VILLAGE OF CAROLINE

WASTEWATER TREATMENT PLANT: RECEIVING WATER QUALITY AND ENVIRONMENTAL RISK ASSESSMENT

MARCH 08, 2021

WASTEWATER TREATMENT PLANT: RECEIVING WATER QUALITY AND ENVIRONMENTAL RISK ASSESSMENT

VILLAGE OF CAROLINE

PROJECT NO.: 171-00699-00
DATE: MARCH 08, 2021

WSP
7710 EDGAR INDUSTRIAL COURT
RED DEER, AB, CANADA T4P 4E2
T: +1 403 342-7650
F: +1 403 342-7691
wsp.com

March 08, 2021

Village of Caroline
Ms. Melissa Beebe
Chief Administrative Officer
Village of Caroline
Box 148
Caroline, Alberta
T0M 0M0

Dear Ms. Beebe

Subject: WASTEWATER TREATMENT PLANT: RECEIVING WATER QUALITY AND ENVIRONMENTAL RISK ASSESSMENT

WSP Canada Inc. (WSP) has completed a Wastewater Treatment Plant: Receiving Water Quality and Environmental Risk Assessment.

The receiving water quality of Raven River and the Environmental Risk Assessment of the disposal of treated sewage effluent in to the Raven River have been completed. The study has been undertaken in response to the requirements of Alberta Environment and Parks for the renewal of Approval No. 494-02-00.

Please contact the undersigned if you have any questions.

Yours truly,

Craig Suchy, P. Eng
Manager, Central Region - Infrastructure

WSP ref.: 171-00699-00

7710 Edgar Industrial Court
Red Deer, AB, Canada T4P 4E2

Tel.: +1 403 342-7650
Fax: +1 403 342-7691

SIGNATURES

PREPARED BY

Govind Nadadur, M.Sc., E.I.T

REVIEWED BY

Michelle Albert, P.Eng.
Director, Water & Wastewater

This report was prepared by WSP Canada Inc. for the Village of Caroline, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP Canada Inc.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

APPENDICES

TABLES

FIGURES

GLOSSARY OF TERMS

BOD_5: Biochemical Oxygen Demand
cBOD: Carbonaceous BOD_5
CCME: Canadian Council of Ministers of the Environment
DO: Dissolved Oxygen
TAN: Total Ammonia Nitrogen
TKN: Total Kjeldahl Nitrogen
TN: Total Nitrogen
TP: Total Phosphorus
TRC: Total Residual Chlorine
TSS: Total Suspended Solids
UIN: Unionized Ammonia Nitrogen
WWTP: Wastewater Treatment Plant

1 INTRODUCTION

1.1 BACKGROUND

The Caroline Wastewater Treatment Plant consists of two aerated wastewater treatment lagoons which continuously discharge into the nearby Raven River. According to the Capital Infrastructure Plan, the WWTP is designed to treat an average flow of 400 m^3/day. The WWTP is located at the southwest corner of Range Road 61 and Township Road 362 in Caroline, Alberta. The treated effluent is discharged into the Raven River at a location approximately 250 meters southwest of the treatment plant.

The permit to operate sewage works (No. 494-03-00) establishes a compliance limit for carbonaceous biochemical oxygen demand (cBOD).

1.2 OBJECTIVE

The Village of Caroline, to satisfy the approval renewal requirements imposed by Alberta Environment and Parks in October 2016, needs to complete a Receiving Water Quality and Environmental Risk Assessment of its WWTP. The Assessment needs to follow the approach described in the Canadian Council of Ministers of the Environment Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CCME, 2009).

The assessment summarizes the ambient water quality and current conditions, in the receiving stream in the vicinity of the wastewater treatment plant effluent discharge location, and proposes new effluent criteria for the plant.

1.3 DATA SOURCES

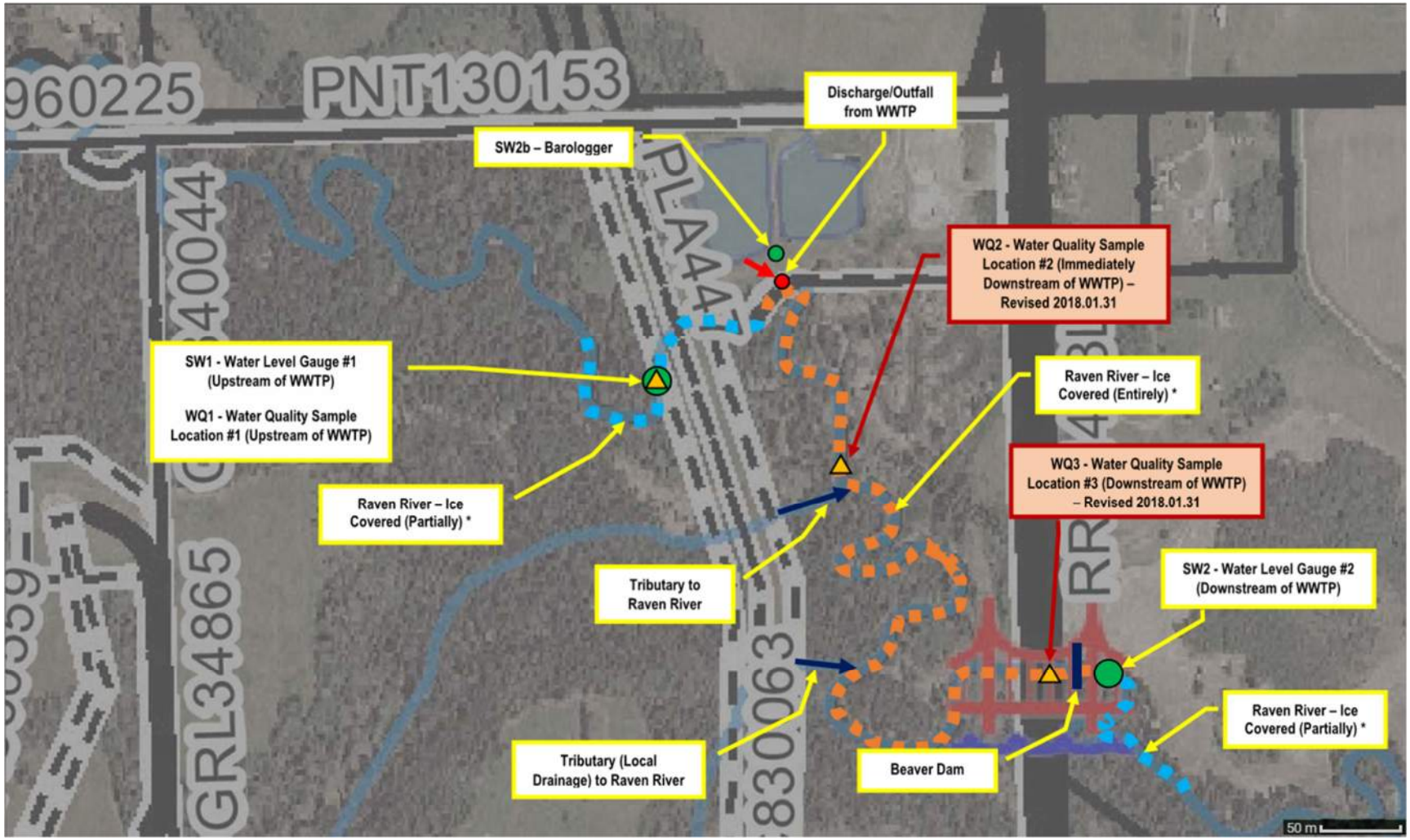
There is limited data available on the Raven River water quality, and flow conditions near the WWTP outfall. To compensate for this lack of data, field investigation including river sampling and monitoring were undertaken. Data sources used in this assessment, to establish ambient conditions include two Continuous Flow Monitoring Systems, and three Water Quality sampling locations. Details regarding each data source, are provided in Table 1-1 and a location map (revised on 2018.01.31) is provided on Figure 1-1.

Table 1-1 Ambient Water Quality Data Sources

DATA SOURCE	APPROXIMATE DISTANCE FROM OUTFALL DISCHARGE	PERIOD OF RECORD	WATER QUALITY PARAMETERS MONITORED
Continuous Flow Monitoring Systems (SW1)	120 m (upstream)	December 2017 to September 2018	Water level, Temperature
Continuous Flow Monitoring Systems (SW2)	1000 m (downstream)	December 2017 to September 2018	Water level, Temperature
Water Quality Sampling location (WQ1)	120 m (upstream)	December 2017 to September 2018	cBOD, TSS, Nutrients, pH, DO
Water Quality Sampling location (WQ2)	160 m (downstream)	December 2017 to September 2018	cBOD, TSS, Nutrients, pH, DO
Water Quality Sampling location (WQ3)	800 m (downstream)	December 2017 to September 2018	cBOD, TSS, Nutrients, pH, DO

Refer Table 1-1 for approximate distances of Data logging and Water Quality Sampling locations from discharge outfall.

Figure 1-1 Raven River Water Quality Data Source Location Map



2 WASTEWATER CHARACTERIZATION

2.1 INFLUENT WASTEWATER QUALITY

The Village of Caroline WWTP has an approved average day flow capacity of 400 m^3/d. The wastewater treatment plant consists of two aerated lagoon cells.

Per the Monitoring Requirements listed in Appendix-A of '*Canada-wide Strategy for the Management of Municipal Wastewater Effluent'* (2009), for a very small facility (less than/equal to 500m^3/day), the compliance monitoring involves monthly testing for BOD_5 and TSS. Total Residual Chlorine (or dechlorination agent) is only required if chlorine is used in the wastewater facility, which is not the case here.

Further, per approval 494-03-00 dated March 6th, 2017, only BOD_5 and TSS are to be measured weekly by means of grab samples. The volume of flow is to be continuously recorded. The samples are to be from the influent entering the wastewater treatment plant.

Provided below are summary tables and figures of the collected data. Only data for the period of 2013 to 2018 were analyzed. The data has been taken from the Village of Caroline Annual Wastewater Reports.

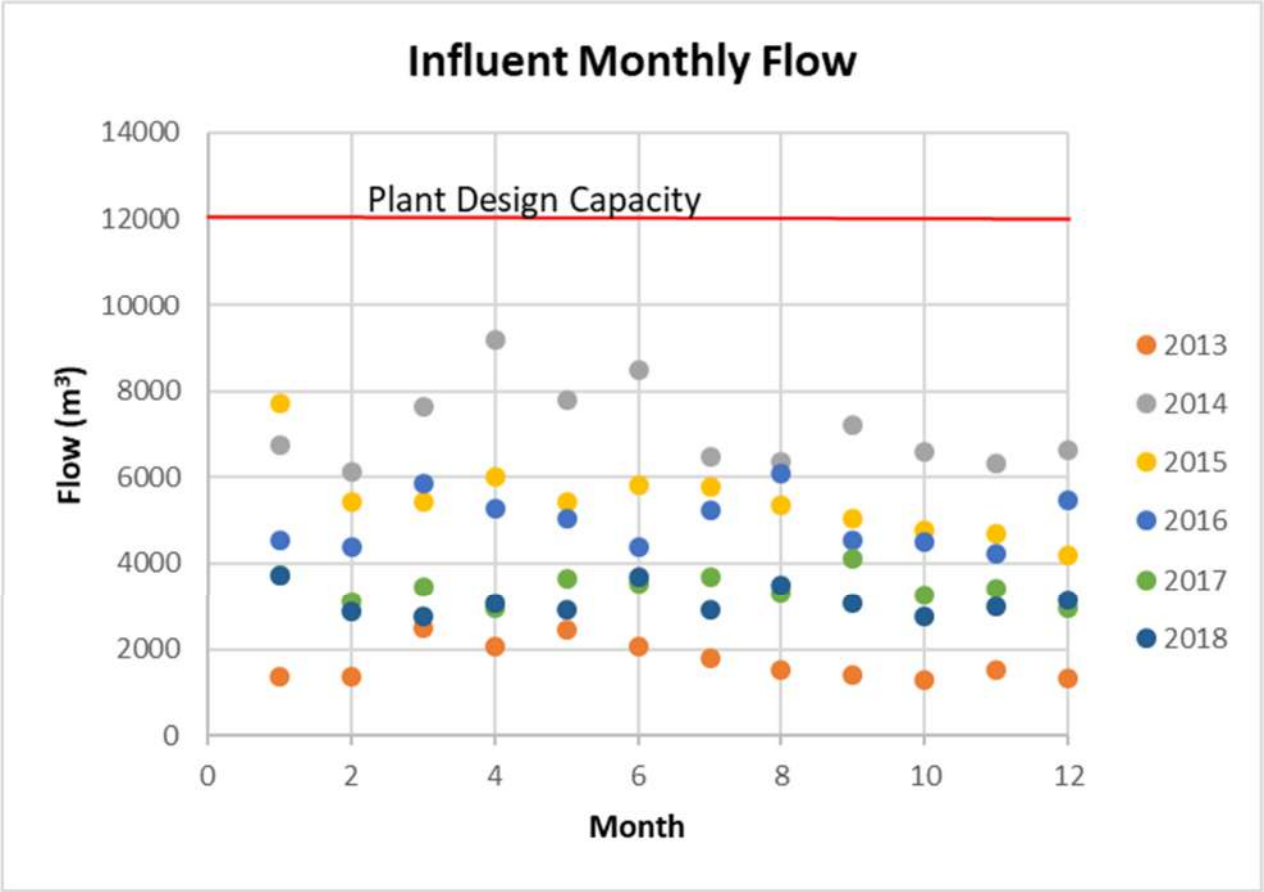
2.1.1 INFLUENT FLOWRATE

Per approval 494-03-00 dated March 6th, 2017, volume of flow is to be recorded daily. The values provided in Table 2-1 and Figure 2-1 are the total monthly flow rates as taken from the Village of Caroline Annual Wastewater Reports.

Table 2-1 Influent Total Monthly Flow Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
4303 m^3	9178 m^3	1281 m^3	8697m^3

Figure 2-1 Monthly Influent Flow Data



Assuming a constant flow and dividing the average monthly flow by 30 days, we get an average daily flow of 137 m^{3}/day. Even considering the maximum monthly flow of 9178 m^3/month, we get an average daily flow of 305.93 m^3/day. Both these values are less than the plant design capacity of 400 m^3/day or 12,000 m^3/month.

Furthermore, it is clear from the above figure that for the year 2013, the monthly influent flow was at an all-time low with an average monthly flow of value of 1715.75 m^3/month. The highest flow to the plant was observed in 2014 with an average monthly influent flow of 7130.17 m^3/month. Since 2014, the flow has been gradually decreasing and appears to be relatively consistent between 2017 and 2018 with an average flow of 3279.83 m^3/month. This average flow translates to roughly 110 m^3/day.

Additionally, the highest monthly average flow, from the year 2014 to 2018, is found to be during the months of April to June and this could be attributed to major snowmelt.

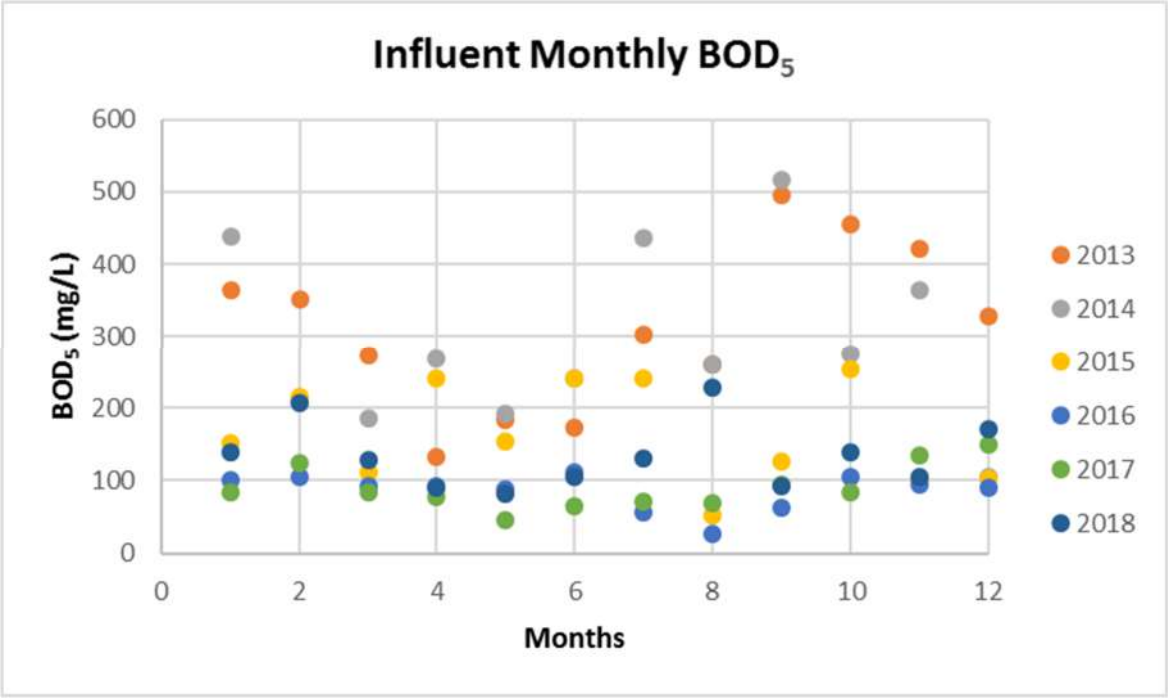
2.1.2 INFLUENT BOD_5

Per approval 494-03-00 dated March 6th, 2017, BOD_5 is to be recorded once a week by means of grab sample. The values presented in Table 2-2 and Figure 2-2 are the average monthly BOD_5 values. These values were taken from the Village of Caroline Annual Wastewater Reports.

Table 2-2 Influent Monthly BOD5 Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
179 mg/L	516 mg/L	27 mg/L	501 mg/L

Figure 2-2 Influent Monthly BOD5 Data



From Figure 2-2, it is apparent that since 2013, the influent BOD has been decreasing yearly. In 2013, the average influent BOD_5 was 312.06 mg/L and since then, it has dropped to 134.88 mg/L in 2018. It can also be seen that the BOD_5 tends to drop during the months of April to June. The drop is the BOD5 concentration during the months of April to June can be attributed to periods of high snow melt.

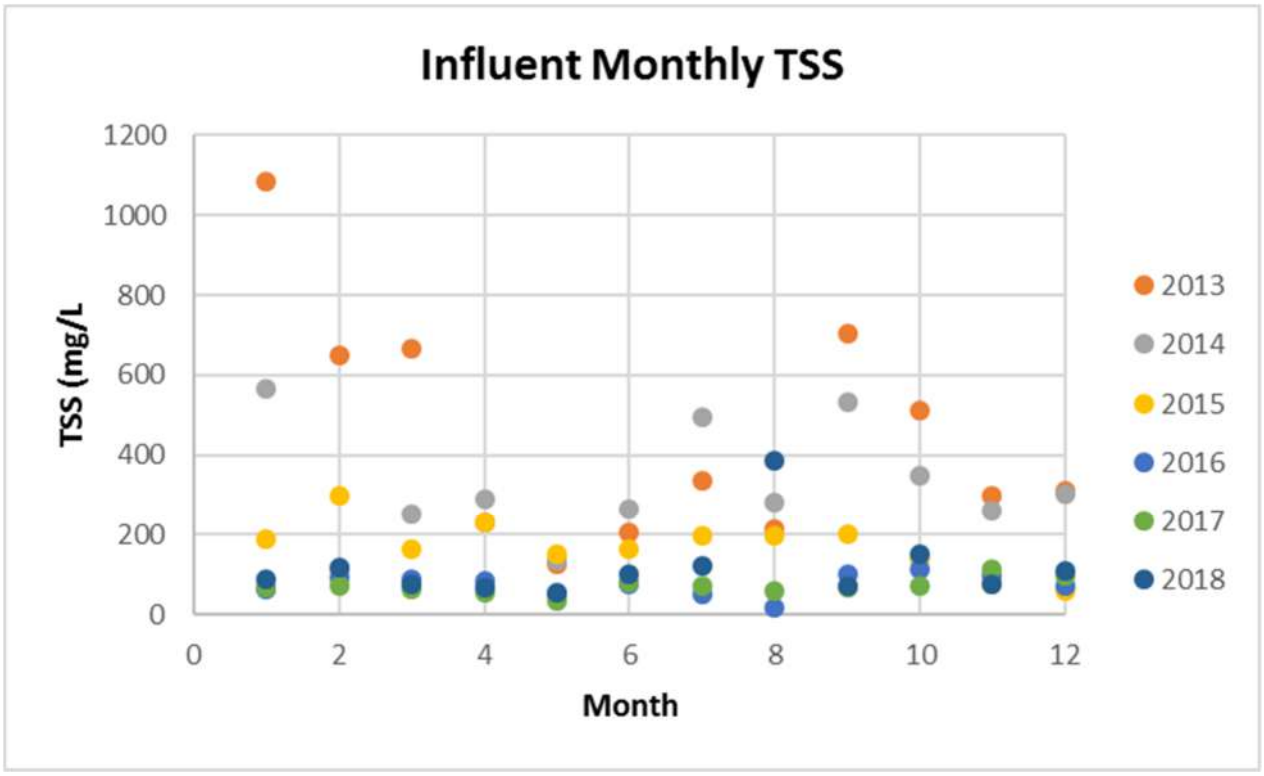
2.1.3 INFLUENT MONTHLY TSS

Per approval 494-03-00 dated March 6th, 2017, TSS is to be recorded once a week by means of grab sample. The values presented in Table 2-3 and Figure 2-3 are the average monthly TSS values as taken from the Village of Caroline Annual Wastewater Reports.

Table 2-3 Influent Monthly TSS Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
200 mg/L	1086 mg/L	16 mg/L	815 mg/L

Figure 2-3 Influent Monthly TSS Data



From Figure 2-3, it can be seen that since 2013, the influent TSS has been decreasing yearly. In 2013, the average TSS value was 445.46 mg/L and since then, it has dropped to 118.73 mg/L in 2018.

It can also be seen that the TSS concentration tends to drop during the months of April to June. This drop in concentration, during the months of April to June, is similar to that observed for the BOD5 as evident in Figure 2-2. The trend is opposite to the high influent flow rate as can be seen in Figure 2-1. In all three cases, the trend can be attributed to high snowmelt.

2.1.4 INFLUENT METAL CONCENTRATION

A single grab sample, for analysing metals in the influent, was taken on December 30th, 2019. The results are summarized in Table 2-4.

Table 2-4 Influent Metal Concentration

PARAMETER	CONCENTRATION
Total Mercury	0.002 µg/L
Total Aluminum	0.032 mg/L
Total Antimony	<0.006* mg/L
Total Arsenic	0.00030 mg/L
Total Barium	0.287 mg/L
Total Beryllium	<0.001* mg/L
Total Boron	0.07 mg/L
Total Cadmium	0.00013 mg/L

Total Chromium[+]	<0.008* mg/L
Total Cobalt	<0.002* mg/L
Total Copper	0.0296 mg/L
Total Iron	0.16 mg/L
Total Lead	0.0005 mg/L
Total Manganese	0.028 mg/L
Total Molybdenum	0.0010 mg/L
Total Nickel	0.0016 mg/L
Total Selenium	<0.006* mg/L
Total Silver	<0.00007* mg/L
Total Strontium	1.11 mg/L
Total Thallium	<0.0002* mg/L
Total Tin	<0.02* mg/L
Total Titanium	0.144 mg/L
Total Uranium	0.00057 mg/L
Total Vanadium	<0.0006* mg/L
Total Zinc	0.033 mg/L

* Metal concentration was below the Detection Limit

[+] Sum of Trivalent (Cr III) and Hexavalent (Cr VI)

2.1.5 INFLUENT HERBICIDE AND PESTICIDE CONCENTRATION

A single grab sample, for analysing herbicides and pesticides in the influent, was taken on December 30th, 2019. The results are summarized in Table 2-5.

Table 2-5 Influent Herbicide and Pesticide Concentration

PARAMETER	CONCENTRATION*
Phenoxyalkyl acid Pesticides	
3,5-dichlorobenzoic acid	<0.080 µg/L
Dicamba	<0.0050 µg/L
MCPP	<0.080 µg/L
MCPA	<0.020 µg/L
Dichlorprop	<0.080 µg/L
Bromoxynil	<0.020 µg/L
2,4-D	<0.050 µg/L

Pentachlorophenol	<0.080 µg/L
2,4,5-TP	<0.080 µg/L
2,4,5-T	<0.080 µg/L
Chloramben	<1.0 µg/L
Dinoseb (DNBP)	<0.020 µg/L
Bentazon	<0.080 µg/L
2,4-DB	<0.080 µg/L
Picloram	<0.080 µg/L
Diclofop-methyl	<0.080 µg/L
Organochlorine Pesticides	
Aldrin	<0.0030 µg/L
a-BHC	<0.0030 µg/L
b-BHC	<0.0030 µg/L
d-BHC	<0.0030 µg/L
a-Chlordane	<0.0030 µg/L
g-Chlordane	<0.0030 µg/L
Chlorothalonil	<0.0030 µg/L
o,p'-DDD	<0.0010 µg/L
o,p'-DDE	<0.0010 µg/L
o,p'-DDT	<0.0010 µg/L
p,p'-DDD	<0.0010 µg/L
p,p'-DDE	<0.0010 µg/L
p,p'-DDT	<0.0010 µg/L
Dieldrin	<0.0020 µg/L
Endosulfan I	<0.0030 µg/L
Endosulfan II	<0.0030 µg/L
Endosulfan Sulfate	<0.0030 µg/L
Endrin	<0.0050 µg/L
Endrin Aldehyde	<0.0030 µg/L
Endrin ketone	<0.0030 µg/L
Heptachlor	<0.0030 µg/L
Heptachlor Epoxide	<0.0030 µg/L
Hexachlorobenzene	<0.0030 µg/L

Hexachlorobutadiene	<0.0040 µg/L
Hexachlorocyclopentadiene	<0.010 µg/L
Hexachloroethane	<0.0030 µg/L
Lindane	<0.0030 µg/L
Methoxychlor	<0.0030 µg/L
Mirex	<0.0030 µg/L
Octachlorostyrene	<0.0030 µg/L
Oxychlordane	<0.0030 µg/L

* Guidelines values listed are the Long-Term (Chronic) values and are taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1: Surface water quality guidelines for the protection of freshwater aquatic life (PAL).

2.2 TREATED EFFLUENT WATER QUALITY

The Permit to Operate the Sewage Works (No. 494-03-00, dated March 6th, 2017) requires the monitoring of carbonaceous Biochemical Oxygen Demand (cBOD) and Total Suspended Solids (TSS) in the treated wastewater. The same permit however, establishes a compliance limit for carbonaceous Biochemical Oxygen Demand (cBOD) only.

Weekly grab samples were collected prior to discharge of the treated effluent wastewater to Raven River. Table 2-6 to Table 2-12 and Figure 2-4 to Figure 2-11 summarize the data taken from the Village of Caroline Annual Wastewater Reports, for the period starting from January 2013 and ending in December 2018. In the case of effluent flow, only data from January 2014 to December 2018 were available in the Village of Caroline annual Reports and they have been summarized in Table 2-6 and Figure 2-4.

The facility does not receive wastewater from any industry. Hence, sampling for hydrocarbons and other chemicals was not undertaken. Additionally, given that there have been no reported toxicity issues at the plant but as requested by the Alberta – Environment and Parks, two effluent grab samples, for analyzing metals, herbicides and pesticides, were collected on December 30th, 2019. The results are summarized in Table 2-13 and Table 2-14.

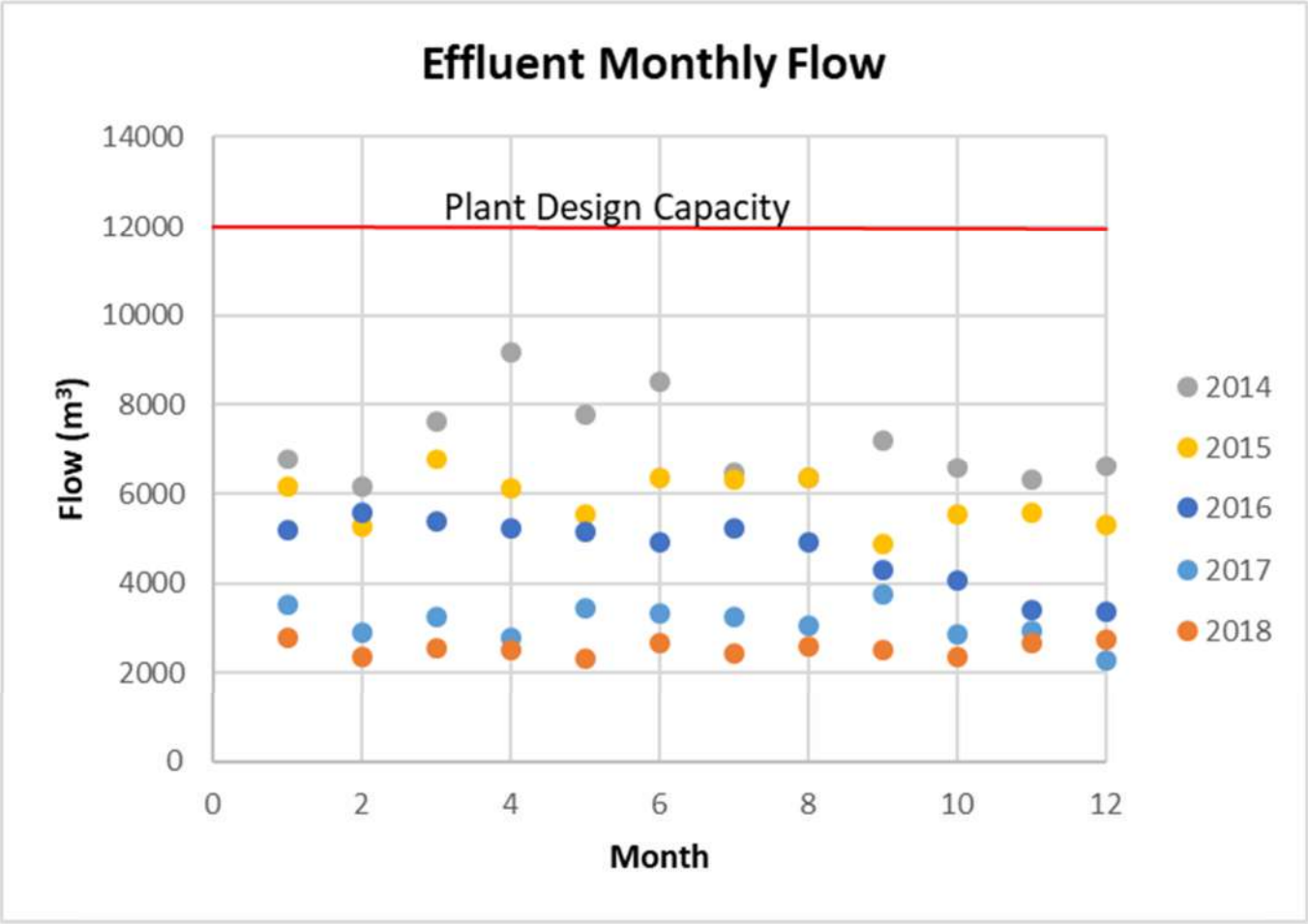
2.2.1 TREATED EFFLUENT FLOW

In January 2014, the Village of Carline started reporting of the volume flow of the treated effluent being discharged by the WWTP into the Raven River. The results are summarized in Table 2-6 and Figure 2-4.

Table 2-6 Effluent Monthly Flow Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
4671.6 m^3	9178 m^3	2265 m^3	8778.57 m^3

Figure 2-4 Effluent Monthly Flow Data



2.2.2 TREATED EFFLUENT cBOD

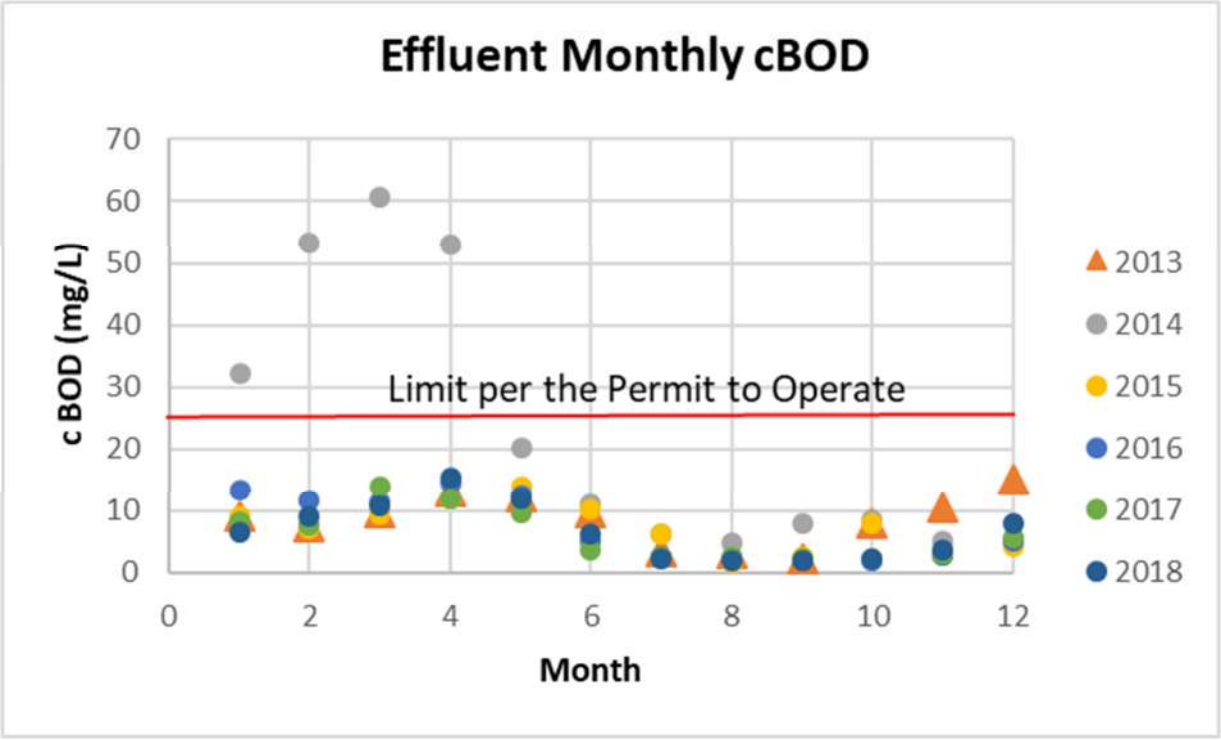
The Permit to Operate the Sewage Works (No. 494-03-00, dated March 6th, 2017) establishes a compliance limit for carbonaceous Biochemical Oxygen Demand (cBOD). The limit is set at less than or equal to 25 mg/L of monthly arithmetic mean of weekly grab samples collected.

Table 2-7 and Figure 2-5 provide a summary of the values taken from the Village of Caroline Annual Wastewater Reports. A combined number of three (3) data points from February to April of 2014 were deemed extraneous or suspect and accordingly were removed from the analysis shown in Table 2-7. They are shown in Figure 2-5.

Table 2-7 Effluent Monthly cBOD Data Summary

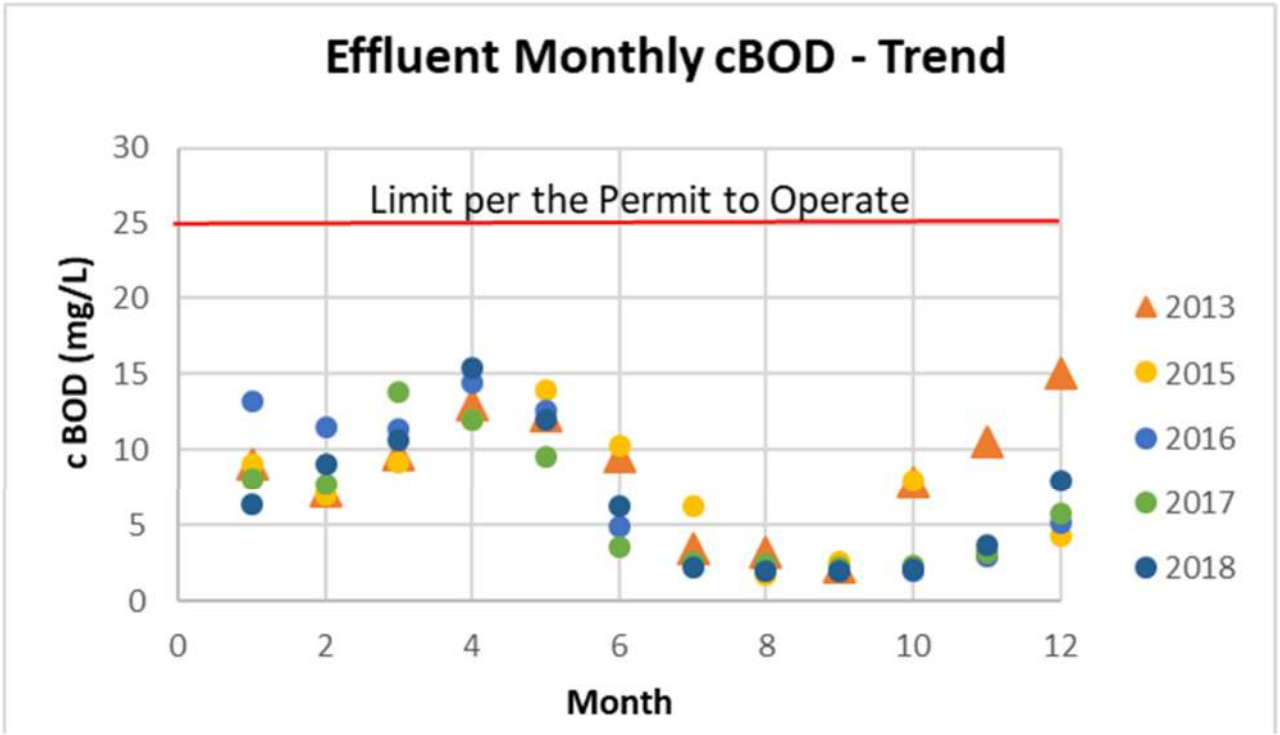
AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
7.9 mg/L	32 mg/L	1.72 mg/L	22.6 mg/L

Figure 2-5 Effluent Monthly cBOD Data



It can be seen in Figure 2-5 that, the cBOD is at the lowest during the months of July to September with an average value of 2 mg/L. Conversely, the highest cBOD concentration is observed in April and December. The average value during these two months is 12 mg/L. Figure 2-6 better shows this trend.

Figure 2-6 Effluent Monthly cBOD Trend



2.2.3 TREATED EFFLUENT TSS

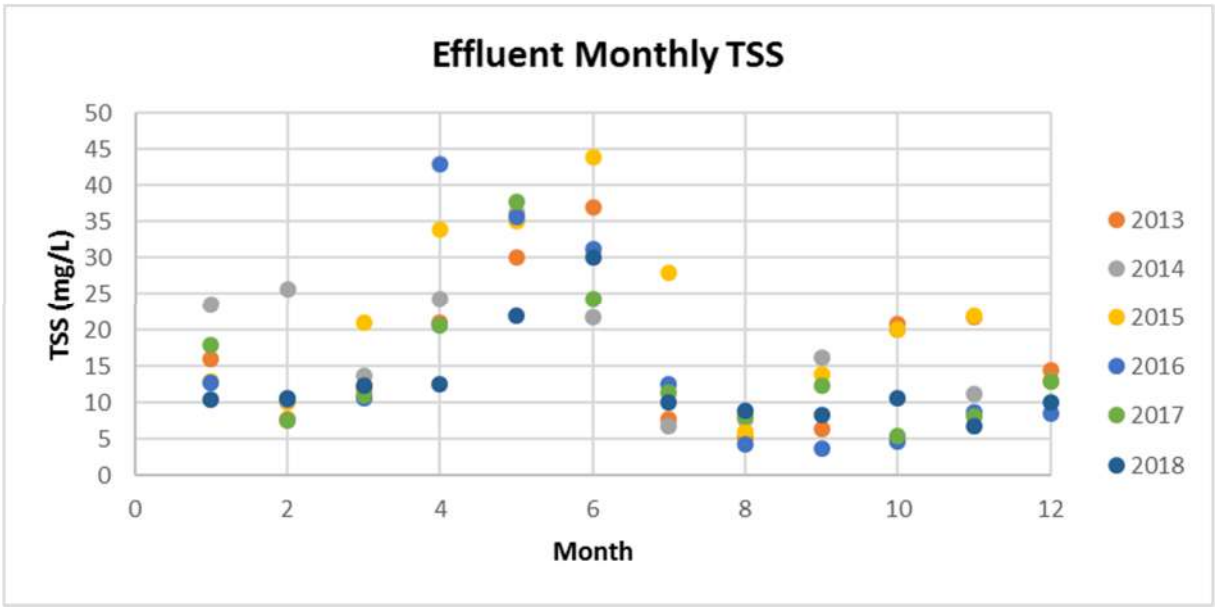
There is no limit set on the TSS in the effluent per the permit to operate sewage works (No. 494-03-00, dated March 6th, 2017). However, the CCME sets National Performance Standards as the minimum performance requirements for effluent quality from all municipal, community and government wastewater facilities that discharge municipal wastewater effluent to surface water. The National Performance Standards for TSS are 25 mg/L.

The TSS data collected from the Village of Caroline Annual Wastewater Reports, for the period from January 2013 to December 2018 is summarized in Table 2-8 and Figure 2-7.

Table 2-8 Effluent Monthly TSS Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
18.95 mg/L	44 mg/L	3.7 mg/L	43.26 mg/L

Figure 2-7 Effluent Monthly TSS Data



2.2.4 TREATED EFFLUENT DO

Dissolved Oxygen is the amount of gaseous oxygen (O_2) dissolved in the water. Oxygen enters the water by direct absorption from the atmosphere, by rapid movement, or as a waste product of plant photosynthesis. Water temperature and the volume of moving water can affect dissolved oxygen levels.

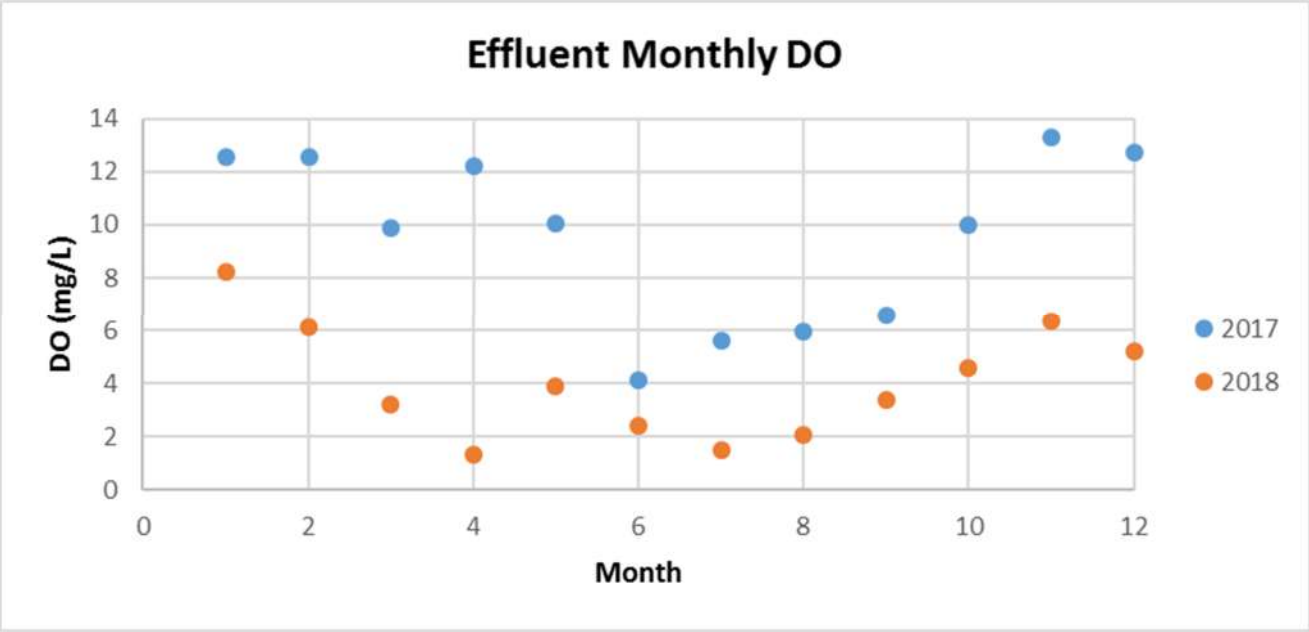
There is no limit set on the DO in the effluent per the permit to operate sewage works (No. 494-03-00, dated March 6th, 2017). However, per 'Surface Water Quality Guidelines for use in Alberta', the minimum Dissolved Oxygen to be maintained for the protection of freshwater aquatic life is 5.0 mg/L (Acute) and varies between 6.5 to 9.5 mg/L (Chronic). Further, per CCME guidelines, the limit is to be 5.5 – 9.15 mg/L.

The DO data collected from the Village of Caroline Annual Wastewater Reports, for the period from January 2017 to December 2018, is summarized in Table 2-9 and Figure 2-8.

Table 2-9 Effluent Monthly DO Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
6.82 mg/L	13.3 mg/L	1.3 mg/L	13.17 mg/L

Figure 2-8 Effluent Monthly DO Data



From Figure 2-8, the DO appears to drop in summer or during the months of June to August. During this period, the average DO in the effluent is around 2 mg/L. The DO is at its highest concentration from November to February with an average value of 9.5 mg/L. This is as expected since DO is heavily dependent on the temperature of water. In winter and early spring, when the water temperature is low, the dissolved oxygen concentration is high. In summer and fall, when the water temperature is high, the dissolved-oxygen concentration is low

2.2.5 TREATED EFFLUENT NH_3-N

The ionized ammonium ion (NH_4^+) and unionized ammonia molecule (NH_3) are interrelated through the below shown chemical equilibrium equation:

$$NH_4^+ - OH^- \leftrightarrow NH_3 \cdot H_2O \leftrightarrow NH_3 + H_2O$$ (Emerson et al. 1975; Russo 1985)

The concentration of total ammonia, often expressed on the basis of nitrogen as total ammonia-nitrogen or TAN, is the sum of NH_4^+ and NH_3 concentrations.

When ammonia is present in water at high enough levels, it is difficult for aquatic organisms to sufficiently excrete the toxicant, leading to toxic buildup in internal tissues and blood, and potentially death. Environmental factors, such as pH and temperature, can affect ammonia toxicity to aquatic animals.

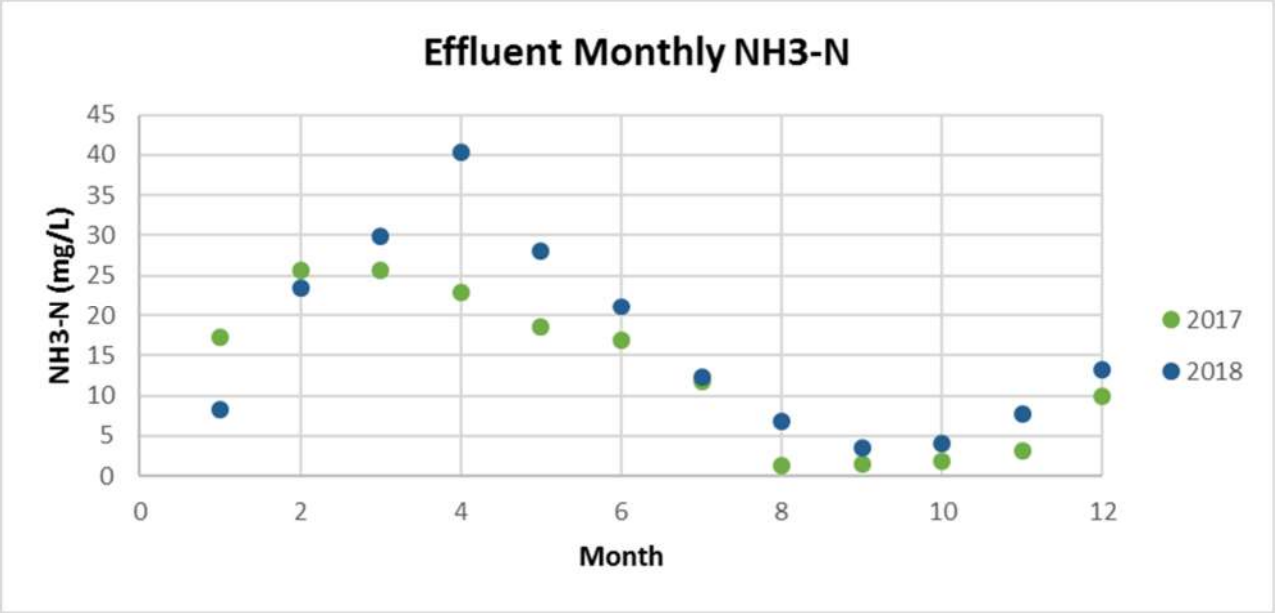
Ammonia varies in toxicity at different pH and temperature of the water. For instance, ammonia (NH_3) continually changes to ammonium (NH_4^+) and vice versa, with the relative concentrations of each depending on the water's
temperature and pH. At higher temperatures and higher pH, more of the nitrogen is in the toxic ammonia form than at lower pH.

The Ammonia-Nitrogen data, for the period of January 2017 to December 2018, taken from the Village of Caroline Annual Wastewater Report is summarized in the Table 2-10 and Figure 2-9.

Table 2-10 Effluent Monthly NH3-N Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
14.79 mg/L	40.3 mg/L	1.34 mg/L	37.91 mg/L

Figure 2-9 Effluent Monthly NH3- Data



From Figure 2-9, it is apparent that the concentration of Ammonia-Nitrogen in the effluent is consistent between the two years. Further, the NH_3-N concentration drops during the summer months and is highest during March-April. This corresponds to an average value of 30 mg/L. The lowest concentration is observed during August-October with an average value of 3.5 mg/L.

2.2.6 TREATED EFFLUENT TP

Phosphorus is an important parameter to consider as high concentrations in the effluent can result in eutrophication or algal blooms in the receiving water body. The TP data taken, for the period of January 2017 to December 2018, from the Village of Caroline Annual Wastewater Reports is summarized in Table 2-11 and Figure 2-10.

