2020 WASTEWATER FLOW MONITORING PROGRAM

REGIONAL DISTRICT OF CENTRAL OKANAGAN

January 13, 2021

URBAN SYSTEMS

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File: 1179.0073.92

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APPENDICES

EXECUTIVE SUMMARY

The proposed jurisdictional split for flows into the regional wastewater treatment plant, operated by RDCO, was calculated by two methods, which are summarized in **Table 1** below.

Table 1: WWTP Flow Splitting Results for 2020

JURISDICTION	CALCULATION METHOD		
	Flow Monitor	Lift Station SCADA	Average
District of Peachland	7.43%	7.43%	7.43%
City of West Kelowna	67.96%	70.22%	69.05%
Westbank First Nation	24.61%	22.35%	23.52%
Wastewater Treatment Plant	100.00%	100.00%	100.00%

The results from the two methods are within 2.3% of each other, which confirms that the flow meter data are reliable. Given that there is a significant financial impact for each percentage point in the allocation, it is recommended that the Flow Monitor method of calculation be adopted for the 2020 results as the Lift Station SCADA method relies on significantly more parcel counts and estimation than the Flow Monitoring method.

Recall that the District of Peachland is not included in the trunk sewer calculation since it has its own separate connection to the plant. Thus, the split for the regional trunks is calculated using the ratio of City of West Kelowna to Westbank First Nation flows. The 2020 regional trunk allocation is shown in **Table 2**.

Table 2: Regional Trunk Sewer Apportionment

FLOW SPLITTING FOR REGIONAL TRUNK SEWERS	
City of West Kelowna	73.4%
Westbank First Nation	26.6%

The flow splitting calculations and background of the monitoring program are explained in greater detail in the report:

- Section 1 of the report describes how the flow splitting by jurisdiction is undertaken.
- Section 2 provides details and results of the different flow splitting methods.
- Section 3 gives information and the flow monitoring devices used by the program.
- Section 4 list recommendations to improve the program.

1.0 FLOW MONITORING PROGRAM

1.1 BACKGROUND

The Regional District of Central Okanagan (RDCO) maintains and operates the regional wastewater treatment plant (WWTP) which provides service to the District of Peachland (DoP), the City of West Kelowna (CWK) and Westbank First Nation (WFN). The purpose of the flow monitoring program is to determine the flow contribution into the plant from each of the three jurisdictions for billing purposes.

RDCO also operates and maintains regional trunk sewers and lift stations that collect flows from West Kelowna and WFN customers. The District of Peachland has a direct connection to the treatment plant via the Okanagan Lake forcemain and is not considered a user of the regional trunks and lift stations.

Prior to 2011, the flow splitting for the WWTP was based upon the population within each municipality. While this method was considered fair and transparent, it relied on some broad assumptions regarding per-capita flow and had no mechanism to deal with vacant properties, part-time residents or visitors during peak tourist seasons. Also, the sewer flow for commercial properties varied significantly based on actual use.

In 2011, a cost allocation method based on measured sewer flow would be adopted to improve transparency and fairness in the flow-splitting program. Flows were already being measured at:

- the wastewater treatment plant;
- the Peachland Main lift station; and
- the IR10 (WFN) dosing chamber

All that remained was to measure the flows generated on IR9 (WFN) since the West Kelowna flows could be directly calculated as the WWTP flows less those from Peachland and WFN.

WWTP = DoP + CWK + IR9 (WFN) + IR10 (WFN)

CWK = WWTP – DoP – IR9 – IR10

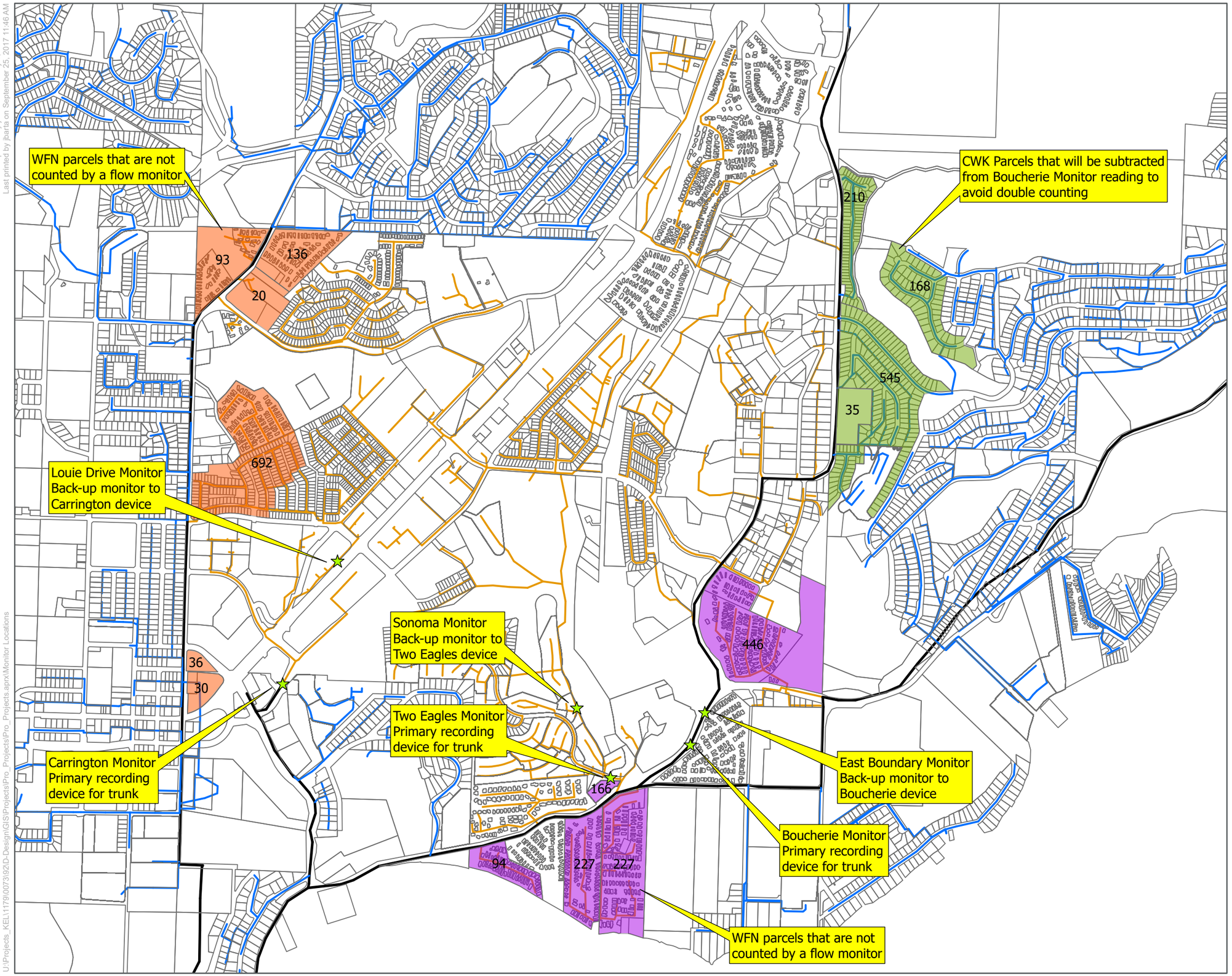
1.2 FLOW MONITORING PROGRAM

The first flow monitoring devices were installed in April of 2011 and one device was situated on each of the three major trunks leaving Westbank First Nation IR#9 as shown on **Figure 1**.

