STORM WATER MONITORING PROGRAM 2018 ANNUAL REPORT

Hecla Greens Creek Mining Company

March 2019

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1.0 Introduction

This Storm Water Report is submitted by Hecla Greens Creek Mining Company (HGCMC) pursuant to Parts 1.3, 1.6.2 and 1.8 of Alaska Pollutant Discharge Elimination System (APDES) Permit AK-0043206, effective 1 October 2015. APDES Permit AK-0043206 authorizes Hecla (HGCMC to discharge from the Greens Creek Mine facility located on Admiralty Island at 11 locations (Table 1).

Table 1: Authorized Discharge Locations

Outfall	Receiving Water or Body	Latitude	Longitude
002	Hawk Inlet	58° 06’ 06” N	134° 46’ 30” W
003	Hawk Inlet	58° 07’ 32” N	134° 45’ 16” W
004	Wetlands	58° 09’ 01” N	134° 45’ 16” W
005.2	Zinc Creek	58° 05’ 28” N	134° 44’ 10” W
005.3	Greens Creek	58° 04’ 23” N	134° 43’ 25” W
005.4	Greens Creek	58° 04’ 21” N	134° 43’ 12” W
005.5	Greens Creek	58° 04’ 41” N	134° 39’ 07” W
006	Greens Creek	58° 04’ 43” N	134° 38’ 49” W
007	Greens Creek	58° 04’ 50” N	134° 38’ 27” W
008	Greens Creek	58° 04’ 52” N	134° 38’ 06” W
009	Greens Creek	58° 04’ 47” N	134° 37’ 47” W

Outfall 002 discharges treated wastewater contributed by mine contact water, storm water, mill process water, treated domestic wastewater, and intercepted groundwater at the mouth of Hawk Inlet. Monitoring associated with the APDES Outfall 002 diffuser is included in the Hawk Inlet Monitoring Program Annual Report.

This report includes results of monitoring associated with storm water outfalls 003, 004, 005.2, 005.3, 005.4, 005.5, 006, 007, 008, and 009. Outfall monitoring requirements (AK-0043206 Part 1.3) are summarized in Table 2. Outfall locations are shown in Figure 1.

Table 2: Storm Water Outfall Monitoring Requirements

Outfall	Location	Parameters[a]	Minimum Frequency[b]	Sample Type
003	Southern part of Hawk Inlet facilities area near the cannery buildings	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
004	Pit 7 (inactive rock quarry and topsoil storage) off of A-road at mile 1.9	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.2	Zinc Creek (east side of bridge) off of B-road at mile 3.0	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.3	Site E (inactive waste rock storage area) off of B-road at mile 4.7	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.4	Pit 6 (inactive rock quarry and top soil storage) off of B-road at mile 4.6	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
005.5	Culvert at B-road mile 7.8	Flow, oil & grease, lead, zinc, TSS, pH, hardness	twice per year	Grab
006	Pond D (sediment pond from inactive waste rock storage area D) off of B-road at mile 8.0	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
007	Pond C (sediment pond from inactive waste rock storage area C) off of B-road at mile 8.2	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
008	960 laydown site (initial portal development waste rock)	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab
009	Site 1350 adit inactive waste rock storage area	Flow, lead, zinc, TSS, pH, hardness	twice per year	Grab

a. Flow shall be reported in gpm, lead and zinc shall be measured as total recoverable in µg/L, oil & grease and TSS shall be measured in mg/L, pH shall be measured in s.u., and hardness shall be measured as mg/L of CaCO3.

b. The samples must be collected once during the spring runoff or snow-melt and once during the fall rainfall events. Sampling is only required when an outfall is discharging.

Section 1.6.2 of APDES Permit AK-0043206 requires monitoring of the receiving water directly upstream and downstream of where each storm water outfall enters the receiving water. The

upstream and downstream monitoring sites are summarized in Table 3 and locations are shown in Figures 2 through 9.

Receiving water monitoring is to be conducted semiannually (Table 2) and at the same time (within three hours) as each associated outfall. Samples are to be collected during the spring runoff or snow-melt and during the fall rainfall events. Because of the time required to visit all ten storm water outfalls and associated receiving water sites, it is likely that each semiannual monitoring event will occur over multiple days and potentially during separate storm events.