Table 2-11 Effluent Monthly TP Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
3.72 mg/L	5.32 mg/L	2.3 mg/L	5.32 mg/L

Figure 2-10 Effluent Monthly TP Data

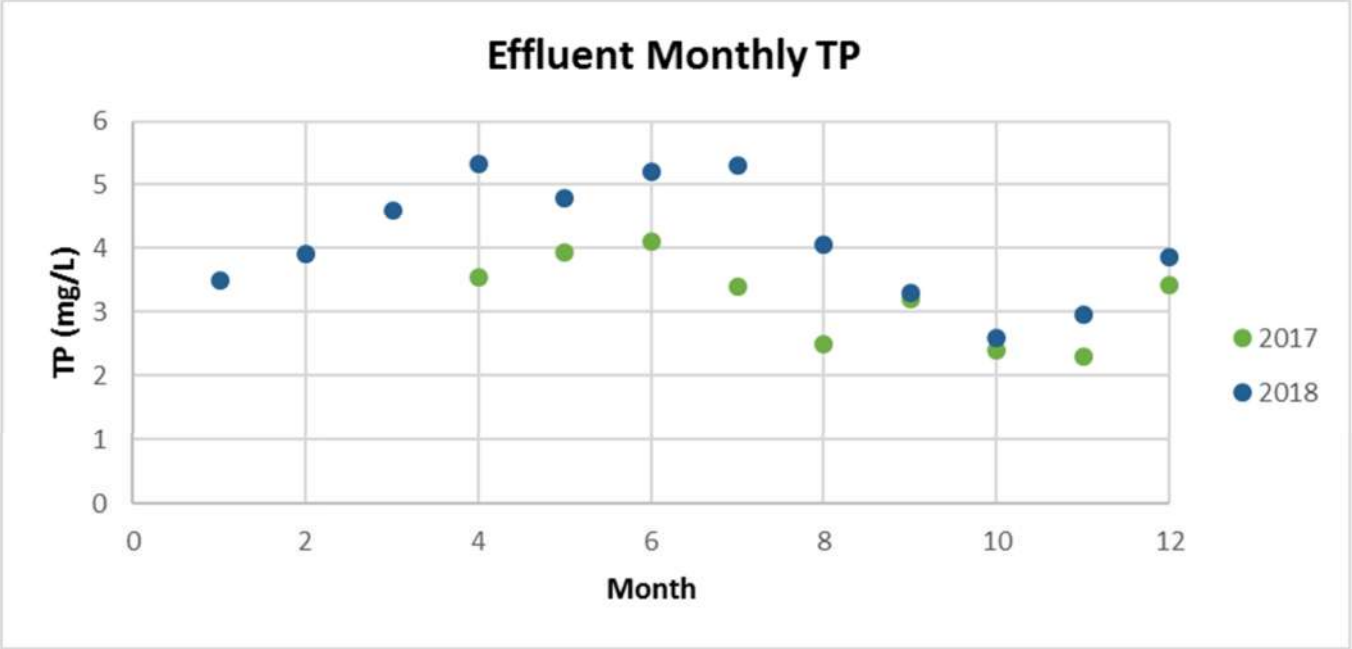


Figure 2-10 shows that the TP concentration is at its highest during the months of April to July. The average value during this period is 4.5 mg/L. The lowest average value corresponds to 2.7 mg/L and is during the months of October-November.

2.2.7 TREATED EFFLUENT UIA

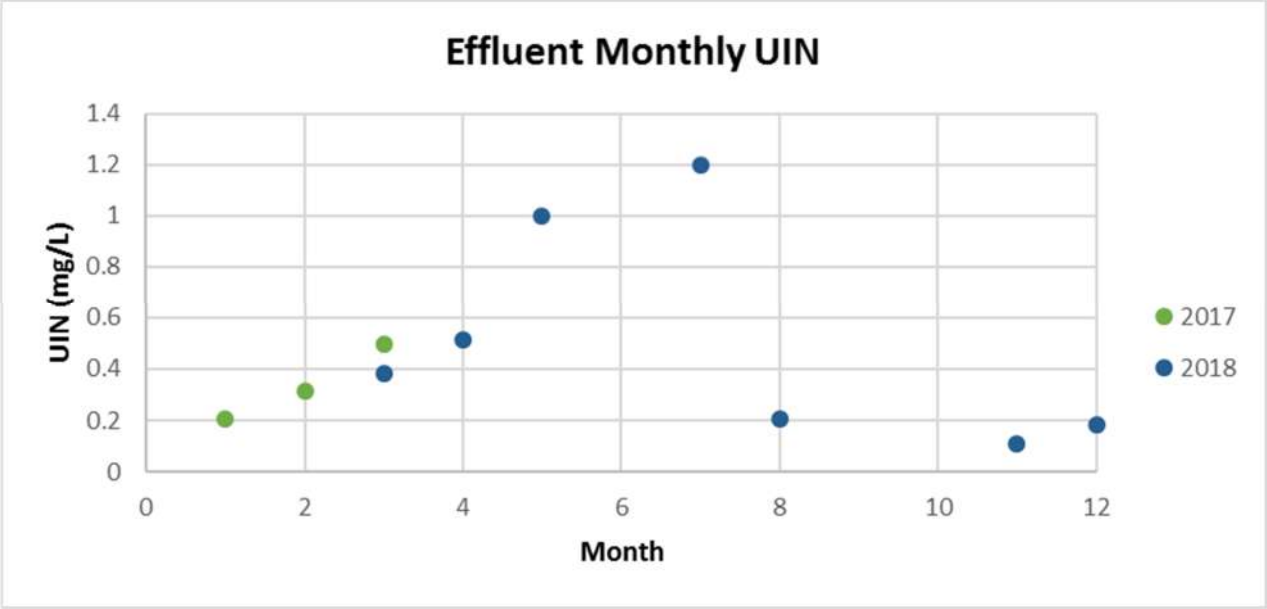
The percentage of un-ionized ammonia (UIA) in aqueous solution is a function of total ammonia concentration, pH, and water temperature. Per the Wastewater Systems Effluent Regulations (SOR/2012-139), part of the Fisheries Act, the maximum concentration of un-ionized ammonia in the effluent is to be less than 1.25 mg/L, expressed as nitrogen (N), at 15°C ± 1°C.

The un-ionized Ammonia data, for the period of January 2017 to December 2018, taken from the Village of Caroline Annual Wastewater Report is summarized in Table 2-12 and Figure 2-11.

Table 2-12 Effluent Monthly UIN Data Summary

AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
0.46 mg/L	1.2 mg/L	0.11 mg/L	1.18 mg/L

Figure 2-11 Effluent Monthly UIN Data



It is apparent from Figure 2-11 that, the effluent un-ionized ammonia concentration is below the prescribed limit of 1.25 mg/L.

2.2.8 TREATED EFFLUENT METAL CONCENTRATION

Two effluent grab sample, analyzed for metal concentrations, were collected on December 30th, 2019. The average concentration from the analysis is summarized in Table 2-13.

Table 2-13 Treated Effluent Metal Concentration

PARAMETER	CONCENTRATION	LIMIT [+]
Total Mercury	0.002 µg/L	0.013 µg/L
Total Aluminum	0.1105 mg/L	0.10[1] mg/L
Total Antimony	<0.006* mg/L	N/A
Total Arsenic	0.000965 mg/L	0.005^ mg/L
Total Barium	0.2075 mg/L	N/A
Total Beryllium	<0.001* mg/L	N/A
Total Boron	0.16 mg/L	29 mg/L
Total Cadmium	<0.00004* mg/L	0.0062[2] mg/L
Total Chromium[3]	<0.008* mg/L	0.0099 mg/L
Total Cobalt	0.004 mg/L	0.0016[4] mg/L
Total Copper	0.0047 mg/L	0.045[2] mg/L
Total Iron	0.37 mg/L	0.3^ mg/L
Total Lead	0.00045 mg/L	0.007[4] mg/L

Total Manganese	0.0945 mg/L	N/A
Total Molybdenum	0.0007 mg/L	0.073^ mg/L
Total Nickel	0.002 mg/L	1.15[2] mg/L
Total Selenium	<0.006* mg/L	0.002[5] mg/L
Total Silver	<0.00007* mg/L	0.00025^ mg/L
Total Strontium	1.06 mg/L	N/A
Total Thallium	<0.0002* mg/L	0.0008^ mg/L
Total Tin	<0.02* mg/L	N/A
Total Titanium	0.1605 mg/L	N/A
Total Uranium	0.000455 mg/L	0.033 mg/L
Total Vanadium	0.00105 mg/L	N/A
Total Zinc	0.013 mg/L	0.03^ mg/L

* Metal concentration was below the Detection Limit

⁺ Guidelines values listed are the Short-Term (Acute) values and are taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1: Surface water quality guidelines for the protection of freshwater aquatic life (PAL).

^ No Short-Term (Acute) value listed. Long-Term (Chronic) value listed instead.

1 Taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1.1 at a pH of 8.5 (Average for Raven River. Refer Table 3-7)

2 Taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1.3 at a hardness of 290 mg/L of $CaCO_3$.

3 Sum of Trivalent (Cr III) and Hexavalent (Cr VI)

4 Taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1.3 at a hardness of 290 mg/L of $CaCO_3$. No Short-Term (Acute) value listed. Long-Term (Chronic) value listed instead.

5 No Short-Term (Acute) value listed. The Long-Term (Chronic) Guideline is 0.002mg/L and the Alert Concentration is 0.001 mg/L.

It is evident from Table 2-13 that, with the exception of Aluminum, all the metal tested were less than the instream guideline. The average of the two effluent grab samples resulted in a concentration of 0.1105 mg/L as compared to an instream guideline of 0.101 mg/L. This is however not of concern bearing in mind the fact that the design effluent flow from the treatment plant is 1.1%, of the 7Q10 flow of Raven River, as discussed in Section 3.3, resulting in sufficient dilution.

2.2.9 TREATED EFFLUENT HERBICIDES AND PESTICIDES

Two effluent grab sample, analyzed for herbicides and pesticides, were collected on December 30th, 2019. The average concentration from the analysis is summarized in Table 2-14.

Table 2-14 Treated Effluent Herbicide and Pesticide Concentration

PARAMETER	CONCENTRATION*	LIMIT +
Phenoxyalkyl acid Pesticides		
3,5-dichlorobenzoic acid	<0.080 µg/L	N/A
Dicamba	<0.0050 µg/L	10 µg/L
MCPP	<0.080 µg/L	13 µg/L
MCPA	<0.020 µg/L	2.6 µg/L

Dichlorprop	<0.080 µg/L	N/A
Bromoxynil	<0.020 µg/L	5 µg/L
2,4-D	<0.050 µg/L	4 µg/L
Pentachlorophenol	<0.080 µg/L	0.5 µg/L
2,4,5-TP	<0.080 µg/L	N/A
2,4,5-T	<0.080 µg/L	N/A
Chloramben	<1.0 µg/L	N/A
Dinoseb (DNBP)	<0.020 µg/L	0.05 µg/L
Bentazon	<0.080 µg/L	N/A
2,4-DB	<0.080 µg/L	25 µg/L
Picloram	<0.080 µg/L	29 µg/L
Diclofop-methyl	<0.080 µg/L	6.1 µg/L
Organochlorine Pesticides		
Aldrin	<0.0030 µg/L	N/A
a-BHC	<0.0030 µg/L	N/A
b-BHC	<0.0030 µg/L	N/A
d-BHC	<0.0030 µg/L	N/A
a-Chlordane	<0.0030 µg/L	N/A
g-Chlordane	<0.0030 µg/L	N/A
Chlorothalonil	<0.0030 µg/L	0.18 µg/L
o,p'-DDD	<0.0010 µg/L	N/A
o,p'-DDE	<0.0010 µg/L	N/A
o,p'-DDT	<0.0010 µg/L	N/A
p,p'-DDD	<0.0010 µg/L	N/A
p,p'-DDE	<0.0010 µg/L	N/A
p,p'-DDT	<0.0010 µg/L	N/A
Dieldrin	<0.0020 µg/L	N/A
Endosulfan I	<0.0030 µg/L	0.003 µg/L
Endosulfan II	<0.0030 µg/L	0.003 µg/L
Endosulfan Sulfate	<0.0030 µg/L	0.003 µg/L
Endrin	<0.0050 µg/L	N/A
Endrin Aldehyde	<0.0030 µg/L	N/A
Endrin ketone	<0.0030 µg/L	N/A

Heptachlor	<0.0030 µg/L	N/A
Heptachlor Epoxide	<0.0030 µg/L	N/A
Hexachlorobenzene	<0.0030 µg/L	N/A
Hexachlorobutadiene	<0.0040 µg/L	N/A
Hexachlorocyclopentadiene	<0.010 µg/L	N/A
Hexachloroethane	<0.0030 µg/L	N/A
Lindane	<0.0030 µg/L	0.01 µg/L
Methoxychlor	<0.0030 µg/L	0.03 µg/L
Mirex	<0.0030 µg/L	0.001 µg/L
Octachlorostyrene	<0.0030 µg/L	N/A
Oxychlordane	<0.0030 µg/L	N/A

+ Guidelines values listed are the Long-Term (Chronic) values and are taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018, Table 1: Surface water quality guidelines for the protection of freshwater aquatic life (PAL).

2.3 LAGOON WATER QUALITY

As requested by Alberta Environment and Parks, the water in the lagoon was sampled from May 2018 to August 2018. The data for Carbonaceous Biological Demand (cBOD) and Total Suspended Solids (TSS) concentrations from the three (3) collected lagoon samples are summarized in Table 2-15 along with the average value of other parameters such as conductivity, DO, pH, Total Phosphorus, Total Kjeldahl Nitrogen, Total Ammonia.

Table 2-15 Lagoon water quality data Summary

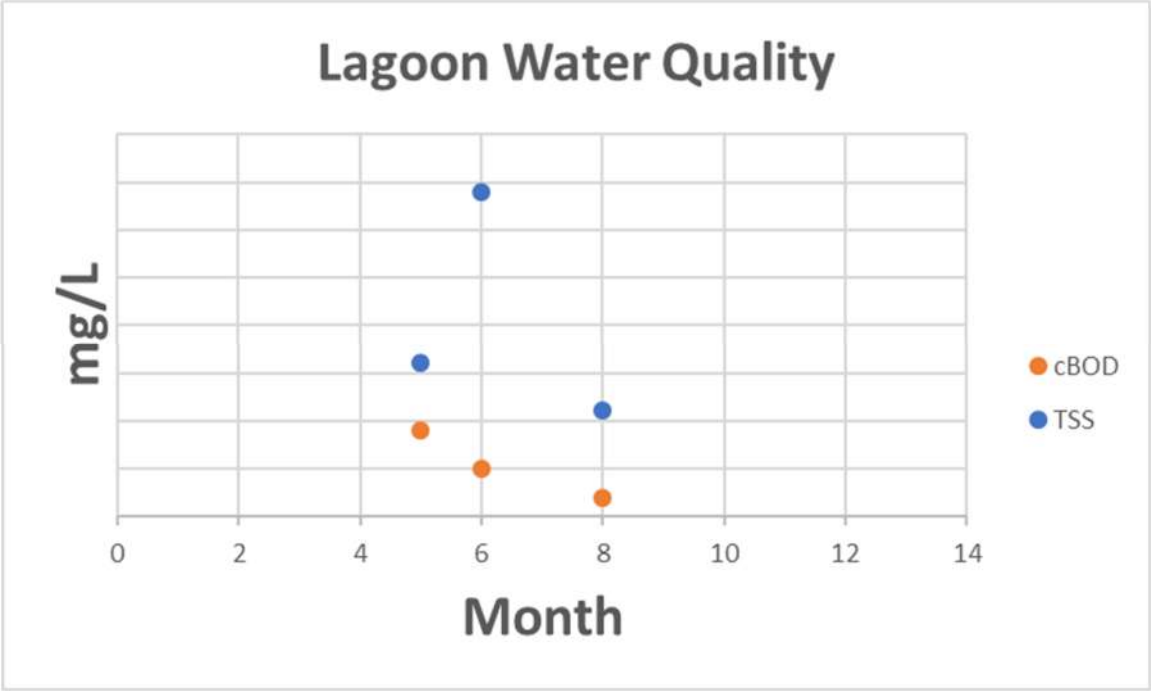
PARAMETER	AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
cBOD (mg/L)	5.33	9	2	8.92
TSS (mg/L)	20.33	34	11	33.64
Electrical Conductivity (uS/cm)	1153.33	1200	1110	1199
Dissolved Oxygen (mg/L)	4.17	5.6	3.4	5.56
pH	8.09	8.3	7.92	8.29
Total Phosphorus (mg/L)	4.92	5.59	4.16	5.58
Total Nitrogen* (mg/L)	12.29	23.72	2.3	23.46
Total Kjeldahl Nitrogen** (mg/L)	11.4	23.7	0.5	23.43
Total Ammonia*** (mg/L)	18.8	N/A	N/A	N/A

* Only three data points are available for this parameter. Total Nitrogen was calculated as the sum of Total Kjeldahl Nitrogen and Nitrate-Nitrite Nitrogen.

** Only three data points are available for this parameter.

*** Only one sample (dated 05/09/2018) was tested for Total Ammonia.

Figure 2-12 Lagoon water quality data



3 RECEIVING WATER QUALITY

Representative water quality conditions in the Raven River were identified by examining water quality data collected in the vicinity (both upstream and downstream) of the WWTP outfall. The Permit to Operate the Sewage Works (No. 494-03-00) establishes a compliance limit for carbonaceous Biochemical Oxygen Demand (cBOD). There is currently no limit for suspended solids, total ammonia, total phosphorus, etc. Furthermore, the Village of Caroline WWTP has an approved average day flow capacity of 400 m^3/d which corresponds to a facility size classification as per the CCME Technical Supplement 3 of "very small". For a "very small" wastewater treatment plant, the potential substances of concern include cBOD5, TSS, TAN, TP, TKN, etc. The water quality parameters examined as part of this study include:

- Carbonaceous Biochemical Oxygen Demand (cBOD);
- Total Suspended Solids (TSS);
- Total Ammonia-Nitrogen
- Total Phosphorus
- Total Kjeldahl Nitrogen
- pH
- Dissolved Oxygen

Total Residual Chlorine (TRC) is not being reviewed and was not included in the list above as no chlorine is added in the wastewater treatment plant.

Twelve (12) samples, were collected during a period of ten (10) months, to initially characterize and identify substances of concern in Raven River. Samples were collected from December 2017 to September 2018. The results of the potential substances of concern are summarized in Sections 3.1.1 to 3.1.8.

3.1 RIVER WATER QUALITY

Since there was insufficient available data to characterize the existing conditions in the river and to complete the analysis for the risk assessment, additional field data collection was required and performed.

As mentioned in Section 1.2, three (3) water quality sampling locations along the river were sampled: one upstream and two downstream of the WWTP outfall. At each of the selected locations, grab samples were collected and tested over a ten (10) month period. The results are summarized in Sections 3.1.1 to 3.1.8.

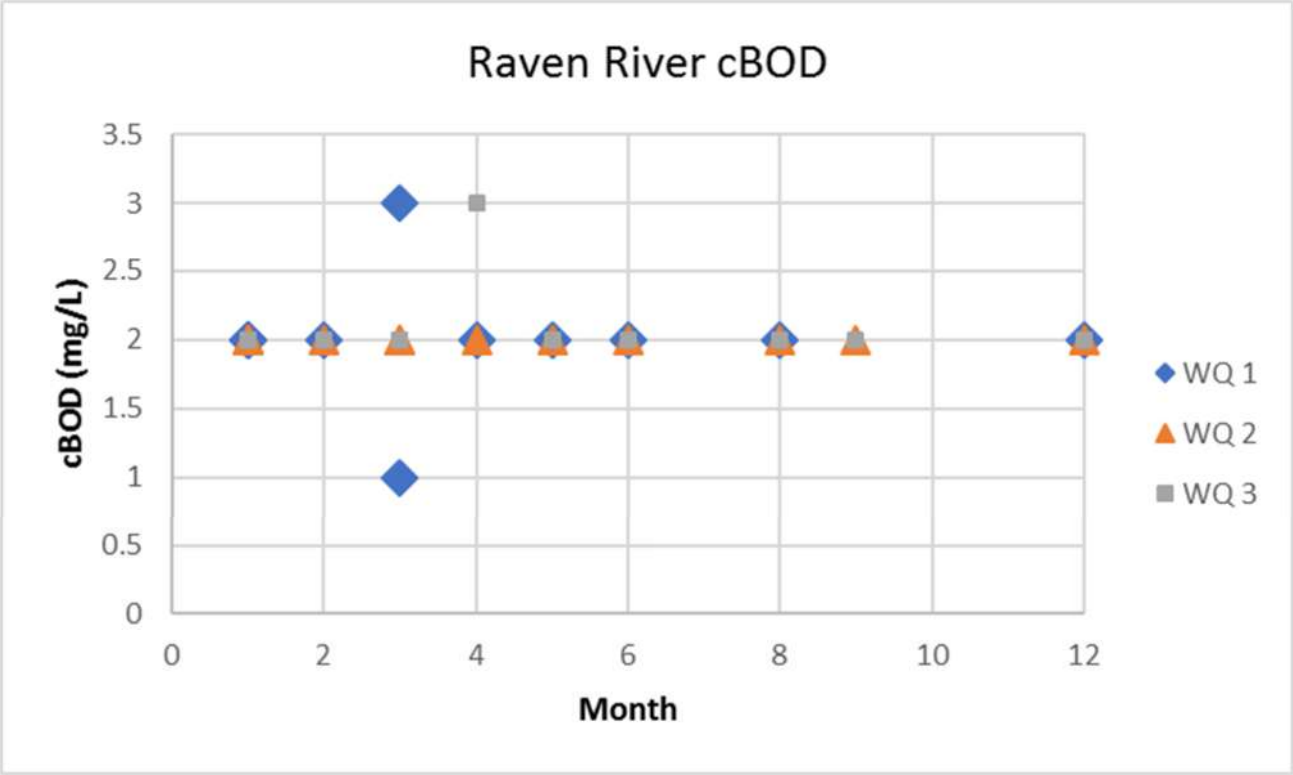
3.1.1 CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND (cBOD)

The cBOD concentrations from the 12 samples tested at the three locations, in Raven River, is summarized in Table 3-1 and Figure 3-1. Table 3-1 shows that, the average cBOD concentration, at all three sampled locations, is 2mg/L.

Table 3-1 Raven River cBOD Data Summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	2	3	1	2.89
WQ 2	2	2	2	2
WQ 3	2.08	3	2	2.89

Figure 3-1 Raven River cBOD Data



From Figure 3-1, it is apparent that, the effluent from the treatment plant has a minimal effect on the cBOD of Raven River.

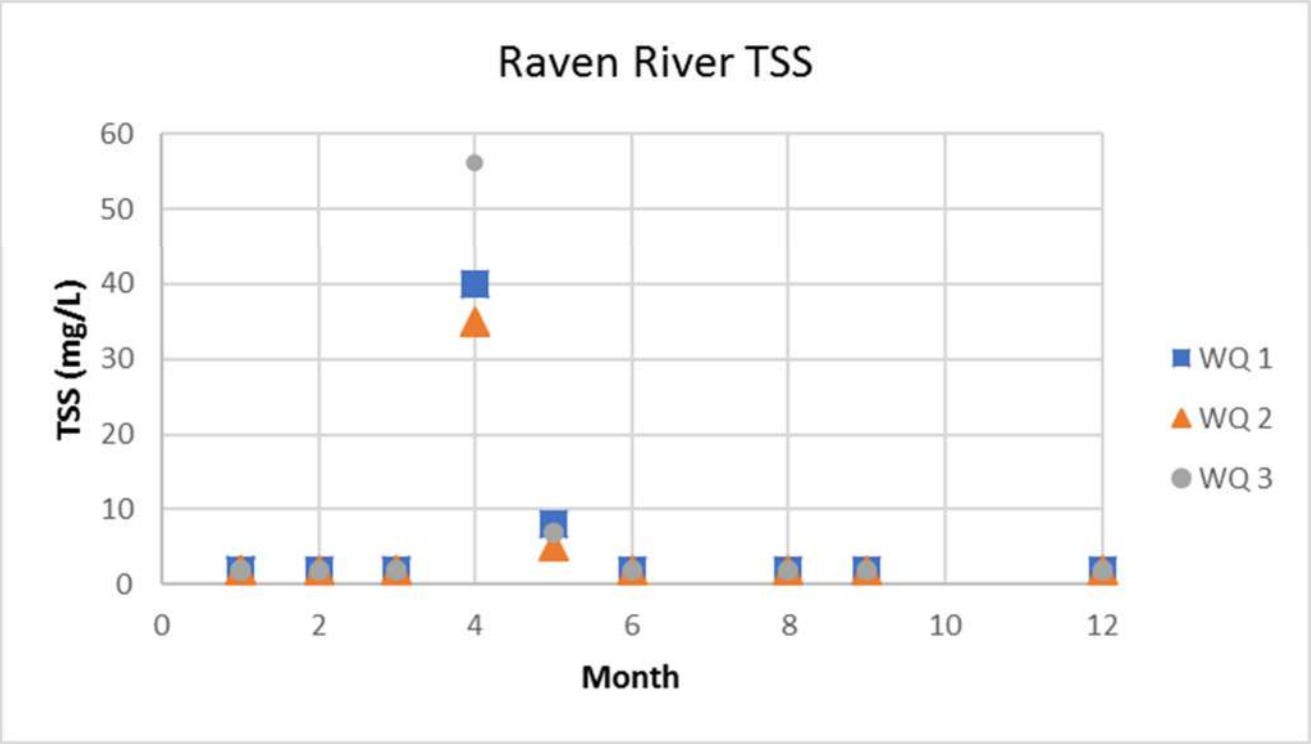
3.1.2 TOTAL SUSPENDED SOLIDS

The TSS concentration, in Raven River, is summarized in Table 3-2 and Figure 3-2.

Table 3-2 Raven River TSS Data Summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	2.55	8	2	7.4
WQ 2	2.27	5	2	4.7
WQ 3	2.45	7	2	6.5

Figure 3-2 Raven River TSS Data



Three data points (taken at the three locations on 04/25/2018) were deemed extraneous or suspect and accordingly were removed from the analysis presented in Table 3-2. Samples from this day correspond to major snowmelt periods and could be a reason for the observed spike in TSS. The values are however, shown in Figure 3-2.

From Figure 3-2, it is clear that Raven River is unaffected by the discharge of effluent. This can be seen by the minimal change in the TSS concentration upstream and downstream of the discharge.

3.1.3 TOTAL AMMONIA

As per the 'Water Quality Based Effluent Limits Procedure Manual', the maximum limit, for ammonia, is typically represented by the 85th percentile and not the 99th percentile as in all the other substances. A higher background representation is justifiable, such as the 85th percentile since, ammonia is such a fast-acting toxicant.

Referring Table 3.2 from the '*Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems'* (March 2013), for populations greater than 20,000, (Village of Caroline estimates a population of 1,810 in 2041 considering a high growth rate of 5.18%) NH_3-N is of importance. The samples collected between April 2018 and September 2018 were analyzed and reported as Total Ammonia in Table 3-3 and Figure 3-3.

Table 3-3 Raven River Total Ammonia summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	0.07	0.1	0.05	0.09
WQ 2	0.05	0.05	0.05	0.05
WQ 3	0.05	0.05	0.05	0.05

Figure 3-3 Raven River Total Ammonia data

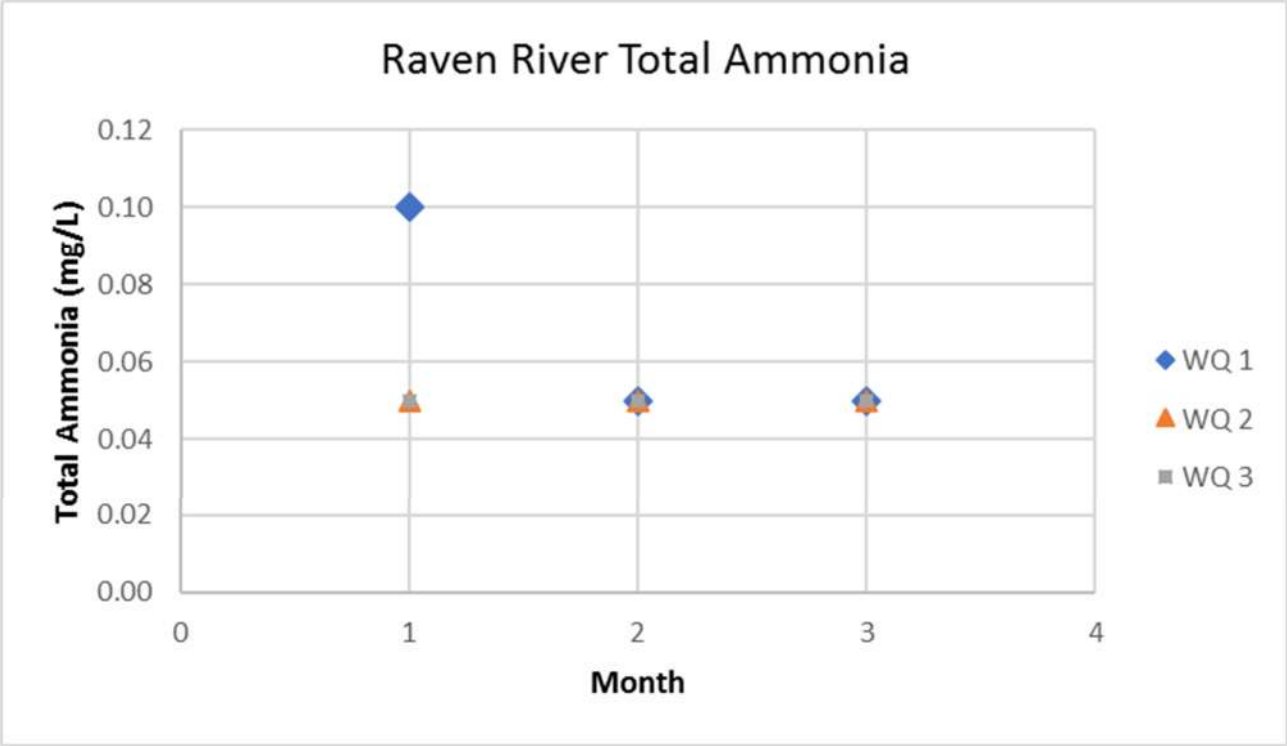


Figure 3-3 shows the that the effluent from the treatment plant has a minimal or negligible impact on the total ammonia concentration in Raven River. The concentration at both locations downstream of the effluent discharge are 0.05 mg/L.

3.1.4 TOTAL PHOSPHORUS

Total Phosphorus is an important parameter to consider, as excess concentration can lead to eutrophication (growth of algae and other aquatic plants) in the water body, thereby, negatively impacting the ecosystem. Table 3-4 and Figure 3-4 summarize the concentration of Total Phosphorus in the three sampling locations along Raven River.

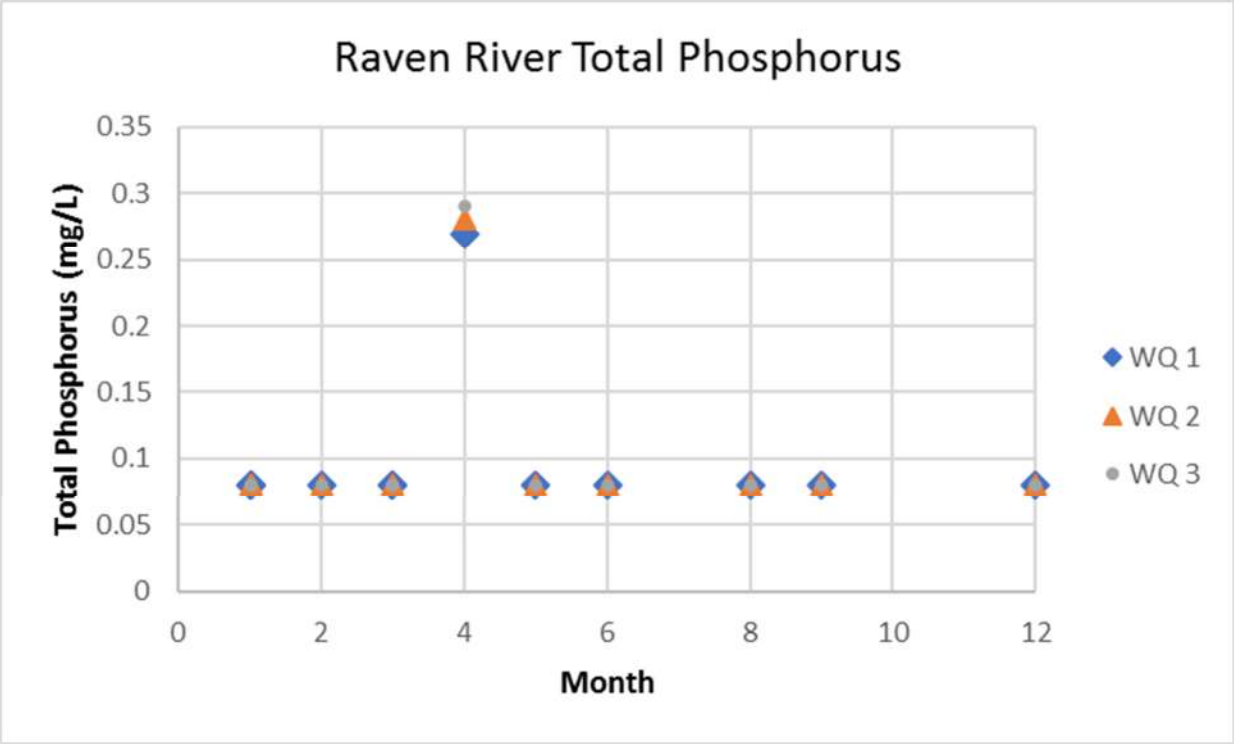
Table 3-4 Raven River Total Phosphorus summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)

WQ 1	0.096	0.27	0.08	0.249
WQ 2	0.096	0.28	0.08	0.258
WQ 3	0.097	0.29	0.08	0.267
AVERAGE				0.258

As per the Environmental Quality Guidelines for Alberta Surface Waters (dated March 28, 2018), the previously published values of 0.05 mg/L for total phosphorus has been withdrawn. The phosphorus concentration is to be maintained so as to prevent detrimental changes to the aquatic ecosystem. We are therefore considering the guideline, for total phosphorus, to be 0.29 mg/L.

Figure 3-4 Raven River Total Phosphorus data



The data summarized in Total Phosphorus is an important parameter to consider, as excess concentration can lead to eutrophication (growth of algae and other aquatic plants) in the water body, thereby, negatively impacting the ecosystem. Table 3-4 and Figure 3-4 summarize the concentration of Total Phosphorus in the three sampling locations along Raven River.

indicates that the concentration of phosphorus, both upstream and downstream of the treatment plant are the same. This indicates that the effluent has minimal or no affect on the total phosphorus concentration on Raven River.

3.1.5 TOTAL NITROGEN

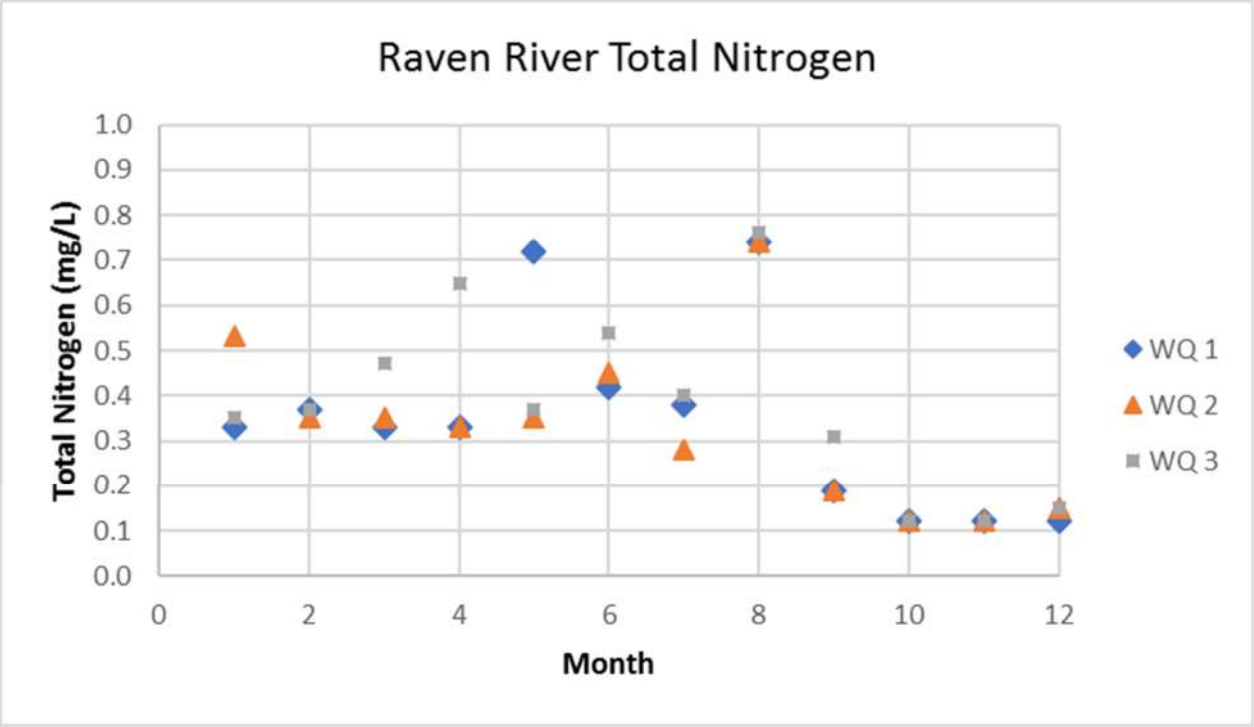
Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), organic nitrogen and ammonia (all expressed as N). The Total Nitrogen data is presented in Table 3-5 and Figure 3-5.

As per the Environmental Quality Guidelines for Alberta Surface Waters (dated March 28, 2018), the previously published values of 1.0 mg/L for total nitrogen has been withdrawn. The nitrogen concentration is to be maintained so as to prevent detrimental changes to the aquatic ecosystem and we are hence considering a guideline of 0.7 mg/L.

Table 3-5 Raven River Total Nitrogen summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	0.35	0.7	0.12	0.74
WQ 2	0.33	0.7	0.12	0.72
WQ 3	0.38	0.8	0.12	0.75
AVERAGE				0.736

Figure 3-5 Raven River Total Nitrogen data



The data summarized in Table 3-5 and Figure 3-5 indicate a maximum Total nitrogen concentration during summer months corresponding to the period between April to August. Furthermore, those values show that, the Total Nitrogen concentration of Raven River is unaffected by the effluent discharge. It is also worth noting that the Total Nitrogen concentration was well below the limit of 1.0 mg/L for all the samples collected at the three locations along the river.

3.1.6 TOTAL KJELDAHL NITROGEN

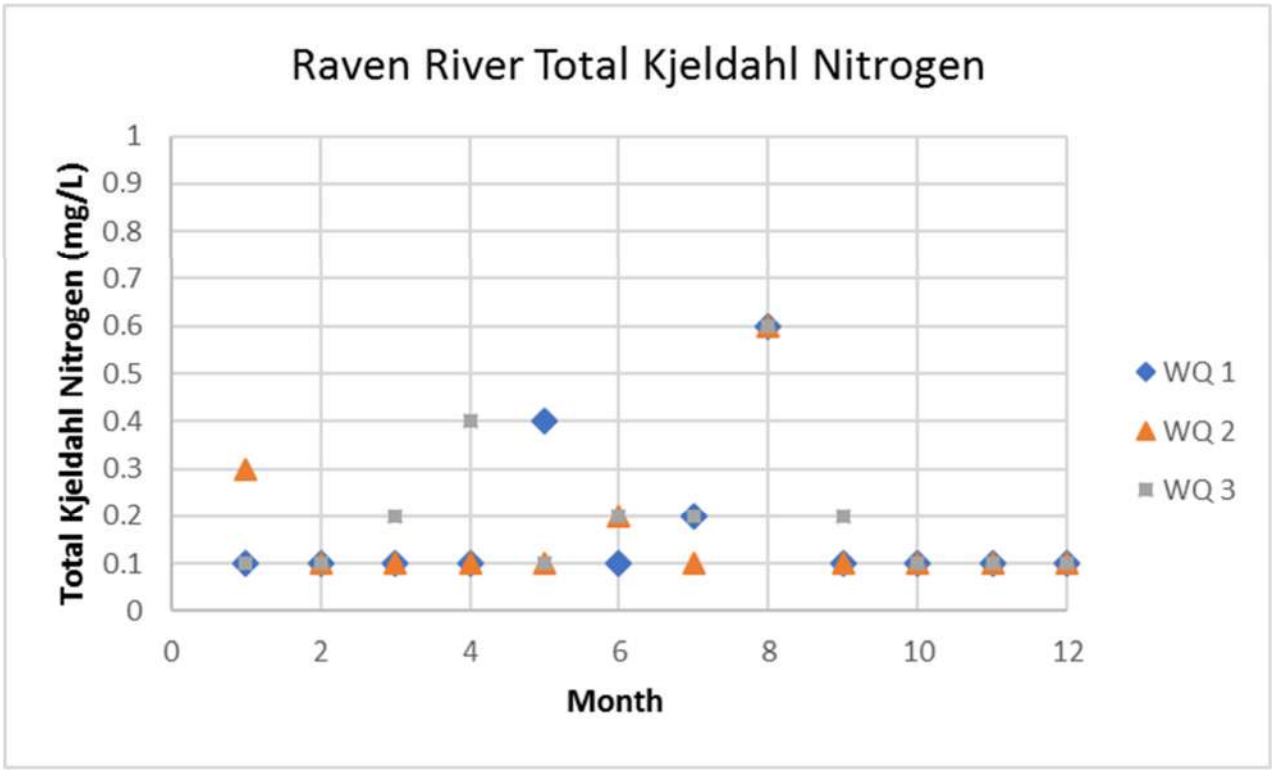
TKN (Total Kjeldahl Nitrogen) is the total concentration of organic nitrogen and ammonia. In other words, TKN analysis provides the opportunity to quantify the amount of nitrogen contained in organic form which is essential for all living organisms to function.

The Total Kjeldahl Nitrogen data collected from the various sampling locations along the river is summarized in Table 3-6 and Figure 3-6.

Table 3-6 Raven River Total Kjeldahl Nitrogen summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	0.18	0.60	0.10	0.58
WQ 2	0.17	0.60	0.10	0.57
WQ 3	0.20	0.60	0.10	0.58

Figure 3-6 Raven River Total Kjeldahl Nitrogen data



The TKN concentration of Raven River is fairly stable and on an average 0.1 mg/L. There was however a spike observed in August, both upstream and downstream of the treatment plant. The average value in August rose to 0.6 mg/L.

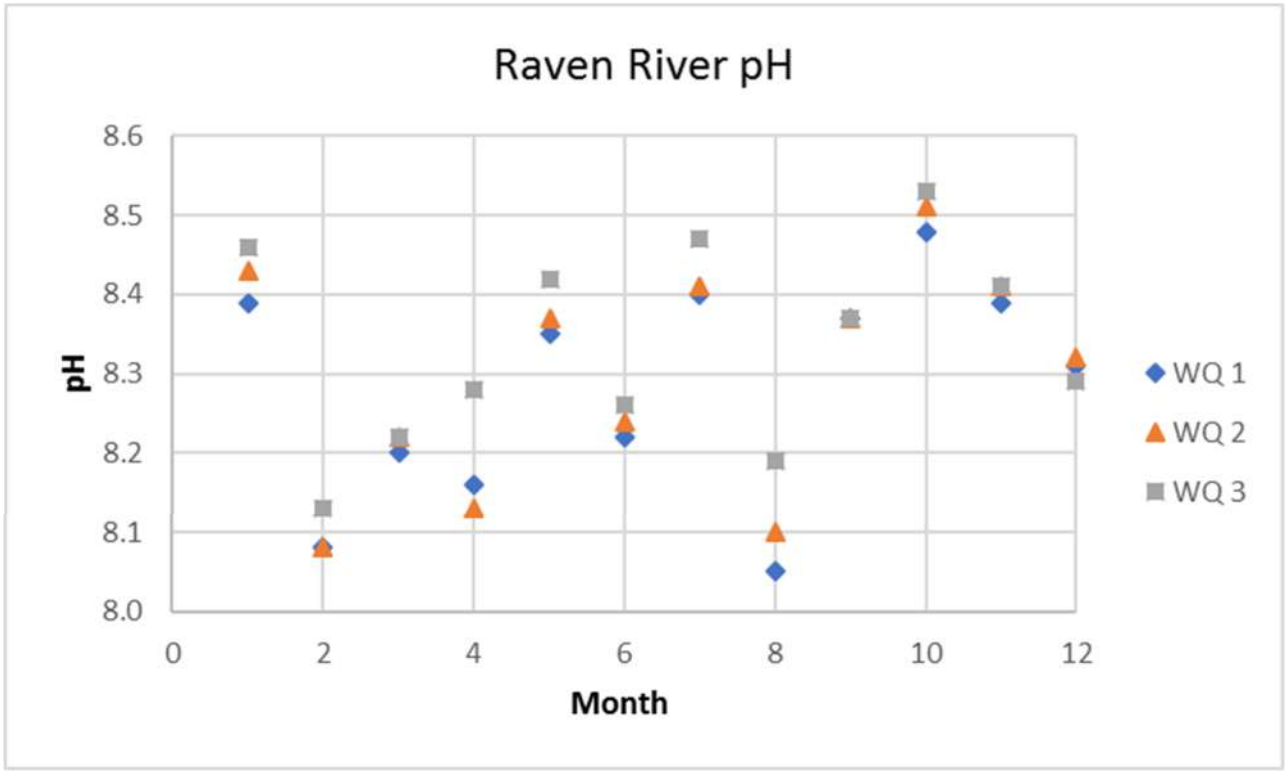
3.1.7 pH

The details of the pH taken from the three (3) sampling points along the river are summarized in the Table 3-7 and Figure 3-7.

Table 3-7 Raven River pH summary

SAMPLE LOCATION	AVERAGE	MAXIMUM	MINIMUM	99TH PERCENTILE
WQ 1	8.28	8.48	8.05	8.47
WQ 2	8.30	8.51	8.08	8.50
WQ 3	8.34	8.53	8.13	8.52

Figure 3-7 Raven River pH data



The pH of Raven River varies between 8 to 8.5. The average value of the pH upstream of the treatment plant is 8.28. The pH marginally increases to 8.3 in the sampling location 160m downstream of the treatment plant. At the third sampling point, located 800m downstream of the treatment plant, the pH was 8.34.

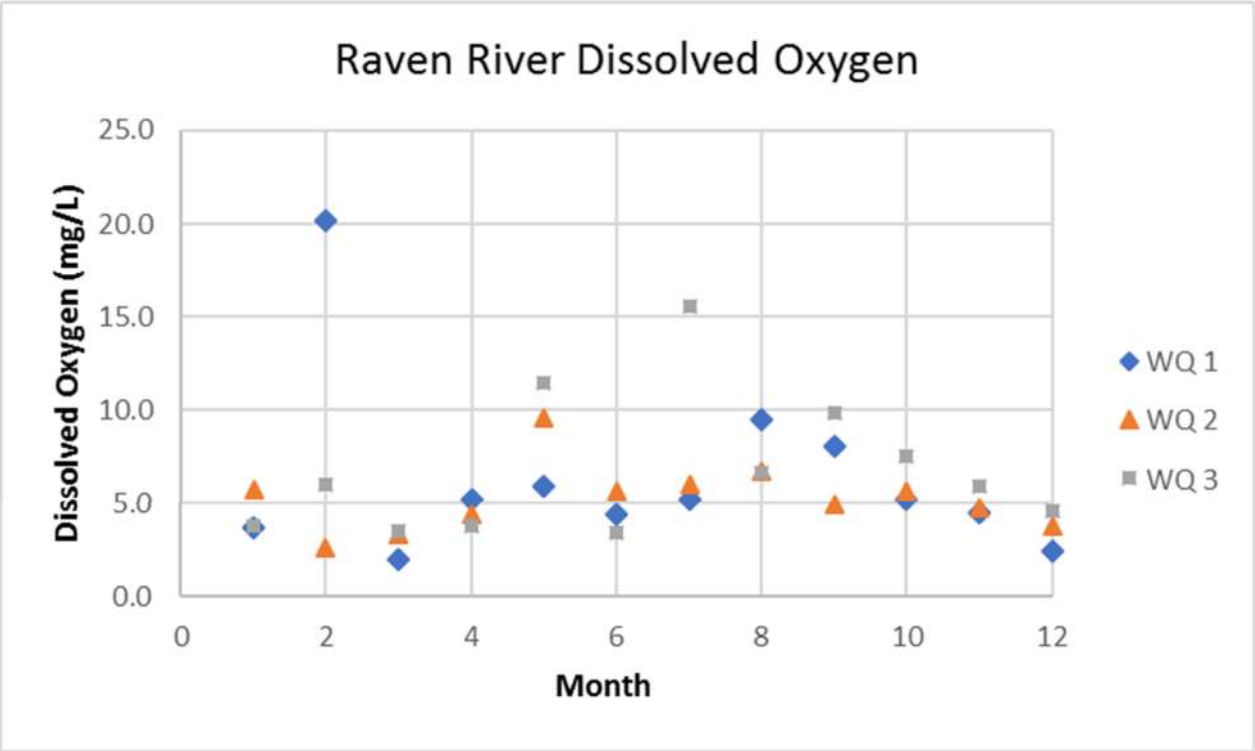
3.1.8 Dissolved Oxygen

The details of the Dissolved Oxygen taken from the three (3) sampling points along the river are summarized in the Table 3-8 and Figure 3-8. As per *'Surface Water Quality Guidelines for use in Alberta'*, the minimum Dissolved Oxygen is to be 5.0 mg/L. This is maintained throughout the river.

Table 3-8 Raven River Dissolved Oxygen summary

SAMPLE LOCATION	AVERAGE (mg/L)	MAXIMUM (mg/L)	MINIMUM (mg/L)	99TH PERCENTILE (mg/L)
WQ 1	6.35	20.20	2	19.02
WQ 2	5.25	9.6	2.6	9.28
WQ 3	6.82	15.5	3.40	15.05

Figure 3-8 Raven River Dissolved Oxygen Data



It can be seen from Table 3-8 and Figure 3-8 that, for the most part, a DO of 5 mg/L is maintained throughout the river all year round. The highest DO value was observed upstream in February while the lowest value was also observed at the same sampling location, upstream in March.

There are instances when the DO, upstream of the discharge, drops below 5 mg/L, resulting in a low concentration downstream.

3.2 RAVEN RIVER FLOW RATE

A continuous water quantity monitoring program was completed to support the required assessment of the WWTP. The technical memo titled 'Raven River Flow Monitoring Field Work – WWTP Environmental Risk Assessment for the Village of Caroline' dated December 6, 2017 (included in Appendix A) was prepared to provide the details of the monitoring program. It describes the installation of the continuous flow monitoring stations, confirms the water quality sampling location and presents the methodology to develop rating curves to generate the corresponding flows based on the collected water levels at each station.

As indicated in the memo, dated December 6th, 2017 and included in Appendix A, two (2) continuous flow monitoring stations were installed at the Raven River. Station SW1 was located approximately 120 m upstream of WWTP discharge outfall, and Station SW2 was located approximately 650 m downstream of the outfall. Each flow monitoring station included a pressure transducer to record water temperature and water levels continuously based on the programmed 1-hour interval. Staff gauge was also installed at each station for reference purposes. A "barologger" located at the WWTP was used to monitor the air pressures. The level data collected, at the established flow stations, was corrected by compensation for atmospheric pressure fluctuations. The collected water levels were then converted to flows by using the "depth to flow" rating curve developed at each flow station.

Figure 3-9 to 3-13 represent the collected flows and temperatures at each station. For reference purposes, the precipitation data recorded at Environmental Canada's weather station at Rocky Mountain House (Climate ID 3015523 / WMO ID 71928) has also plotted in these figures. The details of the development of the rating curves are included in Appendix B.

