Mabel Lake Sewer
2020 Annual Report

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ACRONYMS

CALA	Canadian Association for Laboratory Accreditation Inc.
CARO	Caro Analytical Laboratories
CSR	Contaminated Sites Regulation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EMS	Environmental Monitoring System
EOCP	Environmental Operators Certificate Program
ERP	Emergency Response Plan
Golder	Golder Associates
OC	Operational Certificate
masl	meters above sea level
mbg	meters below ground
mbtc	meters below top of casing
MLW	Mabel Lake Water Utility
MLS	Mabel Lake Sewer
MOE	Ministry of Environment
MW	Monitoring well
MWWT-II	Municipal Wastewater Treatment II
QA/QC	Quality Assurance/Quality Control
RDNO	Regional District of North Okanagan
SCADA	Supervisory Control and Data Acquisition
SDWQG	Source Drinking Water Quality Guidelines
SRWs	Stat Right of Ways
STEP	Septic Tank Effluent Pump
SWWS	Small Wastewater System
WWC-I	Waste Water Collection I

1.0 INTRODUCTION

The Mabel Lake Sewer (MLS) is managed and operated by the Regional District of North Okanagan (RDNO) and services a portion of the community of Mabel Lake/Kingfisher located 35 km east of Enderby (Appendix A). The Ministry of Environment (MOE) has set criteria for the operations, maintenance and monitoring of the MLS within the Operational Certificate (OC) 14490, issued on January 23, 2012 (Appendix B).

The MLS is a "Septic Tank Effluent Pump" (STEP) system with each user collecting sewage in an individual privately owned septic tank, and the effluent from these tanks is collected in a community sewer main and pumped to a community effluent field.

This annual report is completed to fulfil the reporting requirements of OC 14490. It includes a review of a number of conditions within OC 14490 as follows:

- Contingency Plan (Section 6.1),
- Operation and Maintenance Plan (Section 6.2),
- Facility Classification (Section 6.3), and
- An annual report summarizing the previous year's monitoring program (this document).

This report also provides background information on MLS, details on the sampling and monitoring program including methodology, observations and results.

This annual report and data analysis was completed by RDNO staff, as was the Emergency Response Plan (ERP) which includes the Contingency Plan.

2.0 BACKGROUND

The MLS is a function of the RDNO located in the community of Kingfisher/Mabel Lake (Appendix A). RDNO Utilities staff is responsible for the management and operations of this service and contracts an operator to complete day to day operational tasks. The operator is also required to respond 24/7 to emergencies and have a backup available if they are not available to complete the daily operations and respond to emergencies.

Currently the service area of MLS includes most of the community of Kingfisher (Appendix C), however only a portion of the those in the service area are connected as shown in the Mabel Lake Site Plan (Appendix D). MLS future plans do include connection of the entire service area however there has not been sufficient community support to do this yet.

The MLS system currently services 160 single family dwelling units, 68 multi-family dwelling units, and 2 commercial units which include a golf clubhouse with restaurant, and a campground resort with 90 camp sites, 6 cabins and a store. The majority of connections are seasonal, with approximately 10 residential connections currently considered permanent or year round. The seasonal units are generally only occupied through the summer months with peak flows usually occurring over the July or August long weekends.

A site plan for the MLS is provided in Appendix D and a brief description of the system is as follows:

- Each user has an individual private septic tank for effluent collection.
- The individual septic tanks are connected via a pipe to the community sewer collection main fronting their property, which is designed to collect the liquid effluent only. Solids collect in the septic tanks and are periodically removed by pumper truck, as arranged by each user.
- The liquid effluent is directed via gravity in the sewer collection main to a sanitary lift station located on Mabel Lake Place at the southwest area of the community.
- The lift station pumps the effluent via a force main to the effluent collection tank located at the northwest corner or upgradient end of the airstrip.
- The effluent is distributed to the community effluent fields on both sides of the airstrip and on taxiways to the east of the airstrip.
- There are three active zones in the effluent field with one reserve area set aside for a future effluent field zone for future expansion due to development.
- The effluent is directed to two of the three active zones at any time with one at rest, and the zones are switched and rotated in the spring, mid-summer, and fall.

3.0 METHODS

The following sections provide an overview of the methods used for the MLS groundwater and effluent flow monitoring program.

3.1 GROUNDWATER MONITORING

As per the requirements of OC 14990, three groundwater monitoring wells were installed to monitor the effluent fields in the fall of 2011 and labelled as MW11-01, 02 and 03 (Attachment E). These wells have been monitored twice a year since 2012, typically in the spring and the fall. A fourth well was installed May 12, 2016 (MW16-01) after monitoring of the first three wells

demonstrated the groundwater flow direction was more to the south and not to the west as preliminary studies first predicted. This well is located directly downgradient of the effluent field and has been sampled with the same frequency as the other three wells since installation.

Groundwater samples are collected to monitor the efficiency of the effluent treatment and verify the system is not causing negative environmental impacts. Collection of all samples for routine groundwater monitoring is completed by a RDNO Technician using groundwater sampling techniques that followed provincial standards (MoE, 2013) and meet the intent of the OC.

In 2020, groundwater samples from the four groundwater wells were collected on May 27 and 28, and September 30, and October 1. The following summarizes the methods used to sample the monitoring wells:

1. Static groundwater levels are taken at all monitoring wells using a water-level indicator before purging is completed.

2. Each well is purged and sampled using a bladder pump with low flow to minimize disturbance and sample turbidity. Depth to water measurements were recorded during the purging process to ensure water was being drawn from the aquifer rather than the water column. A dedicated or one-time usage low density polyethylene (LDPE) tubing is used during sampling to avoid cross contamination.

3. While the well is being purged, field parameters are monitored and recorded until consistent. Field parameters include Electrical Conductivity (EC), Dissolved Oxygen, pH, and Temperature.

4. Once field parameters are stabilized, groundwater samples are collected in laboratory-supplied sampling bottles and preserved as required. Samples are stored in ice-filled coolers to maintain the temperature below 10°C and samples are submitted to Caro Analytical Laboratories (Caro) in Kelowna, B.C. for analysis within the required holding times.

Quality assurance and quality control (QA/QC) field measures implemented during sampling include: using site-specific field forms, wearing nitrile gloves, and using either sampling supplies that are dedicated to the well, single use items or cleaning the equipment between wells with Liquinox and rinsing with de-ionized water thereafter. Properly completed chain-of-custody forms accompanied each sample to the lab. In addition to field QA/QC, an internal laboratory QA/QC program is followed which includes analysis of reference samples, blanks, matrix spikes and laboratory duplicates. Caro performed analysis for the groundwater samples submitted for testing

and they have achieved certification by the Canadian Association for Laboratory Accreditation Inc. (CALA) for the analyses conducted.

3.2 EFFLUENT FLOW MONITORING

To monitor the effluent flow to the infiltration fields as required in the Operating Permit, there is a volumetric magnetic flow meter (magmeter) located at the effluent collection tank. Historically the magmeter was manually read by the Operator approximately twice per month at peak times (May 15 to September 15) and once per month at non-peak times (September 16 to May 14).

The magmeter was connected to the Supervisory Control and Data Acquisition (SCADA) program in November 2018 to conduct continuous flow monitoring with funding provided by the Electoral Area "F" Community Works Fund. This has generally provided consistent and continuous data with some exceptions due to power outages or other operational issues. In 2020, there are six days of data missing from the SCADA data due to computer issues which have been rectified.

4.0 APPLICABLE WATER QUALITY STANDARDS

The drinking water wells located in the Community of Mabel Lake and documented in the Ministry of Environment BC Water Atlas[1] as of January 2022 are provided in Appendix F. All the drinking water wells are located due west or northwest of the MLS effluent fields. The closest drinking water well is approximately 400 m west of the community effluent fields. However, these wells are either at a side gradient or upgradient to the effluent fields (see Section 5.2).

Mabel Lake is located approximately 400 m to the south of the end of zone 2 of the effluent fields. The lake supports aquatic life and there are also lake intakes for the cottages on the north shore. The travel path of the effluent undergoes significant filtration through on average 22 m of sand and gravel before reaching the groundwater table as well as undergoing significant dilution in its flow path to the lake (Golder, 2012 and 2016). The monitoring wells are situated to assess the groundwater flow direction and assess if the effluent is impacting the groundwater before potentially reaching either a drinking water well or the lake or intakes within the lake. Section 5 provides more details on the information provided by each of the monitoring wells.

As there are drinking water wells in the area and the lake is 400 m to the south, the BC Contaminated Sites Regulations (CSR) (drinking water and aquatic life criteria) and the BC Source Drinking Water Quality Guidelines (SDWQG) are used to compare with the groundwater monitoring results to assist in management of the utility.

[1] Available at: www.env.gov.bc.ca/wsd/data_searches/wrbc/index.html

5.0 RESULTS

The following sections provide the results of the monitoring program and an interpretation of the monitoring data collected in 2020 and in previous years.

5.1 GROUNDWATER ELEVATION AND FLOW DIRECTION

The static water level measurements completed in the field confirm that the groundwater flow direction is to the south (Appendix G). Based on the groundwater flow direction to the south, the following provides an impact assessment for each of the monitoring wells based on their location:

- MW11-01 is situated between the effluent fields and the known local drinking water wells and is considered to be at a side gradient to the effluent fields.
- MW11-02 is situated upgradient of the effluent fields providing a background sample.
- MW11-03 is situated between the effluent fields and the lake when zone 3 is in operation.
- MW16-01 is situated between the effluent fields and the lake when zone 1 and/or 2 is in operation.

The groundwater flow elevations measured since 2011 has had very little variation (Figure 3) which indicates that the flow direction is consistently flowing to the south without significant seasonal variation as identified in Appendix G.

5.2 ENVIRONMENTAL MONITORING SYSTEM

The four monitoring wells (MW11-01, MW11-02, MW11-03, and 16-01) have been provided with Environmental Monitoring System (EMS) numbers from the MOE for input into the EMS database (Table 3). An EMS number was requested in 2020 for MW16-01 from MOE and was received July 16, 2020. The EMS number for MW16-01 is E320791 and Table 2 provides the spatial and elevation information for each of the monitoring wells.

5.3 GROUNDWATER SAMPLING RESULTS AND ANALYSIS

OC 14490 requires biannual sampling of the groundwater monitoring wells to be analyzed for:

- Total Phosphorous, ortho phosphorous and total dissolved phosphorous, mg/L,
- total nitrogen, nitrate nitrogen and ammonia nitrogen, mg/L,
- pH and conductivity,
- sodium and chloride, mg/L, and
- E.coli, MPN or CFU/100 ml.

Ortho Phosphorous has been included in all analysis since 2012 (Figure 5). As of 2018, Orthophosphate/dissolved reactive phosphorous is being reported by the lab as Phosphate (as P).

OC 14490 requires graphical trend analysis of the monitoring data and analysis of the results. A summary of the 2020 laboratory results and long term trend observations is provided in Table 1 with graphical trends provided in Figures 4 to 12 and the laboratory reports provided in Appendix H.

Table 1: Summary of Groundwater Sampling Results

Figure – Parameter (guideline)	2020 Observation	Long Term Trend Observations from 2011
Figure 4 – Total Phosphorous (SDWQG AO of 0.01)	Slight fluctuation in MW11-02. All other wells were under the SDWQG AO of 0.01 mg/L. This guideline is not a health concern.	W11-02 shows a consistently higher concentration trend compared to other three wells. The higher trend is in the background well and do not show similar trending in the downstream monitoring wells, this is likely a natural source or from a source upstream of the site. MW11-01 showed an increase in concentration fall 2015 with a notable spike in the spring 2016 but concentrations in this well returned to a low level in fall 2016. Most wells slightly exceed the SDWQG AO of 0.01 for phosphorous but this guideline is not a health concern.
Figure 5 – Phosphate (as P) (no applicable guideline)	All wells were non-detect in 2020.	Long term trends demonstrate a stable non-detect trend with a spike seen in all wells in the fall 2016 with measurable concentrations ranging from 0.006 to 0.016 mg/L. Concentrations returned to non-detect in spring 2017.

Figure – Parameter (guideline)	2020 Observation	Long Term Trend Observations from 2011
Figure 6 – Total Dissolved Phosphorous (no applicable guideline)	All wells within their historical range.	Long term trends demonstrate a stable very low concentration trend with a spike of 0.5 mg/L seen in spring 2016 in MW11-01. Concentrations returned to normal in spring 2017.
Figure 7 – Total Nitrogen (no applicable guideline)	Slight decrease in MW11-03 compared to historical data. MW11-02 was normal compared to historical data.	Long term trends demonstrate a stable trend with a non-detect in MW11-02 in 2016. Concentrations at this well returned to within the normal trend range of 2.3 to 3.3 mg/L in 2017. MW11-02 shows slightly higher concentrations compared to the other three wells. These higher concentrations are in the background well and do not show similar trending in the downstream monitoring wells, this is likely a natural source or from a source upstream of the site.
Figure 8 – Nitrate (as N) (400 mg/L aquatic life and 10 mg/L for drinking water)	All wells fluctuate nominally but are within their historic range.	Long term trends demonstrate a stable trend in all wells with some fluctuation with higher levels seen in MW16-01 but well below standards for both aquatic life and drinking water. Note that there are no spring 2014 nitrate samples analyzed at any of the wells due to a lab error.
Figure 9 – Ammonia, Total (as N) (no applicable guideline)	All wells fluctuate nominally but are within their historic range.	Long term trends demonstrate a stable trend in all wells with slight fluctuation with MW11-02 showing elevated concentrations compared to the other three wells. These higher concentrations are in the background well and do not show similar trending in the downstream monitoring wells, this is likely a natural source or from a source upstream of the site.

Figure – Parameter (guideline)	2020 Observation	Long Term Trend Observations from 2011
Figure 10 – Conductivity (EC) (no applicable guideline)	All wells fluctuate nominally but are within their historic range.	All wells show little change compared to historical data. MW11-02 shows elevated concentrations compared to the other three wells. These higher concentrations are in the background well and do not show similar trending in the downstream monitoring wells, this is likely a natural source or from a source upstream of the site.
Figure 11 – Sodium, dissolved (200 mg/L for drinking water)	Slight increase in MW16-01 and MW11-03 in 2020. All other wells are normal compared to historical data.	Long term trends demonstrate a stable trend in all wells with slight fluctuation but in fall 2013 all wells showed a decrease in concentrations followed by a sharp increase in spring 2014. In fall 2014, all sodium concentrations returned to normal in all wells.
Figure 12 – Chloride (1500 mg/L aquatic life and 250 mg/L for drinking water)	An increase in MW11-01. MW11-03 also showing elevated concentrations since fall 2019 compared to previous years.	Long term trends demonstrate a stable trend in all wells with slight fluctuation with slight decreasing trend in MW11-03 since 2011.

