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April 24<sup>th</sup>, 2020  
File No. W2020-20

**KICKING HORSE MOUNTAIN UTILITIES CORP.**  
1505 17<sup>th</sup> Avenue SW  
Calgary, Alberta  
T2T 0E2

Attention: Mr. Patrick Majer  
  
Tel: 403.861.6730  
e-mail: [pmajer@skircr.com](mailto:pmajer@skircr.com)

Dear Mr. Majer:

**Re: KICKING HORSE MOUNTAIN RESORT  
WASTEWATER TREATMENT PLANT  
2019 ANNUAL REPORT**

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Forwarded is a pdf copy of the 2019 Annual Wastewater Report for the above property.

Should you have any questions, please call us at 403-238-9510 or email to [jana@iqwater.ca](mailto:jana@iqwater.ca).

Sincerely,

**IQWATER INC.**

A handwritten signature in blue ink, appearing to read "Jana Zverina", is written over a faint, circular blue stamp or watermark.

Jana Zverina, M.Sc., P.Eng.

**IQWater Inc.**



**2019 WASTEWATER TREATMENT PLANT  
ANNUAL REPORT**

**KICKING HORSE MOUNTAIN RESORT  
1339 KICKING HORSE TRAIL  
GOLDEN, B.C.**

Prepared for:

**KICKING HORSE MOUNTAIN UTILITIES CORP.**  
1505-17<sup>th</sup> Avenue SW  
Calgary, Alberta  
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Prepared by:

***IQWATER INC.***  
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April 24<sup>th</sup>, 2020  
Report # W2020-020

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## **1.0 INTRODUCTION**

### **1.1 BACKGROUND**

The following annual report for the Wastewater Treatment Plant at Kicking Horse Mountain Resort (further KHMR) operated by Kicking Horse Mountain Utility Corporation (further KHMUC) is compiled in accordance with the requirements of the Municipal Sewage Regulation (further MSR). This report summarizes the calendar year 2019.

In January 2012 Resorts of the Canadian Rockies (RCR) took over the resort and the plant operations and formed KHMUC. KHMUC has made changes to the way the plant operates, mainly by using a spare tank as an equalization tank. There has been a noticeable difference in plant operations since RCR took over and KHMUC was formed.

The resort is an ongoing development currently consisting of a combination of a single family, multi-family, and rental pool/hotel style facilities. These contribute to the total loading of the site in addition to ski hill use and ancillary services.

### **1.2 RESORT CONSTRUCTION AND OCCUPANCY**

Kicking Horse Mountain Resort is located approximately 13 km from Golden, B.C. The sewage treatment plant, which was constructed in 2000, is located adjacent to the resort. The treatment USBF (Upflow Sludge Blanket Filtration) technology employed is a modified conventional activated sludge process applying an up-flow sludge blanket filtration clarifier. There are two independent treatment trains that are operated in parallel during the peak season (December to April) and as a single train during the rest of the calendar year.

The system incorporates two treatment zones and one clarification zone that are interconnected with the flow been driven by the hydraulic pressure from the influent storage tank pumps.

The two treatment zones consist of an Anoxic Zone and Aeration Zone discharging into an effluent clarifier.

Each zone is triangular in shape. Two 10" underflow pipes on either side of the clarification zone join in the anoxic and aeration zones together. The aeration zone is connected to the clarifier by a slotted flow through, approximately 18" above the clarifier bottom and the width of the clarifier wall. Each zone is approximately 15' deep. Effluent clarification is enhanced by an up-flow sludge blanket in the clarifier that serves to filter the solids.

Clarified effluent flows over the clarifier weir into a dual micro filtration well, equipped with dual drum screens. Leaving the drum screens, the final effluent enters an open channel Trojan U.V. disinfection system to be discharged through a 4 km long gravity main to the outfall in the Columbia River.

Waste activated sludge used to be stored in a thickener and removed by a vacuum tanker. In the fall of 2014, a 12 unit Teknofanghi (Model Number 12BCAVPK) supplied by Drycake was installed and was commissioned in mid-December. Historically, the sludge was bagged and disposed of at the CSRD Landfill located in Golden, BC; however, due to increased costs for disposal at this facility, the sludge is now disposed of at the Crowsnest/Pincher Creek Landfill site.

## 2.0 REGISTRATION REQUIREMENTS

This section describes operating requirements as specified in the Kicking Horse Mountain Resort (KHMR) Registration Letter RE 15474. The registration describes parameters that must be tested for as well as the operating conditions, sampling frequency and sampling locations.

### 2.1 PARAMETERS

The following parameters are to be monitored:

pH	Field Sample
Temperature	Field Sample, measured in Celsius
Flow	Field Samples, measured as m <sup>3</sup> /d
BOD <sub>5</sub>	Five day biochemical oxygen demand, measured in mg/l
TSS	Total suspended solids or non-filterable residue, measured in mg/l
NH <sub>3</sub>	Ammonia concentration, expressed as nitrogen in mg/l
NO <sub>3</sub>	Nitrate concentration, expressed as nitrogen in mg/l
NO <sub>2</sub>	Nitrite concentration, expressed as nitrogen in mg/l
Total-P	Total phosphorous concentration, measured in mg/l
Ortho-P	Orthophosphate concentration, measured in mg/l
Fecal coliform	Bacterial concentration, measured as colony forming units per 100ml
Enterococci	Bacterial concentration, measured as colony forming units per 100ml
E. Coli	Bacterial concentration, measured as colony forming units per 100ml
Toxicity Bioassay	96 hour toxicity test, recorded as pass or fail

### 2.2 REGISTRATION LETTER OPERATING CONDITIONS

The treatment plant is required to meet the effluent discharge conditions outlined in Table 1.

Table 1

Effluent Limits

Parameter	Limit	Unit
Flow	300	m <sup>3</sup> /d
BOD <sub>5</sub>	45	mg/l
TSS	45	mg/l
Total-P	1.0	mg/l
Ortho-P	0.5	mg/l
Fecal Coliforms*	200	CFU/100ml
E. Coli*	77	CFU/100ml
Enterococci*	20	CFU/100ml
Toxicity Bioassay	pass	n/a

\*Limit for recreational waters only, not included in RCRI registration letter

Waste activated sludge used to be stored in a thickener and removed by a vacuum tanker. In the fall of 2014, a 12 unit Teknofanghi (Model Number 12BCAVPK) supplied by Drycake was installed and was commissioned in mid-December. The sludge is bagged and disposed of at the Crowsnest/Pincher Creek Landfill site.

Operators at the plant are required to be certified in Accordance with Section 22 of the MSR.

## **2.3 REPORTING REQUIREMENTS**

An annual report demonstrating the performance of the facility is to be publicly posted on the Internet within 120 days of the end of the calendar year.

In addition the report must also include the following:

- Tabulated results of the Effluent and Environmental Monitoring Data with standards and criteria
- Interpretation of the monitoring data
- The total volume discharged over the year
- Total sludge wasted over the year and its final destination
- The state of compliance of the treatment facility/process
- Indicated the percentage of residential development, as defined in the regulation, that contributes to the effluent discharge
- Any additional relevant information the discharger wishes to provide

## **2.4 SAMPLING FREQUENCY**

The MSR Registration requires KHMR and, as such, the contract operator KHMUC, to undertake the environmental testing program outlined in Table 2 below.

Columbia River testing requires that a minimum of 10 samples annually are taken from each of the upstream, the side channel (further also referred to as a side stream) and downstream river locations, relative to the outfall diffuser. The sampling locations were identified in Masse & Miller Consulting Ltd. letter dated February 17<sup>th</sup>, 2005. Flow data is to be collected continuously.

The intent of the environmental testing procedure outlined in Table 2 is to collect weekly samples of effluent during the summer and winter seasons. Commencement of the winter weekly seasonal sampling (weekly samples for a period of 5 weeks) is when the river sampling sites open up and the summer monitoring usually commences during low water flow in the river, usually in September or October.

In addition to the program and tests listed above, other in-plant testing is needed to permit operational control of the process.

Table 2

Sampling Location/Frequency/Type

Parameter	Location				
	Columbia River Upstream at Bridge	Columbia River ~200 d/s of outfall from east shore	Columbia River d/s of island from west shore ~1km d/s of outfall	Columbia River side channel ~350m d/s of outfall	Effluent
EMS Number	E256694	E258898	E258899	E258897	E256696
	Winter/Summer	Winter/Summer	Winter	Summer	Winter/Summer
pH	WS/G	WS/G	WS/G	WS/G	W
Temp	WS/G	WS/G	WS/G	WS/G	W
Flow	/	/	/	/	W
BOD <sub>5</sub>	/	/	/	/	W
TSS	WS/G	WS/G	WS/G	WS/G	WS/G+Q/G
NH <sub>3</sub> -N	WS/G	WS/G	WS/G	WS/G	WS/G
NO <sub>3</sub> -N	WS/G	WS/G	WS/G	WS/G	WS/G
NO <sub>2</sub> -N	WS/G	WS/G	WS/G	WS/G	WS/G
Total-P	WS/G	WS/G	WS/G	WS/G	WS/G
Ortho-P	WS/G	WS/G	WS/G	WS/G	WS/G
Fecal Coliform	WS/G	WS/G	WS/G	WS/G	WS/G+Q/G
Enterococci	WS/G	WS/G	WS/G	WS/G	WS/G
E. Coli	WS/G	WS/G	WS/G	WS/G	WS/G
Toxicity Bioassay	/	/	/	/	1/3Y/G
Coordinates	11.500456 5684421	11.500288 5684880	N51 19.364 W 11700.218	11.500126 5684835	At sewage treatment plant

Where:

WS	Weekly seasonal (weekly samples for a period of 5 weeks)
Q	Quarterly
W	Weekly
G	Grab
1/3Y	Once every 3 years

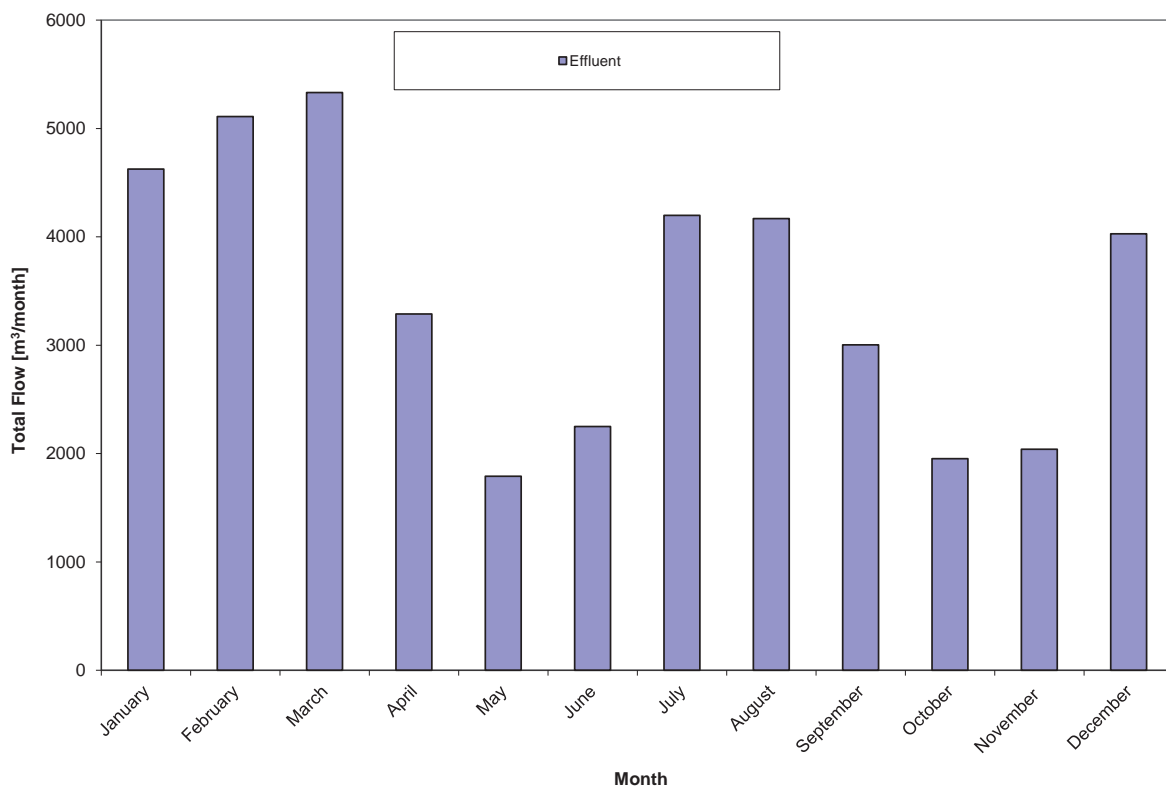
### 3.0 SEWAGE FLOW RECORDS

This section provides data and analysis regarding plant effluent flows, and compares 2019 data to the previous years.

Flow data is continuously monitored at the discharge to the outfall using a flow meter to be recorded in the SCADA system. Operators then transcribe the daily flows into a logbook.

The total effluent flow recorded for 2019 was 41,785 m<sup>3</sup> with an average of 114 m<sup>3</sup>/day. Available monthly total effluent flow meter records for 2019 are provided in Figure 1a.