Figure 3-9 Water Levels and Precipitation

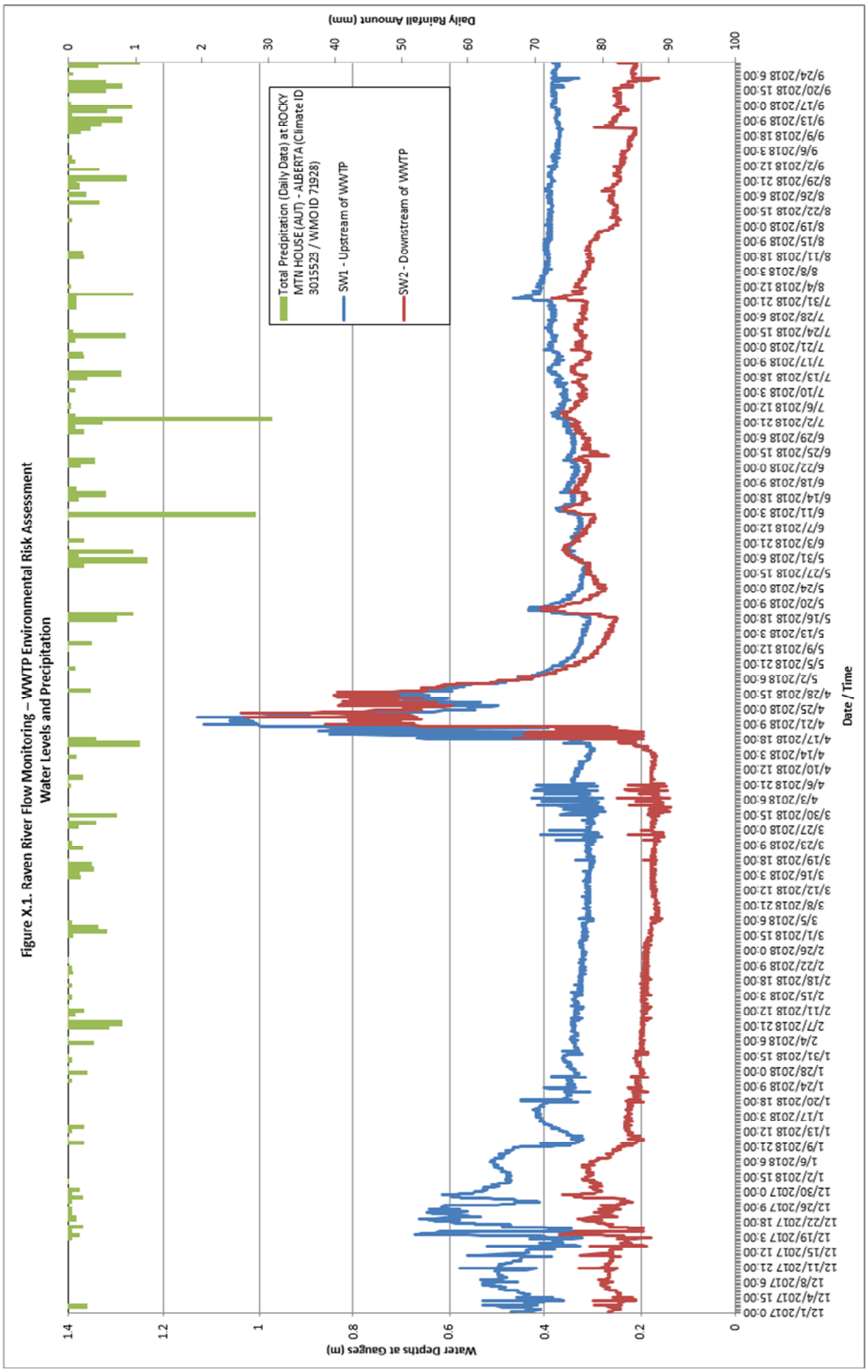


Figure 3-10 Water Levels and Air Temperature at SW-1 (Upstream of WWTP)

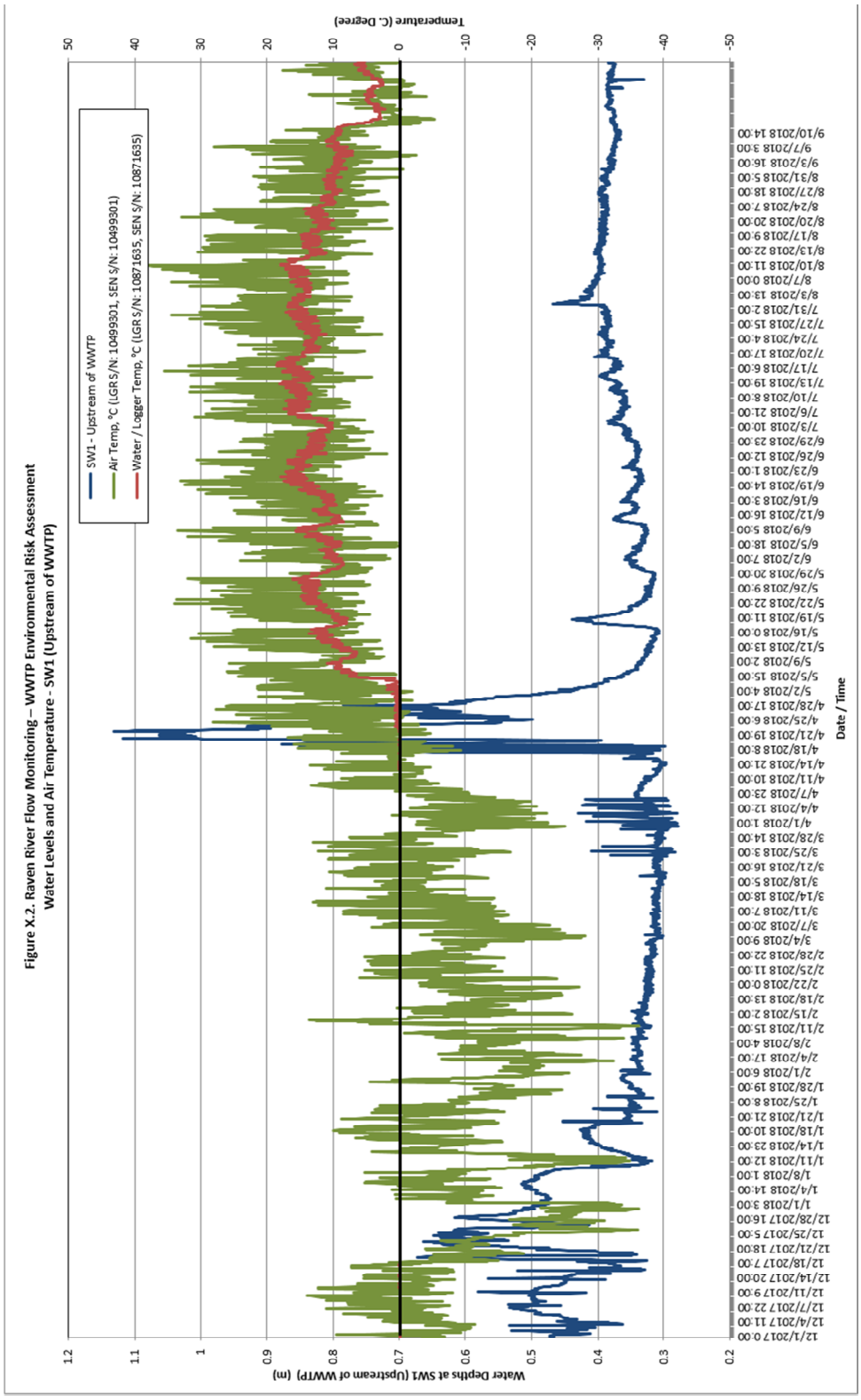


Figure 3-11 Water Levels and Air Temperature at SW-2 (Downstream of WWTP)

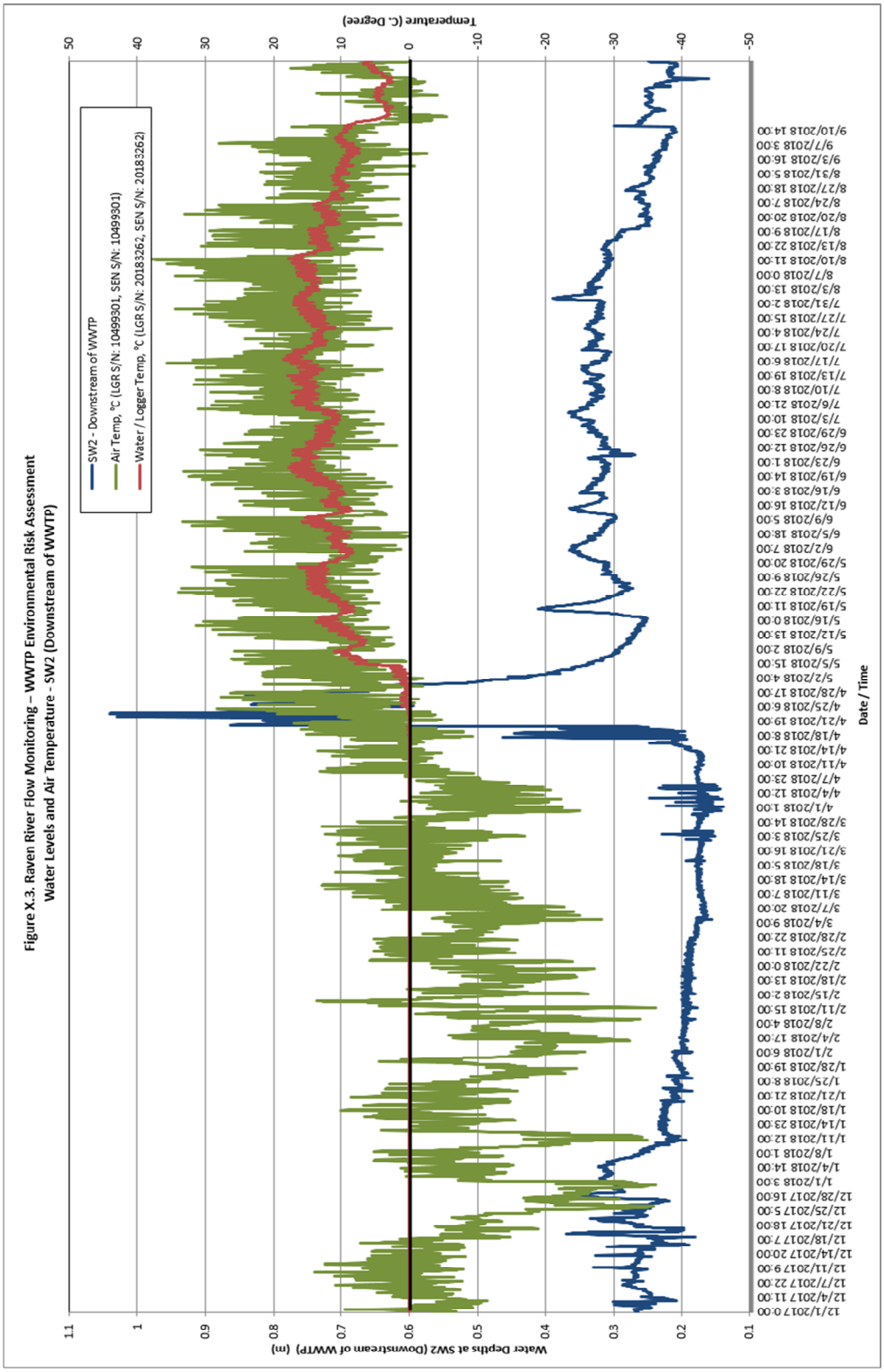


Figure 3-12 Flows and Temperature at SW-1 (Upstream of WWTP)

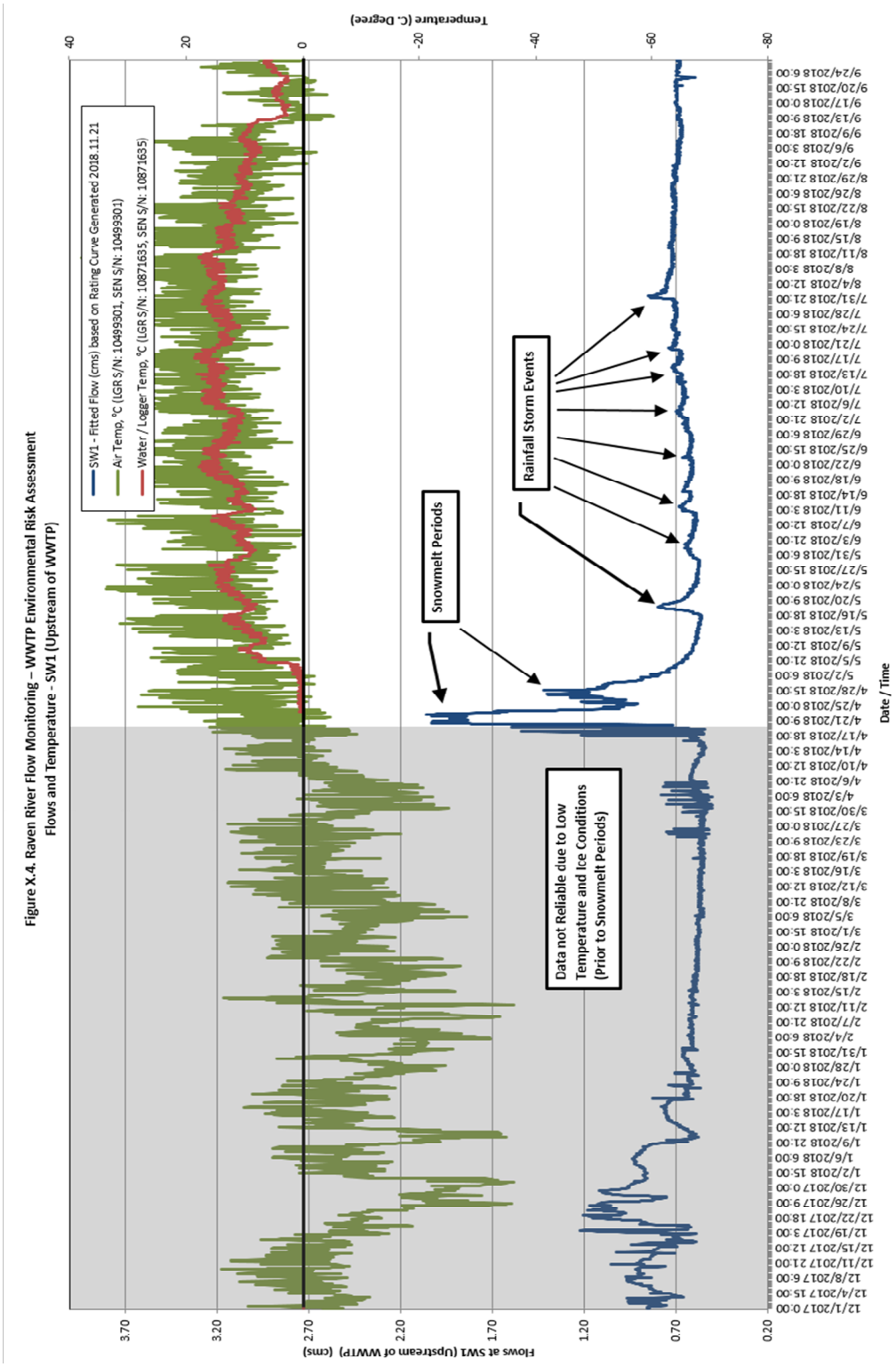


Figure 3-13 Water Levels and Air Temperature at SW-2 (Downstream of WWTP)

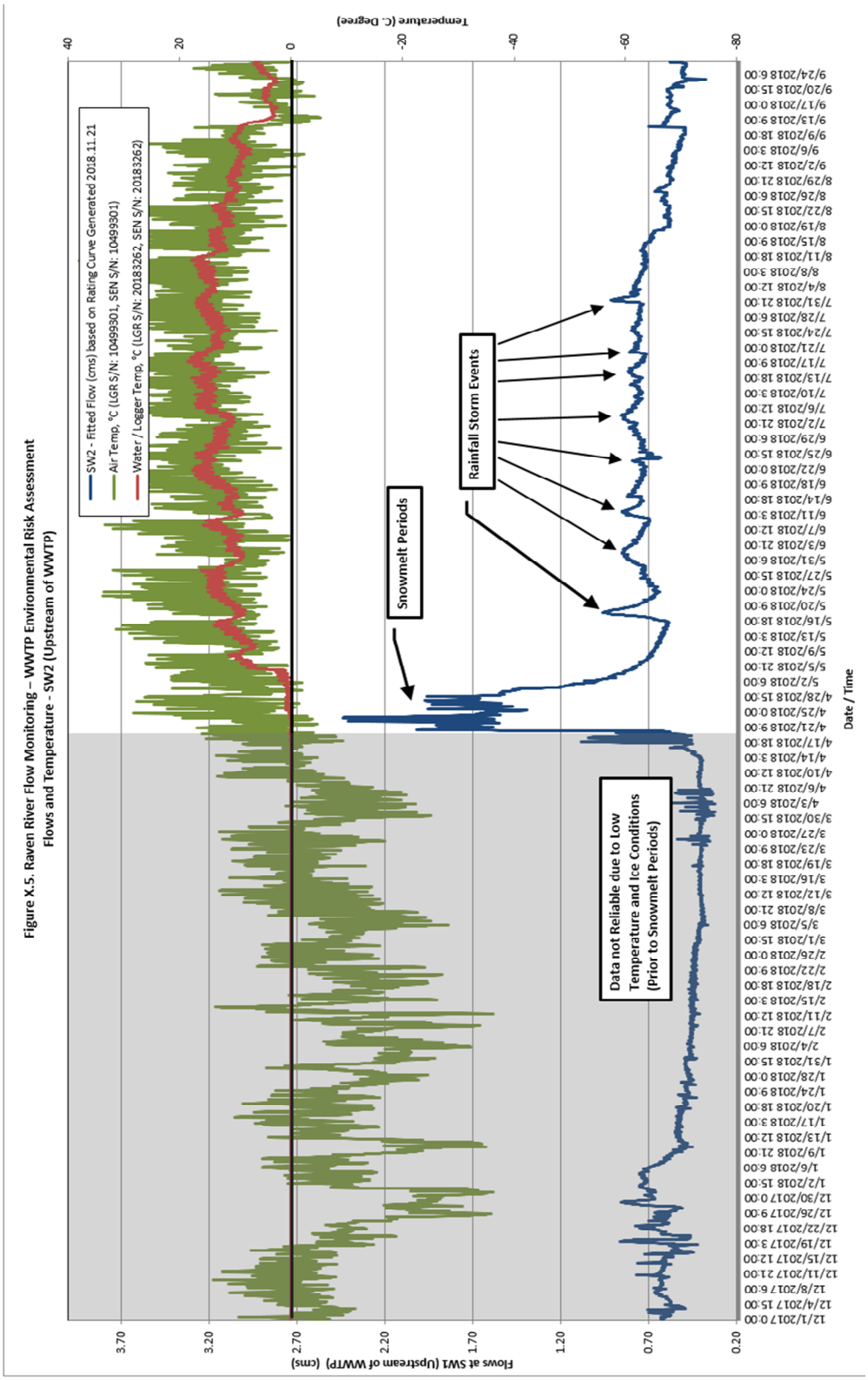


Figure X.5. Raven River Flow Monitoring – WWTP Environmental Risk Assessment
Flows and Temperature - SW2 (Upstream of WWTP)
SW2 - Fitted Flow (cms) based on Rating Curve Generated 2018.11.21
Air Temp, °C (LGR S/N: 10499301, SEN S/N: 10499301)
Water / Logger Temp, °C (LGR S/N: 20183262, SEN S/N: 20183262)
Snowmelt Periods
Rainfall Storm Events
Data not Reliable due to Low Temperature and Ice Conditions (Prior to Snowmelt Periods)
Flows at SW1 (Upstream of WWTP) (cms)
Temperature (C. Degree)
Date / Time

3.3 RATIO OF FLOWRATE TO EFFLUENT DISCHARGE RATE

Alberta Environment has been monitoring water discharge rates. In the Raven River, the average discharge rates are very similar from April-October ranging from 1-3 m^3/s. Historically rates have deviated from this range by a maximum of 1 m^3/s. In spring and early summer of 2008, the water discharge rates were well above historical levels and exceeded 30 m^3/s. This is believed to be due to snow melt and high precipitation events. Figure 3-14 is taken from Alberta Environment "Discharge Rates of the Raven River near Raven" and indicates the same.

Figure 3-14 Discharge Rate of Raven River

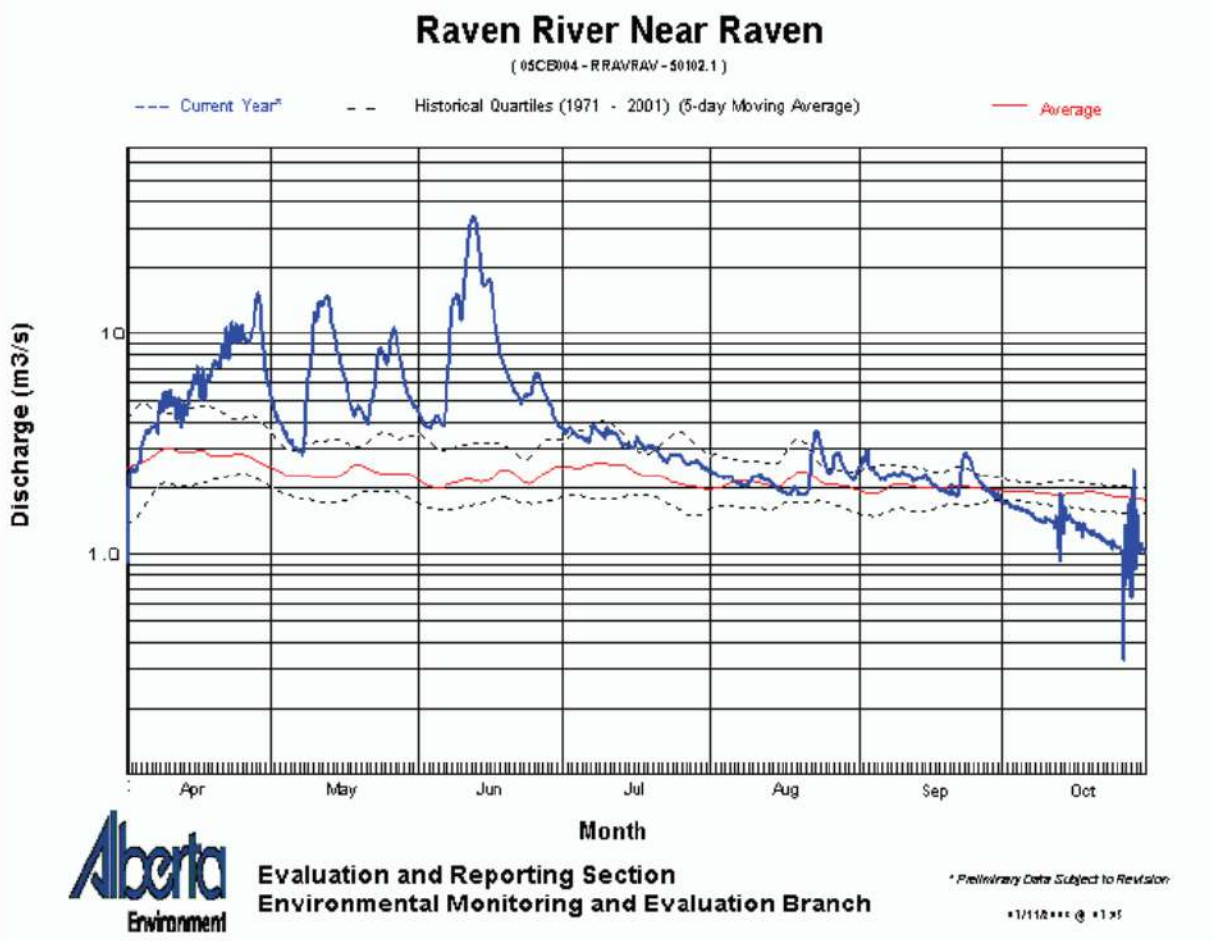


Figure 103. Discharge rates of the Raven River near Raven (Government of Alberta, 2008c). "Current year" indicates water discharge rates in 2008.

A drainage area is the total surface area, upstream of a point on a stream, where the water from rain, snowmelt, or irrigation which is not absorbed into the ground flows over the ground surface, back into streams, to finally reach that point. The drainage area of Raven River and Caroline WWTP are shown in Figure 3-15. The ratio of the drainage area of the Caroline WWTP to that of the Raven River was determined to be 0.3447.

The 7-day consecutive low flow with a 10-year return frequency or 7Q10 value, for Raven River, was performed based on the low flow frequency analysis at EC WSC Raven River Near Raven Station (05CB004) with daily flows recorded from 1971 to 2012. It was determined to be 1.208 m^3/s.

The 7Q10 at Caroline WWTP site was then considered to be proportion to the drainage area and calculated using the above ratio of 0.3447. The 7Q10 value at Caroline WWTP site is therefore 0.42 m^3/s. Detailed analysis results are included in Appendix C.

As listed in Table 1-1, SW1 is located 120 m upstream of the Caroline WWTP while SW2 is located 1000 m downstream. The exact location is indicated in Figure 1-1. Figure 3-16 and Figure 3-17 show the recorded flows from the monitoring program (2017.12 – 2018.09) at SW1 and SW2, with the determined 7Q10 of 0.42 m3/s at Caroline WWTP site. The comparison results confirm that the calculated 7Q10 reasonably represents the low flows at the Caroline WWTP site.

It is worth noting that the design flowrate of the Wastewater Treatment Plant is 400m^3/day or 0.0046 m^3/second. This amounts to 1% of the Raven River 7Q10 value.

Figure 3-15 Drainage area of Raven River and Caroline WWTP

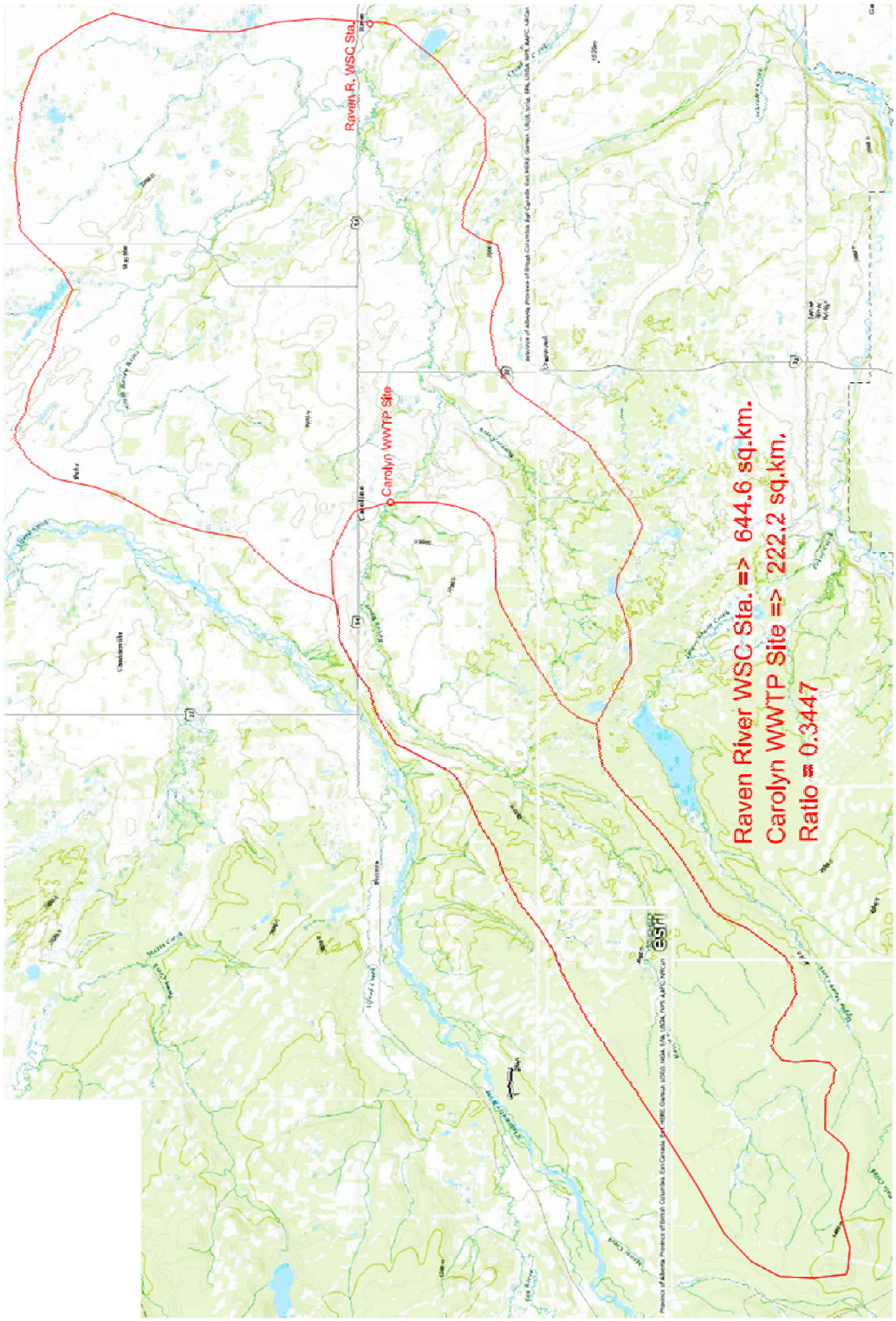


Figure 3-16 Monitored Flow with 7Q10 low flow reference at SW-1 (Upstream of WWTP)

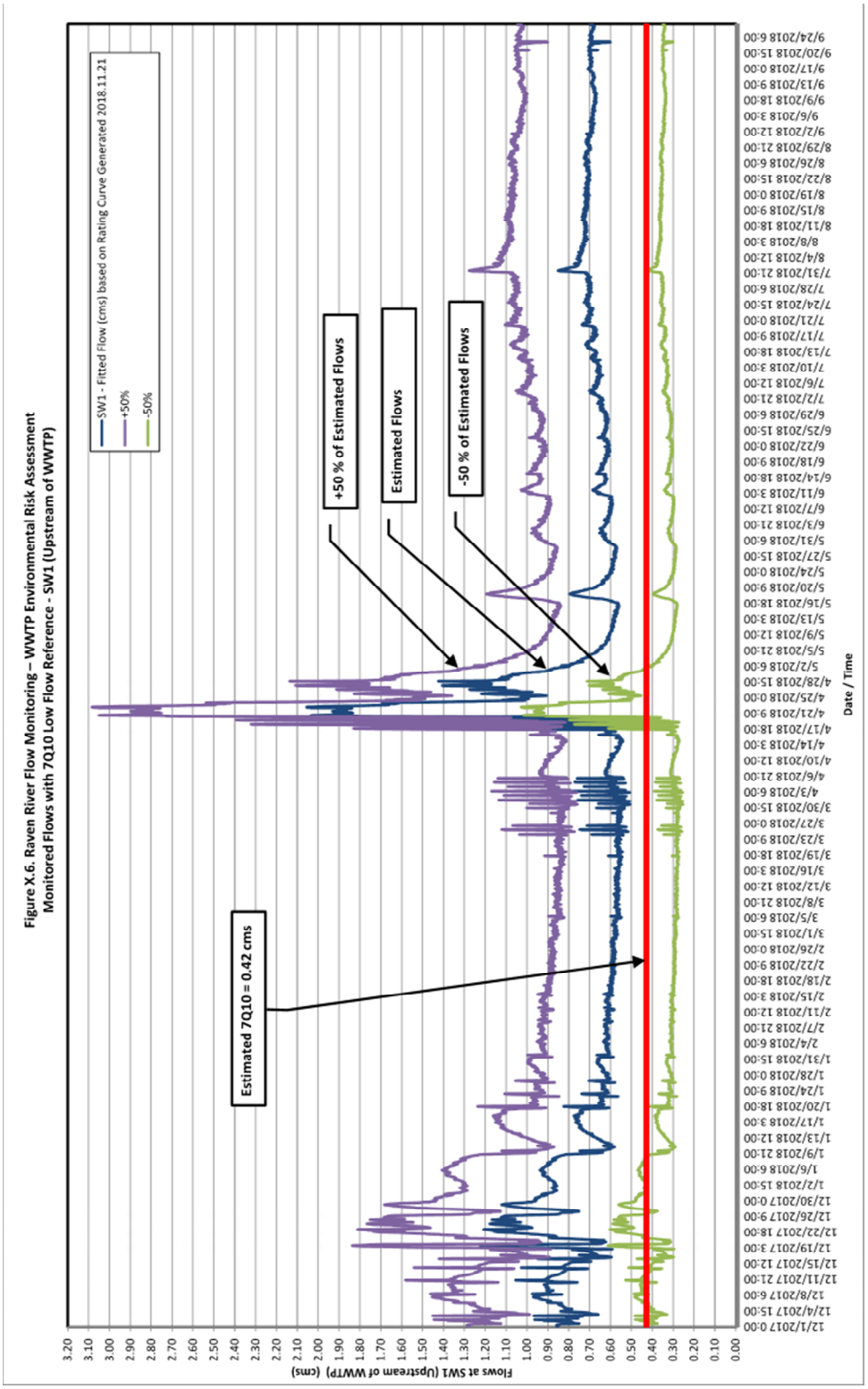
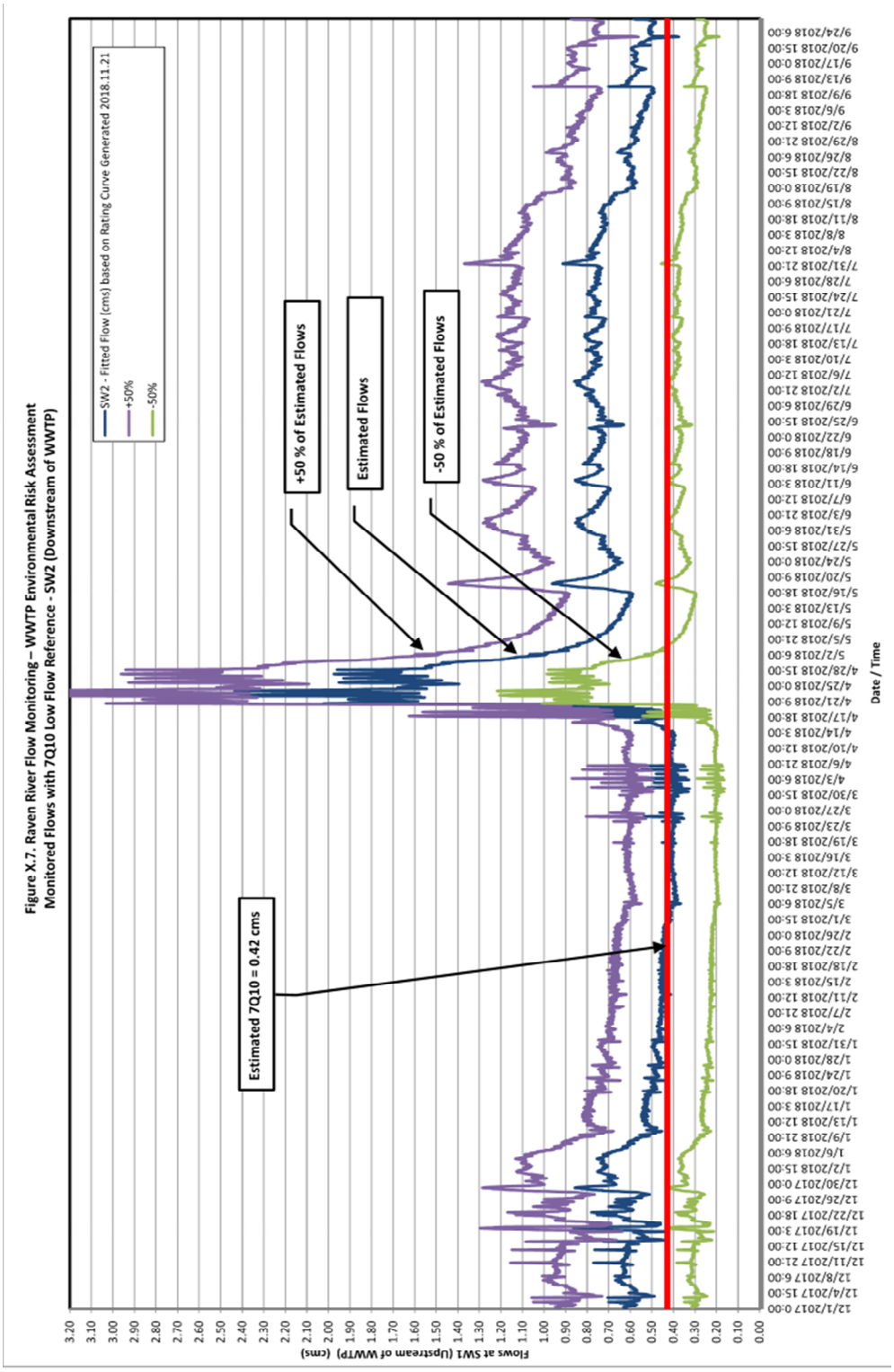


Figure 3-17 Monitored Flow with 7Q10 low flow reference at SW-2 (Downstream of WWTP)



3.4 AQUATIC HEALTH OF RAVEN RIVER

The Raven River is classified as a class 'A' fishery. It runs diagonally just south of the Village of Caroline and the wastewater treatment plant. Recreation activities and amenities are present along the river. The river and the lands adjacent also represent an important corridor for wildlife and habitat for a variety of species.
Raven river, especially its tributary the North Raven River, is a very popular spot for anglers. Brook trout, longnose sucker, white sucker, and stocked brown trout are the predominant species of fish located in the river. Being a tributary of the Red Deer River, Raven River likely also contains northern pike, sauger, lake whitefish, yellow perch, burbot, lake sturgeon, mountain whitefish, goldeye, brown trout, bull trout, rainbow trout, brook trout, cutthroat trout, emerald shiner, river shiner, spottail shiner, flathead chub, longnose dace, quillback carpsucker, shorthead redhorse, silver redhorse, trout-perch, spoonhead sculpine, lake chub, northern pearl dace, northern redbelly dace, finescale dace, fathead minnow, brook stickleback, and muskellunge. Trout, mountain whitefish, walleye and northern pike are found in Raven River and with the exception of Walleye and Trout (all trout species), can be fished and caught.

According to the *Red Deer River State of Watershed Report* dated 2009, the predominant species are white sucker and brook trout. They have not been any significant changes in the population of these species over the sampling period (1972 to 2005). The brook trout is also the species that is most consistently found during the above-mentioned sampling period. This was also reiterated by the report titled 'Abundance of Sport Fish in the North Raven River, Alberta' published in 2005 by Alberta Conservation Association which estimated trout abundance via mark-recapture surveys at the four study sections previously surveyed using methods comparable to those used in past surveys. Further, per the Alberta Fishing Guide, downstream of the discharge outfall in Red Deer River, trout, Burbot, Goldeye, Mountain whitefish, Northern Pike and Sauger are permitted to be fished with the exception of Walleye and Lake Sturgeon which must be released if caught.

In addition to the above species, longnose suckers also inhabit the river. They eat aquatic plants, algae and small vertebrates. Being bottom-feed fish, they are preyed upon by larger predatory fish such as bass, trout, northern pike, burbot, muskellunge and walleye. The longnose sucker is fished for food and game apart from being used as bait to catch larger fish.

The same species of fish are found both upstream and downstream of the treatment plant outfall discharge indicating minimal or no impact of the effluent water on the ecosystem of Raver River and the Red Deer River system.

4 ENVIRONMENTAL QUALITY AND EFFLUENT DISCHARGE OBJECTIVES

The permit to operate sewage works (No. 494-03-00, dated March 6th, 017) requires the monitoring of carbonaceous Biochemical Oxygen Demand (cBOD) and Total Suspended Solids (TSS) in the treated wastewater. The permit also establishes a compliance limit for carbonaceous Biochemical Oxygen Demand (cBOD) only.

Table 4-1 provides a summary of all the data presented in the above sections.

The below discharge objectives were calculated using basic dilution formula as outlined in the *Water Quality Based Effluent Limits Procedure Manual* (1995). The formula used is as follows:

$$C = \frac{(ff * Qs * Cs) + (Qe * Ce)}{(ff * Qs + Qe)}$$

Formula 1 Basic Dilution formula

where :

C : Resultant instream concentration of substance after mixing

Q_s : Volume of receiving stream for mixing

C_s : Upstream concentration in stream/river

Q_e : Volume of effluent discharge

C_e : Concentration of substance in effluent (maximum concentration from sampling data)

ff : Fraction of streamflow (5% for Acute)

In this case, it was assumed that the mean effluent flow rate (Qe) is the plant design capacity of 400 m^3/d (or 0.0046 m^3/s). The river flow rate (Qs) was taken to be the 7Q10 value which is 0.42 m^3/s.

Table 4-1 Summary of all Water Quality data

PARAMETER	INFLUENT	EFFLUENT	LAGOON	WQ1	WQ2	WQ3	GUIDELINE	LIMIT EXCEEDED
BOD_5 (mg/L)	501							
TSS (mg/L)	815	43.2616	33.64	2.55	2.27	2.45	Max increase of 25mg/L from background levels	No
cBOD (mg/L)		22.6	8.92	2	2	2.08	25	No
DO (mg/L)		13.17	5.56	6.35	5.24	6.81	5	No
TP (mg/L)		5.32	5.58	0.096	0.097	0.098	Levels to be maintained per Interim guidelines.	Yes

TN (mg/L)			23.46	0.35	0.33	0.38	Levels to be maintained per Interim guidelines.	Yes
TAN (mg/L)		14.79		0.07	0.05	0.05	0.262	Yes

Note:

- All values are 99th percentile value with the exception of WQ1, WQ2 and WQ3 where average seasonal low flow values were used.
- WQ1 is upstream of the discharge outfall while WQ2 and WQ3 are both downstream of the outfall discharge. Refer Table 1-1 for more details.
- Guidelines values listed are the Short-Term (Acute) values and are taken from the Environmental Quality Guidelines for Alberta Surface Waters dated March 28, 2018.
- Ammonia guideline taken at effluent temperature of 10.9^{0}C and pH of 8.5 (Average for Raven River. Refer Table 3-7)
- For TP and TN, the baseline level is the concentration upstream of the outfall discharge or at WQ 1.
- Calculations shown in Appendix D
- WWTP Annual Reports and Sampling Laboratory Data included in Appendix E

4.1 Carbonaceous Biochemical Oxygen Demand (cBOD)

As per approval 494-03-00 dated March 6th, 2017, the cBOD limit in the effluent is 25 mg/L. Further, the National Performance Standards, which are the minimum performance requirements for effluent quality from all municipal, community and government wastewater facilities that discharge municipal wastewater effluent to surface water, list the cBOD limit as 25 mg/L.

The effluent cBOD concentration is 22.6 mg/L, taken from Table 4-1, which is less than the limit of 25 mg/L. Furthermore, from the data and graphs presented in the previous sections, it is clear that the effluent has a minimal impact on the Raven River and we can see negligible change in the TSS concentration in the river. We hence recommend that the existing cBOD limit of 25 mg/L be retained.

4.2 Total Suspended Solids (TSS)

The upstream TSS value was considered to be the maximum value (12 samples in all) taken from the sampling location upstream of the Wastewater Treatment Plant outfall discharge. This corresponds to a concentration (Cs) of 7.4 mg/L. As per the *Environmental Quality Guidelines for Alberta Surface Waters (dated March 28, 2018),* a maximum increase of 25 mg/L from the background levels (2.55 mg/L or concentration at WQ1) is permitted at any time. The instream guideline is therefore 27.55 mg/L.

Using Formula -1 and an effluent concentration of 43.26 mg/L, taken from Table 4-1, the instream concentration equates to 9.17 mg/L which is less than the instream guideline of 27.55 mg/L.

Furthermore, owing to the fact that the effluent flowrate is 1% of the Raven River flow, we anticipate that the effluent has a minimal or negligible impact of Raven River and we do not anticipate any increase in the TSS concentration in the river as a result of this minor contribution.

4.3 Total Phosphorus (TP)

The upstream TP value was considered to be the maximum value (12 samples in all) taken from the sampling location upstream of the Wastewater Treatment Plant outfall discharge. This corresponds to a concentration (Cs) of 0.249 mg/L. As per the *Environmental Quality Guidelines for Alberta Surface Waters* (dated March 28, 2018), the previously published values of 0.05 mg/L for total phosphorus has been withdrawn. The phosphorus concentration, in Raven River, is to be maintained so as to prevent detrimental changes to the aquatic ecosystem as per the interim guidelines. The instream guideline is therefore 0.096 mg/L, the concentration upstream of the Caroline WWTP or at WQ1.

Using Formula -1 and an effluent concentration of 5.32 mg/L, taken from Table 4-1, we get a resultant instream concentration of 1.67 mg/L. This resultant instream concentration is more than the instream guideline of 0.096 mg/L and demonstrates a reasonable potential to exceed the instream guideline.

This parameter, Total Phosphorus, is hence evaluated using the CORMIX Model in the following section (Section 5).

4.4 Total Nitrogen (TN)

The upstream TN value was considered to be the maximum value (12 samples in all) taken from the sampling location upstream of the Wastewater Treatment Plant outfall discharge. This corresponds to a concentration (Cs) of 0.737 mg/L. As per the *Environmental Quality Guidelines for Alberta Surface Waters* (dated March 28, 2018), the previously published values of 1.0 mg/L for total nitrogen has been withdrawn. The total nitrogen concentration is to be maintained so as to prevent detrimental changes to the aquatic ecosystem as per the interim guidelines. The instream guideline is therefore 0.35 mg/L.

The 99th percentile concentration from Table 2-15 is 23.46. However, given that there were only three data points available for this parameter, at 99% percentile, 95th% confidence level and with Cv of 0.6, a multiplier of 3.0 was used resulting in an effluent value of 70.38 mg/L.

Using Formula -1 and an effluent concentration of 70.38 mg/L, we get a resultant instream concentration of 7.3 mg/L. This resultant instream concentration is more than the instream guideline of 0.35 mg/L and demonstrates a reasonable potential to exceed the instream guideline.

This parameter, Total Nitrogen, is hence evaluated using the CORMIX Model in the following section (Section 5).

4.5 Total Ammonia Nitrogen (TAN)

The upstream TAN value was considered to be the average value (3 samples in all) taken from the sampling location upstream of the Wastewater Treatment Plant outfall discharge which is 0.07 mg/L. However, given that there were only three data points available for this parameter, at 99% percentile, 95th% confidence level and with Cv of 0.6, a multiplier of 3.0 was used resulting in an upstream value (Cs) of 0.297 mg/L.

As per the *Environmental Quality Guidelines for Alberta Surface,* the Instream Guideline (Chronic), taken at a pH of 8.5 and at 11deg C is 0.262 mg/L.

Using Formula -1 and an effluent concentration of 14.79 mg/, we get a resultant instream concentration of 1.53 mg/L. This resultant instream concentration is more than the instream guideline of 0.262 mg/L and demonstrates a reasonable potential to exceed the instream guideline.

This parameter, Total Ammonia Nitrogen, is hence evaluated using the CORMIX Model in the following section (Section 5).

However, the Acute Lethality Test using Rainbow Trout (96-hour Single Concentration) conducted in 2017 showed a 60% mortality at 100% effluent concentration. Similarly, the Acute Lethality pH Controlled Test using Rainbow Trout (96-hour Single Concentration) conducted in 2017 showed a 0% mortality at 100% effluent concentration. Both Test Reports are included in **Appendix E**.

5 EFFLUENT DISCHARGE ANALYSIS (CORMIX MODEL)

5.1 METHODOLOGY

A mixing zone assessment of the proposed Village of Caroline WWTP effluent discharge was conducted using the modelling software CORMIX Version 11.0GT. The analysis applied the design WWTP flow of 400 m^3/day and the limits for Nitrogen and Phosphorus. Typically, the pollutants that are limiting or of concern in a river are nitrogen and phosphorus. This is because an excess concentration of these parameters leads to eutrophication (growth of algae and other aquatic plants) in the water body, thereby, negatively impacting the ecosystem.

The *Environmental Quality Guidelines for Alberta Surface Waters* (dated March 28, 2018), withdrew the previously published values of 0.05 mg/L for total phosphorus and 1.0 mg/L for total nitrogen. As per the current narrative, both the total nitrogen and phosphorus are to be maintained so as to prevent detrimental changes to algal and aquatic plant communities, aquatic biodiversity, oxygen levels, and recreational quality.

For both Nitrogen and Phosphorus, the effluent mixing zone within Raven River was assessed at low flow conditions or the 7Q10 river flow period.

5.2 PRELIMINARY OUTFALL DESIGN CONCEPT

The Village of Caroline WWTP discharges the effluent to Raven River and the outfall concept used in the CORMIX Model has been summarized in Table 5-1 in order to confirm adequate dilution is achieved and determine effluent limits for the treatment plant.

Table 5-1 Preliminary Outfall Concept

PARAMETER	VALUE
Outfall Configuration	Open-Pipe
Outfall Pipe Diameter	200 mm
Average Receiver Water Depth	0.5 m
Distance from Nearest Bank	5 m
Outfall Orientation	Horizontal along receiver bottom and perpendicular to average receiver flow direction

5.2.1 MIXING ZONE REQUIREMENTS

A mixing zone is defined as an area of water contiguous to a point source, where water quality does not comply with one or more of the limits. A mixing zone should be small enough so as to not interfere with beneficial uses (*Water Quality Based Effluent Limits Procedure Manual*, *1995*). Furthermore, a mixing zone should be established to ensure protection of the waterbody as a whole (chronic) and to limit acute lethality to organism through the plume (acute). In this case, mixing zone analyses were completed at the design capacity of 400 m^3/d.

The *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* (Alberta Environment and Sustainable Resource Development, March 2013) states that initial mixing (i.e., the near field region) must have a minimum dilution ratio of 10:1 for wastewater discharges. This dilution ratio standard was adopted as a guideline for the assessment of the treatment plant effluent in Raven River.

5.2.2 ANALYSIS OF AVAILABLE DILUTION RATIOS

Modelling was conducted using 99th percentile values for effluent and ambient temperatures and concentrations. An estimated water depth at the outfall location of 0.5 m was assumed based on data collected upstream at (SW1) and downstream (SW2). This estimate is considered to be conservative, as water depth is understood to be closer to 2.44 in this area. A water current speed of 0.042 m/s was calculated using the 7Q10 value (0.42m^3/s), a river depth of 1.0 m and a river width of 10.0 m. It was found that the open pipe outfall with a diameter of 200 mm provides sufficient mixing. Dilution results for this conceptual design are within a dilution ratio of 10:1. A summary of dilution results using this conceptual design are provided in Section 5.4.

