2019 Adaptive Management Report for the Fish Habitat Management System for Yukon Placer Mining

Appendix A: 2019 Water Quality Objective Monitoring Report

Yukon

Water Quality Objective Monitoring Report 2019

Adaptive Management – Fish Habitat Management System for Yukon Placer Mining

May 2021 Draft v.2

Acronyms

AHM	Aquatic Health Monitoring
CMI	Compliance Monitoring and Inspection
FHMS	Fish Habitat Management System
TSS	total suspended solids
WQO	Water Quality Objective
WQOM	Water Quality Objective Monitoring
YG	Government of Yukon (Yukon government)
mg/L	milligrams per litre
%	percent

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Executive Summary

The Water Quality Objective Monitoring Protocol is an effects monitoring program designed to provide ongoing information on water quality in various watersheds and help evaluate the effectiveness of the Fish Habitat Management System for Yukon Placer Mining (FHMS) at conserving and protecting fish and fish habitat. Water Quality Objective Monitoring is one of three monitoring programs within the FHMS developed to support the Adaptive Management Framework, which guides the development of recommendations for changes to the management system. One primary objective of the Water Quality Objective Monitoring Protocol is to assess whether the Water Quality Objectives established under the FHMS are being achieved and whether exceedances are due to placer mining activity or other causes.

In 2019, Hunker Creek, a historically and actively mined tributary of the Klondike River was chosen for an intensive study to better understand the effect that Placer mining might have on a single watercourse. Water samples were collected at 13 Water Quality Objective monitoring sites on Hunker Creek from June 10 to September 24, 2019. Precipitation data was collected using four portable tipping bucket rain gauges. On average for the season the WQO were achieved in Hunker Creek, at the habitat suitability level (low and moderate-low classifications), and at the site level. Spikes in TSS exceeding the WQO were observed at KL_HU06 on numerous occasions (20) and occasionally observed (six or less) at nine other stations. Additional investigations are recommended to determine if active placer mines are operating in compliance, and if non-point sources at historic, reclaimed, and active placer mine sites are contributing to sediment loading.

Introduction

The Fish Habitat Management System for Yukon Placer Mining (FHMS) is the regulatory system for managing placer mining in the Yukon. The FHMS specifies sets of operational regulations and standards for placer mining based on watershed sensitivity and fish habitat suitability. These are designed to support the management system in achieving its dual objectives of supporting a sustainable Yukon placer mining industry alongside the conservation and protection of fish and fish habitat. There are three effects monitoring programs in the Adaptive Management Framework that collect information used to evaluate whether the FHMS is effective at achieving those goals, or whether the system has shifted towards achieving one of the objectives at the expense of the other (YPS, 2008a). The monitoring programs include Water Quality Objective Monitoring (WQOM), Aquatic Health Monitoring (AHM), and Economic Health Monitoring (EHM).

Within the FHMS, Water Quality Objectives (WQO) were established for Yukon streams based on watershed sensitivity to placer mining activity and fish habitat suitability of a stream. The WQO performance measure used to evaluate water quality is total suspended solids (TSS) in mg/L (YPS, 2008a and 2008b). TSS is of concern in the environment as it can decrease egg-to-fry survival rates in fish and can affect stream and benthic macroinvertebrate production in addition to direct effects such as clogging and abrasion of gills, behavioural effects, resistance to disease, blanketing of spawning gravels and other habitat changes (CCME, 2002). Streams in watersheds that are more sensitive or with a higher fish habitat suitability classification have more stringent WQO, meaning less TSS is tolerated within the watercourse. Streams in less sensitive watersheds or with a lower fish habitat suitability classification have less stringent WQO, therefore more TSS is allowed within the watercourse.

The purpose of the WQO monitoring program is to assess if the WQO are being achieved, and if not, whether exceedances of the WQO are due to placer mining activities or other causes. Whether the overall outcome of the monitoring program is acceptable or not depends on the observed conditions and decision rules outlined in the

Adaptive Management Framework. This document reports on the observed conditions of the 2019 monitoring season, including all WQO exceedances and the frequency and magnitude of exceedances.