**Figure 1a**  
2019 Effluent Flow Meter Monthly Flow Totals



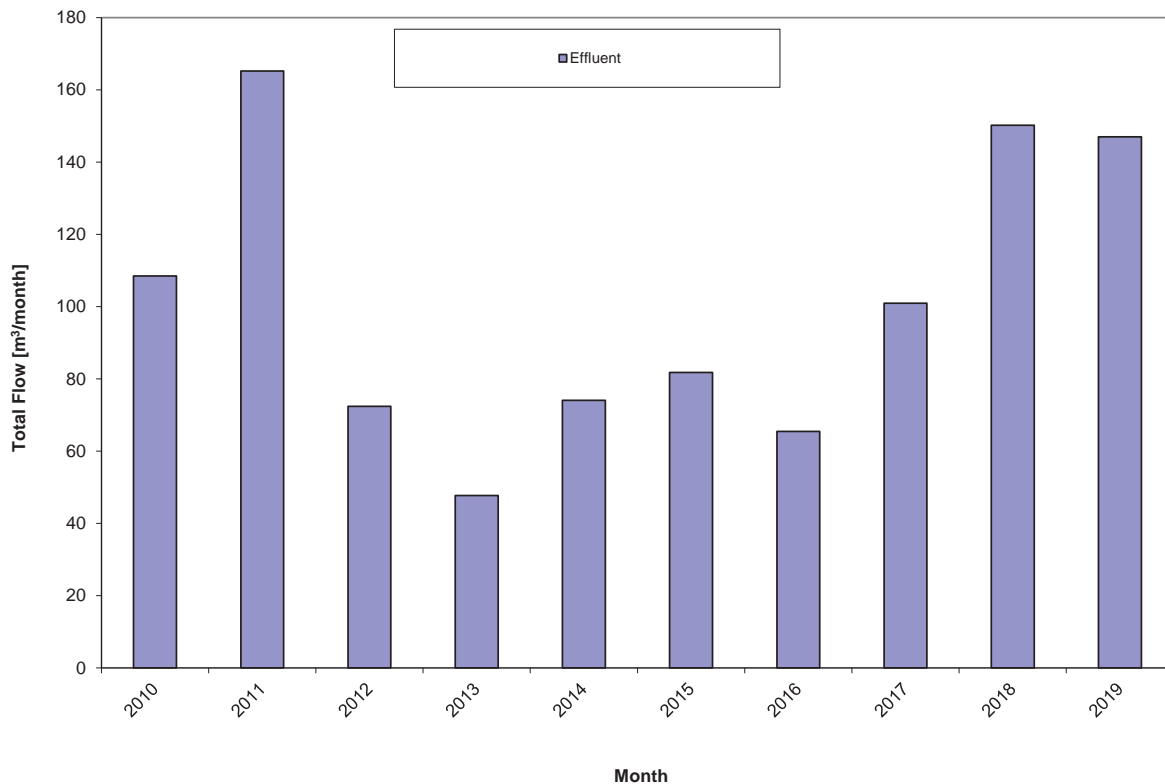
The ski resort operates with higher winter and early spring sewage flows than during any other period. Larger sewage flows were typically observed during January, February, March and December. The highest monthly flow was observed in March at 5,331 m<sup>3</sup>/month. However, summer month flows i.e. July and August are becoming similar to those of December.

The average daily plant flow through January to March and December of 2019 was 156 m<sup>3</sup>/day.



In the previous reports the highest plant flow was compared to January, February, March, April and December. In 2019 the flow for these five months was similar to 2018 at 147 m<sup>3</sup>/day vs 150.2 m<sup>3</sup>/day. These averages are higher compared to 100.96 m<sup>3</sup>/day over the same period in 2017, 65.52 m<sup>3</sup>/day in 2016, 81.79 m<sup>3</sup>/day in 2015, 74.10 m<sup>3</sup>/day in 2014, 47.73 m<sup>3</sup>/day in 2013, 72.41 m<sup>3</sup>/day in 2012 and 108.5 m<sup>3</sup>/day in 2010. The only exception was 2011 at 165.2 m<sup>3</sup>/day (note that data for Dec was missing).

**Figure 1b**  
Average Effluent Flow in Peak Period – Jan to April and Dec (Historical)



Peak flow for the year reached 265 m<sup>3</sup>/day on November 3<sup>rd</sup>, 2019, which is below the allowable limit of 300 m<sup>3</sup>/day. The peak flow is similar to that of the previous two years at 262 m<sup>3</sup>/day in 2018 and 244 m<sup>3</sup>/day in 2017. The peak flow day occurred at the beginning of the ski season.

Historical peak flows were 162.25 m<sup>3</sup>/day in 2016, 137.32 m<sup>3</sup>/day in 2015, 145.71 m<sup>3</sup>/day in 2014, 165.03 m<sup>3</sup>/day in 2013, 159.05 m<sup>3</sup>/day in 2012, 311.54 m<sup>3</sup>/day in 2011 (again note that the data for one of the historically highest months, December was missing), 317.6 m<sup>3</sup>/day in 2010 and 251.3 m<sup>3</sup>/day in 2009.

There is currently no method of measuring influent to the treatment plant.

A summary of sewage flow for years 2009 through 2019 is provided in Table 3 and Figures 2 and 3:

Table 3

2009 – 2019 Flow Comparisons

Year	Sewage Flow (m <sup>3</sup> /day)			Days Over Limit
	Total	Average	Peak	
2009	25,093.9	69.4	251.3	0
2010	27,467.5	77.6	317.6	2
2011	27,771* (42,340) <sup>1</sup>	116	311.54**	2
2012	17,323.4	47.85	159.05	0
2013	16,089	44.73	165.03	0
2014	19,279 <sup>2</sup>	52.88	145.71	0
2015	20,594	56.4	167.32	0
2016	21,125	58.9	162.25	0
2017	31,431 <sup>3</sup>	85.9	240	0
2018	45,147	123.8	262	0
2019	41,785	114.0	265	0

\*not including all of September, October, November or December

\*\*the number does not reflect a true peak as all the data was not available during the high flow months

<sup>1</sup> (data) in bracket – estimate based on daily average

<sup>2</sup> The SCADA failed to record flow for the entire day on several occasions; therefore flow was estimated on partial data

<sup>3</sup> The SCADA failed to record correct flow from July 24<sup>th</sup> until September 7<sup>th</sup>; therefore flow was based on partial estimates

### 2009 - 2018

Peak flows in **2009** coincided with the weekends, holidays, ski season and summer recreational activities. The highest daily flow was recorded on Feb 15<sup>th</sup> at 215.1 m<sup>3</sup>/day and on December 31<sup>st</sup> at 251.3 m<sup>3</sup>/day. At no time was the maximum allowed daily flow exceeded.

Peak flows in **2010** coincided with weekends, holidays, ski season and summer recreational activities. The highest daily flow was recorded on New Year's Day at 242.7 m<sup>3</sup>/day, February 14<sup>th</sup> at 206.4 m<sup>3</sup>/day, and on December 31<sup>st</sup> at 317.6 m<sup>3</sup>/day. During the third week of July 2010 a lightning strike damaged the level sensors in the wastewater treatment plant resulting in inaccurate measurement of flows. The Ministry of Environment was notified. The operators indicated that during daily monitoring of the system, there was no time when the flows came close to exceeding the permit based on visual observation and process control monitoring.

Peak flows in **2011** also coincided with weekends, holidays, ski season and summer recreational activities. The highest daily flow was recorded on a weekend (March 26<sup>th</sup>) at 311.54 m<sup>3</sup>/day and the second highest peak was observed on New Year's Day at 303.04 m<sup>3</sup>/day. The daily flow limit was exceeded on both occasions. Please note the data was incomplete for September, October, November and December 2011.

Peak flows in **2012** also coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2012. The reduction in daily flows and reduction in peak flow is due to flow equalization which has now been implemented in the facility using the vacant tank that will one day be used for additional process trains. Flow equalization began in January 2012.

Peak flows in **2013** also coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2013. The highest daily flow was recorded on December 29<sup>th</sup> at 165.03 m<sup>3</sup>/day.

Peak flows in **2014** coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2014. The highest daily flow was recorded on January 2<sup>nd</sup> at 145.71 m<sup>3</sup>/day. The SCADA failed to record flow for the entire day on several occasions and partial data was used to estimate total flow. The failure was due to computer issues.

On January 9, 24, 25; February 4; March 3, 28, 29; May 23 to June 2, June 9, 14, 15, 23, 27; July 4, 6-10, 12, 13, 28; August 12, 13, 16, 17; September 5, 6; October 1, 3; November 21, 22, 25, 26; and December 7, 8, and 9 the flow was estimated.

Peak flows in **2015** coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2015. The highest daily flow was recorded on January 2<sup>nd</sup> at 167.32 m<sup>3</sup>/day.

Peak flows in **2016** coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2016. The highest daily flow was recorded on December 29<sup>th</sup> at 162.25 m<sup>3</sup>/day.

Peak flows in **2017** coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2017. The highest daily flow was recorded on December 29<sup>th</sup> at 244 m<sup>3</sup>/day. Please note that the SCADA failed to record correct flow from July 24<sup>th</sup> until September 7<sup>th</sup>; therefore flow was based on partial estimates.

Peak flows in **2018** coincided with the peak season in January, February, March and December. There were no daily flow limit exceedances observed in 2018. The highest daily flow was recorded on December 31<sup>st</sup> at 262 m<sup>3</sup>/day.

## **2019**

Peak flows in 2019 generally coincided with the peak season in January, February, March and December. The highest daily flow, however, was recorded on November 3<sup>rd</sup> at 265 m<sup>3</sup>/day. Also note that the summer months i.e. July and August are becoming busy with the flows similar to those in December. There were no daily flow limit exceedances observed in 2019.

Daily wastewater flows are strongly correlated to weather and the number of day-users at the resort with the peak ski season having the highest flows. Summer flows result from non-skiing related recreational activities, generally hiking or mountain biking events. The lowest plant flow is experienced in the shoulder season periods (April to June and September to November).

There are approximately 35 full time year round residents at the resort. In total, there are currently:

- ✓ 98 single family homes (Purcell Woods, Cache Estates, Cache Residences, Dogtooth and Cedar Creek Estates)
- ✓ 112 multi-family units i.e. duplexes and triplexes (Whispering Pines, The Cedars, Selkirk Resort Homes, Aspen – Phase 1 and 2)
- ✓ 155 multi-storey condos (Mountaineer Lodge, Palliser Lodge, Glacier Lodge)
- ✓ 3 commercial lodges (Cache Lodges)
- ✓ Five seasonal restaurants
- ✓ Administration office, day-care facilities, general store and rental shop)

OCCUPANCY*	Family Residences	Rental Units	Bedrooms	Units
<b>Seasonal</b>				
Multi-story condos (3 units)	-	155	310	-
Commercial Lodges (3)	-	-	30	-
Single Family Residences	98	-	282	-
Multi-Family Units (Duplex & Triplex)	112	-	322	-
<b>Non-residential</b>	-	-	-	
5 Restaurants	-	-	-	1076 m <sup>2</sup>
Office	-	-	-	20 persons
Miscellaneous	-	-	-	5 units

\*Note that the occupancy significantly varies throughout the year with near full occupancy only during the ski season and during the long weekends.

The original occupancy was based on a total of 2254 EBU (equivalent bed units). Based on the up to date information the current occupancy was updated as shown in the table above.

Figure 2 provides historical average and peak flow and Figure 3 shows historical total flows for 2009 to 2019 for comparison.