Storm event data and analytical water quality monitoring data for storm water and receiving water for the reporting period are presented in Section 2.0 of this report. An evaluation of the results for each outfall, including comparison of upstream and downstream monitoring, is presented in Section 3.0 pursuant to AK-0043206 Part 1.8. Section 4.0 of this report contains the required annual certification (AK-0043206 Appendix A, Part 1.12). Graphical presentations of the data at each monitoring station versus time are included in Attachment A. Attachment B is a tabulation of historical data for the outfalls and receiving waters. The data are also submitted as an electronic spreadsheet per AK-0043206 Part 1.8.

Table 3: Storm Water Outfall and Receiving Water Monitoring Sites

Location	Outfall	Site	Type	Site Description
Hawk Inlet	003	527SW	S	NPDES Stormwater #003 - North Cannery Building @ Culvert Outfall
		529SW	RD	NPDES Stormwater - Hawk Inlet Float Plane Dock
Pit 7	004	520SW	S	NPDES Stormwater #004 - "A" Road @ 1.8 Mile - Pit "7"
		532SW	RU	NPDES Stormwater at Pit 7 - Upstream of Outfall 004
		524SW	RD	Pit 7 - Fowler Creek
Zinc Creek Bridge	005.2	539SW	S	NPDES Stormwater #005.2 - "B" Road @ 3.0 Mile - Zinc Creek Bridge
		371SW	RU	Zinc Creek - Above B Road
		368SW	RD	Zinc Creek - 0466 ft below bridge
Site E	005.3	545SW	S	NPDES Stormwater #005.3 - "B" Road @ 4.5 Mile - Waste Rock Area "E"
		595SW	RU	NPDES Stormwater - Greens Creek upstream of Outfalls 005.3 and 005.4
		591SW	RD	NPDES Stormwater Greens Creek Below Site E
Pit 6	005.4	547SW	S	NPDES Stormwater #005.4 - "B" Road @ 4.6 Mile - Pit "6"
		595SW	RU	NPDES Stormwater - Greens Creek upstream of Outfalls 005.3 and 005.4
		591SW	RD	NPDES Stormwater Greens Creek Below Site E
7.8 Mile	005.5	560SW	S	NPDES Stormwater #005.5 - "B" Road @ 7.8 Mile - Culvert Outfall
		6SW	RU	Greens Creek - Middle, Above Bruin Creek
		590SW	RD	NPDES Stormwater - 920 Down Gradient - Greens Creek
Pond D	006	562SW	S	NPDES Stormwater #006 - Pond "D" Overflow - Waste Rock Area "D"
		6SW	RU	Greens Creek - Middle, Above Bruin Creek
		590SW	RD	NPDES Stormwater - 920 Down Gradient - Greens Creek
Pond C	007	565SW	S	NPDES Stormwater #007 - Pond "C" Overflow - Waste Rock Area "C"
		1SW	RU	Greens Creek - Upper, At 920 Weir
		6SW	RD	Greens Creek - Middle, Above Bruin Creek
960 Waste Rock Pile	008	570SW	S	NPDES Stormwater #008 - Waste Rock Area "980"
		1SW	RU	Greens Creek - Upper, At 920 Weir
		6SW	RD	Greens Creek - Middle, Above Bruin Creek
1350 Waste Stockpile	009	580SW	S	NPDES Stormwater #009 - Mine Adit Drainage - East, Below Sediment Pond
		48SW	RU	Greens Creek - Background Control Site
		1SW	RD	Greens Creek - Upper, At 920 Weir

* S = Storm water, RU = Receiving water upstream, RD = Receiving water downstream

2.0 Annual Monitoring Results

This section includes the results of storm water outfall and receiving waterbody monitoring pursuant to APDES Permit AK-0043206 Parts 1.3 and 1.6.2. Section 2.1 includes the date and duration (in hours) of the storm event sampled; rainfall measurements or estimates (in inches) of the storm event; the duration between the storm event sampled and the end of the previous measurable (greater than 0.1 inch rainfall) storm event; and an estimate of the total volume (in gallons) of the discharge (AK-0043206 Part 1.3.7). Water quality data are included in Section 2.2.