- Two Eagles;
- Carrington Road; and
- East Boundary Road

The three flow monitoring devices measure most, but not all, of the flow from IR9. Missing from the recordings are several WFN properties along First Avenue and Boucherie Road. Also, there are some West Kelowna parcels located on the east side of East Boundary Road (Vineyard Road, Merlot Drive, Merlot Court) that must be subtracted from IR9 flow total.

In order to approximate the flows from these areas, a unit flow rate of 200 L/capita/day was applied to the equivalent population within each catchment. The value of 200 L/capita/day is consistent with the flow measurements through most of the CWK, Peachland and RDCO lift stations.



Regional District of Central Okanagan

Flow Monitoring Program
Monitor Locations and Data Assumptions

Legend

- Flow Monitors
- CWK-Boundary
- WFN-Boucherie
- WFN-First
- Sewer - Regional
- Sewer - CWK
- Sewer - WFN

Notes:
- Notes go here

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1,000
Meters

Coordinate System:
NAD 1983 UTM Zone 11N

Scale: 1:15,000
(When plotted at 11"x17")

Data Sources:
- RDCO, WFN and CWK Open Data websites

Project #:	1179.0073.92
Author:	JB
Checked:	JB
Status:	Current 2020
Revision:	A
Date:	2021 / 1 / 6

URBAN systems

FIGURE 1

Figure 1 shows the WFN parcels that are not measured by a flow monitor as well as the West Kelowna properties that need to be subtracted from the monitor totals.

Thus, the estimated flow for each jurisdiction is estimated as follows:

Peachland Measured by Main lift station meter/backup meter at WWTP

IR10 Measured by dosing chamber meter

IR9 Measured by three flow monitors

- plus estimated flow from First avenue parcels,
- plus estimated flow from Boucherie Road parcels,
- less estimated flow from CWK parcels in Vineyard/Merlot Drive area

WFN IR9 flows plus IR10 flows

West Kelowna WWTP flows

- less Peachland flows
- less WFN flows.

1.3 DATA ERRORS AND CONFIDENCE

Initially, the flow monitoring data suffered from significant uncertainty since there was no historical of data to compare against. Operational challenges also plagued the program, including poor battery life and a need for increased maintenance from RDCO staff to keep the units free of obstructions in the flow stream.

In order to improve confidence in the data recorded, the Sewer Select Committee authorized the installation of three new meters. The new meters provided redundancy to the existing devices on the IR9 trunk mains and were installed in March of 2013. The redundancy meters have been very useful in providing a baseline or trend to compare the original meters against and have been used to help correct erroneous data when battery failures or flow stream clogs have occurred.

At the request of RDCO, an additional check on the flow monitoring program was created. This backup method – called the lift station method - uses the SCADA data from numerous pump stations along the East Trunk to provide a second estimate of the flows generated on IR9. This method does not use the data from the flow monitoring devices but applies an assumed unit flow rate to a greater population (area) than the monitoring method. **Figure 2** illustrates the areas that need to be estimated by applying a unit flow rate of 200 L/capita/day to the equivalent population.

Data for both methods are provided in Section 2 of this report.

The Two Eagles monitor has been problematic during the last few years, sometimes reading 50% of expected, and sometimes twice as much. A detailed review of the Two Eagles and Sonoma Pines upstream catchments was undertaken to provide more certainty on expected flows and examine the relationship between the two monitors to allow adjustment to Two Eagles using the Sonoma Pines trend where warranted. This is discussed further in Section 3.

URBANSYSTEMS.

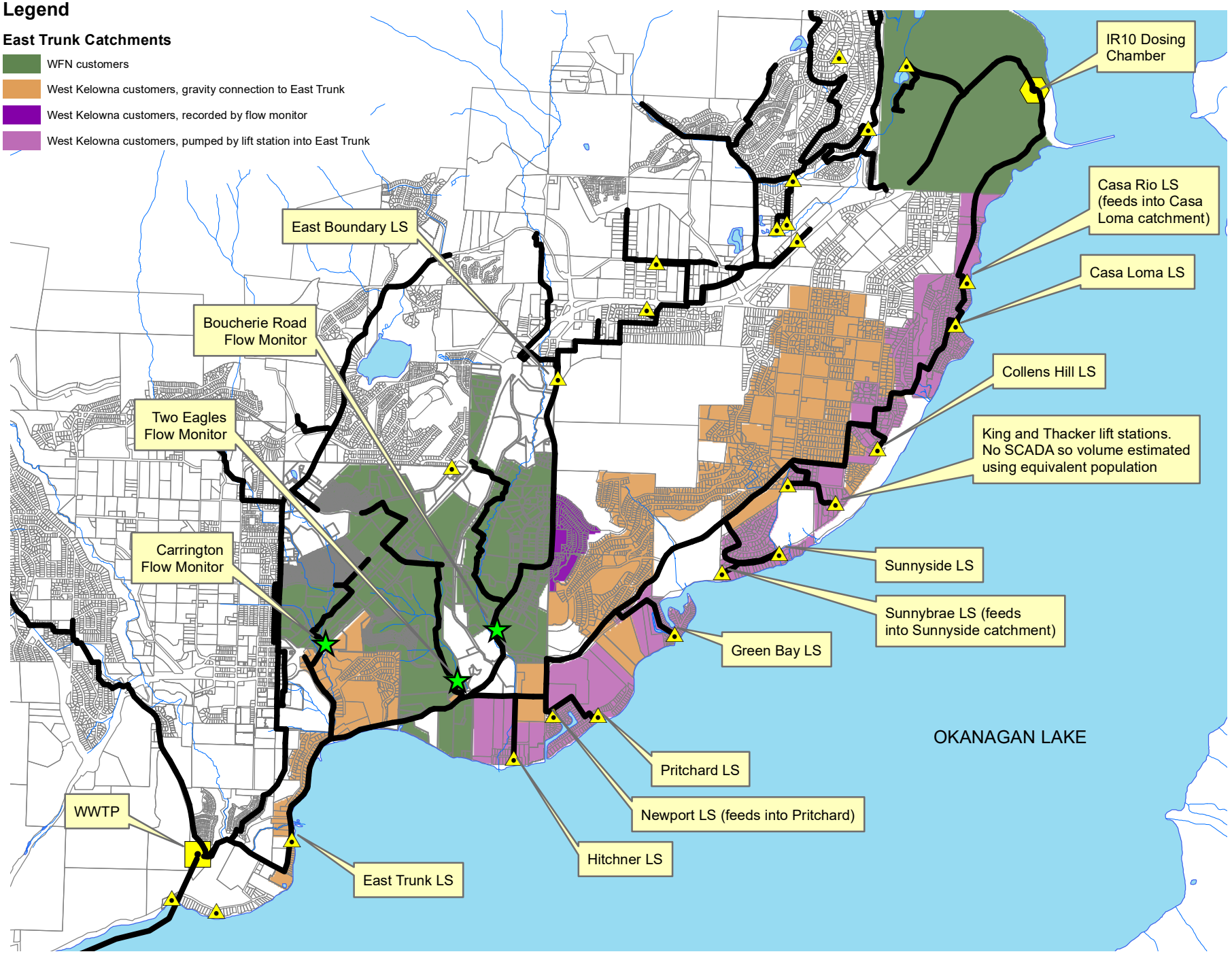
CATCHMENTS AND EQUIVALENT POPULATIONS FOR LIFT STATION SCADA BACKUP CALCULATION METHOD