Figure 2

Historical (2009 – 2019) Average and Peak Sewage Effluent Flow Comparison Graph

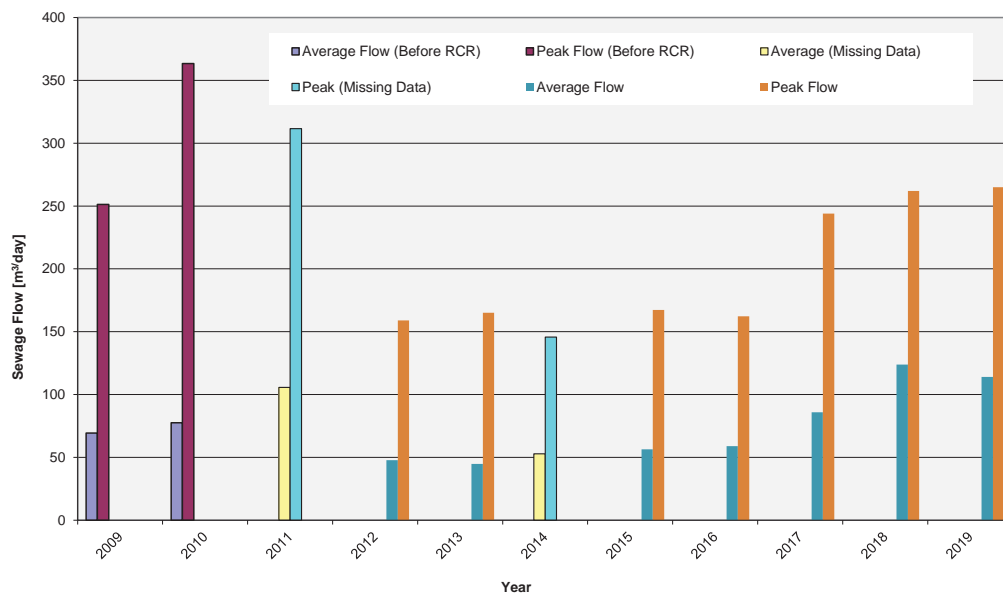


Figure 3

Historical (2009 – 2019) Total Sewage Effluent Flow Graph

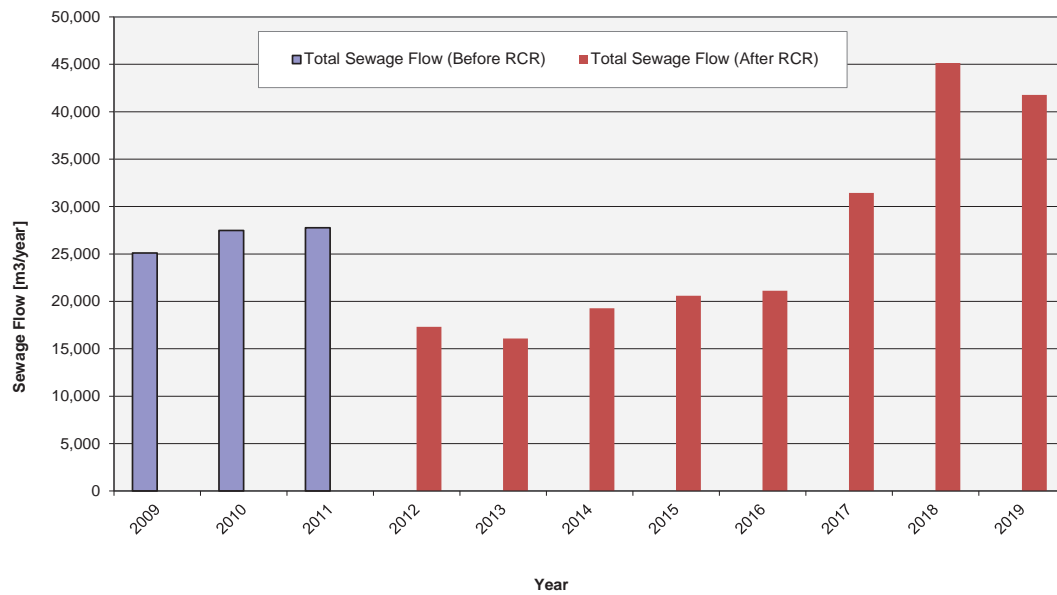
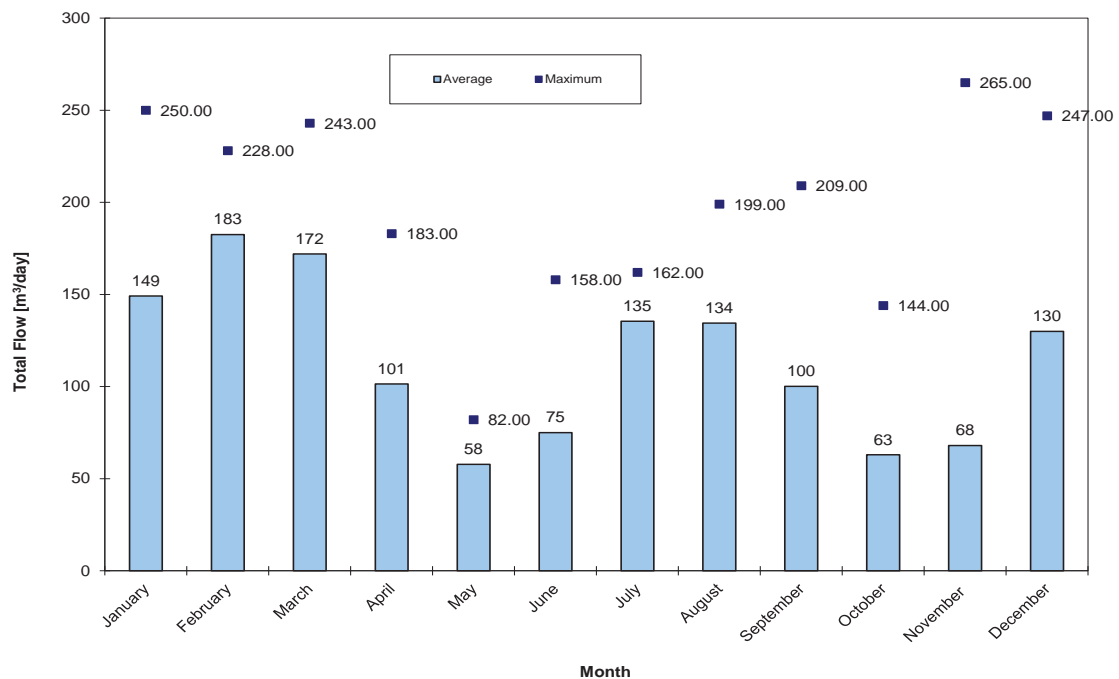


Figure 4 below shows 2019 average and peak flows for 2019.

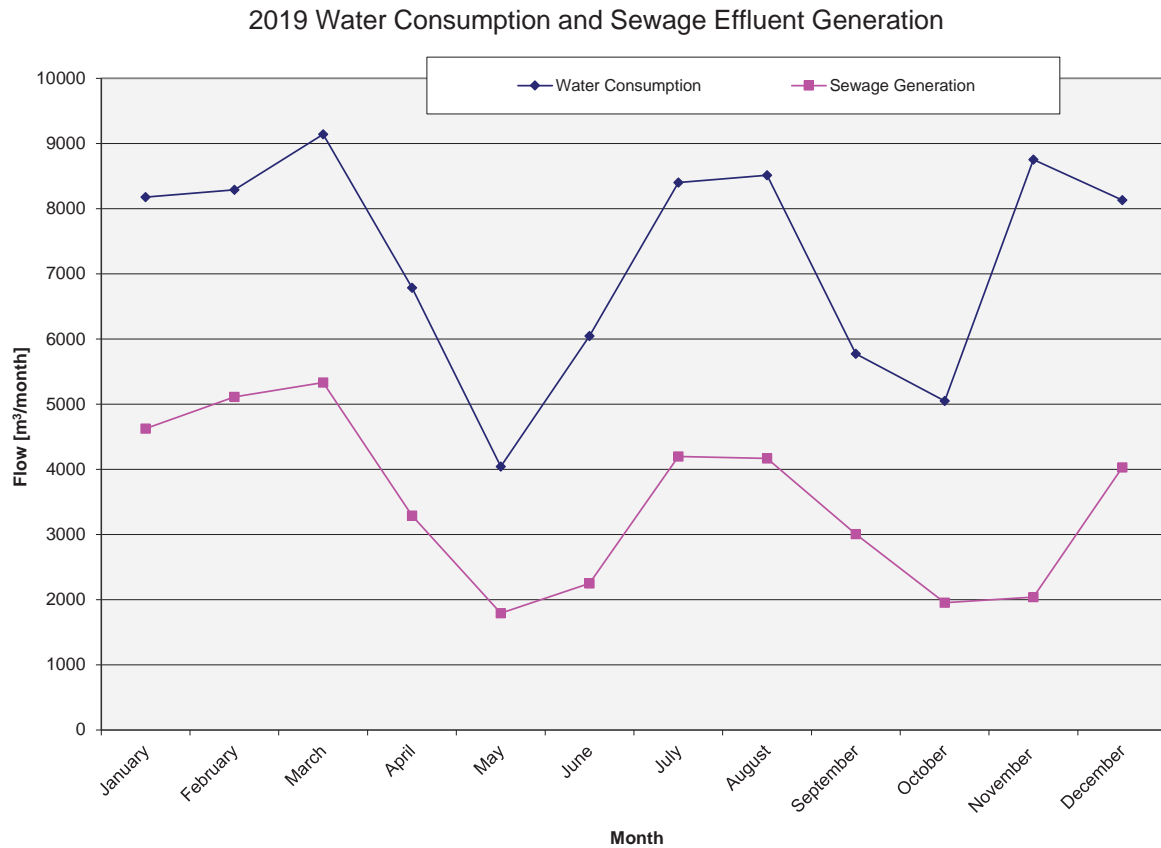
Figure 4

2019 Sewage Effluent Average and Peak Flows by Month



This year, the total effluent discharged was equal to 48.0 % of the total water production, which is similar or lower than during the previous years. Monthly water usage at the hill is compared to the amount of effluent discharged at the WWTP in Figure 5.

Figure 5



## 4.0 SEWAGE FLOW PROJECTION

This section shows projected wastewater flow for 2011 through 2019 based on current development plans and provides an estimate of remaining plant capacity.

Based on unit generation rates provided in the BC Health Act for various lodging types as well as the assumption that wastewater generation would have been similar in 2011 to that calculated in 2015, the estimated highest day wastewater generation for 2011 would have been 705.5 m<sup>3</sup>/day. Using the actual peak flow of 312 m<sup>3</sup>/day, a correction factor of 0.44 was calculated. Averaged correction factor for the last seven years (2012, 2013, 2014, 2015, 2016, 2017, 2018) was also calculated and multiplied by the future estimated flows to more accurately reflect potential resort sewage generation rates. In 2018 the correction factor was 0.37. The correction factor for 2019 was calculated at 0.38 and the average correction factor for 2011 to 2019 was 0.30.

Projected daily peak wastewater flows from 2011 by year were provided in Table 4 for the Resort's planned expansions. The highest water generation for 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 and 2020 was calculated based on the BC Health Act (refer to Table 10 enclosed at the end of this report). The future flows will be re-evaluated as further expansion occurs. The resort is committed to continuing the initiative on introducing a stormwater infiltration program, flow restrictive devices, and other water consumption measures.

Flow restrictive devices are intended to be utilized in all new construction and the infiltration/rehabilitation program is expected to be ongoing. The intent is to reduce the amount of per unit sewage generation and to reduce the amount of ground and surface water infiltration into the sewer system. KHMUC will monitor sewage flows to determine the efficiency of the program.

Even with additional expansion, KHMUC may not require an increase to permit discharge above the current limit of 300 m<sup>3</sup>/day if the flow restriction measures prove to be sustainable. Sewage discharge rates will be monitored and an application will be submitted to increase the maximum daily discharge when warranted.

Based on 2019 flow data, the plant has an unused capacity of 35 m<sup>3</sup>/day (based on an operating limit of 300 m<sup>3</sup>/day) due to the flow saving measures. This still needs to be closely monitored during 2020 and further considered when adding additional development.

Table 4  
Projected Peak Flows: 2011-2019

	2011	2012	2013	2014
<b>Estimated Wastewater Flow (m<sup>3</sup>/day)</b>	705.5*	705.5*	705.5*	705.5
<b>Actual and Corrected (m<sup>3</sup>/day)</b>	312** (a)	159 (a)	165 (a)	146 (a)

	2015	2016	2017	2018
<b>Estimated Wastewater Flow (m<sup>3</sup>/day)</b>	705.5	705.5	705.5	705.5
<b>Actual and Corrected (m<sup>3</sup>/day)</b>	167 (a)	162 (a)	244 (a)	262 (a)

\*the number was calculated based on 2014 occupancy, which is likely overestimated

\*\*the number does not reflect a true peak as all the data was not available during the high flow months

	2019	2020
Estimated Wastewater Flow (m <sup>3</sup> /day)	705.5	707.2
Actual and Corrected (m <sup>3</sup> /day)	265 (a)	212 (b)

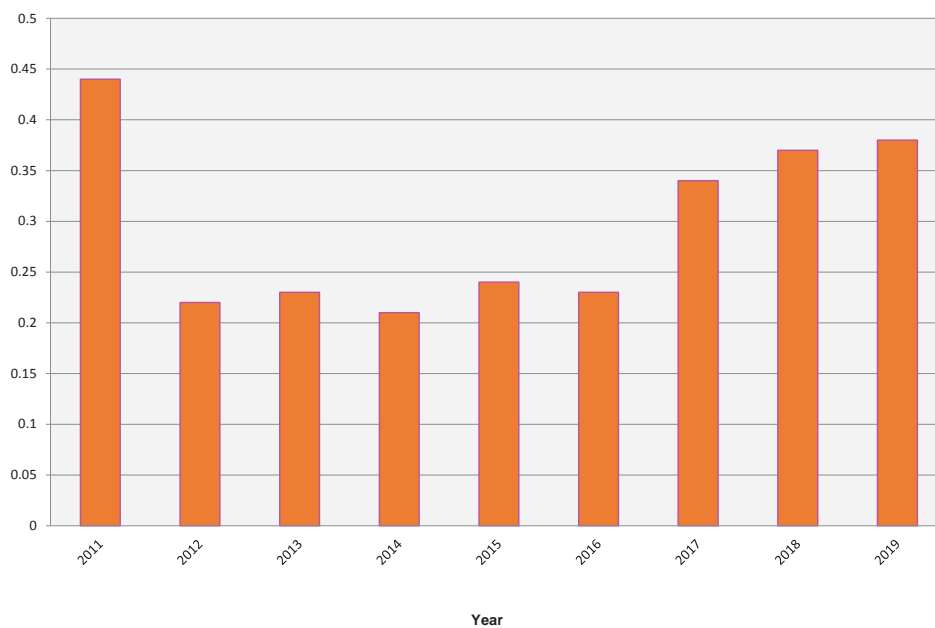
- (a) actual peak flow  
(b) corrected daily peak flows by the averaged correction faction for 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 correction factor:

2011	correction factor of	312*/705.5.	0.44
2012	"	159/705.5	0.22
2013	"	165/705.5	0.23
2014	"	146/705.5	0.21
2015	"	167/705.5	0.24
2016	"	162/705.5	0.23
2017	"	244/705.5	0.34
2018	"	262/705.5	0.37
2019	"	265/705.5	0.38
AVERAGE			0.30

A graph showing estimated vs actual historical peak flows is shown below.

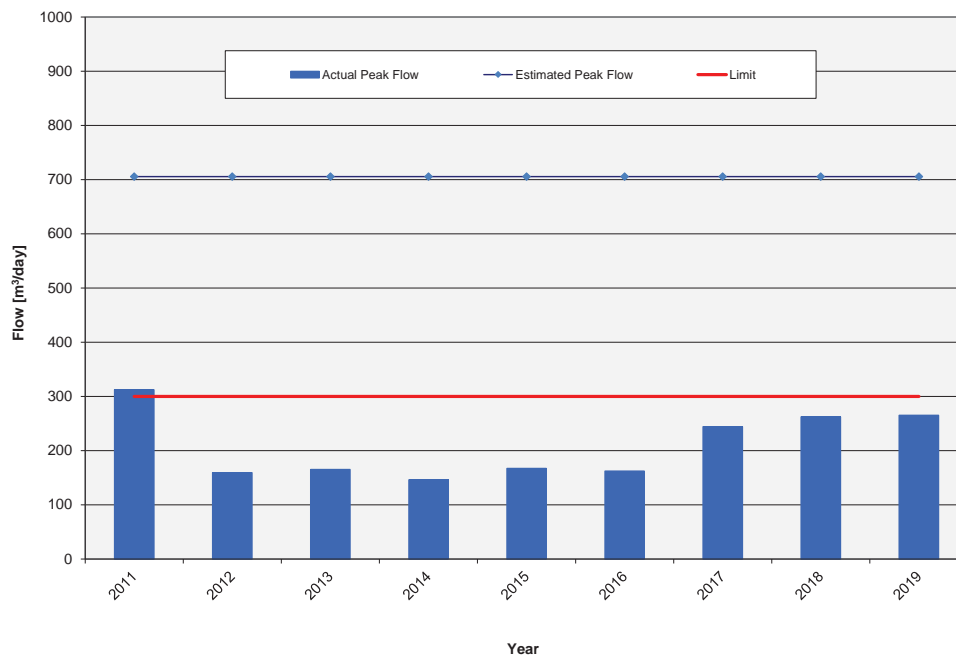
Figure 6a

Historical Correction Factors





**Figure 6b**  
Estimated vs Actual Peak Flows (Historical)



## 5.0 OVERVIEW OF COLUMBIA RIVER SAMPLE RESULTS

This section provides data and analysis for the Columbia River samples taken during 2019.

