Environment | Water Resources Branch

Water Licence Audit Report

Date of site visit: July 24, 2018 & August 14, 2018

Licence number: MN11-030-3

Site contact: Dave Hatherley

Date of report: April 25, 2019

Team: Nicole Novodvorsky, Justin Hooper, Holly Goulding

Licensee: Village of Haines Junction (VHJ)

Prepared by: Nicole Novodvorsky

Distribution list: YG – Environment (EC&I), Parks Canada, Village of Haines Junction, Champagne-Aishihik First Nation, Environment and Climate Change Canada

Executive Summary

- The objectives of the audit were to confirm compliance with water licence MN11-030-3, understand whether residual wastewater persists within the wetlands outside of periods of active discharge, determine the flow path of wastewater from the WWTF (Wastewater Treatment Facility) into the Dezadeash River, and evaluate whether there were detectible concentrations of wastewater contributed to the Dezadeash River from Pine Lake via Pine Creek.
- The discharge sampled at the time of the audit at HJ-4 was in compliance with water licence MN11-030-3
- Artificial sweetener results indicated the following:
    - Residual water derived from wastewater persists within the Kluane wetlands beyond the period of active discharge.
    - The flow path of wastewater from the WWTF travels further west than previously assumed into the Dezadeash River at station DR-DS. Some wastewater may be flowing into the Dezadeash River near HJ-5.
    - There is no detectable water derived from wastewater originating from Pine Lake into Pine Creek.

- Recommendations:
    - Establish a new water sampling station upstream of HJ-5 to represent true water quality in the river upstream of the influence of treated wastewater discharge on the Dezadeash River.
    - Establish a new water sampling station downstream of HJ-6 that captures all potential wastewater impacts into the Dezadeash River near station PROP-DS.
    - Cease sampling of HJ-5 and HJ-6 with the establishment of two new stations recommended above.
    - Monitor pH in the lagoons weekly (but at least 5 days after any other sample) for two months leading up to discharge. A two month lead time will allow for a proactive approach to ameliorating any exceedances in pH prior to or during discharge.

Background

- Artificial sweeteners (acesulfame, sucralose, saccharin, and cyclamate) were used as a tracer of wastewater in this audit to understand possible flow paths and receptors. Artificial sweeteners are widespread in products consumed by humans such as diet beverages, pharmaceuticals, and toothpaste, and therefore are ubiquitous in domestic wastewater. The use of artificial sweeteners as tracers of wastewater is advantageous because artificial sweeteners are found in relatively high concentrations in human waste, they are very source specific, and they degrade at relatively slow rates.
- The use of artificial sweeteners is a novel approach in a regulatory context, however as Spoelstra et al. (2017) states: "*Numerous studies have now demonstrated that artificial sweeteners are powerful tracers of wastewater in the environment*." Peer-reviewed studies have been published over the last 10 years demonstrating the efficacy of using artificial sweeteners as a tracer of domestic wastewater. Refer to Spoelstra et al. (2017) and references therein.
- Artificial sweetener results are reported in ng/L. Some results are reported as <MDL or MDL< x <PQL. MDL is the method detection limit, and PQL is the practical quantitation limit. Results below the MDL indicates no detectable concentrations of the parameter. Results between the MDL and PQL indicate that there is a very low but detectable concentration present but with a significantly greater level of uncertainty associated with the reported concentration.

- WRB's 2017 audit suggested that the flow path of wastewater from the wastewater treatment facility (WWTF) may be different than assumed in the water licence. The outfall of the discharge was assumed to enter the Dezadeash River between HJ-5 and HJ-6. Artificial sweetener analysis suggested that wastewater was flowing further westward through the wetlands.
- The discharge from the VHJ WWTF discharged from August 21 to October 10, 2018. Discharge commenced late due to the installation of a flow meter at the discharge pipe.
- Water originating from Pine Lake was sampled to identify whether wastewater from septic systems from the residences or campground surrounding the lake were contributing to the Dezadeash River system downgradient.

Audit objectives

1. Ensure that discharge from the VHJ WWTF is in compliance with the Effluent Quality Standards (EQS) in water licence MN11-030-3
2. Identify whether residual water derived from wastewater persists within the Kluane wetlands outside of periods of active discharge
3. Determine the flow path of wastewater into the Dezadeash River
4. Identify whether Pine Creek and Dezadeash River are receptors of water derived from wastewater originating from septic systems of the residences or the campground surrounding Pine Lake.

Audit conditions

Date	Weather	Site Conditions
July 24, 2018	Sunny and clear	Accessed Dezadeash River sites via jet boat allowing for shallow water driving. Sites along Alaska accessible via truck.
September 11, 2018	Overcast, no precipitation.	Accessed Dezadeash River sites via jet boat allowing for shallow water driving. Sites along Alaska accessible via truck.

Field notes

July 24, 2018

Team

Nicole Novodvorsky, Water Quality Technologist, Government of Yukon
Justin Hooper, Environmental Compliance Officer, Government of Yukon
Lance Goodwin, Boat Operator, Icefield Discovery

Sampling Summary

Stations along the Dezadeash River were accessed by jet boat, captained by Lance Goodwin. The launch was at the highway bridge. Stations along the Alaska Highway and the Pine Lake outflow were accessed by truck.

Station Code	Station Description	Field Notes	WQ Parameters Sampled
HJ-5 (River Right)	Dezadeash River, previously assumed immediately upstream of outfall	Water has a lot of suspended solids	Artificial sweeteners
HJ-5 (Center)	Dezadeash River, previously assumed immediately upstream of outfall	Water has a lot of suspended solids	Field parameters, artificial sweeteners
HJ-5 (River Left)	Dezadeash River, previously assumed immediately upstream of outfall	Water has a lot of suspended solids	Artificial sweeteners
DR-DS	Parks Canada Station. Assumed discharge outflow into Dezadeash River	-	Field parameters, artificial sweeteners

PROP-DS (River Right)	New proposed downstream location on Dezadeash River.	Water brown and turbid	Artificial sweeteners
PROP-DS (Center)	New proposed downstream location on Dezadeash River.	Water brown and turbid	Field parameters, artificial sweeteners
PROP-DS (River Left)	New proposed downstream location on Dezadeash River.	Water brown and turbid	Artificial sweeteners
PROP-DS (Center) Replicate	New proposed downstream location on Dezadeash River.	Forgot to take replicate right away, came back 1 hour later	Field parameters, artificial sweeteners
Pine-DS	Downstream of input of Pine Creek into Dezadeash River	Water bluish-green and turbid	Artificial sweeteners
Pine-Input	Input from Pine Creek into Dezadeash River	Sampled upstream of beaver dam	Artificial sweeteners
Pine-US	Upstream of input of Pine Creek into Dezadeash River	Water bluish-green and turbid	Artificial sweeteners
Pine-Hwy	Pine Creek upstream of Alaska Highway	Sampled upstream of culvert ~ 20m	Artificial sweeteners
Pine-Out	Outflow of Pine Lake, which turns into Pine Creek; upstream of road	Sampled just upstream of culvert	Artificial sweeteners

September 11, 2018

Team

Nicole Novodvorsky, Water Quality Technologist, Government of Yukon
Holly Goulding, Operations Manager, Government of Yukon
Lance Goodwin, Boat Operator, Icefield Discovery

Sampling Summary

Stations along the Dezadeash River were accessed by jet boat, captained by Lance Goodwin. The launch was at the highway bridge. Stations along the Alaska Highway and the Pine Lake outflow were accessed by truck.

Station Code	Station Description	Field Notes	WQ Parameters Sampled
HJ-5 (River Right)	Dezadeash River, previously assumed immediately upstream of outfall. River right.	Water slightly turbid	Artificial sweeteners
HJ-5 (Center)	Dezadeash River, previously assumed immediately upstream of outfall. Centre of river.	Water slightly turbid	Field parameters, routine, major ions, nutrients, total metals, O&G, TSS, artificial sweeteners
HJ-5 (River Left)	Dezadeash River, previously assumed immediately upstream of outfall. River left.	Water slightly turbid	Artificial sweeteners
HJ-6 (River Right)	Dezadeash River, previously assumed downstream location of outfall. River right.	-	Artificial sweeteners
HJ-6 (Center)	Dezadeash River, previously assumed downstream location of outfall. Centre of river.	-	Field parameters, routine, major ions, nutrients, total metals, O&G, TSS, artificial sweeteners
HJ-6 (River Left)	Dezadeash River, previously assumed downstream location of outfall. River left.	-	Artificial sweeteners
DR-DS	Parks Canada Station. Assumed discharge outflow into Dezadeash River	Water is flowing more than last visit	Field parameters, routine, major ions, nutrients, total metals,

			O&G, TSS, artificial sweeteners
PROP-DS (River Right)	New proposed downstream location on Dezadeash River.	Some floating debris in the water	Artificial sweeteners
PROP-DS (Center)	New proposed downstream location on Dezadeash River.	Some floating debris in the water	Field parameters, routine, major ions, nutrients, total metals, O&G, TSS, artificial sweeteners
PROP-DS (River Left)	New proposed downstream location on Dezadeash River.	Some floating debris in the water	Artificial sweeteners
Pine-DS	Downstream of input of Pine Creek into Dezadeash River	-	Field parameters, artificial sweeteners
Pine-Input	Input from Pine Creek into Dezadeash River	-	Field parameters, routine, major ions, nutrients, total metals, TSS, artificial sweeteners
Pine-US	Upstream of input of Pine Creek into Dezadeash River	-	Field parameters, artificial sweeteners
Pine-Hwy	Pine Creek upstream of Alaska Highway	Water clear, green algae on substrate	Field parameters, artificial sweeteners
Pine-Out	Outflow of Pine Lake, which turns into Pine Creek; upstream of road	-	Field parameters, routine, major ions, nutrients, total metals, TSS, artificial sweeteners

Field Data

A summary of the field data collected during the site visit is presented in Table 1, below.

Table 1: Physical/chemical field results from July 24 and September 11, 2018

Station	Date	Time	Water temp °C	Specific conductance µS/cm	pH	Dissolved oxygen mg/L	Turbidity NTU
HJ-5	7/24/2018	8:56	14.2	224.8	8.04	9.37	11.25
DR-DS	7/24/2018	9:30	11.2	437.6	7.48	5.72	2.96
PROP-DS	7/24/2018	9:55	14.4	227.6	8.08	9.33	12.35
Pine-Input	7/24/2018	10:36	12.7	382.8	8.12	8.67	2
PROP-DS (Replicate)	7/24/2018	11:04	14.8	228.1	8.11	9.38	13.4
HJ-5 (Center)	9/11/2018	9:49	8.5	220	7.9	10.67	5.89
HJ-6 (Center)	9/11/2018	10:00	8.6	220.1	7.65	10.86	4.8
PROP-DS (Center)	9/11/2018	10:07	8.6	221.1	7.61	10.79	3.95
Pine-DS	9/11/2018	10:15	8.6	237	162.9	10.56	7.9
Pine-Input	9/11/2018	10:40	7.7	433.1	7.8	9.3	0.88
Pine-US	9/11/2018	10:54	8.5	230.1	8.03	10.64	4.8
DR-DS	9/11/2018	11:21	7.3	712	7.6	8.5	1.5
Pine-Hwy	9/11/2018	12:06	7.5	421.8	8.34	11.43	0.95
HJ-4	9/11/2018	12:28	12	645	8.43	5	8.8
Pine-Out	9/11/2018	12:56	10.6	256.3	8.91	15.13	0.22

Figure 1: Locations of stations visited by Water Resources Branch (WRB) during the July and September 2018 audit. Additional samples were collected by Parks Canada to supplement the artificial sweetener dataset in June and July, 2018.