Methods

The Water Quality Objective Monitoring Protocol (YPS, 2008b) guides the sampling design for the annual WQO monitoring program, including locations, timing, frequency, and methods employed. The 2019 field sampling program diverged from the protocol in terms of sampling location, in which all sampling efforts were focused on a single watercourse (Hunker Creek) instead of multiple watersheds and watercourses.

Hunker Creek, a tributary of the Klondike River, drains an area of approximately 207 km2. The Hunker Creek watershed has been mined since the gold rush and stream channel conditions reflect the cumulative effects of mining activities. Bank erosion and sediment production is common due to the extensive mining. Hunker Creek is classified in the FHMS as a Category A watershed and includes moderate-low and low habitat suitability classifications (Table 1, Figure 1).

Water quality samples were collected at 13 WQO monitoring sites (Table 1, Figure 1) from the mouth (KL_HU01C) to near the headwaters of Hunker Creek (KL_HU09) and at the confluence of Gold Bottom Creek and Hunker Creek (KL_HU_GO01). Eight of the 13 WQO sites were established in previous years and have been sampled historically, although sporadically. Five new sites were selected in 2019 (site code suffix '_KMXX') to obtain water quality data from Hunker Creek approximately every two kilometers.

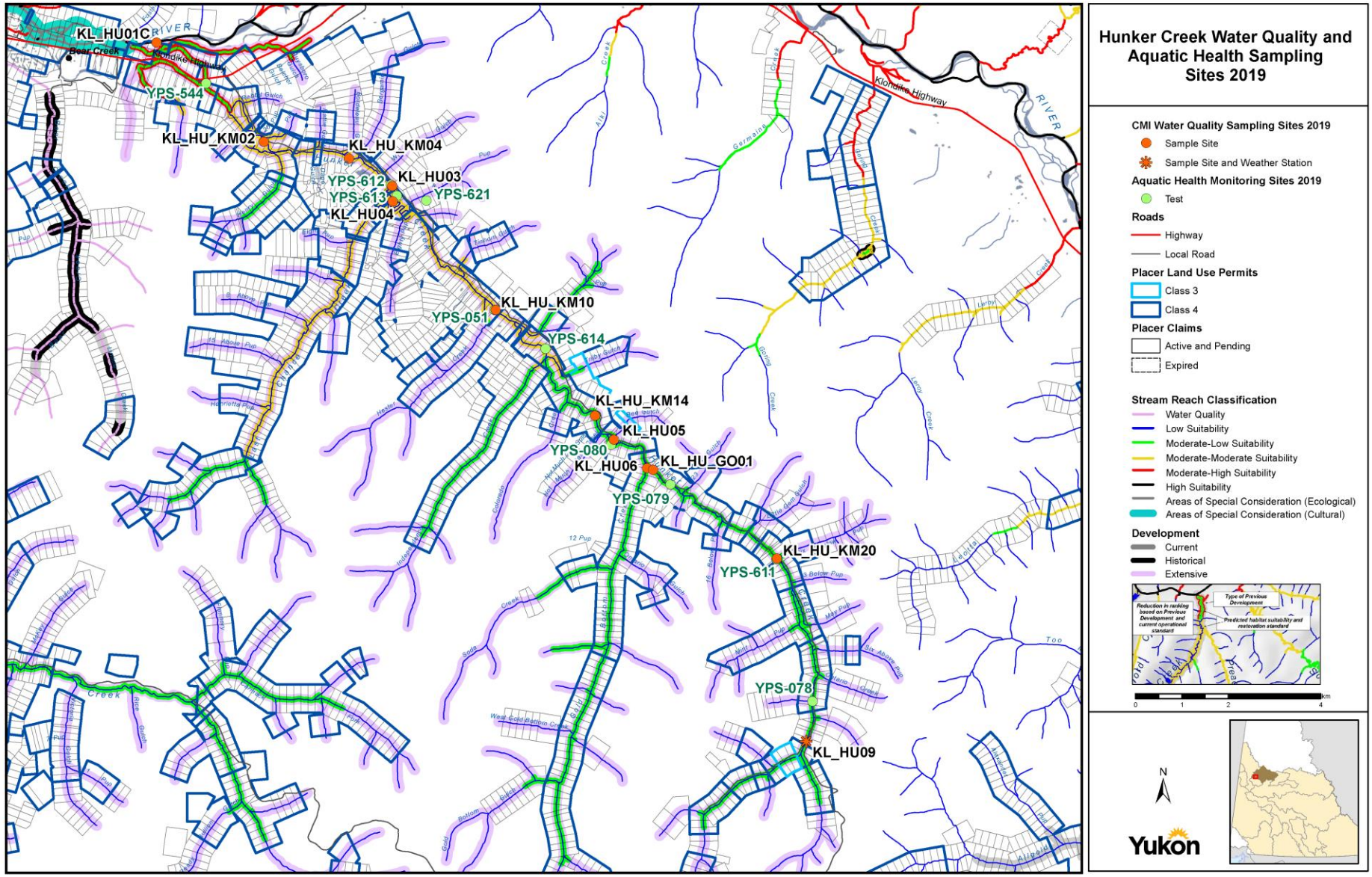
The rationale for this design was to identify specific segments of the stream where sediment loading was occurring, and to better assess whether the observed results were due to instances of non-compliance, lawfully operating placer miners, or other causes.

