fire Stations & Other City Pressure Monitors

		Current Alarms					
Firehall Stations	**Elevation, m**	**LOLO**	**LO**	**HI**	**HIHI**	**Low Pressure SD**	**High Pressure Setpoints**
Fire Hall #1 (Headquarters)	661.759	310	360	550	700	N/A	N/A
Fire Hall #2 (Downtown)	667.018	270	320	495	645	N/A	N/A
Fire Hall #3 (University)	667.792	370	420	520	670	N/A	N/A
Fire Hall #5 (Norwood)	663.986	235	285	515	665	N/A	N/A
Fire Hall #6 (Mill Creek)	663.863	360	410	520	670	N/A	N/A
Fire Hall #7 (Highlands)	655.873	280	330	550	700	N/A	N/A
Fire Hall #8 (Hagman)	674.153	295	345	450	600	N/A	N/A
Fire Hall #9 (Roper Station)	693.967	240	290	460	610	N/A	N/A
Fire Hall #11 (Capilano)	665	260	310	475	625	N/A	N/A
Fire Hall #15 (Coronet)	675.232	285	335	470	625	N/A	N/A
Fire Hall 12 (Meadowlark)	673.546	250	300	445	595	N/A	N/A
Fire Hall 13 (Rainbow Valley)	669.812	285	335	515	665	N/A	N/A
Fire Hall #16 (Mill Woods)	693.516	260	310	430	580	N/A	N/A
Fire Hall #17 (Castledowns)	680.669	230	280	470	620	N/A	N/A
Fire Hall #20 (Kaskitayo)	679.57	230	280	430	580	N/A	N/A
Fire Hall #22 (Oliver)	668.561	230	280	520	670	N/A	N/A
Fire Hall #24 (Terwillegar)	686	265	315	450	600	N/A	N/A
Fire Hall #26 (Meadows)	712.5m	295	345	475	525	N/A	N/A
Firehall #27 (Ellerslie)	686	375	425	470	615	N/A	N/A
Fire Hall #28 (Heritage Valley)	695.408	290	300	400	550	N/A	N/A
Other City Pressure Monitoring Stations	**Elevation, m**	**LOLO**	**LO**	**HI**	**HIHI**	**Low Pressure SD**	**High Pressure Setpoints**
U of A #1 (Sask Dr)	669.63					N/A	N/A
U of A #2 (83 Ave)	670.762					N/A	N/A
U of A #3 (116st)		330	360	460	490	N/A	N/A
Sobeys	682	305	355	490	640	N/A	N/A
Northest Line		420	450	580	610	N/A	
Westview	696.7	320	340	500		N/A	N/A
HD Windermere	682.7	410	460	550	770	N/A	N/A
HD 17st	707.6	340	390	490	640	N/A	N/A
TAMS	assume 679.44	270	320	410	560	N/A	N/A
Clover Bar						N/A	N/A

(End of Section)

2.4 Regional Customers

Customer	Elevation (m)	Minimum		Normal Range			
		Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)	Pressure (kPa)	HGL (m)
Regional Water Customer Group*							
CRPWSC (Parkland)	711.95	89	722.3	89	722.3	138	727
Sturgeon County	692	240	717	304	723	354	723
Strathcona County	664.384	349	700	379	703	438	709
Morinville	662.65	383	698	422	702	471	707
St. Albert Sturgeon	685.173	175	703	214	707	263	712
St. Albert Oakmont	655.45	402	696	441	700	491	706
CRNWSC (Northeast)	643.05	470	691	519	696	578	702
CRSWSC (Southwest)	716	390	755.7	430	759.8	495	766
Bulk Customers*							
Enoch Cree Nation	703.7	128	717	160	720	240	728
Namao	681.495	280	710	309	713	437	726

*Based on Water Supply Agreements

(End of Section)

2.5 Pumping Facilities

Facilities	Year Built	Number of Pumps			Maximum Design Discharge Flow by Pump (ML/d)
		Total	Fixed Speed	Variable Speed	
Water Treatment Plants Highlift Pump Stations					
Rossdale Plant	1947	6	4	2	4 @ 100, 2 @ 105
E.L. Smith Plant	1976	4	2	2	2 @ 95, 2 @ 205
Field Reservoir & Booster Pump Stations					
Primary Zone					
Clareview	1979	3	1	2	1 @ 14, 2 @ 30
Rosslyn 1	1955	3	3	0	3 @ 20
Rosslyn 2	1969	1	1	0	1 @ 22
North Jasper Place	1974	4	3	1	2 @ 13, 2 @ 26
Thorncliff	1970	3	3	0	3 @ 12
Ormsby*	1969	3	2	1*	2 @ 16, 1@ 32
Papaschase 1	1976/82	2	2	0	2 @ 20
North Secondary Zone					
Londonderry	1974/79	3	1	2	2 @ 15, 1 @ 21
Castledowns	1979	3	1	2	3 @ 17
Rosslyn 3	1963	3	3**	0	2 @ 26; 1@18
West Secondary & Big Lake Zones					
Parkland Booster St.	1973	5	3	2	1 @ 2, 1 @ 4, 1 @ 10, 1 @ 14, 1 @ 25
Ormsby, Lewis Estates	1969	3	0	3	1 @ 20, 1@ 15, 1 @ 5
Big Lake Booster St.	2016	5	0	5	2 @ 8, 2 @ 25, 1 @ 34
South Secondary Zone					
Papaschase 2	1968/71	3	2	1	2 @ 13, 1 @ 23
Mill Woods	1977	6	3	2	3 @ 16, 1 @ 24, 1 @ 32, 1 @ 18
Kaskitayo	1980	5	3	2	3 @ 10, 2 @ 15
Terwillegar Booster St.	1998	3	2	1	3 @ 17
South Tertiary Zone					
Burnewood Booster St.	1985	4	2	2	3 @ 19, 1 @ 14
Ellerslie Booster St.	2007	2	0	2	2 @ 6
Laurel Booster St.	2018	2	0	2	2 @ 2
Blackmud Creek Booster S	1982	3	0	3	1@17, 1@34, 1@2.6
Discovery Park	2020	5	0	5	1@1.12,2@2.68,2@11.2
South Quaternary Zone					
Walker Booster St.	2015	5	0	5	2 @ 2, 2 @ 7, 1@ 17
TOTAL		**88**	**38**	**45**	

*Ormsby Pump #3 can be used to support Primary Pressure Zone or West Secondary Pressure Zone depending on the discharge header valve configuation. The totals include this pump once.

(End of Section)

2.6 Production Summary

Water Production	2022	2021	2020
Treated and Pumped into the System	136,309	137,214	129,825
Water Treated at Rossdale Plants	54,690	51,848	45,877
Water Treated at E. L. Smith Plant	81,619	85,366	83,948
Supplied to Residential Customers	66,096	69,534	66,604
Supplied to Commercial/Industrial Customers	24,581	22,342	21,407
Supplied to Suburban Customers	36,254	37,659	33,610
Percentage Accounted for from:			
Metered & Bulk Sources	94%	94%	94%
Assumed System Leakage	6%	6%	6%
Average Day Pumpage (ML)	373	376	355
Peak Day Demand (ML)	513	608	441

Population Served	2022	2021	2020
Approximate Population Served (City)	1,087,172	1,010,899	1,047,003
Approximate Population Served (Region)	360,000	356,000	354,000
Approximate Population Served (Total)	1,447,172	1,366,899	1,401,003

Per Capita Consumption (L/cap)	2022	2021	2020
Average Day Demand	258	275	253
Peak Day Demand	354	445	315

(End of Section)

2.7 Raw Water Intake (ML)

2022

Month	Rossdale									E.L. Smith				Plants Combined Total
	Plant 1				Plant 2				Plant Total	Min	Max	Avg	Plant Total	
	Min	Max	Avg	Total	Min	Max	Avg	Total						
January	50	60	57	1,762	90	97	94	2,901	4,663	227	261	244	7,561	12,225
February	19	60	58	1,636	26	118	97	2,725	4,362	38	270	242	6,778	11,139
March	55	63	60	1,861	86	120	103	3,195	5,056	135	256	229	7,099	12,154
April	23	72	64	1,915	34	120	106	3,193	5,108	101	260	232	6,971	12,079
May	25	71	62	1,914	38	113	100	3,095	5,009	92	301	267	8,284	13,293
June	50	80	62	1,853	90	124	102	3,071	4,924	200	330	288	8,626	13,550
July	50	105	75	2,325	76	128	104	3,213	5,538	224	345	297	9,195	14,734
August	55	102	79	2,457	95	147	118	3,666	6,123	165	360	293	9,083	15,207
September	53	101	71	2,127	85	123	107	3,217	5,343	122	330	268	8,039	13,382
October	25	105	70	2,167	0.0	119	74	2,279	4,446	133	328	278	8,621	13,068
November	0.0	60	50	1,510	0.0	125	101	3,025	4,536	20	301	264	7,928	12,464
December	17	80	61	1,899	31	120	88	2,742	4,641	154	301	260	8,068	12,709
Annual Total				23,426				36,322	59,749				96,254	156,002
Annual Min/Max/Avg	0.0	105	64		0.0	147	100			20	360	264		

2.8 Treated Water Production (ML)

2022

Month	Rossdale (Plant 1 & Plant 2)				E.L. Smith								Plants Combined	
	Flow Meters				Flow Meters				Estimated (Highlift Flow)				Avg	Total
	Min	Max	Avg	Total	Min	Max	Avg	Total	Min	Max	Avg	Total		
January	43	208	137	4,255	184	260	216	6,681	184	260	210	6,512	347	10,766
February	0.0	208	144	4,025	0.0	290	203	5,692	0.0	294	202	5,668	346	9,693
March	0.0	209	150	4,649	0.0	288	197	6,098	0.0	292	195	6,043	345	10,692
April	0.0	207	155	4,646	0.0	286	189	5,672	0.0	432	195	5,848	350	10,494
May	0.0	403	149	4,617	0.0	635	222	6,897	0.0	612	222	6,874	371	11,492
June	0.0	227	150	4,495	0.0	302	246	7,376	0.0	326	249	7,459	398	11,954
July	32	281	161	5,000	0.0	302	255	7,891	0.0	330	256	7,932	417	12,932
August	0.0	302	187	5,799	0.0	348	252	7,808	0.0	351	254	7,873	441	13,672
September	0.0	288	167	5,025	0.0	314	238	7,126	0.0	317	234	7,033	402	12,058
October	0.0	300	130	4,039	0.0	326	238	7,364	0.0	331	231	7,150	361	11,188
November	0.0	209	133	3,990	0.0	366	222	6,674	0.0	305	217	6,506	350	10,496
December	0.0	207	134	4,149	0.0	301	225	6,962	0.0	303	217	6,723	351	10,872
Annual Total				54,690				82,242				81,619		136,309
Annual Min/Max/Avg	0.0	403	150		0.0	635	225		0.0	612	224		373	

NOTES: ' -- ' indicates plant offline

- Estimated flows are based on UV effluent flow meters to address inaccuracy of highlift flow meters.
- As of July 1, 2009, plants combined data is the sum of Rossdale flow meters and E.L. Smith estimated flow data.