Quality Assurance and Control

Quality assurance was ensured through following standard protocols for water quality sampling and using trained water collectors. An accredited laboratory was used for sample analysis to ensure data quality and reliability. Deviations from the protocol include not collecting field/trip blanks. Quality control was conducted by using a functioning and calibrated field meter, and calculating relative differences between field and lab results, and between replicates and duplicates.

The results of the quality control show that there was good concordance (<25% relative percent difference (RPD)) between field and laboratory parameters (conductivity and pH). A replicate was collected at PROP-DS in July; and most results were below 25% RPD except for Sucralose and TSS. Sucralose results were 50% difference, but since the values are <10 times the MDL, the acceptable threshold is 67% RPD. Differences between values approaching the MDL will have high RPD percentages, and therefore a higher RPD is acceptable. TSS was 80.7% different between replicates. It was noted that there was floating debris in the water, and likely resulted in the variation is suspended solids results. Duplicates were analyzed in the lab for artificial sweeteners and resulted in RPD's of <40% (results were <10xMDL), showing good concordance between lab duplicates and therefore further strengthen reliability of sweetener results. The QC results are attached to this report.

Compliance

Objective 1: Ensure that discharge from the VHJ WWTF is in compliance with the Effluent Quality Standards (EQS) in water licence MN11-030-3

Samples were collected to identify any exceedances of water licence effluent quality standards (EQS). At the time of sampling, none of the parameters exceeded the EQS and all measured parameters were deemed compliant. However LC50 was not analyzed and therefore could not be compared (Table 2).

In-situ field parameters were measured by Parks Canada on August 30, 2018 at HJ-4, and pH was 9.51, exceeding EQS. Measurements thereafter appear to decrease but remain within the range of 8.53-9.4 from September 1 to October 10.

Table 2: Audit results at HJ-4 on September 11, 2018 compared to water licence effluent quality standards

Parameter	Effluent Quality Standard	Result
CBOD5	20 mg/L	3.6 mg/L
Total Suspended Solids	25 mg/L	3.8 mg/L
pH	6-9.5	8.43 (field)
Oil and Grease	5 mg/L	<2.0 mg/L
Fecal Coliforms	400 CFU / 100mL	<10 CFU/100mL
Total Phosphorus	1 mg/L	0.481 mg/L
LC50, pH non-adjusted	Non-toxic (>96hrs)	N/A
Unionized Ammonia	1.25 mg/L	0.046 mg/L

Water Quality Results

Objective 2: Identify whether residual water derived from wastewater persists within the Kluane wetlands outside of periods of active discharge

Artificial sweeteners were used as an indicator of wastewater to identify whether wastewater resides within the surface water in the wetland well beyond the discharge period. The results as illustrated in Figure 2 indicate that sweeteners were detected at HJ-Hwy, MegaEgg, and DR-DS in significant concentrations. Once discharge ends the hydraulic gradient across the wetlands is reduced and flow through the wetlands is minimal until spring freshet. These stagnant waters had a lower Dissolved Oxygen (DO) concentration, which proved to have a strong negative correlation with acesulfame and sucralose (R^2=-0.74 and R^2=-0.74, respectively). A positive correlation was also observed with acesulfame and specific conductance (SC) (R^2 = 0.76) and specific conductance and $\delta^{18}O$ (R^2 = 0.78). Acesulfame and sucralose were also positively correlated with water isotopes $\delta^{2}H$ and $\delta^{18}O$ (R^2=0.7 and R^2=0.65, respectively). MegaEgg, HJ-Hwy, and Pine-Out had the highest isotope values (Figure 3) deviating from the Whitehorse Local Meteoric Water Line, representing a greater influence of evaporation relative to water inputs. These results suggest that some stations represent sites with relatively stagnant water (as evidenced by relatively low DO concentrations) that is relatively prone to evaporation (as evidenced by the stable water isotopic data) where residual water derived from wastewater persists (as evidenced by higher SC values and higher concentrations of artificial sweeteners).

Stations on the Dezadeash River (HJ-5, Pine-DS, and PROP-DS) indicate concentrations of saccharin between MDL and PQL. Results within this range may result from the natural breakdown of organic matter, and likely not an indication of wastewater (John Spoelstra, personal communication).

Figure 2: Artificial Sweetener results prior to discharge from VHJ WWTF. Samples were collected between June 27 and July 31, 2018. Where multiple samples were collected on different dates at a station, the highest concentrations detected were displayed.

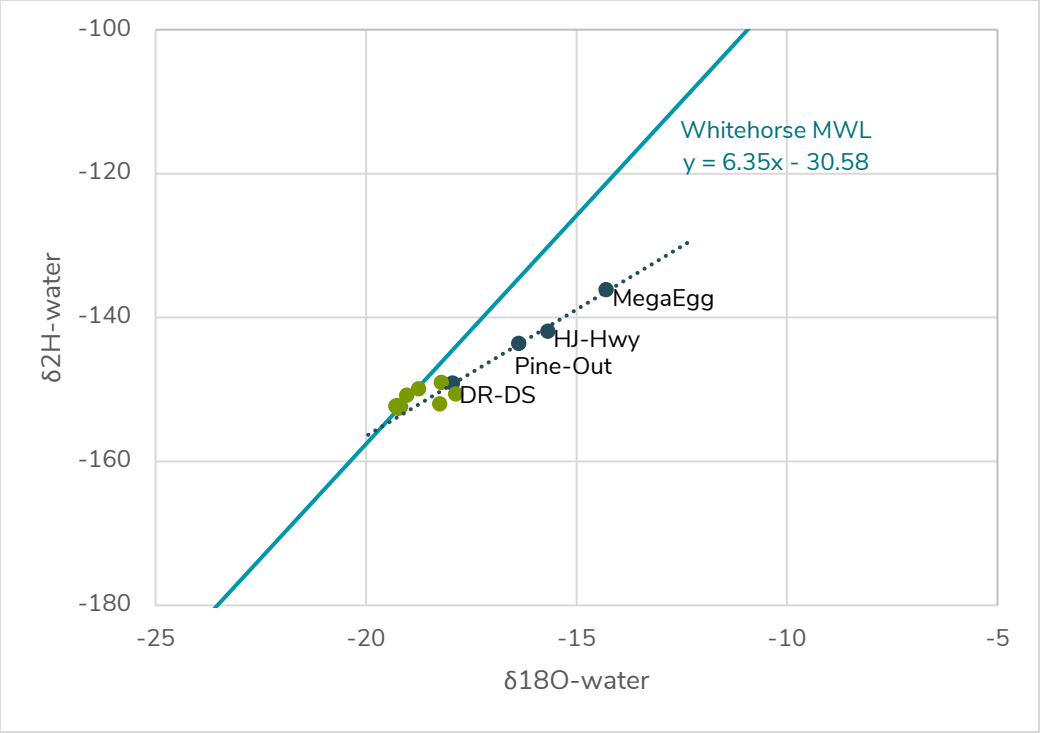

Figure 3: Water isotopes δ^2H vs $\delta^{18}O$ illustrating the greater evaporative influence relative to water inputs at stations Pine-Out, HJ-Hwy, and MegaEgg as compared to the Whitehorse Meteoric Water Line (MWL).

Objective 3: To determine the flow path of wastewater into the Dezadeash River

Artificial sweeteners collected during discharge revealed that significant concentrations (primarily acesulfame and sucralose) are detected at DR-DS. Concentrations at this station are about one third to one half the concentrations detected at the source (HJ-4). This result indicates that a significant proportion of the wastewater is discharged into the wetlands through a pathway towards DR-DS (Figure 4). After wastewater flows past DR-DS, a branch of the Dezadeash River travels north past Pine-US and Pine-DS, as indicated by the low concentrations of acesulfame detected at these stations. When water derived from wastewater flowing from this branch reaches PROP-DS, concentrations are diluted by the main branch of the Dezadeash River and therefore no detectable concentrations were observed at river left, right, and center. These results are concordant with last year's audit, which found similar concentrations of sweeteners during discharge at the wetland outflow just upstream of DR-DS (3167 and 3075ng/L of acesulfame and sucralose, respectively).

At HJ-5 a small concentration of sucralose (78ng/L) was detected at river left on the Dezadeash River, whereas the samples collected in the centre and river right had no detectable concentrations of sweeteners. This result suggests that there is a potential pathway through the wetlands around HJ-5, although likely not significant. No significant concentrations of sweeteners were found at HJ-6, with river left concentrations MDL<PQL and <MDL at center and river right. Wastewater flowing upstream of this station is likely diluted below detectable concentrations.

Objective 4: Identify whether Pine Creek and Dezadeash River are receptors of water derived from wastewater originating from septic systems of the residences or the campground surrounding Pine Lake.

Artificial sweetener samples were collected in July and September along the pathway of water flowing from Pine Lake (Figure 5). The results illustrate that there are no detectable concentrations of artificial sweeteners flowing from Pine Lake. This result suggests that wastewater input to the lake is absent or sufficiently low that subsequent dilution by the lake water reduces artificial sweetener concentrations to levels below detection.