Overall, all parameters have been below CSR guidelines for drinking water and aquatic life since the sampling program began. The only parameter to exceed any of the SDWQG guidelines is the background well (MW11-02) for phosphorous, while none of the monitoring wells downgradient or at a side gradient have exceeded parameters.

MW11-02 exceeded the SDWQG AO of 0.01 for phosphorous but this guideline is not a health concern as it is an aesthetic objective guideline for drinking water. As none of the monitoring wells are used as drinking water wells and there are no drinking water wells downgradient, this elevated parameter in MW11-02 is not a concern. In addition, the background well (MW11-02) usually historically had the highest concentrations of Total Phosphorous indicating that the Total Phosphorous concentrations are not caused by the MLS effluent field.

Parameters of particular concern to health and aquatic life are Nitrate (Figure 8), E. coli, sodium and Chloride (Figure 12). Trend results for all wells have been well below guidelines with no indication that any of the parameters are increasing. These parameters will continue to be closely monitored to detect if any changes occur.

It is interesting to note that most of the trending results demonstrate that the background well (MW11-02) has different water chemistry than the downgradient wells. For example, the Ammonia, Total Nitrogen, Total Phosphorus and conductivity within MW11-02 are elevated compared to downgradient wells with lower concentrations of Nitrate and chloride. The Ammonia was elevated compared to the other wells at 2.48 mg/L (spring) and 2.22 mg/L (fall) but is well below the CSR guideline of 18.5 mg/L for pH between < 7.0 and <7.5 for Aquatic Life (Figure 9). The results of the ammonia monitoring since 2011 do not show a discernible increasing trend in ammonia in this well, however, it is a background well and represents upgradient of the MLS effluent field. It is possible that MW11-02 is being influenced by Lusk Lake or from another unknown local source such as an upgradient effluent field or other source. Trending will continue to be monitored and if the downgradient monitoring wells indicate an impact from the MLS effluent, the installation of an alternative background well will be considered.

5.4 EFFLUENT COLLECTION FLOW RATE

OC 14490 authorizes a maximum discharge volume of 250 m^3/day averaged on a monthly basis. Upon reaching this discharge volume, an Environmental Impact Assessment (EIA) must be undertaken to determine if secondary treatment is required. Section 2.17 of the OC (Appendix B) also indicates that 10% of flow may be year-round in nature (i.e. 25 m^3/day), which will be designated as “winter operation for permanent residents.”

The magmeter was connected to the SCADA program in late fall 2018 and in 2020 reliable SCADA data was available to provide more accurate, real time daily effluent flows. Six days of data are missing from the 2020 SCADA data and for this missing data the daily average for the month was inputted to provide a more valid monthly total and average. Figure 1 provides the Daily Flow Data for 2020 and Figure 2 provides the historical flow data since 2009. The results show that the maximum peak flows in 2020 generally occurred the middle of July to the last week in August with a maximum flow of 100 m^3/day recorded. The winter average (November 1 to April 30 as per the OC) for 2020 was 12 m^3/day. These maximums are well below the permitted 250 m^3/day for summer, and 25 m^3/day for winter.

Figure 2 provides the Historical Trend Data with averaged daily flows from March 2009 to December 2020. In 2020, the SCADA data provided more reliable daily effluent flow information which was used in this figure. The trend data indicates that generally July and August are peak use months with the highest recorded historically monthly averaged flow of 117 m^3/day observed

in August of 2009. The flow data also indicates that the effluent flow has been fairly stable since 2009 with no discernable increasing trend.

It should be noted that a pump issue occurred from April 21 to June 17, 2020 and did not trigger an alarm. This resulted in effluent flows being diverted to the overflow chamber instead of being pumped to the septic fields. Once this issue was discovered the following measures were put in place to prevent it from occurring again:

- The failed pump was repaired,
- additional programing and alarms were put in place to provide better back up with the second pump,
- weekly physical checks of the lift station and pumps were implemented and documented, and
- weekly physical testing of the overflow float, which triggers an alarm and the second pump to turn on, were implemented.

This incident means that very little effluent flow was recorded through the magmeter during this time. Monthly total and daily average effluent flows for April, May, and June are not accurate volumes of effluent flow (Figure 1).

6.0 OTHER OC 14490 REQUIREMENTS

6.1 EMERGENCY RESPONSE PLAN AND CONTINGENCY PLAN

Contingency Planning for the MLS was completed as part of the development of the ERP for the MLS in 2012 and is distributed to the relevant parties.

The ERP was completed using the format and template developed by RDNO Utility Staff for all RDNO Utility Functions. The MLS ERP is considered a “living document” and undergoes a review process as outlined in the ERP, which includes a review of the main document at minimum every 5 years or with significant changes to the utility and an annual review of the appendices. The appendices contain information that can change frequently such as contact lists and utility operational information. This document underwent a comprehensive review in 2020 and this updated ERP will be provided to the relevant parties.

Due to the relatively low flows and the low technical nature of the system, the main risk identified for the MLS is a long-term power failure where the loss of power will halt pumping of effluent to the effluent fields. Short term power failures of an hour or less occur approximately 2 or 3 times per year.

For short term overflows, there is an overflow infiltration basin installed next to the lift station where short term flows are directed via gravity when the pump is not working. The infiltration basin avoids effluent surfacing and direct drainage to Mabel Lake, thereby reducing human exposure and protecting the lake environment. The lift station also has a high level float that is connected to SCADA and the alarm system. If the lift station level increases to the overflow, and if there is power, the SCADA alarm system will notify the operator.

However, effluent infiltration at this location may not provide adequate effluent treatment in the event of long term power outage. To accommodate for the potential of a long-term power outage, a manual transfer switch has been installed at the lift station site, so that a generator can be connected and provide power to the lift station for continued pumping to the effluent fields.

The 2022 capital works plan for MLS includes the installation of a generator at the lift station to allow the lift station to continue pumping during a power outage. Funding was provided through Community Works Funding.

In extreme cases where surfacing does occur or an unforeseen emergency occurs, customers would be notified to minimize use of facilities draining to the effluent facility and pumper trucks can be employed to drain the lift station as required.

It should be noted that RDNO is the owner and operator of the Mabel Lake Water Utility (MLW) which serves all MLS customers. MLW has two balancing reservoirs and can provide water via gravity to residents during a short term power outage. However, as there is no backup power at the pump station, the reservoirs will run out of water during longer power outages. This will significantly reduce the amount of effluent being generated during a long term power outage. The RDNO can also turn off the water to reduce flows to the lift station if required until remedial actions can be completed.

As required in the OC (MOE PE#14490), an Environmental Impact Assessment study will be undertaken when effluent flows of 250 m^3/day averaged over a month are reached to assess if secondary treatment is required.

Long term environmental impacts of the effluent fields are being monitored at the four monitoring wells. The water sampling program results in Section 5.3 provides information on the long term impact to the environment and assists in planning.

6.2 OPERATIONS AND MAINTENANCE PLAN

Due to the low technical nature of this system, the operational requirements are generally restricted to ensuring the lift station is operating and system monitoring. The following outlines the regular duties that the system operator undertakes and the time frame they occur:

- The magmeter measuring the volume of sewage effluent being pumped to the effluent collection tank was connected to SCADA in November 2018. Some daily average volumes were available from SCADA for the 2019 report. More consistent readings were available for the 2020 report. Previous to this, manual reading and recording of the magmeter, was completed by the operator who would read the meter at the frequency outlined in OC 14490 at minimum and usually more (i.e. twice per week during peak from May 15th to September 15th and twice per month from September 16th to May 14th). The operator is still taking readings at a minimum of once per month to verify the SCADA readings.
- Manual checks of the lift station pumps are completed weekly during peak summer months and once or twice a month during the winter months. The checks include performing a visual inspection of equipment within the manhole to ensure pumps are working correctly. Periodically the pumps are manually turned on and off and observed if potential issues arise. The sewer system is connected to SCADA which collects and displays data pertaining to lift station operation including pump runs and daily flow information in real time and past trends. A high level alarm at the lift station is programmed through the SCADA system and will alert the operator if it is triggered. If power or communication is lost to the lift station an alarm will be sent to the operator via the SCADA system.
- This effluent treatment zone schedule is followed as outlined in the AECOM Kingfisher Liquid Waste Management Plan Update (AECOM, 2014).
    - May – the operator switches the effluent treatment zones in the effluent field. Zones 1 and 2 are active in the spring.
    - August – the operator switches the effluent treatment zones in the effluent field. Zones 2 and 3 are active in the summer.
    - October – the operator switches effluent treatment zones in the effluent field. Zones 1 and 3 are active in the fall.
- Biannual groundwater sampling is completed by an RDNO technician.

6.3 FACILITY CLASSIFICATION

On September 9, 2019, Mabel Lake Sewer Utility Wastewater System was classified by EOCP as a Small Wastewater System (SWWS) (Appendix I).

The MLS operations is contracted to Aberdeen Electric Ltd. with Warren McKim (EOCP Certification # 1336) as the chief operator, who is currently certified for Waste Water Collection I (WWC-I), and Wastewater Treatment II (MWWT-II).

7.0 WORKS COMPLETED IN 2020

The following are completed works for improvements to the MLS system:

- Surveying of MLS Works for Right of Ways – Right of ways are required to fulfill a Development Works Agreement. This is required for further compliance with OC 14490.
- Odour Control - Repair the existing odor control works at the community septic tank at the north end of the airstrip.

8.0 PLANNED WORKS

8.1 2021 WORK PLANS

The following action items are scheduled for 2021:

- Install Generator at Lift Station – This will allow lift station pumps to continue pumping effluent to the community septic field during power outages.
- Construction of a Storage Shed – There is currently insufficient storage capabilities at Mabel Lake for the utilities' use.
- Odour Control - Construct odour control works at the sewer lift station at Mabel Lake Place, and in the immediate area.
- Statutory Rights of Way (SRWs) – Continue working with land owner to secure SRWs for the effluent fields.

8.2 LONG TERM PLANS

MLS is a small sewer utility that meets provincial requirements and there is capacity within the system for further development in the area for the near future, hence no projects for enhanced treatment or expansion are planned at this time.

9.0 CLOSING

The following summarizes the results of the 2020 monitoring and sampling program and compares the results to the applicable provincial standards and OC 14490 requirements:

- Maximum monthly averaged flows of 80 m^3/day were observed in August of 2020 and is within the OC maximum value of 250 m^3/day averaged on a monthly basis.
- The winter averages for 2020 are 12 m^3/day and are within the permitted 10% year-round flow limit (i.e. 25 m^3/day).
- The groundwater flow direction measured in 2020 was to the south and did not experience any seasonal changes based on groundwater elevations (Figure 3).
- All parameters sampled in the four monitoring wells were within Contaminated Sites Regulations (CSR). Only MW11-02 exceeded the Source Drinking Water Quality Guideline (SDWQG) for Total Phosphorous of 0.01 mg/L in 2020. This is an Aesthetic Objective (AO) guideline though, not a health concern and the wells in this program are not drinking water wells. The background well (MW11-02) has historically had the highest concentrations of Total Phosphorous indicating that the Total Phosphorous concentrations are not caused by the MLS effluent field.

RDNO has made significant strides in fulfilling the RDNO program objectives, meeting Provincial Standards and requirements outlined by MoE, and complying with the conditions of the Operating Certificate at MLS. RDNO will strive for implementation of system improvements within the constraints of the MLS budget and through applications for grant funding.

TABLES

Table 1: Summary of Laboratory Results

	Chloride	Conductivity	Ammonia Nitrogen	Nitrate as N	Total Nitrogen	pH	Total Phosphorous	Phosphate (as P) Orthophosphate/ Dissolved Reactive Phosphorous	Total Dissolved Phosphorous	Sodium	E.coli
CSR AW [1, 2]	**1500.0**		**18.4 – 18.5[3]**	**400.0**							
CSR DW [4]	**250.0**			**10**						**200**	
SDWQG[5]	***250[6]***			***10***			***0.01[6]***				***<10/100 ml: 90th Percentile***
Unit	mg/l	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mpn/100ml
MW11-01 - May 28, 2020	4.22	195	<0.050	1.08	1.15	5.96	0.0049	<0.0050	0.0033	2.55	<1.0
MW11-02 - May 28, 2020	0.26	365	2.48	<0.010	2.48	6.49	**0.159**	<0.0050	0.0029	2.5	<1.0
MW11-03 - May 27, 2020	2.84	140	<0.05	0.599	0.722	7.26	0.0032	<0.005	0.0027	2.08	<1.0
MW16-01 - May 27, 2020	3.19	191	<0.05	1.28	1.33	7.3	0.003	<0.005	0.0024	2.55	<1.0
MW11-01 - Oct 1, 2020	6.27	200	<0.050	0.888	0.888	7.32	0.0066	<0.0050	0.0053	2.38	<1.0
MW11-02 - Oct 1, 2020	0.24	338	2.22	<0.010	2.42	7.69	**0.126**	<0.0050	<0.0050	2.34	<1.0
MW11-03 - Sept 30, 2020	2.54	152	<0.050	0.624	0.736	7.2	0.0084	<0.0050	<0.0050	2.21	<1.0
MW16-01 - Sept 30, 2020	3.7	198	<0.05	1.3	1.44	7.43	<0.0050	<0.0050	<0.0050	2.65	<1.0

Notes:

< value = Indicates parameter not detected above laboratory method detection limit.

As of 2013, lab is reporting Total, Dissolved, and Ortho Phosphates to 0.002 mg/L, 0.002 mg/L, and 0.003 mg/L, respectively, as requested by RDNO. This is to ensure RDNO is in compliance with OC which requires a magnitude of 0.002 mg/L as a detection limit.

As of 2018, lab is reporting Orthophosphate/Dissolve Reactive Phosphate as Phosphate (as P).