Table 5 provides a summary record of the Columbia River test results for the period April 15<sup>th</sup> to May 13<sup>th</sup>, 2019 and September 30<sup>th</sup> to October 29<sup>th</sup>, 2019.

Table 5

2019 Columbia River Sample Results

Sample Date yyyy/mm/dd	NH <sub>4</sub> -N			Ortho-P			Fecal Coliform			E.Coli			Total P mg/L		
	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN
2019-04-15	0.050	0.050	0.050	0.005	0.005	0.005	7	1	1	4	0	1	0.012	0.016	0.008
2019-04-22	0.050	0.088	0.050	0.005	0.005	0.005	2	0	0	0	0	0	0.018	0.014	0.014
2019-04-29	0.050	0.050	0.050	0.005	0.005	0.005	18	1	10	9	0	1	0.021	0.009	0.010
2019-05-06	0.050	0.050	0.050	0.005	0.005	0.005	9	0	3	9	0	1	0.007	0.006	0.013
2019-05-13	0.050	0.050	0.050	0.005	0.005	0.005	19	15	13	9	15	9	0.032	0.025	0.073
2019-09-29	0.050	0.050	0.050	0.005	0.005	0.005	2	1	1	2	0	0	0.015	0.007	0.014
2019-10-07	0.050	0.050	0.050	0.005	0.005	0.005	0	1	1	0	1	1	0.009	0.009	0.009
2019-10-15	0.050	0.050	0.050	0.005	0.005	0.005	1	1	0	1	1	0	0.013	0.031	0.016
2019-10-22	0.050	0.050	0.050	0.005	0.005	0.005	1	2	1	1	1	1	0.005	0.009	0.006
2019-10-30	0.050	0.050	0.050	0.005	0.005	0.005	1	2	1	1	1	1	0.005	0.005	0.005
# Samples	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Average	0.050	0.054	0.050	0.005	0.005	0.005	6	2	3	4	2	2	0.014	0.013	0.017
Maximum	0.050	0.088	0.050	0.005	0.005	0.005	19	15	13	9	15	9	0.032	0.031	0.073
Minimum	0.050	0.050	0.050	0.005	0.005	0.005	0.0	0.0	0.0	0.0	0.0	0.0	0.005	0.005	0.005

Sample Date yyyy/mm/dd	Field pH			TSS			NO <sub>3</sub> -N			NO <sub>2</sub> -N			Enterococcus		
	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN	UP	SIDE	DN
2019-04-15	7.8	8.2	7.8	9.0	5.7	4.3	0.119	0.108	0.120	0.010	0.010	0.010	3.1	1.0	0.0
2019-04-22	-	10.2	-	20.3	25.0	14.3	0.126	0.098	0.112	0.010	0.010	0.010	1.0	0.0	1.0
2019-04-29	8.0	11.0	8.0	12.0	8.7	12.7	0.155	0.113	0.139	0.010	0.010	0.010	2.0	0.0	1.0
2019-05-06	8.2	8.0	8.2	7.0	3.7	11.0	0.131	0.107	0.123	0.010	0.010	0.010	1.0	0.0	0.0
2019-05-13	7.8	13.0	7.8	71.7	39.0	183.0	0.176	0.175	0.227	0.010	0.010	0.010	4.0	2.0	1.0
2019-09-29	8.0	0.0	8.0	11.0	11.0	36.3	0.087	0.069	0.092	0.010	0.010	0.010	1.0	0.0	1.0
2019-10-07	7.8	13.0	7.8	11.7	15.7	15.7	0.140	0.071	0.071	0.010	0.010	0.010	-	-	-
2019-10-15	7.8	3.0	7.8	4.7	9.3	6.7	0.092	0.114	0.101	0.010	0.010	0.010	0.0	0.0	5.2
2019-10-22	7.6	5.0	7.6	4.0	3.0	3.0	0.090	0.104	0.105	0.010	0.010	0.010	1.0	2.0	2.0
2019-10-30	-	8.0	-	7.3	9.3	6.7	0.091	0.099	0.100	0.010	0.010	0.010	2.0	1.0	1.0
# Samples	8	10	8	10	10	7	10	10	10	10	10	10	9	9	9
Average	7.9	1.0	7.9	15.9	13.0	29.4	0.121	0.106	0.119	0.01	0.01	0.01	1.7	0.7	1.4
Maximum	8.2	5.0	8.2	71.7	39.0	183.0	0.176	0.175	0.227	0.01	0.01	0.01	4.0	2.0	5.2
Minimum	7.6	4.0	7.6	4.0	3.0	3.0	0.087	0.069	0.071	0.01	0.01	0.01	0.0	0.0	0.0

Green shaded squares show tests reported at less than the stated value, for calculations these are listed as equal to the value stated, ie; <0.05 is assumed to be 0.05

UP – Upstream

SIDE – 1 km downstream of outfall from west shore (winter) and river side channel 350 m downstream of outfall (summer)

DN – Downstream

### ***Fecal coliforms, E-coli and Enterococci***

Elevated Fecal coliforms, E.Coli as well as Enterococci were observed in the side stream samples on May 13<sup>th</sup>. However, low or below detection results were tested in the effluent on the same date. Positive Fecal coliforms, Enterococci and E-coli results were tested in the up-stream and down-stream samples between April 15<sup>th</sup> and May 13<sup>th</sup>; the results in the effluent as well as the side stream were at or below the detection limit.

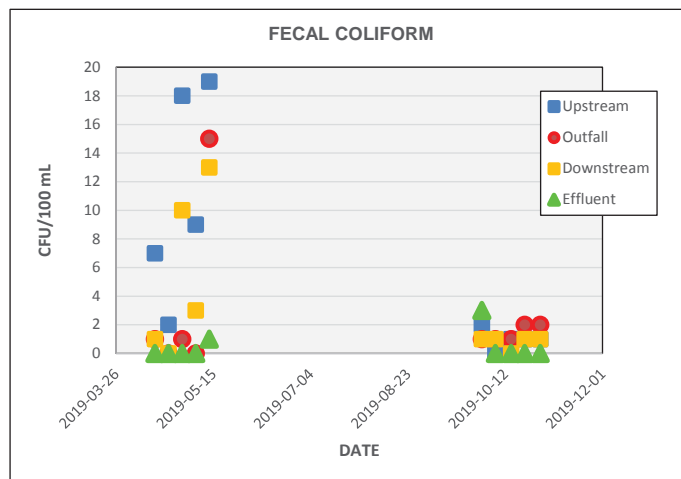
On October 15<sup>th</sup> Enterococci were detected in the downstream river at 5.2 CFU/100 mL, while the results in the effluent, upstream river and the site stream were below the detection limits.

Positive results (2 CFU/100 mL) were recorded sporadically between September 30<sup>th</sup> and October 30<sup>th</sup> for side stream as well as the river upstream and downstream for either parameter. With the exception of Fecal coliform tested at 3 CFU/100 mL on September 30<sup>th</sup> all the effluent results were below the detection limits.

As shown on the graph below the highest Fecal coliform results were recorded in the river upstream.

Figure 7a

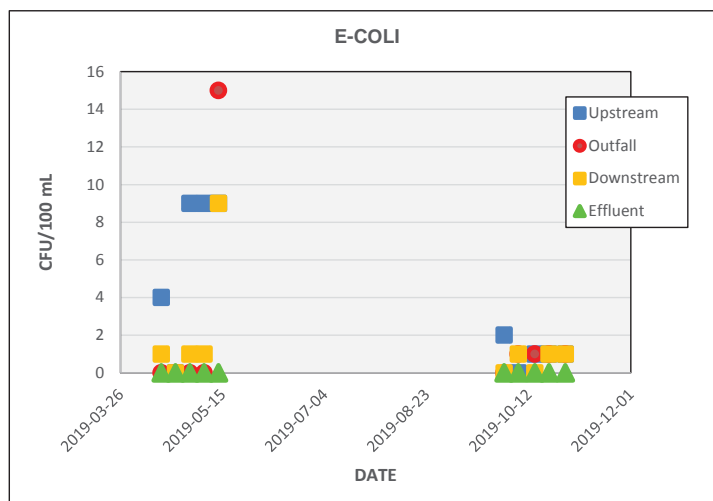
Fecal Coliform Levels in the Columbia River and the Effluent



A graph below shows the highest E-coli results at the outfall followed by the river upstream and downstream.

Figure 7b

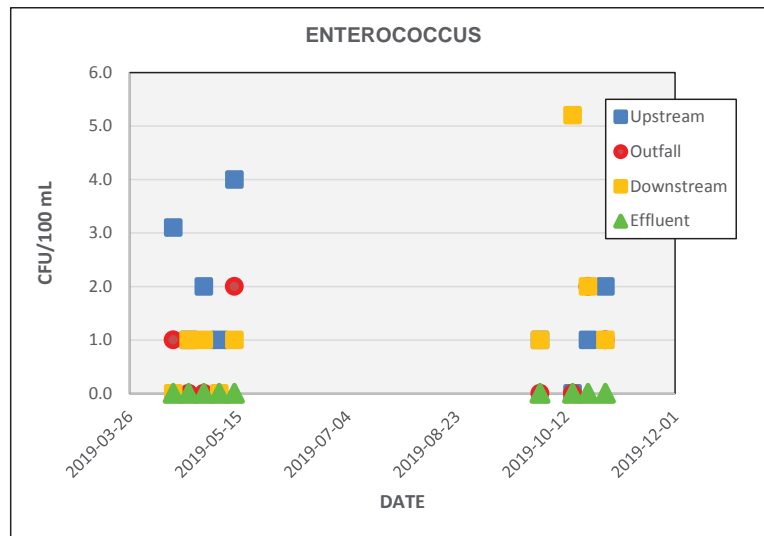
E.Coli Levels in the Columbia River and the Effluent



A graph below shows levels of Enterococci at its highest in the river upstream in the spring and in the river downstream in the fall, note that corresponding levels in the effluent and the outfall are below the detection limits.

Figure 7c

Enterococci Levels in the Columbia River and the Effluent

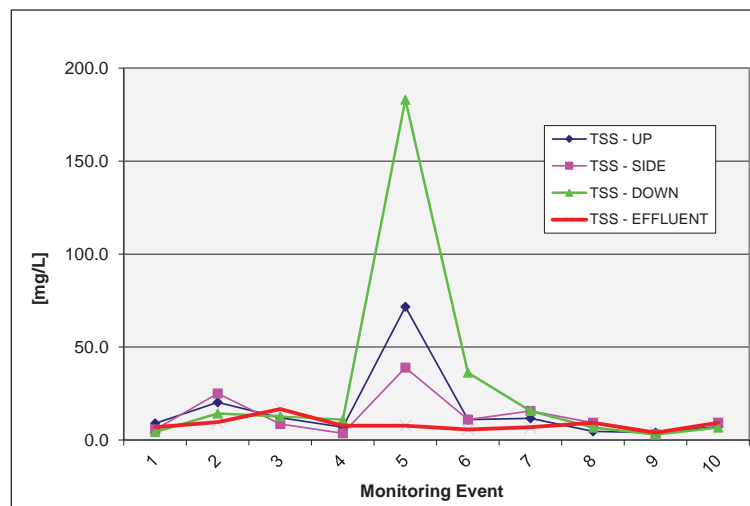


TSS

The highest TSS levels were recorded on May 13<sup>th</sup>, 2019 in the river downstream at 183 mg/L, however, the concentrations in the effluent and the side stream were much lower at 7.7 and 39.0 mg/L, respectively, indicating that the effluent was not likely the source of high TSS results in the river.

Figure 8

TSS Levels in the Columbia River and the Effluent



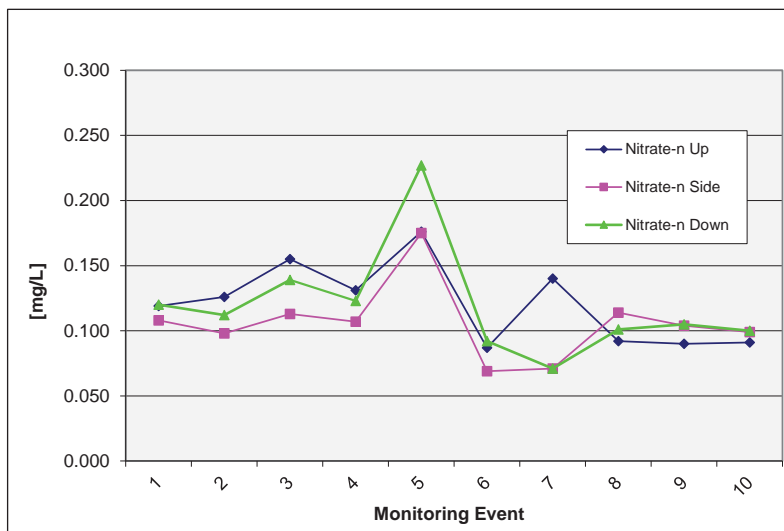
Although another slightly elevated reading was recorded in the river downstream on September 30<sup>th</sup>, 2019 the effluent and side stream results were much lower. Based on the above it was determined that the observed spikes in the river downstream do not correlate with the levels found in the effluent on the same day. Based on the above there were no changes higher than 5 mg/L (B.C. Approved Water Quality Guidelines; Aquatic Life, Wildlife and Agriculture, August 2019; further BC AWQG) between the upstream and downstream values due to the effluent discharge.

#### **Ammonia-N, Nitrate-N and Nitrite-N**

All ammonia-n and nitrite-n levels at the outfall were at or below their respective detection limits. The nitrate-n outfall levels were low with a maximum of 0.227 mg/L on May 13, 2019. The corresponding levels in the river upstream and downstream were 0.176 and 0.175 mg/L. Note that all the downstream results were within the BC AWQG Long Term Chronic threshold at 3.0 mg/L.