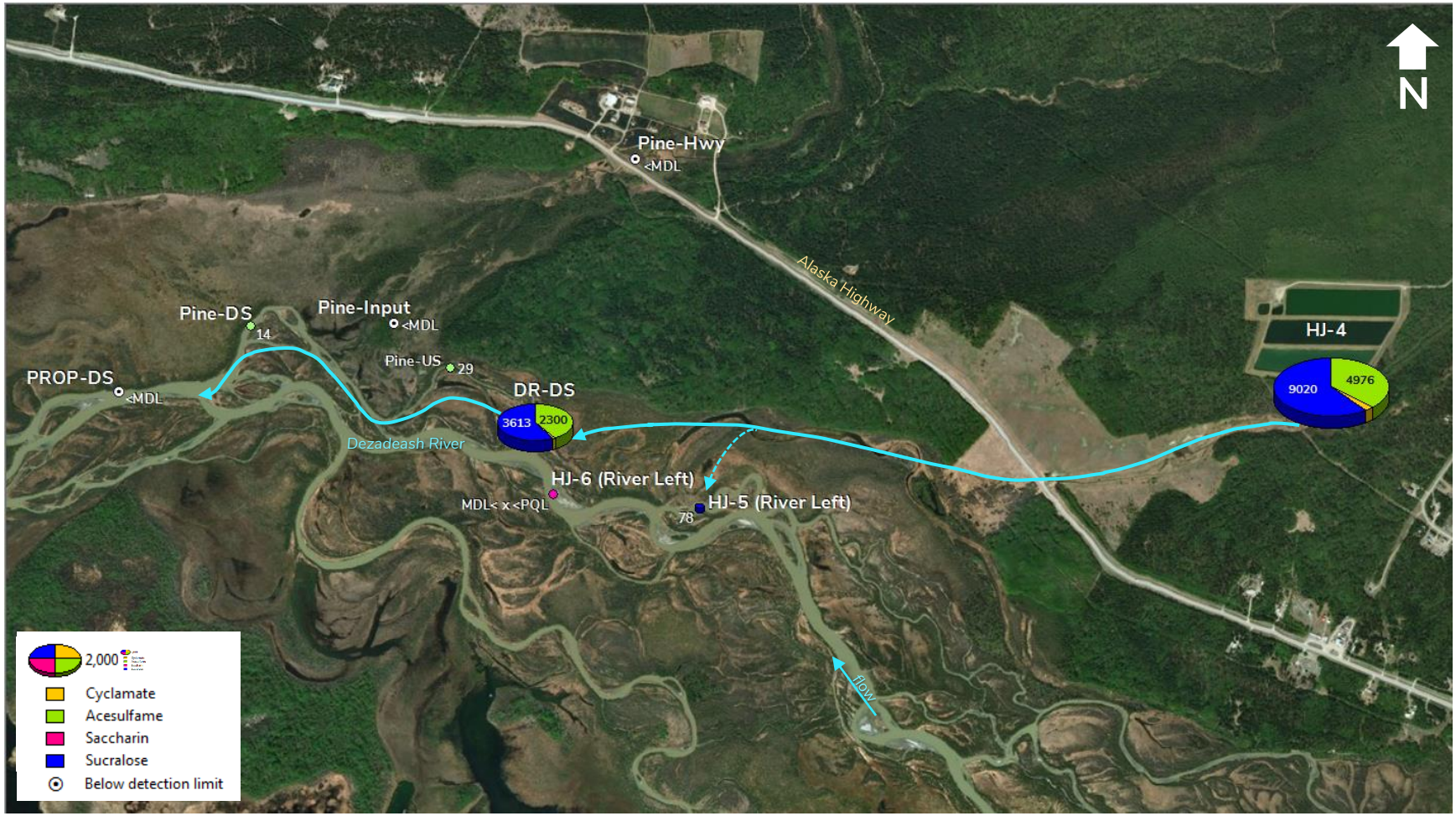

Figure 4: Artificial Sweetener results collected during discharge from VHJ's WWTF on September 11, 2018. Multiple samples were collected across the Dezadeash River; the highest concentrations detected are displayed. The light blue arrows illustrate the likely direction of flow of discharge. Dotted lines are potential or minimal flow.

Figure 5: Artificial Sweetener results of Pine Creek. Where multiple samples were collected on different dates at a station, the highest concentrations detected were displayed.

Conclusions and recommendations

Samples collected at the discharge were in compliance with the water licence for all measured parameters. Quality of the effluent at HJ-4 indicates that the treatment facility was functioning at the time of the audit. However, prior to discharge in 2018, pH in the lagoon was increasing above EQS in water licence MN11-030-3, therefore continuing to monitor the lagoons prior to discharge is strongly recommended.

Based on the audit results, it is the opinion of WRB that discharge from the WWTF is flowing through the Kluane wetlands towards station DR-DS and likely mainly discharging into the Dezadeash River downstream of HJ-6, and potentially a minor amount near/upstream of HJ-5.

Recommendations:

1. Amend licence MN11-030-3 to include two new sampling locations to reflect the conclusions derived from this audit report:
    a. Create a new sampling station upstream of HJ-5 on the Dezadeash River to ensure all potential inputs from the WWTF are downstream of the sampling station that represents upstream reference conditions. It is recommended to sample at the Parks Canada 'DR-US' station.
    b. Create a new sampling station downstream of HJ-6 on the Dezadeash River to ensure all inputs from the WWTF are captured. It is recommended to sample at station 'PROP-DS'.
    c. Cease sampling of HJ-5 and HJ-6 with the establishment of two new stations recommended above.
2. Monitor pH in the lagoons weekly (but at least 5 days after any other sample) for two months leading up to discharge. A two month lead time will allow for a proactive approach to ameliorating any exceedances in pH prior to or during discharge.

Attachments:

Sampling Stations Details
QA/QC Results
References
Photo Log
CARO Analytical Report
Artificial Sweetener Data

Sampling Station Details

Station	Station Name	Station Description	Latitude NAD83	Longitude NAD83
DR-DS	DR Downstream	Parks Canada Station. Assumed discharge outflow into Dezadeash River.	60.76284	-137.58728
DR-DS-NEW	New Dezadeash River D/S WWTF	Dezadeash River Upstream ~50m of PROP-DS, downstream of WWTF	60.76382	-137.61525
DR-US	Dezadeash River Upstream	Dezadeash River Upstream HJ WWTF at bridge	60.74775	-137.50858
DRWetland	Wetland inflow to Dezadeash R	Parks Canada Station. ~40m upstream from DR-DS	60.76265	-137.58669
HJ-4	Haines Junction HJ-4	Effluent from sewage lagoons at outlet of aerobic lagoon #3	60.76405	-137.531569
HJ-5	Haines Junction HJ-5	Dezadeash R imm. u/s of outfall (mid channel) (as stated in licence)	60.75913	-137.57562
HJ-6	Haines Junction HJ-6	Dezadeash R 1km d/s of sewage trmt. Outfall (as stated in licence)	60.76051	-137.5861
HJ-Hwy	Haines Junction HJ-Hwy	Alaska Highway culvert of sewage outflow channel.	60.7608	-137.5516
MegaEgg	Mega Egg Wetland	Parks Canada Station. Kluane Park wetland	60.76231	-137.564
Pine-DS	Pine Creek Input Downstream	Dezadeash River; Downstream of input of Pine Creek into Dezadeash River	60.7662	-137.60721
Pine-Hwy	Pine Creek at Hwy	Pine Creek upstream of Alaska Highway	60.77184	-137.58023
Pine-Input	Pine Lake Input	Input from Pine Lake into Dezadeash River	60.76476	-137.59322
Pine-Out	Pine Lake Outflow	Outflow of Pine Lake, which turns into Pine Creek. Upstream of road.	60.80108	-137.50876
Pine-US	Pine Creek Input Upstream	Dezadeash River; upstream of input of Pine Creek into Dezadeash	60.76476	-137.59322
PROP-DS	Proposed Downstream	New proposed downstream station of WWTF on Dezadeash River.	60.7639	-137.61636

Quality Control Results

Quality control of available field data compared to laboratory data.

Station	Date	Cond-F	Cond-L	RPD (%)	pH-F	pH-L	RPD (%)
HJ-5	24-Jul-2018	224.8	223	0.80	8.04	7.61	5.50
DR-DS	24-Jul-2018	437.6	435	0.60	7.48	7.77	3.80
PROP-DS	24-Jul-2018	227.6	226	0.71	8.08	7.7	4.81
Pine-Input	24-Jul-2018	382.8	383	0.05	8.12	8.01	1.36
PROP-DS (Replicate)	24-Jul-2018	228.1	229	0.39	8.11	7.75	4.54
HJ-5	11-Sep-2018	220	226	2.70	7.9	7.55	4.53
HJ-6	11-Sep-2018	220.1	223	1.31	7.65	7.65	0
PROP-DS	11-Sep-2018	221.1	225	1.75	7.61	7.68	0.92
Pine-Input	11-Sep-2018	433.1	442	2.03	7.8	7.95	1.90
DR-DS	11-Sep-2018	712	727	2.08	7.6	7.99	5.00
HJ-4	11-Sep-2018	645	662	2.60	8.43	8.41	0.24
Pine-Out	11-Sep-2018	256.3	262	2.20	8.91	8.49	4.83

Comparison between lab duplicates

Station	Date	Sample/Duplicate	Acesulfame (ng/L)	Sucralose (ng/L)	Cyclamate (ng/L)	Saccharin (ng/L)
HJ-5	9/11/18	Sample	<2	<20	<3	3
		Duplicate	<2	<20	<3	3
*RPD (%)**			0	0	0	0
Pine-US	9/11/18	Sample	29	<20	<3	<2
		Duplicate	32	<20	<3	<2
*RPD (%)**			9.8	0	0	0
HJ-5 (RL)	7/24/18	Sample	<2	<20	<3	2
		Duplicate	<2	<20	<3	2
*RPD (%)**			0	0	0	0
DR-US	6/27/18	Sample	<2	<20	<3	2
		Duplicate	<2	<20	<3	3
*RPD (%)**			0	0	0	40

**RPD % (Relative percent difference (x,y)) = [|x - y| ÷ |(x + y)/2|] * 100*

Comparison between field replicates

Parameter	PROP-DS 24-Jul-18 Sample	PROP-DS 24-Jul-18 Replicate	RPD (%)
Acesulfame	<2	<2	0
Sucralose	<20	<20	0
Cyclamate	<3	<3	0
Saccharin	3	<2	50
Alkalinity-B	79.1	80.4	1.6
Alkalinity-C	<1.0	<1.0	0
Alkalinity-OH	<1.0	<1.0	0
Alkalinity-P	<1.0	<1.0	0
Alkalinity-T	79.1	80.4	1.6
Chloride	0.2	0.17	16.2
Specific Conductivity	226	229	1.3
δ18O-water	-19.25	-19.30	0.3
δ2H-water	-152.2	-152.5	0.2
Unionized ammonia	0.002	0.002	0
Ammonia	0.052	0.045	14.4
Nitrite	<0.01	<0.01	0
Nitrate	<0.01	<0.01	0
pH	7.7	7.75	0.6
Phosphorus, Total	0.03	0.0297	1.0
Sulphate	30.4	30.4	0
TDS	121	129	6.4
TSS	10.8	25.4	80.7

References

Spoelstra, J., N.D. Senger, and S.L. Schiff. 2017. Artificial Sweeteners Reveal Septic System Effluent in Rural Groundwater. Journal of Environmental Quality. 46:1434-1443.

Photo Log

July 24, 2018

HJ-5 looking downstream

DR-DS looking upstream

PROP-DS facing downstream

Pine-DS looking south

Pine-Input

Pine-US

Pine-Hwy

Pine-Out

September 11, 2018

HJ-6

PROP-DS

PINE-DS

Pine-Input

Pine-US

DR-DS

HJ-4. New discharge pipe

HJ-4a. Newly constructed emergency lagoon.