3.1 Raw Water Quality - North Saskatchewan River

2022

Month	Rossdale									E.L. Smith								
	Turbidity (NTU)			pH			Colour (TCU)			Turbidity (NTU)			pH			Colour (TCU)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	1.1	2.8	1.7	7.9	8.3	8.0	2.6	5.1	3.7	1.3	3.1	1.8	7.9	8.1	8.0	2.5	5.0	3.7
February	1.6	12	3.0	8.0	8.1	8.0	2.4	5.1	3.2	1.5	5.3	2.5	8.0	8.1	8.0	2.4	4.2	3.2
March	1.4	38	7.0	7.9	8.4	8.0	2.2	44.8	13.0	1.1	40	5.9	7.8	8.1	8.0	1.4	44.7	12.7
April	5.0	1,100	50	7.9	8.4	8.1	3.3	41.4	10.9	8.7	1,200	50	7.9	8.4	8.1	3.3	33.0	11.0
May	2.1	50	7.1	8.2	8.5	8.4	6.5	20.4	10.2	3.2	35	7.3	8.0	8.5	8.4	6.7	19.2	10.2
June	2.0	3,400	250	7.9	8.5	8.3	6.1	86.5	27.7	2.9	3,400	230	7.9	8.5	8.2	6.4	94.0	31.8
July	11	380	60	8.1	8.5	8.4	6.3	72.6	24.2	9.8	400	60	8.1	8.5	8.3	7.6	89.6	29.6
August	2.2	45	8.7	8.4	8.6	8.5	2.4	8.4	4.8	3.4	35	10.0	8.2	8.7	8.4	3.2	10.5	5.8
September	1.8	6.4	3.3	8.4	8.5	8.4	2.1	5.0	3.1	2.7	13	4.7	8.3	8.7	8.4	2.2	5.1	3.0
October	1.3	3.6	1.9	8.3	8.4	8.4	2.1	3.7	3.0	1.6	7.8	2.7	8.2	8.4	8.3	1.8	3.8	2.9
November	1.4	4.0	2.6	8.1	8.4	8.2	2.5	3.9	3.1	1.7	8.4	3.3	8.1	8.3	8.2	2.0	4.0	2.9
December	1.5	3.3	2.3	8.0	8.1	8.0	2.8	5.3	4.0	1.9	4.6	2.8	7.9	8.3	8.1	2.8	6.0	4.1
Annual Min/Max/Avg	1.1	3,400	33	7.9	8.6	8.2	2.1	86.5	9.3	1.1	3,400	32	7.8	8.7	8.2	1.4	94.0	10.1

NOTES: ' -- ' indicates plant offline

3.2 Treated Water Quality Entering the Distribution System

2022

Month	Rossdale														E.L. Smith											
	Turbidity (NTU)			Chloramine Residual (mg/L)			pH			Fluoride Residual (mg/L)			Total Hardness (mg/L as $CaCO_3$)	Colour (TCU)	Turbidity (NTU)			Chloramine Residual (mg/L)			pH			Fluoride Residual (mg/L)			Total Hardness (mg/L as $CaCO_3$)	Colour (TCU)
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Avg	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Avg	Avg
January	0.03	0.08	0.05	1.9	2.21	2.04	7.7	8.1	7.9	0.7	0.8	0.73	181	0.6	0.05	0.06	0.05	1.93	2.08	2.01	7.5	7.9	7.7	0.61	0.82	0.74	181	0.7
February	0.03	0.08	0.05	1.9	2.16	2.02	7.8	8.1	8	0.66	0.74	0.67	168	0.5	0.05	0.09	0.05	1.93	2.08	1.98	7.6	7.8	7.7	0.7	0.8	0.75	168	0.6
March	0.03	0.08	0.04	1.9	2.21	2.04	7.6	8.1	7.9	0.62	0.73	0.66	164	0.5	0.04	0.09	0.05	1.88	2.08	1.96	7.6	7.9	7.8	0.65	0.82	0.77	163	0.5
April	0.03	0.07	0.04	1.8	2.21	2.01	7.7	8.1	7.8	0.64	0.76	0.69	159	0.6	0.04	0.05	0.04	1.87	2.11	1.97	7.6	8	7.8	0.65	0.83	0.73	158	0.6
May	0.03	0.1	0.05	1.8	2.11	1.97	7.7	7.9	7.8	0.65	0.71	0.68	182	0.8	0.04	0.06	0.05	1.38	2.12	1.94	7.8	8	7.9	0.6	0.81	0.7	182	0.7
June	0.04	0.1	0.06	1.9	2.26	2.01	7.5	7.9	7.7	0.61	0.69	0.66	174	0.9	0.04	0.07	0.05	1.73	2.28	2.15	7.7	8.3	7.9	0.64	0.81	0.71	172	1
July	0.05	0.1	0.06	1.9	2.16	1.99	7.6	7.8	7.7	0.64	0.74	0.69	175	0.8	0.04	0.06	0.05	1.71	2.27	2.13	7.6	8.3	8	0.65	0.85	0.73	174	1.1
August	0.03	0.07	0.05	1.6	2.36	2.06	7.8	8	7.9	0.64	0.71	0.68	173	0.4	0.05	0.06	0.05	1.89	2.23	2.11	7.6	8.2	8	0.7	0.82	0.76	170	0.6
September	0.04	0.08	0.05	1.9	2.16	2.06	7.7	8	7.9	0.66	0.74	0.71	156	0.3	0.02	0.06	0.05	1.78	2.24	2.06	7.7	8.2	7.9	0.62	0.8	0.72	156	0.4
October	0.03	0.1	0.05	1.9	2.21	2.07	7.7	8.3	7.9	0.67	0.79	0.72	159	0.4	0.04	0.08	0.06	1.78	2.22	2.02	7.8	8.3	8	0.62	0.77	0.71	160	0.5
November	0.03	0.09	0.06	1.9	2.26	2.08	7.9	8.1	8.1	0.66	0.77	0.69	170	0.7	0.06	0.08	0.06	1.88	2.15	1.99	7.8	8.2	8	0.6	0.79	0.71	168	0.6
December	0.02	0.1	0.05	1.9	2.26	2.06	7.8	8.1	8	0.68	0.74	0.71	177	0.8	0.05	0.08	0.06	1.85	2.12	1.98	7.6	8.2	7.9	0.64	0.82	0.74	176	0.9
Annual Min/Max/Avg	0.02	0.1	0.05	1.6	2.36	2.03	7.5	8.3	7.9	0.61	0.8	0.69	170	0.61	0.02	0.09	0.05	1.38	2.28	2.03	7.5	8.3	7.9	0.6	0.85	0.73	169	0.7

NOTES: ' -- ' indicates plant offline

3.2-1 Treated Water Quality Entering the Distribution System

2022

	Rossdale									E.L. Smith								
	Temperature (°C)			pH			Hourly Flow (ML per day)			Temperature (°C)			pH			Hourly Flow (ML per day)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	0.5	0.7	0.5	7.7	8.1	7.9	60	206	138	0.4	0.9	0.5	7.5	7.9	7.7	194	253	215
February	0.5	0.8	0.5	7.8	8.1	8	0	206	144	0.4	0.5	0.4	7.6	7.8	7.7	0	289	205
March	0.5	0.7	0.5	7.6	8.1	7.9	0	204	151	0.4	6.9	0.5	7.6	7.9	7.8	0	284	198
April	0.5	9.4	2.4	7.7	8.1	7.8	0	204	155	0.4	13.6	2.4	7.6	8	7.8	0	283	191
May	9.1	17.9	13.3	7.7	7.9	7.8	0	322	151	8.8	17.3	13	7.8	8	7.9	0	300	215
June	11.6	19	16.3	6.7	7.9	7.7	53	211	149	11.2	18.7	15.8	7.7	8.3	7.9	0	299	248
July	14.4	23.8	19.9	7.6	7.8	7.7	47	266	161	14.2	23.3	19.4	7.6	8.3	7.9	0	303	261
August	18.4	23.5	21.3	7.8	8	7.9	85	299	188	17.9	22.6	20.7	7.6	8.2	8	0	345	255
September	12.7	20.3	15.9	7.7	8	7.9	44	277	168	12.4	19.8	15.5	7.7	8.2	7.9	0	309	239
October	4.9	14.8	10	7.7	8.3	7.9	0	257	131	4.7	15.8	9.5	7.8	8.3	8	0	291	238
November	0.5	5.8	1.2	7.8	8.1	8.1	0	206	132	0.5	5.4	1	7.8	8.2	8	0	301	219
December	0.5	2.7	0.5	7.8	8.1	8	0	206	134	0.4	9.2	0.7	7.6	8.2	7.9	0	298	221
Annual Min/Max/Avg	**0.5**	**23.8**	**8.5**	**6.7**	**8.3**	**7.9**	**0**	**322**	**150.2**	**0.4**	**23.3**	**8.3**	**7.5**	**8.3**	**7.9**	**0**	**345**	**225.4**

3.3 Rossdale Filters 1 - 9 Particle Counts (no./mL >2um)

2022

Filter	1			2			3			4			5			6			7			8			9		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	1	41	4	1	13	1	1	38	2	1	34	2	1	23	2	1	31	4	1	43	8	1	34	3	1	29	2
February	1	31	1	1	33	3	1	26	1	1	38	2	1	30	2	1	30	2	4	31	8	1	45	2	1	23	1
March	1	30	2	1	34	2	1	39	2	1	34	2	1	29	2	1	41	2	1	44	2	1	36	2	1	30	2
April	1	30	4	1	35	4	1	19	3	1	37	4	1	45	7	1	29	4	1	25	5	1	47	5	1	36	5
May	1	24	5	2	26	7	1	21	4	1	29	7	2	30	9	1	29	7	1	35	9	2	34	8	2	28	8
June	1	29	2	1	40	4	1	40	3	1	32	3	1	35	5	1	33	4	1	44	4	1	45	5	1	23	4
July	1	18	2	1	19	3	1	16	2	1	43	2	1	28	3	1	21	2	1	25	3	1	14	2	1	21	3
August	1	28	4	1	23	5	1	24	4	1	17	4	1	27	6	1	21	4	1	22	5	1	19	4	1	22	5
September	1	19	4	1	19	3	1	44	5	1	18	3	1	24	5	1	24	4	1	20	4	1	16	3	1	35	4
October	1	45	3	1	33	3	1	20	3	1	44	4	1	25	4	1	22	3	1	24	3	1	41	3	1	45	4
November	1	32	5	1	36	6	1	24	4	1	44	5	1	36	6	1	23	5	1	34	6	1	50	5	1	29	7
December	1	44	3	1	44	4	1	19	3	1	42	3	1	38	5	1	25	3	1	24	4	1	38	4	1	44	5
Annual Min/Max/Avg	1	45	3	1	44	4	1	44	3	1	44	3	1	45	5	1	41	4	1	44	5	1	50	4	1	45	4

NOTE: ' -- ' indicates filter offline

3.4 E.L. Smith Filters 1 - 9 Particle Counts (no./mL >2um)

2022

Filter	1			2			3			4			5			6			7			8			9		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	--	--	--	--	--	--	1	20	2	1	31	2	1	29	2	1	38	3	1	30	4	1	37	3	1	35	4
February	1	23	3	--	--	--	1	45	2	1	45	3	1	45	2	1	45	3	1	35	4	1	35	3	1	43	4
March	1	33	2	--	--	--	1	34	2	1	44	4	1	45	2	1	45	6	1	33	3	1	32	2	1	31	3
April	1	45	3	--	--	--	1	44	4	1	45	4	1	33	4	1	45	4	1	42	6	1	34	5	1	44	5
May	1	37	8	--	--	--	1	41	8	1	35	8	1	34	9	1	38	9	1	45	12	1	37	10	1	36	11
June	1	41	5	1	18	3	1	45	5	1	44	5	1	40	4	1	45	6	1	45	5	1	44	4	1	39	6
July	1	39	5	1	43	3	1	43	4	1	44	3	1	34	3	1	45	4	1	34	5	1	28	4	1	33	7
August	1	44	7	1	34	5	1	23	6	1	28	7	1	31	6	1	34	7	1	31	9	1	31	9	1	44	10
September	1	34	7	1	43	6	1	40	7	1	39	7	1	31	6	1	32	8	2	31	9	2	42	10	1	36	9
October	1	28	5	1	26	4	1	42	5	1	29	5	1	30	5	1	30	6	1	34	7	1	33	6	1	36	7
November	1	39	8	2	31	8	1	42	8	1	28	8	1	28	8	1	31	9	1	30	9	2	31	8	1	43	9
December	1	35	4	1	31	4	1	45	5	1	29	5	1	43	5	1	45	7	1	39	6	1	35	5	1	42	6
Annual Min/Max/Avg	1	45	5	1	43	4	1	45	5	1	45	5	1	45	5	1	45	6	1	45	6	1	44	6	1	44	6