2.1 Storm Event Data

Precipitation and duration data associated with the sampling events that occurred during the reporting period are summarized in Table 4. HGCMC maintains three meteorological stations at the site; one located at the mill site, one located at the tailings facility, and one located at the Hawk Inlet float plane dock. When possible, the meteorological station in closest proximity to the outfalls being sampled is used as the reference station for the precipitation and duration data.

The estimated total gallons of storm water discharged through the outfalls that were sampled during the reporting period are presented in Table 5. These discharge estimates were calculated using the rational method equation. Catchment areas were calculated based on high resolution LiDAR aerial imagery acquired in 2015.

2.2 Water Quality Data

Analytical results for the required monitoring parameters (Table 2) for each outfall and associated receiving water sites are presented in Table 6. Also provided are the method detection limit (MDL) and minimum level of quantification (ML) for total recoverable lead, total recoverable zinc, oil and grease, and total suspended solids. As required by Permit Part 1.3.6, if a value is less than the MDL it is reported as less than the numeric value of the MDL, and if a value is less than the ML it is reported as less than the numeric value of the ML.

The results in Table 6 are organized first by the permitted outfall, and then by the date of the sample or observation. The results for the storm water effluent (S) are grouped with the

receiving water upstream sites (RU) and downstream sites (RD), as appropriate for each sampling event. A discussion and evaluation of the results for each outfall and sampling event is provided in the following section.

Table 4: Storm Event Details

Date	6/4/2018	6/4/2018	10/8/2018	10/8/2018	10/15/2018
Outfalls Sampled	003, 005.2	005.5, 008, 009	003	005.3, 005.4, 005.5, 008, 009	005.2
Outfalls Observed (not sampled)	004	006, 007	004, 005.2	006, 007	004
Meteorological Station Reference	Hawk Inlet	Mill Site	Hawk Inlet	Mill Site	Tailings
SAMPLE EVENT					
Duration (hours)	10.25	11.75	18	18	32
Start Date	6/4/18	6/4/18	10/7/18	10/7/18	10/14/18
Start Time	4:00	3:00	17:00	17:15	4:00
Precipitation (inches)	0.49	0.74	0.56	0.68	1.59
Same Day Precip. (inches)	0.49	0.74	0.32	0.4	0.49
PRIOR EVENT					
Lapse Between Events (hours)	37.25	32	25.5	19.75	12.75
Duration (hours)	2.5	6	3.75	12.5	3.25
Start Date	6/2/18	6/2/18	10/6/18	10/6/18	10/13/18
Start Time	12:15	13:00	11:30	9:00	12:00
Precipitation (inches)	0.2	0.25	0.15	0.31	0.33

Table 5: Storm Water Outfall Area and Estimated Total Discharge Volume

Outfall	Date	Catchment Area (acre)	Total Discharge (gallons)
003	6/4/2018	0.2	1,855
005.2	6/4/2018	0.6	2,385
005.5	6/4/2018	5.3	31,696
008	6/4/2018	0.7	5,582
009	6/4/2018	3.3	26,314
003	10/8/2018	0.2	2,104
005.3	10/8/2018	6.8	62,628
005.4	10/8/2018	1.9	13,999
005.5	10/8/2018	5.3	29,288
008	10/8/2018	0.7	5,158
009	10/8/2018	3.3	24,314
005.2	10/15/2018	0.6	7,756