Pine-Out

CERTIFICATE OF ANALYSIS

REPORTED TO	Yukon Government - Water Resources Suite 203, 1191 Front Street Whitehorse, YT Y1A 0K5		
ATTENTION	Nicole Novodvorsky	**WORK ORDER**	8072400
PO NUMBER		**RECEIVED / TEMP**	2018-07-25 13:30 / 7°C
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04
PROJECT INFO	YK Water Resources - C00043458		

Introduction:

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Big Picture Sidekicks

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

We've Got Chemistry

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

Ahead of the Curve

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

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

Authorized By:

Maggie Chan, DipT
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
2018129 (8072400-01) | Matrix: Water | Sampled: 2018-07-24 08:56					
Anions					
Chloride	**0.19**	0.10	mg/L	2018-07-28	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-07-28	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-07-28	
Sulfate	**29.5**	1.0	mg/L	2018-07-28	
General Parameters					
Alkalinity, Total (as CaCO3)	**76.4**	1.0	mg/L	2018-07-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Bicarbonate (as CaCO3)	**76.4**	1.0	mg/L	2018-07-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Ammonia, Total (as N)	**0.053**	0.020	mg/L	2018-07-28	
Conductivity (EC)	**223**	2.0	µS/cm	2018-07-27	
pH	**7.61**	0.10	pH units	2018-07-27	HT2
Phosphorus, Total (as P)	**0.0341**	0.0020	mg/L	2018-07-30	
Solids, Total Dissolved	**131**	15	mg/L	2018-07-27	
Solids, Total Suspended	**27.0**	2.0	mg/L	2018-07-27	
2018130 (8072400-02) | Matrix: Water | Sampled: 2018-07-24 09:30					
Anions					
Chloride	**2.84**	0.10	mg/L	2018-07-28	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-07-28	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-07-28	
Sulfate	**11.2**	1.0	mg/L	2018-07-28	
General Parameters					
Alkalinity, Total (as CaCO3)	**222**	1.0	mg/L	2018-07-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Bicarbonate (as CaCO3)	**222**	1.0	mg/L	2018-07-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Ammonia, Total (as N)	**0.035**	0.020	mg/L	2018-07-28	
Conductivity (EC)	**435**	2.0	µS/cm	2018-07-27	
pH	**7.77**	0.10	pH units	2018-07-27	HT2
Phosphorus, Total (as P)	**0.0100**	0.0020	mg/L	2018-07-30	
Solids, Total Dissolved	**250**	15	mg/L	2018-07-27	
Solids, Total Suspended	**2.2**	2.0	mg/L	2018-07-27	
2018131 (8072400-03) | Matrix: Water | Sampled: 2018-07-24 09:55					
Anions					
Chloride	**0.20**	0.10	mg/L	2018-07-28	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
2018131 (8072400-03) | Matrix: Water | Sampled: 2018-07-24 09:55, Continued					
Anions, Continued					HT1
Nitrate (as N)	< 0.010	0.010	mg/L	2018-07-28	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-07-28	
Sulfate	**30.4**	1.0	mg/L	2018-07-28	
General Parameters					
Alkalinity, Total (as CaCO3)	**79.1**	1.0	mg/L	2018-07-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Bicarbonate (as CaCO3)	**79.1**	1.0	mg/L	2018-07-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Ammonia, Total (as N)	**0.052**	0.020	mg/L	2018-07-28	
Conductivity (EC)	**226**	2.0	µS/cm	2018-07-27	
pH	**7.70**	0.10	pH units	2018-07-27	HT2
Phosphorus, Total (as P)	**0.0300**	0.0020	mg/L	2018-07-30	
Solids, Total Dissolved	**121**	15	mg/L	2018-07-27	
Solids, Total Suspended	**10.8**	2.0	mg/L	2018-07-27	
2018132 (8072400-04) | Matrix: Water | Sampled: 2018-07-24 10:36					
Anions					
Chloride	**0.29**	0.10	mg/L	2018-07-28	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-07-28	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-07-28	
Sulfate	**21.8**	1.0	mg/L	2018-07-28	
General Parameters					
Alkalinity, Total (as CaCO3)	**180**	1.0	mg/L	2018-07-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Bicarbonate (as CaCO3)	**180**	1.0	mg/L	2018-07-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Ammonia, Total (as N)	**0.068**	0.020	mg/L	2018-07-28	
Conductivity (EC)	**383**	2.0	µS/cm	2018-07-27	
pH	**8.01**	0.10	pH units	2018-07-27	HT2
Phosphorus, Total (as P)	**0.0113**	0.0020	mg/L	2018-07-30	
Solids, Total Dissolved	**217**	15	mg/L	2018-07-27	
Solids, Total Suspended	< 2.0	2.0	mg/L	2018-07-27	
2018133 (8072400-05) | Matrix: Water | Sampled: 2018-07-24 11:04					
Anions					
Chloride	**0.17**	0.10	mg/L	2018-07-28	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-07-28	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
2018133 (8072400-05) | Matrix: Water | Sampled: 2018-07-24 11:04, Continued					
Anions, Continued					HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2018-07-28	
Sulfate	**30.4**	1.0	mg/L	2018-07-28	
General Parameters					
Alkalinity, Total (as CaCO3)	**80.4**	1.0	mg/L	2018-07-27	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Bicarbonate (as CaCO3)	**80.4**	1.0	mg/L	2018-07-27	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-07-27	
Ammonia, Total (as N)	**0.045**	0.020	mg/L	2018-07-28	
Conductivity (EC)	**229**	2.0	µS/cm	2018-07-27	
pH	**7.75**	0.10	pH units	2018-07-27	HT2
Phosphorus, Total (as P)	**0.0297**	0.0020	mg/L	2018-07-30	
Solids, Total Dissolved	**129**	15	mg/L	2018-07-27	
Solids, Total Suspended	**25.4**	2.0	mg/L	2018-07-27	

Sample Qualifiers:

HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2011)	Automated Colorimetry (Phenate)	Kelowna
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Kelowna
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2011)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna
Solids, Total Dissolved in Water	SM 2540 C* (2011)	Gravimetry (Dried at 103-105C)	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2011)	Gravimetry (Dried at 103-105C)	Kelowna

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

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B8G2243										
Blank (B8G2243-BLK2)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Chloride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B8G2243-BS1)				Prepared: 2018-07-28, Analyzed: 2018-07-28						
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Nitrate (as N)	3.88	0.010	mg/L	4.00		97	93-108			
Nitrite (as N)	1.93	0.010	mg/L	2.00		97	85-114			
Sulfate	15.9	1.0	mg/L	16.0		100	91-109			
LCS (B8G2243-BS2)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Chloride	16.1	0.10	mg/L	16.0		100	90-110			
Nitrate (as N)	3.75	0.010	mg/L	4.00		94	93-108			
Nitrite (as N)	1.95	0.010	mg/L	2.00		98	85-114			
Sulfate	15.6	1.0	mg/L	16.0		97	91-109			
Duplicate (B8G2243-DUP1)		**Source: 8072400-01**		Prepared: 2018-07-28, Analyzed: 2018-07-28						
Chloride	0.19	0.10	mg/L		0.19				10	
Nitrate (as N)	0.010	0.010	mg/L		0.010				10	
Nitrite (as N)	< 0.010	0.010	mg/L		< 0.010				6	
Sulfate	29.6	1.0	mg/L		29.5			< 1	6	
Matrix Spike (B8G2243-MS1)		**Source: 8072400-01**		Prepared: 2018-07-28, Analyzed: 2018-07-28						
Chloride	15.0	0.10	mg/L	16.0	0.19	93	75-125			
Nitrate (as N)	3.56	0.010	mg/L	4.00	0.010	89	75-125			
Nitrite (as N)	1.91	0.010	mg/L	2.00	< 0.010	95	80-120			
Sulfate	44.3	1.0	mg/L	16.0	29.5	93	75-125			
General Parameters, Batch B8G2208										
Blank (B8G2208-BLK1)				Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	< 0.020	0.020	mg/L							
Blank (B8G2208-BLK2)				Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	< 0.020	0.020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8G2208, Continued										
Blank (B8G2208-BLK2), Continued				Prepared: 2018-07-28, Analyzed: 2018-07-28						
LCS (B8G2208-BS1)				Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	1.03	0.020	mg/L	1.00		103	90-115			
LCS (B8G2208-BS2)				Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	1.06	0.020	mg/L	1.00		106	90-115			
Duplicate (B8G2208-DUP1)		**Source: 8072400-01**		Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	0.056	0.020	mg/L		0.053				15	
Matrix Spike (B8G2208-MS1)		**Source: 8072400-01**		Prepared: 2018-07-28, Analyzed: 2018-07-28						
Ammonia, Total (as N)	0.311	0.020	mg/L	0.250	0.053	103	75-125			
General Parameters, Batch B8G2246										
Blank (B8G2246-BLK1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Solids, Total Dissolved	< 15	15	mg/L							
LCS (B8G2246-BS1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Solids, Total Dissolved	234	15	mg/L	240		98	85-115			
General Parameters, Batch B8G2247										
Blank (B8G2247-BLK1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B8G2247-BS1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Solids, Total Suspended	94.0	10.0	mg/L	100		94	91-106			
Reference (B8G2247-SRM1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Solids, Total Suspended	288	20.0	mg/L	328		88	80-120			
General Parameters, Batch B8G2256										
Blank (B8G2256-BLK1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
Blank (B8G2256-BLK2)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B8G2256-BS1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Alkalinity, Total (as CaCO3)	94.5	1.0	mg/L	100		94	92-106			
LCS (B8G2256-BS2)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Alkalinity, Total (as CaCO3)	96.3	1.0	mg/L	100		96	92-106			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8072400
PROJECT	Haines Junction WWTF	**REPORTED**	2018-08-01 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8G2256, Continued										
LCS (B8G2256-BS3)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Conductivity (EC)	1400	2.0	µS/cm	1410		100	95-104			
LCS (B8G2256-BS4)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
Conductivity (EC)	1410	2.0	µS/cm	1410		100	95-104			
Reference (B8G2256-SRM1)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
pH	7.00	0.10	pH units	7.01		100	98-102			HT2
Reference (B8G2256-SRM2)				Prepared: 2018-07-27, Analyzed: 2018-07-27						
pH	7.00	0.10	pH units	7.01		100	98-102			HT2
General Parameters, Batch B8G2367										
Blank (B8G2367-BLK1)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8G2367-BLK2)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8G2367-BLK3)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8G2367-BLK4)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
LCS (B8G2367-BS2)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	0.102	0.0020	mg/L	0.100		102	80-112			
LCS (B8G2367-BS4)				Prepared: 2018-07-29, Analyzed: 2018-07-30						
Phosphorus, Total (as P)	0.102	0.0020	mg/L	0.100		102	80-112			