Table 1. 2019 Water Quality Objective Monitoring Sites

Site Code	Monitoring Site Description	Latitude	Longitude	Fish Habitat Suitability Classification	WQO (mg/L)
KL_HU01C	Hunker Creek mouth	64.03619	-139.20204	Moderate-Low	80
KL_HU01	Hunker Creek at highways	64.02943	-139.17867	Moderate-Low	80
KL_HU_KM02	2 Km from Hunker Creek mouth	64.01933	-139.15031	Low	200
KL_HU_KM04	4 Km from Hunker Creek mouth	64.01785	-139.11209	Low	200
KL_HU03	Hunker Creek downstream of Last Chance Creek	64.01345	-139.09187	Low	200
KL_HU04	Hunker Creek upstream of Last Chance Creek	64.0105	-139.09091	Low	200
KL_HU_KM10	10 Km from Hunker Creek mouth	63.9917	-139.04062	Low	200
KL_HU_KM14	14 Km from Hunker Creek mouth	63.9734	-139.99225	Low	200
KL_HU05	Hunker Creek downstream of Gold Bottom Creek	63.96918	-138.98291	Low	200
KL_HU_GO01	Gold Bottom Creek mouth	63.96433	-138.96706	Low	200
KL_HU06	Hunker Creek upstream of Gold Bottom Creek	64.96433	-138.96706	Low	200
KL_HU_KM20	20 Km from Hunker Creek mouth	63.9495	-138.90613	Low	200
KL_HU09	Upper Hunker Creek	63.91503	-138.88501	Low	200

Note: Sites are listed moving upstream from the confluence with the Klondike River

Figure 1. Hunker Creek drainage basin showing monitoring locations and placer mining land use permits and claims.



2019 WQO monitoring activities began on June 10 and finished on September 24. At the start of the season, one automated portable sampler (ISCO) was deployed at each monitoring site, programmed to collect 250 ml of stream water every six hours, generating a composite 1-liter water sample each day. Compliance Monitoring and Inspection (CMI) staff visited the WQO sites on a three-week rotation to collect ISCO samples, replace ISCO bottles and perform any required station maintenance. During each site visit, a 1-liter grab sample was collected from the creek.

Four portable Watchdog tipping bucket rain gauges were installed in the Hunker Creek watershed to try to capture rain events across the drainage (Figure 1). Locations were selected near the confluence of Hunker Creek and Klondike River (KL_HU01), in the upper reaches of Hunker Creek (KL_HU09), and one on each side of the valley (WS Last Chance and WS Gun Range). Each gauge produced a measurement of rainfall in mm every hour and this data was used to produce a daily quantity of rainfall for each station.

Water samples were analyzed in the CMI laboratory for total suspended solids following method 2540 D (APHA et al., 2012). Total Suspended Solids Dried at 103–105°C from Standard Methods for the Examination of Water and Wastewater (APHA et al., 2012).