1. CSR sch3.2 AW - BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards for Aquatic Life: Freshwater. Aquatic life standards assume minimum 1:10 dilution available. Current as of August 25, 2020. Updated from Schedule 6 to Schedule 3.2 as of 2019.
2. Bold and shaded = Parameter concentration greater than CSR AW standard.
3. Standard varies from 1.31 to 18.5 mg/L and is dependent on pH and temperature, see CSR for details.
4. CSR sch3.2 DW - BC Contaminated Sites Regulation Schedule 3.2 - Generic Numerical Water Standards for Drinking Water - Bold and underlined = Parameter concentration greater than CSR DW standard. Current as of August 25, 2020.
5. SDWQG - Source Drinking Water Quality Guidelines - Bold and italicized = Parameter concentration greater than SDWQG.
6. Aesthetic Objective

Table 2: Monitoring Well Spatial, Elevation and Water Level Information

Well	Latitude[1]	Longitude[1]	Ground Elevation[2] (masl)[3]	Well Depth (mbtc)[4]	Depth to Water Level (mbtc)[4] Spring 2020	Depth to Water Level (mbtc)[4] Fall 2020	Water Level Elevation[5] (masl) Spring 2020	Water Level Elevation[5] (masl) Fall 2020
MW11-01	50° 36' 19.977" N	118° 44' 4.934" W	436.4	32.0	26.36	25.32	409.98	411.02
MW11-02	50° 36' 42.281" N	118° 43' 47.894" W	447.3	24.7	18.47	19.31	429.67	428.83
MW11-03	50° 36' 22.099" N	118° 43' 48.578" W	437.2	30.5	25.97	24.93	412.05	413.09
MW16-01	50° 36' 12.726" N	118° 43' 54.970" W	428.3	28.9	26.48	25.928	401.82	402.37

Notes:

1. Measured in the field with a Trimble handheld GPS measurement.
2. Based on Google earth interpretation.
3. masl = meters above sea level
4. mbtc = meters below top of casing
5. Based on Google earth measurement of MW11-1, a stick up height of 0.8 m and relative elevations from survey results conducted by Golder.

Table 3: Monitoring Well Names and EMS IDs

Groundwater Well Name	Monitoring Location ID
MW11-01	E290109
MW11-02	E290110
MW11-03	E290111
MW16-01	E320791

FIGURES

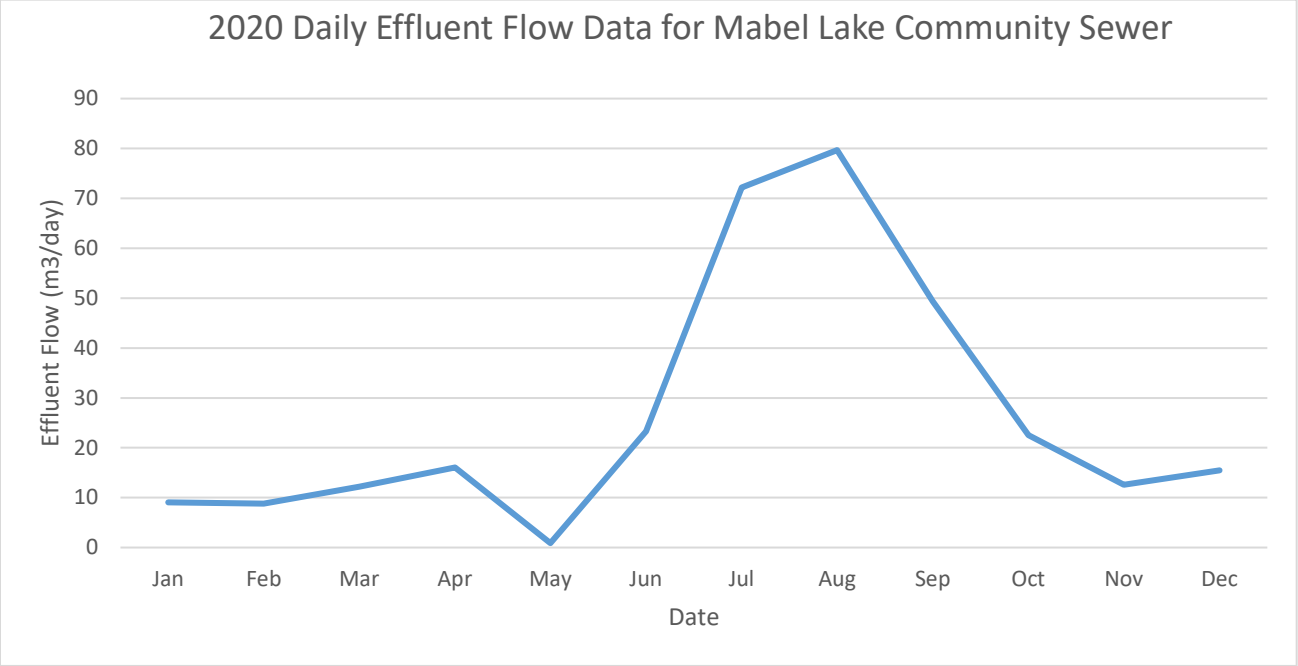

Figure 1: 2020 Daily Flow Data for MLS

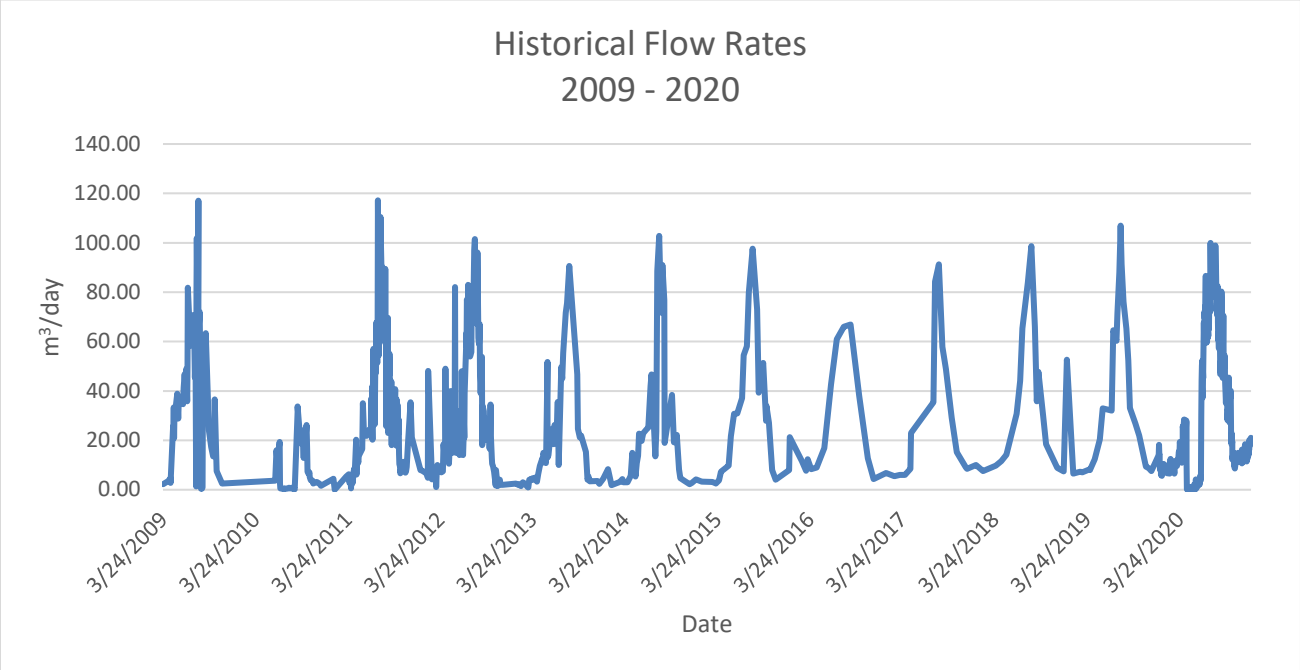

Figure 2: Historical Trend Data (March 2009 – December 2020) – Daily Flows

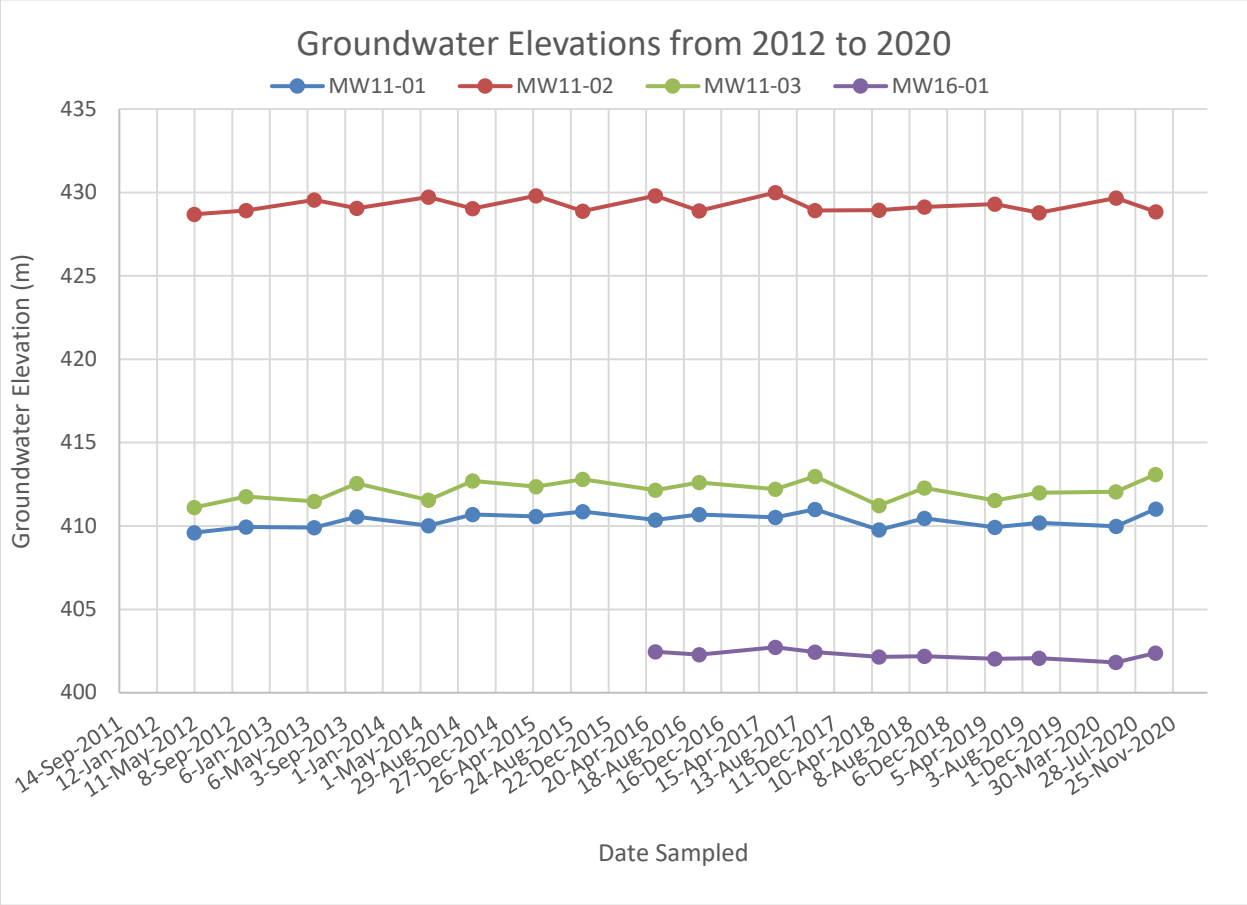

Figure 3: Groundwater Well Water Elevations

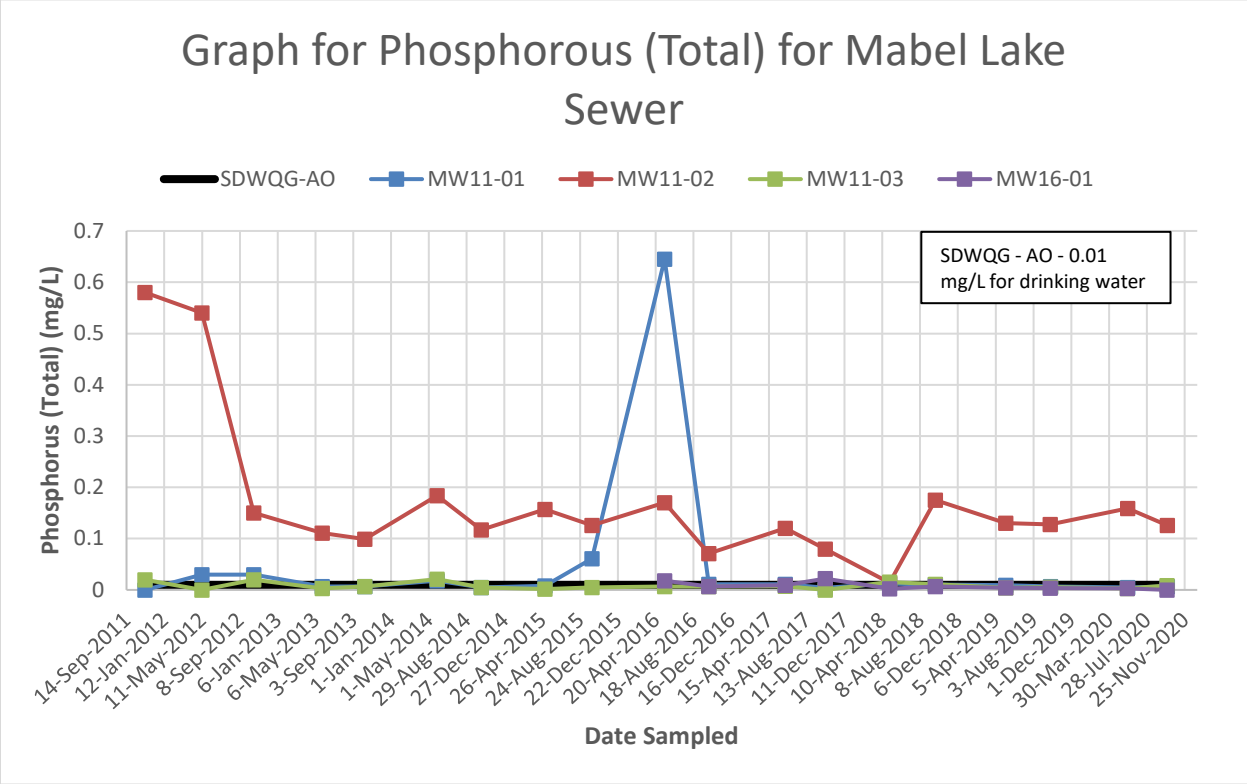

Figure 4: Total Phosphorous Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.