QC Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

CERTIFICATE OF ANALYSIS

REPORTED TO	Yukon Government - Water Resources Suite 203, 1191 Front Street Whitehorse, YT Y1A 0K5		
ATTENTION	Nicole Novodvorsky	**WORK ORDER**	8090968
PO NUMBER		**RECEIVED / TEMP**	2018-09-12 13:15 / 8°C
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13
PROJECT INFO	YK Water Resources - C00043458		

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO 17025:2005 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

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

We've Got Chemistry

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

Ahead of the Curve

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

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

Authorized By:

Maggie Chan, DipT
Client Service Representative

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-01) | Matrix: Water | Sampled: 2018-09-11 09:51					
Anions					
Chloride	**0.24**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**26.1**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**96.1**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**96.1**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.469**	0.020	mg/L	2018-09-15	
BOD, 5-day Carbonaceous	< 2.5	2.0	mg/L	2018-09-18	BOD2, RS2
Conductivity (EC)	**226**	2.0	µS/cm	2018-09-17	
Oil & Grease, Total	< 2.0	2.0	mg/L	2018-09-19	
pH	**7.55**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	**0.0095**	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	**22.6**	2.0	mg/L	2018-09-18	
Temperature, at pH	**22.8**		°C	2018-09-13	HT2
Calculated Parameters					
Hardness, Total (as CaCO3)	**99.4**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	**0.008**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.0949**	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00065**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0270**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.0185**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**30.0**	0.20	mg/L	2018-09-14	
Chromium, total	**0.00054**	0.00050	mg/L	2018-09-14	
Cobalt, total	< 0.00010	0.00010	mg/L	2018-09-14	
Copper, total	**0.00095**	0.00040	mg/L	2018-09-14	
Iron, total	**0.147**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00169**	0.00010	mg/L	2018-09-14	
Magnesium, total	**5.92**	0.010	mg/L	2018-09-14	
Manganese, total	**0.0115**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00104**	0.00010	mg/L	2018-09-14	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-01) | Matrix: Water | Sampled: 2018-09-11 09:51, Continued					
Total Metals, Continued					
Nickel, total	< 0.00040	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**1.11**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**3.5**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**3.09**	0.10	mg/L	2018-09-14	
Strontium, total	**0.192**	0.0010	mg/L	2018-09-14	
Sulfur, total	**8.3**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	**0.0054**	0.0050	mg/L	2018-09-14	
Tungsten, total	< 0.0010	0.0010	mg/L	2018-09-14	
Uranium, total	**0.000545**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	
2018XXX (8090968-02) | Matrix: Water | Sampled: 2018-09-11 10:00					
Anions					
Chloride	**0.26**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**26.0**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**97.3**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**97.3**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.200**	0.020	mg/L	2018-09-15	
BOD, 5-day Carbonaceous	< 2.5	2.0	mg/L	2018-09-18	BOD2, RS2
Conductivity (EC)	**223**	2.0	µS/cm	2018-09-17	
Oil & Grease, Total	**2.5**	2.0	mg/L	2018-09-19	
pH	**7.65**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	**0.0106**	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	**30.2**	2.0	mg/L	2018-09-18	
Temperature, at pH	**22.8**		°C	2018-09-13	HT2

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-02) | Matrix: Water | Sampled: 2018-09-11 10:00, Continued					
Calculated Parameters					
Hardness, Total (as CaCO3)	**99.7**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	**0.004**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.122**	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00066**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0278**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.0191**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**30.0**	0.20	mg/L	2018-09-14	
Chromium, total	**0.00050**	0.00050	mg/L	2018-09-14	
Cobalt, total	**0.00010**	0.00010	mg/L	2018-09-14	
Copper, total	**0.00103**	0.00040	mg/L	2018-09-14	
Iron, total	**0.182**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00173**	0.00010	mg/L	2018-09-14	
Magnesium, total	**6.01**	0.010	mg/L	2018-09-14	
Manganese, total	**0.0135**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00102**	0.00010	mg/L	2018-09-14	
Nickel, total	**0.00041**	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**1.13**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**3.6**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**3.12**	0.10	mg/L	2018-09-14	
Strontium, total	**0.195**	0.0010	mg/L	2018-09-14	
Sulfur, total	**7.3**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	**0.0074**	0.0050	mg/L	2018-09-14	
Tungsten, total	< 0.0010	0.0010	mg/L	2018-09-14	
Uranium, total	**0.000540**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-03) | Matrix: Water | Sampled: 2018-09-11 10:07					
Anions					
Chloride	**0.26**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**26.2**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**97.6**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**97.6**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.026**	0.020	mg/L	2018-09-15	
BOD, 5-day Carbonaceous	< 2.5	2.0	mg/L	2018-09-18	BOD2, RS2
Conductivity (EC)	**225**	2.0	µS/cm	2018-09-17	
Oil & Grease, Total	**2.2**	2.0	mg/L	2018-09-19	
pH	**7.68**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	**12.2**	2.0	mg/L	2018-09-18	
Temperature, at pH	**23.1**		°C	2018-09-13	HT2
Calculated Parameters					
Hardness, Total (as CaCO3)	**101**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	< 0.001	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.0844**	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00063**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0273**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.0192**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**30.3**	0.20	mg/L	2018-09-14	
Chromium, total	**0.00140**	0.00050	mg/L	2018-09-14	
Cobalt, total	< 0.00010	0.00010	mg/L	2018-09-14	
Copper, total	**0.00097**	0.00040	mg/L	2018-09-14	
Iron, total	**0.139**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00168**	0.00010	mg/L	2018-09-14	
Magnesium, total	**6.05**	0.010	mg/L	2018-09-14	
Manganese, total	**0.0134**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00110**	0.00010	mg/L	2018-09-14	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-03) | Matrix: Water | Sampled: 2018-09-11 10:07, Continued					
Total Metals, Continued					
Nickel, total	**0.00057**	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**1.13**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**3.5**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**3.11**	0.10	mg/L	2018-09-14	
Strontium, total	**0.196**	0.0010	mg/L	2018-09-14	
Sulfur, total	**8.2**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	**0.00024**	0.00020	mg/L	2018-09-14	
Titanium, total	**0.0056**	0.0050	mg/L	2018-09-14	
Tungsten, total	**0.0010**	0.0010	mg/L	2018-09-14	
Uranium, total	**0.000525**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	
2018XXX (8090968-04) | Matrix: Water | Sampled: 2018-09-11 10:40					
Anions					
Chloride	**0.35**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**21.8**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**243**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**243**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.046**	0.020	mg/L	2018-09-15	
Conductivity (EC)	**442**	2.0	µS/cm	2018-09-17	
pH	**7.95**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	< 2.0	2.0	mg/L	2018-09-18	
Temperature, at pH	**23.0**		°C	2018-09-13	HT2
Calculated Parameters					
Hardness, Total (as CaCO3)	**211**	0.500	mg/L	N/A	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-04) | Matrix: Water | Sampled: 2018-09-11 10:40, Continued					
Calculated Parameters, Continued					
Ammonia, Un-Ionized (as N)	**0.002**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.0125**	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00124**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0308**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.0261**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**44.9**	0.20	mg/L	2018-09-14	
Chromium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Cobalt, total	< 0.00010	0.00010	mg/L	2018-09-14	
Copper, total	**0.00089**	0.00040	mg/L	2018-09-14	
Iron, total	**0.140**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00496**	0.00010	mg/L	2018-09-14	
Magnesium, total	**24.1**	0.010	mg/L	2018-09-14	
Manganese, total	**0.0332**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00326**	0.00010	mg/L	2018-09-14	
Nickel, total	**0.00069**	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**2.95**	0.10	mg/L	2018-09-14	
Selenium, total	**0.00057**	0.00050	mg/L	2018-09-14	
Silicon, total	**5.6**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**5.89**	0.10	mg/L	2018-09-14	
Strontium, total	**0.258**	0.0010	mg/L	2018-09-14	
Sulfur, total	**6.4**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	< 0.0050	0.0050	mg/L	2018-09-14	
Tungsten, total	< 0.0010	0.0010	mg/L	2018-09-14	
Uranium, total	**0.00117**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	
2018XXX (8090968-05) | Matrix: Water | Sampled: 2018-09-11 11:21					

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-05) | Matrix: Water | Sampled: 2018-09-11 11:21, Continued					
Anions					
Chloride	**17.3**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**74.6**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**321**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**321**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.535**	0.020	mg/L	2018-09-15	
BOD, 5-day Carbonaceous	< 2.5	2.0	mg/L	2018-09-18	BOD2, RS2
Conductivity (EC)	**727**	2.0	µS/cm	2018-09-17	
Oil & Grease, Total	< 2.0	2.0	mg/L	2018-09-19	
pH	**7.99**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	**0.0067**	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	**2.0**	2.0	mg/L	2018-09-18	
Temperature, at pH	**22.8**		°C	2018-09-13	HT2
Calculated Parameters					
Hardness, Total (as CaCO3)	**256**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	**0.024**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.0145**	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00077**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0375**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.142**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**56.5**	0.20	mg/L	2018-09-14	
Chromium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Cobalt, total	< 0.00010	0.00010	mg/L	2018-09-14	
Copper, total	**0.00127**	0.00040	mg/L	2018-09-14	
Iron, total	**0.107**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00322**	0.00010	mg/L	2018-09-14	
Magnesium, total	**27.9**	0.010	mg/L	2018-09-14	
Manganese, total	**0.0256**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00373**	0.00010	mg/L	2018-09-14	

TEST RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-05) | Matrix: Water | Sampled: 2018-09-11 11:21, Continued					
Total Metals, Continued					
Nickel, total	**0.00113**	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**3.84**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**3.7**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**54.7**	0.10	mg/L	2018-09-14	
Strontium, total	**0.343**	0.0010	mg/L	2018-09-14	
Sulfur, total	**26.5**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	< 0.0050	0.0050	mg/L	2018-09-14	
Tungsten, total	< 0.0010	0.0010	mg/L	2018-09-14	
Uranium, total	**0.00164**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	
2018XXX (8090968-06) | Matrix: Water | Sampled: 2018-09-11 12:28					
Anions					
Chloride	**22.7**	0.10	mg/L	2018-09-13	
Nitrate (as N)	**0.072**	0.010	mg/L	2018-09-13	
Nitrite (as N)	**0.061**	0.010	mg/L	2018-09-13	
Sulfate	**20.3**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**346**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	**7.5**	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**331**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	**15.1**	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.423**	0.020	mg/L	2018-09-15	
BOD, 5-day Carbonaceous	**3.6**	2.0	mg/L	2018-09-18	
Conductivity (EC)	**662**	2.0	µS/cm	2018-09-17	
Oil & Grease, Total	< 2.0	2.0	mg/L	2018-09-19	
pH	**8.41**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	**0.481**	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	**3.8**	2.0	mg/L	2018-09-18	
Temperature, at pH	**22.6**		°C	2018-09-13	HT2