Summary statistics were calculated on TSS results including mean, median, minimum and maximum value and standard deviation (Table 2). All WQO exceedances were tabulated, and the magnitude of each exceedance was calculated using the formula $TSS_{observed} / TSS_{WQO}$.

Daily rainfall data was tabulated with WQO exceedances to help assess the potential cause of increased TSS values (Appendix 1).

Compliance monitoring data for the season was collected by CMI Natural Resource Officers. Compliance data was used to verify mining activities were occurring at placer sites upstream of the monitoring locations, and to help understand if WQO monitoring

results observed were the result of non-compliance via effluent discharges from placer operations.

Results

A total of 1333 water samples were collected at WQO monitoring sites along Hunker Creek in 2019. Of these, 1248 were composite 1-litre samples were collected by ISCOs and 85 were grab samples were collected by CMI staff.

The average TSS result based on all samples collected was 43.8 mg/L. The minimum TSS observed was 0.4 mg/L and the maximum TSS observed was 1074.8 mg/L. 46 samples exceeded the WQO; 3% of all samples collected in 2019. Exceedances occurred at 10 of the 13 monitoring sites and were observed on 24 of the 107 days that monitoring occurred. No exceedances were observed at KL_HU01C, KL_HU_KM02 or KL_HU_KM20. Summary statistics are provided in Table 2.

Exceedances are summarized in Appendix 2 including the magnitude of each exceedance. Six exceedances were greater than twice the WQO occurred in 2019 (0.5%).

WQO exceedances at four monitoring sites (KL_HU01, KL_HU_KM04, KL_HU_GO01 and KL_HU09) only occurred once throughout the monitoring program between July 16 and 18. These exceedances follow a rain event captured at all rain gauges in the watershed, which began on July 15 and ended July 16 (Appendix 1).

Low Fish Habitat Suitability Locations

The low fish habitat suitability classification has a WQO of 200 mg/L. Ten monitoring sites have this classification (Table 2). The average TSS was 48.4 mg/L. A total of 43 of the 1136 samples collected (4%) exceeded the WQO in 2019.

Monitoring location KL_HU06 had the most frequent exceedances with 20 out of 111 samples exceeded the WQO (18%). At the remaining sites with low fish habitat

suitability, only 5% or less of the samples collected in 2019 exceeded the WQO (6 or less samples per site).

At the low fish habitat suitability monitoring sites, five exceedances were greater than twice the WQO in 2019 (0.4%) and occurred in these sites KL_HU04, KL_HU05, KL_HU06, and KL_HU09. One of these exceedances at KL_HU09 (461.2 mg/L) occurred on July 16 following a basin-wide rain event July 15-16. The other four high exceedances did not coincide with a rain event recorded at all stations or localized rain recorded at the nearest rain gauge (Appendix 1 and 2).

Moderate-Low Fish Habitat Suitability Locations

The moderate-low fish habitat classification has a WQO of 80 mg/L. KL_HU01C and KL_HU01 near the confluence of Hunker Creek and the Klondike River have a moderate-low classification. The average TSS was 17.0 mg/L. Only three of 197 samples in moderate-low fish habitat (2%) were above the WQO.

Three samples collected at KL_HU01 in 2019 exceeded the WQO following a rain event that ended July 16. One exceedance (190.4 mg/L) was twice the WQO, and occurred on July 17 following the rain event captured at all rain gauges in the watershed July 15-16.

Precipitation

Rain was measured at one or more of the rain gauges 46 of 106 days during the 2019 season (Appendix 1). The greatest amount of rain captured at all rain gauges in the watershed during a single event occurred July 15 to 16. A group of 16 WQO exceedances occurred between July 15 and July 18.

Rain events recorded at all stations with greater than 5 mm rain and presence or absence of exceedances is provided in Table 3. Rain events on July 13, 25 and August 16-17 did not result in any exceedances despite similar rainfall values as July 15-16.