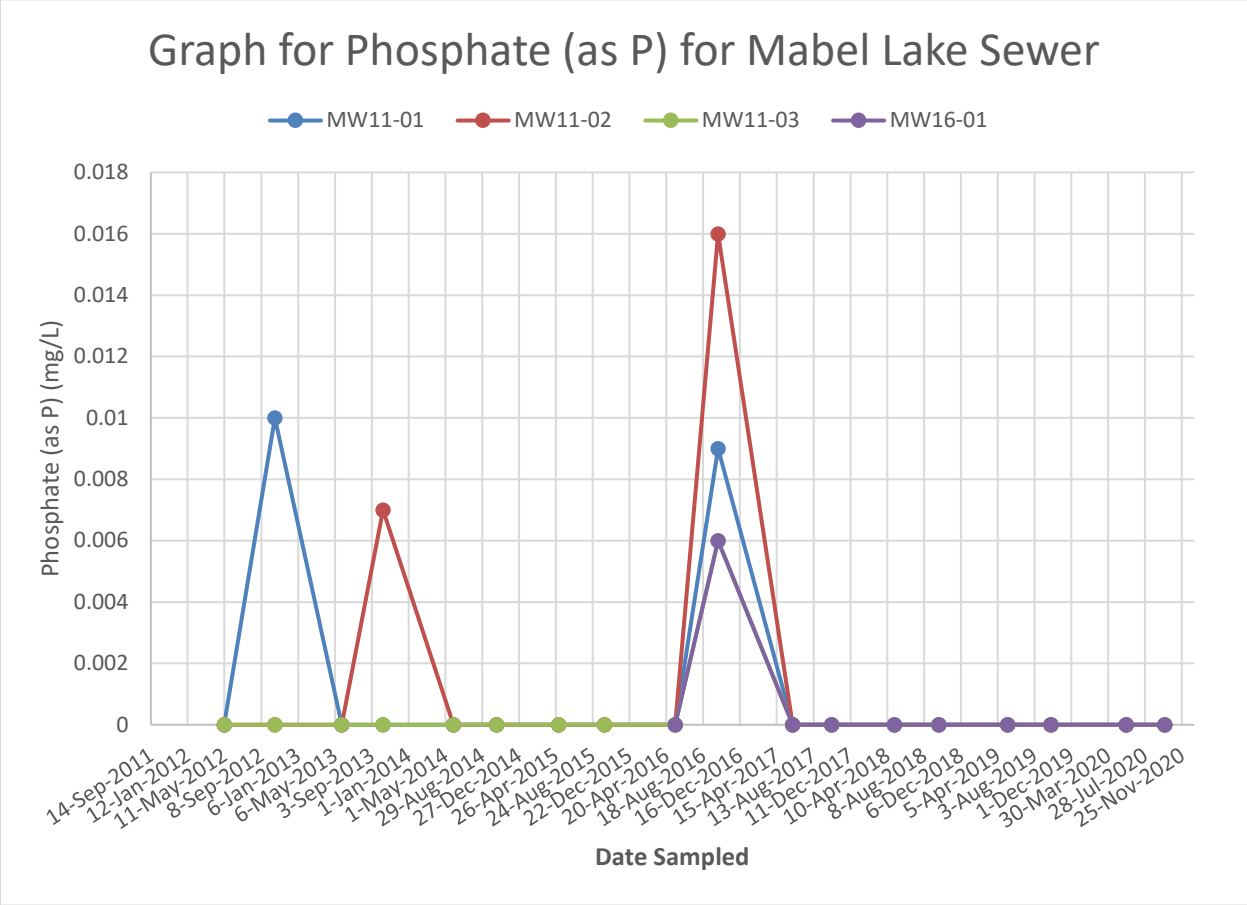

Figure 5: Phosphate (as P) Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.
No applicable guidelines.

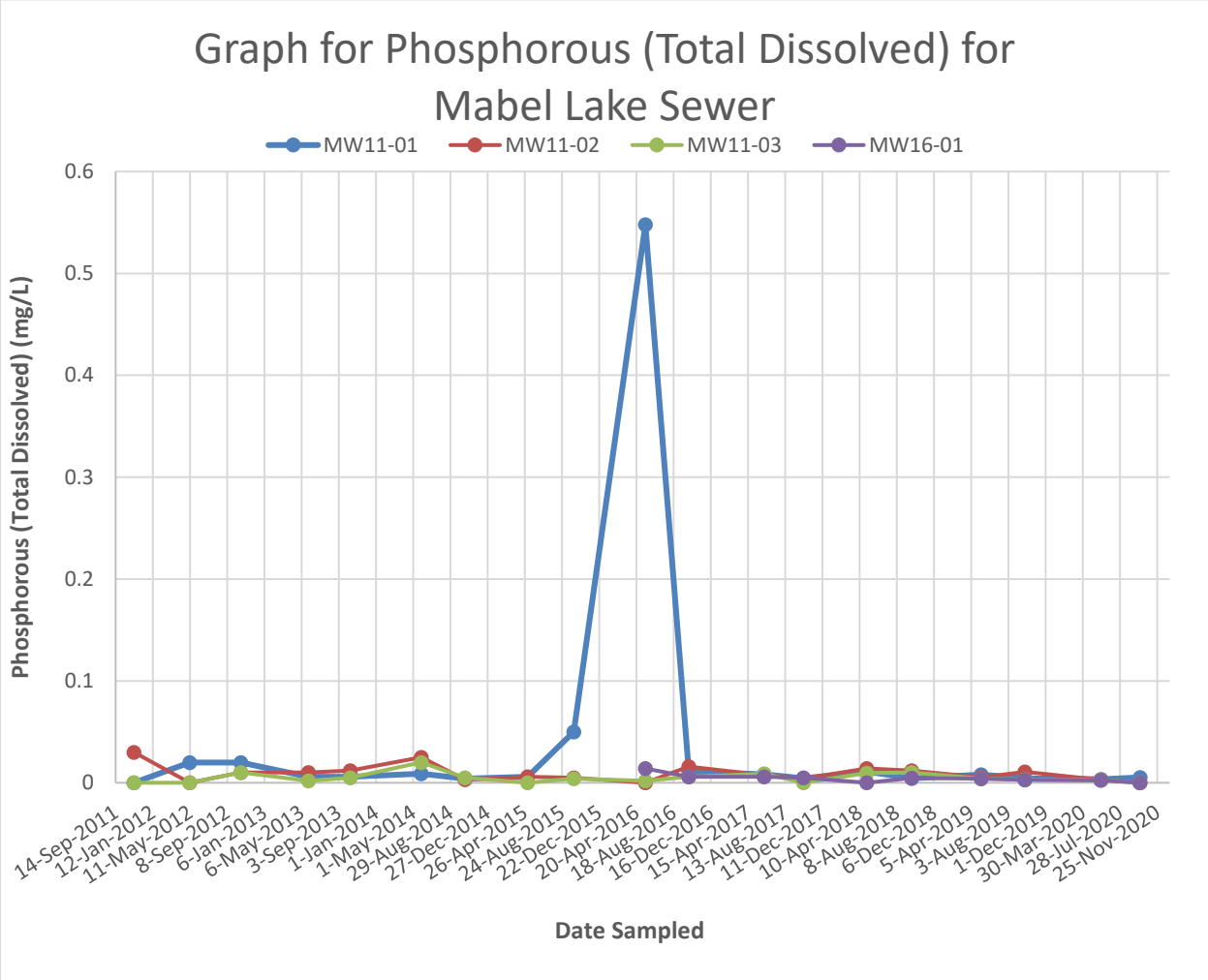

Figure 6: Phosphorous (Total Dissolved) Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.
No applicable guidelines.

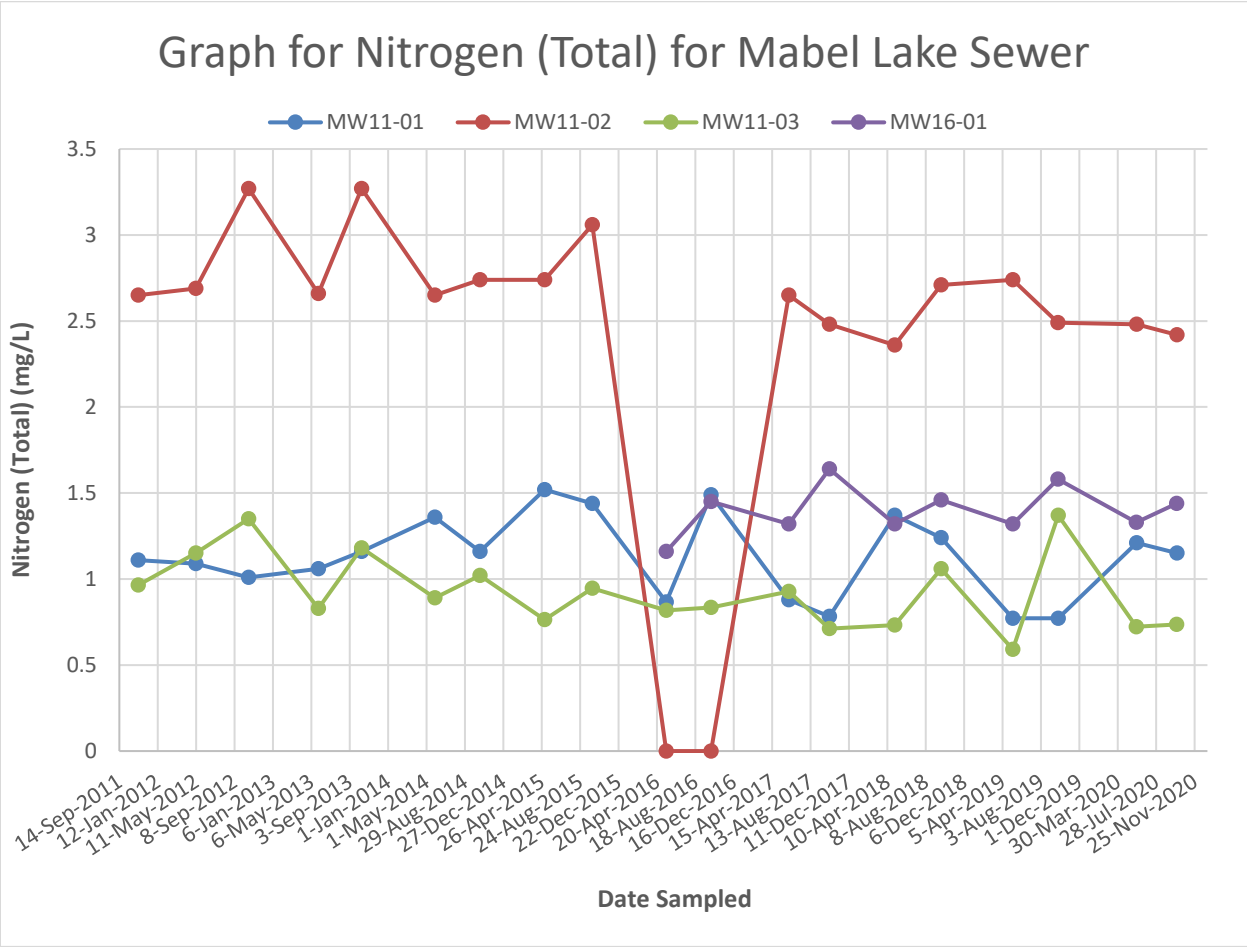

Figure 7: Nitrogen (Total) Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.
No applicable guidelines.

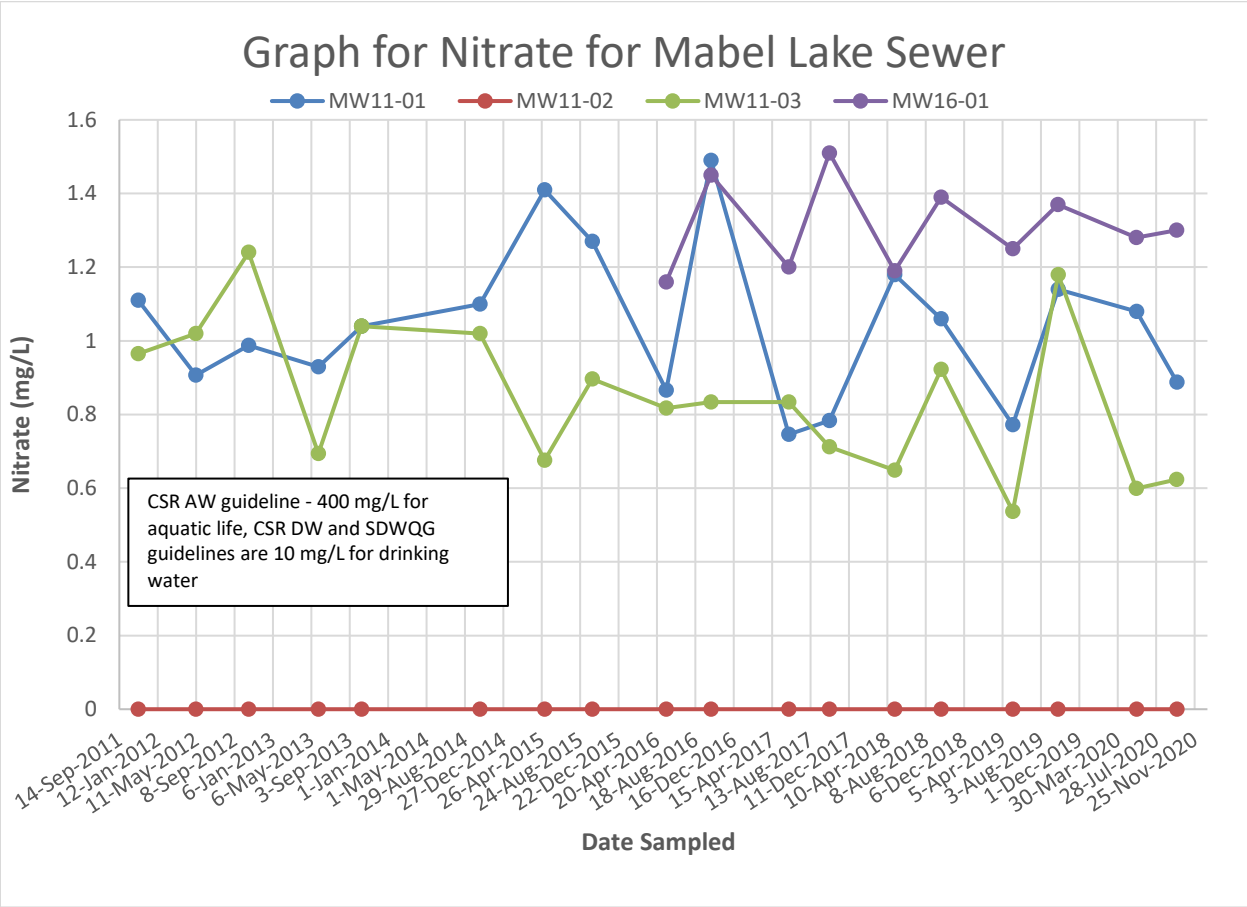

Figure 8: Nitrate Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.
No results for May 2014 due to a lab error.