CARO ANALYTICAL SERVICES

TEST RESULTS

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Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-06) | Matrix: Water | Sampled: 2018-09-11 12:28, Continued					
Calculated Parameters					
Hardness, Total (as CaCO3)	**201**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	**0.046**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	**0.187**	0.0050	mg/L	2018-09-14	
Antimony, total	**0.00024**	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00785**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0569**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.225**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**30.1**	0.20	mg/L	2018-09-14	
Chromium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Cobalt, total	**0.00023**	0.00010	mg/L	2018-09-14	
Copper, total	**0.00054**	0.00040	mg/L	2018-09-14	
Iron, total	**0.140**	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00588**	0.00010	mg/L	2018-09-14	
Magnesium, total	**30.4**	0.010	mg/L	2018-09-14	
Manganese, total	**0.00941**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.0221**	0.00010	mg/L	2018-09-14	
Nickel, total	**0.00201**	0.00040	mg/L	2018-09-14	
Phosphorus, total	**0.429**	0.050	mg/L	2018-09-14	
Potassium, total	**10.3**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**1.1**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**67.3**	0.10	mg/L	2018-09-14	
Strontium, total	**0.411**	0.0010	mg/L	2018-09-14	
Sulfur, total	**7.1**	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	< 0.0050	0.0050	mg/L	2018-09-14	
Tungsten, total	**0.0011**	0.0010	mg/L	2018-09-14	
Uranium, total	**0.00505**	0.000020	mg/L	2018-09-14	
Vanadium, total	**0.0024**	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Microbiological Parameters					

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Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-06) | Matrix: Water | Sampled: 2018-09-11 12:28, Continued					
Microbiological Parameters, Continued					
Coliforms, Fecal	<10	1	CFU/100 mL	2018-09-12	
2018XXX (8090968-07) | Matrix: Water | Sampled: 2018-09-11 12:56					
Anions					
Chloride	**0.22**	0.10	mg/L	2018-09-13	
Nitrate (as N)	< 0.010	0.010	mg/L	2018-09-13	
Nitrite (as N)	< 0.010	0.010	mg/L	2018-09-13	
Sulfate	**9.6**	1.0	mg/L	2018-09-13	
General Parameters					
Alkalinity, Total (as CaCO3)	**148**	1.0	mg/L	2018-09-13	
Alkalinity, Phenolphthalein (as CaCO3)	**6.1**	1.0	mg/L	2018-09-13	
Alkalinity, Bicarbonate (as CaCO3)	**136**	1.0	mg/L	2018-09-13	
Alkalinity, Carbonate (as CaCO3)	**12.2**	1.0	mg/L	2018-09-13	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L	2018-09-13	
Ammonia, Total (as N)	**0.026**	0.020	mg/L	2018-09-15	
Conductivity (EC)	**262**	2.0	µS/cm	2018-09-17	
pH	**8.49**	0.10	pH units	2018-09-13	HT2
Phosphorus, Total (as P)	**0.0056**	0.0020	mg/L	2018-09-17	
Solids, Total Suspended	< 2.0	2.0	mg/L	2018-09-18	
Temperature, at pH	**22.5**		°C	2018-09-13	HT2
Calculated Parameters					
Hardness, Total (as CaCO3)	**127**	0.500	mg/L	N/A	
Ammonia, Un-Ionized (as N)	**0.003**	0.001	mg/L	2018-09-19	
Total Metals					
Aluminum, total	< 0.0050	0.0050	mg/L	2018-09-14	
Antimony, total	< 0.00020	0.00020	mg/L	2018-09-14	
Arsenic, total	**0.00078**	0.00050	mg/L	2018-09-14	
Barium, total	**0.0151**	0.0050	mg/L	2018-09-14	
Beryllium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Bismuth, total	< 0.00010	0.00010	mg/L	2018-09-14	
Boron, total	**0.0248**	0.0050	mg/L	2018-09-14	
Cadmium, total	< 0.000010	0.000010	mg/L	2018-09-14	
Calcium, total	**24.4**	0.20	mg/L	2018-09-14	
Chromium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Cobalt, total	< 0.00010	0.00010	mg/L	2018-09-14	
Copper, total	**0.00067**	0.00040	mg/L	2018-09-14	
Iron, total	< 0.010	0.010	mg/L	2018-09-14	
Lead, total	< 0.00020	0.00020	mg/L	2018-09-14	
Lithium, total	**0.00395**	0.00010	mg/L	2018-09-14	

TEST RESULTS

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Analyte	Result	RL	Units	Analyzed	Qualifier
2018XXX (8090968-07) | Matrix: Water | Sampled: 2018-09-11 12:56, Continued					
Total Metals, Continued					
Magnesium, total	**16.1**	0.010	mg/L	2018-09-14	
Manganese, total	**0.00109**	0.00020	mg/L	2018-09-14	
Molybdenum, total	**0.00147**	0.00010	mg/L	2018-09-14	
Nickel, total	< 0.00040	0.00040	mg/L	2018-09-14	
Phosphorus, total	< 0.050	0.050	mg/L	2018-09-14	
Potassium, total	**2.60**	0.10	mg/L	2018-09-14	
Selenium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Silicon, total	**2.2**	1.0	mg/L	2018-09-14	
Silver, total	< 0.000050	0.000050	mg/L	2018-09-14	
Sodium, total	**4.00**	0.10	mg/L	2018-09-14	
Strontium, total	**0.161**	0.0010	mg/L	2018-09-14	
Sulfur, total	< 3.0	3.0	mg/L	2018-09-14	
Tellurium, total	< 0.00050	0.00050	mg/L	2018-09-14	
Thallium, total	< 0.000020	0.000020	mg/L	2018-09-14	
Thorium, total	< 0.00010	0.00010	mg/L	2018-09-14	
Tin, total	< 0.00020	0.00020	mg/L	2018-09-14	
Titanium, total	< 0.0050	0.0050	mg/L	2018-09-14	
Tungsten, total	< 0.0010	0.0010	mg/L	2018-09-14	
Uranium, total	**0.000734**	0.000020	mg/L	2018-09-14	
Vanadium, total	< 0.0010	0.0010	mg/L	2018-09-14	
Zinc, total	< 0.0040	0.0040	mg/L	2018-09-14	
Zirconium, total	< 0.00010	0.00010	mg/L	2018-09-14	

Sample Qualifiers:

BOD2	The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criterion of at least 2 mg/L.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
RS2	The Reporting Limits for this sample have been raised due to limited sample volume.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
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Analysis Description	Method Ref.	Technique	Location
Alkalinity in Water	SM 2320 B* (2011)	Titration with H2SO4	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2011)	Automated Colorimetry (Phenate)	Kelowna
Ammonia-N, Un-Ionized in Water	CCME WSER	CALC: Total NH3-N x 1/(1+10E((0.0902+(2730/(273.2+Temp)))-pH))	N/A
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Biochemical Oxygen Demand, Carbonaceous in Water	SM 5210 B (2011)	Dissolved Oxygen Meter	Richmond
Coliforms, Fecal in Water	SM 9222 (2006)	Membrane Filtration	Sublet
Conductivity in Water	SM 2510 B (2011)	Conductivity Meter	Richmond
Hardness in Water	SM 2340 B* (2011)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	N/A
Oil and Grease, Total in Water	EPA 1664A*	Liquid-Liquid Extraction with Hexane	Richmond
pH in Water	SM 4500-H+ B (2011)	Electrometry	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2011)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna
Solids, Total Suspended in Water	SM 2540 D* (2011)	Gravimetry (Dried at 103-105C)	Richmond
Total Metals in Water	EPA 200.2* / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond

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

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
<1	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
°C	Degrees Celcius
CFU/100 mL	Colony Forming Units per 100 millilitres
mg/L	Milligrams per litre
pH units	pH < 7 = acidic, ph > 7 = basic
µS/cm	Microsiemens per centimetre
CCME	Canadian Council of Ministers of the Environment, Canada-wide Standard Reference Methods
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

APPENDIX 2: QUALITY CONTROL RESULTS

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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B8I0870										
Blank (B8I0870-BLK1)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Chloride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B8I0870-BLK2)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Chloride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
Blank (B8I0870-BLK3)				Prepared: 2018-09-14, Analyzed: 2018-09-14						
Chloride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B8I0870-BS1)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Chloride	15.5	0.10	mg/L	16.0		97	90-110			
Nitrate (as N)	3.96	0.010	mg/L	4.00		99	93-108			
Nitrite (as N)	1.88	0.010	mg/L	2.00		94	85-114			
Sulfate	15.9	1.0	mg/L	16.0		99	91-109			
LCS (B8I0870-BS2)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Chloride	15.6	0.10	mg/L	16.0		98	90-110			
Nitrate (as N)	4.06	0.010	mg/L	4.00		101	93-108			
Nitrite (as N)	1.92	0.010	mg/L	2.00		96	85-114			
Sulfate	15.8	1.0	mg/L	16.0		99	91-109			
LCS (B8I0870-BS3)				Prepared: 2018-09-14, Analyzed: 2018-09-14						
Chloride	15.7	0.10	mg/L	16.0		98	90-110			
Nitrate (as N)	3.95	0.010	mg/L	4.00		99	93-108			
Nitrite (as N)	1.88	0.010	mg/L	2.00		94	85-114			
Sulfate	15.7	1.0	mg/L	16.0		98	91-109			

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Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8I0861										
Blank (B8I0861-BLK1)				Prepared: 2018-09-13, Analyzed: 2018-09-18						
BOD, 5-day Carbonaceous	< 2.0	2.0	mg/L							
LCS (B8I0861-BS1)				Prepared: 2018-09-13, Analyzed: 2018-09-18						
BOD, 5-day Carbonaceous	190	63.1	mg/L	198		96	85-115			
Duplicate (B8I0861-DUP1)		**Source: 8090968-01**		Prepared: 2018-09-13, Analyzed: 2018-09-18						
BOD, 5-day Carbonaceous	< 2.5	2.0	mg/L		< 2.5				30	BOD2
Reference (B8I0861-SRM1)				Prepared: 2018-09-13, Analyzed: 2018-09-18						
BOD, 5-day Carbonaceous	236	63.1	mg/L	198		119	66-136			
General Parameters, Batch B8I0872										
Blank (B8I0872-BLK1)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Blank (B8I0872-BLK2)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Blank (B8I0872-BLK3)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
LCS (B8I0872-BS1)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	108	1.0	mg/L	1000		11	92-106			SPK1
LCS (B8I0872-BS2)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	108	1.0	mg/L	1000		11	92-106			SPK1
LCS (B8I0872-BS3)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
Alkalinity, Total (as CaCO3)	101	1.0	mg/L	1000		10	92-106			
Reference (B8I0872-SRM1)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
pH	7.02	0.10	pH units	7.00		100	80-120			
Reference (B8I0872-SRM2)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
pH	7.02	0.10	pH units	7.00		100	80-120			
Reference (B8I0872-SRM3)				Prepared: 2018-09-13, Analyzed: 2018-09-13						
pH	7.02	0.10	pH units	7.00		100	80-120			
General Parameters, Batch B8I0878										
Blank (B8I0878-BLK1)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	< 0.020	0.020	mg/L							