**Figure 9**

**Nitrate-N Levels in the Columbia River**



No significant changes were observed in **pH** or **phosphorus** concentrations during any of the river sample periods. In general, ortho-phosphorus values at the outfall and downstream were at or below the respective detection limits. Total phosphorus was highest downstream on May 13, 2019 at 0.073 mg/L with the upstream values at 0.032 and downstream at 0.025 mg/L. pH results in the downstream samples followed closely those in the upstream with no guideline (6.5 – 9.0) exceedance.

Overall, the analyzed concentrations remain constant between the upstream (UP) sampling zone and the downstream (DN) sampling zone. The data indicates that the plant's effluent does not appear to have any adverse effect on background nutrient concentrations in the Columbia River.

## 6.0 OVERVIEW OF EFFLUENT RESULTS

This section provides data and analysis for the effluent (treated) samples and plant flows for 2019.

A total of 18 effluent samples were collected and analysed. Table 6 summarizes effluent test results for 2019.

Table 6

2019 Effluent Results

Date Sampled	2019 Effluent Results Summary												
	Flow	Temp	pH	NH <sub>4</sub> -N	BOD	P-OP04	Coliforms	E.Coli	Total P	TSS	NO <sub>3</sub> -N	NO <sub>2</sub> -N	Enterococci
yyyy/mm/dd	m <sup>3</sup> /d	C		mg/L	mg/L	mg/L	cfu/100ml	cfu/100ml	mg/L	mg/L	mg/L	mg/L	cfu/100ml
2020-01-31	110	-1.0	-	-	2.1	0.670	2	-	0.792	4.7	-	-	-
2020-02-27	228	-5.0	-	-	13.2	0.080	6	6.0	0.554	18.0	-	-	-
2020-04-08	183	-2.0	-	-	4.6	0.136	1	-	0.491	11.7	-	-	-
2019-04-15	127	2.0	6.8	0.064	2.5	0.118	1	1.0	0.332	7.0	16.5	0.043	1.0
2019-04-22	65	6.0	-	0.05	3.0	0.221	1	1.0	0.529	9.7	20.0	0.031	1.0
2019-04-29	69	12.0	7.0	0.05	4.3	0.247	1	1.0	0.789	16.7	15.9	0.028	1.0
2019-05-06	41	10.0	6.8	0.05	2.0	0.347	1	1.0	0.546	7.7	16.3	0.052	1.0
2019-05-13	54	6.0	7.0	0.05	2.0	0.187	1	1.0	0.351	7.7	13.7	0.026	1.0
2020-06-24	142	11.0	-	-	2.0	0.256	1	-	0.3	3.0	-	-	-
2020-07-22	100	11.0	-	-	2.0	0.398	1	-	0.526	3.0	-	-	-
2020-09-04	90	7.0	-	-	6.6	0.064	1	1.0	0.296	8.4	-	-	-
2019-09-30	70	-2.0	6.6	0.059	2.0	0.384	3	1.0	0.457	5.7	21.4	0.141	1.0
2019-10-07	50	2.0	6.5	0.050	2.0	0.362	1	1.0	0.531	7.0	27.7	0.039	-
2019-10-15	144	-2.0	7.0	0.152	2.4	0.708	1	1.0	1.000	9.3	19.7	0.892	1.0
2019-10-22	56	3.0	7.0	0.050	2.0	0.213	1	1.0	0.366	4.0	12.9	0.014	1.0
2019-10-29	49	-13.0	7.0	0.050	2.0	0.144	1	1.0	0.43	9.3	15.4	0.010	1.0
2020-11-28	59	-17.0	-	-	2.0	0.179	1	-	0.309	6.3	-	-	-
2020-12-17	128	-7.0	-	-	2.4	0.298	1	-	0.393	3.0	-	-	-
# Samples	18	18	9	10	18	18	18	12	18	18	10	10	9
Average	98	1.2	6.9	0.063	3.3	0.277	1	1.2	0.506	7.9	18.0	0.128	1.0
High	228	12.0	7.0	0.152	13.2	0.708	6	6.0	1.000	18.0	27.7	0.892	1.0
Low	41	-17.0	6.5	0.050	2.0	0.064	1	1.0	0.296	3.0	12.9	0.010	1.0
Limit	300	N/A	N/A	N/A	45	0.5	200	77	1	45	N/A	N/A	20
# Over Limit	0	N/A	N/A	N/A	0	2	0	0	1	0	N/A	N/A	0

1. Shaded squares show tests reported at less than the stated value, for calculations these are listed as equal to the value stated, ie; <0.05 is assumed to be 0.05

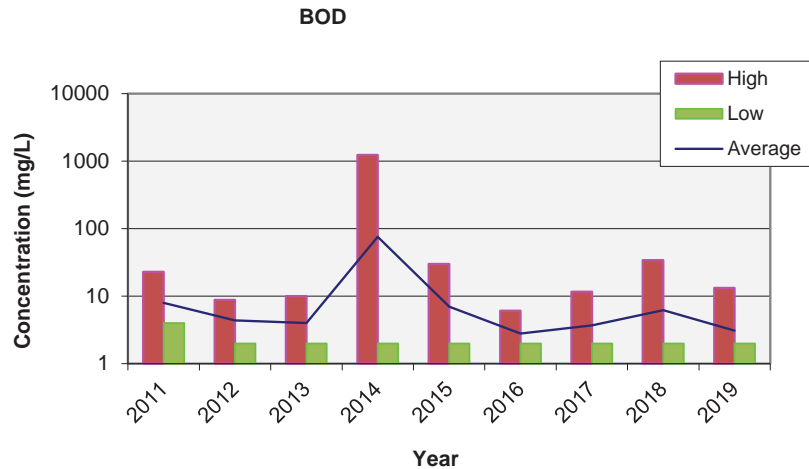
2. Geometric mean is used for coliform results

## 6.1 RESULTS ANALYSIS

Effluent **ammonia-n** concentrations were generally low (slightly above or at/below the detection limit) throughout the year with an elevated result on October 15<sup>th</sup>, 2019 at 0.152 mg/L. The results for ammonia-nitrogen were comparable to those in previous years.

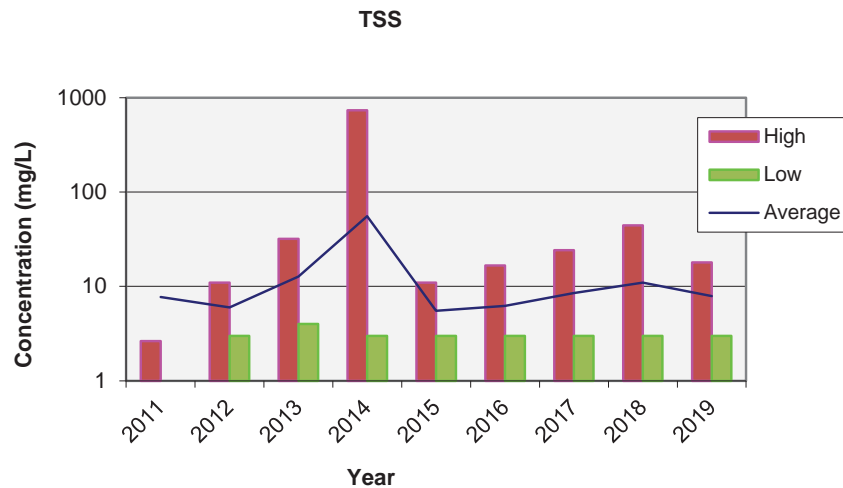
The average **BOD** in the effluent was low at 3.1 mg/L, which is same or lower than the prior years. The highest BOD results were recorded in the effluent on March 7<sup>th</sup>, 2019 at 13.2 mg/L, however, BOD was below the MSR limits for all the samples.

Figure 10



**TSS** results averaged at 7.8 mg/L with a maximum concentration of 18.0 mg/L, both which were similar to or lower than the results during the previous years. TSS was below the MSR limits for all the samples.

Figure 11

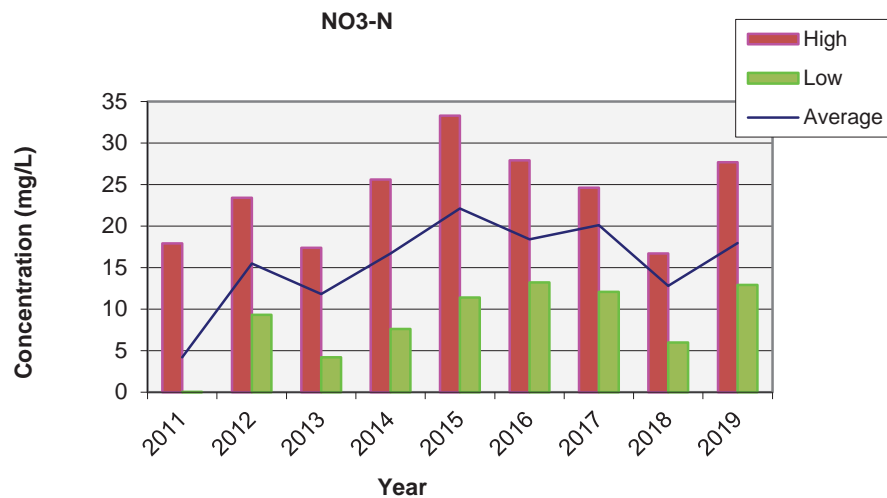


**Nitrate-N** averaged in the effluent at 18.0 mg/L with a maximum concentration at 27.7 mg/L on October 7<sup>th</sup>, 2019. As shown on the graph below the average and maximum values were higher than in 2018 and similar to 2014 to 2017.

**Nitrite-N** averaged in the effluent at 0.128 mg/L with a maximum concentration at 0.89 mg/L on October 15<sup>th</sup>, 2019. The 2019 results were higher compared to the 2018 results at 0.041 and 0.074 mg/L.

Note that nitrate-n levels in the river downstream were similar to the upstream values. All nitrite-n values in the river downstream were at or below the detection limit.

Figure 12



#### **Fecal Coliforms and E-coli**

Majority of the results for fecal coliforms were below the detection limits with the exception of slightly elevated results on January 31<sup>st</sup>, March 07<sup>th</sup> and September 30<sup>th</sup>, 2019. All the results were below the MSR limits.

All E-coli test results were below the detection limits on the day of the testing with slightly positive result on February 27<sup>th</sup>, 2019, all the results were below the MSR limits.

#### **Enterococci**

All the results were at or below their respective detection limits and, therefore, below the MSR limit.

#### **Phosphorus and Ortho-phosphorus**

Only two out of 18 samples for ortho-phosphorus as well as one for phosphorus exceeded the MSR discharge limits in 2019, which is significantly lower than during previous years.

The 2019 average for total phosphorus for 2019 was 0.506 mg/L, which was significantly lower than in 2018 with average at 7.55 mg/L or compared to 1.20 mg/L in 2017, 1.07 mg/L in 2016, 2.77 mg/L in 2015, 2.43 mg/L in 2014, 1.65 mg/L in 2013 and 0.97 mg/L in 2012. (However, note that 2018 average phosphorus value would be 0.61 mg/L if the December 27<sup>th</sup> result was not considered; this high results could have been due to a sampling error).

The 2019 average for ortho-phosphorus was 0.277 mg/L, which is significantly lower than in 2018 at 0.485 mg/L or 0.91 mg/L in 2017, 0.88 mg/L in 2016, 2.37 mg/L in 2015, 2.18 mg/L in 2014, 1.26 mg/L in 2013 and 0.67 mg/L in 2012.



Six results for ortho-phosphorus and four results for phosphorus exceeded the MSR limits in 2018. Twelve samples out of sixteen for ortho phosphorus and eleven out of sixteen for total phosphorus were above MSR discharge limits in 2017. Ten samples out of fourteen for ortho phosphorus and six out of fourteen for total phosphorus were over the limits in 2016. Ten samples out of ten for ortho phosphorus and nine out of ten samples for total phosphorus were over the limits in 2015. Ten samples for ortho phosphorus and eight samples for total phosphours were over the limits in 2014. Nine samples for ortho phosphorus and seven samples for total phosphorus were over the limits in 2013 and five samples for total and ortho phosphorus were over the limits in 2012. Only one sample for total phosphorus was over the limit in 2011. In 2009 and 2010, there were no exceedances for total phosphorus or ortho phosphorus. Phosphorus is further discussed in Section 11. Phosphorus levels are under review and KHMUC will continue to modify and adjust dosing of ClearPac until all the test results show levels within the allowable limits.

The bioassay toxicity testing was not completed this year as it is to be done every 3 years and the testing is planned for 2020. The most recent testing showed that plant effluent was non-toxic. The results of the 2017 tests are shown below in Table 7.

Table 7

Toxicity Test Results

Sample Date	Result
2017-11-21	Pass

## 6.2 COMPLIANCE SUMMARY

Table 8 summarizes the number of days that samples exceeded MSR effluent requirements.

Table 8

2019 MSR Parameter Compliance

Parameter	Unit	MSR Limit	No. Of Samples	Average Value	Max. Value	Samples Over Limit
Flow	m <sup>3</sup> /day	300	365	114	265	0
BOD <sub>5</sub>	mg/l	45	18	3.1	13.2	0
TSS	mg/l	45	18	7.8	18.0	0
Total Phosphorus	mg/l	1	18	0.506	1	1*
Ortho Phosphate	mg/l	0.5	18	0.277	0.71	2*
Fecal Coliforms	CFU/100ml	200	18	1	6	0
Enterococci	CFU/100ml	20	10	<1	1	0
E.Coli	CFU/100ml	77	12	1.2	6	0
96 hr LC <sub>50</sub> Bioassay**	/	Non-toxic	1	Pass	Pass	0

\*This year the test results indicated that out of all the samples collected there were 2 exceedances for ortho-phosphorus and 1 exceedance for total phosphorus.

\*\*The most recent test was done at the end of 2017; the next test will be completed in 2020

## 7.0 SLUDGE PRODUCTION AND DISPOSAL

This section provides data regarding the disposal of bio-solids (sludge) from the treatment facility in 2019.

Waste activated sludge used to be stored in a thickener and removed by a vacuum tanker. In the fall of 2014, a 12 unit Teknofanghi (Model Number 12BCAVPK) supplied by Drycake was installed and was commissioned in mid-December. All solids were transported to the Crowsnest/Pincher Creek Landfill site.