Table 2. Summary Statistics of 2019 WQO Samples

Fish Habitat Suitability Classification	Moderate-Low		All Moderate-Low	Low												All Low	All Sites
Monitoring Site	KL_HU01C	KL_HU01		KL_HU_KM02	KL_HU_KM04	KL_HU03	KL_HU04	KL_HU_KM10	KL_HU_KM14	KL_HU05	KL_HU_GO01	KL_HU06	KL_HU_KM20	KL_HU09			
WQO (TSS, mg/L)	80	80	80	200	200	200	200	200	200	200	200	200	200	200			
Total 2019 Samples	84	113	197	107	109	113	93	110	109	110	102	111	61	111	1136	1333	
# Composite Samples from ISCO	79	106	185	101	103	106	86	103	103	103	95	104	55	104	1063	1248	
# Grab Samples	5	7	12	6	6	7	7	7	6	7	7	7	6	7	73	85	
Minimum TSS	0.8	2.8	0.8	8.0	8.0	5.6	9.6	5.6	3.2	7.2	1.6	3.6	0.4	0.8	0.4	0.4	
Maximum TSS	62.4	190.4	190.4	160.8	202.4	348.4	1074.8	396.4	255.2	718.8	327.6	966.0	69.2	461.2	1074.8	1074.8	
Median TSS	8.4	12.8	10.8	24.0	27.6	37.6	34.4	21.2	35.6	42.8	11.6	89.2	9.6	6.4	27.4	23.6	
Mean TSS	11.6	21.0	17.0	28.4	37.4	59.2	61.3	37.5	48.2	69.0	26.8	121.3	11.3	14.9	48.4	43.8	
Standard Deviation	10.8	23.9	20.0	20.8	32.3	65.0	116.5	54.5	43.4	88.2	44.1	119.6	10.5	45.5	74.5	70.1	
# Exceedances 2019	0	3	3	0	1	6	3	2	3	6	1	20	0	1	43	46	
% Exceeding 2019	0%	3%	2%	0%	1%	5%	3%	2%	3%	5%	1%	18%	0%	1%	4%	3%	
% Exceeding 2007-2018	15%	36%				15%	16%			6%		11%		8%			

Table 3. Rain Events (>5 mm) and Exceedances in Hunker Creek Watershed, 2019

Date	Station Average (mm)*	Exceedances of WQO	Number of Monitoring Sites Exceedances were detected at
July 11-12	12.2	2	2
July 13	5.2	0	-
July 15-16	13.6	16	10
July 25	9.3	0	-
August 16-17	9.7	0	-
September 18-21	13.0 (multiple events)	3	2

*Station average does not include Last Chance rain gauge since it reported drastically less rain during precipitation events and throughout the season

Discussion

Whether the results of the monitoring program are acceptable or not within the context of adaptive management depends on the conditions that are observed and the criteria for decision-making. Any failure to achieve the WQO in highly sensitive habitat or habitat of moderate-high sensitivity will be considered unacceptable; and the significance of a failure to achieve WQO in other habitat classes will depend upon the frequency and magnitude of the failure. Furthermore, results attributable to lasting natural occurrences will not be considered an unacceptable outcome; and results attributable to non-compliance at placer mining operations will be dealt with as an enforcement issue and not adaptive management issues. Details for each of these are provided below.

Are WQO met?

The WQO monitoring program measured TSS within Hunker Creek, to determine if the local WQO were met or exceeded in 2019. On average for the season the WQO were achieved at the stream, at the habitat suitability level, and at the site level. At the moderate-low and low fish habitat suitability sites some exceedances were reoccurring at some sites and some exceedances were twice the WQO. There are no high sensitive or moderate-high sensitive habitats within Hunker Creek, and so no exceedances occurred within those classifications to report.

Are exceedances of WQO due to placer mining, or other causes?

Precipitation leads to surface runoff and can increase the amount of sediment entering a watercourse. Precipitation can also lead to scouring of stream banks, causing additional sediment loading in the stream. Undisturbed areas can be sources of sediment; however, areas where vegetation stripping has occurred are more likely to contribute sediment during and following precipitation events. Both historic disturbances and current activities can experience erosion and contribute to sediment loading via run-off.

Precipitation events were likely to contribute to some of the WQO exceedances in 2019. As previously mentioned, four monitoring sites only recorded exceedances following a rain event captured at all rain gauges July 15-16. Of the 46 WQO exceedances, 16 occurred following the July 15-16 rain event. Of the 30 WQO remaining exceedances, 20 occurred at monitoring site KL_HU06.