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Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8I0878, Continued										
Blank (B8I0878-BLK2)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	< 0.020	0.020	mg/L							
Blank (B8I0878-BLK3)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	< 0.020	0.020	mg/L							
LCS (B8I0878-BS1)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	0.916	0.020	mg/L	1.00		92	90-115			
LCS (B8I0878-BS2)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	0.994	0.020	mg/L	1.00		99	90-115			
LCS (B8I0878-BS3)				Prepared: 2018-09-15, Analyzed: 2018-09-15						
Ammonia, Total (as N)	1.02	0.020	mg/L	1.00		102	90-115			
General Parameters, Batch B8I0974										
Blank (B8I0974-BLK1)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8I0974-BLK2)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8I0974-BLK3)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
Blank (B8I0974-BLK4)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L							
LCS (B8I0974-BS1)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	0.110	0.0020	mg/L	0.100		110	80-112			
LCS (B8I0974-BS2)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	0.0905	0.0020	mg/L	0.100		90	80-112			
LCS (B8I0974-BS3)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	0.103	0.0020	mg/L	0.100		103	80-112			
LCS (B8I0974-BS4)				Prepared: 2018-09-14, Analyzed: 2018-09-17						
Phosphorus, Total (as P)	0.0949	0.0020	mg/L	0.100		95	80-112			
General Parameters, Batch B8I1112										
Blank (B8I1112-BLK1)				Prepared: 2018-09-17, Analyzed: 2018-09-17						
Conductivity (EC)	< 2.0	2.0	µS/cm							
LCS (B8I1112-BS1)				Prepared: 2018-09-17, Analyzed: 2018-09-17						
Conductivity (EC)	146	2.0	µS/cm	147		99	90-110			
Reference (B8I1112-SRM1)				Prepared: 2018-09-17, Analyzed: 2018-09-17						
Conductivity (EC)	1000	2.0	µS/cm	1000		100	95-105			
General Parameters, Batch B8I1223										
Blank (B8I1223-BLK1)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	< 2.0	2.0	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B8I1223, Continued										
Blank (B8I1223-BLK2)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	< 2.0	2.0	mg/L							
LCS (B8I1223-BS1)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	30.0	2.0	mg/L	41.7		72	71-106			
LCS (B8I1223-BS2)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	31.2	2.0	mg/L	41.7		75	71-106			
LCS Dup (B8I1223-BSD1)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	30.1	2.0	mg/L	41.7		72	71-106	< 1	20	
LCS Dup (B8I1223-BSD2)				Prepared: 2018-09-19, Analyzed: 2018-09-19						
Oil & Grease, Total	31.3	2.0	mg/L	41.7		75	71-106	< 1	20	
General Parameters, Batch B8I1261										
Blank (B8I1261-BLK1)				Prepared: 2018-09-18, Analyzed: 2018-09-18						
Solids, Total Suspended	< 2.0	2.0	mg/L							
Blank (B8I1261-BLK2)				Prepared: 2018-09-18, Analyzed: 2018-09-18						
Solids, Total Suspended	< 2.0	2.0	mg/L							
LCS (B8I1261-BS1)				Prepared: 2018-09-18, Analyzed: 2018-09-18						
Solids, Total Suspended	99.0	10.0	mg/L	100		99	83-107			
LCS (B8I1261-BS2)				Prepared: 2018-09-18, Analyzed: 2018-09-18						
Solids, Total Suspended	99.0	10.0	mg/L	100		99	83-107			
Total Metals, Batch B8I0883										
Blank (B8I0883-BLK1)				Prepared: 2018-09-13, Analyzed: 2018-09-14						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0050	0.0050	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8I0883, Continued										
Blank (B8I0883-BLK1), Continued				Prepared: 2018-09-13, Analyzed: 2018-09-14						
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0010	0.0010	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B8I0883-BS1)				Prepared: 2018-09-13, Analyzed: 2018-09-14						
Aluminum, total	0.0205	0.0050	mg/L	0.0200		102	80-120			
Antimony, total	0.0208	0.00020	mg/L	0.0200		104	80-120			
Arsenic, total	0.0206	0.00050	mg/L	0.0200		103	80-120			
Barium, total	0.0206	0.0050	mg/L	0.0200		103	80-120			
Beryllium, total	0.0224	0.00010	mg/L	0.0200		112	80-120			
Bismuth, total	0.0212	0.00010	mg/L	0.0200		106	80-120			
Boron, total	0.0225	0.0050	mg/L	0.0200		113	80-120			
Cadmium, total	0.0207	0.000010	mg/L	0.0200		103	80-120			
Calcium, total	2.19	0.20	mg/L	2.00		109	80-120			
Chromium, total	0.0210	0.00050	mg/L	0.0200		105	80-120			
Cobalt, total	0.0213	0.00010	mg/L	0.0200		106	80-120			
Copper, total	0.0215	0.00040	mg/L	0.0200		108	80-120			
Iron, total	1.96	0.010	mg/L	2.00		98	80-120			
Lead, total	0.0211	0.00020	mg/L	0.0200		106	80-120			
Lithium, total	0.0229	0.00010	mg/L	0.0200		114	80-120			
Magnesium, total	2.03	0.010	mg/L	2.00		101	80-120			
Manganese, total	0.0211	0.00020	mg/L	0.0200		106	80-120			
Molybdenum, total	0.0199	0.00010	mg/L	0.0200		99	80-120			
Nickel, total	0.0214	0.00040	mg/L	0.0200		107	80-120			
Phosphorus, total	2.04	0.050	mg/L	2.00		102	80-120			
Potassium, total	1.96	0.10	mg/L	2.00		98	80-120			
Selenium, total	0.0194	0.00050	mg/L	0.0200		97	80-120			
Silicon, total	2.3	1.0	mg/L	2.00		114	80-120			
Silver, total	0.0203	0.000050	mg/L	0.0200		102	80-120			
Sodium, total	2.00	0.10	mg/L	2.00		100	80-120			
Strontium, total	0.0209	0.0010	mg/L	0.0200		104	80-120			
Sulfur, total	4.5	3.0	mg/L	5.00		90	80-120			
Tellurium, total	0.0200	0.00050	mg/L	0.0200		100	80-120			
Thallium, total	0.0210	0.000020	mg/L	0.0200		105	80-120			
Thorium, total	0.0203	0.00010	mg/L	0.0200		102	80-120			
Tin, total	0.0214	0.00020	mg/L	0.0200		107	80-120			
Titanium, total	0.0222	0.0050	mg/L	0.0200		111	80-120			
Tungsten, total	0.0163	0.0010	mg/L	0.0200		81	80-120			
Uranium, total	0.0207	0.000020	mg/L	0.0200		104	80-120			
Vanadium, total	0.0204	0.0010	mg/L	0.0200		102	80-120			
Zinc, total	0.0233	0.0040	mg/L	0.0200		116	80-120			
Zirconium, total	0.0214	0.00010	mg/L	0.0200		107	80-120			
Reference (B8I0883-SRM1)				Prepared: 2018-09-13, Analyzed: 2018-09-14						
Aluminum, total	0.329	0.0050	mg/L	0.303		108	82-114			
Antimony, total	0.0522	0.00020	mg/L	0.0511		102	88-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Yukon Government - Water Resources	**WORK ORDER**	8090968
PROJECT	Haines Junction WWTF	**REPORTED**	2018-09-19 17:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B8I0883, Continued										
Reference (B8I0883-SRM1), Continued				Prepared: 2018-09-13, Analyzed: 2018-09-14						
Arsenic, total	0.124	0.00050	mg/L	0.118		105	88-111			
Barium, total	0.818	0.0050	mg/L	0.823		99	83-110			
Beryllium, total	0.0558	0.00010	mg/L	0.0496		112	80-119			
Boron, total	3.62	0.0050	mg/L	3.45		105	80-118			
Cadmium, total	0.0506	0.000010	mg/L	0.0495		102	90-110			
Calcium, total	11.1	0.20	mg/L	11.6		95	85-113			
Chromium, total	0.262	0.00050	mg/L	0.250		105	88-111			
Cobalt, total	0.0413	0.00010	mg/L	0.0377		109	90-114			
Copper, total	0.530	0.00040	mg/L	0.486		109	90-117			
Iron, total	0.498	0.010	mg/L	0.488		102	90-116			
Lead, total	0.212	0.00020	mg/L	0.204		104	90-110			
Lithium, total	0.442	0.00010	mg/L	0.403		110	79-118			
Magnesium, total	3.90	0.010	mg/L	3.79		103	88-116			
Manganese, total	0.114	0.00020	mg/L	0.109		105	88-108			
Molybdenum, total	0.201	0.00010	mg/L	0.198		102	88-110			
Nickel, total	0.265	0.00040	mg/L	0.249		106	90-112			
Phosphorus, total	0.249	0.050	mg/L	0.227		110	72-118			
Potassium, total	7.37	0.10	mg/L	7.21		102	87-116			
Selenium, total	0.121	0.00050	mg/L	0.121		100	90-122			
Sodium, total	7.48	0.10	mg/L	7.54		99	86-118			
Strontium, total	0.390	0.0010	mg/L	0.375		104	86-110			
Thallium, total	0.0842	0.000020	mg/L	0.0805		105	90-113			
Uranium, total	0.0309	0.000020	mg/L	0.0306		101	88-112			
Vanadium, total	0.399	0.0010	mg/L	0.386		103	87-110			
Zinc, total	2.59	0.0040	mg/L	2.49		104	90-113			

QC Qualifiers:

BOD2 The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criterion of at least 2 mg/L.

SPK1 The recovery of this analyte was outside of established control limits. The data was accepted based on performance of other batch QC.