NOTE: ' -- ' indicates filter offline

3.5 E.L. Smith Filters 10 - 18 Particle Counts (no./mL >2um)

2022

Filter	10			11			12			13			14			15			16			17			18		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	1	45	8	1	38	3	1	35	6	2	45	19	1	29	4	1	45	7	1	44	6	1	45	6	1	45	6
February	1	45	8	1	39	3	1	44	6	2	45	20	1	39	4	1	45	5	1	45	4	1	45	4	1	45	4
March	1	45	4	1	29	2	1	42	4	1	42	7	1	30	3	1	44	3	1	45	2	1	45	2	1	45	2
April	1	28	4	1	37	5	1	34	6	1	33	4	1	35	6	1	36	5	1	27	4	1	36	4	1	26	4
May	1	42	12	1	45	10	1	45	14	1	41	10	1	40	12	1	45	12	1	45	9	1	35	9	1	42	9
June	1	45	5	1	45	4	1	45	7	1	45	5	1	38	5	1	44	6	1	45	5	1	44	5	1	45	4
July	1	32	4	1	27	4	1	42	7	1	36	5	1	34	5	1	40	5	1	36	4	1	28	4	1	31	4
August	1	32	8	1	42	9	1	41	11	2	42	9	1	31	9	1	45	10	1	45	8	1	39	8	1	41	7
September	2	43	8	2	30	10	1	42	10	2	40	9	3	37	10	2	41	10	2	32	8	1	39	9	2	39	7
October	1	43	7	1	32	6	1	43	8	1	24	7	1	40	8	1	43	7	1	29	6	1	27	6	1	34	6
November	2	27	9	2	39	9	2	45	11	1	36	9	2	38	10	2	37	9	1	40	9	1	39	9	1	41	8
December	1	45	7	1	40	6	3	38	14	1	34	5	1	43	6	1	45	6	1	44	6	1	44	6	1	43	5
Annual Min/Max/Avg	1	45	7	1	45	6	1	45	9	1	45	9	1	43	7	1	45	7	1	45	6	1	45	6	1	45	5

NOTES: ' -- ' indicates filter offline

3.6 Rossdale Filters 1 - 9 Turbidity (NTU)

2022

Filter	1			2			3			4			5			6			7			8			9		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	0.02	0.08	0.03	0.02	0.07	0.03	0.01	0.06	0.02	0.01	0.07	0.02	0.02	0.08	0.03	0.00	0.08	0.02	0.02	0.08	0.04	0.01	0.08	0.03	0.02	0.08	0.03
February	0.02	0.07	0.03	0.02	0.07	0.03	0.01	0.06	0.02	0.01	0.07	0.02	0.02	0.07	0.03	0.00	0.08	0.01	0.02	0.08	0.03	0.01	0.07	0.02	0.02	0.07	0.02
March	0.01	0.07	0.03	0.02	0.07	0.03	0.01	0.08	0.02	0.01	0.06	0.02	0.02	0.07	0.03	0.00	0.07	0.01	0.02	0.08	0.03	0.01	0.07	0.02	0.02	0.06	0.02
April	0.02	0.08	0.03	0.02	0.08	0.03	0.01	0.07	0.02	0.01	0.08	0.02	0.02	0.08	0.03	0.00	0.07	0.01	0.02	0.08	0.03	0.01	0.08	0.02	0.02	0.08	0.02
May	0.01	0.08	0.03	0.02	0.08	0.04	0.01	0.08	0.02	0.01	0.08	0.03	0.02	0.09	0.04	0.01	0.08	0.02	0.03	0.08	0.04	0.01	0.08	0.03	0.02	0.09	0.03
June	0.01	0.09	0.03	0.02	0.08	0.03	0.01	0.07	0.02	0.01	0.07	0.02	0.02	0.08	0.03	0.01	0.09	0.02	0.02	0.08	0.03	0.01	0.08	0.03	0.02	0.08	0.03
July	0.02	0.06	0.03	0.02	0.08	0.03	0.01	0.06	0.02	0.01	0.08	0.02	0.02	0.07	0.03	0.01	0.05	0.01	0.02	0.07	0.03	0.01	0.06	0.02	0.02	0.08	0.03
August	0.01	0.08	0.03	0.02	0.07	0.03	0.00	0.06	0.01	0.01	0.05	0.02	0.02	0.07	0.03	0.00	0.05	0.01	0.02	0.05	0.03	0.01	0.05	0.02	0.02	0.06	0.02
September	0.02	0.07	0.03	0.02	0.05	0.03	0.01	0.04	0.01	0.01	0.06	0.01	0.01	0.06	0.02	0.00	0.07	0.01	0.02	0.05	0.03	0.01	0.05	0.02	0.02	0.05	0.02
October	0.02	0.07	0.03	0.02	0.07	0.03	0.00	0.05	0.02	0.01	0.06	0.02	0.01	0.08	0.03	0.00	0.06	0.01	0.02	0.07	0.03	0.01	0.07	0.02	0.02	0.07	0.02
November	0.02	0.08	0.04	0.03	0.08	0.04	0.01	0.08	0.02	0.01	0.08	0.02	0.02	0.08	0.03	0.01	0.08	0.02	0.01	0.08	0.03	0.01	0.08	0.03	0.02	0.08	0.03
December	0.02	0.08	0.04	0.02	0.08	0.04	0.01	0.08	0.02	0.01	0.08	0.03	0.02	0.08	0.03	0.00	0.08	0.02	0.02	0.08	0.04	0.01	0.08	0.03	0.02	0.08	0.03
Annual Min/Max/Avg	0.01	0.09	0.03	0.02	0.08	0.03	0.00	0.08	0.02	0.01	0.08	0.02	0.01	0.09	0.03	0.00	0.09	0.02	0.01	0.08	0.03	0.01	0.08	0.02	0.02	0.09	0.03

NOTES: ' -- ' indicates filter offline

3.7 E.L. Smith Filters 1 - 9 Turbidity (NTU)

2022

Filter	1			2			3			4			5			6			7			8			9		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	--	--	--	--	--	--	0.01	0.06	0.02	0.01	0.08	0.02	0.01	0.09	0.01	0.01	0.09	0.01	0.01	0.08	0.02	0.02	0.10	0.03	0.01	0.08	0.01
February	0.02	0.05	0.02	--	--	--	0.01	0.07	0.02	0.01	0.09	0.03	0.01	0.09	0.01	0.01	0.09	0.01	0.00	0.10	0.02	0.01	0.08	0.03	0.01	0.10	0.01
March	0.02	0.06	0.02	--	--	--	0.01	0.07	0.02	0.01	0.06	0.02	0.00	0.06	0.01	0.00	0.05	0.01	0.00	0.08	0.01	0.01	0.08	0.03	0.00	0.08	0.01
April	0.01	0.08	0.02	--	--	--	0.01	0.08	0.02	0.01	0.08	0.02	0.00	0.07	0.01	0.00	0.08	0.01	0.00	0.08	0.01	0.01	0.08	0.03	0.00	0.08	0.01
May	0.02	0.08	0.03	--	--	--	0.01	0.08	0.02	0.02	0.08	0.03	0.01	0.08	0.02	0.01	0.08	0.02	0.01	0.08	0.02	0.01	0.08	0.04	0.01	0.08	0.02
June	0.02	0.07	0.02	0.03	0.08	0.07	0.01	0.08	0.02	0.02	0.08	0.03	0.01	0.08	0.01	0.01	0.08	0.02	0.01	0.07	0.01	0.01	0.08	0.03	0.01	0.07	0.01
July	0.02	0.08	0.02	0.01	0.07	0.03	0.01	0.08	0.02	0.02	0.08	0.03	0.01	0.07	0.01	0.01	0.08	0.01	0.01	0.08	0.01	0.01	0.08	0.03	0.00	0.06	0.02
August	0.02	0.07	0.02	0.01	0.07	0.02	0.01	0.08	0.02	0.02	0.08	0.03	0.01	0.07	0.01	0.00	0.07	0.01	0.01	0.07	0.02	0.01	0.08	0.03	0.00	0.07	0.01
September	0.01	0.07	0.02	0.01	0.05	0.01	0.01	0.07	0.01	0.02	0.07	0.03	0.00	0.07	0.01	0.00	0.06	0.01	0.00	0.06	0.01	0.01	0.08	0.03	0.00	0.05	0.01
October	0.01	0.09	0.03	0.01	0.08	0.02	0.01	0.09	0.02	0.01	0.09	0.04	0.00	0.09	0.02	0.00	0.09	0.02	0.00	0.09	0.02	0.01	0.09	0.04	0.00	0.09	0.02
November	0.02	0.08	0.02	0.01	0.08	0.02	0.01	0.08	0.02	0.03	0.09	0.04	0.01	0.09	0.02	0.01	0.09	0.02	0.00	0.09	0.02	0.01	0.09	0.04	0.00	0.09	0.02
December	0.02	0.08	0.02	0.00	0.07	0.01	0.01	0.08	0.02	0.03	0.09	0.04	0.01	0.08	0.01	0.00	0.08	0.01	0.01	0.09	0.02	0.02	0.09	0.04	0.00	0.09	0.01
Annual Min/Max/Avg	0.01	0.09	0.02	0.01	0.08	0.02	0.01	0.09	0.02	0.01	0.09	0.03	0.00	0.09	0.01	0.01	0.09	0.01	0.00	0.10	0.02	0.01	0.10	0.03	0.00	0.10	0.01

NOTES: ' -- ' indicates filter offline

3.8 E.L. Smith Filters 10 - 18 Turbidity (NTU)

2022

Filter	10			11			12			13			14			15			16			17			18		
Month	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
January	0.03	0.09	0.04	0.00	0.08	0.01	0.02	0.09	0.02	0.03	0.08	0.03	0.03	0.09	0.04	0.03	0.09	0.04	0.03	0.09	0.04	0.02	0.09	0.04	0.03	0.09	0.04
February	0.03	0.08	0.04	0.00	0.09	0.01	0.01	0.07	0.02	0.03	0.09	0.03	0.03	0.08	0.04	0.03	0.09	0.03	0.03	0.09	0.03	0.02	0.08	0.03	0.03	0.08	0.04
March	0.03	0.08	0.04	0.01	0.08	0.01	0.01	0.07	0.02	0.02	0.07	0.03	0.03	0.08	0.04	0.03	0.08	0.03	0.02	0.08	0.04	0.03	0.08	0.03	0.03	0.08	0.04
April	0.02	0.08	0.04	0.01	0.07	0.01	0.01	0.08	0.02	0.03	0.08	0.03	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.03	0.02	0.08	0.04
May	0.02	0.08	0.04	0.00	0.08	0.02	0.01	0.08	0.03	0.03	0.08	0.03	0.04	0.08	0.05	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.05
June	0.02	0.08	0.03	0.00	0.07	0.01	0.00	0.08	0.02	0.03	0.08	0.03	0.03	0.08	0.04	0.03	0.07	0.04	0.03	0.08	0.04	0.03	0.08	0.03	0.04	0.08	0.04
July	0.02	0.08	0.03	0.01	0.08	0.02	0.01	0.07	0.02	0.03	0.08	0.03	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.02	0.08	0.04	0.03	0.08	0.05
August	0.02	0.08	0.04	0.01	0.08	0.02	0.01	0.08	0.02	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.04	0.08	0.05
September	0.03	0.08	0.03	0.00	0.08	0.02	0.01	0.08	0.02	0.03	0.08	0.03	0.04	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.03	0.08	0.04	0.04	0.08	0.04
October	0.03	0.09	0.05	0.00	0.09	0.02	0.01	0.09	0.03	0.03	0.09	0.04	0.03	0.09	0.05	0.03	0.09	0.05	0.03	0.09	0.05	0.03	0.09	0.05	0.04	0.09	0.05
November	0.03	0.09	0.04	0.01	0.09	0.02	0.01	0.09	0.03	0.03	0.09	0.04	0.04	0.09	0.05	0.03	0.09	0.04	0.03	0.09	0.04	0.03	0.09	0.04	0.04	0.09	0.05
December	0.03	0.09	0.04	0.01	0.09	0.02	0.01	0.09	0.02	0.03	0.09	0.04	0.03	0.09	0.04	0.03	0.09	0.04	0.02	0.09	0.05	0.03	0.09	0.04	0.03	0.09	0.05
Annual Min/Max/Avg	0.02	0.09	0.04	0.01	0.09	0.02	0.00	0.09	0.02	0.02	0.09	0.03	0.03	0.09	0.04	0.03	0.09	0.04	0.02	0.09	0.04	0.02	0.09	0.04	0.02	0.09	0.05