WQO exceedances that were observed at monitoring sites KL_HU03, KL_HU_KM10 and KL_HU_KM14 were all low magnitude (less than two times the WQO for the purpose of this report). There are active placer mines upstream of these sites, however it is not known from the information collected in 2020 to what extent these mines contributed to sediment loading observed during monitoring.

Three monitoring sites detected exceedances twice the WQO, including KL_HU04, KL_HU05 and KL_HU06. The most frequent exceedances occurred at KL_HU06, which is upstream of KL_HU05 and KL_HU04. Large exceedances that occur outside of precipitation events may be caused by the release of settling ponds, instream works, or collapse of a stream bank. CMI Natural Resources Officers confirmed that placer mines upstream and between these sites were active during the 2019 season, and did not report incidents of non-compliance based on limited spot inspections. The WQO monitoring site photographs for KL_HU06 indicate that site management and non-point sources may be contributing sediment to the watercourse. The monitoring site falls within an active placer mine and so the information was shared with CMI. WQO monitoring and compliance monitoring should continue at KL_HU04, KL_HU05 and KL_HU06 to better understand what is causing the WQO exceedances.

Conclusion

During the 2019 monitoring period, the water sampled at sites in the Hunker Creek watershed met the minimum WQO set under the Fish Habitat Management System. Spikes in TSS exceeding the WQO were observed at KL_HU06 on numerous occasions (20) and occasionally observed (six or less) at nine other stations. Additional investigations are required to determine if active placer mines are operating in

compliance, and if non-point sources at historic, reclaimed, and active placer mine sites are contributing to sediment loading.

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Appendix A1

Precipitation Data for Hunker Creek 2019 with Water Quality Objective Exceedances

Appendix A1. Hunker Creek 2019 daily precipitation data with Water Quality Objective exceedances shown.