1:50,000

Legend

East Trunk Catchments

- WFN customers
- West Kelowna customers, gravity connection to East Trunk
- West Kelowna customers, recorded by flow monitor
- West Kelowna customers, pumped by lift station into East Trunk



FLOW MONITORING PROGRAM
EAST TRUNK CATCHMENTS

FIGURE
2

File Path: U:\Projects_KEL\1179\0073\02\D-Drafting\Design-Analysis\GIS\2013-02-13 IR#9 Catchment Details.MXD

2.0 ANALYSIS FOR 2020

2.1 FLOW MONITORING METHOD

The data from the monitoring devices is reviewed quarterly and summarized in a flow splitting report by jurisdiction. **Table 3** below summarizes the four quarters of 2019 and presents an annual average to be considered for billing purposes.

Table 3: Flow Monitoring Summary (2020)

	Q1	Q2	Q3	Q4	ANNUAL
District of Peachland	7.15%	7.99%	8.37%	6.15%	7.43%
City of West Kelowna	65.08%	67.15%	67.84%	71.30%	67.87%
Westbank First Nation	27.77%	24.86%	23.79%	22.55%	24.70%
Wastewater Treatment Plant	100.00%	100.00%	100.00%	100.00%	100.00%

Please note that the results of the table above supersede any reporting provided during the course of the year. Data for each monitor is examined against data from before and after the subject quarter to ensure data quality, and to apply adjustments, as necessary.

Table 4 and 5 below are a historical summary of the flow splitting percentages and volumes since the program inception.

Table 4: Historical Flow Monitoring Percentages

	2020	2019	2018	2017	2016	2015
DoP	7.43%	6.59%	7.28%	9.90%	7.73%	7.7%
CWK	67.96%	72.04%	72.50%	71.00%	75.71%	73.3%
WFN	24.61%	21.37%	20.22%	19.10%	16.56%	19.0%
WWTP	100.00%	100.00%	100.00%	100.00%	100.00%	100.0%

Table 5: Historical Flow Monitoring Volumes (m^3)

	2020	2019	2018	2017	2016	2015
DoP [1]	318,648	271,998	304,256	434,552	316,893	287,291
CWK [2]	2,914,690	2,973,677	3,031,033	3,122,973	3,104,472	2,748,664
WFN [3]	1,055,312	882,393	845,542	839,584	678,861	711,048
WWTP	4,288,650	4,128,068	4,180,831	4,397,109	4,100,226	3,747,003

(1) Peachland flows are heavily influenced by the level in Okanagan Lake. The flooding in 2017 had a dramatic impact on flows from the Main lift station.

(2) Many CWK lift stations are also influenced by Okanagan Lake Level. The Districts 2012 Water Conservation plan aimed for 10% reduction in water use by 2022.

(3) Development has proceeded rapidly on IR9 and 10, as seen in the trend data. Two Eagles monitor may have been under-reporting in the previous year. The catchment study in 2021 established strong confidence in Sonoma monitor data used to correct erratic Two Eagles readings. The proposed ultra-sonic sensor will provide a third level of reporting at this location to ensure volume accuracy.

2.2 LIFT STATION SCADA METHOD (BACKUP)

This method serves as a check on the flow monitoring devices using a different data set (pump station flow meter records). This method assumes the same per-capita flow rate (200 L/capita/day) as the monitor method for the catchments that are not measured by meters. A historical summary of the lift station SCADA method is provided in **Table 6**.

Table 6: Historical Lift Station SCADA (Backup) Percentages

	2020	2019	2018	2017	2016	2015
DoP	7.43%	6.6%	7.3%	9.9%	7.70%	7.7%
CWK	70.22%	72.3%	71.4%	70.6%	74.95%	73.7%
WFN	22.35%	21.1%	21.3%	19.5%	17.32%	18.6%
WWTP	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%

2.3 WWTP RESULTS FOR 2020

The 2020 flow splitting results between the flow monitoring and lift station SCADA methods are shown in **Table 7** below. It is recommended to adopt the average value from the two methods given the small difference between the two methods.

Table 7: WWTP Flow Splitting Results for 2020

JURISDICTION	CALCULATION METHOD		
	Flow Monitor	Lift Station SCADA	Average
District of Peachland	7.43%	7.43%	7.43%
City of West Kelowna	67.96%	70.22%	69.05%
Westbank First Nation	24.61%	22.35%	23.52%
Wastewater Treatment Plant	100.00%	100.00%	100.00%

2.4 REGIONAL TRUNK APPORTIONMENT

Table 8 provides the regional trunk apportionment between CWK and WFN, based on the adopted values from **Table 7**. **Table 8** also includes historical data from previous years.