NOTES: ' -- ' indicates filter offline

3.9 Combined Filter Effluent Water Quality

2022

Month	Rossdale						E.L. Smith					
	Particle Counts (no./mL,>2um)			Turbidity (NTU)			Particle Counts (no./mL,>2um)			Turbidity (NTU)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	1	11	3	0.01	0.09	0.03	2	13	5	0.02	0.04	0.03
February	1	13	2	0.02	0.10	0.03	1	14	4	0.01	0.05	0.02
March	1	12	2	0.01	0.10	0.03	1	14	3	0.02	0.04	0.02
April	1	30	4	0.01	0.09	0.03	1	20	4	0.01	0.04	0.02
May	1	19	7	0.01	0.10	0.04	1	23	9	0.02	0.04	0.03
June	1	22	3	0.01	0.10	0.04	1	20	5	0.01	0.04	0.03
July	1	19	2	0.03	0.08	0.04	1	35	4	0.01	0.05	0.03
August	2	16	4	0.01	0.09	0.04	1	18	8	0.01	0.05	0.03
September	1	16	4	0.01	0.09	0.03	4	18	8	0.02	0.05	0.02
October	1	40	3	0.02	0.10	0.03	1	11	6	0.02	0.06	0.03
November	1	19	5	0.03	0.10	0.04	1	23	8	0.01	0.05	0.03
December	1	15	3	0.02	0.10	0.04	1	18	6	0.01	0.07	0.03
Annual Min/Max/Avg	1	40	4	0.01	0.10	0.04	1	35	6	0.01	0.07	0.03

NOTES: ' -- ' indicates plant offline

3.10 Rossdale UV Disinfection - Filters 1 - 3

2022

Filter	1						2						3						Transmittance (%)		
Month	Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)					
	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg
January	35.1	101.7	41.8	13.0	30.0	481.5	33.7	90.4	40.9	11.7	30.5	483.1	35.0	74.0	44.3	11.7	27.1	430.1	93.8	96.6	95.3
February	34.2	80.0	42.2	11.6	30.7	490.7	34.8	63.0	41.6	10.9	30.6	228.7	31.1	77.4	44.7	10.0	29.7	413.6	94.9	96.8	95.8
March	35.3	82.7	53.0	11.8	31.0	539.2	34.5	66.2	42.4	11.9	30.4	518.5	33.0	77.5	47.0	10.0	31.7	478.5	94.7	97.1	96.3
April	34.9	117.3	43.9	13.9	31.8	510.1	34.1	65.7	39.1	10.9	31.7	520.5	34.6	78.4	41.8	12.8	30.5	508.6	91.1	97.5	95.3
May	33.6	86.9	36.1	14.3	33.2	550.7	34.4	66.3	35.6	15.7	33.7	532.5	33.6	78.6	35.7	14.0	31.3	514.6	91.2	94.1	92.8
June	33.7	86.7	35.7	15.3	35.3	518.8	33.6	67.0	35.5	10.9	33.7	532.3	33.7	83.1	35.6	14.6	32.9	421.4	87.1	94.9	91.4
July	33.7	71.9	35.7	14.1	33.0	626.4	33.1	59.9	35.4	18.0	34.4	541.9	33.9	57.5	35.7	15.8	33.1	545.6	87.2	94.4	91.1
August	34.4	121.0	36.5	15.1	34.1	642.2	33.9	44.8	35.9	15.5	37.4	655.3	33.9	52.9	38.3	16.7	36.3	645.5	92.8	96.9	95.1
September	34.8	70.3	46.9	14.2	36.2	611.8	35.0	77.4	50.2	16.9	34.9	613.6	35.1	77.7	46.3	16.3	35.3	557.6	95.7	97.4	96.8
October	36.3	165.2	51.8	11.2	36.0	503.7	39.4	109.0	56.9	11.1	34.8	370.5	35.0	262.0	51.9	10.0	35.8	480.1	95.8	98.5	96.8
November	34.2	83.3	46.4	10.6	30.7	444.4	34.3	98.5	51.3	10.5	31.4	440.3	34.4	100.2	47.3	9.9	29.7	453.6	92.6	96.8	95.8
December	34.4	75.9	44.4	12.4	32.9	473.7	35.0	67.5	43.2	12.3	30.9	496.5	33.6	118.9	40.3	11.5	33.1	458.7	93.5	96.2	95.1
Annual Total						6393						5934						5908			
Annual Min/Max/ Avg	33.6	165.2	42.9	10.6	36.2		33.1	109.0	42.1	10.5	37.4		31.1	262.0	42.5	9.9	36.3		87.1	98.5	94.8

NOTES: - Each filter has a UV reactor

- Transmittance (%) is a grab sample of the filter effluent prior to the UV reactor of a random online filter

' -- ' indicates filter and UV reactor offline

3.11 Rossdale UV Disinfection - Filters 4 - 6

2022

Filter	4						5						6						Transmittance (%)		
Month	Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)					
	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg
January	34.1	127.2	51.1	12.0	26.2	473.1	33.3	68.0	40.9	10.7	28.4	495.1	34.2	78.8	45.2	11.9	32.4	477.1	93.8	96.6	95.3
February	35.3	89.8	50.5	11.3	29.9	477.9	33.7	62.1	41.6	11.0	29.8	462.3	33.3	128.8	45.8	10.9	32.9	515.1	94.9	96.8	95.8
March	35.3	85.1	59.6	12.2	29.2	494.4	34.2	69.2	41.5	12.1	29.1	529.5	34.6	71.5	47.2	11.8	32.2	525.3	94.7	97.1	96.3
April	34.8	92.7	49.2	12.7	29.5	517.6	33.1	57.3	38.2	13.7	29.2	516.2	33.8	72.6	41.2	15.0	33.6	570.2	91.1	97.5	95.3
May	34.1	96.3	37.7	14.3	31.4	469.2	32.8	59.1	35.5	16.1	30.5	532.3	34.0	73.8	35.7	15.5	34.5	545.0	91.2	94.1	92.8
June	33.1	91.6	36.2	10.5	35.3	498.3	32.4	65.3	35.4	15.1	28.1	482.8	33.3	64.2	35.6	15.6	32.9	557.4	87.1	94.9	91.4
July	31.6	57.0	35.6	15.7	32.5	546.7	33.1	59.0	36.0	19.3	31.4	566.2	32.6	53.8	35.5	18.0	33.9	639.3	87.2	94.4	91.1
August	34.0	55.8	36.6	17.0	35.5	623.7	34.2	57.6	42.5	15.2	34.9	617.6	33.6	62.3	35.9	15.4	40.6	704.9	92.8	96.9	95.1
September	34.7	147.7	47.4	17.2	35.7	531.4	36.0	206.9	60.5	17.9	33.6	543.5	35.0	69.9	44.9	18.3	37.3	534.2	95.7	97.4	96.8
October	35.2	155.7	53.4	10.5	32.4	462.1	41.6	138.4	68.4	10.7	33.0	427.5	33.7	285.9	54.0	10.2	35.4	466.2	95.8	98.5	96.8
November	30.1	88.2	45.5	10.3	32.1	448.5	33.5	87.9	48.9	10.7	28.5	448.1	34.7	81.1	42.5	8.1	35.1	516.5	92.6	96.8	95.8
December	32.3	63.5	38.5	11.9	32.5	483.3	34.6	65.1	41.2	11.0	30.8	427.2	34.1	98.0	38.5	10.6	34.8	475.5	93.5	96.2	95.1
Annual Total						6026						6048						6527			
Annual Min/Max/ Avg	30.1	155.7	45.1	10.3	35.7		32.4	206.9	43.9	10.7	34.9		32.6	285.9	41.7	8.1	40.6		87.1	98.5	94.8

NOTES: - Each filter has a UV reactor

- Transmittance (%) is a grab sample of the filter effluent prior to the UV reactor of a random online filter

' -- ' indicates filter and UV reactor offline

3.12 Rossdale UV Disinfection - Filters 7 - 9

2022

Filter	7						8						9						Transmittance (%)		
Month	Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)					
	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg
January	33.4	57.9	36.0	12.1	30.3	518.2	33.1	73.6	35.9	14.0	30.5	525.7	35.0	64.1	42.1	13.8	33.4	564.2	93.8	96.6	95.3
February	31.1	77.2	40.1	11.7	36.9	538.6	33.5	72.2	35.8	10.1	32.9	544.0	34.3	62.8	42.2	12.7	32.3	566.1	94.9	96.8	95.8
March	34.0	92.1	47.4	14.3	33.1	590.7	33.0	58.2	35.9	10.5	32.0	590.2	34.7	73.3	44.6	11.4	35.9	617.8	94.7	97.1	96.3
April	34.0	70.2	40.5	15.4	33.7	607.4	34.1	64.5	35.7	12.2	33.2	558.1	33.9	61.0	40.0	14.3	33.6	540.9	91.1	97.5	95.3
May	33.1	87.2	35.6	16.6	34.5	593.5	31.5	48.2	35.5	18.2	32.1	577.7	34.2	78.9	35.6	18.3	31.9	557.4	91.2	94.1	92.8
June	33.9	55.6	35.6	16.4	40.1	610.5	31.6	46.6	35.5	14.3	34.9	484.7	33.9	72.5	35.5	16.7	38.8	564.9	87.1	94.9	91.4
July	33.9	54.5	35.6	20.5	33.7	513.4	34.3	64.9	35.6	18.1	35.6	625.1	34.1	60.5	35.6	17.0	37.3	648.6	87.2	94.4	91.1
August	33.2	116.6	36.2	16.4	37.6	687.5	34.5	50.3	35.9	20.3	37.2	690.8	34.4	49.0	36.1	14.6	40.2	709.7	92.8	96.9	95.1
September	34.4	127.3	44.4	20.2	39.1	629.7	34.8	145.9	42.5	16.8	38.1	617.0	34.7	157.9	45.2	19.4	38.7	599.5	95.7	97.4	96.8
October	35.1	95.2	49.0	10.0	38.3	507.6	35.2	81.9	47.0	10.3	38.2	569.0	34.8	104.1	51.7	11.0	39.3	451.1	95.8	98.5	96.8
November	33.3	121.8	45.0	11.3	32.1	494.2	34.6	99.0	44.9	10.1	33.4	542.4	34.5	94.4	48.3	10.8	34.9	478.2	92.6	96.8	95.8
December	33.2	61.9	38.1	11.4	32.5	562.7	34.7	59.8	38.5	12.2	36.5	504.3	34.5	79.6	40.0	14.7	34.6	522.4	93.5	96.2	95.1
Annual Total						6854						6829						6821			
Annual Min/Max/ Avg	31.1	127.3	40.3	10.0	40.1		31.5	145.9	38.2	10.1	38.2		33.9	157.9	41.3	10.8	40.2		87.1	98.5	94.8

NOTES: - Each filter has a UV reactor

- Transmittance (%) is a grab sample of the filter effluent prior to the UV reactor of a random online filter