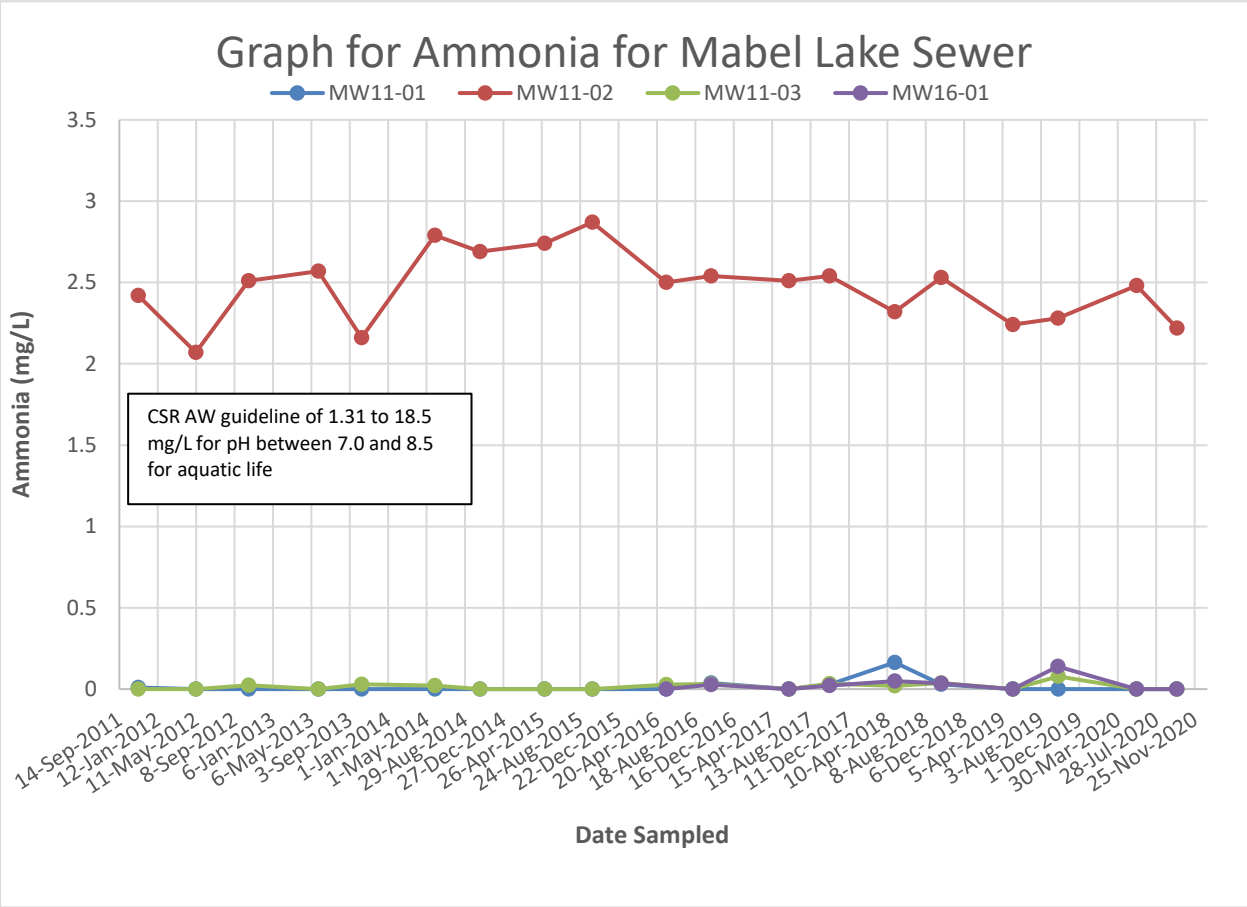

Figure 9: Ammonia Graph for Groundwater Wells

Note: Non-detect results are shown on the graph as 0 mg/L.

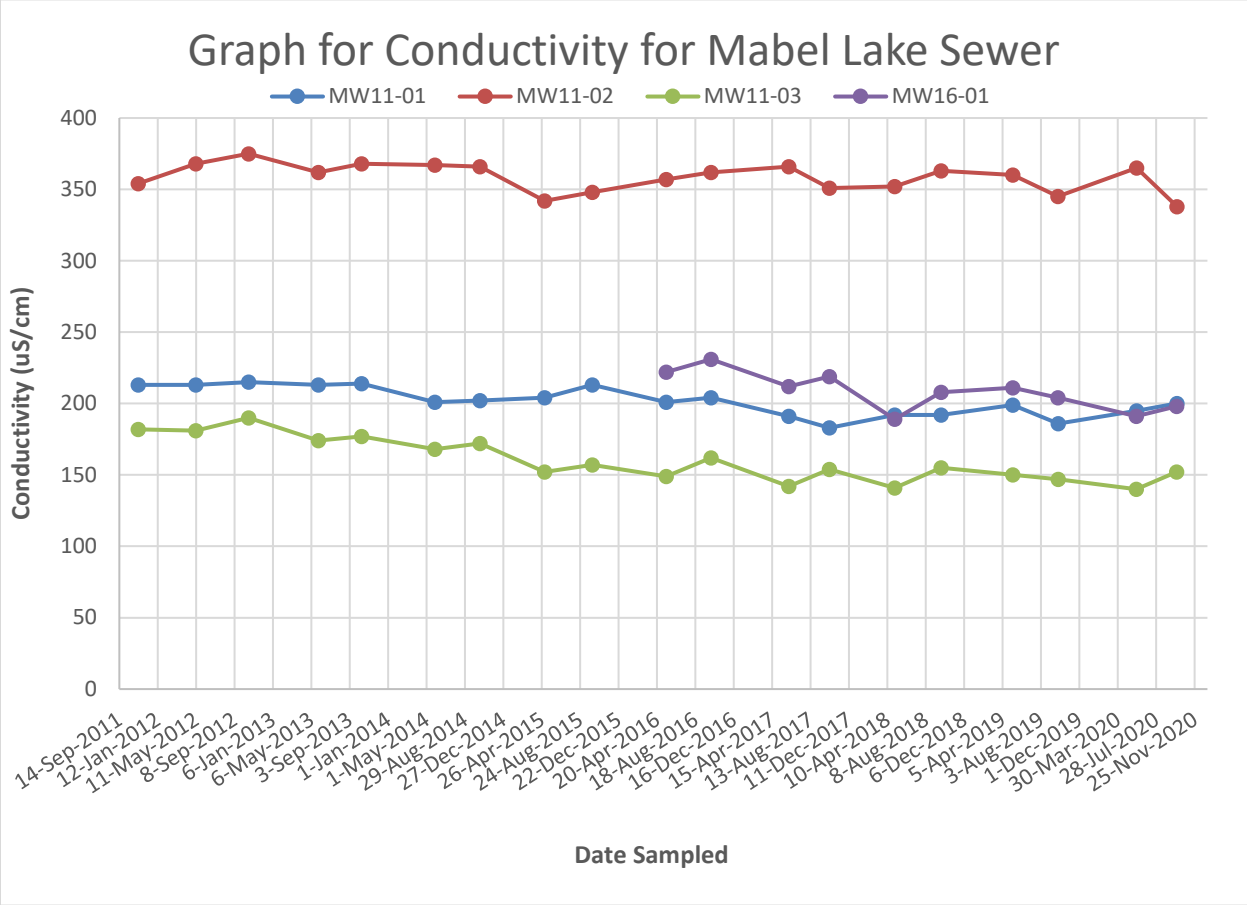

Figure 10: Conductivity Graph for Groundwater Wells

Note: No applicable guidelines.