5.3 CORMIX SIMULATIONS

CORMIX was used to simulate seasonal conditions for the TN and TP for the conceptual outfall design described in Section 5.2. Table 5-2 summarizes the input values used for the mixing zone simulations. Discharge concentration Excess is the difference between the ambient concentration and the proposed effluent limit. Water Quality Excess is the difference between the ambient concentration and the water quality standard. The Water Quality standards were, as narrated in the *'Environmental Quality Guidelines for Alberta Surface Waters'* (dated March 28, 2018), to ensure that the concentration is maintained at current instream levels. The instream concentration/level was determined by taking the ambient concentration.

Table 5-2 CORMIX Input Values

MODEL PARAMETERS	INPUT VALUES
Outfall Distance to Nearest Bank (m)	5
Outfall Diameter (m)	0.20
Average Receiver Local Water Depth (m)	0.5
Center-of-Pipe Height Above Lake Bottom (m)	0.3
Wind Speed[1] (m/s)	2
Manning's n[2]	0.03
Raven River Flowrate (10% of 7Q10 in m3/s)	0.042
Effluent Flowrate (m^3/s)	0.00463 (400 m3/day)
Ambient Water Temperature (°C)	5
Effluent Temperature (°C)	10.9

Ambient TN Concentration (mg/L)	0.35	
Proposed TN Effluent Limit (mg/L-N)	20	
Discharge TN Concentration Excess (mg/L-N)	19.65	
TN Water Quality Standard (mg/L-N)	**0.35**	
TN Water Quality Excess (mg/L-N)	**0.0**	
Ambient TP Concentration (mg/L)	0.096	
Proposed TP Effluent Limit (mg/L)	5.0	
Discharge TP Concentration Excess (mg/L)	4.904	
TP Water Quality Standard (mg/L)	**0.096**	
TP Water Quality Excess (mg/L)	**0.0**	
	SUMMER	**WINTER**
Ambient Water Temperature (°C)	10	5
Ambient TAN Concentration (mg/L)	0.07	0.07
Proposed TAN Effluent Limit (mg/L)	10.0	**15.0**
Discharge TAN Concentration Excess (mg/L)	9.93	14.93
TAN Water Quality Standard (mg/L)	**0.262**	**0.262**
TAN Water Quality Excess (mg/L)	**0.192**	**0.192**

1 Value taken from Alberta Climate Information Service (ACIS).
2 Value obtained assuming a Clean, straight channel with no rifts or deep pools and under Normal conditions. (Source: Chow, V.T., 1959, Open-channel hydraulics: New York, McGraw-Hill, 680 p.)
3 Average value taken from the monthly average reported by Village of Caroline in the Annual Wastewater Report for the years 2015 and 2018.

5.4 MIXING ZONE ANALYSIS RESULTS

The CORMIX results for TN under proposed conditions from the CORMIX modelling are shown in Table5-3

Table 5-3 Mixing Zone Modelling Results for Total Nitrogen

Distance Downstream to meet Limit (m)	8.0
Plume Half-Width when Limit is Encountered (m)	0.72
Near Field Region Dilution Ratio	56.5

The CORMIX results for TP under the proposed conditions from the CORMIX modelling are shown in the below table.

Table 5-4 Mixing Zone Modelling Results for Total Phosphorus

Distance Downstream to meet Limit (m)	6.82
Plume Half-Width when Limit is Encountered (m)	0.59
Near Field Region Dilution Ratio	51.3

The CORMIX results for TAN under the proposed conditions from the CORMIX modelling are shown in the below table. The limit was considered to be the ambient concentration taken upstream in the river or 0.262mg/L.

Table 5-5 Mixing Zone Modelling Results for Total Ammonia Nitrogen

	SUMMER	WINTER
Distance Downstream to meet Limit (m)	6.60	13.08
Plume Half-Width when Limit is Encountered (m)	0.54	1.14
Near Field Region Dilution Ratio	150.4	150.4

At all modelled conditions, the water quality standard for TN, TP and TAN was reached in the near field region (zone of strong initial mixing). The largest mixing zone occurs for TAN during Winter as can be seen above. The mixing zones are considered acceptable as they are less than 10 times the stream width for length. This can be attributed to the very low WWTP effluent design flow.

6 SUMMARY AND RECOMMENDATIONS

6.1 AMBIENT CONDITIONS OF RAVEN RIVER

Key findings of the ambient water quality and assimilative capacity within Raven River, upstream of effluent discharge, are as follows:

- Raven River has an average cBOD concentration of 2.0 mg/L.
- The average TSS, which results in low turbidity, is 5.67 mg/L
- The average DO concentration is 6.4 mg/L which is above the minimum recommended value of 5mg/L.
- The average values of TP and TN are 0.096 mg/L and 0.35 mg/L respectively indicating a low probability of eutrophication due to effluent discharge from the Village of Caroline treatment plant.
- The average pH of Raven River was 8.28.

It must be noted that the effect of the effluent, on the conditions of Raven River, at both sampling locations downstream of the treatment plant were minor and negligible. In other words, the Caroline Treatment Plant has a negligible impact on the quality of water in the river.

6.2 MIXING ZONE ANALYSIS

A summary of the mixing zone analysis results is as follows:

- The outfall was modelled using CORMIX mixing zone software under low flow conditions (7Q10) for Raven River and the TN and TP effluent values used were the 99% Percentile and the 95% confidence values.
- Limited information was available for the characterization of Raven River therefore conservative estimates were made for the purposes of the mixing zone assessment, such as a water depth of 2 m at the outfall discharge location and a wind speed of 2 m/s.
- The ambient or Raven River flowrate was taken as 10% of the 7Q10 value or 0.021 m3/s (10% of 0.42 m3/s).

6.3 PROPOSED EFFLUENT LIMITS AND OBJECTIVES

A summary of the proposed effluent compliance limits and objectives for the Village of Caroline Wastewater Treatment Plant are presented in Table 6-1. The associated compliance limit is also shown based on the design average day flow of 400 m^3/d. Due to the very small size (less than 500m^3/d) of this treatment plant, the impacts to the receiving water body, Raven River, are anticipated to be minor especially with respect to Total nitrogen and Total Phosphorus. Apart from the very small size of the treatment plant, the effluent flow from the treatment plant is 0.0046m^3/s while the 7Q10 value of Raven River is 0.42 m^3/s. In other words, the effluent flow from the treatment plant is a very small fraction, 1.1%, of the 7Q10 flow of Raven River.

As discussed in Section 2.1.1, the influent monthly flowrate was at its highest in 2014 (7,130.17 m^3/month) and since then, has been decreasing. The influent monthly flow appears to be relatively consistent between 2017 and 2018 with an average flow of 3,279.83 m^3/month. This translates to 27.33% of the lagoon design capacity.

Analysis done using the CORMIX Model, considered the current effluent concentrations and an influent monthly flow of 12,000 m^3/month or the lagoon design capacity. It is evident from the CORMIX Model, the existing effluent concentration at the plant design flow will have a negligible impact on Raven River, downstream of the lagoon outfall.

Based on modelling and analysis done with a TP concentration of 5mg/l, we observe a negligible impact on receiving body (Raven River). The CORMIX Model indicates that the mixing zone will be 6.82m downstream with a plume of half width 0.59m

This indicates that there is minimal impact on the Raven River, downstream of the outfall with the continued discharge of TP at the current levels. Therefore, if a limit needs to be set, we recommend 5.0 mg/L.

For Total Nitrogen, the CORMIX Model indicates that the mixing zone will be 8m downstream with a plume of half width 0.\\7293. Therefore, if a limit needs to be set, we recommend a limit of 20.0 mg/L.

Similarly, for Total Ammonia Nitrogen, the CORMIX Model indicates that the mixing zone will be 6.60m and 13.08m downstream with a plume of half width 0.54m and 1.14m respectively in Summer and Winter seasons. Considering that the lagoon is a continuous aerated lagoon, there is minimal ammonia removal. We therefore, recommend a limit of 15.0 mg/L in Winter and a limit of 10mg/L in Summer, considering the temperature dependency of ammonia.

At a pH of 8.5 and a temperature of 11deg C, the un-ionized ammonia is calculated to be 5.9%. For an effluent ammonia limit of 15mg/L, the un-ionized ammonia concentration equates to 0.885 mg/L which is less than the Federal Limit of 1.25 mg/L.

Table 6-1 Proposed Effluent Objectives and Compliance Limits

PARAMETER	RECOMMENDED LIMIT		GUIDELINE
$cBOD_5$	25 mg/L		25 mg/L
Total Suspended Solids	25 mg/L		Maximum increase of 25 mg/L from the background levels is permitted at any time
Total Nitrogen	20 mg/L		Concentration to be maintained so as to prevent detrimental changes to the aquatic ecosystem as per the interim guidelines
Total Phosphorus	5 mg/L		Concentration to be maintained so as to prevent detrimental changes to the aquatic ecosystem as per the interim guidelines
Total Ammonia Nitrogen	10 mg/L	Summer	
	15 mg/L	Winter	

7 REFERENCES

Canadian Council of Ministers of the Environment (CCME), *Canada-wide Strategy for the Management of Municipal Wastewater Effluent.*

Department of Environment and Parks, *Water Quality Based Effluent Limits Procedures Manual.*

Ministry of Environment and Energy. (1994, July). Procedure 1-5: Deriving Receiving-Water Based, Point-Source Effluetn Requirements for Ontario Waters (MOE Green Book).

Ministry of Environment and Energy. (1994, April). Water Management: Policies, Guidelines, Provincial Water Quality Objectives (MOE Blue Book).

Government of Canada. (2012). *Wastewater System Effluent Regulations, Fisheries Act.*

Red Deer River State of Watershed Report (2009), produced by Red Deer River Watershed Alliance.

Lower North Raven River Fishery Assessment (September 2003), produced by Alberta Conservation Association

Rodtka, M., and R. Konynenbelt. 2008. Abundance of sport fish in the North Raven River, Alberta, 2005. Data Report, D-2008-005, produced by the Alberta Conservation Association, Rocky Mountain House, Alberta, Canada. 20 pp + App.

U.S. Environmental Protection Agency (EPA). (n.d.). *Cornell Mixing Zone Expert System CORMIX Version 11.0GT.*

W.F. Baird & Associates Costal Engineer Ltd. (2011). *Surface Water Vulnerability Analysis for LSRCA, Rama Mnjikaning First Nation Water Treatment Plant.*

Village of Caroline- Display Boards from Open House dated August 29 and August 30, 2018.

https://en.wikipedia.org/wiki/Raven_River

Chow, V.T., 1959, Open-channel hydraulics: New York, McGraw-Hill, 680 p.

http://www.albertafishingguide.com/

APPENDIX

A RAVEN RIVER FLOW MONITORING FIELD WORK

MEMO

TO: Gustavo Arvizu (WSP Thornhill), Carla Fernandes (WSP Kingston), Craig Suchy (WSP Red Deer), Yujing Li (WSP Red Deer), Tina Mews (WSP Rocky Mountain House), Warren Minchau (WSP Edmonton), and Ashraf Zaghal (WSP Thornhill)

FROM: Albert Zhuge (WSP Thornhill)

SUBJECT: Raven River Flow Monitoring Field Work – WWTP Environmental Risk Assessment for the Village of Caroline

DATE: Field Work (November 29, 2017); Memo (December 6, 2017)

Background

WSP is retained by the Village of Caroline to perform an Environmental Risk Assessment of its Wastewater Treatment Plant (WWTP) to satisfy the approval renewal requirements imposed by Alberta Environment and Parks in October 2016. To support the assessment, a water quantity and quality monitoring program is required for the adjacent Raven River associated with the subject site. The data collected from the monitoring program will be used to estimate low flow conditions and background water quality characteristics of the Raven River in the vicinity of the WWTP outfall.

Site Visit

A reconnaissance site visit was performed on November 29, 2017 at the subject site. During the visit, two (2) flow monitoring stations were installed; and three (3) water quality (grab sample) locations were confirmed. Any other salient hydrological and hydraulic features associated with the study (including effluent discharge location, beaver dams, tributaries, etc.) are also identified. A detailed Site Plan (attached) was prepared to show the locations of these identified features. A site visit report was also prepared and attached for reference purposes.

Installation of Continuous Flow Monitoring Stations

As indicated, two (2) continuous flow monitoring stations were installed at the Raven River. Station SW1 (Photo 1) is located upstream of WWTP effluent discharge location, while Station SW2 (Photo 2) is located downstream of it. Since there would be no flow data to be captured if the water freezes, both stations were selected by considering the potential for ice formation in the river. Note that, based on site visit on November 29, 2017, it was observed that the Raven River downstream of the WWTP discharge location were entirely covered by ice (Photos 3 ~ 5). Consequently, the location of downstream flow station (SW2) was selected at downstream of the bridge crossing at 50 St, near the identified Beaver Dam, where open water was presented.

100 Commerce Valley Drive West
Thornhill, ON, Canada L3T 0A1

T +1 905 882-1100
F +1 905 882-0055
wsp.com

Each flow monitoring station includes a pressure transducer (i.e., Onset's HOBO Stainless Steel Water Level Logger) secured within a 2-inch PVC screen tube and a locked cap, and reinforced by two metal bars installed approximately 0.5 m ~ 1.0 m into the substrate. Staff gauge was also installed at each station for reference purposes. A barologger (SW2b) was installed at the fence gate near the WWTP effluence discharge location (Photo 6). The data collected by the barologger will be used to correct the level data collected at the established flow stations by compensation for atmospheric pressure fluctuations.

As scoped, the continuous flow monitoring station will operate during a six month period (e.g. from November 2017 to May 2018). The maintenance of the station will be performed during bi-weekly water quality (grab sample) visits.

Identification of Water Quality Sampling Location

Three (3) locations for water quality surveys were identified during the site visit on November 29, 2017: WQ1 – Upstream of WWTP; WQ2 – Immediately Downstream of WWTP Discharge Location; and WQ3 – Downstream of WWTP. These identified water quality locations are shown in the attached Site Plan. Grab samples will be taken at each locations. The collected samples will be properly handled and sent to the laboratory for testing. Note that, in the event, the entirely water course is covered by ice (e.g., WQ2 as November 29, 2017), a drill procedure by an auger will be taken to break the ice cover and collect water samples. The water quality survey will be performed on bi-weekly basis.

Development of Rating Curve (Level vs. Flow)

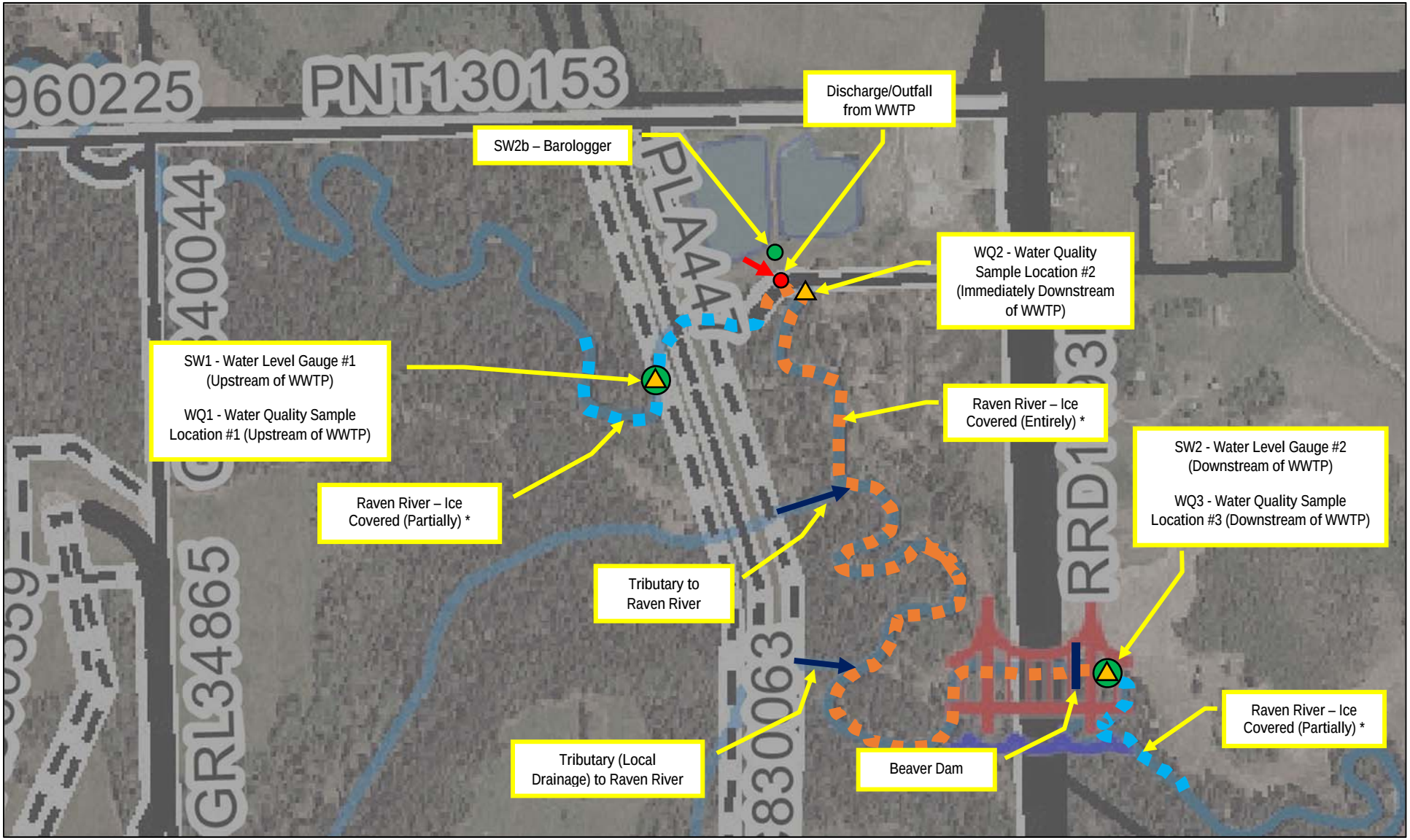
The established flow monitoring stations record parameters of water temperature and water levels continuously based on the programmed 1-hour interval. The collected water levels can be converted to flows by using the "depth to flow" rating curve developed at each flow stations. Unfortunately, an accurate flow measurement was not able to perform during the visit on November 29, 2017 due to partial or entire ice coverage of the Raven River. Alternatively, a "general" flow measurement was performed at an open section of Raven River located downstream of the Beaver Dam by using a Global Water FP201 Flow Probe (Photo 7). It was assumed that the measured flows at such location presented only 75% of the entire flows at this river cross section. Please refer to the attached Site Visit Report for more details.

According to the work scope, flow measurements will be performed during each bi-weekly visit. However, due to the limitation of the site observed (ice formation in the river), we expected that any accurate flow measurement will not be feasible during the entire six month period. Although a reliable "depth to flow" rating curve may not be unavailable, the recorded water levels can still provide indication and be used to identify periods of low flow conditions for the water course to support the water quality modelling.

We believe this memo provides you with a summary of the reconnaissance site visit performed on November 29, 2017. Should you have any questions or require any further information, please feel free to contact undersigned.

Albert Zhuge, M.A.Sc., P.Eng, PMP
Senior Project Manager, Water Resources

SITE PLAN
Caroline WWTP Monitoring
2017.11.29



* As November 29, 2017

Photo 1. Continuous Flow Station SW1 – Upstream of WWTP Effluent Discharge

Photo 2. Continuous Flow Station SW2 – Downstream of WWTP Effluent Discharge

Photo 3. Raven River Covered by Ice (Immediately Downstream of WWTP Discharge)

Photo 4. Raven River Covered by Ice (Upstream of Bridge Crossing at 50 St)

Photo 5. Raven River Covered by Ice (Bridge Crossing at 50 St)

Photo 6. Barologger at Fence Gate near WWTP Discharge Location

Photo 7. Open Water Location at Beaver Dam where Flow Measurement was Performed

100 COMMERCE VALLEY DR. WEST
THORNHILL, ONTARIO L3T 0A1
TEL: (905) 882-1100 FAX: (905) 882-0055
EMAIL: mmm@mmm.ca WEB SITE: www.mmm.ca

SITE VISIT REPORT

Date: Nov 29 / 2017	Weather: Sunny
Project: Caroline WWTP Monitoring	By: AzB (WSP - WR) T.M (WSP) J.T. (Caroline)
Job #: 171-06699-00	

Arrival Time: 10:00 AM Departure Time: 2:30 PM

PURPOSE OF VISIT:

- ☐ Boreholes/Test Pits
- ☒ Surveying
- ☒ Site Monitoring
- ☒ Equipment Install/Maintain
- ☐ Groundwater Sampling
- ☐ Other
- ☒ Photograph Site

EQUIPMENT USED:

- ☐ PID / RKI Eagle
- ☐ Waterra Filters
- ☒ Survey Equipment
- ☒ Water Level / Interface Probe
- ☐ Waterra Line
- ☒ Camera (digital / film)
- ☐ Bailers
- ☐ Foot Valves
- ☒ Other flow monitoring gauge installation tools

SAMPLE COLLECTION:

Were samples collected? ☐ Yes ☒ No

Type ☐ Soil ☐ Groundwater ☐ Surface Water ☐ Air ☐ Other

Location

Was Chain of Custody filled out? ☐ Yes ☐ No

Comments:

- two flow gauges were installed u/s & d/s of WWTP.
- Majority of Raven River was recovered.
- three locations of water quality (grab samples) were identified.
- flow measurement was performed @ beaver dam

WSP Group Limited Signature AzB

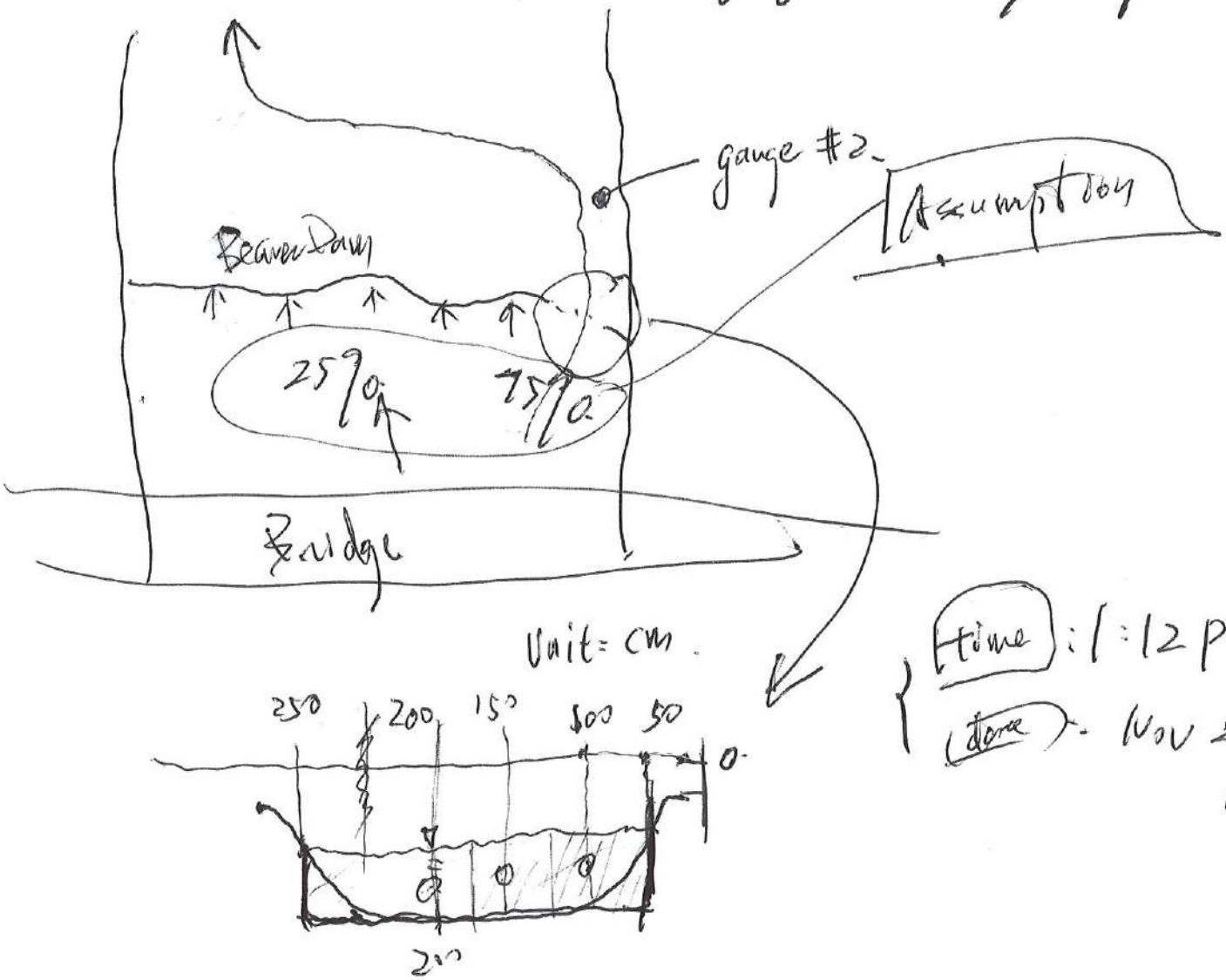
100 COMMERCE VALLEY DR. WEST
THORNHILL, ONTARIO L3T 0A1
TEL: (905) 882-1100 FAX: (905) 882-0055
EMAIL: mmm@mmm.ca WEB SITE: www.mmm.ca

SITE VISIT REPORT

- flow ~~measurement~~ measurement

@ ~1:12 PM Nov 29 / 2017

@ Beaver Dam / flow gauge #2 d/s of WWTP.



WSP Group Limited

Signature _____

100 COMMERCE VALLEY DR. WEST
THORNHILL, ONTARIO L3T 0A1
TEL: (905) 882-1100 FAX: (905) 882-0055
EMAIL: mmm@mmm.ca WEB SITE: www.mmm.ca

SITE VISIT REPORT

Logger # _____

SITE CONDITIONS / NOTE m/s m.

S	trail #1		#2		#3	
	V	D	V	D	V	D
100	1.1	0.40	~~0.7~~ 0.7	0.50	0.6	0.55
150	0.7	0.51	0.7	0.46	0.7	0.50
200	0.5	0.53	0.5	0.55	0.6	0.54

☒ **LOGGER DEPLOYMENT**

Date See gauge installation ~~technical~~ memo. (Dec 6, 2017) Time _____

☐ **LOGGER DOWNLOAD**

Date _____ Time _____

☒ **GAUGE MAINTENANCE**

Date _____ Time _____

☒ **STAFF GAUGE**

Date Nov 2nd, 2017 Time See pics

Read _____

WSP Group Limited

Signature _____

100 COMMERCE VALLEY DR. WEST
THORNHILL, ONTARIO L3T 0A1
TEL: (905) 882-1100 FAX: (905) 882-0055
EMAIL: mmm@mmm.ca WEB SITE: www.mmm.ca

SITE VISIT REPORT

☒ NOTE / COMMENTS

Details please see flow gauge installation technical memo prepared by AZ dated ~~Nov~~ Dec 6, 2017

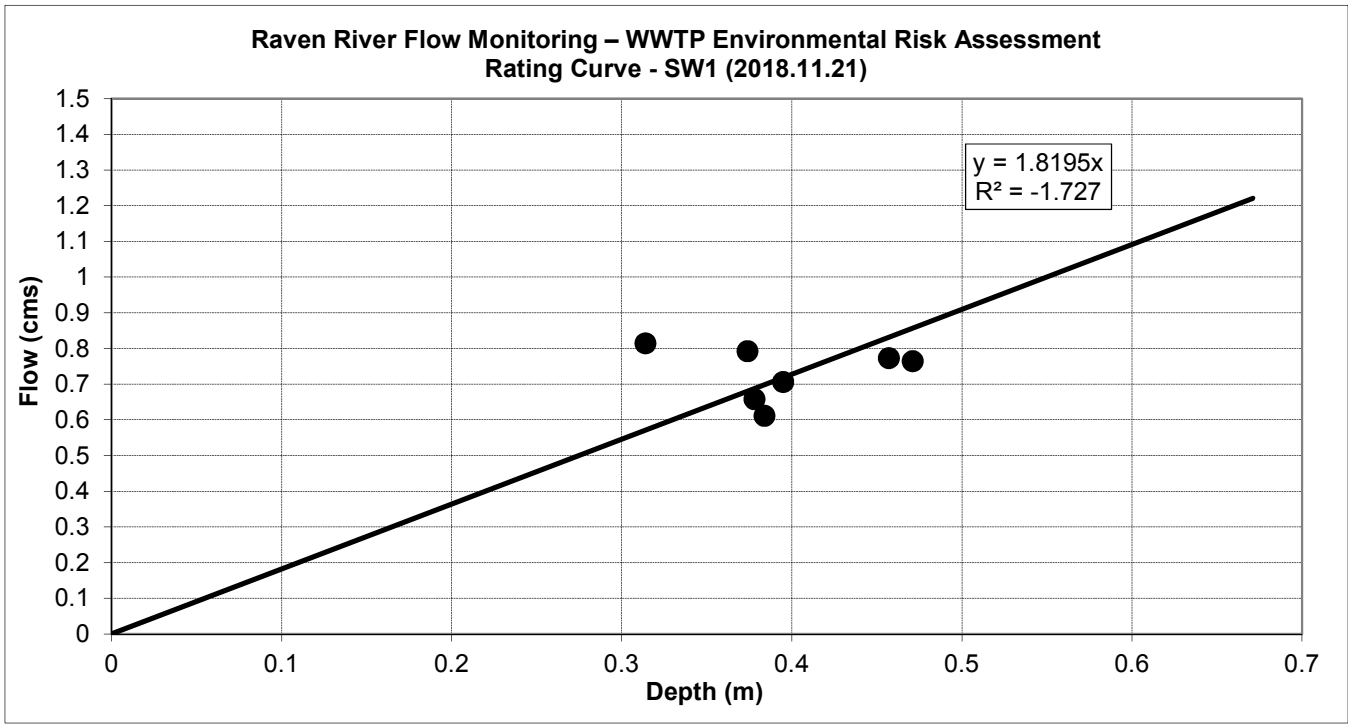
WSP Group Limited

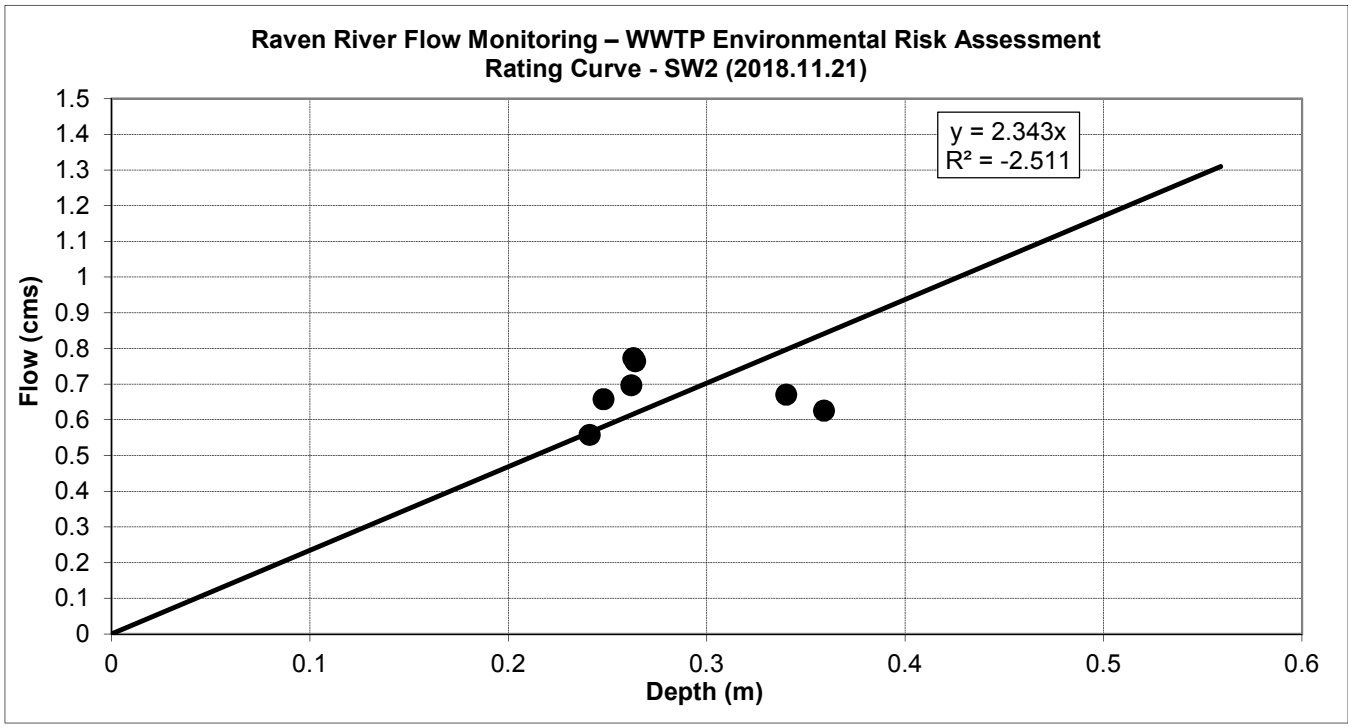
Signature AZ

APPENDIX

B

RAVEN RIVER FLOW MONITORING RATING CURVES


Raven River Flow Monitoring – WWTP Environmental Risk Assessment
Rating Curve - SW1 (2018.11.21)
y = 1.8195x
R² = -1.727
Flow (cms)
Depth (m)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5


Raven River Flow Monitoring – WWTP Environmental Risk Assessment
Rating Curve - SW2 (2018.11.21)
y = 2.343x
R² = -2.511
Flow (cms)
Depth (m)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5

APPENDIX

C

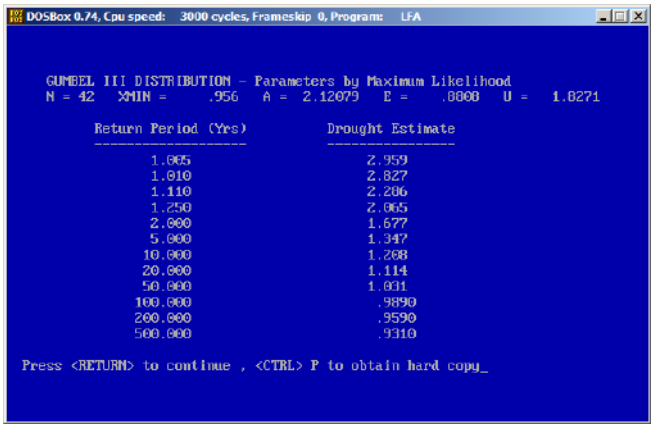
RAVEN RIVER LOW FLOW OR 7Q10 CALCULATIONS

RAVEN RIVER NEAR RAVEN
05CB004
AREA = 644.6 sq.km

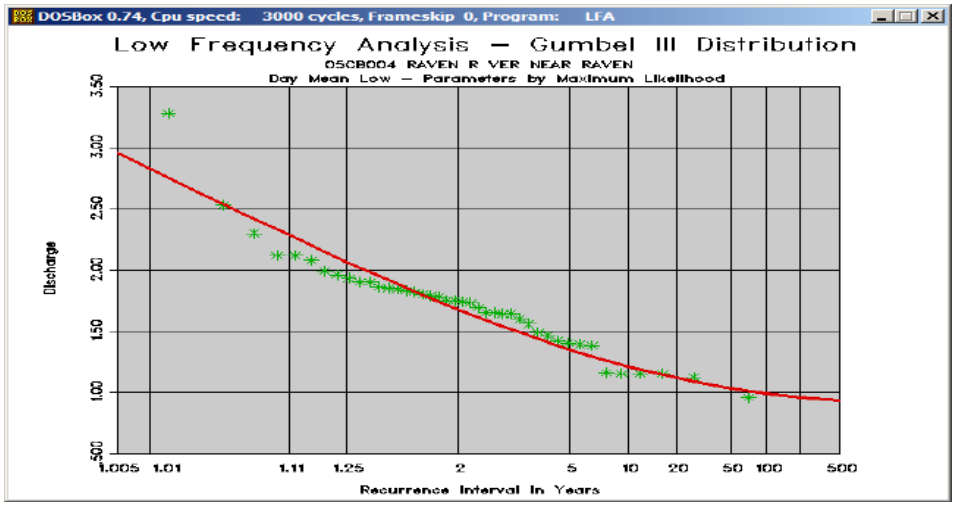
Stations | 05CB004

RAVEN RIVER NEAR RAVEN			Prov/Terr/State	AB	Regional Office	CALGARY	
Latitude	52°5'21.4" N	Longitude	114°28'38.9" W	Drainage Area (km²), Gross	644.6	Effective	634.1
Hyd Status	Active	Sed Status		RHBN		RealTime	Yes

MetaData	Details
FundingAgency	WATER SURVEY OF CANADA (DOE) (CANADA)
Operator	WATER SURVEY OF CANADA (DOE) (CANADA)
Datum	ASSUMED DATUM
DataCollection	Flow, (1971 - 2011), Recorder, Continuous
DataCollection	Water Level, (2012 - 2016), Recorder, Continuous
DataCollection	Flow, (2012 - 2016), Recorder, Continuous
Remark	ANNUAL HYDROMETRIC 1997 MAX INST DISCHARGE NOT VALID - ICE CONDITIONS



Low Flow Frequency Analysis
7Q10 = 1.208 m^3/s



Caroline WWTP Site
Estimated Drainage Area = 222.2 sq.km
Ratio = 0.3447

7Q10 = 0.42 m^3/s

APPENDIX

D

WQBEL REASONABLE POTENTIAL TO EXCEED CALCULATIONS AND CORMIX MODEL OUTPUT

REASONABLE POTENTIAL TO EXCEED

Taken from WQBEL Procedures Manual, Alberta Environmental Protection, December 1995

Mass balance dilution model

The determination of "reasonable potential to exceed" involves employing the mass balance dilution model at worst case conditions on the substances that might be expected to be found in the effluent and for which instream guidelines exist:

$$C = (QeCe + ff(Qs)Cs) / (Qe + ff(Qs)) \qquad \textit{Equation (7)}$$

where
Qe = volume of effluent discharge
Qs = volume of receiving stream available for mixing
Ce = concentration of a substance in the effluent
Cs = upstream concentration of substance
C = resultant instream concentration of substance after mixing
ff = fraction of streamflow (5% for Acute, 10% for Chronic)

Instream concentration (C) not to exceed instream guideline

The maximum value of C should not exceed the instream guideline value. If it does, reasonable potential to exceed is considered to have been demonstrated.

Qe	0.0046	m3/s	Design Capacity of Village of Caroline Wastewater Treatment Plant was used
Qs	0.42	m3/s	7Q10 Value was used to calculate for the worst case or low Raven River flow condition
ff	10%		Chronic Value

	Ce	Cs	C	Instream Guideline (Chronic)	No. of data points		NOTES
					Ce	Cs	
Total Suspended Solids (mg/L)	43.26	2.55	9.1700	27.55	72	12	No more than 25mg/L increase over background level or Cs
Total Phosphorus (mg/L)	5.32	0.096	1.6700	0.096	21	12	No increase in background level
Total Nitrogen (mg/L)	23.46	0.35	7.3000	0.35	3	12	No increase in background level
cBOD (mg/L)	22.6	2	5.3900	25	72	12	Per Permit
TAN (mg/L)	14.79	0.07	1.5300	0.262	24	3	Guideline taken at 11degC and pH of 8.5
UIN (mg/L)	1.182	N/A			10	0	

At 99% percentile, 95th% confidence level and with Cv of 0.6:

No. of datapoints/samples	Multiplier
3	3
10	1.7
12	1.6

determine the potential for exceeding that guideline under worst case conditions. See Appendix 7 for additional details.

Alternate method

The TSD provides documentation of the EPA's assumptions in determining the multipliers to derive the 99th percentile effluent concentration based on a limited sample size. An alternate method for estimating quartiles from limited data sets with an assumed lognormal distribution is presented in Gilbert (1987). This method produces an estimate of an upper percentile value that is a maximum likelihood estimator which is proportional to the geometric mean. The details of this method are given in Gilbert (1987). Either method is acceptable.

Look-up Tables in Appendix 7

Appendix 7 contains lookup Tables of reasonable potential multiplying factors at the 99th and 95th percentile level and 95th and 99th percent confidence level. **It is recommended that the 99th percentile level and 95th percent confidence level be used as a default.**

Use multipliers for data sets less than 10

The reasonable potential multiplier approach should be used for data sets less than 10. A CV of 0.6 should also be used (unless there is evidence to suggest that it should be higher).

Refine data

If potential is demonstrated, the next step may be to check or refine the data, or require the generation of more data on behalf of the facility to see if the potential persists.

There may be upper bounds to the concentration of a substance in a wastewater discharge depending on the source. For example if the influent value for a substance will never exceed a certain value due to natural constraints, it would be impossible to see values higher than this in the effluent.

Single and multiple discharge situations

The use of reasonable potential multipliers in multiple discharge situations on individual effluents can quickly lead to higher probabilities of occurrence than otherwise desired. Ideally, in these situations the analyst will conduct probability or basin wide dynamic modelling to more realistically calculate reasonable potential scenarios. Nevertheless, small data sets still need to be manipulated and the basic theory of the reasonable potential multiplier is still valid. In the final analysis, best professional judgment must be employed by analysts who understand the relationships and the sensitivity of the various assumptions employed.

Appendix 7 Cont...

# of samples	Reasonable Potential Multiplying Factors: 95% desired percentile and 95% desired confidence level																			
	Coefficient of Variation																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1	1.5	2.2	3.2	4.6	6.5	9.0	12.3	16.3	21.3	27.3	34.3	42.5	52.0	62.6	74.5	87.8	102.4	118.3	135.5	154.2
2	1.4	1.8	2.5	3.3	4.3	5.5	7.0	8.8	10.8	13.1	15.6	18.4	21.5	24.9	28.5	32.4	36.5	40.8	45.4	50.2
3	1.3	1.7	2.2	2.8	3.5	4.4	5.4	6.5	7.8	9.2	10.7	12.4	14.1	16.0	18.0	20.1	22.3	24.5	26.9	29.3
4	1.3	1.6	2.0	2.5	3.1	3.8	4.5	5.4	6.3	7.3	8.4	9.6	10.8	12.1	13.5	14.9	16.3	17.8	19.3	20.9
5	1.2	1.5	1.9	2.3	2.8	3.4	4.0	4.7	5.5	6.3	7.1	8.0	8.9	9.9	10.9	12.0	13.0	14.1	15.2	16.3
6	1.2	1.5	1.8	2.2	2.6	3.1	3.7	4.2	4.9	5.5	6.2	7.0	7.7	8.5	9.3	10.1	11.0	11.8	12.7	13.6
7	1.2	1.5	1.8	2.1	2.5	2.9	3.4	3.9	4.4	5.0	5.6	6.2	6.9	7.5	8.2	8.9	9.5	10.2	11.0	11.7
8	1.2	1.4	1.7	2.0	2.4	2.8	3.2	3.6	4.1	4.6	5.1	5.7	6.2	6.8	7.3	7.9	8.5	9.1	9.7	10.3
9	1.2	1.4	1.7	2.0	2.3	2.6	3.0	3.4	3.9	4.3	4.8	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.2
10	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.3	3.6	4.0	4.5	4.9	5.3	5.8	6.2	6.6	7.1	7.5	8.0	8.4
11	1.2	1.4	1.6	1.9	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.6	5.0	5.4	5.8	6.2	6.6	7.0	7.4	7.8
12	1.2	1.4	1.6	1.8	2.1	2.4	2.7	3.0	3.3	3.7	4.0	4.4	4.7	5.1	5.4	5.8	6.1	6.5	6.9	7.2
13	1.2	1.3	1.6	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.5	4.8	5.1	5.5	5.8	6.1	6.4	6.8
14	1.2	1.3	1.5	1.8	2.0	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8	6.1	6.4
15	1.2	1.3	1.5	1.7	2.0	2.2	2.4	2.7	3.0	3.2	3.5	3.8	4.1	4.4	4.6	4.9	5.2	5.5	5.7	6.0

# of samples	Reasonable Potential Multiplying Factors: 99% desired percentile and 95% desired confidence level																			
	Coefficient of Variation																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
1	1.4	1.9	2.6	3.6	4.7	6.2	8.0	10.1	12.6	15.5	18.7	22.4	26.4	30.8	35.6	40.7	46.3	52.1	58.4	64.9
2	1.3	1.6	2.0	2.5	3.1	3.8	4.6	5.4	6.4	7.4	8.5	9.7	10.9	12.2	13.6	15.0	16.5	18.0	19.6	21.1
3	1.2	1.5	1.8	2.1	2.5	3.0	3.5	4.0	4.6	5.2	5.8	6.5	7.2	7.9	8.6	9.3	10.1	10.8	11.6	12.3
4	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.3	3.7	4.2	4.6	5.0	5.5	6.0	6.4	6.9	7.4	7.8	8.3	8.8
5	1.2	1.4	1.6	1.8	2.1	2.3	2.6	2.9	3.2	3.5	3.9	4.2	4.5	4.9	5.2	5.6	5.9	6.2	6.6	6.9
6	1.1	1.3	1.5	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.4	3.7	3.9	4.2	4.4	4.7	5.0	5.2	5.5	5.7
7	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.1	3.3	3.5	3.7	3.9	4.1	4.3	4.5	4.7	4.9
8	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	3.8	4.0	4.2	4.3
9	1.1	1.2	1.4	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.2	3.3	3.5	3.6	3.8	3.9
10	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.2	3.3	3.4	3.5
11	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0	3.1	3.2	3.3
12	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.0
13	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.4	2.5	2.6	2.7	2.8	2.8
14	1.1	1.2	1.3	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.2	2.3	2.4	2.5	2.5	2.6	2.7
15	1.1	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.1	2.2	2.3	2.4	2.4	2.5	2.5

CORMIX SESSION REPORT:

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CORMIX MIXING ZONE EXPERT SYSTEM

CORMIX Version 11.0GT

HYDRO1:Version-11.0.1.0 August,2019

SITE NAME/LABEL: Village of Caroline WWTP

DESIGN CASE: Total Nitrogen

FILE NAME: C:\Users\cagn070129\Desktop\PROJECTS\PROJECTS\Caroline CORMIX\CORMIX Results\January 6, 2021\TN Model.prd

Using subsystem CORMIX1: Single Port Discharges

Start of session: 01/06/2021--22:28:03

****

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded

Width BS = 10 m

Channel regularity ICHREG = 1

Ambient flowrate QA = 0.04 m^3/s

Average depth HA = 0.5 m

Depth at discharge HD = 0.5 m

Ambient velocity UA = 0.0084 m/s

Darcy-Weisbach friction factor F = 0.0889

Calculated from Manning's n = 0.03

Wind velocity UW = 2 m/s

Stratification Type STRCND = U

Surface temperature = 5 degC

Bottom temperature = 5 degC

Calculated FRESH-WATER DENSITY values:

Surface density RHOAS = 999.9667 kg/m^3

Bottom density RHOAB = 999.9667 kg/m^3

DISCHARGE PARAMETERS: Single Port Discharge

Nearest bank = left

Distance to bank DISTB = 0.5 m

Port diameter D0 = 0.02 m

Port cross-sectional area A0 = 0.0003 m^2

Discharge velocity U0 = 14.74 m/s

Discharge flowrate Q0 = 0.00463 m^3/s

Discharge port height H0 = 0.5 m

Vertical discharge angle THETA = 10 deg

Horizontal discharge angle SIGMA = 0 deg

Discharge density RHO0 = 1000 kg/m^3

Density difference DRHO = -0.0333 kg/m^3

Buoyant acceleration GP0 = -0.0003 m/s^2

Discharge concentration C0 = 19.650000 mg/l

Surface heat exchange coeff. KS = 0 m/s

Coefficient of decay KD = 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.02 m Lm = 31.10 m Lb = 2.55 m

LM = 108.63 m Lm' = 99999 m Lb' = 99999 m

NON-DIMENSIONAL PARAMETERS:

Port densimetric Froude number FR0 = 5769.45

Velocity ratio R = 1754.49

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no

Water quality standard specified = yes

Water quality standard CSTD = 0.35 mg/l

Regulatory mixing zone = yes

Regulatory mixing zone specification = distance

Regulatory mixing zone value = 10 m (m^2 if area)

Region of interest = 100 m

****

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = IH5-0 |

This flow configuration applies to a layer corresponding to the full water

depth at the discharge site.

Applicable layer depth = water depth = 0.5 m

Limiting Dilution S = (QA/Q0)+ 1.0 = 10.1

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:

Origin is located at the BOTTOM below the port/diffuser center:

0.5 m from the left bank/shore.

Number of display steps NSTEP = 20 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory

implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge c = 0.1351 mg/l

Dilution at edge of NFR s = 145.5

NFR Location: x = 45.45 m

(centerline coordinates) y = 0 m

z = 0.5 m

NFR plume dimensions: half-width (bh) = 4.58 m

thickness (bv) = 0.5 m

Cumulative travel time: 936.3268 sec.

WARNING:

The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 10.07

This value is below the computed dilution of 145.50 at the end of the Near Field Region (NFR). Mixing for this discharge configuration is constrained by the ambient flow.

Please carefully review the prediction file for additional warnings and information.

Buoyancy assessment:

The effluent density is greater than the surrounding ambient water density at the discharge level.

Therefore, the effluent is NEGATIVELY BUOYANT and will tend to sink towards the bottom.

IMPORTANT NOTE:

Since the effluent is NEGATIVELY BUOYANT, it is recommended that you consider using the Brine or Sediment options for Effluent specification for a more detailed analysis, particularly for coastal discharges over a sloping bottom where density currents are important.

CORMIX will however continue with the current simulation.

Near-field instability behavior:

The discharge flow will experience instabilities with full vertical mixing

in the near-field.

There may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m

downstream and continues as vertically mixed into the far-field.

PLUME BANK CONTACT SUMMARY:

Plume in bounded section contacts nearest bank at 0 m downstream.

Plume contacts second bank at 0 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration c = 0.305924 mg/l

Corresponding dilution s = 64.4

Plume location: x = 10 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.93 m

thickness (bv) = 0.5 m

Cumulative travel time < 936.3268 sec. (RMZ is within NFR)

Note:

Plume concentration c and dilution s values are reported based on prediction

file values - assuming linear interpolation between predicted points just before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction step size) the - Output Steps per Module - in CORMIX input.

Debug:

Plume centerline at RMZ distance to left bank: 0.5

Discharge location distance to bank DISTB: 0.5

Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:

The ambient water quality standard was encountered at the following plume position:

Water quality standard = 0.35 mg/l

Corresponding dilution s = 56.5

Plume location: x = 8.00 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.72 m

thickness (bv) = 0.5 m

Regulatory Mixing Zone Analysis:

The specified RMZ occurs within the near-field region (NFR). This RMZ specification may be highly restrictive.