Table 8: Regional Trunk Apportionment

	2020	2019	2018	2017	2016	2015
City of West Kelowna	73.4%	77.3%	78.2%	78.8%	82.1%	79.4%
Westbank First Nation	26.6%	22.7%	21.8%	21.2%	17.9%	20.6%

2.5 DATA ERRORS IN SCADA

This section describes the errors encountered with the lift station and treatment plant SCADA data and the methods of reconciliation. Details for errors pertaining to the flow monitoring devices are explained in section 3 of this report.

The most prevalent error found in the SCADA data was a flow meter counter not resetting at midnight. These errors were easily seen when graphing the quarterly data and were rectified by subtracting the flow volumes of the previous day.

2.5.1 WASTEWATER TREATMENT PLANT ((WWTP)

No issues during any quarter

2.5.2 PEACHLAND MAIN LIFT STATION

Q1 Meter did not reset March 9th. Subtracted value from previous day to correct.

Q2 Meter did not reset May 26 & 29, June 23, 26 & 27. Subtracted value from previous day to correct.

Q3 Meter did not reset August 14th. Subtracted value from previous day to correct.

Q4 Meter did not reset November 18th. Subtracted value from previous day to correct.

2.5.3 EAST TRUNK LIFT STATION (REGIONAL)

Q1 Meter did not reset March 9th. Subtracted value from previous day to correct.

Q2 Meter did not reset May 29th. Subtracted value from previous day to correct.

Q3 No issues

Q4 No issues

2.5.4 DOSING CHAMBER (WFN IR10)

Q1 Meter did not reset March 9th. Subtracted value from previous day to correct.

Missing data March 12-18. Used rolling average of previous 7 days to fill gap.

Q2 Meter did not reset May 29th. Subtracted value from previous day to correct.

Missing data May 11-29. Used rolling average to previous 7 days to fill gap.

Q3 No issues

Q4 Near-zero readings October 16 to 22. Used a rolling average of previous 7 days to fill gap.

2.5.5 CASA LOMA LIFT STATION (REGIONAL)

No issues during any quarter

3.0 FLOW MONITORING DEVICES

The locations of the flow monitoring devices are shown on **Figure 1**, with the exception of the Glenrosa monitor.

All of the devices have had numerous battery and signal issues since the inception of the program in 2011, however increased maintenance and data collection by plant staff has improved data quality.

3.1 GLENROSA MONITOR

The Glenrosa flow monitor device is located along Gellatly Road, just north of the main line into the wastewater treatment plant. This monitor is not used in the calculation for the flow splitting process, but rather serves as a growth indicator for the Glenrosa catchment. Data from this device was used as part of another report for the District, entitled "Inflow and Infiltration – Phase 1" (April 2016).

3.2 CARRINGTON MONITOR

The Carrington flow monitor is located along Carrington Road, approximately two hundred (200) meters east of the Gellatly Road intersection. The monitor is perfectly situated at the catchment outlet and records flows from only WFN sewer customers.

Trend data for the Carrington flow monitor is shown graphically in **Appendix A**. As the graph in the appendix shows, there is a linear relationship between the Carrington monitor and the Louie Drive monitor, located upstream. The ratio between the two monitors has been used to correct data during times of poor data (dead battery, debris covering the monitor, etc.).

3.3 LOUIE DRIVE MONITOR

The Louie Drive monitor is located a few hundred meters upstream of the Carrington flow monitor. With the exception of a few days of no data (dead battery), the monitor has continuously trended in a smooth cyclical pattern, with peaks in the summer and dips in the fall and winter. The trend graph for the station is included as part of **Appendix A**.

3.4 TWO EAGLES MONITOR

The Two Eagles flow monitoring device is located near the Tuscany Villa development along Boucherie Road, where it meets Sonoma Pines Road. The monitor only records flow from WFN sewer customers.

The monitor is difficult to access and maintain and generated erratic data throughout the year. The expected daily volume, on average, based on upstream unit counts and area is 900 cubic meters per day. Readings varied from zero to over 1,400 cubic meters per day.

The trend data with the Sonoma monitor was used to adjust the erroneous data. The trend data for this device is provided in **Appendix B**.

3.5 SONOMA PINES (PREVIOUSLY ELK ROAD) MONITOR

The Sonoma monitor is located approximately 400 meters upstream of the Two Eagles monitor. Since its installation in 2017, the monitor has read higher than the Two Eagles site but has trended well with the other monitor. A recent calibration and cleaning of the device in November 2019 appears to have corrected the overly high reading to a value more in line with the Two Eagles monitor. A graph of the daily flow volume is shown in **Appendix B**, along with the Two Eagles monitor.

The 2020 data stream from Sonoma Pines showed little if any erroneous data and served as the basis to correct the Two Eagles flow values where necessary. The subcatchment between the Two Eagles and Sonoma monitors consists of approximately 222 residential units. Based on the unit types are area, the average difference between the two monitors is estimated at 200 cubic meters per day.

3.6 EAST BOUNDARY MONITOR

The East Boundary flow monitor is located near the intersection of Red Cloud Way and Boucherie Road. The monitor has trended well with the Boucherie monitor. The 2020 trend is provided graphically in **Appendix C**.

Both the East Boundary and Boucherie monitors experience occasional data spikes, which could be a result of peak flows from the upstream forcemain connected to the east Boundary lift station.

Based on the number and type of units between the Boucherie and East Boundary monitors, the expected daily volume difference is approximately 30 cubic meters.

The East Boundary monitor is used to correct data gaps in the Boucherie monitor (zero readings due to dead battery or odd spikes, where the Boucherie data reads lower than the upstream lift station) using the typical trend difference.

3.7 BOUCHERIE EAST BOUNDARY ROAD MONITOR

The Boucherie flow monitor trends well with the East Boundary monitor and lift station. There are occasional data spikes where the Boucherie monitor reads lower than the lift station volume, which is not possible. In these instances, the trend with the Eat Boundary monitor is used to adjust the Boucherie readings to a reasonable estimate where the spike appeared.

A review of the units and area between the Boucherie/East Boundary monitors and the East Boundary lift station was undertaken. Based on the number and types of units between the monitor pair and the lift station, the expected daily volume difference is estimated at 800 cubic meters.

The trend data for the East Boundary lift station, East Boundary monitor and the Boucherie flow monitor is included in **Appendix C**.

4.0 RECOMMENDATIONS

The Regional District is currently investigating the procurement and use of additional flow monitoring devices, to be placed at the Two Eagles and Boucherie sites. The new monitors will be ultra-sonic and may reduce maintenance call-outs for in-stream clogs that sometimes occur with the current monitoring devices.