Hauling data for pumped solids are in Table 9.

Table 9

2019 Pumped Solids Data

Month	Vol. Pumped (m <sup>3</sup> )
January	248
February	244
March	311
April	133
May	77
June	24
July	66
August	90
September	75
October	94
November	94
December	104
<b>Total</b>	<b>1533</b>

Volumes of sludge are currently being estimated by counting the quantity of bags produced. Long range plans call for the installation of a flow meter to better measure the quantity of sludge bagged.

Please note, the calculations for bagged solids are being reviewed to ensure consistency.

## **8.0 PLANT IMPROVEMENTS & BYPASS EVENTS**

The resort is committed to improvements to the phosphorus monitoring program and to implement further monitoring and increase dosage of clearpac. The resort will continue to address the phosphorus concern and bring phosphorus levels down.

KHMUC will undertake an assessment in the next year to determine the plant's capacity to accommodate additional growth.

KHMUC will be looking into purchasing a new flow meter for the sludge and they will calibrate their flow meter for the effluent.

There were no bypass events for 2019.

## 9.0 PHOSPHORUS REMOVAL

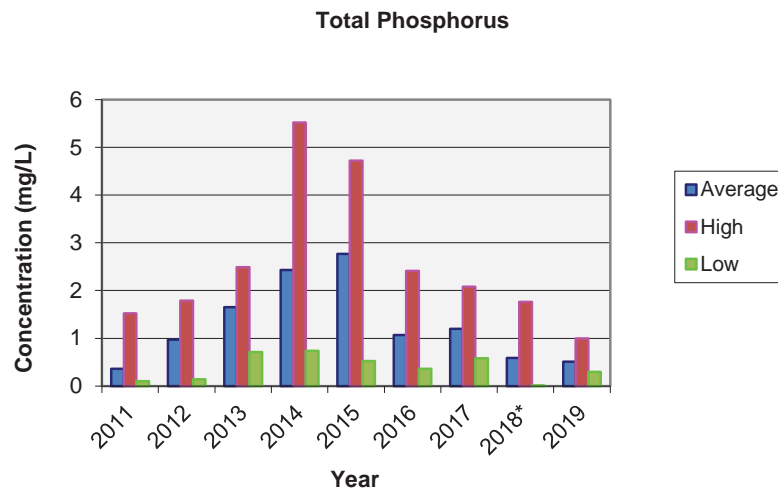
This section describes the phosphorus monitoring and removal strategy being implemented to bring the plant into compliance with effluent limits.

During 2019 total phosphorus varied between 0.296 and 1.000 mg/L with an average value at 0.506 mg/L.

As seen in the graphs below, the levels of phosphorus were increasing from 2011 until 2015 and there had been a slight decrease since 2015. The values in 2019 were low with the maximum value at its lowest ever and average value just slightly above the 2011 level. The highest values were recorded in January and October 2019.

The average total phosphorus in 2011 was 0.36 mg/L, 0.97 mg/L in 2012, 1.65 mg/L in 2013, 2.43 mg/L in 2014, 2.77 mg/L in 2015, 1.07 mg/L in 2016, 1.20 mg/L in 2017. Note that on December 27<sup>th</sup>, 2018 high phosphorus value was tested resulting in very high yearly average at 7.55 mg/L. This value was likely a sampling error; without the high result being included, the 2018 yearly average would be 0.61 mg/L which is consistent with historical levels as shown on the following graph.

Figure 13  
Total Phosphorus Levels 2011-2019



During 2019 ortho-phosphorus varied between 0.064 and 0.708 mg/L with an average value at 0.277 mg/L.

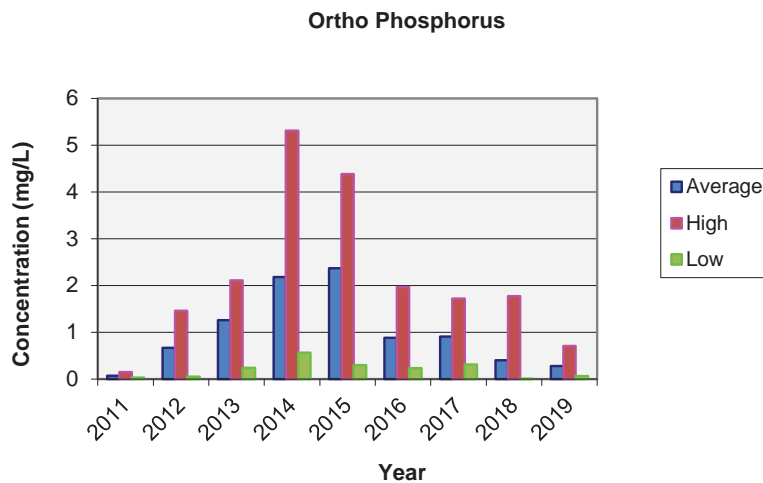
The historical levels of ortho-phosphorus were increasing until they peaked in 2014/2015, there has been a decreasing trend since. The average ortho-phosphorus in 2011 was 0.07 mg/L, 0.67 mg/L in 2012, 1.26 mg/L in 2013, 2.18 mg/L in 2014, 2.37 mg/L in 2015, 0.88 mg/L in 2016, 0.91 mg/L in 2017 and lower in 2018 at 0.48 mg/L. The days over limit for ortho phosphorus were increasing from 2011 to 2014 and then were fairly consistent for several years (10 days over limit for 2014, 2015 and 2016), increased again in 2017 at 12 days over the limit and then decreased to 6 days over the limit in 2018. The days over limit for total phosphorus increased from 2011 until 2015, decreased in 2016, increased to 11 days over the limit in 2017 and decreased again to four days over the limit in 2018.

In the fall of 2015 KHMUC began injecting alum into the effluent to reduce the phosphorus levels in the plant effluent. There was a noticeable drop in the levels in the final EMS test run in 2015.

Beginning in December 2016, KHMUC switched to ClearPac addition in the winter months to control phosphorus. In 2019 ClearPac was used year round. Phosphorus levels are under review and KHMUC will continue to modify and adjust dosing of ClearPac until all the test results show levels within the allowable limits. Note that the levels in 2019 have been the lowest since 2011.

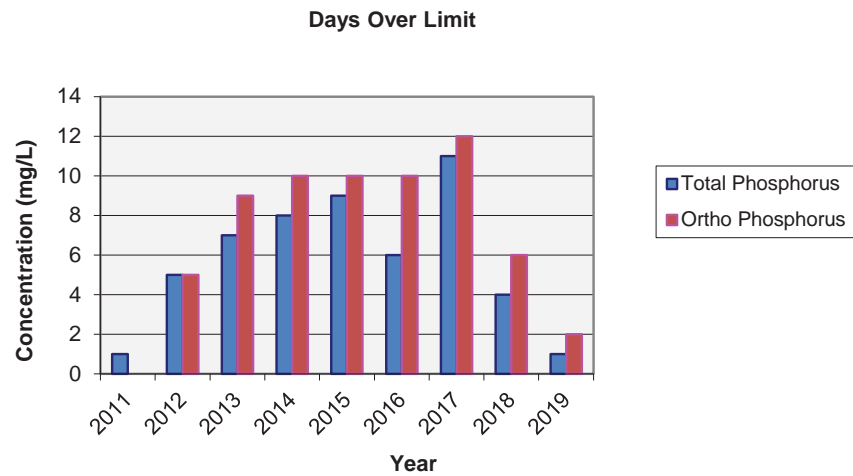
Additionally, KHMUC will continue to test total phosphorus and ortho phosphorus with the monthly effluent sampling. This will help to monitor the levels on an ongoing basis and help to determine dosage levels. KHMUC has also agreed to collect a laboratory sample in first week of January going forward in order to better characterize/monitoring the effluent during the peak capacity. It is also recommended that as soon as very high results are found, samples be collected immediately and submitted for testing to ensure the levels drop below the allowable limits.

Figure 14  
Ortho-Phosphorus Levels 2011-2019



Historical limits exceedance is shown on the graph below, the 2019 exceedances for both total phosphorus and ortho-phosphorus are the lowest since 2011 indicating the current phosphorus reduction strategy has been successful.

**Figure 15**  
**Days over Limit 2011-2019**



## 10.0 ASSESSMENT SUMMARY

The total effluent flow recorded for 2019 was 41,785 m<sup>3</sup> with an average of 114 m<sup>3</sup>/day and a maximum peak flow at 265 m<sup>3</sup>/day. There were no days where the flow was over the allowable limit.

The average **BOD** in the effluent was low at 3.1 mg/L, which is same or lower than the prior years. The highest BOD results were recorded in the effluent on March 7<sup>th</sup>, 2019 at 13.2 mg/L, however, BOD was below the MSR limits for all the samples.

**TSS** results averaged at 7.8 mg/L with a maximum concentration of 18.0 mg/L, both which were similar to or lower than the results during the previous years. TSS was below the MSR limits for all the samples.

### **Fecal Coliforms and E-coli**

Majority of the results for fecal coliforms were below the detection limits with the exception of slightly elevated results on January 31<sup>st</sup>, March 07<sup>th</sup> and September 30<sup>th</sup>, 2019. All the results were below the MSR limits.

All E-coli test results were below the detection limits on the day of the testing with slightly positive result on February 27<sup>th</sup>, 2019, all the results were below the MSR limits.

### **Enterococci**

All the results were at or below their respective detection limits and, therefore, below the MSR limit.

### **Nitrogen**

Effluent ammonia-n concentrations were generally low (slightly above or at/below the detection limit) throughout the year with an elevated result on October 15<sup>th</sup>, 2019 at 0.152 mg/L. The results for ammonia-nitrogen were comparable to those in previous years.

Nitrate-N averaged in the effluent at 18.0 mg/L with a maximum concentration at 27.7 mg/L on October 7<sup>th</sup>, 2019. As shown on the graph below the average and maximum values were higher than in 2018 and similar to 2014 to 2017. Nitrite-N averaged in the effluent at 0.128 mg/L with a maximum concentration at 0.89 mg/L on October 15<sup>th</sup>, 2019. The 2019 results were higher compared to the 2018 results at 0.041 and 0.074 mg/L. Note that nitrate-n levels in the river downstream were similar to the upstream values. All nitrite-n values in the river downstream were at or below the detection limit.

### **Phosphorus and Ortho-phosphorus**

During 2019 total phosphorus varied between 0.296 and 1.000 mg/L with an average value at 0.506 mg/L. The levels of phosphorus were increasing from 2011 until 2015 and there had been a slight decrease since 2015. The values in 2019 were low with the maximum value at its lowest ever and average value just slightly above the 2011 level.

During 2019 ortho-phosphorus varied between 0.064 and 0.708 mg/L with an average value at 0.277 mg/L. The historical levels of ortho-phosphorus were increasing until they peaked in 2014/2015, there has been a decreasing trend since.

In the fall of 2015 KHMUC began injecting alum into the effluent to reduce the phosphorus levels in the plant effluent. There was a noticeable drop in the levels in the final EMS test run in 2015. Beginning in December 2016, KHMUC switched to ClearPac addition in the winter months to control phosphorus. In 2019 ClearPac was used year round. Phosphorus levels are under review and

KHMUC will continue to modify and adjust dosing of ClearPac until all the test results show levels within the allowable limits. Note that the levels in 2019 have been the lowest since 2011.

Only two out of 18 samples for ortho-phosphorus and one for phosphorus exceeded the MSR discharge limits in 2019, which is significantly lower than during previous years and actually the lowest since 2011 indicating the current phosphorus reduction strategy has been successful.

KHMUC will continue to test total phosphorus and ortho-phosphorus with the monthly effluent sampling. This will help to monitor the levels on an ongoing basis and help to determine dosage levels.

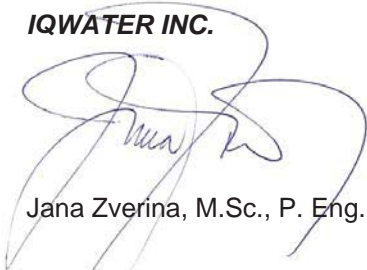
A small 26 unit subdivision was proposed and construction started in 2014. Out of the 26 units approved, Phase 1 (8 units) and Phase 2 (8 units) are now completed. Phase 3 (10 units) is currently being scheduled for construction. Flows should be monitored closely and additional improvements may be required as growth at the resort continues.



## 11.0 AUTHORIZATION AND CLOSING

This report, titled *2018 Sewage Treatment Plant Annual Report*, was prepared for KHMUC by IQWater Inc. The material in this report reflects the best judgement of IQWater Inc. based on the information available at the time of preparation. Any use that a third party makes of this report, or reliance on or decisions based on it, is the responsibility of the third party. IQWater Inc. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions taken based on this report.

**IQWATER INC.**

A handwritten signature in blue ink, appearing to read 'Jana Zverina', is written over a large, faint, circular watermark or stamp.