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

CORMIX SESSION REPORT:

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CORMIX MIXING ZONE EXPERT SYSTEM

CORMIX Version 11.0GT

HYDRO1:Version-11.0.1.0 August,2019

SITE NAME/LABEL: Village of Caroline WWTP

DESIGN CASE: Total Phosphorus

FILE NAME: C:\Users\cagn070129\Desktop\PROJECTS\PROJECTS\Caroline CORMIX\CORMIX Results\December 13, 2020\TP Model.prd

Using subsystem CORMIX1: Single Port Discharges

Start of session: 12/14/2020--01:06:29

****

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded

Width BS = 10 m

Channel regularity ICHREG = 1

Ambient flowrate QA = 0.04 m^3/s

Average depth HA = 0.5 m

Depth at discharge HD = 0.5 m

Ambient velocity UA = 0.0084 m/s

Darcy-Weisbach friction factor F = 0.0889

Calculated from Manning's n = 0.03

Wind velocity UW = 2 m/s

Stratification Type STRCND = U

Surface temperature = 5 degC

Bottom temperature = 5 degC

Calculated FRESH-WATER DENSITY values:

Surface density RHOAS = 999.9667 kg/m^3

Bottom density RHOAB = 999.9667 kg/m^3

DISCHARGE PARAMETERS: Single Port Discharge

Nearest bank = left

Distance to bank DISTB = 0.5 m

Port diameter D0 = 0.02 m

Port cross-sectional area A0 = 0.0003 m^2

Discharge velocity U0 = 14.74 m/s

Discharge flowrate Q0 = 0.00463 m^3/s

Discharge port height H0 = 0.5 m

Vertical discharge angle THETA = 10 deg

Horizontal discharge angle SIGMA = 0 deg

Discharge density RHO0 = 990 kg/m^3

Density difference DRHO = 9.9667 kg/m^3

Buoyant acceleration GP0 = 0.0977 m/s^2

Discharge concentration C0 = 4.904 mg/l

Surface heat exchange coeff. KS = 0 m/s

Coefficient of decay KD = 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.02 m Lm = 31.10 m Lb = 763.54 m

LM = 6.28 m Lm' = 99999 m Lb' = 99999 m

NON-DIMENSIONAL PARAMETERS:

Port densimetric Froude number FR0 = 333.33

Velocity ratio R = 1754.49

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no

Water quality standard specified = yes

Water quality standard CSTD = 0.096 mg/l

Regulatory mixing zone = yes

Regulatory mixing zone specification = distance

Regulatory mixing zone value = 10 m (m^2 if area)

Region of interest = 100 m

****

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = IPH5 |

This flow configuration applies to a layer corresponding to the full water

depth at the discharge site.

Applicable layer depth = water depth = 0.5 m

Limiting Dilution S = (QA/Q0)+ 1.0 = 10.1

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:

Origin is located at the BOTTOM below the port/diffuser center:

0.5 m from the left bank/shore.

Number of display steps NSTEP = 20 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory

implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge c = 0.0337 mg/l

Dilution at edge of NFR s = 145.5

NFR Location: x = 45.45 m

(centerline coordinates) y = 0 m

z = 0.5 m

NFR plume dimensions: half-width (bh) = 4.58 m

thickness (bv) = 0.5 m

Cumulative travel time: 936.3268 sec.

WARNING:

The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 10.07

This value is below the computed dilution of 145.50 at the end of the Near Field Region (NFR). Mixing for this discharge configuration is constrained by the ambient flow.

Please carefully review the prediction file for additional warnings and information.

Buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Near-field instability behavior:

The discharge flow will experience instabilities with full vertical mixing in the near-field.

There may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m

downstream and continues as vertically mixed into the far-field.

PLUME BANK CONTACT SUMMARY:

Plume in bounded section contacts nearest bank at 0 m downstream.

Plume contacts second bank at 0 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration c = 0.076349 mg/l

Corresponding dilution s = 64.4

Plume location: x = 10 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.93 m

thickness (bv) = 0.5 m

Cumulative travel time < 936.3268 sec. (RMZ is within NFR)

Note:

Plume concentration c and dilution s values are reported based on prediction

file values - assuming linear interpolation between predicted points just

before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account

for this linear interpolation. Step size can be controlled by increasing

(reduces the prediction step size) or decreasing (increases the prediction

step size) the - Output Steps per Module - in CORMIX input.

Debug:

Plume centerline at RMZ distance to left bank: 0.5

Discharge location distance to bank DISTB: 0.5

Furthermore, the specified water quality standard has indeed been met within the RMZ. In particular:

The ambient water quality standard was encountered at the following plume position:

Water quality standard = 0.096 mg/l

Corresponding dilution s = 51.3

Plume location: x = 6.82 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.59 m

thickness (bv) = 0.5 m

Regulatory Mixing Zone Analysis:

The specified RMZ occurs within the near-field region (NFR). This RMZ specification may be highly restrictive.

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the CORMIX predictions on dilutions and concentrations (with associated plume geometries) are reliable for the majority of cases and are accurate to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

CORMIX SESSION REPORT:

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CORMIX MIXING ZONE EXPERT SYSTEM

CORMIX Version 11.0GT

HYDRO1:Version-11.0.1.0 August,2019

SITE NAME/LABEL: Village of Caroline WWTP

DESIGN CASE: Total Ammonia Nitrogen - Summer

FILE NAME: C:\Users\cagn070129\Desktop\PROJECTS\PROJECTS\Caroline CORMIX\CORMIX Results\Feb 18, 2021\TAN Model-Summer.prd

Using subsystem CORMIX1: Single Port Discharges

Start of session: 03/05/2021--23:44:33

****

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded

Width BS = 10 m

Channel regularity ICHREG = 1

Ambient flowrate QA = 0.21 m^3/s

Average depth HA = 0.5 m

Depth at discharge HD = 0.5 m

Ambient velocity UA = 0.042 m/s

Darcy-Weisbach friction factor F = 0.0889

Calculated from Manning's n = 0.03

Wind velocity UW = 2 m/s

Stratification Type STRCND = U

Surface temperature = 10 degC

Bottom temperature = 10 degC

Calculated FRESH-WATER DENSITY values:

Surface density RHOAS = 999.7019 kg/m^3

Bottom density RHOAB = 999.7019 kg/m^3

DISCHARGE PARAMETERS: Single Port Discharge

Nearest bank = left

Distance to bank DISTB = 0.5 m

Port diameter D0 = 0.02 m

Port cross-sectional area A0 = 0.0003 m^2

Discharge velocity U0 = 14.74 m/s

Discharge flowrate Q0 = 0.00463 m^3/s

Discharge port height H0 = 0.5 m

Vertical discharge angle THETA = 10 deg

Horizontal discharge angle SIGMA = 0 deg

Discharge density RHO0 = 990 kg/m^3

Density difference DRHO = 9.7019 kg/m^3

Buoyant acceleration GP0 = 0.0952 m/s^2

Discharge concentration C0 = 9.93 mg/l

Surface heat exchange coeff. KS = 0 m/s

Coefficient of decay KD = 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.02 m Lm = 6.22 m Lb = 5.95 m

LM = 6.36 m Lm' = 99999 m Lb' = 99999 m

NON-DIMENSIONAL PARAMETERS:

Port densimetric Froude number FR0 = 337.80

Velocity ratio R = 350.90

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no

Water quality standard specified = yes

Water quality standard CSTD = 0.192 mg/l

Regulatory mixing zone = yes

Regulatory mixing zone specification = distance

Regulatory mixing zone value = 10 m (m^2 if area)

Region of interest = 100 m

****

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = IPH5 |

This flow configuration applies to a layer corresponding to the full water

depth at the discharge site.

Applicable layer depth = water depth = 0.5 m

Limiting Dilution S = (QA/Q0)+ 1.0 = 46.4

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:

Origin is located at the BOTTOM below the port/diffuser center:

0.5 m from the left bank/shore.

Number of display steps NSTEP = 20 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory

implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge c = 0.066 mg/l

Dilution at edge of NFR s = 150.4

NFR Location: x = 45.45 m

(centerline coordinates) y = 0 m

z = 0.5 m

NFR plume dimensions: half-width (bh) = 3.84 m

thickness (bv) = 0.5 m

Cumulative travel time: 935.7391 sec.

WARNING:

The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 46.36

This value is below the computed dilution of 150.39 at the end of the Near Field Region (NFR). Mixing for this discharge configuration is constrained by the ambient flow.

Please carefully review the prediction file for additional warnings and information.

Buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Near-field instability behavior:

The discharge flow will experience instabilities with full vertical mixing in the near-field.

There may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m downstream and continues as vertically mixed into the far-field.

PLUME BANK CONTACT SUMMARY:

Plume in bounded section contacts nearest bank at 0 m downstream.

Plume contacts second bank at 0 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration c = 0.148862 mg/l

Corresponding dilution s = 66.9

Plume location: x = 10 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.86 m

thickness (bv) = 0.5 m

Cumulative travel time < 935.7391 sec. (RMZ is within NFR)

Note:

Plume concentration c and dilution s values are reported based on prediction file values - assuming linear interpolation between predicted points just before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction

step size) the - Output Steps per Module - in CORMIX input.

Debug:

Plume centerline at RMZ distance to left bank: 0.5

Discharge location distance to bank DISTB: 0.5

Furthermore, the specified water quality standard has indeed been met
within the RMZ. In particular:

The ambient water quality standard was encountered at the following
plume position:

Water quality standard = 0.192 mg/l

Corresponding dilution s = 52.2

Plume location: x = 6.60 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.54 m

thickness (bv) = 0.5 m

Regulatory Mixing Zone Analysis:

The specified RMZ occurs within the near-field region (NFR). This RMZ
specification may be highly restrictive.

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known
technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the
CORMIX predictions on dilutions and concentrations (with associated
plume geometries) are reliable for the majority of cases and are accurate
to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

CORMIX SESSION REPORT:

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CORMIX MIXING ZONE EXPERT SYSTEM

CORMIX Version 11.0GT

HYDRO1:Version-11.0.1.0 August,2019

SITE NAME/LABEL: Village of Caroline WWTP

DESIGN CASE: Total Ammonia Nitrogen - Winter

FILE NAME: C:\Users\cagn070129\Desktop\PROJECTS\PROJECTS\Caroline CORMIX\CORMIX Results\Feb 18, 2021\TAN Model-Winter.prd

Using subsystem CORMIX1: Single Port Discharges

Start of session: 02/17/2021--00:11:56

****

SUMMARY OF INPUT DATA:

AMBIENT PARAMETERS:

Cross-section = bounded

Width BS = 10 m

Channel regularity ICHREG = 1

Ambient flowrate QA = 0.21 m^3/s

Average depth HA = 0.5 m

Depth at discharge HD = 0.5 m

Ambient velocity UA = 0.042 m/s

Darcy-Weisbach friction factor F = 0.0889

Calculated from Manning's n = 0.03

Wind velocity UW = 2 m/s

Stratification Type STRCND = U

Surface temperature = 5 degC

Bottom temperature = 5 degC

Calculated FRESH-WATER DENSITY values:

Surface density RHOAS = 999.9667 kg/m^3

Bottom density RHOAB = 999.9667 kg/m^3

DISCHARGE PARAMETERS: Single Port Discharge

Nearest bank = left

Distance to bank DISTB = 0.5 m

Port diameter D0 = 0.02 m

Port cross-sectional area A0 = 0.0003 m^2

Discharge velocity U0 = 14.74 m/s

Discharge flowrate Q0 = 0.00463 m^3/s

Discharge port height H0 = 0.5 m

Vertical discharge angle THETA = 10 deg

Horizontal discharge angle SIGMA = 0 deg

Discharge density RHO0 = 990 kg/m^3

Density difference DRHO = 9.9667 kg/m^3

Buoyant acceleration GP0 = 0.0977 m/s^2

Discharge concentration C0 = 14.93 mg/l

Surface heat exchange coeff. KS = 0 m/s

Coefficient of decay KD = 0 /s

DISCHARGE/ENVIRONMENT LENGTH SCALES:

LQ = 0.02 m Lm = 6.22 m Lb = 6.11 m

LM = 6.28 m Lm' = 99999 m Lb' = 99999 m

NON-DIMENSIONAL PARAMETERS:

Port densimetric Froude number FR0 = 333.33

Velocity ratio R = 350.90

MIXING ZONE / TOXIC DILUTION ZONE / AREA OF INTEREST PARAMETERS:

Toxic discharge = no

Water quality standard specified = yes

Water quality standard CSTD = 0.192 mg/l

Regulatory mixing zone = yes

Regulatory mixing zone specification = distance

Regulatory mixing zone value = 10 m (m^2 if area)

Region of interest = 100 m

****

HYDRODYNAMIC CLASSIFICATION:

| FLOW CLASS = IPH5 |

This flow configuration applies to a layer corresponding to the full water

depth at the discharge site.

Applicable layer depth = water depth = 0.5 m

Limiting Dilution S = (QA/Q0)+ 1.0 = 46.4

****

MIXING ZONE EVALUATION (hydrodynamic and regulatory summary):

X-Y-Z Coordinate system:

Origin is located at the BOTTOM below the port/diffuser center:

0.5 m from the left bank/shore.

Number of display steps NSTEP = 20 per module.

NEAR-FIELD REGION (NFR) CONDITIONS :

Note: The NFR is the zone of strong initial mixing. It has no regulatory

implication. However, this information may be useful for the discharge designer because the mixing in the NFR is usually sensitive to the discharge design conditions.

Pollutant concentration at NFR edge c = 0.0993 mg/l

Dilution at edge of NFR s = 150.4

NFR Location: x = 45.45 m

(centerline coordinates) y = 0 m

z = 0.5 m

NFR plume dimensions: half-width (bh) = 3.84 m

thickness (bv) = 0.5 m

Cumulative travel time: 935.7391 sec.

WARNING:

The LIMITING DILUTION (given by ambient flow/discharge ratio) is = 46.36

This value is below the computed dilution of 150.39 at the end of the Near Field Region (NFR). Mixing for this discharge configuration is constrained by the ambient flow.

Please carefully review the prediction file for additional warnings and information.

Buoyancy assessment:

The effluent density is less than the surrounding ambient water density at the discharge level.

Therefore, the effluent is POSITIVELY BUOYANT and will tend to rise towards the surface.

Near-field instability behavior:

The discharge flow will experience instabilities with full vertical mixing in the near-field.

There may be benthic impact of high pollutant concentrations.

FAR-FIELD MIXING SUMMARY:

Plume becomes vertically fully mixed ALREADY IN NEAR-FIELD at 0 m downstream and continues as vertically mixed into the far-field.

PLUME BANK CONTACT SUMMARY:

Plume in bounded section contacts nearest bank at 0 m downstream.

Plume contacts second bank at 0 m downstream.

********** TOXIC DILUTION ZONE SUMMARY **********

No TDZ was specified for this simulation.

********** REGULATORY MIXING ZONE SUMMARY **********

The plume conditions at the boundary of the specified RMZ are as follows:

Pollutant concentration c = 0.223818 mg/l

Corresponding dilution s = 66.9

Plume location: x = 10 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 0.86 m

thickness (bv) = 0.5 m

Cumulative travel time < 935.7391 sec. (RMZ is within NFR)

Note:

Plume concentration c and dilution s values are reported based on prediction file values - assuming linear interpolation between predicted points just before and just after the RMZ boundary has been detected.

Please ensure a small step size is used in the prediction file to account for this linear interpolation. Step size can be controlled by increasing (reduces the prediction step size) or decreasing (increases the prediction

step size) the - Output Steps per Module - in CORMIX input.

Debug:

Plume centerline at RMZ distance to left bank: 0.5

Discharge location distance to bank DISTB: 0.5

However, the specified water quality standard has not been met
within the RMZ. In particular:

The ambient water quality standard was encountered at the following
plume position:

Water quality standard = 0.192 mg/l

Corresponding dilution s = 77.8

Plume location: x = 13.08 m

(centerline coordinates) y = 0 m

z = 0.5 m

Plume dimensions: half-width (bh) = 1.14 m

thickness (bv) = 0.5 m

Regulatory Mixing Zone Analysis:

The specified RMZ occurs within the near-field region (NFR). This RMZ
specification may be highly restrictive.

********** FINAL DESIGN ADVICE AND COMMENTS **********

REMINDER: The user must take note that HYDRODYNAMIC MODELING by any known
technique is NOT AN EXACT SCIENCE.

Extensive comparison with field and laboratory data has shown that the
CORMIX predictions on dilutions and concentrations (with associated
plume geometries) are reliable for the majority of cases and are accurate
to within about +-50% (standard deviation).

As a further safeguard, CORMIX will not give predictions whenever it judges the design configuration as highly complex and uncertain for prediction.

Table 1.2. Ammonia guidelines for protection of aquatic life at varying pH and temperature (continued).
Total ammonia-N, as mg/L

Temperature - Celsius	pH																				
	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0
0	1.91	1.52	1.21	0.967	0.771	0.616	0.492	0.394	0.316	0.255	0.205	0.166	0.135	0.111	0.091	0.076	0.063	0.053	0.046	0.040	0.035
1	1.76	1.40	1.12	0.890	0.710	0.567	0.454	0.364	0.292	0.235	0.190	0.154	0.126	0.103	0.085	0.071	0.059	0.050	0.043	0.038	0.033
2	1.62	1.29	1.03	0.820	0.655	0.523	0.419	0.336	0.270	0.218	0.176	0.143	0.117	0.096	0.080	0.066	0.056	0.048	0.041	0.036	0.032
3	1.49	1.19	0.948	0.756	0.604	0.483	0.387	0.311	0.250	0.202	0.163	0.133	0.109	0.090	0.074	0.062	0.053	0.045	0.039	0.034	0.030
4	1.38	1.10	0.875	0.698	0.558	0.446	0.358	0.287	0.231	0.187	0.152	0.124	0.102	0.084	0.070	0.059	0.050	0.043	0.037	0.033	0.029
5	1.27	1.01	0.807	0.645	0.515	0.412	0.331	0.266	0.215	0.174	0.141	0.115	0.095	0.079	0.066	0.055	0.047	0.041	0.036	0.031	0.028
6	1.17	0.935	0.746	0.596	0.476	0.382	0.306	0.247	0.199	0.161	0.131	0.108	0.089	0.074	0.062	0.052	0.045	0.039	0.034	0.030	0.027
7	1.08	0.864	0.689	0.551	0.441	0.353	0.284	0.229	0.185	0.150	0.122	0.100	0.083	0.069	0.058	0.049	0.042	0.037	0.033	0.029	0.026
8	1.00	0.799	0.638	0.510	0.408	0.327	0.263	0.212	0.172	0.140	0.114	0.094	0.078	0.065	0.055	0.047	0.040	0.035	0.031	0.028	0.025
9	0.926	0.739	0.590	0.472	0.378	0.304	0.244	0.197	0.160	0.130	0.107	0.088	0.073	0.061	0.052	0.044	0.039	0.034	0.030	0.027	0.025
10	0.858	0.684	0.547	0.438	0.351	0.282	0.227	0.184	0.149	0.122	0.100	0.083	0.069	0.058	0.049	0.042	0.037	0.032	0.029	0.026	0.024
11	0.794	0.634	0.507	0.406	0.326	0.262	0.211	0.171	0.139	0.114	0.093	0.077	0.065	0.055	0.047	0.040	0.035	0.031	0.028	0.025	0.023
12	0.736	0.588	0.470	0.377	0.302	0.243	0.197	0.159	0.130	0.106	0.088	0.073	0.061	0.052	0.044	0.038	0.034	0.030	0.027	0.025	0.023
13	0.683	0.546	0.437	0.350	0.281	0.227	0.183	0.149	0.121	0.100	0.082	0.069	0.058	0.049	0.042	0.037	0.032	0.029	0.026	0.024	0.022
14	0.634	0.506	0.406	0.325	0.262	0.211	0.171	0.139	0.114	0.093	0.077	0.065	0.055	0.047	0.040	0.035	0.031	0.028	0.025	0.023	0.022
15	0.588	0.471	0.377	0.303	0.244	0.197	0.159	0.130	0.106	0.088	0.073	0.061	0.052	0.044	0.038	0.034	0.030	0.027	0.025	0.023	0.021
16	0.547	0.438	0.351	0.282	0.227	0.184	0.149	0.122	0.100	0.082	0.069	0.058	0.049	0.042	0.037	0.032	0.029	0.026	0.024	0.022	0.021
17	0.508	0.407	0.327	0.263	0.212	0.171	0.139	0.114	0.094	0.078	0.065	0.055	0.047	0.040	0.035	0.031	0.028	0.025	0.023	0.022	0.021
18	0.473	0.379	0.304	0.245	0.198	0.160	0.131	0.107	0.088	0.073	0.061	0.052	0.044	0.039	0.034	0.030	0.027	0.025	0.023	0.021	0.020
19	0.440	0.353	0.284	0.229	0.185	0.150	0.122	0.100	0.083	0.069	0.058	0.049	0.042	0.037	0.033	0.029	0.026	0.024	0.022	0.021	0.020
20	0.410	0.329	0.265	0.213	0.173	0.140	0.115	0.094	0.078	0.065	0.055	0.047	0.041	0.035	0.031	0.028	0.026	0.024	0.022	0.021	0.020
21	0.383	0.307	0.247	0.200	0.162	0.132	0.108	0.089	0.074	0.062	0.052	0.045	0.039	0.034	0.030	0.027	0.025	0.023	0.021	0.020	0.019
22	0.357	0.287	0.231	0.187	0.152	0.124	0.101	0.084	0.070	0.059	0.050	0.043	0.037	0.033	0.029	0.026	0.024	0.022	0.021	0.020	0.019
23	0.333	0.268	0.216	0.175	0.142	0.116	0.095	0.079	0.066	0.056	0.047	0.041	0.036	0.032	0.028	0.026	0.024	0.022	0.021	0.020	0.019
24	0.311	0.251	0.202	0.164	0.133	0.109	0.090	0.075	0.063	0.053	0.045	0.039	0.034	0.030	0.027	0.025	0.023	0.022	0.020	0.019	0.019
25	0.291	0.235	0.189	0.154	0.125	0.103	0.085	0.071	0.059	0.050	0.043	0.038	0.033	0.029	0.027	0.024	0.023	0.021	0.020	0.019	0.018
26	0.272	0.220	0.178	0.144	0.118	0.097	0.080	0.067	0.056	0.048	0.041	0.036	0.032	0.028	0.026	0.024	0.022	0.021	0.020	0.019	0.018
27	0.255	0.206	0.167	0.136	0.111	0.091	0.076	0.063	0.054	0.046	0.040	0.035	0.031	0.028	0.025	0.023	0.022	0.020	0.019	0.019	0.018
28	0.239	0.193	0.157	0.128	0.105	0.086	0.072	0.060	0.051	0.044	0.038	0.033	0.030	0.027	0.025	0.023	0.021	0.020	0.019	0.018	0.018
29	0.224	0.181	0.147	0.120	0.099	0.082	0.068	0.057	0.049	0.042	0.036	0.032	0.029	0.026	0.024	0.022	0.021	0.020	0.019	0.018	0.018
30	0.210	0.170	0.138	0.113	0.093	0.077	0.065	0.054	0.046	0.040	0.035	0.031	0.028	0.025	0.023	0.022	0.021	0.020	0.019	0.018	0.018

Table 1.2. Ammonia guidelines for protection of aquatic life at varying pH and temperature (concluded).
Total ammonia-N, as mg/L

Source: CCME 2001

Values falling outside the shaded region should be used with caution.

To calculate un-ionized ammonia fraction (*f*): $f = 1/[10^{(pKa - pH)} + 1]$
where pKa = 0.0901821 + 2729.92/*T*
T = Temperature in K
T(in K) = T (in ºC) + 273.15

Total Ammonia Guideline (as N) = (0.019/*f*) *0.8224

To convert to mg/L total ammonia, multiply the corresponding guideline value by 1.216.

Temperature = 11deg C
= 284.15 K

pKa = 0.0901821 + 2729.92/T
= 0.0901821 + 2729.92/284.15
= 9.6975

Un-ionized ammonia fraction (f) = 1/[10^(pKa-pH) + 1]
= 1/[10^(9.6975-8.5) + 1]
= 0.05967 or 5.9%

Assuming a TAN limit of 15 mg/L, we get an un-ionized ammonia concentration = 5.9% x 15
= 0.885 mg/L

APPENDIX

E ANNUAL REPORTS AND LABORATORY DATA

20 / 3 ANNUAL REPORT - WASTEWATER TREATMENT FACILITIES (Mechanical)

ALBERTA ENVIRONMENTAL PROTECTION & ENHANCEMENT ACT

COMMUNITY NAME: Village of Caroline **APPROVAL NO.** 494-02-00

A. PERFORMANCE DATA SUMMARY Insert Average Monthly Results

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	TOTAL	AVG.
Flows (m3)	1352	1354	2488	2072	2435	2071	1773	1511	1415	1281	1518	1,319	20,589	1,715.75
BOD5 -Raw	365	352	273	133	183.2	172.5	303	261	495	456	422	329	3,744.7	312
TSS -Raw	1086	648	668	232	127.5	206	336	216	705	513	298	310	5,345.5	445.4
TSS -Treated	16	7.7	12	21	30	37	7.8	5.2	6.5	20.8	21.8	14.4	200.2	16.68
BOD -Treated	9	7.25	9.7	13	12.2	9.5	3.4	3.2	2.2	7.8	10.5	15	102.75	8.56
CI2 RESIDUAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

D. COMMENTS/SUMMARY OF NOTIFICATIONS AND CORRECTIVE ACTIONS TAKEN. **(Add additional pages if necessary)**

To be submitted prior to February 28 for the previous year to Alberta Environment

(Fax No. 340-5022) Attn: Municipal Approvals

Wastewater Treatment Plant
Year End Report

AQUATECH
CANADIAN WATER SERVICES INC.

Village of Caroline Wastewater Treatment Facility 2014
Approval: 494-02-00

	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Influent flow (m3)													
Total	6758.0	6138.0	7631.0	9178.0	7791.0	8501.0	6477.0	6351.0	7212.0	6592.0	6302.0	6631.0	85562.0
Min	190.0	171.0	189.0	195.0	215.0	171.0	158.0	186.0	181.0	173.0	170.0	186.0	158.0
Max	698.0	846.0	880.0	1175.0	1019.0	866.0	638.0	848.0	798.0	940.0	693.0	799.0	1175.0
Avg	298.55	314.05	354.38	439.33	373.10	396.67	287.23	318.15	334.81	300.00	322.74	329.27	339.02
Effluent flow (m3)													
Total	6758.0	6138.0	7631.0	9178.0	7791.0	8501.0	6477.0	6351.0	7212.0	6592.0	6302.0	6631.0	85562.0
Min	190.0	171.0	189.0	195.0	215.0	171.0	158.0	186.0	181.0	173.0	170.0	186.0	158.0
Max	698.0	846.0	880.0	1175.0	1019.0	866.0	638.0	848.0	798.0	940.0	693.0	799.0	1175.0
Avg	298.5	314.1	354.4	439.3	373.1	396.7	287.2	318.2	334.8	300.0	322.7	329.3	339.0
Influent BOD (mg/L)													
Min	237.0	193.0	123.0	146.0	118.0	210.0	227.0	183.0	283.0	210.0	257.0	43.0	43.0
Max	827.0	239.0	294.0	648.0	289.0	306.0	858.0	366.0	835.0	356.0	506.0	261.0	858.0
Avg	437.8	211.7	185.5	268.8	191.5	240.3	437.2	259.8	516.2	275.3	363.3	104.4	291.0
Effluent BOD													
Min	24.00	48.0	52.0	37.0	12.0	7.0	3.0	3.0	4.0	6.0	3.0	3.0	3.0
Max	43.00	63.0	70.0	65.0	27.0	15.0	12.0	6.0	13.0	11.0	7.0	7.0	70.0
Avg	32.25	53.33	60.75	53.00	20.25	11.00	6.20	4.75	7.80	8.50	5.00	5.00	22.32
Influent TSS (mg/L)													
Min	107.00	85.0	123.0	70.0	74.0	178.0	209.0	92.0	233.0	291.0	148.0	201.0	70.0
Max	1200.00	153.0	381.0	893.0	237.0	381.0	1224.0	634.0	1072.0	440.0	308.0	455.0	1224.0
Avg	565.25	112.67	252.00	287.80	133.75	266.25	492.80	281.50	531.60	350.00	260.00	301.80	319.62
Effluent TSS (mg/L)													
Min	20.0	23.0	10.0	14.0	19.0	9.0	5.0	3.0	7.0	14.0	9.0	10.0	3.0
Max	25.0	31.0	17.0	58.0	61.0	29.0	9.0	15.0	35.0	26.0	13.0	15.0	61.0
Avg	23.50	25.67	13.75	24.40	36.25	21.75	6.80	7.75	16.20	20.00	11.25	13.00	18.36

234

AQUATECH
CANADIAN WATER SERVICES INC.

Caroline

VILLAGE OF CAROLINE ANNUAL WATEWATER SUMMARY 2015

APPROVAL #000000494-02-01

		JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE		JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER		ANNUAL	
INFLUENT	LAGOON METER INFLUENT (RAW WELL)	7719.00	5416.00	5423.00	6001.00	5416.00	5828.00	TOTAL	5778.00	5360.50	5052.00	4765.00	4700.00	4197.00	TOTAL	65686.50	LAGOON METER INFLUENT (RAW WELL)
		196.00	148.00	140.00	130.00	143.00	96.00	MIN	87.00	146.00	96.69	130.00	42.00	112.00	MIN	42.00	
		833.00	766.00	597.00	1182.50	720.00	612.00	MAX	603.00	731.00	731.70	616.00	485.00	510.00	MAX	1182.00	
		690.32	515.79	483.10	555.19	512.45	528.00	AVG	505.23	495.85	485.23	433.71	452.35	405.00	AVG	505.23	
	TSS	102.00	39.00	81.00	104.00	16.00	137.00	MIN	182.00	84.00	196.00	40.00	26.67	40.00	MIN	16.00	TSS
		285.00	596.00	275.00	313.00	388.00	242.00	MAX	240.00	432.00	204.00	320.60	173.30	173.30	MAX	596.00	
		187.50	296.75	163.40	230.00	153.00	165.25	AVG	197.25	196.00	200.00	140.14	77.01	61.32	AVG	172.47	
	BOD	136.00	120.00	14.00	188.00	98.00	212.00	MIN	200.00	11.44	120.90	97.00	6.33	43.85	MIN	6.33	BOD
		179.00	409.00	234.00	315.00	220.00	305.00	MAX	323.00	111.40	132.40	470.00	236.00	235.00	MAX	470.00	
		152.75	214.75	110.60	240.75	154.60	240.75	AVG	241.00	51.27	126.50	253.40	101.33	102.14	AVG	165.82	
	Ph	7.91	7.87	7.85	7.45	3.82	7.06	MIN	7.91	7.98	7.91	7.66	7.92	7.96	MIN	3.82	Ph
		8.19	8.24	8.18	8.21	8.27	7.82	MAX	7.59	8.15	8.14	8.65	8.33	8.41	MAX	8.65	
		8.09	8.04	7.88	7.65	6.30	7.43	AVG	7.45	8.03	7.99	8.10	8.03	7.99	AVG	7.75	
LAGOON EFFLUENT	LAGOON METER FLOW M3	6158.00	5267.00	6777.00	6126.00	5530.00	6358.00	TOTAL	6794.00	6341.00	4985.00	5533.00	5576.00	5291.00	TOTAL	70136.00	LAGOON METER m3
		131.00	352.00	157.00	174.00	154.00	122.00	MIN	132.00	141.00	135.00	143.00	110.00	156.00	MIN	110.00	
		643.00	667.00	827.00	605.00	662.00	608.00	MAX	678.00	902.00	530.00	735.00	544.00	712.00	MAX	902.00	
		547.64	511.33	608.14	553.71	519.95	584.15	AVG	552.45	590.40	468.00	501.81	536.00	513.10	AVG	540.39	
	TSS	13	8	6	14	2	35	MIN	22	1	13	16	17	7	MIN	1.00	TSS
		14	13	71	57	61	95	MAX	43	12	15	31	36	27	MAX	95.00	
		13	10	21	34	35	44	AVG	28	6	14	20	22	13	AVG	21.73	
	BOD	5.00	6.00	6.00	8.00	4.90	5.00	MIN	4.00	0.66	7.53	5.13	0.54	2.90	MIN	0.54	BOD
		12.00	8.00	14.00	18.00	13.90	19.00	MAX	9.00	3.01	7.76	18.07	5.33	6.80	MAX	23.00	
		9.00	6.99	9.20	12.00	13.96	10.25	AVG	6.25	1.72	2.61	7.98	2.88	4.24	AVG	7.26	
	Ph	7.58	7.61	7.40	7.93	0.00	7.47	MIN	7.34	7.60	7.38	7.37	7.34	6.36	MIN	0.00	Ph
		7.75	7.79	7.89	8.48	0.00	9.09	MAX	7.88	7.78	7.55	7.69	7.91	7.77	MAX	9.09	
		7.58	7.67	7.59	8.22	0.00	7.95	AVG	7.55	7.65	7.44	7.55	7.55	7.15	AVG	6.99	
	TEMP	2.8	3.2	3.9	5.8	15.1	18.6	MIN	22.2	17.0	10.4	6.2	6.7	7.0	MIN	2.80	TEMP
		4.1	4.2	5.8	15.5	17.6	22.7	MAX	24.1	18.8	15.2	8.6	10.3	8.3	MAX	24.10	
		3.6	3.6	4.5	10.9	16.3	20.4	AVG	22.3	17.8	12.0	7.3	8.6	7.6	AVG	11.24	
	DIBOLVED OXYGEN	7.3	7.0	6.8	9.2	6.3	2.9	MIN	2.4	4.1	6.6	6.3	6.8	6.7	MIN	2.40	DIBOLVED OXYGEN
		7.5	7.5	8.3	10.3	13.5	13.9	MAX	4.1	6.9	7.9	10.3	10.3	10.9	MAX	13.50	
		7.3	7.2	7.3	9.9	9.9	4.9	AVG	3.2	5.3	7.0	8.4	8.5	8.4	AVG	7.29	

192

Village of Caroline

Village of Caroline Annual Waste water Summary 2016

Approval # 00000494-2016

		January	February	March	April	May	June		July	August	September	October	November	December	Total	Average
Influent	Lagoon meter Influent (Raw well)	4537	4395	5844	5285	5045	4369	Total	5218	6108	4525	4486	4218	5469	4958	5102
		87	127	156	134	97	120	Min	134	121	118	116	117	130	1457	121.4
		180	214	264	261	201	234	Max	304	335	238	236	177	292	2936	244.7
		134	171	189	176	163	146	Average	217	228	195	158	161	211	2149	179.1
	TSS	40.5	49.5	28.7	32.8	30.7	72	Min	38	12.6	47	54	37	28.3	471.1	39.26
		92	158	150	129	107	91	Max	60	19.7	159	203	174	132	1474.7	122.89
		65.13	91.25	88.98	86.24	50.93	77	Average	49	16	101	114	95	69.9	904.43	75.37
	BOD	62.3	72.9	37.3	66.4	65.3	86.7	Min	38.3	14.4	45.3	64.6	55.8	48	657.3	54.78
		129	146	157	121	98.1	143	Max	82.1	42.8	84.9	152	139	135	1429.9	119.16
		100.58	104.2	91.88	91.98	88.33	110.6	Average	56.7	26.9	62	106	94.25	90.2	1023.62	85.3
	PH	7.69	7.55	7.76	7.6	7.44	7.75	Min	7.57	7.56	7.6	7.7	7.71	7.82	91.75	7.65
		7.93	8.15	8.04	7.72	7.73	7.92	Max	8.04	7.64	7.79	7.87	7.9	8.01	94.74	7.9
		7.81	7.85	7.9	7.66	7.59	7.84	Average	7.81	7.6	7.7	7.82	7.8	7.91	93.29	7.77

Effluent	Lagoon Flow Meter M3	5197	5570	5393	5228	5129	4896	Total	5209	4919	4283	4061	3418	3375	56678	4723.17
		172	186	173	177	166	168	Min	160	133	70	62	47	15	1529	127.4
		198	222	207	210	196	214	Max	210	210	174	167	137	119	2264	188.6
		186	199	193	187	183	140	Average	186	176	122	116	98	96	1882	156.8
	TSS	10.3	8.2	9.4	11.2	24.5	10.2	Min	4.2	<3	3	3.4	6.2	8	98.6	16.43333333
		14	12.5	11.7	94	53	52	Max	27	6	5.11	5.4	11.2	9.2	301.11	46.32461538
		12.68	10.39	10.63	42.96	35.68	31.1	Average	12.6	4.3	3.7	4.7	8.73	8.58	186.05	28.62307692
	BOD	11.9	10.2	10.4	9.54	10.5	<2.0	Min	<2	<2	<2	<2	2.32	4.59	59.45	14.8625
		14.4	13.6	12.6	20	14.8	11.9	Max	3	<3	2.12	<2	3.94	5.94	102.3	18.6
		13.25	11.5	11.33	14.37	12.6	4.95	Average	2.5	2.3	2	<2	2.89	5.17	82.86	13.81
	PH	7.43	7.32	7.5	7.63	7.93	7.66	Min	7.83	7.76	7.65	7.92	7.95	7.87	92.45	14.22307692
		7.78	7.51	7.56	8.43	8.14	7.93	Max	7.94	7.9	7.88	8.07	8.15	7.99	95.28	14.65846154
		7.65	7.46	7.53	8	8.5	7.81	Average	7.88	7.85	7.72	7.9	8.05	7.94	94.29	14.50615385
	Temp	5.7	4.7	3.4	5.4	8.7	11.4	Min	13.9	12.4	11.8	8.8	8.4	7.2	101.8	15.66153846
		7.5	8.5	7.7	11.4	13.6	18.1	Max	16.1	15.4	13.9	12.5	12.5	9.9	147.1	22.63076923
		6.75	6	6.13	9.3	11.43	15.1	Average	15	14	13.8	10.3	10.45	9.03	127.29	19.58307692
	Disolved Oxygen	6.9	10.8	6.7	6	5	4.5	Min	4.2	8.8	6.6	5.7	7	8.6	80.8	6.7
		7.1	11.6	8.4	10	10	7.5	Max	7	9.6	7.9	10.3	10	11	110.4	9.2
		7	11.2	7.3	8	7.5	6	Average	5.6	9.2	7	8	8.5	9.8	95.1	7.9

155

Operator Jacob Tricker Cell 403 846 7454

Village of Caroline — Operator: Jacob Tricker Cell: 1403 846 7454

Village of Caroline Annual Waste water Summary 2017

Approval # 00000494-2017

		January	February	March	April	May	June		July	August	September	October	November	December	Total	Average
Influent	Lagoon meter Influent (Raw well)	3735	3098	3446	2942	3655	3540	Total	3692	3302	4130	3260	3421	2957	41178	3431
		100	96	91	100	99	100	Min	100	105	109	95	103	101	1199	100
		131	136	140	135	142	143	Max	179	140	124	133	121	103	1627	136
		120.5	116	116	118	121	122	Average	119	107	142	116	114	102	1413	118
	TSS	28.5	45.5	30	15.8	11.5	20	Min	29.3	28.8	30.2	48.3	55.3	68.5	411.7	34
		109	93	117	81.2	55	126	Max	145	81	91	123	155	139	1315.2	110
		69	73	62	57	35	79	Average	71.4	57.6	67.3	73	113	97	854.3	71
	BOD	37.4	95.6	51	25.7	13.5	37	Min	46.2	40.4	34.3	72	92	98.5	643.6	54
		134	156	151	82.8	55.8	95	Max	105	101	125	118	194	199	1516.6	126
		84.6	124.4	84	77	44.8	65	Average	71.2	68.4	94.1	85	135	149	1082.5	90
	PH	7.78	7.79	7.71	7.57	7.52	7.56	Min	7.69	7.62	7.81	7.69	7.79	7.77	92.3	7.7
		8.14	8.15	8.7	7.8	7.7	7.86	Max	7.79	7.69	7.93	7.86	8.05	8.17	95.84	8
		7.96	7.95	7.91	7.71	7.61	7.7	Average	7.7	7.66	7.8	7.8	7.9	7.96	93.66	7.8
Effluent	Lagoon Flow Meter M3	3511	2912	3239	2765	3436	3328	Total	3241	3049	3755	2856	2947	2265	37304	3109
		94	90	86	94	92	93	Min	84	81	88	98.4	83	72.7	1056.1	88
		123	130	134	129	133	131	Max	126	109	137	105	103	78.6	1438.6	188.6
		113	110	110	112	113	114	Average	104	98	129	102	98	73.1	1276.1	106
	TSS	7.6	6.27	9.4	13.5	14.5	5.86	Min	6.8	3	3.5	3.6	4.6	5.14	83.77	7
		28.4	10	14.2	34.4	81.2	51.5	Max	18.2	17	23.9	6.62	14.2	37	336.62	28
		18	7.53	11.1	20.65	37.7	24.27	Average	11.4	8.1	12.4	5.5	8.15	12.9	177.7	15
	BOD	6.93	5.79	11.5	10.9	6.79	2	Min	2	2.02	2	2	2.1	5.05	59.08	4.9
		9.29	11.2	15.8	14.5	15.8	7.24	Max	3	3	3	3	4.04	6.4	96.27	8.1
		8.11	7.74	13.8	12.03	9.5	3.6	Average	2.6	2.4	2.2	2.3	3.2	5.73	73.21	6.1
	PH	7.81	7.72	7.73	7.84	8.13	7.89	Min	7.91	7.93	7.86	7.87	7.81	7.69	94.19	7.85
		7.87	7.97	7.94	8.15	8.6	8.13	Max	8	8.01	7.96	8.12	8.04	7.82	96.61	8.05
		7.84	7.83	7.78	8.03	8.33	8	Average	7.97	7.98	7.9	7.9	7.9	7.76	95.22	7.9
	Temp	8	7.2	3.3	9.4	9.8	14	Min	16.9	14.3	11.9	7.7	3.7	2.5	108.7	9.06
		9	7.3	7	9.5	12.2	17.1	Max	18.3	18.7	18.9	12.1	5.2	5.3	140.6	11.7
		8.5	7.3	5.88	9.45	11.33	11.17	Average	17.5	16	14.3	7.9	4.3	4.1	117.73	9.8
	Disolved Oxygen	12.2	12	8.5	10.4	6.76	2	Min	4.75	4.81	5.7	9	12.5	11.8	100.42	8.4
		12.7	12.8	12.3	15.25	13.32	6.03	Max	7.2	6.7	7.6	10.7	14	13.5	132.1	11
		12.55	12.58	9.89	12.24	10.04	4.1	Average	5.6	5.96	6.6	10	13.3	12.75	115.61	9.6
Eff	Ammonia Nitrogen	11..5	21	19.8	21	15.1	14.9	Min	5.52	0.71	0.98	1.6	2.13	6.84	121.1	10.1
		21.1	37.9	27.8	25.8	21.6	18.6	Max	16.8	3.09	1.85	2.05	4.31	13	193.9	16.2
		17.3	25.7	25.6	23	18.6	16.9	Average	11.7	1.34	1.44	1.8	3.15	9.89	156.4	13
Eff	Total Phosphorus				3.39	3.44	3.43	Min	2.55	2.3	2.87	2.06	2.09	2.66	24.8	2.8
					3.64	4.25	4.57	Max	4.26	2.84	3.55	2.81	2.37	5.12	33.4	3.7
					3.54	3.93	4.1	Average	3.4	2.5	3.19	2.4	2.3	3.41	28.5	3.2
Eff	Unionized Ammonia	0.0206	0.316	0.494												

Village of Caroline

Operator: Jacob Tricker Cell: 1403 846 7454

Village of Caroline Annual Waste water Summary 2018

Approval # 00000494-2018

		January	February	March	April	May	June		July	August	September	October	November	December	Total	Average
Influent (weekly Fridays)	Lagoon meter Influent	3728	2860	2776	3049	2905	3694	Total	2901	3509	3049	2741	2984	3126	37322	3110
		594	120	104	708	701	631	Min	718	625	726	420	102	500	5949	495
		1020	736	704	801	761	875	Max	736	726	821	803	744	716	9443	786
		745	714	665	707	726	738	Average	725	701	762	685	596	625	8389	699
	TSS	49.5	69.3	62	31	19	56	Min	52	103	45	108	45	87	726	60
		190	180	99	127	96	132	Max	241	608	90	187	121	136	2207	183
		87.7	120	76	67	57	100	Average	121	386	71	152	77	110	1424	118
	BOD	98	119	91.6	67.8	32	68	Min	69	125	59	110	71	139	1048	87
		204	288	219	149	140	129	Max	243	273	134	189	137	203	2308	192
		139	206	129	89.6	82	106	Average	130	229	93	139	105	171	1618	134
	PH	7.89	7.95	7.88	7.62	7.62	7.69	Min	7.62	7.7	7.78	7.7	7.89	7.85	93	7.76
		8.32	8.24	8.12	8.07	7.93	7.86	Max	8.07	7.83	7.95	7.9	8.06	8.08	96	8
		8.1	8.1	8	54.6	7.8	7.78	Average	7.75	7.76	7.9	7.82	7.9	7.9	141	11.7
Effluent (weekly Fridays)	Lagoon Flow Meter (Eff)	2794	2371	2553	2528	2321	2658	Total	2435	2607	2498	2358	2676	2757	30556	2546
		445	99	95	587	560	454	Min	603	475	595	384	93	433	4823	401
		765	610	647	664	608	630	Max	618	537	673	672	672	644	7740	645
		558	588	616	588	580	531	Average	608	521	624	589	535	551	6889	574
	TSS	8.13	9.33	11	10.2	10.9	26.4	Min	6.8	4.2	3	3.8	4.12	7.5	105	8.7
		12.8	11	13.8	17.5	46	40	Max	18.3	14.8	12.8	25.6	8.89	12.8	228	19
		10.4	10.6	12.3	12.6	22	30	Average	10	9	8.3	10.7	6.7	10	149	12
	BOD	4.15	6.27	9.63	12.7	7	4.2	Min	2	2	2	2	2.1	6.3	59.7	4.9
		7.13	11.7	11.6	20.6	18	7.3	Max	2.5	2	2	2.3	5	10.2	90	7.5
		6.4	9.1	10.7	15.4	12	6.2	Average	2.2	2	2	2.1	3.7	7.9	76	6
	PH	7.59	7.54	7.53	7.53	7.75	7.9	Min	7.78	7.65	7.61	7.7	7.67	7.49	91.7	7.6
		7.64	7.68	7.63	7.62	8.27	8.1	Max	7.9	7.83	7.66	7.77	7.82	7.58	93.5	7.79
		7.6	7.6	7.6	7	7	8	Average	7.75	7.7	7.63	7.7	7.7	7.5	90	7.56
	Temp	1.1	0	1.7	3.4	9.8	12.8	Min	14.8	11	6.5	4.9	1.3	0	67	5.6
		4	2.6	4	7.3	16	17	Max	18.8	15.7	11.4	6.4	6.4	6.9	116	9.7
		2.8	1.2	2.5	4.6	12	14.6	Average	16.7	13.3	8.9	5.7	3	3.3	88.6	7.3
	Disolved Oxygen	5.85	4.15	2.5	0.5	1.3	0.5	Min	0.4	0.9	2.95	4.2	5.2	2.2	30.6	2.55
		10.5	10	4.1	3	8	7.25	Max	3.15	3	4	5	7.5	10.75	76.2	6.3
		8.2	6.1	3.2	1.3	3.9	2.4	Average	1.48	2.05	3.39	4.6	6.34	5.18	48.1	4.01
Eff	Ammonia Nitrogen	14.4	20.6	26.8	33.5	25.8	16.8	Min	12.8	4.21	3.09	3.3	5.02	10.5	176.8	14.7
		19.9	25.9	33.3	56.3	29.4	27.8	Max	16.4	10.1	4.45	4.5	12.3	15.4	255.7	21.3
		8.2	23.5	29.9	40.3	28	21	Average	12.3	6.76	3.5	4	7.7	13.3	198.3	16.5
Eff	Total Phosphorus	3.3	3.82	4.39	4.94	4.39	4.83	Min	4.97	3.69	3	2.48	2.66	3.52	45.9	3.8
		3.65	4.2	5.07	5.59	5.1	5.4	Max	5.58	4.57	3.57	2.68	3.34	4.12	52.8	4.4
		3.5	3.9	4.6	5.32	4.8	5.21	Average	5.3	4.06	3.3	2.6	2.95	3.86	49.4	4.1
Eff	Unionized Ammonia			0.359	0.414	0.673			0.335	0.207			0.103	0.122	2.213	0.316
				0.405	0.611	1.3			2.04	0.207			0.167	0.24	5.21	0.744

Raven River Sampling Laboratory Reports

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: **WSP CANADA INC.**
4407-45A AVENUE, BAY 204
ROCKY MOUNTAIN HOUSE, AB T4T1A3
(403) 845-5662

ATTENTION TO: **TINA MEWS**

PROJECT: **171-00699-00**

AGAT WORK ORDER: **17C294743**

WATER ANALYSIS REVIEWED BY: **Krystyna Krauze, Senior Analyst**

DATE REPORTED: **Dec 21, 2017**

PAGES (INCLUDING COVER): **10**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis - Total, Fecal, E. Coliforms

DATE RECEIVED: 2017-12-13

DATE REPORTED: 2017-12-21

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: Sample Location #1 / SAMPLE TYPE: Water / DATE SAMPLED: 2017-12-13 / 8973639	SAMPLE DESCRIPTION: Sample Location #2 / SAMPLE TYPE: Water / DATE SAMPLED: 2017-12-13 / 8973640	SAMPLE DESCRIPTION: Sample Location #3 / SAMPLE TYPE: Water / DATE SAMPLED: 2017-12-13 / 8973641
Total Coliforms (MF)	CFU/100 mL		10	160	300	340
Fecal Coliforms (MF)	CFU/100 mL		1	8	6	7
Escherichia coli in Water	CFU/100 mL		1	15	19	12

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

8973639-8973641 Results for fecal coliforms and E. Coli from two separate plates, values are within duplicate criteria.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2017-12-13

DATE REPORTED: 2017-12-21

Parameter	Unit	G / S	RDL	Sample Location #1 Water 2017-12-13 8973639	Sample Location #2 Water 2017-12-13 8973640	Sample Location #3 Water 2017-12-13 8973641
pH	pH Units	7.0-10.5	N/A	8.39	8.43	8.46
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	6
T - Alkalinity (as CaCO3)	mg/L		5	276	279	288
Bicarbonate	mg/L		5	329	329	337
Carbonate	mg/L		5	<5	6	7
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	484	490	496
Chloride	mg/L	(250)	1	3	3	3
Fluoride	mg/L	1.5	0.01	0.08	0.08	0.08
Nitrate	mg/L	45	0.1	1.0	1.0	1.1
Nitrate-N	mg/L	10	0.02	0.23	0.23	0.25
Nitrite	mg/L	3	0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L	1	0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.23	0.23	0.25
Sulfate	mg/L	(500)	1	4	4	4
Dissolved Calcium	mg/L		0.3	70.6	72.0	72.8
Dissolved Magnesium	mg/L		0.2	22.0	21.2	22.6
Dissolved Sodium	mg/L		0.6	5.3	5.7	5.7
Dissolved Potassium	mg/L		0.6	1.1	1.1	1.1
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	0.006	0.017	0.008
Calculated TDS	mg/L		0.6	269	276	283
Sodium Adsorption Ratio	N/A			0.14	0.15	0.15
Hardness	mg CaCO3/L		1	267	267	275
Ion Balance	%		1	100	97	97

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2017-12-13

DATE REPORTED: 2017-12-21

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to 2017 Canadian Drinking Water Quality MAC (AO)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8973639-8973641 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Water Analysis - BOD, CBOD, COD, Diss. Oxygen, O-PO4, TKN, T-P, TSS,