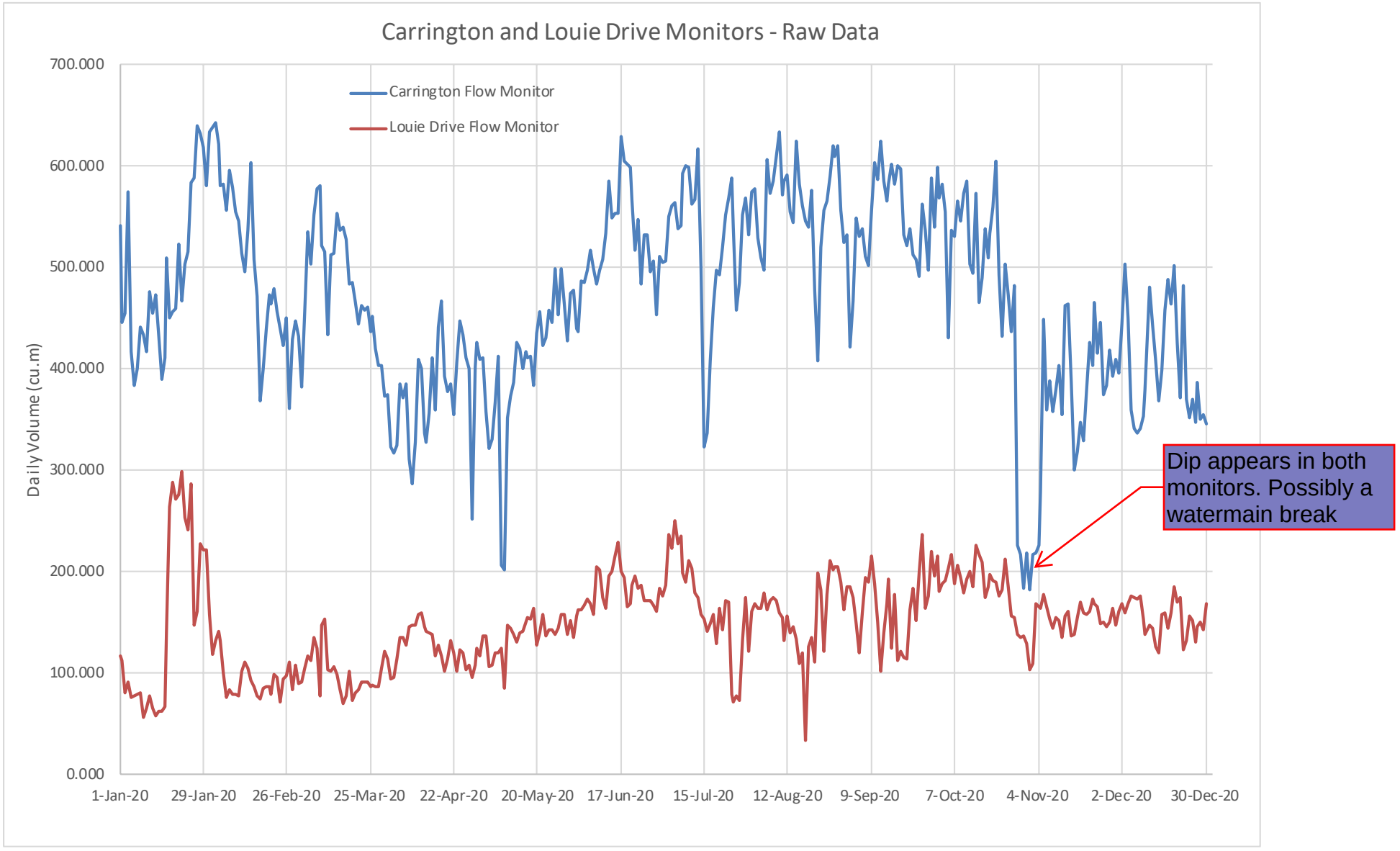
The flowing recommendations are suggested to maintain or improve current levels of service:

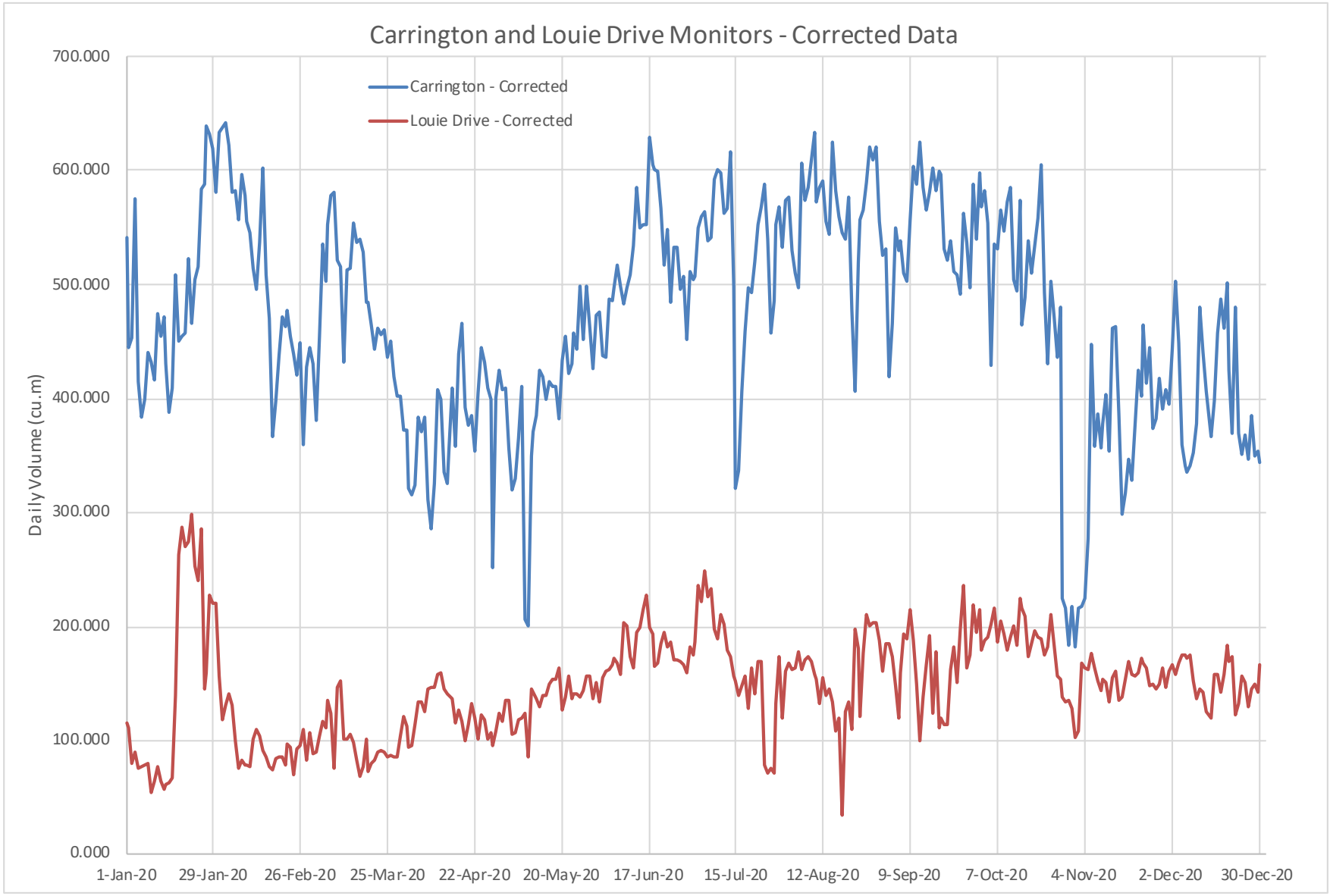
- Provide data collection at no greater than one month intervals to catch monitor issues quickly.
- Frequently monitor Two Eagles monitoring device for clogs and battery life
- Consider relocating Two Eagles monitor if new ultra-sonic sensor also records erratic flow
- Continue to perform the lift station back-up method to verify monitoring results.