CARO.ca 1-888-311-8846
#110-4011 Viking Way, Richmond, BC V6V 2K9
#102-3677 Highway 97N, Kelowna, BC V1X 5C3
17225 109 Avenue NW, Edmonton, AB T5S 1H7

CARO BC COC, Rev 2017-05

CHAIN OF CUSTODY RECORD

COC# _____ PAGE OF

RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
Nicole Novodvorsky	SEP 11/18	NOVEX ROB C	09/12
	TIME: 16:00		TIME: 13:15

TURNAROUND TIME REQUESTED:
Routine: (5-7 Days) ☐
Rush: 1 Day* ☐ 2 Day* ☐ 3 Day* ☐
Other* _____
*Contact Lab To Confirm. Surcharge May Apply

REGULATORY APPLICATION: Show on Report ☐
Canadian Drinking Water Quality ☐ BC WQG ☐ BC HWR ☐
BC CSR Soil: WL ☐ AL ☐ PL ☐ RL-LD ☐ RL-HD ☐ CL ☐ IL ☐
BC CSR Water: AW ☐ IW ☐ LW ☐ DW ☐
CCME: _____ Other: _____

PROJECT NUMBER / INFO: ~~City of Whitehorse~~ Haines Junction WWTF

A: Biohazard B: Cyanide C: PCBs D: Asbestos E: Heavy Metals F: Flammable G: Strong Odour H: High Contamination I: Other (please specify*)

REPORT TO:
COMPANY: Yukon Government, Dept of ENV
ADDRESS: Water Resources Branch (V-310)
Box 2703, Whitehorse, YT Y1A 2C6
CONTACT: Nicole Novodvorsky
TEL/FAX:
DELIVERY METHOD: EMAIL ☒ MAIL ☐ OTHER* ☐
DATA FORMAT: EXCEL ☒ WATERTRAX ☐ ESdat ☐ EQuIS ☐ BC EMS ☐ OTHER* ☒
EMAIL 1: nicole.novodvorsky@gov.yk.ca
EMAIL 2:
EMAIL 3:

INVOICE TO: SAME AS REPORT TO ☒
COMPANY:
ADDRESS:
CONTACT: Holly Goulding
TEL/FAX:
DELIVERY METHOD: EMAIL ☒ MAIL ☐ OTHER* ☐
EMAIL 1: holly.goulding@gov.yk.ca
EMAIL 2: nicole.novodvorsky@gov.yk.ca
EMAIL 3:
PO #:

** If you would like to sign up for ClientConnect and/or EnviroChain, CARO's online service offerings, please check here: ☐

COMMENTS:

SAMPLED BY: Holly Goulding

ANALYSES REQUESTED:

	SAMPLE ID - SAMPLE CLASS - STATION CODE	MATRIX: DRINKING WATER	OTHER WATER	SOIL	OTHER	CONTAINER QTY	SAMPLING: DATE YYYY-MM-DD	TIME HH:MM	CHLORINATED	FILTERED	PRESERVED	(e.g. flow/volume media ID/notes)	METALS - WATER TOTAL Hg	METALS - WATER DISSOLVED Hg	pH, EC, Spec. Alkalinity	TSS	TIC, TOC, DIC, DOC	Chloride, Sulphate, Nitrite, Nitrate	Total Phosphorus, Total Ammonia - N	un-ionized ammonia	Hexavalent Chromium (Cr VI)	Fecal Coliforms	Total Oil & Grease	BTEX/VPH	LEPH/HEPH/PAH	LC50	CBOD5		HOLD	POSSIBLE SAMPLE HAZARD CODE(S)
1	2018XXX - M - HJ-5		✓				2018-09-11	9:51			✓		✓		✓	✓		✓	✓	✓			✓				✓			
2	2018XXX - M - HJ-6		✓				2018-09-11	10:00			✓		✓		✓	✓		✓	✓	✓			✓				✓			
3	2018XXX - M - PROP D/S		✓				2018-09-11	10:07			✓		✓		✓	✓		✓	✓	✓			✓				✓			
4	2018XXX - M - PINE INPUT		✓				2018-09-11	10:40			✓		✓		✓	✓		✓	✓	✓										
5	2018XXX - M - DR D/S		✓				2018-09-11	11:21			✓		✓		✓	✓		✓	✓	✓			✓				✓			
6	2018XXX - P - HJ-4		✓				2018-09-11	12:28			✓		✓		✓	✓		✓	✓	✓		✓	✓				✓			
7	2018XXX - M - PINE OUTFLOW		✓				2018-09-11	12:56			✓		✓		✓	✓		✓	✓	✓										

SHIPPING INSTRUCTIONS: Return Cooler(s) ☒
Supplies Needed:

SAMPLE RETENTION:
30 Days (default) ☐
60 Days ☐ 90 Days ☐
Other (surcharges will apply): _____

*** OTHER INSTRUCTIONS:**
Please Return Cooler.

If you would like to talk to a real live Scientist about your project requirements, please check here: ☐

SAMPLE RECEIPT CONDITION:
COOLER 1 (°C): 7.9 ICE: Y ☐ N ☐
COOLER 2 (°C): _____ ICE: Y ☐ N ☐
COOLER 3 (°C): _____ ICE: Y ☐ N ☐
CUSTODY SEALS INTACT: NA ☐ Y ☐ N ☐

Artificial Sweetener Results

Method:	IC/ESI/MS/MS	ACS500 suppressor
mdl	minimum detection limit	
pql	practical quantitation limit	
j	indicates >mdl but < pql	
n.d.	not detected	

				Acesulfame	Saccharin	Cyclamate	Sucralose		
				ng/L	ng/L	ng/L	ng/L		
			mdl	2	2	3	20		
			pql	6	6	8	60		
								Water Isotopes	
Sample Name	**Date Sampled**	**Date Analysed**	**Analysis Sample Name**	**Acesulfame**	**Saccharin**	**Cyclamate**	**Sucralose**	**2H (ave)**	**18O (ave)**
HJ-5 - RIGHT	11-Sep-18	16-Oct-18	20181039	n.d.	<dl	n.d.	n.d.	-152.1	-19.12
HJ-5 - CENTRE	11-Sep-18	16-Oct-18	20181040	n.d.	3j	n.d.	n.d.	-152.2	-19.21
HJ-5 - CENTRE	11-Sep-18	16-Oct-18	20181040 dup	n.d.	3j	n.d.	n.d.		
HJ-5 - LEFT	11-Sep-18	16-Oct-18	20181041	n.d.	n.d.	n.d.	78	-152.3	-19.21
HJ-6 - LEFT	11-Sep-18	16-Oct-18	20181042	n.d.	2j	n.d.	n.d.	-152.3	-19.14
HJ-6 - CENTRE	11-Sep-18	16-Oct-18	20181043	n.d.	<dl	n.d.	n.d.	-152.4	-19.15
HJ-6 - RIGHT	11-Sep-18	16-Oct-18	20181044	n.d.	<dl	n.d.	n.d.	-152.6	-19.17

Prop. D/s - RIGHT	11-Sep-18	16-Oct-18	20181045	<dl	<dl	n.d.	n.d.	-152.2	-19.10
Prop. D/s - CENTRE	11-Sep-18	16-Oct-18	20181046	n.d.	<dl	n.d.	n.d.	-152.3	-19.15
Prop. D/s - LEFT	11-Sep-18	16-Oct-18	20181047	n.d.	<dl	n.d.	n.d.	-152.4	-19.20
Pine D/s	11-Sep-18	16-Oct-18	20181048	14	<dl	n.d.	n.d.	-152.1	-19.06
Pine Input	11-Sep-18	16-Oct-18	20181049	n.d.	n.d.	n.d.	n.d.	-155.1	-19.01
Pine U/s	11-Sep-18	16-Oct-18	20181050	29	<dl	n.d.	n.d.	-152.3	-19.17
Pine U/s	11-Sep-18	16-Oct-18	20181050 dup	32	<dl	n.d.	n.d.		
DR D/s	11-Sep-18	16-Oct-18	20181051	2300	31	81	3613	-143.9	-16.33
Pine @ Hwy	11-Sep-18	16-Oct-18	20181052	n.d.	n.d.	n.d.	n.d.	-156.0	-19.22
HJ-4	11-Sep-18	16-Oct-18	20181053	4976	109	401	9020	-135.9	-14.06
Pine Outflow	11-Sep-18	16-Oct-18	20181054	n.d.	n.d.	n.d.	n.d.	-142.1	-16.18
Mega Egg	27-Jun-18	7-Aug-18	20180721	1252	29	23	1577	-149.4	-17.30
HJ-Hwy	27-Jun-18	7-Aug-18	20180722	1997	18	24	1350	-143.2	-16.03
DR Wetland	27-Jun-18	7-Aug-18	20180723	230	6	n.d.	340	-150.4	-18.61
DR D/S NEW	27-Jun-18	7-Aug-18	20180724	n.d.	n.d.	n.d.	n.d.	-152.5	-19.35
DR U/S	27-Jun-18	7-Aug-18	20180725	n.d.	2j	n.d.	n.d.	-152.4	-19.35
DR U/S	27-Jun-18	7-Aug-18	20180725 dup	n.d.	2j	n.d.	n.d.		
Prop D/S North Bank	24-Jul-18	7-Aug-18	20180726	n.d.	3j	n.d.	n.d.	-152.2	-19.25

Prop D/S North Bank	24-Jul-18	7-Aug-18	20180727	n.d.	n.d.	n.d.	n.d.	-152.5	-19.30
Pine input U/S	24-Jul-18	7-Aug-18	20180728	n.d.	n.d.	n.d.	n.d.	-152.3	-19.22
Pine L Outflow at highway	24-Jul-18	7-Aug-18	20180729	n.d.	n.d.	n.d.	n.d.	-150.6	-17.87
Pine L Outflow	24-Jul-18	7-Aug-18	20180730	n.d.	3j	n.d.	n.d.	-143.6	-16.37
Pine input D/S	24-Jul-18	7-Aug-18	20180731	n.d.	4j	n.d.	n.d.	-152.6	-19.23
Pine input	24-Jul-18	7-Aug-18	20180732	n.d.	n.d.	n.d.	n.d.	-152.0	-18.25
HJ-5 North Bank	24-Jul-18	7-Aug-18	20180733	n.d.	n.d.	n.d.	n.d.	-152.3	-19.29
HJ-5 Center	24-Jul-18	7-Aug-18	20180734	n.d.	3j	n.d.	n.d.	-152.4	-19.27
HJ-5 South Bank	24-Jul-18	7-Aug-18	20180735	n.d.	2j	n.d.	n.d.	-152.5	-19.24
HJ-5 South Bank	24-Jul-18	7-Aug-18	20180735 dup	n.d.	3	n.d.	n.d.		
Prop D/S centre	24-Jul-18	7-Aug-18	20180736	n.d.	n.d.	n.d.	n.d.	-152.4	-19.18
DR D/S	24-Jul-18	7-Aug-18	20180737	289	8	n.d.	380	-149.1	-17.95
Alsek 1	11-Jul-18	7-Aug-18	20180738	n.d.	2j	n.d.	n.d.	-151.6	-19.15
Alsek 2	11-Jul-18	7-Aug-18	20180739	n.d.	2j	n.d.	n.d.	-172.9	-22.45

Alsek 2	11-Jul-18	7-Aug-18	20180739 dup	n.d.	4j	n.d.	n.d.		
Mega Egg	31-Jul-18	7-Aug-18	20180740	985	24	n.d.	1414	-136.1	-14.30
DR Wetland	31-Jul-18	7-Aug-18	20180741	164	4j	n.d.	256	-149.0	-18.21
DR D/S NEW	31-Jul-18	7-Aug-18	20180742	n.d.	4j	n.d.	n.d.	-149.9	-18.75
DR U/S	31-Jul-18	7-Aug-18	20180743	n.d.	2j	n.d.	n.d.	-150.8	-19.03
Culvert	31-Jul-18	7-Aug-18	20180744	1558	14	n.d.	1281	-141.9	-15.68