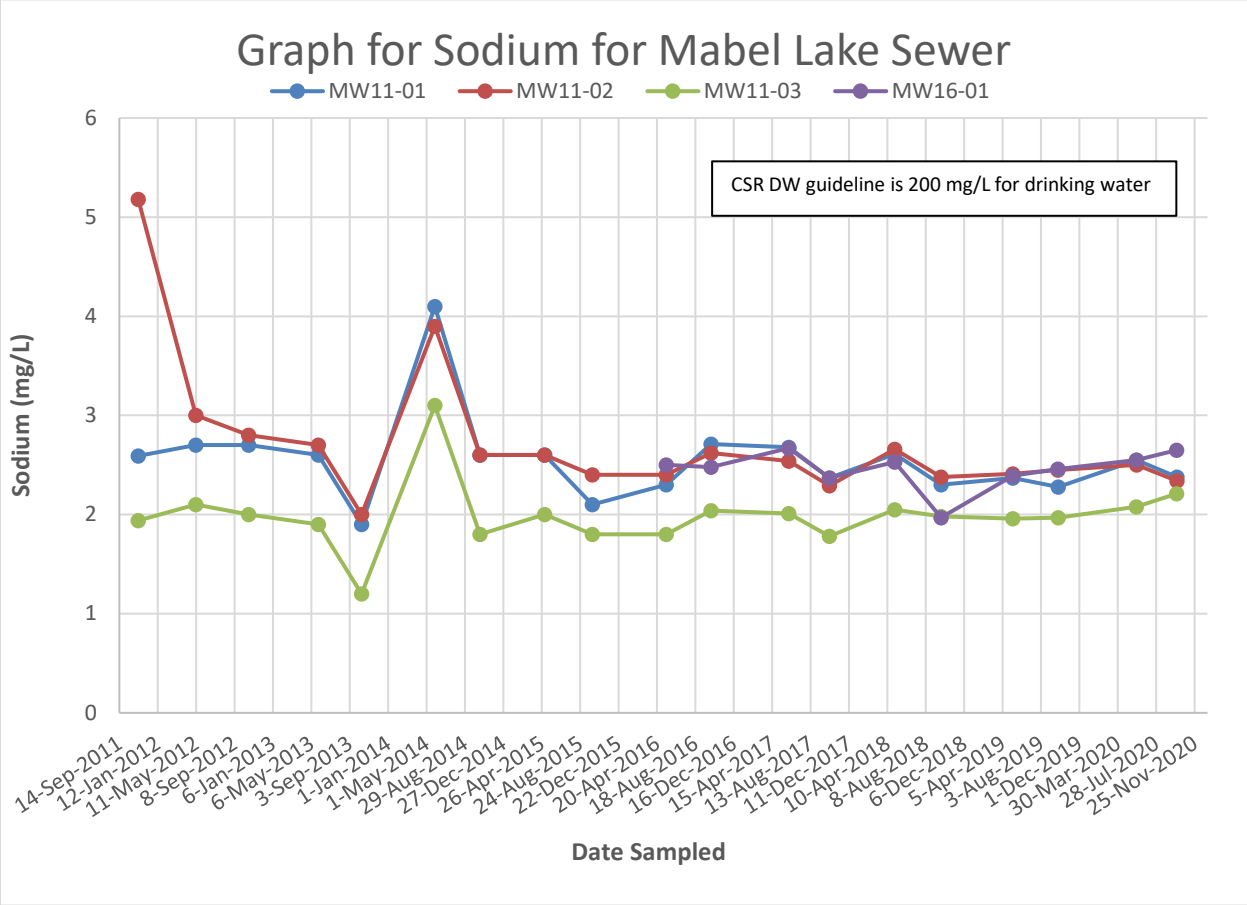

Figure 11: Sodium Graph for Groundwater Wells

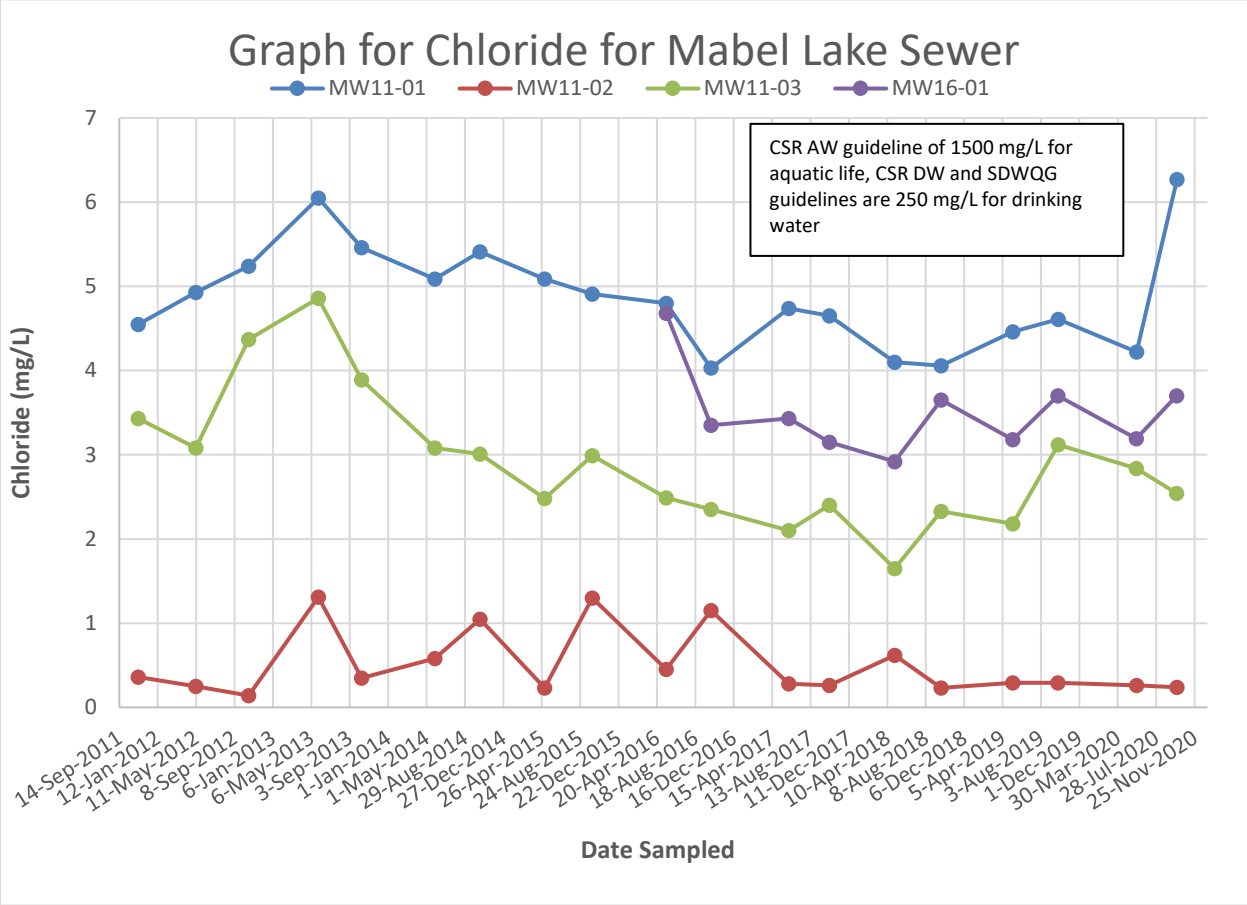

Figure 12: Chloride Graph for Groundwater Well

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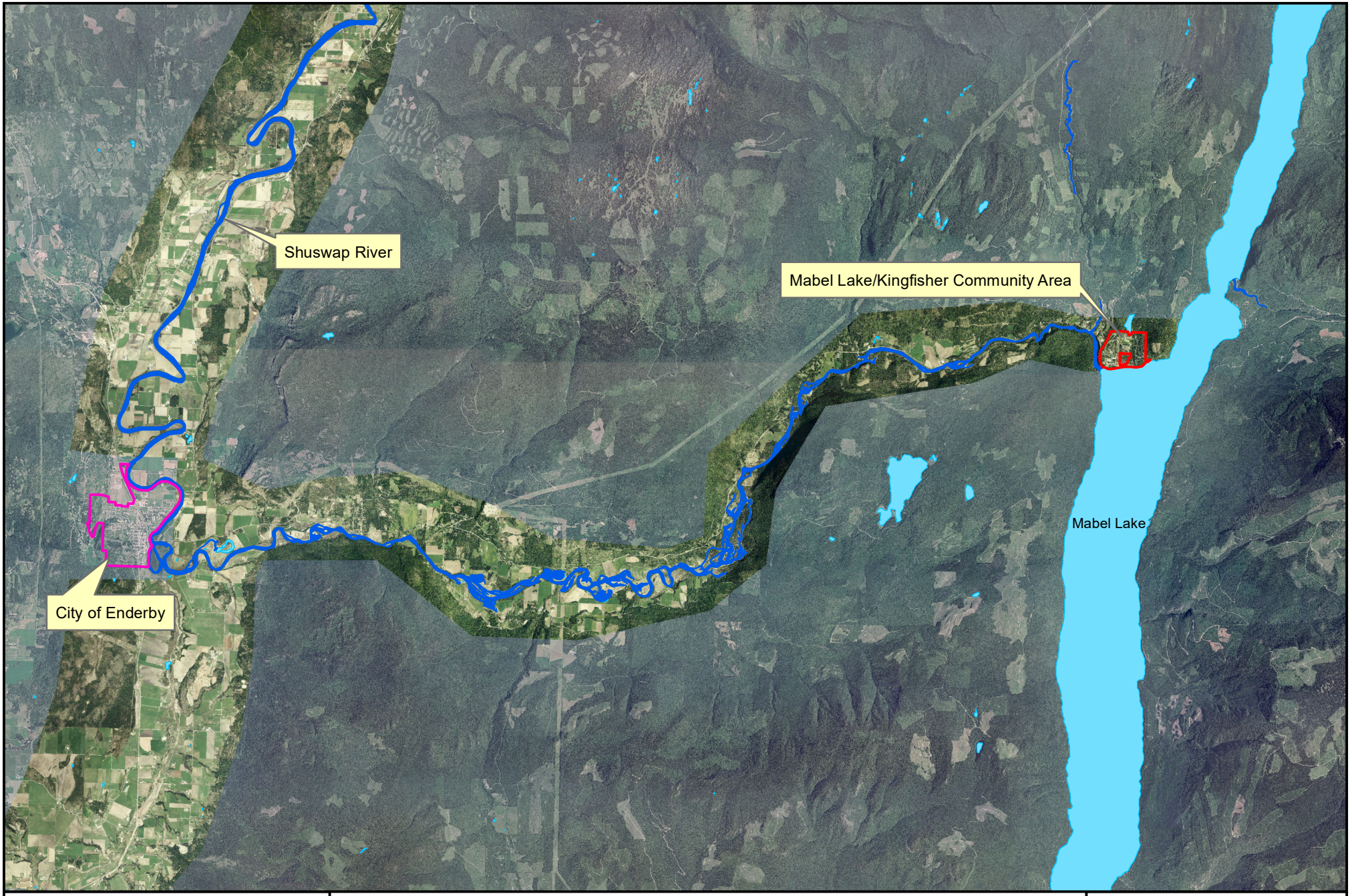
APPENDIX A

KINGFISHER COMMUNITY AREA MAP



This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Mabel Lake/Kingfisher Community Area

Plot Date: Jan 12, 2022

Scale: 1:150,000
Plot Size: 11" x 8.5"

0 3,500 7,000 14,000 Meters

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

APPENDIX B

MLS OPERATIONAL CERTIFICATE

BRITISH COLUMBIA
The Best Place on Earth

RECEIVED
JAN 31 2012
REGIONAL DISTRICT OF
NORTH OKANAGAN

January 23, 2012

Tracking Number: 77
Authorization Number: 14490

REGISTERED MAIL

NORTH OKANAGAN REGIONAL DISTRICT
9848 Aberdeen Road
Vernon, BC V1B 2K9

Dear Operational Certificate Holder:

Enclosed is Operational Certificate 14490 issued under the provisions of the *Environmental Management Act*. Your attention is respectfully directed to the terms and conditions outlined in the operational certificate. An annual fee will be determined according to the Permit Fees Regulation.

This operational certificate does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rests with the operational certificate holder. It is also the responsibility of the operational certificate holder to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This decision may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given. For further information, please contact the Environmental Appeal Board at (250) 387-3464.

Administration of this operational certificate will be carried out by staff from the Okanagan Region. Plans, data and reports pertinent to the operational certificate are to be submitted to the Regional Manager, Environmental Protection, at Ministry of Environment, Regional Operations, Okanagan Region, 102 Industrial Pl., Penticton, BC V2A 7C8.

Yours truly,

Sajid A. Barlas, Ph.D. , P.Ag.
for Director, *Environmental Management Act*
Okanagan Region

Enclosure

cc: Environment Canada

Ministry of Environment | Environmental Protection Division | 102 Industrial Pl. Penticton, BC V2A 7C8 | Southern Interior Region - Okanagan
Telephone: (250) 490-8200
Facsimile: (250) 490-2231

BRITISH COLUMBIA
The Best Place on Earth

MINISTRY OF ENVIRONMENT

OPERATIONAL CERTIFICATE

14490

Under the Provisions of the *Environmental Management Act*

NORTH OKANAGAN REGIONAL DISTRICT

9848 ABERDEEN ROAD
VERNON, BC V1B 2K9

Hereinafter referred to as "the Regional District"

is authorized to discharge effluent to the ground from a municipal sewage treatment facility located at Mabel Lake, which is part of the larger community of Kingfisher, British Columbia, subject to the terms and conditions listed below. Contravention of any of these conditions is a violation of the *Environmental Management Act* and may lead to prosecution.

1. AUTHORIZED DISCHARGES

1.1 Authorized Source

This section applies to the discharge of effluent from INDIVIDUAL SEPTIC TANKS DRAINING TO A COMMON TILE FIELD. The site reference number for this discharge is E248369.

1.1.1 The maximum rate of discharge is 250 cubic metres per day averaged on a monthly basis.

1.1.2 The characteristics of the discharge are similar to those of a typical septic tank effluent and for the purposes of permit fee calculations the following discharge factors will be used:

Biochemical Oxygen Demand	Maximum: 130 mg/L
Total Suspended Solids	Maximum: 130 mg/L

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for Director, *Environmental Management Act*
Okanagan Region

1.1.3 The authorized works are a series of septic tanks on individual properties, STEP pumping system to a centrally located septic tank, dosing siphon or pumps, disposal fields and related appurtenances approximately located as shown on Site Plan A.

1.1.4 The authorized works are complete and in operation.

1.1.5 The location of the facilities from which the discharge originates is within the community of Kingfisher.

1.1.6 The location of the point of discharge is Lot A, KAP 45947 (existing airstrip), KAP 47282 (existing taxiways), and the Remainder of Part of West 25 Chains of the SE 1/4 of Sec 14 (proposed taxiways MLG and CC).

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The Regional District must inspect the authorized works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the Regional District which prevents effective operation of the authorized works or leads to unauthorized discharge, the Regional District must comply with all applicable statutory requirements, immediately notify the Director and take appropriate remedial action for the prevention or mitigation of pollution. The Director may reduce or suspend operations to protect the environment until the authorized works have been restored and/or corrective steps have been taken to prevent unauthorized discharges.

2.2 Bypasses

The discharge of effluent which has bypassed the authorized treatment works is prohibited unless the prior approval of the Director is obtained and confirmed in writing.

2.3 Process Modifications

The Director must be notified prior to implementing changes to any process that may adversely affect the quality and/or quantity of the discharge.

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Okanagan Region

2.4 **Plans - Existing**

A copy of all "as built", plans of modifications and/or extensions to the sewage collection system must be retained by the Regional District for perusal by the Director, or designate, upon request.

2.5 **Plans - New Works**

Plans of modifications and/or extensions to the existing works must be signed and sealed by a Professional Engineer licensed to practise in the Province of British Columbia.

Plans and specifications of any proposed modifications or additions to works authorized in this Operational Certificate, with the exception of the sewage collection system, must be submitted to the Director, and his written consent obtained before construction commences. The works must be constructed in accordance with such plans.

2.6 **Sludge Management**

Sludge wasted from the effluent treatment facilities must be disposed of to a site and in a manner approved by the Director. The residue, removed from the individual septic tanks, must be disposed of in a manner authorized by the Director, or as authorized by regulation under the *Environmental Management Act*.

2.7 **Contingency Plan**

The Regional District must prepare a Contingency Plan that will address the appropriate course of action to be taken in any particular preconceived emergency situation, and submit a copy of the Contingency Plan to the Director on or before **March 1, 2012**. The Contingency Plan must include Spill Procedures including other leaks and any potential point of concern in the collection, treatment and disposal systems. Attention is to be given to public safety and the protection of the environment. The Contingency Plan is to be continually updated as necessary to reflect the current operation. Any revisions to the Contingency Plan are to be submitted annually to the Director.

2.8 **Additional Phosphorus Treatment**

In the event that significant levels of phosphorus are found in the groundwater

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wells or surface waters, as a result of effluent infiltration, a higher level of phosphorus removal may be specified by the Director.

2.9 Odours

Should there be objectionable odours being produced, as determined by the Director, additional works may be required if so directed in writing by the Director.

2.10 Operation and Maintenance

2.10.1 The Regional District must develop and maintain both an Operational and Maintenance Manual for the sewage collection, sewage treatment and effluent disposal works on or before **March 1, 2012.** A copy of the Operational and Maintenance Manuals must be retained at the Regional District office for inspection by the Director or designate.

2.10.2 Operate and maintain a system of preventative maintenance for the wastewater collection, wastewater treatment and effluent disposal.

2.11 Facility Classification and Operator Certification

The operational certificate holder must have the works authorized by this permit classified (and the classification must be maintained) by the Environmental Operators Certification Program Society (the Society). The works must be operated and maintained by persons certified within and according to the program provided by the Society.
Certification must be completed to the satisfaction of the Director. In addition, the Director must be notified of the classification level of the facility and certification level of the operators and changes of operators and/or operator certification levels within 30 days of any change.

Alternatively, the works authorized by this permit must be operated and maintained by persons who the operational certificate holder can demonstrate to the satisfaction of the Director, are qualified in the safe and proper operation of the facility for the protection of the environment.

2.12 Alternate Water Supply

The Regional District must provide a potable water supply (for domestic use only) to affected residents should groundwater wells become adversely affected

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by the effluent treatment facilities or disposal, as determined by the Director.

2.13 **Water Conservation**

The Regional District must take all reasonable measures to ensure that the consumptive use of water is minimized, by utilizing all appropriate water conserving devices throughout the collection area.

2.14 **Improvement of Works**

The Regional District must acquire and/or reserve sufficient land for the construction and/or expansion of future sewage treatment facilities. The installation of new works must be in accord with the Regional District of North Okanagan's, Kingfisher Liquid Waste Management Plan.

2.15 **Observation and Ventilation Ports**

Place observation and monitoring ports at the extremities of the disposal pipe to provide a clear view of the end of the disposal pipe and to the bottom of the backfill. To assist in maintaining an aerobic atmosphere within the pipe layout and the interstices in the granular backfill provide one ventilation port of the same diameter as, and connected to, the distribution pipe for every 152 m of pipe, with a minimum of four, arranged to promote air circulation throughout the field except during periods of sub-freezing temperature when they should be closed.

2.16 **Tile Field Operation**

The Regional District must alternate the use of the tile fields. The Director may change this period of alternation based on the results of visual inspections by Ministry staff and/or other information.

2.17 **Requirement to Upgrade Treatment Works and Operating Period**

The operating certificate authorizes a seasonal cottage operation for the purposes of field design. The operating period authorized for the seasonal component is from May 1st to Oct 31st each year. It is recognized that up to 10% of the flow may be year-round in nature. When the year-round flows exceed 10% of the maximum flow, the operation will no longer be considered seasonal in nature and disposal fields and reserve areas re-designated to reflect the change. When the system reaches effluent flows of 250 m^3/d, an

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for Director, *Environmental Management Act*
Okanagan Region

Environmental Impact Assessment (EIS) study must be undertaken to determine if the disposal fields are capable of supporting additional loading without significant adverse impact of the receiving environment. The scope of the work for EIS study must be approved by the Director prior to the study being undertaken.

2.18 **Sewage Collection System - Groundwater Infiltration, Inflow and Cross Connections**

Institute a routine inspection, operation and maintenance schedule for the sewage collection system. Maintain the sewage collection system works so as to minimize the possibility of cross connections between any future storm and sanitary sewer systems, minimize infiltration of groundwater, minimize inflow of water from basement sump pumps and roof drains, and minimize exfiltration of the collected sewage from the sewage collection system to the ground. Report of efforts made to reduce infiltration, inflow and cross-connections are to be included in the Annual Report each year.

2.19 **Influent Wastes Bylaw**

In order to minimize the potential effect of heavy metals, or other toxic materials in the effluent and/or sludge, prepare, implement and/or amend an Influent Wastes Bylaw, Building Bylaw, or other similar bylaw(s), to regulate the input of such wastes to the sewage collection system. The Regional District is encouraged to prohibit devices to process household putrescible waste for disposal to the sewage collection system. Copy of existing Influent Bylaws, or amendments, or similar bylaws or building codes, is to be included in the first Annual Report and any amendments submitted with subsequent annual reports.

2.20 **Surface Water Diversionary Works**

Surface water must be intercepted and diverted away from the effluent treatment and infiltration facilities to the greatest extent possible.

2.21 **Restrictive Covenant**

The Operational certificate holder must register a restrictive covenant on the property designated as sewage treatment works, disposal tile fields and standby field area to preclude the use of land for any other purpose. This restrictive covenant must not be removed without written authorization from the Director.

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2.22 **Standby Facilities**

A standby area must be set aside equivalent to 50% of the total installed disposal field area. The standby area is to be held in reserve for future use as a disposal field and is to be maintained free of any permanent structures.

3. MONITORING REQUIREMENTS

3.1 Effluent - Monitoring Program

3.1.1 Provide and maintain a suitable flow measuring device and record the daily effluent volume discharged as follows:
Septic Treatment:

- May 15th to September 15th record average daily flow twice per week.
- September 16th to May 14th record average daily flow once per 2 weeks

The EMS reference number for this site is E248369.