APPENDIX A:

FLOW MONITOR TREND DATA

CARRINGTON AND LOUIE DRIVE

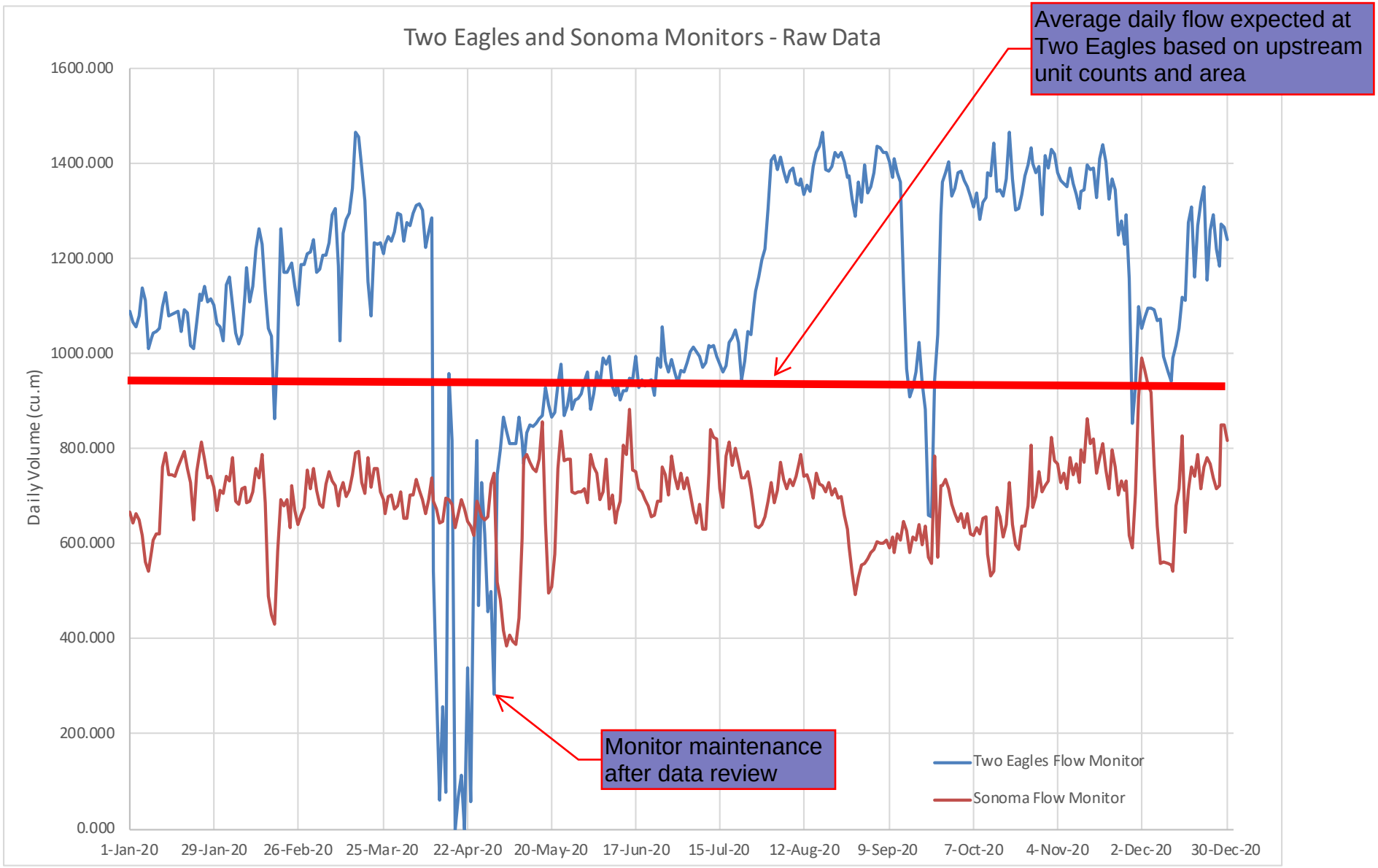

Carrington and Louie Drive Monitors - Raw Data
Carrington Flow Monitor
Louie Drive Flow Monitor
Daily Volume (cu.m)
700.000
600.000
500.000
400.000
300.000
200.000
100.000
0.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20
Dip appears in both monitors. Possibly a watermain break