DATE RECEIVED: 2017-12-13

DATE REPORTED: 2017-12-21

Parameter	Unit	G / S	RDL	SAMPLE DESCRIPTION: Sample Location #1 / SAMPLE TYPE: Water / DATE SAMPLED: 2017-12-13	Sample Location #2 / Water / 2017-12-13	Sample Location #3 / Water / 2017-12-13
				8973639	8973640	8973641
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Chemical Oxygen Demand	mg/L		1	<1	<1	<1
Dissolved Oxygen	mg/L		0.1	3.7	5.7	3.8
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1	<0.1	0.3	<0.1
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2	<2	<2	<2

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Dec 21, 2017

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	8973461		7.91	7.92	0.1%	N/A	99%	90%	110%						
T - Alkalinity (as CaCO3)	8973461		616	612	0.7%	< 5	106%	80%	120%						
Electrical Conductivity	8973461		1200	1200	0.0%	< 5	102%	80%	120%						
Chloride	8972743		91	91	0.0%	< 1	106%	80%	120%	106%	80%	120%	NA	80%	120%
Fluoride	8972743		<0.06	<0.06	NA	< 0.01	102%	80%	120%	100%	80%	120%	104%	80%	120%
Nitrate	8972743		146	144	1.4%	< 0.1	113%	80%	120%	111%	80%	120%	NA	80%	120%
Nitrite	8972743		1.46	1.53	4.7%	< 0.05	91%	80%	120%	91%	80%	120%	100%	80%	120%
Sulfate	8972743		81	78	3.8%	< 1	105%	80%	120%	103%	80%	120%	NA	80%	120%
Dissolved Calcium	8971854		64.1	63.1	1.6%	< 0.3	103%	80%	120%	109%	80%	120%	NA	80%	120%
Dissolved Magnesium	8971854		49.8	49.4	0.8%	< 0.2	106%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Sodium	8971854		19.4	19.0	2.1%	< 0.6	101%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Potassium	8971854		1.8	1.7	NA	< 0.6	95%	80%	120%	95%	80%	120%	90%	80%	120%
Dissolved Iron	8971854		<0.1	<0.1	NA	< 0.1	103%	80%	120%	93%	80%	120%	94%	80%	120%
Dissolved Manganese	8971854		0.009	0.008	NA	< 0.005	105%	80%	120%	101%	80%	120%	103%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Routine Chemistry Water Analysis												
pH	8972156		7.89	7.90	0.1%	N/A	100%	90%	110%	NA		NA
T - Alkalinity (as CaCO3)	8972156		679	679	0%	< 5	107%	80%	120%	NA		NA
Electrical Conductivity	8972156		1670	1670	0%	< 5	104%	80%	120%	NA		NA

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis - Total, Fecal, E. Coliforms						
Total Coliforms (MF)	2203	639	160	180	11.8%	< 1
Fecal Coliforms (MF)	2203	639	8	6	NA	< 1
Escherichia coli in Water	2203	639	15	16	6.5%	< 1

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - BOD, CBOD, COD, Diss. Oxygen, O-PO4, TKN, T-P, TSS,															
Biochemical Oxygen Demand (BOD)	5669	639	< 2	< 2	NA	< 2	90%	80%	120%						
CBOD - Carbonaceous	5669	639	< 2	< 2	NA	< 2	87%	80%	120%						
Chemical Oxygen Demand	1321	751	10	11	9.5%	< 1	101%	80%	120%	95%	80%	120%	104%	80%	120%

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Dec 21, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Oxygen	160	639	3.7	3.7	0.0%	< 0.1									
Orthophosphate	8973639	8973639	<0.15	<0.15	NA	< 0.15	106%	80%	120%	111%	80%	120%	106%	80%	120%
Total Kjeldahl Nitrogen	8973576		1.2	1.1	8.7%	< 0.1	88%	80%	120%	82%	80%	120%	107%	80%	120%
Total Phosphorus	8969607		0.31	0.31	NA	< 0.08	98%	80%	120%	97%	80%	120%	97%	80%	120%
Total Suspended Solids	8973639	8973639	<2	<2	NA	< 2	100%	80%	120%				98%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 17C294743

PROJECT: 171-00699-00

ATTENTION TO: TINA MEWS

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 3.3°C
AGAT Job Number: 17C 294743
Date and Time: 13-DEC-17 PM 5:24

Report Information
Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387 / Rocky Mountain House / AB / T4T 1A3
Phone: 403-845-5662 Fax: 403-845-5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert.Zhuge@wsp.com
Email: Albert Zhuge
3. Name:
Email:

Report Format
☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To
Same Yes / No
Company: WSP Canada Inc.
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements (Selection may impact detection limits)
☐ CCME: ☐ Agricultural ☐ Industrial ☐ Residential/Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1: ☐ Agricultural ☐ Industrial ☐ Residential/Park ☐ Commercial ☐ Natural Area
☐ AB Surface Water
☐ BC CSR: ☐ AW ☐ IW ☐ LW ☐ DW
☐ Other: ☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill: Dissolved Oxygen	BC Landfill: Total Phosphorus	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEX/VPH/EPH ☐ LEPH/HEPH ☐	CBOD	BOD	T & F Coliforms / Ecoli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
847639	Sample Location # 1	SW	Dec. 13/17 @ 11:20 am		11					X	X	X		X		X	X	X	X	X	X			
40	Sample Location # 2	SW	Dec 13/17 12:05 pm		11					X	X	X		X		X	X	X	X	X	X			
41	Sample Location # 3	SW	Dec 13/17 1:00 pm		11					X	X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign): Robert McCleary	Date/Time Dec 13, 2017 5:24	Samples Received By (Print Name and Sign):	13-DEC-17	Date/Time 5:24	Pink Copy - Client	Page 1 of 1	
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):		Date/Time	Yellow Copy - AGAT		
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):		Date/Time	White Copy - AGAT	N°: AB 071807	

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA INC

Courier: O/O Prepaid Collect

Waybill#

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other: —

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle) (Mibi) (BOD) Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: 13-OCT-17 5:20 PM

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: (Icepack) Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 33 + + = 33 °C 2 (Bottle/Jar) + + = °C

3 (Bottle/Jar) + + = °C 4 (Bottle/Jar) + + = °C

5 (Bottle/Jar) + + = °C 6 (Bottle/Jar) + + = °C

7 (Bottle/Jar) + + = °C 8 (Bottle/Jar) + + = °C

9 (Bottle/Jar) + + = °C 10 (Bottle/Jar) + + = °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 17C294743

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 3.3°C
AGAT Job Number: 17C 294743
Date and Time: 13-DEC-17 PM 5:24

Report Information
Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387 / Rocky Mountain House / AB / T4T 1A3
Phone: 403-845-5662 Fax: 403-845-5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert.Zhuge@wsp.com
Email: Albert Zhuge
3. Name:
Email:

Report Format
☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To
Same Yes / No
Company: WSP Canada Inc.
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements (Selection may impact detection limits)
☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^6 ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr^6	Routine Water Potability	AB Class 2 Landfill: Dissolved Oxygen	BC Landfill: Total Phosphorus	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	cBOD	BOD	T&F Coliforms / Ecoli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
897639	Sample Location #1	SW	Dec. 13/17 @ 10:20am		11					X	X	X		X		X	X	X	X	X	X			1
40	Sample Location #2	SW	Dec 13/17 @ 12:25pm		11					X	X	X		X		X	X	X	X	X	X			
41	Sample Location #3	SW	Dec 13/17 @ 1:00pm		11					X	X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Robert McCleary	Dec 13, 2017 5:24		13-DEC-17 5:24
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page 1 of 1

N°: AB 071807

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA INC

Courier: O/O Prepaid Collect

Waybill#

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other: —

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle) (Mibi) (BOD) Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: 13-OCT-17 5:20 PM

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: (Icepack) Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 33 + + = 33 °C 2 (Bottle/Jar) + + = °C

3 (Bottle/Jar) + + = °C 4 (Bottle/Jar) + + = °C

5 (Bottle/Jar) + + = °C 6 (Bottle/Jar) + + = °C

7 (Bottle/Jar) + + = °C 8 (Bottle/Jar) + + = °C

9 (Bottle/Jar) + + = °C 10 (Bottle/Jar) + + = °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 17C794743

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R299491

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: Jan 11, 2018

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-01-03

DATE REPORTED: 2018-01-11

		SAMPLE DESCRIPTION:		Upstream Sample	At Discharge		Downstream Sample
		SAMPLE TYPE:		Water	Water		Water
		DATE SAMPLED:		2018-01-03	2018-01-03		2018-01-03
Parameter	Unit	G / S	RDL	9000321	9000330	RDL	9000331
Total Coliforms (MF)	CFU/100 mL		10	190	750	1	120
Fecal Coliforms (MF)	CFU/100 mL		1	4	18	1	18
Escherichia coli in Water	CFU/100 mL		1	2	12	1	16

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-01-03

DATE REPORTED: 2018-01-11

SAMPLE DESCRIPTION:				Upstream Sample	At Discharge	Downstream Sample
SAMPLE TYPE:				Water	Water	Water
DATE SAMPLED:				2018-01-03	2018-01-03	2018-01-03
Parameter	Unit	G / S	RDL	9000321	9000330	9000331
pH	pH Units		N/A	8.08	8.08	8.13
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	277	274	281
Bicarbonate	mg/L		5	338	335	342
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	494	502	517
Chloride	mg/L		1	1	1	2
Fluoride	mg/L		0.01	0.11	0.10	0.10
Nitrate	mg/L		0.1	1.2	1.1	1.2
Nitrate-N	mg/L		0.02	0.27	0.25	0.27
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.27	0.25	0.27
Sulfate	mg/L		1	6	6	7
Dissolved Calcium	mg/L		0.3	72.3	72.4	75.0
Dissolved Magnesium	mg/L		0.2	20.8	21.1	21.5
Dissolved Sodium	mg/L		0.6	5.5	5.5	5.7
Dissolved Potassium	mg/L		0.6	1.0	0.9	1.1
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	0.008	0.008	0.009
Calculated TDS	mg/L		0.6	274	273	282
Sodium Adsorption Ratio	N/A			0.15	0.15	0.15
Hardness	mg CaCO3/L		1	266	268	276
Ion Balance	%		1	98	99	99

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9000321-9000331 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

DATE RECEIVED: 2018-01-03

DATE REPORTED: 2018-01-11

		SAMPLE DESCRIPTION:		Upstream Sample	At Discharge	Downstream Sample
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-03	2018-01-03	2018-01-03
Parameter	Unit	G / S	RDL	9000321	9000330	9000331
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Chemical Oxygen Demand	mg/L		1	1	<1	<1
Dissolved Oxygen	mg/L		0.1	20.2	2.6	6.0
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1	<0.1	<0.1	<0.1
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2	<2	<2	<2

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9000321 Note: Sample past holding time for Dissolved Oxygen analysis.

9000330-9000331 Note: Sample past holding time for Dissolved Oxygen analysis.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jan 11, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9001775		8.48	8.49	0.1%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9001775		534	531	0.6%	< 5	106%	80%	120%						
Electrical Conductivity	9001775		1930	1830	5.3%	< 5	106%	80%	120%						
Chloride	9000321	9000321	1	1	NA	< 1	97%	80%	120%	95%	80%	120%	99%	80%	120%
Fluoride	9000321	9000321	0.11	0.10	9.5%	< 0.01	94%	80%	120%	85%	80%	120%	92%	80%	120%
Nitrate	9000321	9000321	1.2	1.2	0.0%	< 0.1	99%	80%	120%	96%	80%	120%	96%	80%	120%
Nitrite	9000321	9000321	<0.05	<0.05	NA	< 0.05	97%	80%	120%	96%	80%	120%	97%	80%	120%
Sulfate	9000321	9000321	6	6	0.0%	< 1	99%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Calcium	8999983		65.4	65.2	0.3%	< 0.3	110%	80%	120%	107%	80%	120%	NA	80%	120%
Dissolved Magnesium	8999983		31.6	32.5	2.8%	< 0.2	107%	80%	120%	105%	80%	120%	NA	80%	120%
Dissolved Sodium	8999983		41.5	40.8	1.7%	< 0.6	105%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Potassium	8999983		4.4	4.6	4.4%	< 0.6	101%	80%	120%	95%	80%	120%	NA	80%	120%
Dissolved Iron	8999983		<0.1	<0.1	NA	< 0.1	103%	80%	120%	100%	80%	120%	100%	80%	120%
Dissolved Manganese	8999983		<0.005	<0.005	NA	< 0.005	101%	80%	120%	101%	80%	120%	100%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis															
Total Coliforms (MF)	2216	652	< 1	< 1	NA	< 1									
Fecal Coliforms (MF)	2216	652	< 1	< 1	NA	< 1									
Escherichia coli in Water	2216	652	< 1	< 1	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS															
Biochemical Oxygen Demand (BOD)	5675	321	< 2	< 2	NA	< 2	105%	80%	120%						
CBOD - Carbonaceous	5675	321	< 2	< 2	NA	< 2	101%	80%	120%						
Chemical Oxygen Demand	1331	537	10	9	10.5%	< 1	104%	80%	120%	101%	80%	120%	100%	80%	120%
Dissolved Oxygen	161	331	6.0	6.1	1.7%	< 0.1									
Orthophosphate	9000321	9000321	<0.15	<0.15	NA	< 0.15	118%	80%	120%	88%	80%	120%	88%	80%	120%
Total Kjeldahl Nitrogen	8998212		<0.1	<0.1	NA	< 0.1	99%	80%	120%	97%	80%	120%	NA	80%	120%
Total Phosphorus	8999239		0.37	0.38	NA	< 0.08	98%	80%	120%	95%	80%	120%	98%	80%	120%
Total Suspended Solids	8999236		9	10	NA	< 2	102%	80%	120%	NA			102%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Jan 11, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R299491

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 2°C
AGAT Job Number: 18R299491
4-JAN-18 AM 9:11
Date and Time:

Report Information

Company: WSP Canada Inc
Contact: Tina Mews
Address: PO Box 387 Rocky Mountain house / AB / T4T 1A3
Phone: 403 845 5662 Fax: 403 845
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
   Email: Tina.mews@wsp.com
2. Name: Albert Zhuge @ wsp.com
   Email: Albert.Zhuge
3. Name:
   Email:

Report Format

- ☐ Single Sample per Page
- ☒ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☐ 5 to 7 business days

Rush TAT
- ☐ Less than 24 hours
- ☐ 24 to 48 hours
- ☐ 48 to 72 hours

Date Required:

RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. *SEE BACK FOR SURCHARGE.*

Invoice To

Same Yes / No

Company: WSP Canada Inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements *(Selection may impact detection limits)*

- ☐ CCME
  - ☐ Agricultural
  - ☐ Industrial
  - ☐ Residential/Park
  - ☐ Commercial
  - ☐ Drinking Water
  - ☐ FWAL
- ☐ AB Tier 1
  - ☐ Agricultural
  - ☐ Industrial
  - ☐ Residential/Park
  - ☐ Commercial
  - ☐ Natural Area
  - ☐ AB Surface Water
- ☐ BC CSR
  - ☐ AW
  - ☐ IW
  - ☐ LW
  - ☐ DW
- ☐ Other
  - ☐ D50 (Drilling)
  - ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐ HWS-B ☐ Cr^6 ☐ Hg	Water Metals ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^6	Routine Water Potability	AB Class 2 Landfill Dissolved oxygen	BC Landfill total phosphorus.	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	cBOD	BOD	T & F Coliforms & Ecoli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
1000321	Up stream sample	SW	Jan 3 18 10:10		11					X	X	X		X										
330	at discharge	SW	Jan 3 18 10:40		11					X	X	X		X										
321	Down stream sample	SW	Jan 3 18 11:25		4					X	X	X		X										

Samples Relinquished By (Print Name and Sign)	Date/Time	Samples Received By (Print Name and Sign)	Date/Time
Jacob Tricker	Jan 3 18 1:37		
	Date/Time	Jan 3/2017 1:37	Date/Time
	Date/Time	JAN 04 2018 09:11	Date/Time

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page _____ of _____

N°: AB 071812

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JM200 Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: JAN 04 2018 @ 16:40

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 2+3+2=7 °C 2(Bottle/Jar)___+___+___=___ °C

3 (Bottle/Jar)___+___+___=___ °C 4 (Bottle/Jar)___+___+___=___ °C

5 (Bottle/Jar)___+___+___=___ °C 6 (Bottle/Jar)___+___+___=___ °C

7 (Bottle/Jar)___+___+___=___ °C 8 (Bottle/Jar)___+___+___=___ °C

9 (Bottle/Jar)___+___+___=___ °C 10 (Bottle/Jar)___+___+___=___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R299491

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: Dev Vyas have they been notified of the above issues: Yes No

Whom spoken to: Dev Date/Time: Jan. 04/18

CPM Initial DV

General Comments: Please proceed with DO past hold time

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 2°C
AGAT Job Number: 18R299491
Date and Time: JAN 18 AM 9:11

Report Information

Company: WSP Canada Inc
Contact: Tina Mews
Address: PO Box 387 Rocky Mountain house / AB / T4T 1A3
Phone: 403 845 5662 Fax: 403 845
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
   Email: Tina.mews@WSP.com
2. Name: Albert Zhuge @ wsp.com
   Email: Albert.Zhuge
3. Name:
   Email:

Report Format

☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☐ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:

RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To

Same Yes / No

Company: WSP Canada Inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements (Selection may impact detection limits)

☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐ HWS-B ☐ Cr^{6} ☐ Hg	Water Metals ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6}	Routine Water Potability	AB Class 2 Landfill Dissolved oxygen	BC Landfill total phosphorus	D50 Detailed Soil Salinity (As Received)	Mineotox COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	cBOD	BOD	T+F Coliforms + Ecoli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
1000321	Upstream sample	SW	Jan 3 18 10:10		11					X	X	X		X										
330	at discharge	SW	Jan 3 18 10:40		11					X	X	X		X										
331	Down stream sample	SW	Jan 3 18 11:25		4					X	X	X		X										

Samples Relinquished By (Print Name and Sign)	Date/Time	Samples Received By (Print Name and Sign)	Date/Time
Jacob Trocker	Jan 3 18 1:37		
		Jan 3/2017 1:37	
		JAN 04 2018 09:11	

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ____ of ____

N°: AB 071812

Document ID: DIC 50-1507 003

Date Revised: December 9th, 2014

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JAZOO Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: JAN 04 2018 @ 16:40

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 2 + 3 + 2 = 2 °C 2(Bottle/Jar)___+___+___=___°C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R299491

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: Dev Vyas have they been notified of the above issues: Yes No

Whom spoken to: Dev Date/Time: Jan. 04/18

CPM Initial DV

General Comments: Please proceed with DO past hold time

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R302979

WATER ANALYSIS REVIEWED BY: Loan Nguyen, Senior Analyst

DATE REPORTED: Jan 24, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-01-17

DATE REPORTED: 2018-01-24

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-17	2018-01-17	2018-01-17
Parameter	Unit	G / S	RDL	9016456	9016483	9016484
Total Coliforms (MF)	CFU/100 mL		1	89	103	91
Fecal Coliforms (MF)	CFU/100 mL		1	1	2	1
Escherichia coli in Water	CFU/100 mL		1	2	2	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories
2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-01-17

DATE REPORTED: 2018-01-24

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-17	2018-01-17	2018-01-17
Parameter	Unit	G / S	RDL	9016456	9016483	9016484
pH	pH Units		N/A	8.20	8.22	8.22
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	277	281	281
Bicarbonate	mg/L		5	338	342	343
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	500	498	504
Chloride	mg/L		1	<1	1	2
Fluoride	mg/L		0.01	0.05	0.07	0.06
Nitrate	mg/L		0.1	1.0	1.1	1.2
Nitrate-N	mg/L		0.02	0.23	0.25	0.27
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.23	0.25	0.27
Sulfate	mg/L		1	6	6	6
Dissolved Calcium	mg/L		0.3	76.3	74.9	80.9
Dissolved Magnesium	mg/L		0.2	22.0	21.2	23.1
Dissolved Sodium	mg/L		0.6	5.2	5.3	5.7
Dissolved Potassium	mg/L		0.6	1.0	0.9	1.1
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	0.006	0.007	0.087
Calculated TDS	mg/L		0.6	278	279	289
Sodium Adsorption Ratio	N/A			0.13	0.14	0.14
Hardness	mg CaCO3/L		1	281	274	297
Ion Balance	%		1	103	99	107

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9016456-9016484 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

DATE RECEIVED: 2018-01-17

DATE REPORTED: 2018-01-24

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-17	2018-01-17	2018-01-17
Parameter	Unit	G / S	RDL	9016456	9016483	9016484
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Chemical Oxygen Demand	mg/L		1	<1	<1	<1
Dissolved Oxygen	mg/L		0.1	2.0	3.3	3.5
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1	0.1	0.1	0.2
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2	<2	<2	<2

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jan 24, 2018

PARAMETER	Batch	Sample Id	DUPLICATE Dup #1	DUPLICATE Dup #2	DUPLICATE RPD	Method Blank	REFERENCE MATERIAL Measured Value	REFERENCE MATERIAL Acceptable Limits Lower	REFERENCE MATERIAL Acceptable Limits Upper	METHOD BLANK SPIKE Recovery	METHOD BLANK SPIKE Acceptable Limits Lower	METHOD BLANK SPIKE Acceptable Limits Upper	MATRIX SPIKE Recovery	MATRIX SPIKE Acceptable Limits Lower	MATRIX SPIKE Acceptable Limits Upper
Routine Chemistry Water Analysis															
pH	9016456	9016456	8.20	8.20	0.0%	N/A	99%	90%	110%						
T - Alkalinity (as CaCO3)	9016456	9016456	277	278	0.5%	< 5	107%	80%	120%						
Electrical Conductivity	9016456	9016456	500	499	0.2%	< 5	104%	80%	120%						
Chloride	9015662		2	2	NA	< 1	101%	80%	120%	101%	80%	120%	102%	80%	120%
Fluoride	9015662		2.24	2.19	2.5%	< 0.01	99%	80%	120%	91%	80%	120%	105%	80%	120%
Nitrate	9015662		<0.5	<0.5	NA	< 0.1	99%	80%	120%	98%	80%	120%	99%	80%	120%
Nitrite	9015662		<0.20	<0.20	NA	< 0.05	100%	80%	120%	99%	80%	120%	102%	80%	120%
Sulfate	9015662		101	103	1.1%	< 1	101%	80%	120%	101%	80%	120%	NA	80%	120%
Dissolved Calcium	9016456	9016456	76.3	79.3	3.9%	< 0.3	109%	80%	120%	113%	80%	120%	NA	80%	120%
Dissolved Magnesium	9016456	9016456	22.0	22.1	0.8%	< 0.2	112%	80%	120%	103%	80%	120%	NA	80%	120%
Dissolved Sodium	9016456	9016456	5.2	5.2	1.2%	< 0.6	107%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Potassium	9016456	9016456	1.0	1.0	NA	< 0.6	103%	80%	120%	94%	80%	120%	91%	80%	120%
Dissolved Iron	9016456	9016456	<0.1	<0.1	NA	< 0.1	111%	80%	120%	96%	80%	120%	96%	80%	120%
Dissolved Manganese	9016456	9016456	0.006	0.006	NA	< 0.005	110%	80%	120%	100%	80%	120%	99%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis

Total Coliforms (MF)	2226	662	2	< 1	NA	< 1									
Fecal Coliforms (MF)	2226	662	< 1	< 1	NA	< 1									
Escherichia coli in Water	2226	662	< 1	< 1	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

Biochemical Oxygen Demand (BOD)	5681	456	<2	<2	NA	< 2	104%	80%	120%						
CBOD - Carbonaceous	5681	456	<2	<2	NA	< 2	90%	80%	120%						
Chemical Oxygen Demand	1336	693	13	11	16.7%	< 1	100%	80%	120%	101%	80%	120%	102%	80%	120%
Dissolved Oxygen	162	456	2.0	2.0	0.0%	< 0.1									
Orthophosphate	9016456	9016456	<0.15	<0.15	NA	< 0.15	106%	80%	120%	110%	80%	120%	108%	80%	120%
Total Kjeldahl Nitrogen	9015996		0.7	0.7	3.5%	< 0.1	85%	80%	120%	108%	80%	120%	106%	80%	120%
Total Phosphorus	8906029		0.18	0.16	NA	< 0.08	96%	80%	120%	88%	80%	120%	107%	80%	120%
Total Suspended Solids	9018437	9018437	44	46	4.4%	< 2	100%	80%	120%				99%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Jan 24, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R302979

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 0.6 °C
AGAT Job Number: 18R 302979
Date and Time: 17 JAN 18 PM 3:23

Report Information
Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mountain House, AB, T4T 1A3
Phone: 403 845-5662 Fax: 403-845-5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: albert.zhuge@wsp.com
3. Name:
Email:

Report Format
☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. *SEE BACK FOR SURCHARGE.*

Invoice To
Same Yes / No
Company:
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements *(Selection may impact detection limits)*
☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^6 ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr⁶	Routine Water Potability	~~AB Class 2 Landfill~~ Dissolved Oxygen	~~BC Landfill~~ Total Phosphorus	D50 Detailed Soil Salinity (As Received)	~~Microtox~~ COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	CBOD	BOD	T & F Coliforms / E coli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
901643	WQ1	SW	01/17/18@09:45		11					X		X		X		X	X	X	X	X	X			
482	WQ2	SW	01/17/18@10:15		11																			
484	WQ3	SW	01/17/18@10:50		11																			

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Tina Mews Tina Mews	01/17/18 12:20	Shirley Reinwelder	Jan 17/18 12:20
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
			Jan 17/18
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
			03:22

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ____ of ____

N°: AB 071815

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other sd Cooler Quantity: 1

Time Sensitive - DISSOLVED OXYGEN

TIME SENSITIVE ISSUES:

Earliest Date Sampled: JAN 17/18

Microbiology: Test: ✓

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☒

ALREADY EXCEEDED? Yes☐ No☑

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 1+3+4=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: Jazz Prepaid Collect

Waybill#

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: Jan. 18/18

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 0.6+0.9+0.6=0.6 °C 2(Bottle/Jar)___+___+___=___ °C

3 (Bottle/Jar)___+___+___=___ °C 4 (Bottle/Jar)___+___+___=___ °C

5 (Bottle/Jar)___+___+___=___ °C 6 (Bottle/Jar)___+___+___=___ °C

7 (Bottle/Jar)___+___+___=___ °C 8 (Bottle/Jar)___+___+___=___ °C

9 (Bottle/Jar)___+___+___=___ °C 10 (Bottle/Jar)___+___+___=___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R302979

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 0.6 °C
AGAT Job Number: 18R 302979
Date and Time: 17 JAN 18 PM 3:23

Report Information
Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mountain House, AB, T4T 1A3
Phone: 403 845-5662 Fax: 403-845-5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: albert.zhuge@wsp.com
3. Name:
Email:

Report Format
☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To (Same Yes / No)
Company:
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements *(Selection may impact detection limits)*
☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^6 ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr^6	Routine Water Potability	~~AB Class 2 Landfill~~ Dissolved Oxygen	~~BC Landfill~~ Total Phosphorus	D50 Detailed Soil Salinity (As Received)	~~Microtox~~ COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	CBOD	BOD	T & F Coliforms / E coli	TSS	TKN	Orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
901642	WQ1	SW	01/17/18@09:45		11					X	X	X		X		/		X						
483	WQ2	SW	01/17/18@10:15		11																			
484	WQ3	SW	01/17/18@10:50		11																			

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Tina Mews Tina Mews	01/17/18 12:20	Shirley Reinwelder	Jan 17/18 12:20
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
			Jan 17/18 03:22
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ____ of ____

Nº: AB 071815

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other sd Cooler Quantity: 1

Time Sensitive - Dissolved Oxygen

TIME SENSITIVE ISSUES:

Earliest Date Sampled: JAN 17/18 ALREADY EXCEEDED? Yes☐ No☒

Microbiology: Test: ✓ Expiry: _____

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☒

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 1 + 3 + 4 = ___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: Jazz Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): (Mibi) , (BOD) , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: Jan. 18/18

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack (Bagged Ice) Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 0.6+0.5+0.6=0.6 °C 2(Bottle/Jar)___+___+___=___ °C

3 (Bottle/Jar)___+___+___=___ °C 4 (Bottle/Jar)___+___+___=___ °C

5 (Bottle/Jar)___+___+___=___ °C 6 (Bottle/Jar)___+___+___=___ °C

7 (Bottle/Jar)___+___+___=___ °C 8 (Bottle/Jar)___+___+___=___ °C

9 (Bottle/Jar)___+___+___=___ °C 10 (Bottle/Jar)___+___+___=___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R302979

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699

AGAT WORK ORDER: 18R306738

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: Feb 06, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-01-30

DATE REPORTED: 2018-02-06

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-30	2018-01-30	2018-01-30
Parameter	Unit	G / S	RDL	9037080	9037092	9037093
Total Coliforms (MF)	CFU/100 mL		1	118	149	140
Escherichia coli in Water	CFU/100 mL		1	3	5	3
Fecal Coliform	CFU/100 mL		1	<1	4	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-01-30

DATE REPORTED: 2018-02-06

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-30	2018-01-30	2018-01-30
Parameter	Unit	G / S	RDL	9037080	9037092	9037093
pH	pH Units		N/A	8.16	8.13	8.28
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	273	273	279
Bicarbonate	mg/L		5	333	332	341
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	486	490	496
Chloride	mg/L		1	<1	1	2
Fluoride	mg/L		0.01	0.04	0.04	0.04
Nitrate	mg/L		0.1	1.0	1.0	1.1
Nitrate-N	mg/L		0.02	0.23	0.23	0.25
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.23	0.23	0.25
Sulfate	mg/L		1	6	6	6
Dissolved Calcium	mg/L		0.3	78.1	77.5	77.4
Dissolved Magnesium	mg/L		0.2	21.3	21.3	22.0
Dissolved Sodium	mg/L		0.6	5.3	5.5	5.5
Dissolved Potassium	mg/L		0.6	0.9	1.0	1.0
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	0.006	0.010	0.009
Calculated TDS	mg/L		0.6	276	277	283
Sodium Adsorption Ratio	N/A			0.14	0.14	0.14
Hardness	mg CaCO3/L		1	283	281	284
Ion Balance	%		1	105	105	103

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9037080-9037093 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

DATE RECEIVED: 2018-01-30

DATE REPORTED: 2018-02-06

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-01-30	2018-01-30	2018-01-30
Parameter	Unit	G / S	RDL	9037080	9037092	9037093
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Chemical Oxygen Demand	mg/L		1	1	8	<1
Dissolved Organic Carbon (DOC)	mg/L		1	2	1	1
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1	0.1	0.1	0.4
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2	2	<2	<2
Dissolved Oxygen	mg/L		0.1	5.2	4.4	3.8

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Feb 06, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9035200		8.10	7.99	1.4%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9035200		127	128	0.8%	< 5	101%	80%	120%						
Electrical Conductivity	9035200		326	327	0.3%	< 5	102%	80%	120%						
Chloride	9037080	9037080	<1	<1	NA	< 1	100%	80%	120%	99%	80%	120%	101%	80%	120%
Fluoride	9037080	9037080	<0.03	<0.03	NA	< 0.01	97%	80%	120%	82%	80%	120%	86%	80%	120%
Nitrate	9037080	9037080	0.9	0.9	NA	< 0.1	90%	80%	120%	94%	80%	120%	92%	80%	120%
Nitrite	9037080	9037080	<0.10	<0.10	NA	< 0.05	95%	80%	120%	98%	80%	120%	97%	80%	120%
Sulfate	9037080	9037080	6	6	0.0%	< 1	95%	80%	120%	98%	80%	120%	98%	80%	120%
Dissolved Calcium	9037070		77.2	77.4	0.3%	< 0.3	105%	80%	120%	112%	80%	120%	NA	80%	120%
Dissolved Magnesium	9037070		42.0	42.4	0.9%	< 0.2	102%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Sodium	9037070		228	229	0.4%	< 0.6	101%	80%	120%	96%	80%	120%	NA	80%	120%
Dissolved Potassium	9037070		4.0	4.1	2.5%	< 0.6	94%	80%	120%	93%	80%	120%	NA	80%	120%
Dissolved Iron	9037070		0.1	0.1	NA	< 0.1	102%	80%	120%	100%	80%	120%	95%	80%	120%
Dissolved Manganese	9037070		0.687	0.672	2.2%	< 0.005	102%	80%	120%	103%	80%	120%	NA	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis															
Total Coliforms (MF)	2237	080	118	114	3.4%	< 1									
Escherichia coli in Water	2237	080	3	1	NA	< 1									
Fecal Coliform	2237	080	<1	<1	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis – BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS															
Biochemical Oxygen Demand (BOD)	5687	080	< 2	< 2	NA	< 2	103%	80%	120%						
CBOD - Carbonaceous	5687	080	< 2	< 2	NA	< 2	91%	80%	120%						
Chemical Oxygen Demand	1340	514	9	8	11.8%	< 1	100%	80%	120%	101%	80%	120%	100%	80%	120%
Dissolved Organic Carbon (DOC)	9037093	9037093	1	1	NA	< 1	119%	80%	120%	96%	80%	120%	108%	80%	120%
Orthophosphate	9037080	9037080	<0.15	<0.15	NA	< 0.15	107%	80%	120%	108%	80%	120%	115%	80%	120%
Total Kjeldahl Nitrogen	9038521		0.7	0.7	0.0%	< 0.1	93%	80%	120%	119%	80%	120%	NA	80%	120%
Total Phosphorus	9026981		0.31	0.30	NA	< 0.08	95%	80%	120%	88%	80%	120%	101%	80%	120%
Total Suspended Solids	9036924		35	37	5.6%	< 2	97%	80%	120%				96%	80%	120%
Dissolved Oxygen	163	092	4.4	4.2	4.7%	< 0.1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Feb 06, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R306738

PROJECT: 171-00699

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliform	MIC 0203	SM 9222 D	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Organic Carbon (DOC)	INST 0170	SM 5310 B DW	COMBUSTION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature: 2.6 °C
AGAT Job Number: 18 12306738

Date and Time: 30-JAN-18 04:05

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada inc
Contact: Tina Mews
Address: PO Box 387 / Rocky Mountain house AB / T4T 1A3
Phone: 403 845 5662 Fax: 403 845 5663
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
   Email: Tina.mews@WSP.com
2. Name: Albert Zhuge
   Email: Albert.Zhuge@WSP.com
3. Name:
   Email:

Report Format

☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:

RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. *SEE BACK FOR SURCHARGE.*

Invoice To

Same Yes / No

Company: WSP Canada inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements *(Selection may impact detection limits)*

☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr⁶ ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr⁶	Routine Water Potability	AB Class 2 Landfill Dissolved Oxygen	BC Landfill Total Phosphorus	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	cBOD	BOD	T+F Coliforms / Ecoli	TSS	TKN	Ortho-phosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
9037080	Upstream	SW		Jan 30 2018 10:00AM	11					X	X	X		X		X	X	X	X	X	X			
001	outfall	SW		Jan 30 2018 10:20AM	11					X	X	X		X		X	X	X	X	X	X			
097	Down stream	SW		Jan 30 2018 10:40AM	11					X	X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Jacob Trittler	Jan 30 2018	Kim Parkes	Jan. 30/18 12:10pm
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time
Samples Relinquished By (Print Name and Sign):	Date/Time	Samples Received By (Print Name and Sign):	Date/Time Jan 30/18 @ 4:05

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page 1 of 1

N°: AB 071817

Document ID: DIC 50-1507-003

Date Revised: December 9th, 2014

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: Jazod (Prepaid) Collect

Waybill#_____

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:_____

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other_____

Cooler Quantity: _____

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: 30-Jun 30/18 @ CPM

Hydrocarbons: Earliest Expiry _____

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:_____

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 2.6 + 2.7 + 2.6 = 2.6 °C 2(Bottle/Jar)___+___+___=___°C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R306738

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other: _____

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date/Time: _____

CPM Initial_____

General Comments: _____

* Subcontracted Analysis (See CPM)

AGAT Laboratories Time Sensitive

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP Canada Inc

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Jan. 30/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☑

ALREADY EXCEEDED? Yes☐ No☑

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 5.0+3.7+3.5=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories
2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 2.6 °C
AGAT Job Number: 18 12306738
Date and Time: 30-JAN-18 @ 4:05

Report Information
Company: WSP Canada inc
Contact: Tina Mews
Address: PO Box 387 / Rocky Mountain house AB / T4T 1A3
Phone: 403 845 5662 Fax: 403 845 5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: Tina.mews@WSP.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@WSP.com
3. Name:
Email:

Report Format
☐ Single Sample per Page
☒ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☒ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To Same Yes / No
Company: WSP Canada inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements *(Selection may impact detection limits)*
☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^{6} ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr^{6}	Routine Water Potability	~~AB Class 2 Landfill~~ Dissolved Oxygen	~~BC Landfill~~ Total Phosphorus	D50 Detailed Soil Salinity (As Received)	~~Microtox~~ COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	cBOD	BOD	T+F Coliforms / Ecoli	TSS	TKN	Ortho phosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
9037080	Upstream	SW		Jan 30 2018 10:00AM	11					X	X	X		X		X	X	X	X	X	X			
001	outfall	SW		Jan 30 2018 10:20AM	11					X	X	X		X		X	X	X	X	X	X			
002	Down stream	SW		Jan 30 2018 10:40AM	11					X	X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign): Jacob Trichler — Date/Time: Jan 30 2018
Samples Received By (Print Name and Sign): Kim Parkes — Date/Time: Jan. 30/18 12:10pm
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): — Date/Time: Jan 30/18 @ 4:05
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): — Date/Time:

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page 1 of 1
N°: AB 071817

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: Jazod Prepaid Collect

Waybill#_____

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:_____

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other_____

Cooler Quantity: _____

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: 60 - Jun 30/18 @ CPM

Hydrocarbons: Earliest Expiry _____

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:_____

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 2.6 + 2.7 + 2.6 = 2.6 °C 2(Bottle/Jar)___+___+___=___°C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 1818306738

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other: _____

Account Project Manager: _____ have they been notified of the above issues: Yes No

Whom spoken to: _____ Date/Time: _____

CPM Initial_____

General Comments: _____

_____

_____

_____

_____

* Subcontracted Analysis (See CPM)

AGAT Laboratories Time Sensitive

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP Canada Inc

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Jan. 30/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☑

ALREADY EXCEEDED? Yes☐ No☑

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 5.0+3.7+3.5=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature:
AGAT Job Number: [illegible]
Date and Time: FEB 18 14:47

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
   Email: tina.mews@wsp.com
2. Name: Albert Zhuge
   Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
   Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Invoice To Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME: ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1: ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area
☐ AB Surface Water
☐ BC CSR: ☐ AW ☐ IW ☐ LW ☐ DW
☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr6+ ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr6+	Routine Water Potability	~~AB-Class-2 Landfill~~ Dissolved Oxygen	~~BC Landfill~~ Total Phosphorus	D50 Detailed Salinity (As Received)	~~Microtox~~ COD	☐ BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD	T & F Coliforms/E Coli	TSS, TKN	Orthophosphate	Total & Dissolved Metals	Pesticides	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9067677	WQ1	SW	Feb 14, 2017 09:40	Filter total metals	14					x	x	x		x		x	x	x	x	x	x			
679	WQ2B	SW	Feb 14, 2017 10:20	but put total metals	13					x	x	x		x		x	x	x	x	x	x			
68[illegible]	WQ3B	SW	Feb 14, 2017 10:45	dissolved metals and	13					x	x	x		x		x	x	x	x	x	x			
				pesticides on HOLD																				
				until further notices																				
				→ for all Samples																				
				3 coolers																				

Samples Relinquished By (Print Name and Sign): Tina Mews	Date/ Time: Feb 14, 2017 12:10	Samples Relinquished By (Print Name and Sign): [illegible]	Date/ Time: Feb 14/18 12:05 PM	Page	of
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:		
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:		

C 29499

Document ID: DIV-50-1507.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other sd Cooler Quantity: 3

TIME SENSITIVE ISSUES: Time Sensitive

Earliest Date Sampled: FEB 14/18 ALREADY EXCEEDED? Yes☐ No☒

Microbiology: Test: _____ Expiry: _____

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☒

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) /+/+/=__°C (2) /+/+/=__°C (3) /+/+/=__°C (4) __+__+__=__°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JAZOO Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 3

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi, (BOD), Nitrate/Nitrite, Turbidity, Microtox, (Ortho PO4), Tedlar Bag, Residual Chlorine, Chlorophyll*, Chloroamines*

DISS D.

Earliest Expiry: FEB 14 @ 17:40 FOR D.O

Hydrocarbons: Earliest Expiry FEB 14 @ 15:40 FOR MIBI

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 0.4 + 0.4 = 0.4 °C 2(Bottle/Jar) 0.6 + 0.6 + 0.6 °C

3 (Bottle/Jar) 0.3 + 0.3 = 0.3 °C 4 (Bottle/Jar) ___ + ___ + ___ = ___ °C

5 (Bottle/Jar) ___ + ___ + ___ = ___ °C 6 (Bottle/Jar) ___ + ___ + ___ = ___ °C

7 (Bottle/Jar) ___ + ___ + ___ = ___ °C 8 (Bottle/Jar) ___ + ___ + ___ = ___ °C

9 (Bottle/Jar) ___ + ___ + ___ = ___ °C 10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R311584

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: 2 BOTH FOR D.O WQ1 + WQ2B GIVEN TO LAB

SAMPLE WQ3B NO D.O BOTTLE BUT GAVE 1 LTR BOT FOR BOD TO LAB IN LIEU OF D.O

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-0699-00

AGAT WORK ORDER: 18R316266

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: Mar 07, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-03-01

DATE REPORTED: 2018-03-07

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-03-01	2018-03-01	2018-03-01
Parameter	Unit	G / S	RDL	9096303	9096377	9096378
Total Coliforms (MF)	CFU/100 mL		1	95	88	75
Fecal Coliforms (MF)	CFU/100 mL		1	3	<1	1
Escherichia coli in Water	CFU/100 mL		1	3	<1	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-03-01

DATE REPORTED: 2018-03-07

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-03-01	2018-03-01	2018-03-01
Parameter	Unit	G / S	RDL	9096303	9096377	9096378
pH	pH Units		N/A	8.22	8.24	8.26
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	276	275	274
Bicarbonate	mg/L		5	337	335	335
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	500	497	495
Chloride	mg/L		1	1	2	2
Fluoride	mg/L		0.01	0.07	0.08	0.08
Nitrate	mg/L		0.1	1.4	1.1	1.5
Nitrate-N	mg/L		0.02	0.32	0.25	0.34
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.32	0.25	0.34
Sulfate	mg/L		1	7	7	7
Dissolved Calcium	mg/L		0.3	78.6	78.2	75.5
Dissolved Magnesium	mg/L		0.2	21.8	23.4	22.1
Dissolved Sodium	mg/L		0.6	6.1	6.3	5.9
Dissolved Potassium	mg/L		0.6	1.0	1.1	1.1
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	0.007	0.009	0.009
Calculated TDS	mg/L		0.6	283	284	280
Sodium Adsorption Ratio	N/A			0.16	0.16	0.15
Hardness	mg CaCO3/L		1	286	292	280
Ion Balance	%		1	105	107	103

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9096303-9096378 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

DATE RECEIVED: 2018-03-01

DATE REPORTED: 2018-03-07

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-03-01	2018-03-01	2018-03-01
Parameter	Unit	G / S	RDL	9096303	9096377	9096378
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Chemical Oxygen Demand	mg/L		1	<1	<1	<1
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1	0.1	0.2	0.2
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2	<2	<2	<2
Dissolved Oxygen	mg/L		0.1	4.4	5.6	3.4

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Mar 07, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9098167		8.34	8.38	0.5%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9098167		366	369	0.8%	< 5	102%	80%	120%						
Electrical Conductivity	9098167		746	752	0.8%	< 5	104%	80%	120%						
Chloride	9096303	9096303	1	1	NA	< 1	103%	80%	120%	101%	80%	120%	105%	80%	120%
Fluoride	9096303	9096303	0.07	0.08	13.3%	< 0.01	101%	80%	120%	97%	80%	120%	110%	80%	120%
Nitrate	9096303	9096303	1.4	1.4	0.0%	< 0.1	106%	80%	120%	105%	80%	120%	106%	80%	120%
Nitrite	9096303	9096303	<0.05	<0.05	NA	< 0.05	103%	80%	120%	102%	80%	120%	106%	80%	120%
Sulfate	9096303	9096303	7	7	0.0%	< 1	103%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Calcium	9095571		55.5	55.5	0.0%	< 0.3	103%	80%	120%	108%	80%	120%	NA	80%	120%
Dissolved Magnesium	9095571		15.2	14.9	2.0%	< 0.2	101%	80%	120%	102%	80%	120%	NA	80%	120%
Dissolved Sodium	9095571		4.8	4.8	0.0%	< 0.6	102%	80%	120%	104%	80%	120%	98%	80%	120%
Dissolved Potassium	9095571		0.7	0.7	NA	< 0.6	92%	80%	120%	97%	80%	120%	94%	80%	120%
Dissolved Iron	9095571		<0.1	<0.1	NA	< 0.1	94%	80%	120%	91%	80%	120%	94%	80%	120%
Dissolved Manganese	9095571		<0.005	<0.005	NA	< 0.005	97%	80%	120%	101%	80%	120%	101%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis															
Total Coliforms (MF)	2258	303	95	81	15.9%	< 1									
Fecal Coliforms (MF)	2258	303	3	1	NA	< 1									
Escherichia coli in Water	2258	303	3	2	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS															
Biochemical Oxygen Demand (BOD)	5701	303	< 2	< 2	NA	< 2	97%	80%	120%						
CBOD - Carbonaceous	5701	303	< 2	< 2	NA	< 2	89%	80%	120%						
Chemical Oxygen Demand	1352	303	< 1	< 1	0.0%	< 1	100%	80%	120%	95%	80%	120%	104%	80%	120%
Orthophosphate	9096303	9096303	<0.15	<0.15	NA	< 0.15	96%	80%	120%	105%	80%	120%	109%	80%	120%
Total Kjeldahl Nitrogen	9096303	9096303	0.1	0.1	NA	< 0.1	101%	80%	120%	93%	80%	120%	91%	80%	120%
Total Phosphorus	9051182		0.30	0.29	NA	< 0.08	93%	80%	120%	93%	80%	120%	98%	80%	120%
Total Suspended Solids	9093812		<2	<2	NA	< 2	102%	80%	120%	NA			102%	80%	120%
Dissolved Oxygen	165	303	4.4	4.4	0.0%	< 0.1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Mar 07, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R316266

PROJECT: 171-0699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.736.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature: 10C
AGAT Job Number: 18R-316266
Date and Time: 1 MAR '18 PM 3:57

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Invoice To

Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area
☐ AB Surface Water
☐ BC CSR
☐ AW ☐ IW ☐ LW ☐ DW
☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals: ☑ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEX/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
2009303 377 378	WQ1	SW	8:06AM	Filter total metals at the lab but	14				x	x						x	x	x	x	x	x			
	WQ2B	SW	8:30 AM	put all total and dissolved metal	14				x	x						x	x	x	x	x	x			
	WQ3B	SW	9:00 AM	samples on hold until further notice	14				x	x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Date/ Time: March 1 2018 10:45 AM
Samples Relinquished By (Print Name and Sign): Date/ Time:
Samples Relinquished By (Print Name and Sign): Date/ Time:

Samples Relinquished By (Print Name and Sign): Date/ Time: March 1/18 10:45 Am
Samples Relinquished By (Print Name and Sign): Date/ Time:
Samples Relinquished By (Print Name and Sign): Date/ Time:

MAR 0 1 2018

Page of

@3.57

C 29843

Document ID: DIV-50-1507.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

18R316266

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES: Extremely Time Sensitive

Earliest Date Sampled: MARCH 1/18

Microbiology: Test: _____ ALREADY EXCEEDED? Yes☐ No☐

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☐ Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 2 + 3 + 7 = ___°C (2) ___ + ___ + ___ = ___°C (3) ___ + ___ + ___ = ___°C (4) ___ + ___ + ___ = ___°C

Additional integrity issues (note here and on COC next to the sample ID):

DISSOLVED OXYGEN MAY BE EXPIRED

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JANEX Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* NO.

Earliest Expiry: MAR 01 2018 @ 4:00 PM

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 1 + 1 + 1 = 1 °C 2(Bottle/Jar) ___+___+___=___°C

3 (Bottle/Jar) ___+___+___=___°C 4 (Bottle/Jar) ___+___+___=___°C

5 (Bottle/Jar) ___+___+___=___°C 6 (Bottle/Jar) ___+___+___=___°C

7 (Bottle/Jar) ___+___+___=___°C 8 (Bottle/Jar) ___+___+___=___°C

9 (Bottle/Jar) ___+___+___=___°C 10 (Bottle/Jar) ___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 1812346266

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: NO BOTTLE GIVEN IN THE LAB

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories
2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature: 10°C
AGAT Job Number: 18R 316266
Date and Time: MAR 18 PM 3:57

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Invoice To

Same [x] Yes [ ] No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

[ ] Single Sample per Page
[x] Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT [x] 5-7 Business Days

Rush TAT (Surcharge)
[ ] Less than 24 Hours (200%)
[ ] Less than 48 Hours (100%)
[ ] Less than 72 Hours (50%)

Date Required:

Requirements (Selection may impact detection limits)

[ ] CCME
- [ ] Agricultural
- [ ] Industrial
- [ ] Residential/ Park
- [ ] Commercial
- [ ] Drinking Water
- [ ] FWAL

[ ] AB Tier 1
- [ ] Agricultural
- [ ] Industrial
- [ ] Residential/ Park
- [ ] Commercial
- [ ] Natural Area
- [ ] AB Surface Water

[ ] BC CSR
- [ ] AW
- [ ] IW
- [ ] LW
- [ ] DW

[ ] Other:
- [ ] D50 (Drilling)
- [ ] SPIGEC
- [ ]

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: [ ] HWS-B [ ] Cr^{6+} [ ] Hg	Water Metals: [ ] Dissolved [ ] Total [ ] Hg [ ] Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	[ ] BTEX/VPH/EPH [ ] LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
2096303	WQ1	SW	8:06AM	Filter total metals at the lab but	14				x	x						x	x	x	x	x	x			
377	WQ2B	SW	8:30 AM	put all total and dissolved metal	14				x	x						x	x	x	x	x	x			
378	WQ3B	SW	9:00 AM	samples on hold until further notice	14				x	x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:

March 1 2018 10:45 AM
March 1/18 10:45 Am
MAR 0 1 2018

Page of

C 29843

@3.57

Document ID: DIV-50-1507.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

18R316264

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES: Extremely Time Sensitive

Earliest Date Sampled: MARCH 1/18

Microbiology: Test: ✓

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☐

ALREADY EXCEEDED? Yes☐ No☐

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 2 + 3 + 7 = ___°C (2) ___ + ___ + ___ = ___°C (3) ___ + ___ + ___ = ___°C (4) ___ + ___ + ___ = ___°C

Additional integrity issues (note here and on COC next to the sample ID):

DISSOLVED OXYGEN MAY BE EXPIRED

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JANEX Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* NO.