Daily Rain (mm)	HU01	Gun Range	HU09	Station Average	Monitoring Site	KL_HU01	KL_HU_KM04	KL_HU03	KL_HU04	KL_HU_KM10	KL_HU_KM14	KL_HU05	KL_HU_GO01	KL_HU06	KL_HU09
					WQO	80	200	200	200	200	200	200	200	200	200
					# samples	113	109	113	93	110	109	110	102	111	111
					# exceedances	3	1	6	3	2	3	6	1	20	1
					% Exceeding	3%	1%	5%	3%	2%	3%	5%	1%	18%	1%
10-Jun	0			0.0											
11-Jun	1.2		0	0.6											
12-Jun	0		0	0.0											
13-Jun-19	0.7	0	0	0.2											
14-Jun-19	0.2	0.2	0	0.1											
15-Jun-19	1.4	1.7	0.9	1.3											
16-Jun-19	4.4	3.9	7.6	5.3											
17-Jun-19	4.3	3.1	3.7	3.7										278.4	
18-Jun-19	1.2	0	1.7	1.0											
19-Jun-19	0.2	0	0	0.1										275.6	
20-Jun-19	0	0	0	0.0											
21-Jun-19	0	0	0	0.0											
22-Jun-19	0	0	0	0.0											
23-Jun-19	0	0	0	0.0											
24-Jun-19	1.4	0.7	1.7	1.3											
25-Jun-19	0	0	0	0.0											
26-Jun-19	0	0	0	0.0											
27-Jun-19	0	0	0	0.0											
28-Jun-19	0	0	0	0.0											
29-Jun-19	0	0	0	0.0											
30-Jun-19	0	0	0	0.0											
1-Jul-19	0	0	0	0.0											
2-Jul-19	0	0	0	0.0										205.2	
3-Jul-19	0	0	0	0.0									270, 424.4 (G)		
4-Jul-19	0	0	0	0.0											
5-Jul-19	0	0	0	0.0											
6-Jul-19	0	0	0	0.0											
7-Jul-19	0	0	0	0.0											
8-Jul-19	0	0	0	0.0										276	
9-Jul-19	0	0	0	0.0							255.2	718.8		262.4	
10-Jul-19	0	0	0	0.0				315.6	261.2						
11-Jul-19	11	8.5	11.7	10.4											
12-Jul-19	1.4	1.9	2.1	1.8				289.6						278	
13-Jul-19	7.7	7.4	5.6	6.9											
14-Jul-19	0	0	0	0.0											
15-Jul-19	12.8	12.9	9.4	11.7										231.2	
16-Jul-19	1.9	1.8	1.9	1.9		98		280.4			206.4	255.6	327.6		461.2
17-Jul-19	0	0	0	0.0		190.4	202.4	346	309.2	396.4	218.8	292.8		377.2	
18-Jul-19	0	0	0	0.0		124									
19-Jul-19	0	0.7	0.4	0.4											
20-Jul-19	0	0	0	0.0											
21-Jul-19	0	0	0	0.0											
22-Jul-19	0	0	0	0.0											
23-Jul-19	0	0	0	0.0										217.6	
24-Jul-19	0	0	0	0.0											
25-Jul-19	10.8	9.5	7.6	9.3											
26-Jul-19	0	0	0	0.0											
27-Jul-19	2.4	2.4	4.4	3.1											
28-Jul-19	1.9	1.3	2.1	1.8											
29-Jul-19	0	0	0	0.0											
30-Jul-19	0	0	2.7	0.9											
31-Jul-19	0	0	3.7	1.2											
1-Aug-19	0.5	0.7	2.3	1.2											
2-Aug-19	0	0.2	0.2	0.1											
3-Aug-19	0.7	0.4	0.2	0.4											
4-Aug-19	0	0	0	0.0											
5-Aug-19	0	0	0	0.0											
6-Aug-19	2.3	2.4	0.8	1.8											
7-Aug-19	0	0	0	0.0											
8-Aug-19	0	0	0	0.0											
9-Aug-19	2.2	2.1	0.8	1.7											
10-Aug-19	1.4	1.2	0.6	1.1											
11-Aug-19	1.6	1	0.2	0.9							212		966		
12-Aug-19	0	0	0.2	0.1					378.9 (G)				328, 296.4 (G)		
13-Aug-19	4.1	3.8	2.2	3.4											
14-Aug-19	0	0.2	0	0.1											
15-Aug-19	0	0	0	0.0											
16-Aug-19	7.2	7.6	9.9	8.2											
17-Aug-19	1.2	0.9	2.3	1.5											
18-Aug-19	0	0	0	0.0											
19-Aug-19	0	0	0	0.0											
20-Aug-19	0	0	0	0.0											
21-Aug-19	0.7	0.4	1.4	0.8											
22-Aug-19	0	0	0	0.0										317.6	
23-Aug-19	0	0	0	0.0											
24-Aug-19	0	0	0	0.0											
25-Aug-19	0	0	0	0.0											
26-Aug-19	0	0	0	0.0											
27-Aug-19	0	0	0	0.0											
28-Aug-19	0	0	0	0.0											
29-Aug-19	0	0	0	0.0											
30-Aug-19	0	0	0	0.0											
31-Aug-19	0	0	0	0.0											
1-Sep-19	0	0	0	0.0											
2-Sep-19	0.2	0.2	0.2	0.2											
3-Sep-19	0	0	1.4	0.5											
4-Sep-19	0	0	0	0.0					1074.8						
5-Sep-19	0	0	0	0.0											
6-Sep-19	0	0	0	0.0											
7-Sep-19	0	0	0	0.0				348.4							
8-Sep-19	0	0	0	0.0											
9-Sep-19	0	0	0	0.0											
10-Sep-19	0	0	0	0.0											
11-Sep-19	0	0	0	0.0											
12-Sep-19	0	0	0	0.0										224	
13-Sep-19	0.2	0.2	1	0.5										245.2	
14-Sep-19	0	0.2	0.4	0.2										238.4	
15-Sep-19	0.2	0.2	0	0.1										210.4	
16-Sep-19	4.5	3.5	0.4	2.8											
17-Sep-19	4.3	2.9	1.4	2.9											
18-Sep-19	3.1	3.1	3.3	3.2											
19-Sep-19	4.7	4.3	7.3	5.4											
20-Sep-19	1.5	1.1	6.4	3.0											
21-Sep-19	3.5	3.5	6.6	4.5								375.6			
22-Sep-19	0	0	0	0.0				215.2				319.6			
23-Sep-19	0	0		0.0										226.4	