' -- ' indicates filter and UV reactor offline

3.13 E.L. Smith UV Disinfection - UV Reactors 1 - 4

2022

Filter	1						2						3						4						Transmittance (%)		
Month	Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)			Dosage (mJ/cm²)			Flow (MLD)					
	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg	Min	Max	Total	Min	Max	Avg
January	48.8	115.1	60.3	32.2	86.2	1,240.7	44.7	129.9	66.5	49.0	85.0	1,198.0	46.5	143.4	69.2	54.7	94.1	2,414.1	46.8	120.1	47.5	54.3	80.3	2,143.3	93.0	96.9	95.2
February	46.1	152.1	58.7	33.9	90.7	1,373.4	44.8	115.0	66.3	42.6	82.8	834.6	45.0	117.2	60.5	49.2	93.9	2,150.4	44.8	124.6	47.7	49.5	78.8	1,702.5	94.0	96.6	95.7
March	53.2	273.1	76.3	47.5	88.1	1,280.8	45.2	203.2	63.1	38.1	81.5	1,039.6	53.2	123.6	84.0	49.8	90.1	2,261.8	41.2	155.3	48.6	31.7	77.4	1,969.4	93.4	98.6	96.2
April	49.5	151.2	68.1	57.0	98.9	2,072.5	46.2	107.2	75.5	51.3	82.0	929.5	50.8	114.9	69.9	62.0	105.6	2,269.8	46.4	139.0	47.9	52.2	73.2	983.3	91.8	98.2	95.9
May	43.1	208.3	65.9	39.8	100.5	1,666.3	40.4	163.9	61.1	32.1	114.4	1,433.7	46.2	96.4	66.5	44.4	108.7	2,542.5	46.6	99.6	47.6	36.6	109.5	1,739.2	91.6	96.3	92.9
June	42.2	194.0	60.8	36.2	108.6	2,201.5	40.1	200.4	60.4	33.0	106.1	1,562.9	43.5	107.9	61.8	41.1	117.0	2,478.6	45.2	147.7	47.2	37.7	86.0	1,591.3	88.5	94.1	91.5
July	42.3	213.0	62.8	38.9	99.7	2,165.7	41.0	219.9	59.6	41.4	81.4	1,834.5	44.8	223.7	62.9	51.8	101.7	2,431.2	46.2	99.0	48.1	41.6	84.9	1,938.1	89.2	94.6	91.3
August	45.7	195.3	60.9	34.7	124.5	2,083.1	44.7	91.6	64.6	41.3	86.1	1,914.1	45.0	106.3	61.8	50.8	105.9	2,452.7	44.0	125.7	47.3	42.8	81.0	1,865.3	92.9	96.7	94.6
September	62.8	182.8	79.9	45.4	101.6	2,257.4	46.3	183.1	72.5	38.3	86.1	768.0	50.6	192.0	72.7	50.4	102.6	2,389.4	46.6	159.9	47.5	45.7	85.8	1,979.1	95.0	97.7	96.5
October	56.8	138.7	71.9	47.7	112.8	2,490.0	45.3	101.6	55.8	43.7	71.3	521.1	56.7	145.5	71.6	45.7	113.2	2,449.5	46.1	143.6	48.9	43.1	94.0	2,168.1	95.4	97.4	96.2
November	48.8	76.4	61.6	58.1	102.1	2,456.5	--	--	--	--	--	0.0	47.6	77.6	60.1	55.2	98.1	2,337.4	46.8	48.4	47.2	61.9	87.5	2,130.4	94.3	96.3	95.6
December	45.5	99.1	64.2	51.7	114.6	1,204.1	45.5	129.8	59.3	53.9	88.1	1,259.7	45.5	133.5	65.9	49.5	105.1	2,425.7	46.6	107.5	48.5	45.3	90.8	2,230.8	93.1	96.8	94.7
Annual Total						22,492						13,296						28,603						22,441			
Annual Min/Max/ Avg	42.2	273.1	66.1	32.2	124.5		40.1	219.9	63.7	32.1	114.4		43.5	223.7	67.3	41.1	117.0		41.2	159.9	47.9	31.7	109.5		88.5	98.6	94.7

NOTES: ' -- ' indicates UV reactor offline

- Transmittance (%) is a grab sample of the combined filter effluent prior to the UV reactor

3.14 Log Removal

2022

Month	Rossdale									E.L. Smith								
	Log Removal									Log Removal								
	Giardia			Virus			*Cryptosporidium*			*Giardia*			Virus			*Cryptosporidium*		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	7.3	7.9	7.5	12	16	14	6.4	6.5	6.5	6.4	6.7	6.7	5.7	8.7	7.1	6.2	6.5	6.5
February	7.2	7.9	7.5	12	15	13	6.0	6.5	6.5	6.6	6.7	6.7	5.5	8.2	7.0	6.4	6.5	6.5
March	7.2	8.8	7.8	12	16	14	6.4	7.0	6.7	6.6	7.2	6.9	5.7	9.6	7.2	6.5	7.0	6.7
April	7.0	9.6	8.2	13	24	15	7.0	7.0	7.0	7.1	7.3	7.2	6.1	15	8.5	6.9	7.0	7.0
May	8.8	10.7	9.6	17	36	26	6.9	7.0	7.0	7.2	7.6	7.3	9.6	25	15	7.0	7.0	7.0
June	7.0	12.2	10.8	24	41	30	6.8	7.0	7.0	7.0	8.0	7.4	15	27	20	6.7	7.0	7.0
July	9.3	14.0	11.7	25	54	36	7.0	7.0	7.0	7.4	7.8	7.5	16	32	22	7.0	7.0	7.0
August	9.6	12.1	10.6	28	55	37	7.0	7.0	7.0	7.4	7.8	7.5	16	32	23	7.0	7.0	7.0
September	7.0	10.6	9.6	21	36	27	6.9	7.0	7.0	7.2	7.6	7.4	10.0	25	17	7.0	7.0	7.0
October	7.7	11.9	9.1	14	34	22	6.5	7.0	6.9	6.7	7.4	6.9	7.3	17	11	6.5	7.0	6.7
November	6.8	8.0	7.4	12	21	14	6.0	6.5	6.5	6.6	6.7	6.7	5.2	10	6.8	6.5	6.5	6.5
December	7.3	8.3	7.6	11	15	13	6.4	6.5	6.5	6.6	6.7	6.7	5.2	8.6	6.8	6.5	6.5	6.5
Annual Min/Max/Avg	6.8	14.0	9.0	11	55	22	6.0	7.0	6.8	6.4	8.0	7.1	5.2	32	13	6.2	7.0	6.8

NOTES: ' -- ' indicates plant offline

4.1 Liquid Alum Chemical Consumption

2022

Month	Dosage (mg/L)			Consumption (kg)			
	Rossdale		E.L. Smith	Rossdale			E.L. Smith
	Plant 1	Plant 2		Plant 1	Plant 2	Plant Total	
January	5.00	5.00	5.00	18,170	29,907	48,077	77,967
February	4.98	5.01	5.06	16,818	28,144	44,962	70,424
March	29.7	29.7	32.8	114,718	196,495	311,213	487,687
April	45.4	45.3	55.3	176,514	299,997	476,512	800,582
May	49.0	49.0	57.0	193,617	312,862	506,478	968,811
June	121	121	143	444,741	744,082	1,188,823	2,533,875
July	90.4	90.5	117	376,384	604,308	980,691	2,134,861
August	24.3	24.4	30.3	121,182	182,161	303,343	559,497
September	20.0	20.0	21.9	87,955	132,939	220,894	365,896
October	17.1	16.7	12.5	79,240	78,035	157,275	223,317
November	5.80	5.80	5.28	18,073	36,275	54,347	85,032
December	5.01	4.90	5.19	19,607	27,707	47,314	86,198
Annual Total				1,667,018	2,672,912	4,339,930	8,394,146
Annual Avg	35.0	35.2	41.0				

NOTES : ' -- ' indicates plant offline
- Liquid alum consumption (kg) at 100% by weight (solution delivered to sites at a concentration of 48.5%)

4.2 Primary Polymer (Magnafloc LT 27AG) Chemical Consumption 2022

Month	Dosage (mg/L)			Consumption (kg)			
	Rossdale		E.L. Smith	Rossdale			E.L. Smith
	Plant 1	Plant 2		Plant 1	Plant 2	Plant Total	
January	0.10	0.10	--	176	290	466	0.14
February	0.10	0.10	--	168	273	441	--
March	0.19	0.19	0.15	352	598	950	493.26
April	0.29	0.29	0.18	555	928	1,482	1,267.00
May	0.34	0.34	0.17	651	1,052	1,703	1,449.69
June	0.32	0.32	0.26	596	987	1,583	2,271.18
July	0.31	0.31	0.28	687	982	1,669	2,555.48
August	0.25	0.25	0.21	614	916	1,531	1,855.98
September	0.25	0.25	0.16	532	804	1,335	1,300.74
October	0.21	0.21	0.16	478	466	944	476.33
November	0.10	0.10	--	154	303	457	--
December	0.10	0.10	--	190	274	464	--
Annual Total				5,152	7,875	13,026	11,670
Annual Avg	0.21	0.21	0.20				

NOTES: ' -- ' indicates plant offline

- Primary polymer consumption (kg) at 100% by weight mixed at the sites to required solution

4.3 Carbon Chemical Consumption

2022

Month	Dosage (mg/L)			Consumption (kg)			
	Rossdale		E.L. Smith	Rossdale			E.L. Smith
	Plant 1	Plant 2		Plant 1	Plant 2	Plant Total	
January	--	--	--	--	--	--	--
February	--	--	--	--	--	--	--
March	52.7	52.1	52.7	44,609	75,167	119,776	170,079
April	10.5	10.5	11.2	2,512	5,026	7,538	10,658
May	--	--	--	--	--	--	--
June	15.6	14.9	16.5	4,276	6,733	11,010	16,758
July	--	--	10.1	--	--	--	3,076
August	--	--	--	--	--	--	--
September	--	--	--	--	--	--	--
October	--	--	--	--	--	--	--
November	--	--	--	--	--	--	--
December	--	--	--	--	--	--	--
Annual Total				51,397	86,927	138,324	200,571
Annual Avg	37.3	36.8	35.4				

NOTES: ' -- ' indicates carbon not being used

4.4 Sodium Hypochlorite Chemical Consumption

2022

Month	Rossdale					E.L. Smith	
	Dosage (mg/L)		Consumption (kg)			Dosage (mg/L)	Consumption (kg)
	Plant 1	Plant 2	Plant 1	Plant 2	Plant Total		
January	2.72	2.85	596,501	1,034,439	1,630,940	2.90	2,883,945
February	2.78	2.75	569,544	938,370	1,507,914	2.95	2,626,069
March	3.09	3.05	718,059	1,216,502	1,934,561	3.30	3,080,941
April	2.82	2.80	675,769	1,124,392	1,800,161	3.00	2,756,627
May	3.04	3.05	727,956	1,181,292	1,909,248	3.32	3,634,389
June	3.12	3.02	719,967	1,157,951	1,877,918	3.94	4,466,900
July	3.42	3.37	994,115	1,350,016	2,344,131	4.10	4,962,973
August	3.08	3.06	941,391	1,399,350	2,340,740	3.55	4,231,868
September	2.83	2.81	754,397	1,132,115	1,886,512	2.98	3,158,606
October	2.95	2.88	780,156	802,421	1,582,577	2.78	3,159,957
November	2.76	2.77	510,917	1,040,616	1,551,533	2.75	2,845,406
December	2.79	2.76	664,085	944,159	1,608,244	3.04	3,225,549
Annual Total			8,652,858	13,321,621	21,974,479		41,033,230
Annual Avg	2.95	2.93				3.22	

NOTES: ' -- ' indicates plant offline

- Sodium hypochlorite consumption (kg) at 0.8% by weight (sodium hypochlorite generated onsite at a concentration of 0.8%)
- Plant Total Consumption is the combined addition of Plant 1, Plant 2 and Post Filter Trim.

4.5 Filter Polymer (Magnafloc LT 7981) Chemical Consumption

2022

Month	Dosage (mg/L)		Consumption (kg)	
	Rossdale	E.L. Smith	Rossdale	E.L. Smith
January	0.39	0.34	1,717	2,588
February	0.37	0.30	1,582	2,022
March	0.27	0.20	1,313	1,383
April	0.16	0.12	774	860
May	0.26	0.19	1,275	1,538
June	0.18	0.16	857	1,408
July	0.15	0.09	778	810
August	0.19	0.11	1,154	1,010
September	0.20	0.12	1,036	958
October	0.25	0.35	1,042	3,008
November	0.43	0.38	1,837	3,003
December	0.38	0.37	1,687	3,026
Annual Total			15,053	21,612
Annual Avg	0.27	0.23		

NOTES: ' -- ' indicates plant offline

- Filter polymer consumption (kg) at 100% by weight mixed at the sites to required solution

4.6 Aqua Ammonia Chemical Consumption

2022

Month	Dosage (mg/L)		Consumption (kg)	
	Rossdale	E.L. Smith	Rossdale	E.L. Smith
January	0.63	--	14,750	--
February	0.63	--	14,050	--
March	0.62	--	15,965	--
April	0.61	--	15,438	--
May	0.61	--	15,538	--
June	0.61	--	14,931	--
July	0.61	--	16,721	--
August	0.61	--	19,189	--
September	0.61	--	16,681	--
October	0.61	--	13,577	--
November	0.61	--	13,675	--
December	0.61	--	14,128	--
Annual Total			184,641	--
Annual Avg	0.61	--		

NOTES: ' -- ' indicates plant offline
- Aqua ammonia consumption (kg) at 100% by weight (solution delivered to sites at a concentration of 40%)

4.6-1 LAS Ammonia Chemical Consumption

2022

Month	Dosage (mg/L)	Consumption (kg)
	E.L. Smith	E.L. Smith
January	0.59	38,862
February	0.59	34,362
March	0.59	36,282
April	0.59	35,512
May	0.59	42,106
June	0.62	46,811
July	0.64	51,487
August	0.64	50,969
September	0.64	45,578
October	0.64	46,973
November	0.64	42,631
December	0.64	43,789
Annual Total		515,360
Annual Avg	0.62	

NOTES: ' -- ' indicates plant offline
- LAS ammonia consumption (kg) at 100% by weight (solution delivered to sites at a concentration of 40%)