Table 6: Storm Water Outfall and Receiving Water Monitoring Results

Outfall	Type *	Site	Date	Time	Flow (gpm)	pH (su)	Hardness (mg/L)	Lead-TR (µg/L)	MDL	ML	Zinc-TR (µg/L)	MDL	ML	Oil & Grease (mg/L)	MDL	ML	TSS (mg/L)	MDL	ML
003	S	527SW	4-Jun	14:10	0.8	7.78	153	45.5	0.1	0.5	106	2	5	<2	2	9.9	<20	5	20
	RD	529SW	4-Jun	14:23		8.12	3150	1.2	0.5	3	10	2	5	<2	2	9.9	22	5	20
	S	527SW	8-Oct	14:28	0.5	7.77	193	1.8	0.1	0.5	55	4	10	<2	2	10	<5	5	20
	RD	529SW	8-Oct	14:38		7.83	1390	4.1	0.5	3	<50	20	50	<2	2	10	<20	5	20
004	S	520SW	4-Jun	14:40	No sample taken due to no discharge														
	S	520SW	8-Oct	14:15	No sample taken due to no discharge														
005.2	S	539SW	4-Jun	12:32	0.26	4.3	28	9.1	0.1	0.5	100	2	5	<2	2	9.9	<20	5	20
	RU	371SW	4-Jun	12:44		6.88	30	<0.5	0.1	0.5	15	2	5	<2	2	9.9	<5	5	20
	RD	368SW	4-Jun	12:56		7.21	31	<0.1	0.1	0.5	8	2	5	<2	2	9.9	<5	5	20
	S	539SW	15-Oct	11:15	2	4.14	39	3.9	0.1	0.5	90	2	5	<2	2	9.9	<5	5	20
	RU	371SW	15-Oct	11:31		7.21	28	<0.5	0.1	0.5	14	2	5	<2	2	9.9	<5	5	20
	RD	368SW	15-Oct	11:48		7.26	28	<0.5	0.1	0.5	13	2	5	<2	2	9.9	<5	5	20
005.3	S	545SW	8-Oct	12:37	20	7.56	294	27.8	0.1	0.5	710	4	10	<2.2	2.2	11.1	<20	5	20
	RU	595SW	8-Oct	13:22		7.88	54	2.2	0.1	0.5	14	4	10	<2.1	2.1	10.5	<20	5	20
	RD	591SW	8-Oct	13:10		7.82	57	1.5	0.1	0.5	11	4	10	<2	2	10	<20	5	20
005.4	S	547SW	8-Oct	12:21	0.26	7.41	78	<0.1	0.1	0.5	<4	4	10	<2	2	10	<5	5	20
	RU	595SW	8-Oct	13:22		7.88	54	2.2	0.1	0.5	14	4	10	<2.1	2.1	10.5	<20	5	20
	RD	591SW	8-Oct	13:10		7.82	57	1.5	0.1	0.5	11	4	10	<2	2	10	<20	5	20
005.5	S	560SW	4-Jun	11:32	2	8.06	509	4690	0.1	0.5	5750	2	5	<2	2	9.9	2280	50	200
	RU	6SW	4-Jun	10:50		7.59	42	0.4	0.1	0.5	11	2	5	<2	2	9.9	<20	5	20
	RD	590SW	4-Jun	11:46		7.72	46	0.7	0.1	0.5	12	2	5	<2	2	9.9	<5	5	20
	S	560SW	8-Oct	11:36	1	8.14	67	3910	0.5	3	3190	20	50	<2	2	10	1150	20	80
	RU	6SW	8-Oct	11:17		7.76	49	<0.5	0.1	0.5	13	4	10	<2.1	2.1	10.5	<20	5	20
	RD	590SW	8-Oct	11:50		7.92	54	<0.5	0.1	0.5	11	4	10	<2.1	2.1	10.5	<20	5	20
006	S	562SW	4-Jun	10:40	No sample taken due to no discharge														
	S	562SW	8-Oct	11:10	No sample taken due to no discharge														
007	S	565SW	3-Jan	14:20	10		146	950.1	0.1	0.5	1630	2	5				264	5	20
	RU	GC-860	3-Jan	14:50			54	<0.5	0.1	0.5	12	2	5				<5	5	20
	RD	6SW	3-Jan	14:30	22,900		53	1.6	0.1	0.5	19	2	5				<5	5	20
	S	565SW	4-Jun	10:35	No sample taken due to no discharge														
	S	565SW	8-Oct	11:05	No sample taken due to no discharge														