Jana Zverina, M.Sc., P. Eng.

iqw/jobs/W2020-020

## 12.0 REFERENCES

- American Public Health Association, American Water Works Association and the Water Environment Federation: Standard Methods for Examination of Water and Wastewater
- American Public Health Association, American Water Works Association and Water Environment Federation. Standard Methods for the Examination of Water and Wastewater. 23<sup>rd</sup> Edition
- BC Environmental Management Act, Municipal Wastewater Regulation B.C. Reg. 87/2012, last Amended April 1<sup>st</sup>, 2018 by B.C. Reg. 46/2018
- BC Ministry of Health, Health Protection Branch, Sewerage System Standard Practice Manual, Version 3, September 2014
- BC Ministry of Environment & Climate Change Strategy, British Columbia Approved Water Quality Guidelines; Aquatic Life, Wildlife and Agriculture, August 2019
- Canadian Council of Ministers of the Environment. Canadian Water Quality Guidelines for the Protection of Aquatic Life
- Canadian Council of Ministers of the Environment. Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses
- Canadian Council of Ministers of the Environment. Protocols Manual for Water Quality Sampling in Canada. 2011
- Health Canada. Guidelines for Canadian Drinking Water Quality. June 2019

### 13. TERMS AND CONDITIONS

1. Our reports are prepared to specifically fulfil our Clients' requirements. The conclusions are based on the time limitations and scope of the services provided and information obtained from those services. The Inspector certifies that he/she has no present or contemplated future interest in the inspected property.
  2. IQWATER INC. will provide skill, care and diligence in accordance with generally accepted engineering practices and procedures at the time and location in which the services are performed. With time, conditions may change and the interpretation of the findings may be altered.
  3. IQWATER INC. cannot assume responsibility for any deficiency, misstatement or inaccuracy in the report resulting from the omissions or misrepresentations of persons providing information to use in the report. Any sketch appearing in or attached to the inspection report, or any statement of dimensions, capacities, quantities, or distances, are approximate and are included to assist the reader in visualizing the property.
  4. The contents of the report are for the sole use of the Client. The report is the property of the Client and copies shall only be made by the Client or with the approval of the Client. IQWATER INC. is not responsible for any use of information contained in the report, or any reliance or decisions made based on it by an unauthorized third party.
  5. This report represents the conditions investigated and sampled at the time of study. Some of the services performed were based on visual observations of the site and the areas surrounding the site, and our opinion cannot be extended to areas that were unavailable for direct observation.
  6. The Client is responsible for all permits, authorization, or consents and giving any required notices that enable EDI to perform the services required.
- IQWATER INC. may use any contractor with appropriate recognized professional status or with special skills or knowledge to assist in performing the services, at the expense of the client.
7. Any documents provided to IQWATER INC. from the Client will remain the property of the Client, and upon written request IQWATER INC. will return such documents as soon as possible. Any information or documents obtained by IQWATER INC. while performing the services requested will remain the property of IQWATER INC.
  8. IQWATER INC. and the client will take reasonable care to prevent any disclosure of the reports or documents, or any information obtained or contained in the reports prepared by IQWATER INC., unless it is to the persons who require such access to the information in order to discharge their responsibilities to IQWATER INC. or as required by law.
  9. This report is not intended to have any direct effect on the value of the property, but rather to provide information on apparent site conditions. The Client acknowledges that IQWATER INC. is not making any recommendations with respect to the purchase, sale, investment, or development of the property; and that all decisions associated therewith are the sole responsibility and liability of the Client. Further, EDI assumes no responsibility for matters of legal nature affecting the property or title thereto.
  10. Limits of Liability – To the fullest extent permitted by law, and notwithstanding any other provision of the Service Agreement between the Client and IQWATER INC., total liability, in the aggregate, of IQWATER INC. and the IQWATER INC. officers, directors, partners, employees and sub-consultants, and any of them, to the Client and anyone claiming by or through the Client, for any and all claims, losses, costs or damages, including attorneys' fees and costs and expert-witness fees and costs of any nature whatsoever or claims expenses resulting from or in any way related to the Project shall not exceed the limit of IQWATER's insurance in effect at the time of this report.
  11. In accepting and using this report the Client agrees to indemnify and hold harmless IQWATER INC., its officers, partners, employees and consultant (collectively IQWATER INC.) from and against any and all claims, suits, demands, liabilities, losses, damages or costs, including reasonable attorney's fees and defence costs arising out of or in any way connected to the findings and results of the proposed work, whether liability arises under breach of contract or warranty, tort, including negligence, strict liability or statutory liability or any other cause of action.
  12. IQWATER INC. will exercise due diligence, however, IQWATER INC. will not assume any liability for any damage to any facilities, utilities, ground or above-ground surface infrastructure within or outside the subject property boundary since any sampling if needed is intrusive in nature and damage may have to be done to obtain samples.
  13. IQWATER INC. will not assume any responsibility for any actual or perceived loss of business to owner's operations as a result of the work proposed herein.
  14. The governing law for this contract will be the Alberta law.
  15. All claims of costs, losses, damages, etc. have to be immediately forward to IQWATER INC. insurance

Table 10 - Kicking Horse Mountain Resort Estimated Sewage Generation (m3/day)

Current Development	Flow* (l/unit/day)	Units	2018 Generation (m3/day)	2019 Generation (m3/day)	Flow* (l/unit/day)	Units
Single Family	318	972	309.1	309.1	1300	98
Duplexes & Triplexes	318	see single family	see single family	see single family	1000	112
Lodges (EBU)	318	296	94.1	94.1	700	296
Condominiums	318	952	302.7	302.7	1000	155
	Subtotal	2220	706.0	706.0	Subtotal	661

Commercial	Flow* (l/unit/day)	Unit	2011 Generation (m3/day)	2018 Generation (m3/day)	Flow* (l/unit/day)	Units
Administration	75	20	0	0.0	57	20
Other (day care, shops etc.)	20	5	0	0.0	20	5
	Subtotal	5	0	0.0	Subtotal	5

Dining Facilites/Bars	Flow* (l/m <sup>2</sup> /day)	Area (m2)	2011 Generation (m3/day)	2018 Generation (m3/day)	Flow* (l/m <sup>2</sup> /day)	Area (m2)
Peaks Grill	97	256	0	0.0	97	256
Double Black	97	190	0	0.0	97	190
Whitetooth Grill	97	300	0	0.0	97	300
Copperhorse Steak House	97	110	0	0.0	97	110
Winston	97	220	0	0.0	97	220
	Subtotal	1076	0	0.0	Subtotal	1076

Daily Wastewater Flow (m3/day)*	705.5	705.5
Corrected Daily Peak Flow Projections**	262 (actual)	265 (actual)

\*Estimated Wastewater Flows - Residential and Non-residential Daily Flows  
Note that the occupancy significantly varies throughout the year with near full occupancy only during the ski season and during the long weekends.



April 28, 2005

File: RE-15474

**REGISTERED MAIL**

Kicking Horse Mountain Sanitary Sewer Services Ltd.  
2100- 1075 W. Georgia Street  
Vancouver, BC V6E 3G2

Attn: Arijan van Vuure

Dear Mr. van Vuure:

**Re: Letter of Transmittal for Registration under the *Municipal Sewage Regulation* of the discharge to Columbia River from the Kicking Horse Mountain Resort located at Unsurveyed Crown land in the vicinity of Section 9, together with those parts of the Northwest  $\frac{1}{4}$  of Section 14 and 15, all of Township 27, R22 West of 5<sup>th</sup> Meridian, and Unsurveyed Crown Foreshore, being part of the Columbia River, Kootenay District**

Enclosed herewith is a copy of the registration letter RE-15474 in the name of the Kicking Horse Mountain Sanitary Sewer Services Ltd. Your attention is respectfully directed to the conditions outlined in the registration letter.

In addition to the registration letter and the terms and conditions of the Environmental Impact Study, dated November 20, 2000, you are directed to comply with the following requirements:

**A. Outfall**

The outfall shall consist of a permanent outfall with diffusers.

The permittee shall have the outfall inspected once each five years by independent qualified personnel to ensure it is in good working condition. An inspection report shall be submitted to the Regional Manager, Environmental Protection within 30 days after the inspection date. The first report shall be submitted by January 2006.

...2

B. Environmental Monitoring

In accordance with Part 7, Section 26 and 27 and applicable conditions of Schedule 6 of the *Regulation*, the discharger shall undertake the discharge and receiving environment monitoring programs established by Masse & Miller Consulting Ltd., in their letter dated February 17, 2005.

The person collecting samples shall be properly trained in sample collection and handling.

C. Reporting non-compliances


The discharger is required to report instances of non-compliance within 15 days of the date of discovery. The discharger is required to provide a report of actions taken to remediate non-compliance within 30 days from the start of non-compliance.

D. Financial Security requirements

The discharger is required to notify the Ministry and to set up either a capital replacement fund or financial security or assurance plan when the residential development content, as defined by the *regulation*, exceeds 10%.

The administration of this registration, including periodic inspections and audits shall be carried out by staff from our sub-regional office located at 205 Industrial Road G, Cranbrook, BC, V1C 7G5. Any required information may be submitted to the Regional Manager, Environmental Protection at this address in lieu of the Director.

Yours truly,



Kathy Eichenberger, P.Eng.  
for Director, *Environmental Management Act*  
Kootenay and Okanagan Regions

AMT/KE:lkmm

cc: Environment Canada  
Kicking Horse Mountain Sanitary Sewer Services Ltd., 1500 Kicking Horse Trail, PO  
Box 839, Golden, BC V0A 1H0, Attn: John Urie  
Ecofluid, #101-334 E. Kent Ave. South, Vancouver, BC V5X 4N5 Attn: Rolf Loker, VP  
& Manager of Operations  
Ana C. May Tsui, MWLAP-Environment Protection, Cranbrook





April 28, 2005

File: RE-15474

**REGISTERED MAIL**

Kicking Horse Mountain Sanitary Sewer Services Ltd.  
2100-1075 W. Georgia Street  
Vancouver, BC V6E 3G2

Attn: Arijan van Vuure

Dear Mr. van Vuure:

Re: Registration under the Municipal Sewage Regulation of the discharge to Columbia River from the Kicking Horse Mountain Resort located at Unsurveyed Crown land in the vicinity of Section 9, together with those parts of the Northwest  $\frac{1}{4}$  of Section 14 and 15, all of Township 27, R22 West of 5<sup>th</sup> Meridian, and Unsurveyed Crown Foreshore, being part of the Columbia River, Kootenay District

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Receipt of the completed Municipal Sewage Regulation registration form for the subject discharge is acknowledged. Pursuant to Part 2, section 3 of the Municipal Sewage Regulation, the effective date of registration of this discharge is November 24, 2000. The ministry file number for this discharge is RE-15474. Please indicate this number on all future correspondence regarding this discharge.

An annual registration fee will be determined according to the Waste Management Permit Fees Regulation and you will be receiving an annual invoice from the ministry for payment of this fee. Payment of all fees due is necessary to comply with the Municipal Sewage Regulation. Fees will be calculated using a maximum daily effluent discharge of 300 m<sup>3</sup>/day, a maximum BOD<sub>5</sub> of 45 mg/L and a maximum TSS of 45 mg/L.

Acceptance of this registration under the Regulation is based on the following documents:

1. Kicking Horse Mountain Resort Ltd. Partnership, Registration Form dated November 24, 2000 and submitted by McElhanney Consulting Services Ltd.
2. Environmental Impact Study entitled Kicking Horse Mountain Resort – Environmental Impact Study for Sewage Treatment and Disposal, dated November 20, 2000, prepared by Western BioResources Consulting Ltd. and signed by Christopher Bullock, P.Eng.

... 2

Pursuant to Part 2, Section 3 (2) (k) of the Municipal Sewage Regulation, more stringent standards or requirements may be specified by the Director. Accordingly, in addition to the terms and conditions of the regulation, for this discharge the following standards and requirements apply. The following information related to RE-15474 must be submitted within 30 days:

1. Tables that summarize the Discharge Monitoring Program and the Environment Monitoring Sampling Programs. Tables should indicate sampling sites/locations and short description of the locations, parameters, sampling frequency, reporting frequency and standards and criteria to be met.
2. GPS coordinates for all sampling sites. Specify in decimal degrees to 4 decimal places using NAD83 Datum.

The discharger shall **report monitoring data** in accordance with Part 7, Section 28 of the *Regulation* and in accordance with the following requirements. Monitoring data shall be submitted to the Ministry (EMS) database quarterly within 30 days of the end of each quarter. Instances of non-compliances are to be notified and reported to the Manager in writing, with an explanation and action taken to remediate non-compliance.

In accordance with Part 7, Section 28 (3) of the *Regulation*, the discharger shall submit an annual report and do so in accordance with the annual report requirements of Section 28 of the *Regulation*. The annual report shall be prepared by a suitably qualified professional and shall include the following:

- Tabulated results of the Effluent and Environmental Monitoring Data with standards and criteria
- Interpretation of the monitoring data
- The total volume discharged over the year
- Total sludge wasted over the year and its final destination
- The state of compliance of the treatment facility/process
- Indicate the percentage of residential development, as defined in the *Regulation*, that contributes to the effluent discharge
- Any additional relevant information the discharger wishes to provide

The annual report shall contain recommendations of a qualified professional regarding changes (additions, deletions, modifications) to the monitoring program. Electronic and hard copies of the annual report submission is due within 120 days of the end of each calendar year.

This decision to specify more stringent standards or requirements under the Municipal Sewage Regulation may be appealed to the Environmental Appeal Board in accordance with Part 8 of the *Environmental Management Act*. An appeal must be delivered within 30 days from the date that notice of this decision is given, in accordance with the practices, procedures and forms prescribed by regulation under the *Environment Management Act*. For further information, please contact the Environmental Appeal Board at (250) 387-3464.



The ministry uses a reference number to track monitoring data associated with discharges. The following are the EMS site numbers assigned to the monitoring sites listed above. These numbers are to be used when entering data directly into the Ministry EMS database in accordance with Part 7, Section 28 (2) of the *Regulation*.

SAMPLING SITE/LOCATION	EMS NUMBER	DESCRIPTION
Columbia River UP IDZ	E256694	Upstream at the bridge
Columbia River 100m DN, main stem	E256695	~ 100 m downstream of outfall, at main stem from island
Columbia River 100m DN, side channel	E258897	~ 100 m downstream of outfall, at side channel
Columbia River 200m DN, east shore	E258898	~ 200 m downstream of outfall, from east shore
Columbia River 1km DN, west shore	E258899	~ 1 km downstream of outfall, downstream of island from west shore
Plant Effluent	E256696	Sample prior to the discharge outfall

For information on the use of EMS and the electronic data transfer utility, please refer to the following website: [http://wlapwww.gov.bc.ca/epd/ems\\_edt.html](http://wlapwww.gov.bc.ca/epd/ems_edt.html)

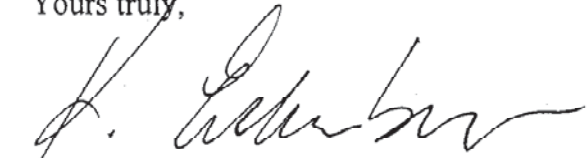
Your attention is respectfully directed to the terms and conditions outlined in the Municipal Sewage Regulation. Compliance with all the terms and conditions of the regulation is required. Contravention of any of the conditions of the regulation is a violation of the *Environmental Management Act* and may result in prosecution.