3.2 Groundwater Observation Wells

3.2.1 On or before **December 30, 2011**, a minimum of three observation wells must be installed at locations hydrogeologically appropriate, relative to the final location of the discharge to monitor the surface elevation of the groundwater table and to allow sampling of the renovated effluent on a semi-annual basis. One of the wells must be hydrogeologically located for sampling of background elevations and analyses and must be located outside of the zone of influence, up gradient of the disposal fields.

3.2.2 Obtain analyses of the sample for the following:

- total phosphorus, ortho phosphorus and total dissolved phosphorus, mg/L;
- total nitrogen, nitrate nitrogen and ammonia nitrogen, mg/L;
- pH and conductivity;
- sodium and chloride, mg/L; and
- E. coli, MPN (or CFU)/100 ml.

3.3 Sampling and Analytical Procedures

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3.3.1 Sampling is to be carried out in accordance with the procedures described in the "British Columbia Field Sampling Manual (Field Sampling Manual)for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples, 2003 Edition (Permittee)", or most recent edition, or by suitable alternative procedures as authorized by the Director.

A copy of the above manual may be purchased from the Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Gov't. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409) or via the internet at www.crownpub.bc.ca. A copy of the manual is also available for review at all Environmental Protection offices.

3.3.2 Analyses are to be carried out in accordance with procedures described in the "British Columbia Laboratory Manual (2009 Permittee Edition)", or the most recent edition, or by suitable alternative procedures as authorized by the Director.

A copy of the above manual may be purchased from the Queen's Printer Publications Centre, P. O. Box 9452, Stn. Prov. Gov't. Victoria, British Columbia, V8W 9V7 (1-800-663-6105 or (250) 387-6409) at the internet at www.crownpub.bc.ca. A copy of the manual is also available for review at all Environmental Protection offices.

3.3.3All data of analyses required to be submitted by the operational certificate must be conducted by a laboratory acceptable to the Director. At the request of the Director, the Regional District must provide the laboratory quality assurance data, associated field blanks and duplicate analyses results in accordance with the above mentioned Field Sampling Manual along with the submission of data required under Sec 3 of the operational certificate.

3.4 Environmental Monitoring System (EMS) Sites

The Regional District must provide precise latitude and longitude values, with an accuracy of at least plus or minus 10 metres, for each of the EMS sites monitored and for any additional sites added each year. Monitoring data is to be submitted to the Director.

3.5 Environmental Impact

Environmental Management Program personnel, as a part of the routine permit

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for Director, *Environmental Management Act*
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inspection procedure, will carry out inspections of the discharge. Based on these inspections and any other information available to the Director on the effect of the discharge on the receiving environment, the Operational Certificate holder may be required to undertake additional monitoring and/or install additional pollution control works.

4. REPORTING

4.1 General Reporting

Maintain all monitoring data for inspection by the Director his designate. The groundwater analyses are to be submitted to the Director such that they are received by the Director within 30 days of the results being received, or produced, by the District.

Monitoring data is to be submitted in electronic format and entered into EMS electronically.

4.2 Annual Reporting

Annually all data, as required by this Operational Certificate, is to be combined into a single report, suitably tabulated, indexed and forwarded to the Director, such that it is received by the Director, on or before March 1, each year for the previous year's monitoring. Copies of all raw data are to be attached as appendices to the report. The report must include graphical trend analysis of amenable data, an evaluation of those trends and discussion of any points of action, which may arise from the data.

4.2.1 Maintain records of flow measurements for inspection by the Director his and submit the data, suitably tabulated, to the Director.

4.2.2 Maintain records of ground water elevations and analyses, and submit the data, suitably tabulated, to the Director.

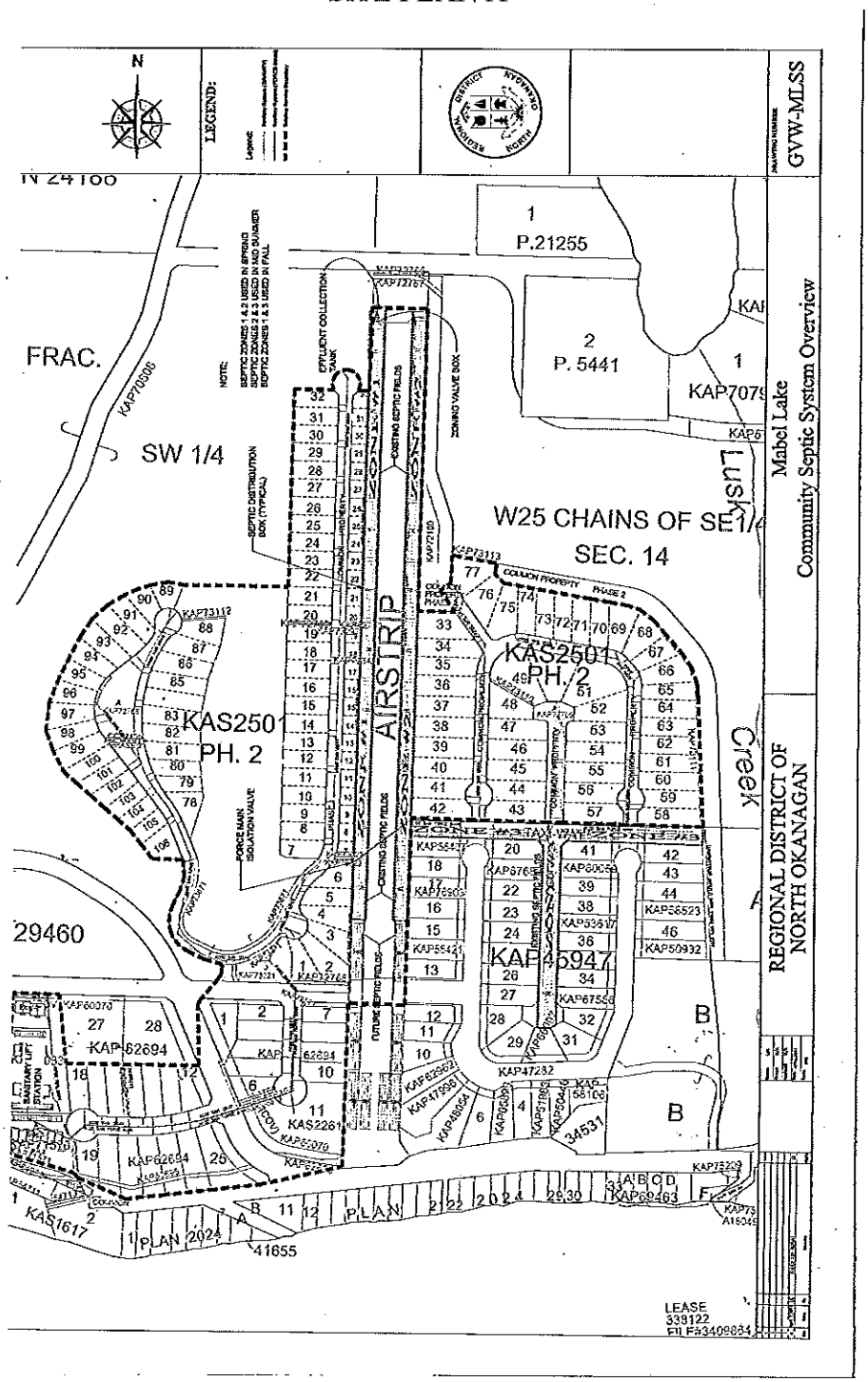
4.2.3 Submit the Contingency Plan, and thereafter any revisions which may have been made to the Plan over the previous year.

4.2.4 Maintain records of efforts to implement water conservation initiatives and submit to the Director.

Date issued: January 23, 2012

Sajid A. Barlas, Ph.D. , P.Ag.
for Director, *Environmental Management Act*
Okanagan Region

SITE PLAN A

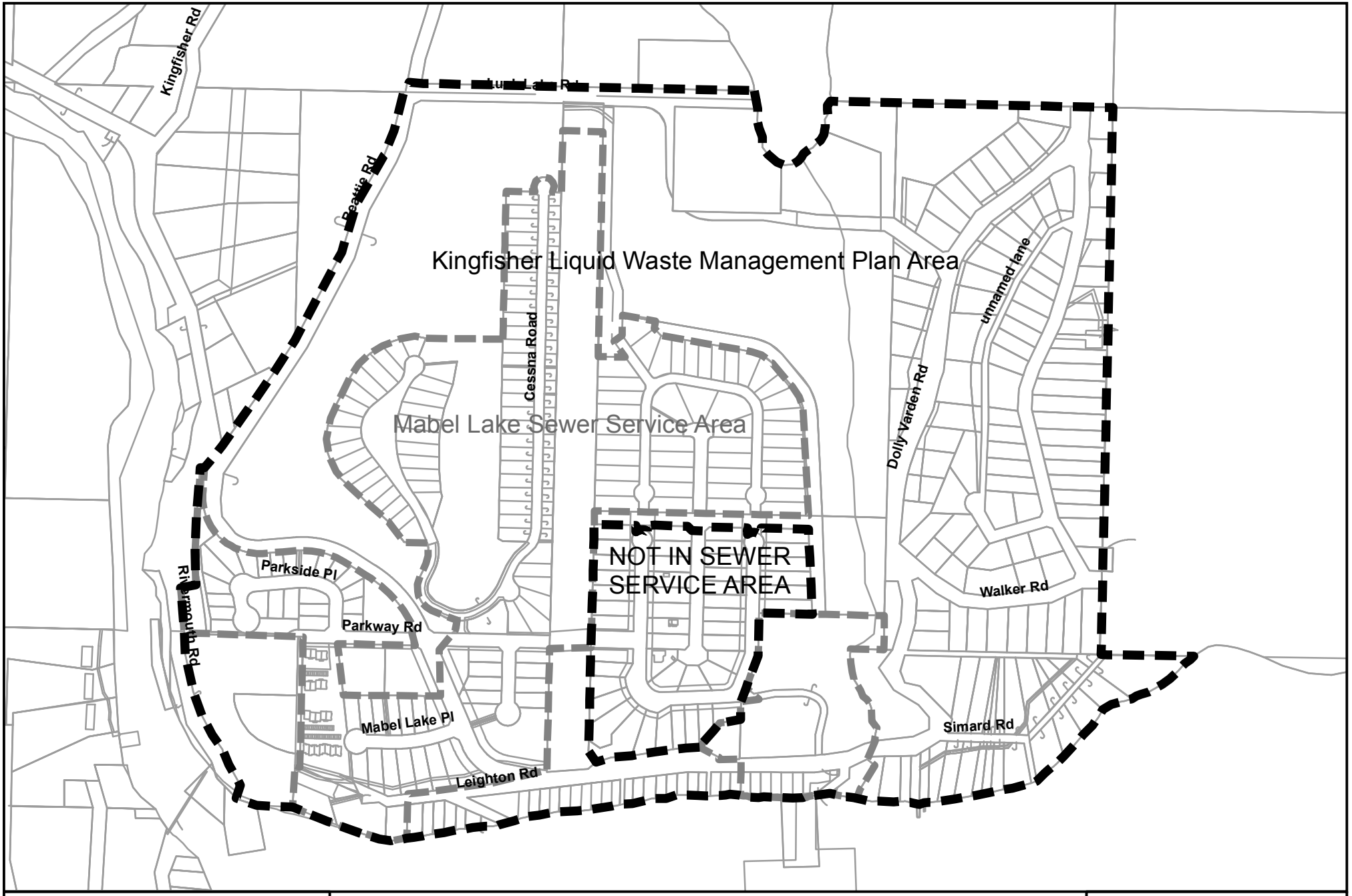


Date issued: January 23, 2012

Sajid A. Barlas, Ph.D. , P.Ag.
for Director, *Environmental Management Act*
Okanagan Region

APPENDIX C

MLS SERVICE AREA



This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Mabel Lake Sewer Service Area

Plot Date: Oct 15, 2018

Scale: 1:7,500
Plot Size: 11" x 8.5"

0 150 300 600 Meters

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

APPENDIX D

MLS SITE PLAN

Legend

- Parcels
- Sewer Service Area
- Septic Fields

Sewer Non-Linear

- Dosing Chamber
- Siphon Chamber
- Primary Distribution Box
- Secondary Distribution Box
- Septic Field Distribution Box
- Manhole
- Distribution Manhole

Sewer Mains

- Gravity
- Pressurized
- Septic Mains
- Sewer Services

Collection Tank
Lift Station
Septic Field Zone 1
Septic Field Zone 2
Septic Field Zone 3
Kingfisher Rd
Beattie Rd
Lusk Lake Rd
private driveway
unnamed lane
Rivermouth Rd
Parkway Rd
Cessna Rd
Leighton Rd
Enderby Mabel Lake Rd
Dolly Varden Rd
Simard Rd
WEATHER STATION
RIVERMOUTH MARINA

Mabel Lake Sewer Utility

This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Plot Date: Jan 12, 2022

Scale: 1:5,000

0 200 400 800 Meters

Plot Size: 17" x 11"

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

APPENDIX E

MLS MONITORING WELL LOCATIONS MAP

This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Site Location Plan for Mabel Lake Sewer

Plot Date: Aug 15, 2019

Scale: 1:6,000
Plot Size: 8.5" x 11"

0 100 200 400 Meters

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

APPENDIX F

DRINKING WATER WELLS IN THE COMMUNITY OF MABEL LAKE

This map was compiled by RDNO, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed without warranties of any kind, either express or implied, including but not limited to warranties of sustainability or particular purpose or use.

Site Location Plan for Drinking Water Wells

Plot Date: Jan 12, 2022

Scale: 1:8,000
Plot Size: 8.5" x 11"

0 125 250 500 Meters

REGIONAL DISTRICT NORTH OKANAGAN

RDNO

APPENDIX G

INFERRED GROUNDWATER DIRECTION MAP

LEGEND

Groundwater Contour

- Minor Contour (1m Interval)
- Major Contour (5m Interval)
- River Flow Direction
- Inferred Groundwater (GW) Flow Direction
- Sanitary System Overview (approx.)
- Monitoring Well & GW Elevation (m)
- Golf Course Irrigation Well

200 0 200 Metres

SCALE 1:7,500

NOTE

1. Groundwater contour elevations are referenced to local benchmark of 100.00m.
2. Water levels at Monitoring Wells observed on November 25, 2011.
3. Sanitary System Overview is not to scale.

REFERENCE

1. Base image: ArcGIS published by Microsoft Corporation, Redmond (2009).
2. Roads: DMTI Spatial Inc.
3. Sanitary System Overview: RDNO, DWG No.: GVW-405; Dated April 2011. Not to scale.