Outfall	Type *	Site	Date	Time	Flow (gpm)	pH (su)	Hardness (mg/L)	Lead-TR (µg/L)	MDL	ML	Zinc-TR (µg/L)	MDL	ML	Oil & Grease (mg/L)	MDL	ML	TSS (mg/L)	MDL	ML
008	S	570SW	4-Jun	9:19	24	6.81	171	2	0.1	0.5	58	2	5				<20	5	20
	RU	1SW	4-Jun	10:00		7.39	46	0.7	0.1	0.5	10	2	5				<20	5	20
	RD	6SW	4-Jun	10:50		7.59	42	<0.5	0.1	0.5	11	2	5	<2	2	9.9	<20	5	20
	S	570SW	8-Oct	10:23	4	7.49	214	<0.5	0.1	0.5	25	4	10				<5	5	20
	RU	1SW	8-Oct	10:50	26,032	7.75	53	1.1	0.1	0.5	19	4	10				<20	5	20
	RD	6SW	8-Oct	11:17		7.76	49	<0.5	0.1	0.5	13	4	10	<2.1	2.1	10.5	<20	5	20
009	S	580SW	4-Jun	9:37	5.3	7.1	68	<0.5	0.1	0.5	213	2	5				<5	5	20
	RU	48SW	4-Jun	10:08		7.55	43	0.5	0.1	0.5	9	2	5				<20	5	20
	RD	1SW	4-Jun	10:00		7.39	46	0.7	0.1	0.5	10	2	5				<20	5	20
	S	580SW	8-Oct	10:05	5	7.3	84	<0.5	0.1	0.5	125	4	10				<5	5	20
	RU	48SW	8-Oct	10:42		7.78	47	<0.5	0.1	0.5	11	4	10				<20	5	20
	RD	1SW	8-Oct	10:50	26,032	7.75	53	1.1	0.1	0.5	19	4	10				<20	5	20

Note * S = Stormwater
RU = Receiving water upstream
RD = Receiving water downstream

3.0 Water Quality Monitoring Summary

Permit AK-0043206 does not establish numeric effluent limits for the individual storm water outfalls. As stated in the Permit Fact Sheet, this is due to the difficulty in developing numeric limits for storm water discharges that are extremely variable in flow and pollutant concentrations and the uncertainty regarding the effect of the storm water discharges on the receiving waters. Instead, the permit requires HGCMC to implement corrective action if a storm water discharge exceeds a water quality criterion *and* results in a statistically significant reduction in receiving water quality for the same criterion.

Statistics can be used to define the statistical uncertainty between sample values collected at different sites (e.g., upstream and downstream receiving waters). Statistics can never prove that a difference between sample values is real, only the probability that one may exist, given the available data. Statistical tests rely on using estimates of the true mean and true variance of a population, where larger sample populations increase statistical confidence. Because the upstream and downstream receiving water monitoring program was implemented in 2016, there are not yet adequate data to perform valid statistical testing to determine if storm water outfall discharges are causing significant reduction in receiving water quality. For this report, monitoring results are discussed in general terms as well as in relation to Alaska Water Quality Standards (AWQS). Table 7 is a tabulation of water quality collected during the reporting period compared to applicable AWQS[1].

[1] Water quality standards are from the Alaska Department of Conservation "ALASKA WATER QUALITY CRITERIA MANUAL FOR TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES" as amended through December 12, 2008