1 greater than 1 mm rain
2 greater than 2 mm rain
3 greater than 3 mm rain
4 greater than 4 mm rain
5 greater than 5 mm rain
Exceedance >2x WQO
(G) indicates grab sample

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Appendix A2

Water Quality Objective Exceedances for Hunker Creek in 2019

Appendix A2. 2019 Hunker Creek Water Quality Objective exceedances.

WQOM Site Code	Sample Date	WQO (mg/L)	TSS (mg/L)	Magnitude of Exceedance ($TSS_{observed}$ / TSS_{WQO})	Following Rain Event?
KL_HU01	16-Jul-19	80	98	1.2	Yes
KL_HU01	17-Jul-19	80	190.4	2.4	Yes
KL_HU01	18-Jul-19	80	124	1.6	Yes
KL_HU_KM04	17-Jul-19	200	202.4	1.0	Yes
KL_HU03	10-Jul-19	200	315.6	1.6	No
KL_HU03	12-Jul-19	200	289.6	1.4	No
KL_HU03	16-Jul-19	200	280.4	1.4	Yes
KL_HU03	17-Jul-19	200	346	1.7	Yes
KL_HU03	7-Sep-19	200	348.4	1.7	No
KL_HU03	22-Sep-19	200	215.2	1.1	No
KL_HU06	17-Jun-19	200	278.4	1.4	No
KL_HU06	19-Jun-19	200	275.6	1.4	No
KL_HU06	2-Jul-19	200	205.2	1.0	No
KL_HU_KM10	12-Aug-19	200	379	1.9	No
KL_HU_KM10	17-Jul-19	200	396.4	2.0	Yes
KL_HU_KM14	9-Jul-19	200	255.2	1.3	No
KL_HU_KM14	16-Jul-19	200	206.4	1.0	Yes
KL_HU_KM14	17-Jul-19	200	218.8	1.1	Yes
KL_HU06	3-Jul-19	200	424.4	2.1	No
KL_HU06	3-Jul-19	200	270	1.4	No
KL_HU06	8-Jul-19	200	276	1.4	No
KL_HU05	9-Jul-19	200	718.8	3.6	No
KL_HU06	9-Jul-19	200	262.4	1.3	No
KL_HU04	10-Jul-19	200	261.2	1.3	No
KL_HU_GO01	16-Jul-19	200	327.6	1.6	Yes
KL_HU06	12-Jul-19	200	278	1.4	No
KL_HU06	15-Jul-19	200	231.2	1.2	Yes
KL_HU05	16-Jul-19	200	255.6	1.3	Yes
KL_HU04	17-Jul-19	200	309.2	1.5	Yes
KL_HU05	17-Jul-19	200	292.8	1.5	Yes
KL_HU06	17-Jul-19	200	377.2	1.9	Yes
KL_HU06	23-Jul-19	200	217.6	1.1	No
KL_HU05	11-Aug-19	200	212	1.1	No
KL_HU06	11-Aug-19	200	966	4.8	No
KL_HU06	12-Aug-19	200	296.4	1.5	No
KL_HU06	12-Aug-19	200	328	1.6	No
KL_HU06	22-Aug-19	200	317.6	1.6	No
KL_HU04	4-Sep-19	200	1074.8	5.4	No
KL_HU06	12-Sep-19	200	224	1.1	No
KL_HU06	13-Sep-19	200	245.2	1.2	No
KL_HU06	14-Sep-19	200	238.4	1.2	No
KL_HU06	15-Sep-19	200	210.4	1.1	No
KL_HU05	21-Sep-19	200	375.6	1.9	No
KL_HU05	22-Sep-19	200	319.6	1.6	No
KL_HU06	23-Sep-19	200	226.4	1.1	No
KL_HU09	16-Jul-19	200	461.2	2.3	Yes