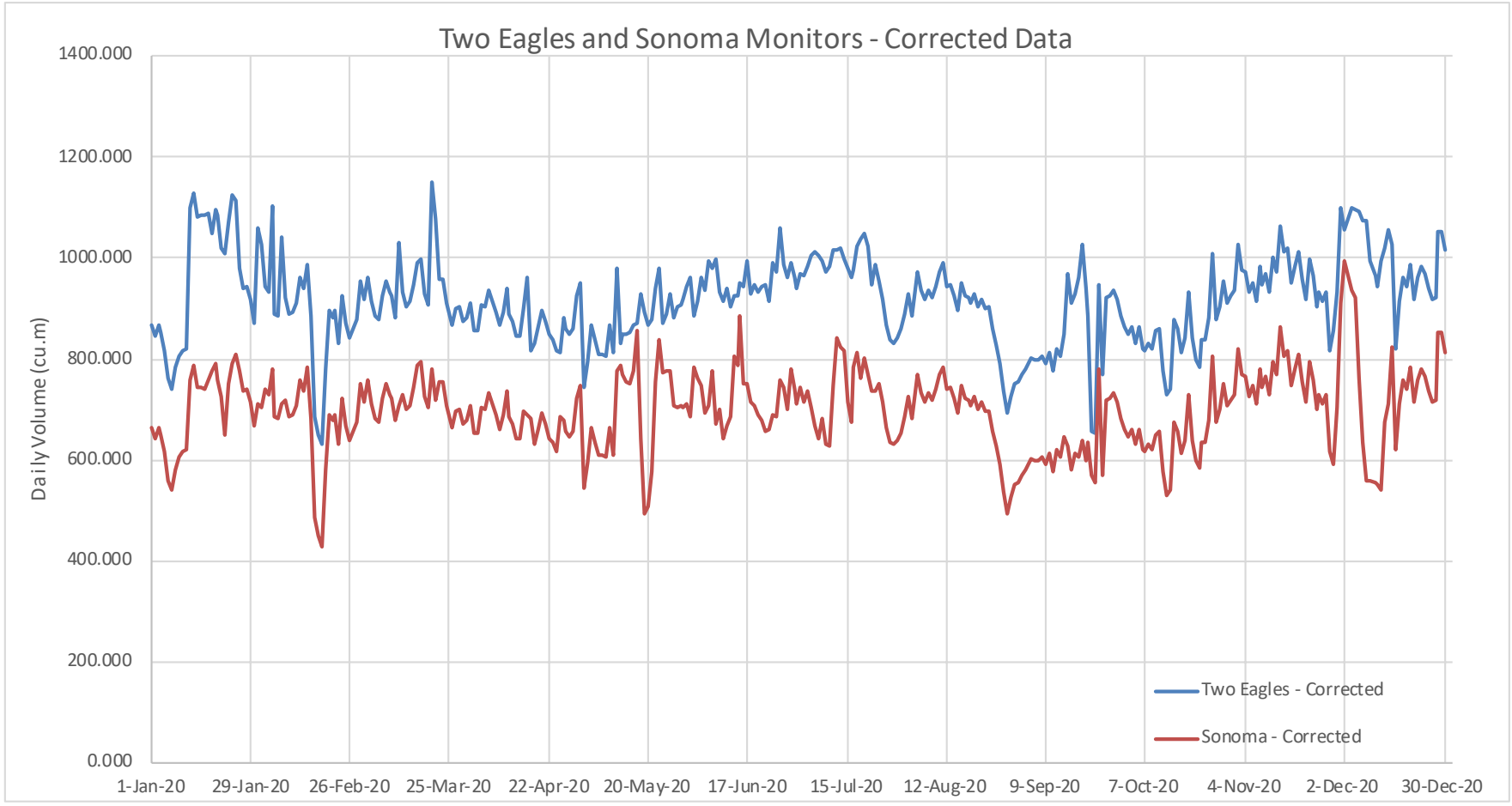

Carrington and Louie Drive Monitors - Corrected Data
Carrington - Corrected
Louie Drive - Corrected
Daily Volume (cu.m)
700.000
600.000
500.000
400.000
300.000
200.000
100.000
0.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20

APPENDIX B:

FLOW MONITOR TREND DATA

TWO EAGLES AND SONOMA PINES

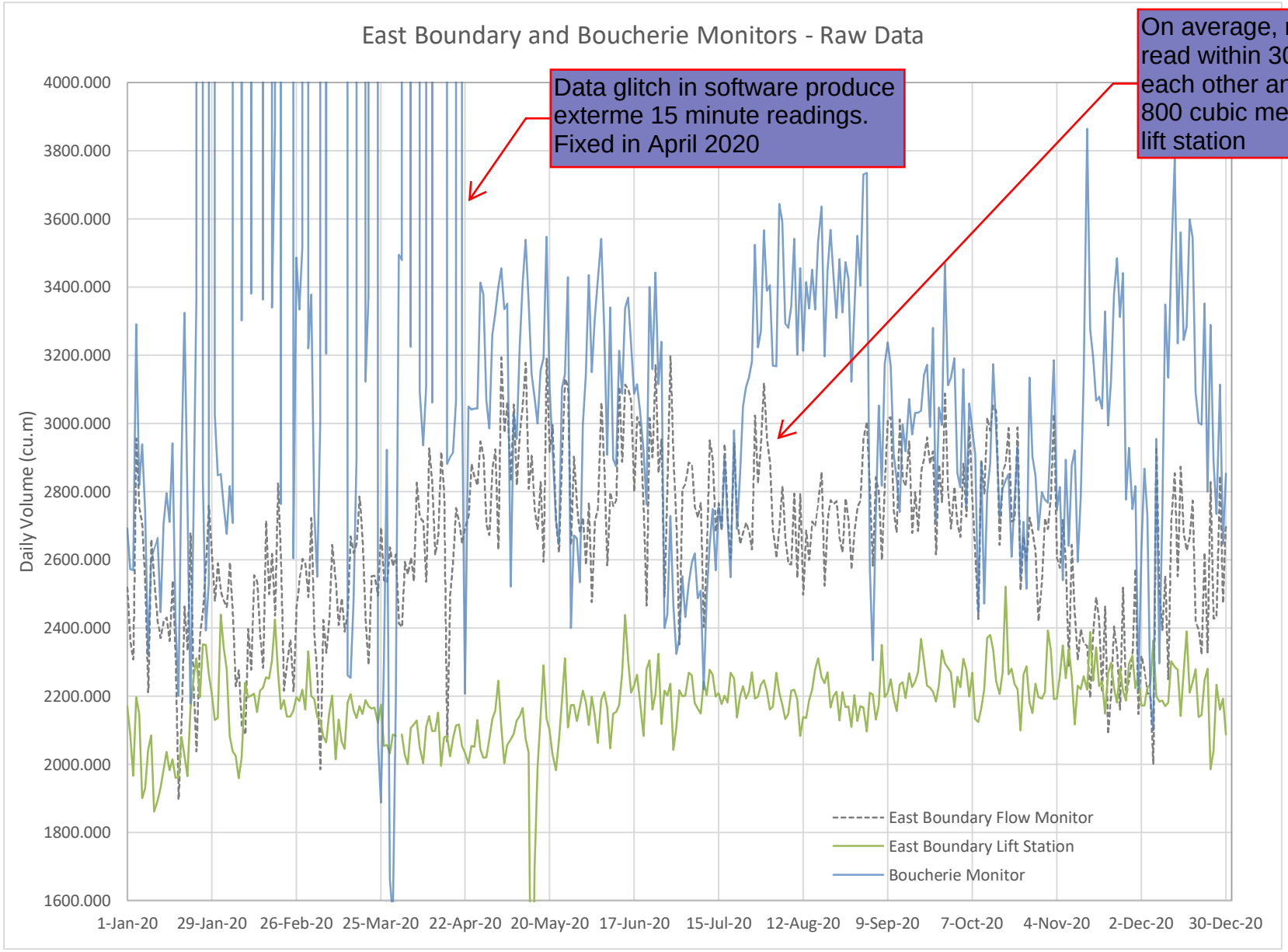

Two Eagles and Sonoma Monitors - Raw Data
Average daily flow expected at Two Eagles based on upstream unit counts and area
Monitor maintenance after data review
Daily Volume (cu.m)
1600.000
1400.000
1200.000
1000.000
800.000
600.000
400.000
200.000
0.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20
Two Eagles Flow Monitor
Sonoma Flow Monitor

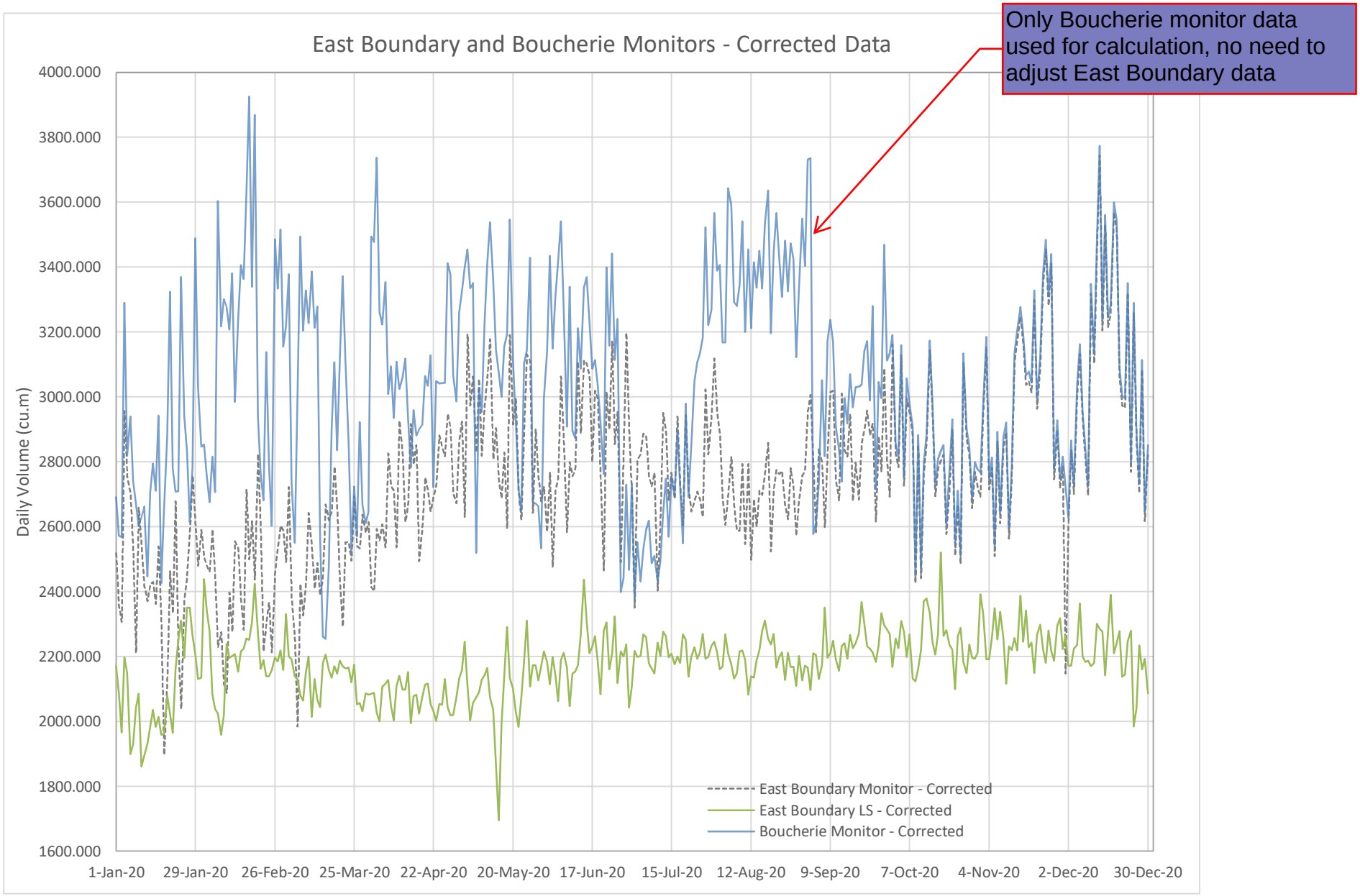

Two Eagles and Sonoma Monitors - Corrected Data
Daily Volume (cu.m)
1400.000
1200.000
1000.000
800.000
600.000
400.000
200.000
0.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20
Two Eagles - Corrected
Sonoma - Corrected

APPENDIX C:

FLOW MONITOR TREND DATA

BOUCHERIE AND EAST BOUNDARY


East Boundary and Boucherie Monitors - Raw Data
Data glitch in software produce exterme 15 minute readings. Fixed in April 2020
On average, monitors should read within 30 cubic meters of each other and approximately 800 cubic meters higher than lift station
Daily Volume (cu.m)
4000.000
3800.000
3600.000
3400.000
3200.000
3000.000
2800.000
2600.000
2400.000
2200.000
2000.000
1800.000
1600.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20
East Boundary Flow Monitor
East Boundary Lift Station
Boucherie Monitor


East Boundary and Boucherie Monitors - Corrected Data
Only Boucherie monitor data used for calculation, no need to adjust East Boundary data
Daily Volume (cu.m)
4000.000
3800.000
3600.000
3400.000
3200.000
3000.000
2800.000
2600.000
2400.000
2200.000
2000.000
1800.000
1600.000
1-Jan-20
29-Jan-20
26-Feb-20
25-Mar-20
22-Apr-20
20-May-20
17-Jun-20
15-Jul-20
12-Aug-20
9-Sep-20
7-Oct-20
4-Nov-20
2-Dec-20
30-Dec-20
East Boundary Monitor - Corrected
East Boundary LS - Corrected
Boucherie Monitor - Corrected