Earliest Expiry: MAR 0 1 2018 @ 4:00 PM

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 1 + 1 + 1 = 1 °C 2(Bottle/Jar) ___ + ___ + ___ = ___ °C

3 (Bottle/Jar) ___ + ___ + ___ = ___ °C 4 (Bottle/Jar) ___ + ___ + ___ = ___ °C

5 (Bottle/Jar) ___ + ___ + ___ = ___ °C 6 (Bottle/Jar) ___ + ___ + ___ = ___ °C

7 (Bottle/Jar) ___ + ___ + ___ = ___ °C 8 (Bottle/Jar) ___ + ___ + ___ = ___ °C

9 (Bottle/Jar) ___ + ___ + ___ = ___ °C 10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18236266

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: NO BOTTLE CHECK IN THE LAB

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R325063

WATER ANALYSIS REVIEWED BY: Jennifer Liu, Analyst, Qualified Person

DATE REPORTED: Apr 06, 2018

PAGES (INCLUDING COVER): 8

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R325063

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-03-29

DATE REPORTED: 2018-04-06

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-03-29	2018-03-29	2018-03-29
Parameter	Unit	G / S	RDL	9157268	9157272	9157273
Total Coliforms (MF)	CFU/100 mL		1	67	68	65
Fecal Coliforms (MF)	CFU/100 mL		1	4	2	1
Escherichia coli in Water	CFU/100 mL		1	4	2	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R325063

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - Diss. Oxygen, CBOD, BOD, O-PO4, T-Phos., COD, TSS, TKN

DATE RECEIVED: 2018-03-29

DATE REPORTED: 2018-04-06

		SAMPLE DESCRIPTION:		WQ1	WQ2	WQ3
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-03-29	2018-03-29	2018-03-29
Parameter	Unit	G / S	RDL	9157268	9157272	9157273
Dissolved Oxygen	mg/L		0.1	5.2	6.0	15.5
CBOD - Carbonaceous	mg/L		2	<2	<2	<2
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08
Chemical Oxygen Demand	mg/L		1	<1	<1	<1
Total Suspended Solids	mg/L		2	2	<2	2
Total Kjeldahl Nitrogen	mg/L		0.1	0.2	0.1	0.2

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R325063

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Apr 06, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Microbial Analysis															
Total Coliforms (MF)	2281	951	< 1	< 1	NA	< 1									
Fecal Coliforms (MF)	2281	951	< 1	< 1	NA	< 1									
Escherichia coli in Water	2281	951	< 1	< 1	NA	< 1									
Water Analysis - Diss. Oxygen, CBOD, BOD, O-PO4, T-Phos., COD, TSS, TKN															
Dissolved Oxygen	166	268	5.2	5.2	0.0%	< 0.1									
CBOD - Carbonaceous	5715	268	< 2	< 2	NA	< 2	90%	80%	120%						
Biochemical Oxygen Demand (BOD)	5715	268	< 2	< 2	NA	< 2	105%	80%	120%						
Orthophosphate	9157268	9157268	<0.15	<0.15	NA	< 0.15	91%	80%	120%	106%	80%	120%	120%	80%	120%
Total Phosphorus	9145438		0.23	0.22	NA	< 0.08	98%	80%	120%	99%	80%	120%	99%	80%	120%
Chemical Oxygen Demand	1363	889	8	6	NA	< 1	101%	80%	120%	98%	80%	120%	97%	80%	120%
Total Suspended Solids	9157268	9157268	2	2	NA	< 2	99%	80%	120%				99%	80%	120%
Total Kjeldahl Nitrogen	9157268	9157268	0.2	0.2	NA	< 0.1	92%	80%	120%	88%	80%	120%	92%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R325063

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 1°C
AGAT Job Number: 18 R325063
Date and Time: 29 MAR 10 PM 4 :24

Report Information
Company: WSP Canada inc
Contact: Tina mews
Address: PO Box 387 Rocky Mountain house AB T4T 1A3
Phone: 403 845 5662 Fax: 403 845 5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina mews
Email: Tina.mews@WSP.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name:
Email:

Report Format
☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:
RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To
Same Yes / No
Company: WSP Canada inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements (Selection may impact detection limits)
☐ CCME ☐ Agricultural ☐ Industrial ☐ Residential/Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1 ☐ Agricultural ☐ Industrial ☐ Residential/Park ☐ Commercial ☐ Natural Area ☐ AB Surface Water
☐ BC CSR ☐ AW ☐ IW ☐ LW ☐ DW
☐ Other ☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^6 ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr^6	Routine Water Potability	AB Class 2 Landfill: Chloride, sulfate	BC Landfill: Total phosphorus	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEX/VPH/EPH ☐ LEPH/HEPH ☐	CBOD	BOD	TKF Calciform / Ecoli	TSS	TKN	orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
915726	WQ 1	SW	March 29 2018 9:45 AM		12						X	X		X		X	X	X	X	X	X			
72	WQ 2	SW	March 29 2018 10:15 AM		12						X	X		X		X	X	X	X	X	X			
					12																			
73	WQ 3	SW	March 29 2018 11:10 AM		12						X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign): Jacob Tricker — Date/Time: March 29 2018 12:26
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): Kim Parkes — Date/Time: Mar. 29/18 12:25pm
Samples Received By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): — Date/Time: 3/29/18 4:25

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page _____ of _____
N°: AB 071981

Document ID: DIC-50-1507-003
Date Revised: December 9th, 2014

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: VAN

Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , (BOD), (Nitrate/Nitrite) , Turbidity , Microtox , (Ortho PO4), Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* Diss. Oxygen

Earliest Expiry: August 24 @ 17:00

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature ((Bottles)/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 1 + 1 + 1 = 1 °C 2(Bottle/Jar)__+__+__=__°C

3 (Bottle/Jar)__+__+__=__°C 4 (Bottle/Jar)__+__+__=__°C

5 (Bottle/Jar)__+__+__=__°C 6 (Bottle/Jar)__+__+__=__°C

7 (Bottle/Jar)__+__+__=__°C 8 (Bottle/Jar)__+__+__=__°C

9 (Bottle/Jar)__+__+__=__°C 10 (Bottle/Jar)__+__+__=__°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R325763

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: ________ have they been notified of the above issues: Yes No

Whom spoken to: ______ Date/Time: ______

CPM Initial____

General Comments:

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015

Document ID: SR-9505.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Time Sensitive

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP Canada Inc

TAT: <24hr☐ 24-48hr☐ 48-72hr☐ Reg☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Mar. 29/18

Microbiology: Test: _____ ALREADY EXCEEDED? Yes☐ No☑

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☑ Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 3.7+2.4+2.4=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 1°C
AGAT Job Number: 18 R325063
Date and Time: 29 MAR 18 PM 4:24

Report Information
Company: WSP Canada inc
Contact: Tina mews
Address: PO Box 387 Rocky Mountain house AB T4T 1A3
Phone: 403 845 5662 Fax: 403 845 5663
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina mews
Email: Tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name:
Email:

Report Format
☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 business days
Rush TAT ☐ Less than 24 hours ☐ 24 to 48 hours ☐ 48 to 72 hours
Date Required:

RUSH TAT REQUESTS UPON SELECTING A RUSH TAT, THE CLIENT ACCEPTS THAT A RUSH SURCHARGE WILL BE ADDED TO THE INVOICE. SEE BACK FOR SURCHARGE.

Invoice To
Same Yes / No
Company: WSP Canada inc
Contact:
Address:
Phone: Fax:
PO/AFE#:

Requirements (Selection may impact detection limits)
☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/Park ☐ Residential/Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other
☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID #)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/TIME SAMPLED	COMMENTS - SITE SAMPLE INFO. SAMPLE CONTAINMENT	# OF CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/F1-F4	Soil Metals ☐HWS-B ☐Cr^6 ☐Hg	Water Metals ☐Dissolved ☐Total ☐Hg ☐Cr^6	Routine Water Potability	AB Class 2 Landfill Dissolved oxygen	BC Landfill Total phosphorus	D50 Detailed Soil Salinity (As Received)	Microtox COD	BTEXS/VPH/EPH ☐ LEPH/HEPH ☐	CBOD	BOD	T+F Coliforms / E.coli	TSS	TKN	orthophosphate	HOLD FOR 60 DAYS	PRESERVED (Y/N)	CONTAMINATED/HAZARDOUS (Y/N)
915726	WQ 1	SW	March 29 2018 9:45 AM		12						X	X		X		X	X	X	X	X	X			
77	WQ 2	SW	March 29 2018 10:15 AM		12						X	X		X		X	X	X	X	X	X			
					12																			
73	WQ 3	SW	March 29 2018 11:10 AM		12						X	X		X		X	X	X	X	X	X			

Samples Relinquished By (Print Name and Sign): Jacob Tricker — Date/Time: March 29 2018 12:26
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): Kim Parkes — Date/Time: Mar. 29/18 12:25pm
Samples Received By (Print Name and Sign): — Date/Time:
Samples Received By (Print Name and Sign): — Date/Time: 3/29/18 4:24

Pink Copy - Client
Yellow Copy - AGAT
White Copy - AGAT

Page ____ of ____
N°: AB 071981

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: VAN ✓ Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:____

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr (Reg) Other________

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , (BOD), (Nitrate/Nitrite) , Turbidity , Microtox , (Ortho PO4) , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* Diss. Oxygen

Earliest Expiry: August 24 @ 17:00

Hydrocarbons: Earliest Expiry ________

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:________

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature ((Bottles)/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 1 + 1 + 1 = 1 °C	2(Bottle/Jar)___+___+___=____°C
3 (Bottle/Jar)___+___+___=____°C	4 (Bottle/Jar)___+___+___=____°C
5 (Bottle/Jar)___+___+___=____°C	6 (Bottle/Jar)___+___+___=____°C
7 (Bottle/Jar)___+___+___=____°C	8 (Bottle/Jar)___+___+___=____°C
9 (Bottle/Jar)___+___+___=____°C	10 (Bottle/Jar)___+___+___=____°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R325063

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other: ________

Account Project Manager: ________ have they been notified of the above issues: Yes No

Whom spoken to: ________ Date/Time: ________

CPM Initial____

General Comments: ________

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Time Sensitive

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP Canada Inc

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Mar. 29/18 ALREADY EXCEEDED? Yes☐ No☑

Microbiology: Test: _____ Expiry: _____

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☑

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 3.7+2.4+2.4 ___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R332633

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: May 02, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-04-25

DATE REPORTED: 2018-05-02

		SAMPLE DESCRIPTION:		WQ1		WQ2B	WQ3B
		SAMPLE TYPE:		Water		Water	Water
		DATE SAMPLED:		2018-04-25		2018-04-25	2018-04-25
Parameter	Unit	G / S	RDL	9200772	RDL	9200775	9200776
Total Coliforms (MF)	CFU/100 mL		100	4700	100	6300	7200
Fecal Coliforms (MF)	CFU/100 mL		1	47	10	290	350
Escherichia coli in Water	CFU/100 mL		1	47	10	300	350

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-04-25

DATE REPORTED: 2018-05-02

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-04-25	2018-04-25	2018-04-25
Parameter	Unit	G / S	RDL	9200772	9200775	9200776
pH	pH Units		N/A	8.05	8.10	8.19
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	100	104	106
Bicarbonate	mg/L		5	122	127	129
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	211	216	224
Chloride	mg/L		1	2	2	2
Fluoride	mg/L		0.01	0.03	0.03	0.03
Nitrate	mg/L		0.1	0.6	0.6	0.7
Nitrate-N	mg/L		0.02	0.14	0.14	0.16
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.14	0.14	0.16
Sulfate	mg/L		1	3	4	4
Dissolved Calcium	mg/L		0.3	28.9	29.1	29.6
Dissolved Magnesium	mg/L		0.2	7.9	8.0	8.1
Dissolved Sodium	mg/L		0.6	2.6	2.8	2.8
Dissolved Potassium	mg/L		0.6	6.0	6.0	6.0
Dissolved Iron	mg/L		0.1	0.2	0.2	0.2
Dissolved Manganese	mg/L		0.005	0.017	0.019	0.020
Calculated TDS	mg/L		0.6	111	115	117
Sodium Adsorption Ratio	N/A			0.11	0.12	0.12
Hardness	mg CaCO3/L		1	105	106	107
Ion Balance	%		1	111	107	107

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9200772-9200776 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - NH3,BOD,CBOD,COD,DO,o-PO4,TKN,T-P,TSS

DATE RECEIVED: 2018-04-25

DATE REPORTED: 2018-05-02

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-04-25	2018-04-25	2018-04-25
Parameter	Unit	G / S	RDL	9200772	9200775	9200776
Biochemical Oxygen Demand (BOD)	mg/L		2	3	4	4
CBOD - Carbonaceous	mg/L		2	3	2	3
Chemical Oxygen Demand	mg/L		1	50	48	46
Dissolved Oxygen	mg/L		0.1	9.5	6.7	6.6
Orthophosphate	mg/L		0.15	0.45	0.47	0.46
Total Kjeldahl Nitrogen	mg/L		0.1	0.6	0.6	0.6
Total Phosphorus	mg/L		0.08	0.27	0.28	0.29
Total Suspended Solids	mg/L		2	40	35	56
Ammonia, Total (as N)	mg/L		0.05	0.10	0.05	<0.05

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: May 02, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9199690		9.01	8.99	0.2%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9199690		252	255	1.2%	< 5	102%	80%	120%						
Electrical Conductivity	9199690		2300	2310	0.4%	< 5	106%	80%	120%						
Chloride	9200772	9200772	2	2	NA	< 1	98%	80%	120%	97%	80%	120%	100%	80%	120%
Fluoride	9200772	9200772	0.03	0.02	NA	< 0.01	96%	80%	120%	88%	80%	120%	98%	80%	120%
Nitrate	9200772	9200772	0.6	0.6	0.0%	< 0.1	97%	80%	120%	97%	80%	120%	99%	80%	120%
Nitrite	9200772	9200772	<0.05	<0.05	NA	< 0.05	95%	80%	120%	95%	80%	120%	101%	80%	120%
Sulfate	9200772	9200772	3	4	NA	< 1	99%	80%	120%	98%	80%	120%	101%	80%	120%
Dissolved Calcium	9200594		63.3	63.7	0.6%	< 0.3	108%	80%	120%	110%	80%	120%	NA	80%	120%
Dissolved Magnesium	9200594		28.7	28.9	0.7%	< 0.2	106%	80%	120%	107%	80%	120%	NA	80%	120%
Dissolved Sodium	9200594		55.3	55.0	0.5%	< 0.6	103%	80%	120%	103%	80%	120%	NA	80%	120%
Dissolved Potassium	9200594		2.4	2.5	NA	< 0.6	99%	80%	120%	102%	80%	120%	101%	80%	120%
Dissolved Iron	9200594		<0.1	<0.1	NA	< 0.1	103%	80%	120%	103%	80%	120%	103%	80%	120%
Dissolved Manganese	9200594		0.816	0.818	0.2%	< 0.005	103%	80%	120%	103%	80%	120%	NA	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis															
Total Coliforms (MF)	2299	772	4700	4900	4.2%	< 1									
Fecal Coliforms (MF)	2299	772	47	46	2.2%	< 1									
Escherichia coli in Water	2299	772	47	49	4.2%	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - NH3,BOD,CBOD,COD,DO,o-PO4,TKN,T-P,TSS															
Biochemical Oxygen Demand (BOD)	5730	866	19	18	5.4%	< 2	102%	80%	120%						
CBOD - Carbonaceous	5730	475	6	5	NA	< 2	97%	80%	120%						
Chemical Oxygen Demand	1377	279	11	10	9.5%	< 1	101%	80%	120%	101%	80%	120%	105%	80%	120%
Dissolved Oxygen	181	776	6.6	6.6	0.0%	< 0.1									
Orthophosphate	9204257		<0.15	<0.15	NA	< 0.15	106%	80%	120%	106%	80%	120%	112%	80%	120%
Total Kjeldahl Nitrogen	9204325		<0.1	<0.1	NA	< 0.1	94%	80%	120%	86%	80%	120%	NA	80%	120%
Total Phosphorus	9199607		0.19	0.21	NA	< 0.08	98%	80%	120%	116%	80%	120%	105%	80%	120%
Total Suspended Solids	9200275		<2	<2	NA	< 2	99%	80%	120%	NA			99%	80%	120%
Ammonia, Total (as N)	9204325		0.23	0.27	NA	< 0.05	96%	80%	120%	103%	80%	120%	106%	80%	120%

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: May 02, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R332633

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Ammonia, Total (as N)	INST 0420	SM 4500-NH3 G W	DISCRETE ANALYZER

182332633
4°C

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature:
AGAT Job Number:
Date and Time: 25 APR '18 PM 4:16

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Invoice To Same [✓] Yes [ ] No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Requirements (Selection may impact detection limits)

- [ ] CCME: [ ] Agricultural [ ] Industrial [ ] Residential/ Park [ ] Commercial [ ] Drinking Water [ ] FWAL
- [ ] AB Tier 1: [ ] Agricultural [ ] Industrial [ ] Residential/ Park [ ] Commercial [ ] Natural Area
- [ ] BC CSR: [ ] AW [ ] IW [ ] LW [ ] DW
- [ ] AB Surface Water
- [ ] Other: [ ] D50 (Drilling) [ ] SPIGEC [ ]

Report Format

- [ ] Single Sample per Page
- [✓] Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT [✓] 5-7 Business Days
Rush TAT (Surcharge): [ ] Less than 24 Hours (200%) [ ] Less than 48 Hours (100%) [ ] Less than 72 Hours (50%)
Date Required:

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: [ ] HWS-B [ ] Cr⁶⁺ [ ] Hg	Water Metals: [ ] Dissolved [ ] Total [ ] Hg [ ] Cr⁶⁺	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	[ ] BTEXS/VPH/EPH [ ] LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9200772	WQ1	SW	04/25/2018 10:00AM	upstream	10					x						x	x	x	x	x	x			
775	WQ2B	SW	04/25/2018 10:30AM	at source	10					x						x	x	x	x	x	x			
776	WQ3B	SW	04/25/2018 10:45AM	down stream	10					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Jacob Tricker [signature] Date/ Time: 04/25/2018 12:27pm
Samples Relinquished By (Print Name and Sign): Kim Parkes [signature] 12:27pm
Date/ Time:
Samples Relinquished By (Print Name and Sign): Date/ Time:
Samples Relinquished By (Print Name and Sign): A. ZORICA [signature] Date/ Time: 25 APR 2018
Samples Relinquished By (Print Name and Sign): Date/ Time:

Page of

Document ID: DIV-50-1507.003

C 30509

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT 18L332633

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other_____ Cooler Quantity: 1

Extremely Time Sensitive

TIME SENSITIVE ISSUES:

Earliest Date Sampled: APRIL 25/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☒

ALREADY EXCEEDED? Yes☐ No☐

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 10+11+11=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JA200 Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* D.O.

Earliest Expiry: 6pm 25 APR 2018

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 4 + 4 + 4 = 4 °C 2(Bottle/Jar) ___ + ___ + ___ = ___ °C

3 (Bottle/Jar) ___ + ___ + ___ = ___ °C 4 (Bottle/Jar) ___ + ___ + ___ = ___ °C

5 (Bottle/Jar) ___ + ___ + ___ = ___ °C 6 (Bottle/Jar) ___ + ___ + ___ = ___ °C

7 (Bottle/Jar) ___ + ___ + ___ = ___ °C 8 (Bottle/Jar) ___ + ___ + ___ = ___ °C

9 (Bottle/Jar) ___ + ___ + ___ = ___ °C 10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: (18R33243)

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

1823326334°C

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 F: 403.735.2771
weberth.agatlabs.com

Laboratory Use Only
Arrival Temperature:
AGAT Job Number: 25 APR 18 PM 4:16
Date and Time: 25 APR 18 PM 4:16

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information
Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information
1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format
☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)
Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Invoice To Same ☑ Yes ☐ No
Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)
☐ CCME ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1 ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area ☐ AB Surface Water
☐ BC CSR ☐ AW ☐ IW ☐ LW ☐ DW
☐ Other: ☐ D50 (Drilling) ☐ SPIGEC

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9200772	WQ1	SW	04/25/2018	10:00AM upstream	10					x						x	x	x	x	x	x			
775	WQ2B	SW	04/25/2018	10:30AM at source	10					x						x	x	x	x	x	x			
776	WQ3B	SW	04/25/2018	10:45AM down stream	10					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Jacob Tricker — Date/ Time: 04/25/2018 12:27pm
Samples Relinquished By (Print Name and Sign): Kim Parkes — Date/ Time: 12:27pm
Samples Relinquished By (Print Name and Sign): — Date/ Time:
Samples Relinquished By (Print Name and Sign): — Date/ Time:
Samples Relinquished By (Print Name and Sign): A. LORICA — Date/ Time: 25 APR 2018
Page of

Document ID: DIV-50-1507.003

C 30509

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT 18L332633

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other_____ Cooler Quantity: 1

Extremely Time Sensitive

TIME SENSITIVE ISSUES:

Earliest Date Sampled: APRIL 25/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☒

ALREADY EXCEEDED? Yes☐ No☐

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 10+11+11=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JK200 Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* D.O.

Earliest Expiry: 6pm 25 APR 2018

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 4 + 4 + 4 = 4 °C

2(Bottle/Jar) ___ + ___ + ___ = ___ °C

3 (Bottle/Jar) ___ + ___ + ___ = ___ °C

4 (Bottle/Jar) ___ + ___ + ___ = ___ °C

5 (Bottle/Jar) ___ + ___ + ___ = ___ °C

6 (Bottle/Jar) ___ + ___ + ___ = ___ °C

7 (Bottle/Jar) ___ + ___ + ___ = ___ °C

8 (Bottle/Jar) ___ + ___ + ___ = ___ °C

9 (Bottle/Jar) ___ + ___ + ___ = ___ °C

10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 1SR3376333

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R337514

WATER ANALYSIS REVIEWED BY: Jennifer Liu, Analyst, Qualified Person

DATE REPORTED: May 18, 2018

PAGES (INCLUDING COVER): 11

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-05-09

DATE REPORTED: 2018-05-10

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B		Lagoon
		SAMPLE TYPE:		Water	Water	Water		Water
		DATE SAMPLED:		2018-05-09 10:00	2018-05-09 10:45	2018-05-09 11:10		2018-05-09 10:15
Parameter	**Unit**	**G / S**	**RDL**	**9231666**	**9231669**	**9231670**	**RDL**	**9231671**
Total Coliforms (MF)	CFU/100 mL		10	210	230	310	100	4700
Fecal Coliforms (MF)	CFU/100 mL		1	89	91	98	10	510
Escherichia coli in Water	CFU/100 mL		1	87	91	97	10	480

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-05-09

DATE REPORTED: 2018-05-14

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B	Lagoon
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2018-05-09 10:00	2018-05-09 10:45	2018-05-09 11:10	2018-05-09 10:15
Parameter	Unit	G / S	RDL	9231666	9231669	9231670	9231671
pH	pH Units	7.0-10.5	N/A	8.37	8.37	8.37	7.92
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	226	232	230	353
Bicarbonate	mg/L		5	270	276	274	431
Carbonate	mg/L		5	<5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5	<5
Electrical Conductivity	uS/cm		5	420	426	425	1200
Chloride	mg/L	(250)	1	1	2	2	142
Fluoride	mg/L	1.5	0.01	0.07	0.07	0.09	0.09
Nitrate	mg/L	45	0.1	0.4	0.4	0.5	<0.1
Nitrate-N	mg/L	10	0.02	0.09	0.09	0.11	<0.02
Nitrite	mg/L	3	0.05	<0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L	1	0.01	<0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	0.09	0.09	0.11	<0.02
Sulfate	mg/L	(500)	1	5	5	5	15
Dissolved Calcium	mg/L		0.3	61.5	62.2	62.4	58.8
Dissolved Magnesium	mg/L		0.2	16.5	16.7	16.7	20.4
Dissolved Sodium	mg/L		0.6	6.4	6.8	6.7	110
Dissolved Potassium	mg/L		0.6	1.3	1.3	1.2	13.6
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1	0.2
Dissolved Manganese	mg/L		0.005	0.010	0.011	0.012	0.126
Calculated TDS	mg/L		0.6	225	230	229	572
Sodium Adsorption Ratio	N/A			0.19	0.20	0.19	3.15
Hardness	mg CaCO3/L		1	222	224	225	231
Ion Balance	%		1	104	102	103	86

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-05-09

DATE REPORTED: 2018-05-14

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to 2017 Canadian Drinking Water Quality MAC (AO)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9231666-9231671 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - CBOD, BOD, COD, TSS, TKN, O-PO4, DO, T-Phos, NH3

DATE RECEIVED: 2018-05-09

DATE REPORTED: 2018-05-15

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B		Lagoon
		SAMPLE TYPE:		Water	Water	Water		Water
		DATE SAMPLED:		2018-05-09 10:00	2018-05-09 10:45	2018-05-09 11:10		2018-05-09 10:15
Parameter	Unit	G / S	RDL	9231666	9231669	9231670	RDL	9231671
CBOD - Carbonaceous	mg/L		2	<2	<2	<2	2	9
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	4	2	2	17
Chemical Oxygen Demand	mg/L		1	14	7	8	1	57
Total Suspended Solids	mg/L		2	8	5	7	2	16
Total Kjeldahl Nitrogen	mg/L		0.1	0.1	0.1	0.2	0.5	23.7
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15	0.75	12.8
Dissolved Oxygen	mg/L		0.1	8.0	4.9	9.8	0.1	3.4
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08	0.08	5.02
Ammonia, Total (as N)	mg/L		0.05	<0.05	<0.05	<0.05	1.0	18.8

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9236998		7.98	7.98	0.0%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9236998		256	255	0.4%	< 5	101%	80%	120%						
Electrical Conductivity	9236998		512	510	0.4%	< 5	105%	80%	120%						
Chloride	9231670	9231670	2	2	NA	< 1	100%	80%	120%	100%	80%	120%	100%	80%	120%
Fluoride	9231670	9231670	<0.06	<0.06	NA	< 0.01	97%	80%	120%	93%	80%	120%	98%	80%	120%
Nitrate	9231670	9231670	<0.5	<0.5	NA	< 0.1	98%	80%	120%	99%	80%	120%	97%	80%	120%
Nitrite	9231670	9231670	<0.20	<0.20	NA	< 0.05	97%	80%	120%	97%	80%	120%	94%	80%	120%
Sulfate	9231670	9231670	5	5	NA	< 1	102%	80%	120%	103%	80%	120%	100%	80%	120%
Dissolved Calcium	9231587		52.3	52.1	0.3%	< 0.3	108%	80%	120%	113%	80%	120%	NA	80%	120%
Dissolved Magnesium	9231587		11.2	11.3	0.5%	< 0.2	102%	80%	120%	104%	80%	120%	NA	80%	120%
Dissolved Sodium	9231587		3.9	3.9	0.0%	< 0.6	100%	80%	120%	106%	80%	120%	98%	80%	120%
Dissolved Potassium	9231587		1.2	1.2	NA	< 0.6	97%	80%	120%	100%	80%	120%	95%	80%	120%
Dissolved Iron	9231587		<0.1	<0.1	NA	< 0.1	105%	80%	120%	106%	80%	120%	105%	80%	120%
Dissolved Manganese	9231587		0.103	0.103	0.0%	< 0.005	105%	80%	120%	106%	80%	120%	NA	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 48 hours in Alberta and 72 hours in British Columbia.

Microbial Analysis															
Total Coliforms (MF)	2308	041	< 1	< 1	NA	< 1									
Fecal Coliforms (MF)	2308	041	<1	<1	NA	< 1									
Escherichia coli in Water	2308	041	< 1	< 1	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - CBOD, BOD, COD, TSS, TKN, O-PO4, DO, T-Phos, NH3															
CBOD - Carbonaceous	5736	666	<2	<2	NA	< 2	100%	80%	120%						
Biochemical Oxygen Demand (BOD)	5736	666	<2	<2	NA	< 2	106%	80%	120%						
Chemical Oxygen Demand	1385	384	21	20	4.9%	< 1	101%	80%	120%	101%	80%	120%	104%	80%	120%
Total Suspended Solids	9223055		10	11	9.5%	< 2	103%	80%	120%				99%	80%	120%
Total Kjeldahl Nitrogen	9230486		0.1	0.1	NA	< 0.1	109%	80%	120%	95%	80%	120%	NA	80%	120%
Orthophosphate	9231577		<0.15	<0.15	NA	< 0.15	118%	80%	120%	114%	80%	120%	108%	80%	120%
Dissolved Oxygen	182	666	8.0	8.0	0.0%	< 0.1									
Total Phosphorus	9230428		0.09	0.09	NA	< 0.08	98%	80%	120%	110%	80%	120%	102%	80%	120%
Ammonia, Total (as N)	9230486		0.10	0.11	NA	< 0.05	115%	80%	120%	102%	80%	120%	101%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R337514

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Ammonia, Total (as N)	INST 0420	SM 4500-NH3 G W	DISCRETE ANALYZER

7°C

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature: MAY 18 PM 4:50
AGAT Job Number:
Date and Time: 18R337514

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Invoice To

Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Requirements (Selection may impact detection limits)

☐ CCME
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL

☐ AB Tier 1
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area
☐ AB Surface Water

☐ BC CSR
☐ AW ☐ IW ☐ LW ☐ DW

☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEX/S/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
973/666	WQ1	SW	5/9/2018	10:00AM	10					x						x	x	x	x	x	x			
669	WQ2B	SW	5/9/2018	10:45 AM	10					x						x	x	x	x	x	x			
670	WQ3B	SW	5/9/2018	11:10 AM	10					x						x	x	x	x	x	x			
671	Lagoon	SW	5/9/2018	10:15 AM	10					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time
Jacob Tucker	May 9 2018 11:56AM	Kim Parkes	May. 9/18 11:56 pm
Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time
		A-LORICA	9 MAY 2078 4:50
Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time

Page ____ of ____
Nº: AB

Document ID: DIV-50-1507.003

C 30746

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Time Sensitive

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____ BR237514

Company/Consultant: WSP

TAT: <24hr☐ 24-48hr☐ 48-72hr☐ Reg☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: May. 9/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☑

ALREADY EXCEEDED? Yes☐ No☑

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 17.9 + 14.4 + 14.9 °C (2) ___ + ___ + ___ = ___ °C (3) ___ + ___ + ___ = ___ °C (4) ___ + ___ + ___ = ___ °C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JA200 Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 2

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* DO

Earliest Expiry: 9 MAY 2018 @ 18:00H

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) (Free Water) None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 7 + 7 + 7 = 7 °C 2(Bottle/Jar) 6.9 + 6.7 + 6.8 = 6.8 °C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 1823375/4

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

7°C

AGAT Laboratories
2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only
Arrival Temperature: MAY 18 PM 4:50
AGAT Job Number:
Date and Time: 18R337514

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Invoice To

Same [✓] Yes [ ] No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

[ ] Single Sample per Page
[✓] Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT [✓] 5-7 Business Days

Rush TAT (Surcharge)
[ ] Less than 24 Hours (200%)
[ ] Less than 48 Hours (100%)
[ ] Less than 72 Hours (50%)

Date Required:

Requirements (Selection may impact detection limits)

[ ] CCME
- [ ] Agricultural
- [ ] Industrial
- [ ] Residential/ Park
- [ ] Commercial
- [ ] Drinking Water
- [ ] FWAL

[ ] AB Tier 1
- [ ] Agricultural
- [ ] Industrial
- [ ] Residential/ Park
- [ ] Commercial
- [ ] Natural Area
- [ ] AB Surface Water

[ ] BC CSR
- [ ] AW
- [ ] IW
- [ ] LW
- [ ] DW

[ ] Other:
- [ ] D50 (Drilling)
- [ ] SPIGEC
- [ ]

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: [ ] HWS-B [ ] Cr^{6+} [ ] Hg	Water Metals: [ ] Dissolved [ ] Total [ ] Hg [ ] Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	[ ] BTEXS/VPH/EPH [ ] LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
973/466	WQ1	SW	5/9/2018	10:00AM	10					x						x	x	x	x	x	x			
469	WQ2B	SW	5/9/2018	10:45 AM	10					x						x	x	x	x	x	x			
470	WQ3B	SW	5/9/2018	11:10 AM	10					x						x	x	x	x	x	x			
471	Lagoon	SW	5/9/2018	10:15 AM	10					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time
Jacob Tricker	May 9 2018 11:56AM	Kim Parkes	May. 9/18 11:56pm
Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time
		A-LORICA	9 MAY 2018 4:50
Samples Relinquished By (Print Name and Sign)	Date/ Time	Samples Relinquished By (Print Name and Sign)	Date/ Time

Page of
N°: AB

Document ID: DIV-50-1507.003

C 30746

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Time Sensitive

18R337514

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP

TAT: <24hr☐ 24-48hr☐ 48-72hr☐ Reg☑ Other_____ Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: May. 9/18

Microbiology: Test: _____

Hydrocarbons: Test: _____

Are samples received >5 days after sampling: Yes☐ No☑

ALREADY EXCEEDED? Yes☐ No☑

Expiry: _____

Expiry: _____

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 17.9 + 14.4 + 14.9 = °C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP

Courier: JA200 Prepaid Collect

Waybill#

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 2

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines* DO

Earliest Expiry: 9 MAY 2018 @ 18:00H

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) (Free Water) None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 7 + 7 + 7 = 7 °C 2(Bottle/Jar) 6.7 + 6.7 + 6.8 = 6.8 °C

3 (Bottle/Jar)___+___+___=____ °C 4 (Bottle/Jar)___+___+___=____ °C

5 (Bottle/Jar)___+___+___=____ °C 6 (Bottle/Jar)___+___+___=____ °C

7 (Bottle/Jar)___+___+___=____ °C 8 (Bottle/Jar)___+___+___=____ °C

9 (Bottle/Jar)___+___+___=____ °C 10 (Bottle/Jar)___+___+___=____ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18233754

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R355760

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: Jul 13, 2018

PAGES (INCLUDING COVER): 11

VERSION*: 3

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

VERSION 3:Version 2 supersedes version 1. Added ammonia analysis to samples: 252, 255, 256 and 257. TKN value for sample: 257 has been updated from 10mg/L to 13.3mg/L - July 13th 2018 CS.

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-06-27

DATE REPORTED: 2018-07-13

				SAMPLE DESCRIPTION:	WQ1	WQ2B	WQ3B	WQ4B
				SAMPLE TYPE:	Water	Water	Water	Water
				DATE SAMPLED:	2018-06-27 10:30	2018-06-27 11:00	2018-06-27 11:20	2018-06-27 11:30
Parameter	Unit	G / S	RDL		9363252	9363255	9363256	9363257
Total Coliforms (MF)	CFU/100 mL		10		440	520	480	320
Fecal Coliforms (MF)	CFU/100 mL		1		44	35	33	49
Escherichia coli in Water	CFU/100 mL		1		57	35	48	54

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-06-27

DATE REPORTED: 2018-07-13

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B	WQ4B
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2018-06-27 10:30	2018-06-27 11:00	2018-06-27 11:20	2018-06-27 11:30
Parameter	Unit	G / S	RDL	9363252	9363255	9363256	9363257
pH	pH Units		N/A	8.48	8.51	8.53	8.30
p - Alkalinity (as CaCO3)	mg/L		5	7	8	9	<5
T - Alkalinity (as CaCO3)	mg/L		5	248	251	252	347
Bicarbonate	mg/L		5	285	287	287	422
Carbonate	mg/L		5	9	10	10	<5
Hydroxide	mg/L		5	<5	<5	<5	<5
Electrical Conductivity	uS/cm		5	434	448	446	1150
Chloride	mg/L		1	1	2	2	158
Fluoride	mg/L		0.01	0.07	0.11	0.11	0.25
Nitrate	mg/L		0.1	<0.1	0.1	0.1	2.1
Nitrate-N	mg/L		0.02	<0.02	0.02	0.02	0.47
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05	1.27
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01	0.39
Nitrate+Nitrite - Nitrogen	mg/L		0.02	<0.02	0.02	0.02	0.86
Sulfate	mg/L		1	5	5	5	9
Dissolved Calcium	mg/L		0.3	66.8	66.9	67.8	68.8
Dissolved Magnesium	mg/L		0.2	20.9	20.3	20.6	23.2
Dissolved Sodium	mg/L		0.6	6.0	5.6	5.5	112
Dissolved Potassium	mg/L		0.6	0.9	0.9	0.9	12.6
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1	0.3
Dissolved Manganese	mg/L		0.005	0.007	0.010	0.010	0.086
Calculated TDS	mg/L		0.6	250	252	253	595
Sodium Adsorption Ratio	N/A			0.16	0.15	0.15	2.98
Hardness	mg CaCO3/L		1	253	251	254	267
Ion Balance	%		1	105	101	103	91

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9363252-9363257 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - Ammonia

DATE RECEIVED: 2018-06-27

DATE REPORTED: 2018-07-13

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B		WQ4B
		SAMPLE TYPE:		Water	Water	Water		Water
		DATE SAMPLED:		2018-06-27 10:30	2018-06-27 11:00	2018-06-27 11:20		2018-06-27 11:30
Parameter	Unit	G / S	RDL	9363252	9363255	9363256	RDL	9363257
Ammonia, Total (as N)	mg/L		0.02	<0.02	0.02	<0.02	0.2	13.0

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, T-P, TSS

DATE RECEIVED: 2018-06-27

DATE REPORTED: 2018-07-13

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B		WQ4B
		SAMPLE TYPE:		Water	Water	Water		Water
		DATE SAMPLED:		2018-06-27 10:30	2018-06-27 11:00	2018-06-27 11:20		2018-06-27 11:30
Parameter	Unit	G / S	RDL	9363252	9363255	9363256	RDL	9363257
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2	2	14
CBOD - Carbonaceous	mg/L		2	<2	<2	<2	2	5
Chemical Oxygen Demand	mg/L		1	4	<1	<1	1	53
Dissolved Oxygen	mg/L		0.1	5.2	5.6	7.5	0.1	5.6
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15	0.75	13.5
Total Kjeldahl Nitrogen	mg/L		0.1	<0.1	<0.1	<0.1	1.0	13.3
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08	0.08	5.59
Total Suspended Solids	mg/L		2	<2	<2	<2	2	34

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jul 13, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9368163		8.25	8.26	0.1%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9368163		419	419	0.0%	< 5	104%	80%	120%						
Electrical Conductivity	9368163		934	930	0.4%	< 5	103%	80%	120%						
Chloride	9363256	9363256	2	2	NA	< 1	98%	80%	120%	92%	80%	120%	91%	80%	120%
Fluoride	9363256	9363256	<0.06	<0.06	NA	< 0.01	98%	80%	120%	104%	80%	120%	110%	80%	120%
Nitrate	9363256	9363256	<0.5	<0.5	NA	< 0.1	103%	80%	120%	102%	80%	120%	101%	80%	120%
Nitrite	9363256	9363256	<0.20	<0.20	NA	< 0.05	102%	80%	120%	100%	80%	120%	98%	80%	120%
Sulfate	9363256	9363256	6	6	0.8%	< 1	110%	80%	120%	108%	80%	120%	100%	80%	120%
Dissolved Calcium	9364939		292	298	2.1%	< 0.3	109%	80%	120%	112%	80%	120%	NA	80%	120%
Dissolved Magnesium	9364939		75.5	76.0	0.7%	< 0.2	102%	80%	120%	104%	80%	120%	NA	80%	120%
Dissolved Sodium	9364939		251	254	1.1%	< 0.6	94%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Potassium	9364939		7.8	7.8	0.5%	< 0.6	84%	80%	120%	83%	80%	120%	NA	80%	120%
Dissolved Iron	9364939		0.2	0.2	NA	< 0.1	105%	80%	120%	103%	80%	120%	104%	80%	120%
Dissolved Manganese	9364939		0.198	0.200	1.0%	< 0.005	103%	80%	120%	101%	80%	120%	NA	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 72 hours.

Microbial Analysis															
Total Coliforms (MF)	2345	637	< 1	< 1	NA	< 1									
Fecal Coliforms (MF)	2345	637	< 1	< 1	NA	< 1									
Escherichia coli in Water	2345	637	< 1	< 1	NA	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, T-P, TSS															
Biochemical Oxygen Demand (BOD)	5766		186	185	0.5%	< 2	95%	80%	120%						
CBOD - Carbonaceous	5766		176	176	0.0%	< 2	90%	80%	120%						
Chemical Oxygen Demand	1411	765	13	14	7.4%	< 1	101%	80%	120%	101%	80%	120%	98%	80%	120%
Dissolved Oxygen	185	252	5.2	5.2	0.0%	< 0.1									
Orthophosphate	9363252	9363252	<0.15	<0.15	NA	< 0.15	103%	80%	120%	112%	80%	120%	NA	80%	120%
Total Kjeldahl Nitrogen	9363252	9363252	<0.1	<0.1	NA	< 0.1	84%	80%	120%	83%	80%	120%	NA	80%	120%
Total Phosphorus	9364765		0.13	0.14	NA	< 0.08	96%	80%	120%	97%	80%	120%	110%	80%	120%
Total Suspended Solids	9368123		<2	<2	NA	< 2	100%	80%	120%				99%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Jul 13, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Analysis - Ammonia															
Ammonia, Total (as N)	9363252	9363252	<0.02	<0.02	NA	< 0.02	108%	80%	120%	102%	80%	120%	94%	80%	120%

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R355760

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Ammonia, Total (as N)	INST 0340	SM 4500-NH3 G W	CONTINUOUS FLOW ANALYZER
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

AGAT Laboratories

Laboratory Use Only
Arrival Temperature: 5 °C
AGAT Job Number: 18Q355760
Date and Time: 27 JUN '18 PM 4:12

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%)
☐ Less than 48 Hours (100%)
☐ Less than 72 Hours (50%)
Date Required:

Invoice To Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME: ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL
☐ AB Tier 1: ☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area
☐ AB Surface Water
☐ BC CSR: ☐ AW ☐ IW ☐ LW ☐ DW
☐ Other: ☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr6+ ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr6+	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9363754	WQ1	SW	June 27 2018 10:30 AM	River sample						x						x	x	x	x	x	x			
55	WQ2B	SW	June 27 2018 11:00 AM	River sample						x						x	x	x	x	x	x			
56	WQ3B	SW	June 27 2018 11:20 AM	River sample						x						x	x	x	x	x	x			
57	WQ4B (Lagoon Effluent)	SW	June 27 2018 11:30 AM	lagoon sample						✓						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:	
Jacob Taylor [signature]	June 27 2018 12:10 PM	[signature]	June 27/18 12:10 PM	Page of
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:	
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign): [signature]	Date/ Time: 6/27/18 4:12	Nº: AB

Document ID: DIV-50-1507.003

C 31764

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: VAN Prepaid Collect

Waybill#

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , D.O Chloroamines*

Earliest Expiry: Oct 22 @ 18:30

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 5 + 5 + 5 = 5 °C	2(Bottle/Jar) ___ + ___ + ___ = ___ °C
3 (Bottle/Jar) ___ + ___ + ___ = ___ °C	4 (Bottle/Jar) ___ + ___ + ___ = ___ °C
5 (Bottle/Jar) ___ + ___ + ___ = ___ °C	6 (Bottle/Jar) ___ + ___ + ___ = ___ °C
7 (Bottle/Jar) ___ + ___ + ___ = ___ °C	8 (Bottle/Jar) ___ + ___ + ___ = ___ °C
9 (Bottle/Jar) ___ + ___ + ___ = ___ °C	10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R35576

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: D.O Samples given to the lab

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA INC.

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☑ Other sd Cooler Quantity: 1

Extremely Time Sensitive

TIME SENSITIVE ISSUES:
Earliest Date Sampled: JUNE 27/18
Microbiology: Test: ✓
Hydrocarbons: Test:
Are samples received >5 days after sampling: Yes☐ No☒

ALREADY EXCEEDED? Yes☐ No☐
Expiry:
Expiry:

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)
3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 11+12+12= __°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C
Additional integrity issues (note here and on COC next to the sample ID):

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only

Arrival Temperature: 5 °C

AGAT Job Number: 18C355760

Date and Time: 27 JUN '18 PM 4:12

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days

Rush TAT (Surcharge)
☐ Less than 24 Hours (200%)
☐ Less than 48 Hours (100%)
☐ Less than 72 Hours (50%)

Date Required:

Invoice To Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME
☐ Agricultural
☐ Industrial
☐ Residential/ Park
☐ Commercial
☐ Drinking Water
☐ FWAL

☐ AB Tier 1
☐ Agricultural
☐ Industrial
☐ Residential/ Park
☐ Commercial
☐ Natural Area
☐ AB Surface Water

☐ BC CSR
☐ AW
☐ IW
☐ LW
☐ DW

☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr⁶⁺ ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr⁶⁺	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9363754	WQ1	SW	June 27 2018 10:30 AM	River sample						x						x	x	x	x	x	x			
55	WQ2B	SW	June 27 2018 11:00 AM	River sample						x						x	x	x	x	x	x			
56	WQ3B	SW	June 27 2018 11:20 AM	River sample						x						x	x	x	x	x	x			
57	WQ4B (Lagoon Effluent)	SW	June 27 2018 11:30 AM	lagoon sample						✓						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Jacob Taylor [signature] Date/ Time: June 27 2018 12:10 PM
Samples Relinquished By (Print Name and Sign): [signature] Date/ Time: June 27/18 12:10 PM
Samples Relinquished By (Print Name and Sign): Date/ Time:
Samples Relinquished By (Print Name and Sign): Date/ Time:
Samples Relinquished By (Print Name and Sign): [signature] Date/ Time: 6/27/18 4:12

Page of

Nº: AB

Document ID: DIV-50-1507.003

C 31764

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: VAN Prepaid Collect

Waybill#

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , D.O Chloroamines*

Earliest Expiry: Oct 22 @ 18:30

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 5 + 5 + 5 = 5 °C 2(Bottle/Jar) ___ + ___ + ___ = ___ °C

3 (Bottle/Jar) ___ + ___ + ___ = ___ °C 4 (Bottle/Jar) ___ + ___ + ___ = ___ °C

5 (Bottle/Jar) ___ + ___ + ___ = ___ °C 6 (Bottle/Jar) ___ + ___ + ___ = ___ °C

7 (Bottle/Jar) ___ + ___ + ___ = ___ °C 8 (Bottle/Jar) ___ + ___ + ___ = ___ °C

9 (Bottle/Jar) ___ + ___ + ___ = ___ °C 10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R35576

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments:

D.O samples given to the lab

* Subcontracted Analysis (See CPM)

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA INC.

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☑ Other sd Cooler Quantity: 1

Extremely Time Sensitive

TIME SENSITIVE ISSUES:

Earliest Date Sampled: JUNE 27/18 ALREADY EXCEEDED? Yes☐ No☐

Microbiology: Test: ✓ Expiry:

Hydrocarbons: Test: Expiry:

Are samples received >5 days after sampling: Yes☐ No☒

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 11+12+12=__°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA INC.
237 - 4 AVE SW SUITE 3300
CALGARY, AB T2P 4K3
(403) 271-4442

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R372082

WATER ANALYSIS REVIEWED BY: Krystyna Krauze, Senior Analyst

DATE REPORTED: Aug 17, 2018

PAGES (INCLUDING COVER): 10

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-08-09

DATE REPORTED: 2018-08-11

			SAMPLE DESCRIPTION:	WQ1	WQ2B	WQ3B		WQ4B
			SAMPLE TYPE:	Water	Water	Water		Water
			DATE SAMPLED:	2018-08-09 09:00	2018-08-09 09:30	2018-08-09 10:00		2018-08-09 10:30
Parameter	**Unit**	**G / S**	**RDL**	**9461177**	**9461180**	**9461181**	**RDL**	**9461183**
Total Coliforms (MF)	CFU/100 mL		100	4100	3700	3500	100	9200
Fecal Coliforms (MF)	CFU/100 mL		1	37	72	42	10	340
Escherichia coli in Water	CFU/100 mL		1	36	63	40	10	340

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis

DATE RECEIVED: 2018-08-09

DATE REPORTED: 2018-08-11

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B	WQ4B
		SAMPLE TYPE:		Water	Water	Water	Water
		DATE SAMPLED:		2018-08-09 09:00	2018-08-09 09:30	2018-08-09 10:00	2018-08-09 10:30
Parameter	Unit	G / S	RDL	9461177	9461180	9461181	9461183
pH	pH Units		N/A	8.39	8.41	8.41	8.07
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	5	<5
T - Alkalinity (as CaCO3)	mg/L		5	235	242	242	322
Bicarbonate	mg/L		5	277	284	284	393
Carbonate	mg/L		5	5	5	5	<5
Hydroxide	mg/L		5	<5	<5	<5	<5
Electrical Conductivity	uS/cm		5	417	426	429	1110
Chloride	mg/L		1	<1	1	2	166
Fluoride	mg/L		0.01	0.11	0.11	0.12	0.12
Nitrate	mg/L		0.1	<0.1	0.1	0.1	5.5
Nitrate-N	mg/L		0.02	<0.02	0.02	0.02	1.24
Nitrite	mg/L		0.05	<0.05	<0.05	<0.05	1.83
Nitrite-N	mg/L		0.01	<0.01	<0.01	<0.01	0.56
Nitrate+Nitrite - Nitrogen	mg/L		0.02	<0.02	0.02	0.02	1.80
Sulfate	mg/L		1	5	5	5	10
Dissolved Calcium	mg/L		0.3	61.9	64.8	64.6	73.9
Dissolved Magnesium	mg/L		0.2	19.6	21.1	21.5	25.2
Dissolved Sodium	mg/L		0.6	5.2	5.5	5.5	117
Dissolved Potassium	mg/L		0.6	0.9	0.9	0.9	11.9
Dissolved Iron	mg/L		0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L		0.005	<0.005	0.006	0.007	0.053
Calculated TDS	mg/L		0.6	234	243	244	605
Sodium Adsorption Ratio	N/A			0.15	0.15	0.15	3.00
Hardness	mg CaCO3/L		1	235	249	250	288
Ion Balance	%		1	103	105	105	97

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

9461177-9461183 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS

DATE RECEIVED: 2018-08-09

DATE REPORTED: 2018-08-16

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B		WQ4B
		SAMPLE TYPE:		Water	Water	Water		Water
		DATE SAMPLED:		2018-08-09 09:00	2018-08-09 09:30	2018-08-09 10:00		2018-08-09 10:30
Parameter	Unit	G / S	RDL	9461177	9461180	9461181	RDL	9461183
Biochemical Oxygen Demand (BOD)	mg/L		2	<2	<2	<2	2	28
CBOD - Carbonaceous	mg/L		2	<2	<2	<2	2	2
Chemical Oxygen Demand	mg/L		1	<1	<1	<1	1	29
Dissolved Oxygen	mg/L		0.1	4.5	4.7	5.9	0.1	3.5
Orthophosphate	mg/L		0.15	<0.15	<0.15	<0.15	0.75	11.1
Total Kjeldahl Nitrogen	mg/L		0.1	<0.1	<0.1	<0.1	0.1	0.5
Total Phosphorus	mg/L		0.08	<0.08	<0.08	<0.08	0.08	4.16
Total Suspended Solids	mg/L		2	<2	<2	<2	2	11

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis															
pH	9462387		7.71	7.71	0.0%	N/A	100%	90%	110%						
T - Alkalinity (as CaCO3)	9462387		559	556	0.5%	< 5	99%	80%	120%						
Electrical Conductivity	9462387		1620	1620	0.0%	< 5	102%	80%	120%						
Chloride	9463239		7	7	0.0%	< 1	103%	80%	120%	99%	80%	120%	NA	80%	120%
Fluoride	9463239		0.22	0.23	4.4%	< 0.01	93%	80%	120%	95%	80%	120%	93%	80%	120%
Nitrate	9463239		<0.1	0.1	NA	< 0.1	93%	80%	120%	92%	80%	120%	99%	80%	120%
Nitrite	9463239		<0.05	<0.05	NA	< 0.05	86%	80%	120%	83%	80%	120%	95%	80%	120%
Sulfate	9463239		59	59	0.0%	< 1	94%	80%	120%	94%	80%	120%	NA	80%	120%
Dissolved Calcium	9461177	9461177	61.9	62.7	1.3%	< 0.3	113%	80%	120%	111%	80%	120%	NA	80%	120%
Dissolved Magnesium	9461177	9461177	19.6	20.4	4.0%	< 0.2	104%	80%	120%	98%	80%	120%	NA	80%	120%
Dissolved Sodium	9461177	9461177	5.2	5.3	1.9%	< 0.6	107%	80%	120%	104%	80%	120%	NA	80%	120%
Dissolved Potassium	9461177	9461177	0.9	0.9	NA	< 0.6	94%	80%	120%	88%	80%	120%	92%	80%	120%
Dissolved Iron	9461177	9461177	<0.1	<0.1	NA	< 0.1	99%	80%	120%	93%	80%	120%	90%	80%	120%
Dissolved Manganese	9461177	9461177	<0.005	<0.005	NA	< 0.005	99%	80%	120%	92%	80%	120%	90%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 72 hours.