4.7 Caustic Soda Chemical Consumption

2022

Month	Dosage (mg/L)		Consumption (kg)	
	Rossdale	E.L. Smith	Rossdale	E.L. Smith
January	--	--	--	--
February	--	--	--	--
March	11.9	15.7	50,276	91,756
April	7.58	13.6	67,805	168,334
May	5.22	12.5	46,733	180,453
June	16.6	30.8	132,825	480,450
July	13.2	27.2	115,748	436,023
August	--	4.62	--	72,069
September	--	2.65	--	40,066
October	--	2.68	--	13,719
November	--	--	--	--
December	--	--	--	--
Annual Total			413,387	1,482,871
Annual Avg	10.7	14.6		

NOTES: ' -- ' indicates plant offline
- Caustic soda consumption (kg) at 100% by weight (solution delivered to sites at a concentration of 50.0%)

4.8 Fluoride Chemical Consumption

2022

Month	Dosage (mg/L)		Consumption (kg)	
	Rossdale	EL Smith	Rossdale	EL Smith
January	0.65	0.63	13,336	19,779
February	0.63	0.63	12,317	17,632
March	0.72	0.64	16,038	18,864
April	0.72	0.66	15,966	18,922
May	0.68	0.67	15,062	22,538
June	0.67	0.66	14,240	23,542
July	0.66	0.66	15,821	25,299
August	0.62	0.63	17,087	23,785
September	0.66	0.65	15,712	21,725
October	0.68	0.65	13,284	22,898
November	0.69	0.64	13,477	20,456
December	0.68	0.64	13,702	20,970
Annual Total			176,040	256,410
Annual Avg	0.67	0.65		

NOTES: ' -- ' indicates plant offline

- Fluoride consumption (kg) at 100% by weight (solution delivered to sites at a concentration of 21.8%)

4.9 Sodium Bisulfite Chemical Consumption
2022

Month	Rossdale			E.L. Smith		
	Dosage (mg/L)	Consumption (kg)	De-chlorinated Waste Stream to Outfall (ML)	Dosage (mg/L)	Consumption (kg)	De-chlorinated Waste Stream to Outfall (ML)
January	21.6	20,535	395	14.9	40,093	1,024
February	25.2	21,853	330	14.2	42,666	1,086
March	20.9	20,741	387	16.6	44,451	993
April	17.5	21,662	452	16.4	45,497	1,067
May	28.1	24,240	351	13.9	51,197	1,355
June	13.9	14,474	446	15.9	47,903	1,142
July	12.3	17,836	525	14.1	45,564	1,218
August	20.6	16,573	311	14.8	45,687	1,178
September	20.6	16,687	306	12.8	31,800	978
October	22.5	23,073	396	12.2	46,876	1,445
November	21.9	35,317	595	12.0	47,433	1,419
December	19.6	23,934	479	14.4	49,833	1,337
Annual Total		256,925	4,974		538,999	14,242
Annual Avg	20.4			14.4		

NOTES: ' -- ' indicates Plant Offline
- Sodium bisulfite consumption (kg) at 38% by weight (solution delivered to sites at a concentration of 38.0%)

5.1 Waste Stream Volumes (ML)

2022

Month	Rossdale						E.L. Smith								
	Clarifier Blowdown	Clarifier Washdown	Backwash Water	Filter to Waste	Bypass	Plant Total	Clarifier Blowdown	Clarifier Washdown	Backwash Water	Filter to Waste	Bypass	LLP Flush	HLP Cooling	Plant Total	De-chlorinated Waste Flow to Outfall
January	244	12	127	29	0.0	412	567	--	291	128	20	0.6	29	1,035	1,024
February	252	--	144	33	9.1	438	519	--	322	160	75	0.5	25	1,102	1,086
March	149	--	138	34	7.1	327	545	--	295	158	21	0.6	24	1,044	993
April	294	--	110	43	11	458	474	--	341	190	57	0.9	25	1,089	1,067
May	194	--	114	69	14	391	634	10	379	287	71	0.6	26	1,408	1,355
June	293	--	96	36	2.8	428	530	13	344	182	27	0.8	29	1,125	1,142
July	382	20	105	26	22	556	619	13	346	170	68	0.7	31	1,248	1,218
August	189	--	106	28	0.0	323	616	--	329	141	87	0.7	27	1,201	1,178
September	180	--	103	29	4.8	317	593	--	241	94	48	0.6	23	999	978
October	197	20	131	33	4.6	386	699	--	425	283	23	0.7	26	1,457	1,445
November	255	--	190	71	26	541	687	--	392	265	32	4.8	22	1,403	1,419
December	219	20	169	54	9.9	472	719	--	351	195	42	0.7	26	1,334	1,337
Annual Total	2,848	73	1,532	485	111	5,049	7,203	35	4,057	2,252	572	12	313	14,445	14,242

NOTES: - Clarifier washdown volume(s) estimated for clarifier cleaning
- LLP flush, HLP cooling and chlorinated waste flow to outfall are not applicable to the Rossdale WTP
- De-chlorinated waste flow to outfall is the estimated chlorinated waste flow to outfall for dechlorination

5.2 Rossdale Clarifier Blowdown Clarifier Washdown and Backwash Water Waste Stream Data

2022

Month	Clarifier Blowdown		Clarifier Washdown		Backwash Water	
	TSS (kg)	Aluminum (kg)	TSS (kg)	Aluminum (kg)	TSS (kg)	Aluminum (kg)
January	25,851	2,098	64	4	14,782	5,117
February	39,095	1,966	0	0	17,262	5,975
March	235,775	13,446	0	0	10,539	3,648
April	724,223	20,629	0	0	4,668	1,616
May	86,648	22,121	0	0	3,218	1,114
June	2,290,580	51,776	0	0	5,701	1,973
July	749,161	43,241	1,066	58	4,839	1,675
August	117,781	13,251	0	0	2,941	1,018
September	49,944	9,641	0	0	2,988	1,034
October	19,961	6,917	133	29	5,711	1,977
November	26,381	2,383	0	0	24,519	8,487
December	22,562	2,066	216	36	20,340	7,041
Annual Total	4,387,961	189,536	1,479	127	117,509	40,676

NOTES: '--' indicates that clarifier washdown did not occur
- Clarifier washdown waste stream solids, TSS and aluminum are calculated values

5.3 Rossdale Waste Stream Data

2022

Month	De-Chlorinated Waste Flow to Waste Stream 3						De-Chlorinated Waste Flow to Waste Stream 7					
	Total Chlorine (mg/L)			Sulfite (mg/L)			Total Chlorine (mg/L)			Sulfite (mg/L)		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	0.00	0.00	0.00	1.28	20.0	7.52	0.00	0.00	0.00	1.68	20.0	8.88
February	0.00	0.00	0.00	0.10	20.0	10.5	0.00	0.00	0.00	1.68	20.0	5.72
March	0.00	0.00	0.00	1.13	20.0	10.0	0.00	0.00	0.00	1.23	20.0	5.81
April	0.00	0.00	0.00	1.04	20.0	7.42	0.00	0.00	0.00	1.24	20.0	7.97
May	0.00	0.00	0.00	1.03	20.0	8.75	0.00	0.00	0.00	0.71	20.0	9.77
June	0.00	0.00	0.00	1.02	20.0	11.8	0.00	0.00	0.00	1.14	20.0	12.3
July	0.00	0.00	0.00	1.11	20.0	13.2	0.00	0.00	0.00	1.00	20.0	9.88
August	0.00	0.00	0.00	2.50	20.0	13.4	0.00	0.00	0.00	1.30	20.0	10.9
September	0.00	0.00	0.00	1.19	20.0	9.39	0.00	0.00	0.00	0.79	20.0	8.99
October	0.00	0.00	0.00	0.26	20.0	8.90	0.00	0.00	0.00	2.35	20.0	8.36
November	0.00	0.00	0.00	1.11	20.0	9.44	0.00	0.00	0.00	1.81	20.0	4.78
December	0.00	0.00	0.00	1.02	20.0	10.7	0.00	0.00	0.00	1.24	20.0	6.25
Annual Min/Max/Avg	0.00	0.00	0.00	0.10	20.0	10.1	0.00	0.00	0.00	0.71	20.0	8.33

5.4 E.L. Smith Clarifier Blowdown Clarifier Washdown and Backwash Water Waste Stream Data

2022

Month	Clarifier Blowdown		Clarifier Washdown		Backwash Water	
	TSS (kg)	Aluminum (kg)	TSS (kg)	Aluminum (kg)	TSS (kg)	Aluminum (kg)
January	42,545	3,403	0	0	26,606	9,210
February	48,410	3,073	0	0	30,243	10,469
March	331,921	21,146	0	0	24,375	8,438
April	713,221	34,938	0	0	21,127	7,313
May	250,197	41,113	425	63	10,524	3,643
June	543,184	109,409	169	37	23,699	8,203
July	1,036,008	92,277	1,340	150	17,307	5,991
August	241,908	23,695	0	0	6,854	2,373
September	104,364	15,463	0	0	4,028	1,394
October	76,887	9,595	0	0	23,569	8,158
November	68,649	3,710	0	0	42,419	14,683
December	57,463	3,761	0	0	36,106	12,498
Annual Total	3,514,757	361,584	1,935	250	266,857	92,374

NOTES: '--' indicates that clarifier wash did not occur

- Clarifier washdown waste stream solids, TSS and aluminum are calculated values

5.5 E.L. Smith Waste Stream Data

2022

Month	De-chlorinated Waste Flow to Outfall								
	Sulphite (mg/L)			Total Chlorine (mg/L)			pH		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
January	0.12	20.0	4.13	0.00	0.00	0.00	6.80	8.07	7.57
February	0.10	20.0	4.37	0.00	0.00	0.00	6.59	7.75	7.52
March	0.10	20.0	6.59	0.00	0.00	0.00	6.89	7.63	7.36
April	0.10	20.0	6.61	0.00	0.00	0.00	6.46	7.99	7.35
May	0.10	20.0	5.19	0.00	0.00	0.00	6.95	7.76	7.52
June	0.10	20.0	5.17	0.00	0.00	0.00	6.56	7.95	7.30
July	0.10	20.0	5.87	0.00	0.00	0.00	6.61	7.96	7.43
August	0.10	20.0	4.35	0.00	0.00	0.00	6.69	8.03	7.71
September	0.10	20.0	6.22	0.00	0.00	0.00	7.14	8.09	7.92
October	0.10	20.0	9.12	0.00	0.00	0.00	7.57	8.49	8.26
November	0.10	20.0	9.42	0.00	0.00	0.00	6.18	8.51	7.79
December	0.11	20.0	12.6	0.00	0.00	0.00	6.77	7.94	7.82
Annual Min/Max/Avg	0.10	20.0	6.65	0.00	0.00	0.00	6.2	8.5	7.6

6.0 Reservoir Chlorine Residual (mg/L) - Part 1

2022

Reservoir	Papaschase 1			Ormsby			Clareview Discharge			Millwoods Discharge			Kaskitayo			Discovery Park		
Day	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Jan	1.76	2.19	1.86	1.66	2.10	2.01	--	--	--	1.81	2.12	1.99	1.71	2.17	2.04	0.72	1.27	1.10
Feb	1.83	2.19	1.93	1.78	2.13	2.02	--	--	--	1.81	2.15	2.00	1.75	2.15	2.03	0.84	1.23	1.11
Mar	1.72	2.14	1.91	1.64	2.04	1.95	1.69	1.86	1.81	1.86	2.06	1.95	1.51	2.08	1.95	1.05	1.54	1.27
Apr	1.55	2.19	1.85	1.58	2.09	1.94	1.34	2.09	1.97	1.83	2.13	1.96	1.61	2.22	1.98	1.12	1.73	1.47
May	1.22	2.05	1.65	1.28	1.97	1.66	1.55	1.96	1.74	1.58	2.00	1.78	1.53	2.11	1.77	0.86	1.69	1.28
Jun	1.13	2.00	1.34	1.51	1.97	1.77	1.16	1.79	1.65	1.13	2.03	1.84	1.57	2.22	1.92	0.89	1.50	1.20
Jul	1.04	1.86	1.24	1.43	2.02	1.67	1.30	1.68	1.54	--	--	--	1.39	2.06	1.83	0.94	1.35	1.16
Aug	0.89	1.88	1.35	1.57	2.15	1.77	1.39	1.84	1.66	--	--	--	1.59	2.15	1.90	0.89	1.48	1.25
Sep	1.02	1.94	1.38	1.63	2.24	1.79	1.43	1.85	1.70	--	--	--	1.54	2.12	1.94	0.89	1.44	1.18
Oct	1.18	2.00	1.44	1.70	2.12	1.84	1.40	1.96	1.75	--	--	--	1.52	2.10	1.94	0.97	1.52	1.15
Nov	1.25	2.07	1.59	1.59	2.12	1.96	1.49	2.09	1.90	--	--	--	1.36	2.12	2.02	1.23	1.51	1.37
Dec	1.51	1.99	1.75	1.76	2.18	1.99	1.54	2.06	1.89	--	--	--	1.60	2.18	2.01	1.35	1.68	1.49
Monthly Min/Max/ Avg	0.89	2.19	1.61	1.28	2.24	1.86	1.16	2.09	1.76	1.13	2.15	1.93	1.36	2.22	1.94	0.72	2.09	1.76