Registration under the Municipal Sewage Regulation should not be construed as a representation that the works are adequately designed or will satisfy all the requirements of the regulation. It is the responsibility of the discharger to ensure that the works are adequately designed, constructed and operated and that the discharge quality complies with the regulation. Registration under the regulation is without prejudice to any additional works that may be required or any additional requirements that may be specified by the Director. The Director may also issue Orders under the *Environmental Management Act*.

Registration under the Municipal Sewage Regulation does not authorise entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorised by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the discharger. It is also the responsibility of the discharger to ensure that all activities conducted under this registration are carried out with regard to the rights of third parties and comply with other applicable legislation that may be in force. The discharger must also obtain any necessary approvals from other agencies.

Administration of the Municipal Sewage Regulation will be carried out by staff from our Sub-regional office located at 205 Industrial Road G, Cranbrook, British Columbia, V1C 7G5 (Telephone 250-489-8540). Plans, data and reports pertinent to the regulation are to be submitted to the Regional Manager, Environmental Protection, at this address. If you have any questions concerning this registration, please contact our Cranbrook Sub-Regional Office at 250-489-8540

Yours truly,



Kathy Eichenberger, P.Eng.  
for Director, *Environmental Management Act*  
Kootenay and Okanagan Regions

cc:	Environment Canada
	Kicking Horse Mountain Sanitary Sewer Services Ltd., 1500 Kicking Horse Trail, PO Box 839, Golden, BC V0A 1H0, Attn: John Urie
	Ecofluid, #101-334 E. Kent Ave. South, Vancouver, BC V5X 4N5 Attn: Rolf Loker, VP & Manager of Operations
	Ana C. May Tsui, MWLAP- Environmental Protection, Cranbrook

AMT/KE:lkmm



KICKING HORSE MOUNTAIN UTILITY  
CORPORATION  
ATTN: TRAVIS JOBIN  
1505 - 17th AVENUE SW  
CALGARY AB T2T 0E2

Date Received: 01-FEB-19  
Report Date: 08-FEB-19 15:30 (MT)  
Version: FINAL

Client Phone: 250-344-6003

## Certificate of Analysis

Lab Work Order #: L2227771

Project P.O. #: NOT SUBMITTED

Job Reference: RCR - KICKING HORSE MOUNTAIN RESORT

C of C Numbers:

Legal Site Desc:

Justine Buma-a  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

# ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2227771-1      EFFLUENT Sampled By:    TJ on 31-JAN-19 @ 13:30 Matrix:         WATER <b>Miscellaneous Parameters</b> Biochemical Oxygen Demand Orthophosphate-Dissolved (as P) Coliform Bacteria - Fecal Phosphorus (P)-Total Total Suspended Solids	   2.1 0.670 2 0.792 4.7	     DLHC	   2.0 0.0050 1 0.050 3.0	   mg/L mg/L CFU/100mL mg/L mg/L	     	   01-FEB-19 02-FEB-19 01-FEB-19 08-FEB-19 05-FEB-19	   R4491636 R4484647 R4485310 R4496770 R4491568

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L2227771-1	EFFLUENT	SPL	TOTAL PHOSPHORUS LAB PRESERVED - Sample was Preserved at the laboratory

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-BC-CL	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B-5 day Incub.-O2 electrode
This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.			
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D
This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.			
P-T-COL-CL	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
PO4-DO-COL-CL	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
TSS-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

## Quality Control Report

Workorder: L2227771

Report Date: 08-FEB-19

Page 1 of 2

Client: KICKING HORSE MOUNTAIN UTILITY CORPORATION  
1505 - 17th AVENUE SW  
CALGARY AB T2T 0E2

Contact: TRAVIS JOBIN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BOD-BC-CL</b>	<b>Water</b>							
Batch	R4491636							
<b>WG2984177-2 LCS</b>								
Biochemical Oxygen Demand			99.2		%		85-115	01-FEB-19
<b>WG2984177-1 MB</b>								
Biochemical Oxygen Demand			<2.0		mg/L		2	01-FEB-19
<b>FCC-MF-CL</b>	<b>Water</b>							
Batch	R4485310							
<b>WG2982408-1 MB</b>								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	01-FEB-19
<b>P-T-COL-CL</b>	<b>Water</b>							
Batch	R4496770							
<b>WG2985675-6 LCS</b>								
Phosphorus (P)-Total			106.6		%		80-120	08-FEB-19
<b>WG2985675-5 MB</b>								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	08-FEB-19
<b>PO4-DO-COL-CL</b>	<b>Water</b>							
Batch	R4484647							
<b>WG2982016-2 LCS</b>								
Orthophosphate-Dissolved (as P)			105.5		%		80-120	02-FEB-19
<b>WG2982016-1 MB</b>								
Orthophosphate-Dissolved (as P)			<0.0050		mg/L		0.005	02-FEB-19
<b>TSS-CL</b>	<b>Water</b>							
Batch	R4491568							
<b>WG2983347-2 LCS</b>								
Total Suspended Solids			93.3		%		85-115	05-FEB-19
<b>WG2983347-1 MB</b>								
Total Suspended Solids			<3.0		mg/L		3	05-FEB-19

# Quality Control Report

Workorder: L2227771

Report Date: 08-FEB-19

Page 2 of 2

## Legend:

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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

## Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.





L2227771-COFC

Chain of Custody / Analytical Request Form  
Canada Toll Free: 1 800 668 9878  
[www.alsglobal.com](http://www.alsglobal.com)

COC #

Page 1 of 1

<b>Report To</b>		<b>Report Format / Distribution</b>				<b>Service Requested</b> (Rush for routine analysis subject to availability)											
Company: Kicking Horse Mountain Water Utility Co. Ltd.		<input checked="" type="checkbox"/> Standard <input type="checkbox"/> Other				<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)											
Contact: Travis Jobin		<input type="checkbox"/> PDF <input type="checkbox"/> Excel <input type="checkbox"/> Digital <input checked="" type="checkbox"/> Fax				<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT											
Address: 1500 Kicking Horse Trail		Email 1: tjobin@kickinghorseresort.com				<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT											
		Email 2: pmaier@skircr.com				<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT											
Phone: 250-344-6003 Fax:		Email 3: mskyring@kickinghorseresort.com				<b>Analysis Request</b>											
Invoice To Same as Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		<b>Client / Project Information</b>				Please indicate below Filtered, Preserved or both (F, P, F/P)											
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: RCR - Kicking Horse Mountain Resort															
Company: Resorts of the Canadian Rockies		PO / AFE:															
Contact: Patrick Majer		LSD:															
Address: 1505 - 17th Ave SW Calgary AB																	
Phone: Fax:		Quote #: Q33059															
Lab Work Order # (lab use only)		ALS Contact: LS		Sampler: TS													
Sample #		Sample Identification (This description will appear on the report)		Date (dd-mm-yy)	Time (hh:mm)	Sample Type	BOD	TSS	Fecal Coliform	Ortho Phosphate	Total P						Number of Containers
Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details																	
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.																	
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.																	
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																	
SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)										
Released by: [Signature]		Date (dd-mm-yy): FEB 1	Time (hh:mm): 12PM	Received by: [Signature]		Date: 2/1	Time: 1155	Temperature: 3 °C	Verified by:		Date:		Time:		Observations: Yes / No ? If Yes add SIF		



## CERTIFICATE OF ANALYSIS

**REPORTED TO** Kicking Horse Mountain Resort  
1500 Kicking Horse Trail  
Golden, BC V0A 1H0

**ATTENTION** Travis Jobin

**PO NUMBER**

**PROJECT** UV Trough

**PROJECT INFO**

**WORK ORDER** 9021954

**RECEIVED / TEMP** 2019-02-28 09:45 / 1°C

**REPORTED** 2019-03-07 12:16

**COC NUMBER** No Number

### 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 [estclair@caro.ca](mailto:estclair@caro.ca)

#### Authorized By:

Eilish St.Clair, B.Sc., C.I.T.  
Client Service Representative

1-888-311-8846 | [www.caro.ca](http://www.caro.ca)

#110 4011 Viking Way Richmond, BC V6V 2K9 | #102 3677 Highway 97N Kelowna, BC V1X 5C3 | 17225 109 Avenue Edmonton, AB T5S 1H7

## TEST RESULTS

**REPORTED TO PROJECT** Kicking Horse Mountain Resort  
UV Trough

**WORK ORDER REPORTED** 9021954  
2019-03-07 12:16

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
UV Trough (9021954-01)   Matrix: Water   Sampled: 2019-02-27 12:00						PRES
<b>Anions</b>						
Phosphate (as P)	0.0810	N/A	0.0050	mg/L	2019-03-01	
<b>General Parameters</b>						
BOD, 5-day	13.2	N/A	2.0	mg/L	2019-03-06	
Phosphorus, Total (as P)	0.554	N/A	0.0020	mg/L	2019-03-04	
Solids, Total Suspended	18.0	N/A	2.0	mg/L	2019-03-01	
<b>Microbiological Parameters</b>						
Coliforms, Total	80	MAC = 0	1	CFU/100 mL	2019-02-28	
Background Colonies	> 200	N/A	200	CFU/100 mL	2019-02-28	
Coliforms, Fecal	6	N/A	1	CFU/100 mL	2019-02-28	
E. coli	6	MAC = 0	1	CFU/100 mL	2019-02-28	

### Sample Qualifiers:

PRES Sample has been preserved for TP in the laboratory and the holding time has been extended.

## APPENDIX 1: SUPPORTING INFORMATION

**REPORTED TO PROJECT** Kicking Horse Mountain Resort  
UV Trough

**WORK ORDER REPORTED** 9021954  
2019-03-07 12:16

Analysis Description	Method Ref.	Technique	Location
Anions in Water	SM 4110 B (2011)	Ion Chromatography	Kelowna
Biochemical Oxygen Demand in Water	SM 5210 B (2011)	Dissolved Oxygen Meter	Kelowna
Coliforms, Fecal in Water	SM 9222 D (2006)	Membrane Filtration / m-FC Agar	Kelowna
Coliforms, Total in Water	SM 9222 B (2006)	Membrane Filtration / m-Endo Agar	Kelowna
E. coli in Water	SM 9222 G (2006)	Membrane Filtration / Nutrient Agar with MUG	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)	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)
>	Greater than the specified Result
CFU/100 mL	Colony Forming Units per 100 millilitres
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

### Guidelines Referenced in this Report:

[Guidelines for Canadian Drinking Water Quality \(Health Canada, Feb 2017\)](#)

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

### General Comments:

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. The quality control (QC) data is available upon request

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method




KICKING HORSE MOUNTAIN UTILITY  
CORPORATION  
ATTN: TRAVIS JOBIN  
1505 - 17th AVENUE SW  
CALGARY AB T2T 0E2

Date Received: 09-APR-19  
Report Date: 18-APR-19 15:08 (MT)  
Version: FINAL

Client Phone: 250-344-6003

## Certificate of Analysis

Lab Work Order #: L2255479  
Project P.O. #: NOT SUBMITTED  
Job Reference: RCR - KICKING HORSE MOUNTAIN RESORT  
C of C Numbers:  
Legal Site Desc:

  
\_\_\_\_\_  
Justine Buma-a  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298  
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# ALS ENVIRONMENTAL ANALYTICAL REPORT

[illegible]

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
UIC	P-T - Unreliable: Improper Container

Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-BC-CL	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B-5 day Incub.-O2 electrode
This analysis is carried out using procedures adapted from APHA Method 5210B - "Biochemical Oxygen Demand (BOD)". All forms of biochemical oxygen demand (BOD) are determined by diluting and incubating a sample for a specified time period, and measuring the oxygen depletion using a dissolved oxygen meter. Dissolved BOD (SOLUBLE) is determined by filtering the sample through a glass fibre filter prior to dilution. Carbonaceous BOD (CBOD) is determined by adding a nitrification inhibitor to the diluted sample prior to incubation.			
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D
This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.			
P-T-COL-CL	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
PO4-DO-COL-CL	Water	Diss. Orthophosphate in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.			
TSS-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.			

\*\* ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample  
mg/kg wwt - milligrams per kilogram based on wet weight of sample  
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight  
mg/L - unit of concentration based on volume, parts per million.  
< - Less than.

D.L. - The reporting limit.  
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.  
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.  
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

## Quality Control Report

Workorder: L2255479

Report Date: 18-APR-19

Page 1 of 2

Client: KICKING HORSE MOUNTAIN UTILITY CORPORATION  
1505 - 17th AVENUE SW  
CALGARY AB T2T 0E2

Contact: TRAVIS JOBIN

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
<b>BOD-BC-CL</b>	<b>Water</b>							
Batch	R4601422							
<b>WG3027864-5 LCS</b>								
Biochemical Oxygen Demand			93.5		%		85-115	09-APR-19
<b>WG3027864-4 MB</b>								
Biochemical Oxygen Demand			<2.0		mg/L		2	09-APR-19
<b>FCC-MF-CL</b>	<b>Water</b>							
Batch	R4601311							
<b>WG3027757-1 MB</b>								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	09-APR-19
<b>P-T-COL-CL</b>	<b>Water</b>							
Batch	R4600985							
<b>WG3027391-2 LCS</b>								
Phosphorus (P)-Total			99.0		%		80-120	14-APR-19
<b>WG3027391-1 MB</b>								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	14-APR-19
<b>PO4-DO-COL-CL</b>	<b>Water</b>							
Batch	R4593802							
<b>WG3024767-10 LCS</b>								
Orthophosphate-Dissolved (as P)			99.0		%		80-120	10-APR-19
<b>WG3024767-9 MB</b>								
Orthophosphate-Dissolved (as P)			<0.0050		mg/L		0.005	10-APR-19
<b>TSS-CL</b>	<b>Water</b>							
Batch	R4600868							
<b>WG3026934-14 LCS</b>								
Total Suspended Solids			104.7		%		85-115	12-APR-19
<b>WG3026934-13 MB</b>								
Total Suspended Solids			<3.0		mg/L		3	12-APR-19

# Quality Control Report

Workorder: L2255479

Report Date: 18-APR-19

Page 2 of 2

## Legend:

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Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

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