Datum: NAD83 Projection: UTM ZONE 11

PROJECT

REGIONAL DISTRICT OF NORTH OKANAGAN
MONITORING WELL INSTALLATIONS
MABEL LAKE RESORT AND AIR PARK, KINGFISHER, BC

TITLE

SITE PLAN AND INFERRED GROUNDWATER FLOW DIRECTION

Golder Associates

PROJECT NO. 11-1493-0073			FILE No.	
DESIGN	AR	5 Dec. 2011	SCALE AS SHOWN	REV. 0
GIS	JG	5 Dec. 2011		
CHECK	AR	27 Jan. 2012		
REVIEW	JF	27 Jan. 2012		

FIGURE: 2

E:_Work\11493 - Kelowna\11-1493-0073 RDNO\Drafting\2000\GIS\Fig 2_1114930073_Site Plan.mxd

APPENDIX H

LABORATORY REPORTS

CERTIFICATE OF ANALYSIS

REPORTED TO	Regional District of North Okanagan 9848 Aberdeen Road Coldstream, BC V1B 2K9		
ATTENTION	James Depfyffer	**WORK ORDER**	0052398
PO NUMBER	Mabel Lake Sewer	**RECEIVED / TEMP**	2020-05-28 10:10 / 7°C
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-04 14:21
PROJECT INFO		**COC NUMBER**	43978.64852

Introduction:

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Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

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Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at acrump@caro.ca

Authorized By:

Alana Crump
Team Lead, Client Service

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052398
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-04 14:21

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW16-01 (No EMS # yet) (0052398-01) | Matrix: Fresh Water | Sampled: 2020-05-27 11:20						F1, FILT, PRES
Anions						
Chloride	**3.19**	AO ≤ 250	0.10	mg/L	2020-05-29	
Nitrate (as N)	**1.28**	MAC = 10	0.010	mg/L	2020-05-29	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-05-29	
Calculated Parameters						
Nitrate+Nitrite (as N)	**1.28**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**1.33**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.55**	N/A	0.10	mg/L	2020-06-02	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-05-29	
Conductivity (EC)	**191**	N/A	2.0	µS/cm	2020-06-01	
pH	**7.30**	7.0-10.5	0.10	pH units	2020-06-01	HT2
Phosphorus, Total (as P)	**0.0030**	N/A	0.0020	mg/L	2020-06-03	
Phosphorus, Total Dissolved	**0.0024**	N/A	0.0020	mg/L	2020-06-03	
Microbiological Parameters						
E. coli	< 1.0	N/A	1.0	MPN/100 mL	2020-05-28	
MW11-03 (E290111) (0052398-02) | Matrix: Fresh Water | Sampled: 2020-05-27 13:15						
Anions						
Chloride	**2.84**	AO ≤ 250	0.10	mg/L	2020-05-29	
Nitrate (as N)	**0.599**	MAC = 10	0.010	mg/L	2020-05-29	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-05-29	
Calculated Parameters						
Nitrate+Nitrite (as N)	**0.599**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.722**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.08**	N/A	0.10	mg/L	2020-06-02	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-05-29	
Conductivity (EC)	**140**	N/A	2.0	µS/cm	2020-06-01	
pH	**7.26**	7.0-10.5	0.10	pH units	2020-06-01	HT2
Phosphorus, Total (as P)	**0.0032**	N/A	0.0020	mg/L	2020-06-03	
Phosphorus, Total Dissolved	**0.0027**	N/A	0.0020	mg/L	2020-06-03	
Microbiological Parameters						
E. coli	< 1.0	N/A	1.0	MPN/100 mL	2020-05-28	

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052398
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-04 14:21

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier

Sample Qualifiers:

F1	The sample was not field-filtered and was therefore filtered through a 0.45 µm membrane in the laboratory and preserved with HNO3 prior to analysis for dissolved metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for NH3, TKN, TP and TDP in the laboratory and the holding time has been extended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052398
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-04 14:21

Analysis Description	Method Ref.	Technique	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
E. coli in Water	NA / SM 9223 (2017)	Quanti-Tray / Enzyme Substrate Endo Agar	Kelowna
pH in Water	SM 4500-H+ B (2017)	Electrometry	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
MPN/100 mL	Most Probable Number per 100 millilitres
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Health Canada, Feb 2017)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

General Comments:

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Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:acrump@caro.ca

CERTIFICATE OF ANALYSIS

REPORTED TO	Regional District of North Okanagan 9848 Aberdeen Road Coldstream, BC V1B 2K9		
ATTENTION	James Depfyffer	**WORK ORDER**	0052518
PO NUMBER	Mabel Lake Sewer	**RECEIVED / TEMP**	2020-05-29 14:30 / 10°C
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-08 11:53
PROJECT INFO		**COC NUMBER**	43979.67255

Introduction:

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If you have any questions or concerns, please contact me at acrump@caro.ca

Authorized By:

Alana Crump
Team Lead, Client Service

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052518
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-08 11:53

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW11-01 xx (0052518-01) | Matrix: Fresh Water | Sampled: 2020-05-28 11:45						F1, FILT, PRES
Anions						
Chloride	**4.22**	AO ≤ 250	0.10	mg/L	2020-05-31	
Nitrate (as N)	**1.08**	MAC = 10	0.010	mg/L	2020-05-31	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-05-31	
Calculated Parameters						
Nitrate+Nitrite (as N)	**1.08**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**1.15**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.55**	N/A	0.10	mg/L	2020-06-06	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-06-02	
Conductivity (EC)	**195**	N/A	2.0	µS/cm	2020-06-01	
pH	**5.96**	7.0-10.5	0.10	pH units	2020-06-01	HT2
Phosphorus, Total (as P)	**0.0049**	N/A	0.0020	mg/L	2020-06-04	
Phosphorus, Total Dissolved	**0.0033**	N/A	0.0020	mg/L	2020-06-04	
Microbiological Parameters						
E. coli	< 1.0	N/A	1.0	MPN/100 mL	2020-05-29	
MW11-02 (E290110) (0052518-02) | Matrix: Fresh Water | Sampled: 2020-05-28 10:15						F1, FILT, PRES
Anions						
Chloride	**0.26**	AO ≤ 250	0.10	mg/L	2020-05-31	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2020-05-31	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-05-31	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**2.48**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.50**	N/A	0.10	mg/L	2020-06-06	
General Parameters						
Ammonia, Total (as N)	**2.15**	None Required	0.050	mg/L	2020-06-02	
Conductivity (EC)	**365**	N/A	2.0	µS/cm	2020-06-01	
pH	**6.49**	7.0-10.5	0.10	pH units	2020-06-01	HT2
Phosphorus, Total (as P)	**0.159**	N/A	0.0020	mg/L	2020-06-04	
Phosphorus, Total Dissolved	**0.0029**	N/A	0.0020	mg/L	2020-06-04	
Microbiological Parameters						
E. coli	< 1.0	N/A	1.0	MPN/100 mL	2020-05-29	

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052518
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-08 11:53

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier

Sample Qualifiers:

F1	The sample was not field-filtered and was therefore filtered through a 0.45 µm membrane in the laboratory and preserved with HNO3 prior to analysis for dissolved metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0052518
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-06-08 11:53

Analysis Description	Method Ref.	Technique	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond
E. coli in Water	NA / SM 9223 (2017)	Quanti-Tray / Enzyme Substrate Endo Agar	Kelowna
pH in Water	SM 4500-H+ B (2017)	Electrometry	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

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pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

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CERTIFICATE OF ANALYSIS

REPORTED TO	Regional District of North Okanagan 9848 Aberdeen Road Coldstream, BC V1B 2K9		
ATTENTION	James Depfyffer	**WORK ORDER**	0109174
PO NUMBER	Mabel Lake Sewer	**RECEIVED / TEMP**	2020-10-01 10:10 / 8°C
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-08 18:35
PROJECT INFO		**COC NUMBER**	44104.65180

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If you have any questions or concerns, please contact me at acrump@caro.ca

Authorized By:

Alana Crump
Team Lead, Client Service

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109174
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-08 18:35

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW16-01 (E320791) (0109174-01) | Matrix: Fresh Water | Sampled: 2020-09-30 11:26						F1, FILT, PRES
Anions						
Chloride	**3.70**	AO ≤ 250	0.10	mg/L	2020-10-02	
Nitrate (as N)	**1.30**	MAC = 10	0.010	mg/L	2020-10-02	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-02	
Calculated Parameters						
Nitrate+Nitrite (as N)	**1.30**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**1.44**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.65**	N/A	0.10	mg/L	2020-10-07	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Conductivity (EC)	**198**	N/A	2.0	µS/cm	2020-10-05	
pH	**7.43**	7.0-10.5	0.10	pH units	2020-10-05	HT2
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-06	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-06	
Microbiological Parameters						
E. coli	< 1	N/A	1	MPN/100 mL	2020-10-01	
MW11-03 (E290111) (0109174-02) | Matrix: Fresh Water | Sampled: 2020-09-30 13:16						F1, FILT, PRES
Anions						
Chloride	**2.54**	AO ≤ 250	0.10	mg/L	2020-10-02	
Nitrate (as N)	**0.624**	MAC = 10	0.010	mg/L	2020-10-02	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-02	
Calculated Parameters						
Nitrate+Nitrite (as N)	**0.624**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.736**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.21**	N/A	0.10	mg/L	2020-10-07	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-06	
Conductivity (EC)	**152**	N/A	2.0	µS/cm	2020-10-06	
pH	**7.20**	7.0-10.5	0.10	pH units	2020-10-06	HT2
Phosphorus, Total (as P)	**0.0084**	N/A	0.0050	mg/L	2020-10-06	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-06	
Microbiological Parameters						
E. coli	< 1	N/A	1	MPN/100 mL	2020-10-01	

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109174
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-08 18:35

Sample Qualifiers:

F1	The sample was not field-filtered and was therefore filtered through a 0.45 µm membrane in the laboratory and preserved with HNO3 prior to analysis for dissolved metals.
FILT	The sample has been filtered for TDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TDP in the laboratory and the holding time has been extended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109174
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-08 18:35

Analysis Description	Method Ref.	Technique	Accredited	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
E. coli in Water	NA / SM 9223 (2017)	Quanti-Tray / Enzyme Substrate Endo Agar	✓	Kelowna
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
MPN/100 mL	Most Probable Number per 100 millilitres
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Health Canada, June 2019)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109174
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-08 18:35

General Comments:

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Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:acrump@caro.ca

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CERTIFICATE OF ANALYSIS

REPORTED TO	Regional District of North Okanagan 9848 Aberdeen Road Coldstream, BC V1B 2K9		
ATTENTION	James Depfyffer	**WORK ORDER**	0109365
PO NUMBER	Mabel Lake Sewer	**RECEIVED / TEMP**	2020-10-02 09:45 / 4°C
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-09 15:27
PROJECT INFO		**COC NUMBER**	44105.65788

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at acrump@caro.ca

Authorized By:

Alana Crump
Team Lead, Client Service

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109365
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-09 15:27

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW11-01 (E290109) (0109365-01) | Matrix: Fresh Water | Sampled: 2020-10-01 12:17						F1, FILT, PRES
Anions						
Chloride	**6.27**	AO ≤ 250	0.10	mg/L	2020-10-04	
Nitrate (as N)	**0.888**	MAC = 10	0.010	mg/L	2020-10-04	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-04	
Calculated Parameters						
Nitrate+Nitrite (as N)	**0.888**	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**0.888**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.38**	N/A	0.10	mg/L	2020-10-09	
General Parameters						
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2020-10-07	
Conductivity (EC)	**200**	N/A	2.0	µS/cm	2020-10-07	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2020-10-08	
pH	**7.32**	7.0-10.5	0.10	pH units	2020-10-07	HT2
Phosphorus, Total (as P)	**0.0066**	N/A	0.0050	mg/L	2020-10-08	
Phosphorus, Total Dissolved	**0.0053**	N/A	0.0050	mg/L	2020-10-08	
Microbiological Parameters						
E. coli	< 1	N/A	1	MPN/100 mL	2020-10-02	
MW11-02 (E290110) (0109365-02) | Matrix: Fresh Water | Sampled: 2020-10-01 10:35						F1, FILT, PRES
Anions						
Chloride	**0.24**	AO ≤ 250	0.10	mg/L	2020-10-04	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2020-10-04	
Phosphate (as P)	< 0.0050	N/A	0.0050	mg/L	2020-10-04	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	
Nitrogen, Total	**2.42**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Sodium, dissolved	**2.34**	N/A	0.10	mg/L	2020-10-09	
General Parameters						
Ammonia, Total (as N)	**2.22**	None Required	0.050	mg/L	2020-10-07	
Conductivity (EC)	**338**	N/A	2.0	µS/cm	2020-10-07	
Nitrogen, Total Kjeldahl	**2.42**	N/A	0.050	mg/L	2020-10-08	
pH	**7.69**	7.0-10.5	0.10	pH units	2020-10-07	HT2
Phosphorus, Total (as P)	**0.126**	N/A	0.0050	mg/L	2020-10-08	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2020-10-08	

TEST RESULTS

REPORTED TO	Regional District of North Okanagan	**WORK ORDER**	0109365
PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-09 15:27

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW11-02 (E290110) (0109365-02) | Matrix: Fresh Water | Sampled: 2020-10-01 10:35, Continued						F1, FILT, PRES
Microbiological Parameters						
E. coli	< 1	N/A	1	MPN/100 mL	2020-10-02	

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HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for TD in the laboratory and the holding time has been extended.

APPENDIX 1: SUPPORTING INFORMATION

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PROJECT	Mabel Lake Sewer - Monitoring Wells (MOE)	**REPORTED**	2020-10-09 15:27

Analysis Description	Method Ref.	Technique	Accredited	Location
Ammonia, Total in Water	SM 4500-NH3 G* (2017)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2017)	Ion Chromatography	✓	Kelowna
Conductivity in Water	SM 2510 B (2017)	Conductivity Meter	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
E. coli in Water	NA / SM 9223 (2017)	Quanti-Tray / Enzyme Substrate Endo Agar	✓	Kelowna
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2017)	Block Digestion and Flow Injection Analysis	✓	Kelowna
pH in Water	SM 4500-H+ B (2017)	Electrometry	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2017)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna

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APPENDIX I

EOCP CERTIFICATE OF CLASSIFICATION

EOCP

CERTIFICATE of CLASSIFICATION

Environmental Operators Certification Program

This is to certify that:

Mabel Lake Sewer Utility Wastewater System

Facility No.

has been classified as a

Small Wastewater System

CHAIR, BOARD OF DIRECTORS

CHIEF EXECUTIVE OFFICER

Dated: September 09, 2019

At: Burnaby, BC

Valid until: September 09, 2024

A society incorporated under the Society Act, S.B.C. S-28724