NOTES: '--' Indication Analyzer Offline

6.1 Reservoir Chlorine Residual (mg/L) - Part 2

2022

Reservoir	Rosslyn 1			Londonderry			N. Jasper Place			Rosslyn 2			Thorncliffe			Blackmud Creek		
Day	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
Jan	1.44	2.23	1.83	1.73	2.14	2.00	1.61	2.07	1.68	1.76	2.39	2.00	1.82	2.20	1.91	1.52	1.80	1.63
Feb	1.62	1.99	1.87	1.71	2.13	2.03	1.46	2.05	1.72	1.83	2.38	2.01	1.76	2.17	1.90	1.49	1.77	1.62
Mar	1.75	1.98	1.86	1.63	2.16	2.03	1.64	2.03	1.72	1.80	2.33	2.03	1.73	2.13	1.88	1.31	1.82	1.60
Apr	1.69	1.87	1.81	1.31	2.14	1.99	1.61	2.05	1.68	1.69	2.28	1.94	1.73	2.23	1.84	1.74	1.96	1.87
May	1.29	1.75	1.47	1.48	1.98	1.75	1.29	1.96	1.50	1.22	2.20	1.71	1.25	2.18	1.59	1.29	1.88	1.54
Jun	1.06	1.42	1.26	1.43	1.84	1.62	1.28	2.09	1.41	1.36	1.96	1.50	1.23	2.39	1.48	1.27	1.77	1.56
Jul	0.98	1.55	1.16	1.25	1.70	1.47	1.18	2.05	1.35	1.06	1.99	1.34	1.11	2.28	1.43	1.34	1.65	1.56
Aug	1.34	1.62	1.48	1.23	1.82	1.54	1.16	1.99	1.35	1.01	2.05	1.38	1.27	2.29	1.47	1.46	1.64	1.57
Sep	1.14	1.67	1.44	1.45	1.88	1.69	1.04	2.01	1.38	1.28	2.05	1.50	1.20	2.22	1.52	1.46	1.61	1.54
Oct	1.36	1.68	1.59	0.96	1.90	1.43	1.28	2.03	1.47	1.26	2.08	1.54	1.42	2.18	1.67	1.41	1.71	1.51
Nov	1.52	1.86	1.76	1.32	2.10	1.85	1.48	2.13	1.64	1.38	2.23	1.66	1.72	2.18	1.83	1.43	1.57	1.50
Dec	1.57	1.87	1.78	1.67	2.08	1.92	1.54	2.16	1.75	1.54	2.08	1.72	1.54	2.18	1.87	1.37	1.99	1.67
Monthly Min/Max/ Avg	0.98	2.23	1.59	0.96	2.16	1.77	1.04	2.16	1.55	1.01	2.39	1.70	1.11	2.39	1.69	1.27	1.99	1.60

NOTES: '--' Indication Analyzer Offline

Residuals Management Program

Rossdale and E.L. Smith Water Treatment Plants

Annual Progress Report

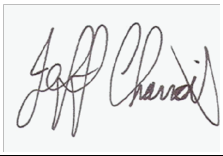
Prepared for Alberta Environment and Protected Areas (AEPA)

EPEA Approval 638-04-00

EPCOR WATER SERVICES INC.

February 2023

Approval

Director, Edmonton WTPs, Audrey Cudrak	25 January 2023 **Date**
 **Sr. Manager, Analytical Operations and Process Development**	25 January 2023 **Date**

Executive Summary

EPCOR has committed to reduce the impact of water treatment plant residuals released to the North Saskatchewan River, a commitment now formalized in the system's Approval issued under the *Environmental Protection and Enhancement Act* (Approval 638-04-00). This report summarizes activities and progress made against those commitments and challenges faced in 2022. The Process Innovation and Residuals Committee's (PIRC) main focus is to promote environmental excellence and stewardship by minimizing environmental impacts through the management of residuals, discussing new research developments and resolving issues related to the water treatment processes.

EPCOR has essentially eliminated release of chlorinated water from the water treatment process where feasible and practical. Our focus now is monitoring and continuous improvements. The Sodium Bisulfite (SBS) dechlorination systems at the Edmonton Water Treatment Plants (EWTPs) continued to operate as intended. In 2022, there were no incidents at Rossdale WTP or E.L. Smith WTP resulting in the release of chlorinated water into the North Saskatchewan River (NSR).

As stated in the Approval, EPCOR's main strategy for reducing solids discharges is to operate in Direct Filtration (DF) during the winter months. EWTPs convert to DF during the fall and winter months to further reduce chemical addition and subsequent solids discharges to the river. In 2022, the WTPs were able to achieve an average of 151 days in DF (144 days at Rossdale and 158 days at E.L. Smith). The internal target of 120 days for DF operations was exceeded. DF operation resulted in a reduction of total solids discharged to the NSR by 50.4% during the months of January, February, November, and December compared to baseline conventional operation. In 2022, both plants operated several days in DF in March, and October. During this Extended DF period, the total solids reduction was 29.7% compared to baseline conventional operation.

During winter DF season in Q1, concentrations *Giardia* and *Cryptosporidium* were consistently near or below levels of detection. During the first week of October, higher concentrations (especially for *Giardia*) were measured in raw water samples and the monitoring frequency was increased to weekly while Operations staff were considering a suitable time to start DF. Whereas the maximum reported *Giardia* concentration in raw water was 77 cysts/100 L, the maximum for *Cryptosporidium* was only 4 oocysts/100 L. After DF was implemented in mid-October at ELS, the counts of *Giardia* declined rapidly and *Cryptosporidium* levels remained near or below the level of detection in raw water samples. One oocyst/cyst per 1000 L was detected in the ROS treated reservoir sample collected on November 17, but no oocysts were detected in a follow-up sample.

Furthermore, EPCOR finalized the proposed wastestream monitoring program, which was approved by AEPA in December 2022. Water quality samples will begin to be collected from each of the wastestreams in 2023, and engineering designs are underway to install flow monitors and autosamplers on clarifier wastestreams. The goal of the wastestream monitoring program is to improve wastestream load quantification to better determine if acute and/or chromic guidelines and regional water quality triggers

and limits are being met. This work will then allow for the development of a science-based strategy for residuals management that will reduce EPCOR's environmental impact on the NSR and will inform if further actions to manage residuals are required.

Table of Contents

1 Introduction

In 2005, EPCOR initiated the Residuals Management Program (RMP) to address Alberta Environment and Parks' proposed limits for discharges to the North Saskatchewan River (NSR). This included discharges from the Edmonton water treatment plants and distribution system. In 2021, EPCOR's commitments in this area were formalized in the system's Approval issued under the *Environmental Protection and Enhancement Act* (Approval no 638-04-00), here after referred to as Approval.

Section 4.5 of the Approval states EPCOR "…shall strive to reduce the impact of water treatment plant residual streams released to the North Saskatchewan River through a long-term residuals management program of continuous improvement..."

EPCOR's Process Innovation and Residuals Committee, comprising a cross-section of water treatment subject matter experts, meets monthly. The focus of this committee is to promote environmental excellence and stewardship by minimizing environmental impacts through the management of residuals, discussing new research developments and resolving issues related to the water treatment processes.

This document outlines the progress and status of the work done by EPCOR in managing residuals discharges for 2022.

2 Residuals Management Improvements

2.1 Dechlorination Update

Edmonton Water Treatment Plants:

Sodium Bi-Sulfite (SBS) based dechlorination systems have been in operation at E.L. Smith WTP and Rossdale WTP since 2009 and 2012, respectively.

In 2022, there were no incidents at Rossdale WTP or E.L. Smith WTP resulting in the release of chlorinated water into the North Saskatchewan River.

2.2 Direct Filtration Operations Update

Provided that the river water quality allows the conversion from conventional treatment, Rossdale and E.L. Smith water treatment plants operate in the direct filtration (DF) mode during the late fall and winter months. This operation mode aims to reduce solids (including aluminium) discharged to the NSR.

Table 1 summarizes the differences in chemical dosage between conventional and DF operation during low raw water Colour and Turbidity conditions (<8 TCU, <10 NTU). DF treatment uses less overall chemical compared to conventional treatment. DF operation has successfully reduced alum usage by approximately 75% compared to conventional mode. Thus, the total mass of solid treatment residuals discharged to the NSR is reduced by approximately 50% during the DF operation period.

Table 1: Chemical Dose comparison in Conventional and Direct Filtration during Fall/Winter operation

Chemical	Conventional (mg/L)	Direct Filtration (mg/L)
Alum	25 – 30	< 10
Primary Polymer	0.2 – 0.3	0 – 0.1
Filter Polymer	0.2 – 0.5	0.4 to 0.7
Caustic Soda	0 – 2.8	0

EPCOR has continuously made improvements to DF operation that would enable DF operation for longer periods during the year. Ongoing trials and investigations to reduce residuals are highlighted in Section 5 of this report.

As per the Approval, EPCOR's main strategy for reducing solids to the river is to operate in Direct Filtration between November and February. When the WTPs are operated in DF outside the months of November/December/January/February, this period is considered as Extended DF. Over the past several years, the year-to-year results have been variable and have depended highly on raw water conditions and other variables. EPCOR has now set a KPI target to operate in DF for a period of at least 120 days in a year. In 2022, the WTPs were able to achieve an average of 151 days in DF (144 days at Rossdale and 158 days at E.L. Smith).

Conversion dates for 2022:

The Rossdale WTP was in DF operation on January 1st, 2022 and converted back to conventional treatment on March 17th, 2022, in preparation for spring run-off in the NSR. Later in the year, Rossdale was converted to DF on October 24th; and remained in DF for the rest of 2022.

The E.L. Smith WTP was in DF operation on January 1st, 2022 and converted back to conventional treatment on March 18th, 2022, in preparation for spring run-off in the NSR. Later in the year, EL. Smith was converted to DF on October 11th; and remained in DF for the rest of 2022.

2.3 Residuals Reduction

Optimization of alum dosing strategy has been a primary focus over the past few years at EPCOR since reduction in alum dosage results in a reduction of chemical residuals produced and discharged to the NSR. Alum dose is reduced through DF and extended DF operation as explained in Section 2.2. Optimal alum dosages are applied in conventional treatment operation based on a dosing model that was developed in-house. The use of this model has resulted in lower alum dosages than historically used to treat raw water of similar quality. This model was optimized in 2017 to include a temperature correction factor.

In 2022, DF operation resulted in a reduction of total solids discharged to the NSR by 50.4% during the months of January, February, November, and December compared to baseline conventional operation. In 2022, both plants operated several days in DF in March, and October. During this Extended DF period, the total solids reduction was 29.7% compared to baseline conventional operation.

Table 2 and Table 3 below summarize total suspended solids loading to the river in 2021 and 2022, respectively.