Microbial Analysis															
Total Coliforms (MF)	2375	177	4100	3400	18.7%	< 1									
Fecal Coliforms (MF)	2375	177	37	31	17.6%	< 1									
Escherichia coli in Water	2375	177	36	41	13.0%	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Analysis - BOD, CBOD, COD, DO, o-PO4, TKN, TP, TSS															
Biochemical Oxygen Demand (BOD)	5788	387	150	133	12.0%	< 2	100%	80%	120%						
CBOD - Carbonaceous	5788	387	125	125	0.0%	< 2	97%	80%	120%						
Chemical Oxygen Demand	1435	177	< 1	< 1	0.0%	< 1	100%	80%	120%	98%	80%	120%	101%	80%	120%
Dissolved Oxygen	188		7.9	7.9	0.0%	< 0.1									
Orthophosphate	9463488		<0.15	<0.15	NA	< 0.15	95%	80%	120%	100%	80%	120%	94%	80%	120%
Total Kjeldahl Nitrogen	9461177	9461177	<0.1	<0.1	NA	< 0.1	88%	80%	120%	86%	80%	120%	83%	80%	120%
Total Phosphorus	9459399		0.27	0.25	NA	< 0.08	87%	80%	120%	89%	80%	120%	88%	80%	120%
Total Suspended Solids	9474024		10	9	NA	< 2	101%	80%	120%				99%	80%	120%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date:			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 18R372082

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC

AGAT Laboratories

2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Laboratory Use Only	18 °C
Arrival Temperature:	
AGAT Job Number:	18R372082
Date and Time:	9 AUG '18 PM 3:53

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Invoice To Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days

Rush TAT (Surcharge)
☐ Less than 24 Hours (200%)
☐ Less than 48 Hours (100%)
☐ Less than 72 Hours (50%)

Date Required:

Requirements (Selection may impact detection limits)

☐ CCME
☐ Agricultural
☐ Industrial
☐ Residential/ Park
☐ Commercial
☐ Drinking Water
☐ FWAL

☐ AB Tier 1
☐ Agricultural
☐ Industrial
☐ Residential/ Park
☐ Commercial
☐ Natural Area
☐ AB Surface Water

☐ BC CSR
☐ AW
☐ IW
☐ LW
☐ DW

☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr6+ ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr6+	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9461177	WQ1	SW	Aug 9/18 9:00	up stream						x						x	x	x	x	x	x			
180	WQ2B	SW	Aug 9/18 9:30	source river						x						x	x	x	x	x	x			
181	WQ3B	SW	Aug 9/18 10:00	down stream						x						x	x	x	x	x	x			
182	WQ4B	SW	Aug 9/18 10:30	Source lagoon.						x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Jacob Tricker [signature]	Date/ Time: Aug 9/2018 11:40 AM	Samples Relinquished By (Print Name and Sign): [signature]	Date/ Time: Aug 9/18 11:40 AM
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign):	Date/ Time:
Samples Relinquished By (Print Name and Sign):	Date/ Time:	Samples Relinquished By (Print Name and Sign): KM MAGINNIS 8/9/18	Date/ Time:

Page of

Nº: AB

Document ID: DIV-50-1507.003

C 32634

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other Extremely Time Sensitive Cooler Quantity: 1

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Aug 9/18 ALREADY EXCEEDED? Yes☐ No☐

Microbiology: Test: _____ Expiry: _____

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☒

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 15+15+15=___°C (2) ___+___+___=___°C (3) ___+___+___=___°C (4) ___+___+___=___°C

Additional integrity issues (note here and on COC next to the sample ID):

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JAZZD Prepaid Collect

Waybill# N/A

Branch: EDM GP FN FM (RD) VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes (No)

Custody Seal Intact: Yes No (NA)

TAT: <24hr 24-48hr 48-72hr (Reg) Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes (No)

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Earliest Expiry: Aug 9 2018 @ 5:00 pm

Hydrocarbons: Earliest Expiry

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES (NO) Precaution Taken:

Legal Samples: Yes (No)

International Samples: Yes (No)

Tape Sealed: Yes (No)

Coolant Used: Icepack Bagged Ice (Free Ice) Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 18 + 18 + 18 = 18 °C 2(Bottle/Jar)___+___+___=___°C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R372092

Samples Damaged: Yes (No) If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: 4 Samples for DO is already in the lab

* Subcontracted Analysis (See CPM)

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

CLIENT NAME: WSP CANADA GROUP LTD.
100 COMMERCE VALLEY DRIVE WEST
THORNHILL, ON L3T0A1
(905) 882-1100

ATTENTION TO: Tina Mews

PROJECT: 171-00699-00

AGAT WORK ORDER: 18R390811

WATER ANALYSIS REVIEWED BY: Loan Nguyen, Senior Analyst

DATE REPORTED: Oct 10, 2018

PAGES (INCLUDING COVER): 11

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA GROUP LTD.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Microbial Analysis

DATE RECEIVED: 2018-09-27

DATE REPORTED: 2018-10-10

				SAMPLE DESCRIPTION:	WQ1	WQ2B	WQ3B
				SAMPLE TYPE:	Water	Water	Water
				DATE SAMPLED:	2018-09-27 11:10	2018-09-27 10:30	2018-09-27 10:00
Parameter	Unit	G / S	RDL		9584199	9584235	9584236
Total Coliforms (MF)	CFU/100 mL		10		830	1140	1190
Fecal Coliforms (MF)	CFU/100 mL		1		79	162	31
Escherichia coli in Water	CFU/100 mL		1		66	123	30

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA GROUP LTD.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis (WSP)

DATE RECEIVED: 2018-09-27

DATE REPORTED: 2018-10-10

		SAMPLE DESCRIPTION:		WQ1	WQ2B	WQ3B
		SAMPLE TYPE:		Water	Water	Water
		DATE SAMPLED:		2018-09-27 11:10	2018-09-27 10:30	2018-09-27 10:00
Parameter	Unit	G / S	RDL	9584199	9584235	9584236
pH	pH Units	7.0-10.5	N/A	8.31	8.32	8.29
p - Alkalinity (as CaCO3)	mg/L		5	<5	<5	<5
T - Alkalinity (as CaCO3)	mg/L		5	236	241	242
Bicarbonate	mg/L		5	285	292	296
Carbonate	mg/L		5	<5	<5	<5
Hydroxide	mg/L		5	<5	<5	<5
Electrical Conductivity	uS/cm		5	430	444	448
Electrical Conductivity	dS/m		0.05	0.43	0.44	0.45
Chloride	mg/L	(250)	1	1	2	2
Fluoride	mg/L	1.5	0.01	0.06	0.06	0.07
Nitrate	mg/L	45	0.1	<0.1	0.2	0.2
Nitrate-N	mg/L	10	0.02	<0.02	0.05	0.05
Nitrite	mg/L	3	0.05	<0.05	<0.05	<0.05
Nitrite-N	mg/L	1	0.01	<0.01	<0.01	<0.01
Nitrate+Nitrite - Nitrogen	mg/L		0.02	<0.02	0.05	0.05
Sulfate	mg/L	(500)	1	5	7	6
Dissolved Calcium	mg/L		0.3	62.2	64.4	64.8
Dissolved Magnesium	mg/L		0.2	19.4	19.6	19.8
Dissolved Sodium	mg/L	(200)	0.6	4.8	5.0	5.1
Dissolved Potassium	mg/L		0.6	1.0	1.0	1.0
Dissolved Iron	mg/L	(0.3)	0.1	<0.1	<0.1	<0.1
Dissolved Manganese	mg/L	0.05	0.005	<0.005	0.006	0.008
Calculated TDS	mg/L		0.6	234	243	244
Sodium Adsorption Ratio	N/A			0.14	0.14	0.14
Hardness	mg CaCO3/L		1	235	242	243
Ion Balance	%		1	103	102	101

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA GROUP LTD.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Routine Chemistry Water Analysis (WSP)

DATE RECEIVED: 2018-09-27

DATE REPORTED: 2018-10-10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to 2017 Canadian Drinking Water Quality MAC (AO)
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

9584199-9584236 < - Values refer to Report Detection Limits.

If sodium results in mg/L are less than detection, SAR is non-calculable and is reported as 0.

Analysis performed at AGAT Calgary (unless marked by *)

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

CLIENT NAME: WSP CANADA GROUP LTD.

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Anaysis - Ammonia, BOD, CBOD, COD, DO, Orthophosphate, TKN, TP, TSS

DATE RECEIVED: 2018-09-27

DATE REPORTED: 2018-10-10

				SAMPLE DESCRIPTION:	WQ1	WQ2B	WQ3B
				SAMPLE TYPE:	Water	Water	Water
				DATE SAMPLED:	2018-09-27 11:10	2018-09-27 10:30	2018-09-27 10:00
Parameter	Unit	G / S	RDL		9584199	9584235	9584236
Ammonia, Total (as N)	mg/L		0.05		<0.05	<0.05	<0.05
Biochemical Oxygen Demand (BOD)	mg/L		2		<2	<2	<2
CBOD - Carbonaceous	mg/L		2		<2	<2	<2
Chemical Oxygen Demand	mg/L		1		<1	<1	<1
Orthophosphate	mg/L		0.15		<0.15	<0.15	<0.15
Total Kjeldahl Nitrogen	mg/L		0.1		0.1	<0.1	<0.1
Total Phosphorus	mg/L		0.08		<0.08	<0.08	<0.08
Total Suspended Solids	mg/L		2		<2	2	<2
Dissolved Oxygen	mg/L		0.1		2.4	3.8	4.6

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA GROUP LTD.

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Oct 10, 2018

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Routine Chemistry Water Analysis (WSP)															
pH	9589600		7.69	7.70	0.1%	N/A	99%	90%	110%						
T - Alkalinity (as CaCO3)	9589600		2430	2430	0.0%	< 5	103%	80%	120%						
Electrical Conductivity	9589600		6040	6000	0.7%	< 5	106%	80%	120%						
Chloride	9584262		33	33	0.4%	< 1	111%	80%	120%	105%	80%	120%	NA	80%	120%
Fluoride	9584262		0.24	0.26	8.0%	< 0.01	95%	80%	120%	87%	80%	120%	NA	80%	120%
Nitrate	9584262		<0.1	<0.1	NA	< 0.1	103%	80%	120%	96%	80%	120%	NA	80%	120%
Nitrite	9584262		<0.05	<0.05	NA	< 0.05	97%	80%	120%	94%	80%	120%	NA	80%	120%
Sulfate	9584262		5	4	NA	< 1	99%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Calcium	9584164		48.8	49.3	0.9%	< 0.3	105%	80%	120%	97%	80%	120%	NA	80%	120%
Dissolved Magnesium	9584164		14.8	14.5	1.9%	< 0.2	96%	80%	120%	93%	80%	120%	NA	80%	120%
Dissolved Sodium	9584164		0.8	0.8	NA	< 0.6	93%	80%	120%	103%	80%	120%	91%	80%	120%
Dissolved Potassium	9584164		<0.6	<0.6	NA	< 0.6	86%	80%	120%	86%	80%	120%	96%	80%	120%
Dissolved Iron	9584164		<0.1	<0.1	NA	< 0.1	103%	80%	120%	100%	80%	120%	98%	80%	120%
Dissolved Manganese	9584164		<0.005	<0.005	NA	< 0.005	101%	80%	120%	98%	80%	120%	96%	80%	120%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

pH has been analyzed past the recommended holding time of 15 minutes from sampling (field measurement ideal if more accurate data required)

Nitrate and Nitrite: The regulatory hold time for the analysis of nitrate and/or nitrite in water is 72 hours.

Microbial Analysis

Total Coliforms (MF)	2415	199	830	730	12.8%	< 1									
Fecal Coliforms (MF)	2415	199	79	81	2.5%	< 1									
Escherichia coli in Water	2415	199	66	71	7.3%	< 1									

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Water Anaysis - Ammonia, BOD, CBOD, COD, DO, Orthophosphate, TKN, TP, TSS

Ammonia, Total (as N)	9605314	9605314	< 0.05	< 0.05	NA	< 0.05	94%	80%	120%	104%	80%	120%	81%	80%	120%
Biochemical Oxygen Demand (BOD)	5807	199	< 2	< 2	NA	< 2	107%	80%	120%						
CBOD - Carbonaceous	5807	199	< 2	< 2	NA	< 2	107%	80%	120%						
Chemical Oxygen Demand	1458	199	< 1	< 1	NA	< 1	101%	80%	120%	101%	80%	120%	98%	80%	120%
Orthophosphate	9585546		<0.15	<0.15	NA	< 0.15	87%	80%	120%	81%	80%	120%	92%	80%	120%
Total Kjeldahl Nitrogen	279	9605626	<0.1	<0.1	NA	< 0.1	100%	80%	120%	NA	80%	120%	NA	80%	120%
Total Phosphorus	9600781		<0.08	<0.08	NA	< 0.08	96%	80%	120%	90%	80%	120%	92%	80%	120%
Total Suspended Solids	9584199	9584199	<2	<2	NA	< 2	97%	80%	120%				96%	80%	120%
Dissolved Oxygen	283	199	2.4	2.6	8.0%	< 0.1									

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: WSP CANADA GROUP LTD.

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Oct 10, 2018			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

2910 12TH STREET NE
CALGARY, ALBERTA
CANADA T2E 7P7
TEL (403)735-2005
FAX (403)735-2771
http://www.agatlabs.com

Method Summary

CLIENT NAME: WSP CANADA GROUP LTD.

AGAT WORK ORDER: 18R390811

PROJECT: 171-00699-00

ATTENTION TO: Tina Mews

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Total Coliforms (MF)	MIC 0202	SM 9222 B	INCUBATOR
Fecal Coliforms (MF)	MIC 0203	SM 9222 D	INCUBATOR
Escherichia coli in Water	MIC 0202	SM 9222 B	INCUBATOR
pH	INST 0101, INST 0104	SM 4500 H+	PH METER
p - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
T - Alkalinity (as CaCO3)	INST 0101	SM 2320 B	TITRATION
Bicarbonate	INST 0101	SM 2320 B	PC TITRATE
Carbonate	INST 0101	SM 2320 B	PC TITRATE
Hydroxide	WAT 0310	SM 2320 B	TITRATION
Electrical Conductivity	INST 0101, INST 0120	SM 2510 B	CONDUCTIVITY METER
Chloride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Fluoride	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrate-N	INST 0150	SM 4110 B	CALCULATION
Nitrite	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Nitrite-N	INST 0150	SM 4110 B	CALCULATION
Nitrate+Nitrite - Nitrogen	INST 0150	SM 4110 B	CALCULATION
Sulfate	INST 0150	SM 4110 B	ION CHROMATOGRAPH
Dissolved Calcium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Magnesium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Sodium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Potassium	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Iron	INST 0140	SM 3120 B DW -R	ICP/OES
Dissolved Manganese	INST 0140	SM 3120 B DW -R	ICP/OES
Calculated TDS		SM 1030E	CALCULATION
Sodium Adsorption Ratio		CARTER & GREGORICH 2007	CALCULATION
Hardness		SM 2340 B	CALCULATION
Ion Balance		SM 1030E	CALCULATION
Ammonia, Total (as N)	INST 0420	SM 4500-NH3 G W	DISCRETE ANALYZER
Biochemical Oxygen Demand (BOD)	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
CBOD - Carbonaceous	MIC 1500	SM 5210 B	DISSOLVED OXYGEN PROBE
Chemical Oxygen Demand	INST 0280	SM 410.4	SPECTROPHOTOMETER
Orthophosphate	INST 0410	SM 4500P	DISCRETE ANALYZER
Total Kjeldahl Nitrogen	INST 0430	SM 4500-N org D TW	AQ-2 DISCRETE ANALYZER
Total Phosphorus	WATR 0200; INST 0140	SM 3030 E; SM 3120 B TW	ICP/OES
Total Suspended Solids	WATR 0600	SM 2540 D	GRAVIMETRIC
Dissolved Oxygen	MIC 1500	SM 4500-O B	TITRATION

AGAT Laboratories
2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 3°C
AGAT Job Number: 18R090811
Date and Time:

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Invoice To

Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME ☐ AB Tier 1 ☐ BC CSR
☐ Agricultural ☐ Agricultural ☐ AW
☐ Industrial ☐ Industrial ☐ IW
☐ Residential/ Park ☐ Residential/ Park ☐ LW
☐ Commercial ☐ Commercial ☐ DW
☐ Drinking Water ☐ Natural Area
☐ FWAL ☐ AB Surface Water
☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEX/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN, Ammonia	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
9847199	WQ1	SW	11:10	Sept 27/2018	11					x						x	x	x	x	x	x			
235	WQ2B	SW	10:30		11					x						x	x	x	x	x	x			
236	WQ3B	SW	10:00	Sept 27/2018	11					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Mallory Westergaard Mallory Westergaard Date/Time: Sept 27/18 12:50 pm
Samples Relinquished By (Print Name and Sign): Date/Time:
Samples Relinquished By (Print Name and Sign): Date/Time:

Samples Relinquished By (Print Name and Sign): Date/Time: Sept 27/18 12:50 pm
Samples Relinquished By (Print Name and Sign): Date/Time: 9/27/18 3:46
Samples Relinquished By (Print Name and Sign):

Page of

Document ID: DIV-50-1507.003

C 33562

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP Canada LTD.

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other sd Cooler Quantity: 1

Very Time Sensitive - Dissolved Oxygen

TIME SENSITIVE ISSUES:

Earliest Date Sampled: Sept 27/18 ALREADY EXCEEDED? Yes☐ No☐

Microbiology: Test: ✓ Expiry:

Hydrocarbons: Test: Expiry:

Are samples received >5 days after sampling: Yes☐ No☑

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 1 + 2 + 2 = ___°C (2) 2 + 2 + 3 = ___°C (3) ___ + ___ + ___ = ___°C (4) ___ + ___ + ___ = ___°C

Additional integrity issues (note here and on COC next to the sample ID):

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JAZZ Prepaid Collect

Waybill# NA

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi, BOD, Nitrate/Nitrite, Turbidity, Microtox, Ortho PO4, Tedlar Bag, Residual Chlorine, Chlorophyll*, Chloramines* Diss oxygen

Earliest Expiry: Sept 27 @ 18:00

Hydrocarbons: Earliest Expiry NA

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 3 + 3 + ___ = 3 °C 2(Bottle/Jar)___+___+___=___°C

3 (Bottle/Jar)___+___+___=___°C 4 (Bottle/Jar)___+___+___=___°C

5 (Bottle/Jar)___+___+___=___°C 6 (Bottle/Jar)___+___+___=___°C

7 (Bottle/Jar)___+___+___=___°C 8 (Bottle/Jar)___+___+___=___°C

9 (Bottle/Jar)___+___+___=___°C 10 (Bottle/Jar)___+___+___=___°C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 18R390811

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: ___ have they been notified of the above issues: Yes No

Whom spoken to: ___ Date/Time: ___

CPM Initial___

General Comments: D.O BTLS. GIVEN TO THE CAB

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

AGAT Laboratories
2910 12 Street NE
Calgary, Alberta T2E 7P7
P: 403.735.2005 • F: 403.735.2771
webearth.agatlabs.com

Chain of Custody Record

Emergency Support Services Hotline 1-855-AGAT 245 (1-855-242-8245)

Laboratory Use Only
Arrival Temperature: 3°C
AGAT Job Number: 18R290811
Date and Time: 27 SEP 2018 3:46

Report Information

Company: WSP Canada Inc.
Contact: Tina Mews
Address: PO Box 387, Rocky Mtn House
AB, T4T 1A3
Phone: (403) 845-5662 Fax:
LSD:
Client Project #: 171-00699-00

Report Information

1. Name: Tina Mews
Email: tina.mews@wsp.com
2. Name: Albert Zhuge
Email: Albert.Zhuge@wsp.com
3. Name: Carla Fernandes
Email: Carla.Fernandes@wsp.com

Report Format

☐ Single Sample per Page
☑ Multiple Samples per Page

Turnaround Time Required (TAT)

Regular TAT ☑ 5-7 Business Days
Rush TAT (Surcharge) ☐ Less than 24 Hours (200%) ☐ Less than 48 Hours (100%) ☐ Less than 72 Hours (50%)
Date Required:

Invoice To

Same ☑ Yes ☐ No

Company:
Contact:
Address:
Phone: Fax:
PO/AFE#

Requirements (Selection may impact detection limits)

☐ CCME
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Drinking Water ☐ FWAL

☐ AB Tier 1
☐ Agricultural ☐ Industrial ☐ Residential/ Park ☐ Commercial ☐ Natural Area ☐ AB Surface Water

☐ BC CSR
☐ AW ☐ IW ☐ LW ☐ DW

☐ Other:
☐ D50 (Drilling) ☐ SPIGEC ☐

LABORATORY USE (LAB ID#)	SAMPLE IDENTIFICATION	SAMPLE MATRIX	DATE/ TIME SAMPLED	COMMENTS- SITE SAMPLE INFO, SAMPLE CONTAINMENT	# of CONTAINERS	Detailed Soil Salinity (Saturated Paste)	CCME BTEX/ F1-F4	Soil Metals: ☐ HWS-B ☐ Cr^{6+} ☐ Hg	Water Metals: ☐ Dissolved ☐ Total ☐ Hg ☐ Cr^{6+}	Routine Water Potability	AB Class 2 Landfill	BC Landfill	D50 Detailed Salinity (As Received)	Microtox	☐ BTEXS/VPH/EPH ☐ LEPH/HEPH	CBOD, BOD, COD	Total & Fecal Coliforms/ Ecoli	TSS, TKN, Ammonia	Orthophosphate	Dissolved Oxygen	Total Phosphorus	HOLD FOR 60 DAYS	PRESERVED	CONTAMINATED/ HAZARDOUS
984799	WQ1	SW	11:10	Sept 27/2018	11					x						x	x	x	x	x	x			
235	WQ2B	SW	10:30		11					x						x	x	x	x	x	x			
236	WQ3B	SW	10:00	Sept 27/2018	11					x						x	x	x	x	x	x			

Samples Relinquished By (Print Name and Sign): Mallory Westergaard Mallory Westergaard — Date/Time: Sept 27/18 12:50 pm
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Relinquished By (Print Name and Sign): — Date/Time:

Samples Relinquished By (Print Name and Sign): — Date/Time: Sept 27/18 12:50 pm
Samples Relinquished By (Print Name and Sign): — Date/Time:
Samples Relinquished By (Print Name and Sign): — Date/Time: 9/27/18 3:46

Page of

Document ID: DIV-50-1507.003

C 33562

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM – BRANCH RECEIPT

Sending From Branch: EDM☐ GP☐ FN☐ FM☐ RD☑ VAN☐ LYD☐ FSJ☐ EST☐ Other:_____

Company/Consultant: WSP CANADA LTD.

TAT: <24hr ☐ 24-48hr ☐ 48-72hr ☐ Reg ☒ Other sd Cooler Quantity: 1

Very Time Sensitive - Dissolved Oxygen

TIME SENSITIVE ISSUES:

Earliest Date Sampled: SEPT 27/18 ALREADY EXCEEDED? Yes☐ No☐

Microbiology: Test: _____ Expiry: _____

Hydrocarbons: Test: _____ Expiry: _____

Are samples received >5 days after sampling: Yes☐ No☑

(TEMPERATURE MUST BE MAINTAINED IF RECEIVED <10 DEGREES C)

3 temperatures of samples* and average of each cooler (taken on jars only): NA (only bags on coolers)

(1) 1 + 2 + 2 = ___°C (2) 2 + 2 + 3 = ___°C (3) ___ + ___ + ___ = ___°C (4) ___ + ___ + ___ = ___°C

Additional integrity issues (note here and on COC next to the sample ID):

_____

AGAT Laboratories

SAMPLE INTEGRITY RECEIPT FORM

RECEIVING BASICS - Shipping

Company/Consultant: WSP CANADA

Courier: JA ZIV Prepaid Collect

Waybill# NA

Branch: EDM GP FN FM RD VAN LYD FSJ EST Other:

If multiple sites were submitted at once: Yes No

Custody Seal Intact: Yes No NA

TAT: <24hr 24-48hr 48-72hr Reg Other

Cooler Quantity: 1

TIME SENSITIVE ISSUES - Shipping

ALREADY EXCEEDED HOLD TIME? Yes No

Inorganic Tests (Please Circle): Mibi , BOD , Nitrate/Nitrite , Turbidity , Microtox , Ortho PO4 , Tedlar Bag , Residual Chlorine , Chlorophyll* , Chloroamines*

Dissolved Oxygen

Earliest Expiry: Sept 29 2015

Hydrocarbons: Earliest Expiry NA

SAMPLE INTEGRITY - Shipping

Hazardous Samples: YES NO Precaution Taken:

Legal Samples: Yes No

International Samples: Yes No

Tape Sealed: Yes No

Coolant Used: Icepack Bagged Ice Free Ice Free Water None

Temperature (Bottles/Jars only) N/A if only Soil Bags Received

FROZEN (Please Circle if samples received Frozen)

1 (Bottle/Jar) 3 + 3 + 3 = 3 °C	2(Bottle/Jar) ___ + ___ + ___ = ___ °C
3 (Bottle/Jar) ___ + ___ + ___ = ___ °C	4 (Bottle/Jar) ___ + ___ + ___ = ___ °C
5 (Bottle/Jar) ___ + ___ + ___ = ___ °C	6 (Bottle/Jar) ___ + ___ + ___ = ___ °C
7 (Bottle/Jar) ___ + ___ + ___ = ___ °C	8 (Bottle/Jar) ___ + ___ + ___ = ___ °C
9 (Bottle/Jar) ___ + ___ + ___ = ___ °C	10 (Bottle/Jar) ___ + ___ + ___ = ___ °C

(If more than 10 coolers are received use another sheet of paper and attach)

LOGISTICS USE ONLY

Workorder No: 1093908 11

Samples Damaged: Yes No If YES why?

No Bubble Wrap Frozen Courier

Other:

Account Project Manager: have they been notified of the above issues: Yes No

Whom spoken to: Date/Time:

CPM Initial

General Comments: D.O BOTS. ACCEPT TO TAKE CARE

* Subcontracted Analysis (See CPM)

Date issued: October 05, 2015
Document ID: SR-9505.003

BV Labs Job #: B9B0406
Report Date: 2020/01/28

KAIZENLAB INC.
Client Project #: 304746
Your P.O. #: 124695

PHENOXYALKYL ACID PESTICIDES/HERBICIDES (WATER)

BV Labs ID		XE4814		XE4815		XE4816			
Sampling Date		2019/12/30 08:00		2019/12/30 08:00		2019/12/30 08:00			
COC Number		1 of 1		1 of 1		1 of 1			
	UNITS	304746-1	MU	304746-2	MU	304746-3	MU	RDL	QC Batch
Phenoxyalkyl acid Pest.									
3,5-dichlorobenzoic acid	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Dicamba	ug/L	<0.0050	N/A	<0.0050	N/A	<0.0050	N/A	0.0050	9726293
MCPP	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
MCPA	ug/L	<0.020	N/A	<0.020	N/A	<0.020	N/A	0.020	9726293
Dichlorprop	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Bromoxynil	ug/L	<0.020	N/A	<0.020	N/A	<0.020	N/A	0.020	9726293
2,4-D	ug/L	<0.050	N/A	<0.050	N/A	<0.050	N/A	0.050	9726293
Pentachlorophenol	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
2,4,5-TP	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
2,4,5-T	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Chloramben	ug/L	<1.0	N/A	<1.0	N/A	<1.0	N/A	1.0	9726293
Dinoseb (DNBP)	ug/L	<0.020	N/A	<0.020	N/A	<0.020	N/A	0.020	9726293
Bentazon	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
2,4-DB	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Picloram	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Diclofop-methyl	ug/L	<0.080	N/A	<0.080	N/A	<0.080	N/A	0.080	9726293
Surrogate Recovery (%)									
2,4-Dichlorophenyl Acetic Acid	%	77	N/A	70	N/A	16 (1)	N/A	N/A	9726293

RDL = Reportable Detection Limit
MU = Measurement Uncertainty
N/A = Not Applicable
(1) Surrogate recovery exceeds acceptance criteria due to matrix interference. Unable to reanalyze due to insufficient sample.

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

PESTICIDES (WATER)

BV Labs ID		XE4814		XE4815		XE4816			
Sampling Date		2019/12/30 08:00		2019/12/30 08:00		2019/12/30 08:00			
COC Number		1 of 1		1 of 1		1 of 1			
	UNITS	**304746-1**	**MU**	**304746-2**	**MU**	**304746-3**	**MU**	**RDL**	**QC Batch**
Organochlorine Pesticides									
Aldrin	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
a-BHC	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
b-BHC	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
d-BHC	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
a-Chlordane	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
g-Chlordane	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Chlorothalonil	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
o,p'-DDD	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
o,p'-DDE	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
o,p'-DDT	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
p,p'-DDD	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
p,p'-DDE	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
p,p'-DDT	ug/L	<0.0010	N/A	<0.0010	N/A	<0.0010	N/A	0.0010	9747026
Dieldrin	ug/L	<0.0020	N/A	<0.0020	N/A	<0.0020	N/A	0.0020	9747026
Endosulfan I	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Endosulfan II	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Endosulfan Sulfate	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Endrin	ug/L	<0.0050	N/A	<0.0050	N/A	<0.0050	N/A	0.0050	9747026
Endrin Aldehyde	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Endrin ketone	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Heptachlor	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Heptachlor Epoxide	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Hexachlorobenzene	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Hexachlorobutadiene	ug/L	<0.0040	N/A	<0.0040	N/A	<0.0040	N/A	0.0040	9747026
Hexachlorocyclopentadiene	ug/L	<0.010	N/A	<0.010	N/A	<0.010	N/A	0.010	9747026
Hexachloroethane	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Lindane	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Methoxychlor	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Mirex	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Octachlorostyrene	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026
Oxychlordane	ug/L	<0.0030	N/A	<0.0030	N/A	<0.0030	N/A	0.0030	9747026

RDL = Reportable Detection Limit
MU = Measurement Uncertainty
N/A = Not Applicable

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

PESTICIDES (WATER)

BV Labs ID		XE4814		XE4815		XE4816			
Sampling Date		2019/12/30 08:00		2019/12/30 08:00		2019/12/30 08:00			
COC Number		1 of 1		1 of 1		1 of 1			
	UNITS	**304746-1**	**MU**	**304746-2**	**MU**	**304746-3**	**MU**	**RDL**	**QC Batch**
Surrogate Recovery (%)									
2-Chloronaphthalene	%	87	N/A	86	N/A	122	N/A	N/A	9747026
DECACHLOROBIPHENYL (sur.)	%	76	N/A	81	N/A	87	N/A	N/A	9747026

RDL = Reportable Detection Limit
MU = Measurement Uncertainty
N/A = Not Applicable

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.7°C

The estimate of uncertainty has been reported as an expanded uncertainty and calculated using a coverage factor of 2, which gives a level of confidence of 95%.

Results relate only to the items tested.

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

BV Labs Job #: B9B0406
Report Date: 2020/01/28

KAIZENLAB INC.
Client Project #: 304746
Your P.O. #: 124695

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
9726293	SJ1	Spiked Blank	2,4-Dichlorophenyl Acetic Acid	2020/01/07		77	%	50 - 140
			3,5-dichlorobenzoic acid	2020/01/07		83	%	50 - 140
			Dicamba	2020/01/07		76	%	50 - 140
			MCPP	2020/01/07		80	%	50 - 140
			MCPA	2020/01/07		77	%	50 - 140
			Dichlorprop	2020/01/07		77	%	50 - 140
			Bromoxynil	2020/01/07		81	%	50 - 140
			2,4-D	2020/01/07		78	%	50 - 140
			Pentachlorophenol	2020/01/07		73	%	50 - 140
			2,4,5-TP	2020/01/07		79	%	50 - 140
			2,4,5-T	2020/01/07		80	%	50 - 140
			Chloramben	2020/01/07		38	%	30 - 130
			Dinoseb (DNBP)	2020/01/07		57	%	30 - 130
			Bentazon	2020/01/07		81	%	50 - 140
			2,4-DB	2020/01/07		79	%	50 - 140
			Picloram	2020/01/07		54	%	30 - 130
			Diclofop-methyl	2020/01/07		75	%	50 - 140
9726293	SJ1	Method Blank	2,4-Dichlorophenyl Acetic Acid	2020/01/07		84	%	50 - 140
			3,5-dichlorobenzoic acid	2020/01/07	<0.080		ug/L	
			Dicamba	2020/01/07	<0.0050		ug/L	
			MCPP	2020/01/07	<0.080		ug/L	
			MCPA	2020/01/07	<0.020		ug/L	
			Dichlorprop	2020/01/07	<0.080		ug/L	
			Bromoxynil	2020/01/07	<0.020		ug/L	
			2,4-D	2020/01/07	<0.050		ug/L	
			Pentachlorophenol	2020/01/07	<0.080		ug/L	
			2,4,5-TP	2020/01/07	<0.080		ug/L	
			2,4,5-T	2020/01/07	<0.080		ug/L	
			Chloramben	2020/01/07	<1.0		ug/L	
			Dinoseb (DNBP)	2020/01/07	<0.020		ug/L	
			Bentazon	2020/01/07	<0.080		ug/L	
			2,4-DB	2020/01/07	<0.080		ug/L	
			Picloram	2020/01/07	<0.080		ug/L	
			Diclofop-methyl	2020/01/07	<0.080		ug/L	
9747026	éEH	Spiked Blank	2-Chloronaphthalene	2020/01/06		83	%	50 - 130
			DECACHLOROBIPHENYL (sur.)	2020/01/06		75	%	50 - 130
			Aldrin	2020/01/06		104	%	50 - 130
			a-BHC	2020/01/06		94	%	50 - 130
			b-BHC	2020/01/06		83	%	50 - 130
			d-BHC	2020/01/06		97	%	50 - 130
			a-Chlordane	2020/01/06		97	%	50 - 130
			g-Chlordane	2020/01/06		94	%	50 - 130
			Chlorothalonil	2020/01/06		94	%	50 - 130
			o,p'-DDD	2020/01/06		101	%	50 - 130
			o,p'-DDE	2020/01/06		98	%	50 - 130
			o,p'-DDT	2020/01/06		111	%	50 - 130
			p,p'-DDD	2020/01/06		103	%	50 - 130
			p,p'-DDE	2020/01/06		85	%	50 - 130
			p,p'-DDT	2020/01/06		102	%	50 - 130
			Dieldrin	2020/01/06		107	%	50 - 130
			Endosulfan I	2020/01/06		98	%	50 - 130
			Endosulfan II	2020/01/06		114	%	50 - 130
			Endosulfan Sulfate	2020/01/06		101	%	50 - 130
			Endrin	2020/01/06		99	%	50 - 130

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Endrin Aldehyde	2020/01/06		99	%	50 - 130
			Endrin ketone	2020/01/06		99	%	50 - 130
			Heptachlor	2020/01/06		106	%	50 - 130
			Heptachlor Epoxide	2020/01/06		111	%	50 - 130
			Hexachlorobenzene	2020/01/06		91	%	50 - 130
			Hexachlorobutadiene	2020/01/06		89	%	50 - 130
			Hexachlorocyclopentadiene	2020/01/06		101	%	50 - 130
			Hexachloroethane	2020/01/06		71	%	50 - 130
			Lindane	2020/01/06		98	%	50 - 130
			Methoxychlor	2020/01/06		97	%	50 - 130
			Mirex	2020/01/06		106	%	50 - 130
			Octachlorostyrene	2020/01/06		99	%	50 - 130
			Oxychlordane	2020/01/06		110	%	50 - 130
9747026	éEH	Method Blank	2-Chloronaphthalene	2020/01/06		80	%	50 - 130
			DECACHLOROBIPHENYL (sur.)	2020/01/06		79	%	50 - 130
			Aldrin	2020/01/06	<0.0030		ug/L	
			a-BHC	2020/01/06	<0.0030		ug/L	
			b-BHC	2020/01/06	<0.0030		ug/L	
			d-BHC	2020/01/06	<0.0030		ug/L	
			a-Chlordane	2020/01/06	<0.0030		ug/L	
			g-Chlordane	2020/01/06	<0.0030		ug/L	
			Chlorothalonil	2020/01/06	<0.0030		ug/L	
			o,p'-DDD	2020/01/06	<0.0010		ug/L	
			o,p'-DDE	2020/01/06	<0.0010		ug/L	
			o,p'-DDT	2020/01/06	<0.0010		ug/L	
			p,p'-DDD	2020/01/06	<0.0010		ug/L	
			p,p'-DDE	2020/01/06	<0.0010		ug/L	
			p,p'-DDT	2020/01/06	<0.0010		ug/L	
			Dieldrin	2020/01/06	<0.0020		ug/L	
			Endosulfan I	2020/01/06	<0.0030		ug/L	
			Endosulfan II	2020/01/06	<0.0030		ug/L	
			Endosulfan Sulfate	2020/01/06	<0.0030		ug/L	
			Endrin	2020/01/06	<0.0050		ug/L	
			Endrin Aldehyde	2020/01/06	<0.0030		ug/L	
			Endrin ketone	2020/01/06	<0.0030		ug/L	
			Heptachlor	2020/01/06	<0.0030		ug/L	
			Heptachlor Epoxide	2020/01/06	<0.0030		ug/L	
			Hexachlorobenzene	2020/01/06	<0.0030		ug/L	
			Hexachlorobutadiene	2020/01/06	<0.0040		ug/L	
			Hexachlorocyclopentadiene	2020/01/06	<0.010		ug/L	
			Hexachloroethane	2020/01/06	<0.0030		ug/L	
			Lindane	2020/01/06	<0.0030		ug/L	
			Methoxychlor	2020/01/06	<0.0030		ug/L	
			Mirex	2020/01/06	<0.0030		ug/L	
			Octachlorostyrene	2020/01/06	<0.0030		ug/L	
			Oxychlordane	2020/01/06	<0.0030		ug/L	

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

Bureau Veritas Laboratories Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

KaizenLAB

333 -50 Avenue SE, Calgary, Alberta T2G 2B3
Phone: (403) 297-0699 Fax: (403) 297-0869
e-mail: kaizencsr@kaizenlab.ca

Sublet TAT: 14-Jan-2020

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

KaizenLAB Job #: 304746

SERVICE REQUESTED (3PM Cut off)

Service	Surcharge	TAT *Business days	
Regular	None	4 days	☑

RUSH TAT (3PM Cut off)

Rush	50%	2 - 3 days	☐
Priority	100%	Next day	☐
Emergency	200%	Weekend/Holiday Same day	☐

Report Date: 6 Jan. 2020

Please call (403) 815-5815 to coordinate rush analysis

REPORT CONTACT

Company: Village of Caroline
Contact: Jacob Tricker
Emails: www.evillageofcaroline.com
Address: Po Box 148 Caroline AB
Tomorrow
Phone: 403 844 7454

INVOICE CONTACT

Same as Report ☑
Company:
Contact:
Email:
Address:
Phone:

PROJECT DETAILS

Project ID: Caroline Lagoon samples
Location ID: Caroline Lagoon
P.O.:
Quotation #:

Guideline

☐ AB Tier 1 ☐ BC
☐ CCME ☐ MB
☐ SPIGEC
☐ Drinking Water
☐ D50
☐ Other ________

	Client	Depot	Lab
Rel. by / Rec. by	Rel. by:	Rec. by:	Rec. by: BD
Date	Date:	Date:	Date: 30-Dec.19
Time	Time:	Time:	Time: 11:07

Additional Notes: Hand delivered same day sample.

LAB USE ONLY
Temp: 5.6°C

ANALYSIS REQUESTED

LAB ID	SAMPLE IDENTIFICATION	DEPTH	DATE SAMPLED (DD/MM/YYYY)	TIME SAMPLED	MATRIX (SOIL / WATER)	Total Mercury (Hg)	Total Metals HNO3	Organochlorine pesticides / phenoxyalkyl Acid herbicides	HOLD ANALYSIS	SPECIAL INSTRUCTIONS
	Effluent sample 1A	surface	30 12 2019	8:00AM	Water			✓		
	″ 1B	″	″	″	″			✓		
	″ 2A	″	″	″	″			✓		
	″ 2B	″	″	″	″			✓		
	Influent Sample 1A	″	″	″	″			✓		
	Influent Sample 1B	″	″	″	″			✓		
	Effluent sample 1	″	″	″	″		✓			
	″ 2	″	″	″	″		✓			
	Influent 1	″	″	″	″		✓			
	Effluent Sample 1A	″	″	″	″	✓				
	″ 1B	″	″	″	″	✓				
	″ 2A	″	″	″	″	✓				
	″ 2B	″	″	″	″	✓				
	Influent sample 1A	″	″	″	″	✓				
	″ 1B	″	″	″	″	✓				

Fill out chain of custody completely to avoid processing delays. Gray fields are for lab use only.

333 50th Ave. S.E.
Calgary, AB, T2G 2B3
Phone (403) 297-0868
Fax: (403) 297-0869

KaizenLAB

ANALYTICAL REPORT

Client: Village of Caroline
Box 148
Caroline, AB T0M 0M0

Attention: Jacob Tricker

KaizenLAB JOB #:	**304746**
DATE RECEIVED:	30-Dec-2019
DATE REPORTED:	06-Jan-2020
PROJECT ID:	Caroline Lagoon Samples
LOCATION:	Caroline Lagoon

KaizenLAB Sample #: 304746_001 **Sample ID:** Effluent Sample 1
Date Sampled: 30-Dec-2019 8:00 **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Total Metals in water including Mercury			
Total Mercury	ug/L	0.002	0.001
Total Metals in Water by ICP-MS			
Total Aluminum	mg/L	0.119	0.005
Total Antimony	mg/L	<0.0006	0.0006
Total Arsenic	mg/L	0.00097	0.00008
Total Barium	mg/L	0.208	0.005
Total Beryllium	mg/L	<0.001	0.001
Total Boron	mg/L	0.16	0.03
Total Cadmium	mg/L	<0.00004	0.00004
Total Chromium	mg/L	<0.0008	0.0008
Total Cobalt	mg/L	0.0005	0.0002
Total Copper	mg/L	0.0048	0.0008
Total Iron	mg/L	0.38	0.02
Total Lead	mg/L	0.0005	0.0003
Total Manganese	mg/L	0.095	0.001
Total Molybdenum	mg/L	0.0007	0.0005
Total Nickel	mg/L	0.0021	0.0005
Total Selenium	mg/L	<0.0006	0.0006
Total Silver	mg/L	<0.00007	0.00007
Total Strontium	mg/L	1.07	0.001
Total Thallium	mg/L	<0.0002	0.0002
Total Tin	mg/L	<0.02	0.02
Total Titanium	mg/L	0.163	0.005
Total Uranium	mg/L	0.00046	0.00005
Total Vanadium	mg/L	0.0011	0.0006
Total Zinc	mg/L	0.015	0.007

333 50th Ave. S.E.
Calgary, AB, T2G 2B3
Phone (403) 297-0868
Fax: (403) 297-0869

KaizenLAB Sample #: 304746_002 **Sample ID:** Effluent Sample 2

Date Sampled: 30-Dec-2019 8:00 **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Total Metals in water including Mercury			
Total Mercury	ug/L	0.002	0.001
Total Metals in Water by ICP-MS			
Total Aluminum	mg/L	0.102	0.005
Total Antimony	mg/L	<0.0006	0.0006
Total Arsenic	mg/L	0.00096	0.00008
Total Barium	mg/L	0.207	0.005
Total Beryllium	mg/L	<0.001	0.001
Total Boron	mg/L	0.16	0.03
Total Cadmium	mg/L	<0.00004	0.00004
Total Chromium	mg/L	<0.0008	0.0008
Total Cobalt	mg/L	0.0004	0.0002
Total Copper	mg/L	0.0046	0.0008
Total Iron	mg/L	0.36	0.02
Total Lead	mg/L	0.0004	0.0003
Total Manganese	mg/L	0.094	0.001
Total Molybdenum	mg/L	0.0007	0.0005
Total Nickel	mg/L	0.0019	0.0005
Total Selenium	mg/L	<0.0006	0.0006
Total Silver	mg/L	<0.00007	0.00007
Total Strontium	mg/L	1.05	0.001
Total Thallium	mg/L	<0.0002	0.0002
Total Tin	mg/L	<0.02	0.02
Total Titanium	mg/L	0.158	0.005
Total Uranium	mg/L	0.00045	0.00005
Total Vanadium	mg/L	0.0010	0.0006
Total Zinc	mg/L	0.011	0.007

333 50th Ave. S.E.
Calgary, AB, T2G 2B3
Phone (403) 297-0868
Fax: (403) 297-0869

KaizenLAB Sample #: 304746_003 **Sample ID:** Influent Sample 1

Date Sampled: 30-Dec-2019 8:00 **Matrix:** Water

Parameter Description	Units	Result	Detection Limit
Total Metals in water including Mercury			
Total Mercury	ug/L	0.002	0.001
Total Metals in Water by ICP-MS			
Total Aluminum	mg/L	0.032	0.005
Total Antimony	mg/L	<0.0006	0.0006
Total Arsenic	mg/L	0.00030	0.00008
Total Barium	mg/L	0.287	0.005
Total Beryllium	mg/L	<0.001	0.001
Total Boron	mg/L	0.07	0.03
Total Cadmium	mg/L	0.00013	0.00004
Total Chromium	mg/L	<0.0008	0.0008
Total Cobalt	mg/L	<0.0002	0.0002
Total Copper	mg/L	0.0296	0.0008
Total Iron	mg/L	0.16	0.02
Total Lead	mg/L	0.0005	0.0003
Total Manganese	mg/L	0.028	0.001
Total Molybdenum	mg/L	0.0010	0.0005
Total Nickel	mg/L	0.0016	0.0005
Total Selenium	mg/L	<0.0006	0.0006
Total Silver	mg/L	<0.00007	0.00007
Total Strontium	mg/L	1.11	0.001
Total Thallium	mg/L	<0.0002	0.0002
Total Tin	mg/L	<0.02	0.02
Total Titanium	mg/L	0.144	0.005
Total Uranium	mg/L	0.00057	0.00005
Total Vanadium	mg/L	<0.0006	0.0006
Total Zinc	mg/L	0.033	0.007

Test Methodologies

Total Mercury in Water: Modified from EPA 1631 Revision E
Total Metals in Water: Modified from EPA 200.2 and SM 3125B

Final Review by:

Loida Agacid
Client Services Administrator

KaizenLAB

333 -50 Avenue SE, Calgary, Alberta T2G 2B3
Phone: (403) 297-0699 Fax: (403) 297-0869
e-mail: kaizencsr@kaizenlab.ca

CHAIN OF CUSTODY / ANALYTICAL REQUEST FORM

KaizenLAB Job #: 304746

Sublet TAT: 14-Jan-2020

SERVICE REQUESTED (3PM Cut off)

Service	Surcharge	TAT *Business days	
Regular	None	4 days	☑

RUSH TAT (3PM Cut off)

Rush	50%	2 - 3 days	☐
Priority	100%	Next day	☐
Emergency	200%	Weekend/Holiday Same day	☐

Report Date: 6 Jan 2020

Please call (403) 815-5815 to coordinate rush analysis

REPORT CONTACT

Company: Village of Caroline
Contact: Jacob Tricker
Emails: wwo@villageofcaroline.com
Address: Po Box 148 Caroline AB T0M 0M0
Phone: 403 846 7454

INVOICE CONTACT

Same as Report ☑
Company:
Contact:
Email:
Address:
Phone:

PROJECT DETAILS

Project ID: Caroline Lagoon samples
Location ID: Caroline Lagoon
P.O.:
Quotation #:

Guideline

- ☐ AB Tier 1
- ☐ BC
- ☐ CCME
- ☐ MB
- ☐ SPIGEC
- ☐ Drinking Water
- ☐ D50
- ☐ Other ______

	Client	Depot	Lab
Rel. by / Rec. by	Rel. by:	Rec. by:	Rec. by: BD
Date	Date:	Date:	Date: 30-Dec-19
Time	Time:	Time:	Time: 11:07

Additional Notes: Hand delivered same day sample.

LAB USE ONLY — Temp: 5.6°C

ANALYSIS REQUESTED

LAB ID	SAMPLE IDENTIFICATION	DEPTH	DATE SAMPLED (DD/MM/YYYY)	TIME SAMPLED	MATRIX (SOIL / WATER)	Total Mercury (Hg)	Total Metals HNO_3	Organochlorine pesticides phenoxyalkyl Acid herbicides	—	—	—	—	—	—	—	HOLD ANALYSIS	SPECIAL INSTRUCTIONS
	Effluent sample 1A	surface	30 12 2019	8:00AM	Water			✓									
	" 1B	"	"	"	"			✓									
	" 2A	"	"	"	"			✓									
	" 2B	"	"	"	"			✓									
	Influent Sample 1A	"	"	"	"			✓									
	Influent Sample 1B	"	"	"	"			✓									
	Effluent sample 1	"	"	"	"		✓										
	" 2	"	"	"	"		✓										
	Influent 1	"	"	"	"		✓										
	Effluent Sample 1A	"	"	"	"	✓											
	" 1B	"	"	"	"	✓											
	" 2A	"	"	"	"	✓											
	" 2B	"	"	"	"	✓											
	Influent sample 1A	"	"	"	"	✓											
	" 1B	"	"	"	"	✓											

Fill out chain of custody completely to avoid processing delays. Gray fields are for lab use only.