Table 2: Total Suspended Solids Discharged to the NSR in 2021

Mode of Operation	Months	Actual Total Solids Loading (tonne)	Chemical Loading (tonne)	Baseline Total Solids Loading [Conventional Model]* (tonne)	Total Solids Loading Reduction (tonne)	Total Solids Loading Reduction (%)
Direct Filtration (DF)	Jan-Feb, Nov-Dec	461	133	961	500	52.0%
Extended DF	Mar	31	14	51	19	38.0%
Chemical Optimization	Mar-Oct	5302	1982	5679	378	6.7%
Total		5794	2129	6691	898	13.4%

Table 3: Total Suspended Solids Discharged to the NSR in 2022

Mode of Operation	Months	Actual Total Solids Loading (tonne)	Chemical Loading (tonne)	Baseline Total Solids Loading [Conventional Model]* (tonne)	Total Solids Loading Reduction (tonne)	Total Solids Loading Reduction (%)
Direct Filtration (DF)	Jan-Feb, Nov-Dec	452	134	911	459	50.4%
Extended DF	Mar, Oct	104	49	148	44	29.7%
Chemical Optimization	Mar-Oct	12911	3467	13064	153	1.2%
Total		13467	3650	14123	656	4.6%

* Table 2 and 3: Total suspended solids discharges are calculated based on a predictive model that accounts for raw water turbidity and colour and chemical dosing. Both are continuously monitored. Baseline load was calculated by applying the 2005 to 2010 conventional treatment strategy to the actual 2021 and 2022 raw water conditions. For extended DF, only the days when the WTPs were in DF were used.

3 Impact of Residuals Management on Water Quality

3.1 Effects of Direct Filtration on Treated Water Quality

Treated water quality during DF operation in 2022 was compared with baseline quality observed during a ten-year period of conventional winter operation (2001 – 2010). Favorable raw water quality conditions

during 2022 allowed DF operation to proceed between January and mid-March and to resume again in October, so that the average number of DF days was 151 at the Edmonton WTPs.

Filter effluent quality comparisons between historic conventional operation and 2022 DF operation are shown in Table 4. Average daily values and standard deviations are shown for seven parameters: turbidity, particle counts (PC>2 µm), total aluminum (Total Al), UV_{254} transmittance (UVT), total organic carbon (TOC), and two groups of disinfection by-products (TTHM and HAA5). Turbidity, particle counts and UVT values were measured with on-line filter effluent analyzers, whereas Total Al, TOC, TTHM and HAA5 values were lab-measured values for treated reservoir samples. As usual, slight decreases in UVT and small increases in Total Al, TTHM and HAA5 were observed. These differences are expected as a result of reduced coagulant use and do not represent a reduction in treated water quality because the parameters remained well within established target ranges.

Table 4: Treated Water Quality Comparions: Former Winter Conventional vs 2022 DF Operation

Parameter	EPCOR Target	ELS Conv. 2001-2010		ELS DF 2022		ROS Conv. 2001-2010		ROS DF 2022	
		Mean	St Dev	Mean	St Dev	Mean	St Dev	Mean	St Dev
Turbidity*	< 0.10NTU	0.027	0.005	0.028	0.007	0.024	0.007	0.027	0.005
PC >2 µm*	< 20/mL	6.0	3.3	5.8	2.3	3.6	3.4	3.2	1.9
Total Al	< 0.10 mg/L**	0.041	0.013	0.106	0.040	0.036	0.015	0.100	0.032
$UV_{254}T$ %*	> 90%	96.2	1.2	95.4	0.7	95.9	1.0	95.6	0.7
TOC (mg/L)	No target	1.19	0.33	1.20	0.36	1.23	0.34	1.12	0.12
TTHM	< 40 µg/L	6.30	2.56	8.86	2.03	8.35	3.04	10.87	1.90
HAA5	< 35 µg/L	11.1	5.3	15.7	3.8	13.5	5.7	15.5	2.5

* Parameters measured in filter effluent rather than the treated water reservoir

** 2021 Health Canada Guideline for Aluminum, Operational Guidance (OG) is < 0.1 mg/L. Health Canada no longer distinguishes OG for Al between conventional and other treatment types.

3.2 Risk Analysis of *Cryptosporidium* during DF

Assays for *Giardia* and *Cryptosporidium* were performed on samples of raw and treated water from both WTPs during periods of DF operation. During winter DF season in Q1, concentrations of both parasites were consistently near or below levels of detection. During the first week of October, higher concentrations (especially for *Giardia*) were measured in raw water samples and the monitoring frequency was increased to weekly while Operations staff were considering a suitable time to start DF. Whereas the maximum reported *Giardia* concentration in raw water was 77 cysts/100 L, the maximum for *Cryptosporidium* was only 4 oocysts/100 L. After DF was implemented in mid-October at ELS, the counts of *Giardia* declined rapidly and *Cryptosporidium* levels remained near or below the level of detection in raw water samples. One oocyst/cyst per 1000 L was detected in the ROS treated reservoir

sample collected on November 17, but no oocysts were detected in a follow-up sample. Full analytical details are provided in the EPCOR Edmonton Waterworks 2022 Annual Report.

4 Environmental Impacts of Residuals Discharges

4.1 Residuals Characterization and Effluent Toxicity Summary

Clarifier and filter waste streams were sampled quarterly from locations as close as practical to river discharge points. Samples were characterized by the Process Development Team, and 96-hour trout assays were conducted by Bureau Veritas to evaluate acute toxicity. Initial DO concentrations were measured and checks were made to ensure that no residual chlorine was present. Results are shown in Table 5. Samples were reported as non-toxic (LC_{50} > 100%) except for the ELS Clarifier sample collected on May 17 and a follow-up sample collected on June 2 that were both reported as LC_{50} = 70.7%. As documented in the notification provided to AEPA (Reference No. 391211) both samples had high concentrations of TSS and TOC. It is likely that dissolved oxygen (DO) levels sagged while these samples were in storage awaiting the toxicity assays, and low initial DO (< 2 mg/L) during the first few minutes of each full-strength assay would have stressed the juvenile trout resulting in mortalities. Corrective actions have included extra measures to keep samples cool during transport and requiring assays to begin within 24 hours of reception.

Table 5: Residuals Characterization and Effluent Toxicity Summary

Date	Operating Mode	Sample Description	TSS (mg/L)	pH	TOC (mg/L)	LC50
22-Feb-22	Direct Filtration	ELS Clarifier Waste	256	7.97	1.5	>100%
22-Feb-22	Direct Filtration	ELS Filter Waste	<5	7.70	1.4	>100%
23-Feb-22	Direct Filtration	Rossdale WS 3 Filter Waste	<5	7.53	1.4	>100%
23-Feb-22	Direct Filtration	Rossdale WS 5 Clarifier Waste	<5	7.84	1.5	>100%
23-Feb-22	Direct Filtration	Rossdale WS 6 Clarifier Waste	15	7.97	1.5	>100%
23-Feb-22	Direct Filtration	Rossdale WS 7	5	7.82	1.4	>100%
17-May-22	Conventional	ELS Clarifier Waste	41300	7.40	85.8	70.7
17-May-22	Conventional	ELS Filter Waste	<5	7.15	2.4	>100
18-May-22	Conventional	Rossdale WS 3 Filter Waste	5	7.32	2.4	>100%
18-May-22	Conventional	Rossdale WS 5 Clarifier Waste	21	7.64	3.5	>100%
18-May-22	Conventional	Rossdale WS 6 Clarifier Waste	490	7.52	4.3	>100%
18-May-22	Conventional	Rossdale WS7	14	6.65	2.1	>100%
2-Jun-22	Conventional	ELS Clarifier Waste	26600	7.38	60.0	70.7
17-Aug-22	Conventional	ELS Clarifier Waste	9600	7.72	3.2	>100%
17-Aug-22	Conventional	ELS Filter Waste	10	7.67	1.7	>100%
18-Aug-22	Conventional	Rossdale WS 3 Filter Waste	8	7.04	2.0	>100%
18-Aug-22	Conventional	Rossdale WS 5 Clarifier Waste	21	8.45	2.1	>100%
18-Aug-22	Conventional	Rossdale WS 6 Clarifier Waste	170	7.93	2.2	>100%
18-Aug-22	Conventional	Rossdale WS7	26	7.37	1.7	>100%
7-Nov-22	Direct Filtration	ELS Clarifier Waste	330	7.94	1.7	>100%
7-Nov-22	Direct Filtration	ELS Filter Waste	13	7.95	1.5	>100%

8-Nov-22	Direct Filtration	Rossdale WS 3 Filter Waste	5	7.88	1.8	>100%
8-Nov-22	Direct Filtration	Rossdale WS 5 Clarifier Waste	5	8.19	1.9	>100%
8-Nov-22	Direct Filtration	Rossdale WS 6 Clarifier Waste	12	8.11	1.8	>100%
8-Nov-22	Direct Filtration	Rossdale WS7	4	7.14	1.7	>100%

4.2 Wastestream Monitoring Program and Assessment of Impacts of Wastes

Since 2013, EPCOR has conducted a variety of monitoring programs to assess the environmental impacts of WTP residual wastestreams to the NSR. Previous work has included monitoring water quality, sediment quality, benthic invertebrate communities and conducting chronic toxicity tests on residual discharges.

As part of the current AEPA Approval, EPCOR submitted a proposed "Wastestream Monitoring Program and Assessment of Impacts of Wastes to the NSR" to AEPA in December 2021. EPCOR incorporated AEPA comments and edits, and a finalized document was submitted to AEPA in November 2022, and was approved by AEPA in December 2022. The goal of the wastestream monitoring program is to improve wastestream load quantification to better determine if acute and/or chromic guidelines and regional water quality triggers and limits are being met. This work will then allow for the development of a science-based strategy for residuals management that will reduce EPCOR's environmental impact on the NSR and will inform if further actions to manage residuals are required.

The wastestream monitoring program will begin in 2023, and will begin collecting water quality samples from each WTP wastestream for total suspended solids (TSS), turbidity, total and dissolved metals, hardness and pH. Samples will be collected under and various plant operations and river conditions to better estimate concentrations and loads throughout the year to the NSR. EPCOR will also work to characterize wastestream flows to determine the episodic, daily and annual loads from each WTP wastestream. Flow monitoring equipment and autosamplers will be installed on clarifier wastestreams once engineering designs have been completed. Results from the wastestream monitoring program will submitted to AEPA annually in February.

5 Process Development Initiatives

The Process Development Team (PDT) continued to explore opportunities to reduce alum use and the associated production of alum residuals. Preliminary investigations were conducted to explore the possibility of recycling filter waste during ripening (filter-to-waste) by returning it to a point upstream of the filters. Alum consumption could potentially be reduced (by up to 10%) because recycling filter waste would reduce raw water requirements and the associated alum use. This would also directly reduce the volume of filter waste discharged to the river and the associated dechlorination requirements.

The PDT also participated in some long-term planning discussions to consider possibilities for extending the direct filtration season by using deeper bed granular media filters or (hypothetically) direct ultrafiltration.

6 Strategy for Moving Forward

The Approval requirements commits EPCOR to pursue continuous improvement of the residuals management to the North Saskatchewan River and to explore opportunities to further reduce solids loading outside of the November to February winter period. EPCOR's strategy moving forward will continue to emphasize operation of the water treatment plants in direct filtration mode during the fall and winter months when it is practically feasible and the environmental benefits are greatest. EPCOR has set a KPI to provide DF for a period of at least 120 days in a year. This target is formalized under the 2022 - 2026 Performance Based Rates agreement with the City of Edmonton. Failure to meet this target could result in financial penalties to EPCOR.

EPCOR will initiate the wastestream monitoring program in 2023 to better characterize wastestream quality and flows. The goal of the wastestream monitoring program is to improve wastestream load quantification to better determine if acute and/or chromic guidelines and regional water quality triggers and limits are being met. This work will then allow for the development of a science-based strategy for residuals management that will reduce EPCOR's environmental impact on the NSR and will inform if further actions to manage residuals are required.

7 Appendix

A-1 Chronological List of Meetings and Document Exchanges between EPCOR and AEPA, 2022

Date	Meeting Description	Document Description
May 6, 2022	-	Fengquin Wang provided AEPA's comments on EPCOR's proposed wastestream monitoring program, submitted to AEPA on December 30, 2021. Requested a response by June 1, 2022.
June 1, 2022	-	EPCOR provided a response to AEP's comments from May 6, 2022.
October 25, 2022	-	Fengquin Wang provided AEPA's second round of responses to EPCOR's proposed wastestream monitoring program. Requested a response by November 30, 2022.
November 30, 2022	-	EPCOR provided an updated proposed wastestream monitoring plan, addressing all of AEPA's previous comments
December 7, 2022	-	Fengquin Wang asked an additional question in AEPA's third round of responses to EPCOER's proposed wastestream monitoring program
December 14, 2022	-	EPCOR provided an updated proposed wastestream monitoring plan, addressing all of AEPA's previous comments
December 21, 2022	-	AEPA provided a Letter of Authorization, authorizing EPCOR to implement the proposed wastestream monitoring program, as submitted on December 14, 2022.