Table 7: Comparison of Water Quality Data to Alaska Water Quality Standards

Sample Data[1,2]							Alaska Water Quality Standards (AWQS)[3]			
Outfall	**Type[4]**	**Site**	**Date**	**pH**	**Pb (µg/L)**	**Zn (µg/L)**	**Acute Pb (µg/L)**	**Chronic Pb (µg/L)**	**Acute Zn (µg/L)**	**Chronic Zn (µg/L)**
003	S	527SW	4-Jun	7.78	45.5	106	140.3	5.5	171.8	171.8
003	RD	529SW	4-Jun	8.12	1.2	10	217.2	8.5	95.1	86.1
003	S	527SW	8-Oct	7.77	1.8	55	188.6	7.4	209.2	209.2
003	RD	529SW	8-Oct	7.83	4.1	*20*	217.2	8.5	95.1	86.1
005.2	S	539SW	4-Jun	4.3	9.1	100	16.2	0.6	40.8	40.8
005.2	RU	371SW	4-Jun	6.88	*0.1*	15	17.6	0.7	43.2	43.2
005.2	RD	368SW	4-Jun	7.21	*0*	8	18.4	0.7	44.4	44.4
005.2	S	539SW	15-Oct	4.14	3.9	90	24.6	1.0	54.0	54.0
005.2	RU	371SW	15-Oct	7.21	*0.1*	14	16.2	0.6	40.8	40.8
005.2	RD	368SW	15-Oct	7.26	*0.1*	13	16.2	0.6	40.8	40.8
005.3	S	545SW	8-Oct	7.56	27.8	710	322.2	12.6	298.8	298.8
005.3	RU	595SW	8-Oct	7.88	2.2	14	37.3	1.5	71.1	71.1
005.3	RD	591SW	8-Oct	7.82	1.5	11	39.9	1.6	74.4	74.4
005.4	S	547SW	8-Oct	7.41	*0*	*0*	59.5	2.3	97.1	97.1
005.4	RU	595SW	8-Oct	7.88	2.2	14	37.3	1.5	71.1	71.1
005.4	RD	591SW	8-Oct	7.82	1.5	11	39.9	1.6	74.4	74.4
005.5	S	560SW	4-Jun	8.06	4690	5750	648.0	25.3	475.7	475.7
005.5	RU	6SW	4-Jun	7.59	0.4	11	27.1	1.1	57.5	57.5
005.5	RD	590SW	4-Jun	7.72	0.7	12	30.4	1.2	62.1	62.1
005.5	S	560SW	8-Oct	8.14	3910	3190	49.0	1.9	85.3	85.3
005.5	RU	6SW	8-Oct	7.76	*0.1*	13	32.9	1.3	65.5	65.5
005.5	RD	590SW	8-Oct	7.92	*0.1*	11	37.3	1.5	71.1	71.1
007	S	565SW	3-Jan		950.1	1630	132.2	5.2	165.1	165.1
007	RU	GC-860	3-Jan		*0.1*	12	37.3	1.5	71.1	71.1
007	RD	6SW	3-Jan		1.6	19	36.4	1.4	70.0	70.0
008	S	570SW	4-Jun	6.81	2	58	161.6	6.3	188.8	188.8
008	RU	1SW	4-Jun	7.39	0.7	10	30.4	1.2	62.1	62.1
008	RD	6SW	4-Jun	7.59	*0.1*	11	27.1	1.1	57.5	57.5
008	S	570SW	8-Oct	7.49	*0.1*	25	215.1	8.4	228.3	228.3
008	RU	1SW	8-Oct	7.75	1.1	19	36.4	1.4	70.0	70.0
008	RD	6SW	8-Oct	7.76	*0.1*	13	32.9	1.3	65.5	65.5
009	S	580SW	4-Jun	7.1	*0.1*	213	50.0	2.0	86.4	86.4
009	RU	48SW	4-Jun	7.55	0.5	9	27.9	1.1	58.6	58.6
009	RD	1SW	4-Jun	7.39	0.7	10	30.4	1.2	62.1	62.1

Sample Data[1,2]							Alaska Water Quality Standards (AWQS)[3]			
Outfall	**Type[4]**	**Site**	**Date**	**pH**	**Pb (µg/L)**	**Zn (µg/L)**	**Acute Pb (µg/L)**	**Chronic Pb (µg/L)**	**Acute Zn (µg/L)**	**Chronic Zn (µg/L)**
009	S	580SW	8-Oct	7.3	*0.1*	125	65.4	2.6	103.4	103.4
009	RU	48SW	8-Oct	7.78	*0.1*	11	31.2	1.2	63.2	63.2
009	RD	1SW	8-Oct	7.75	1.1	19	36.4	1.4	70.0	70.0

1 - Shaded cells indicate exceedance of AWQS

2 - Italic font indicates the laboratory result was non-detect and tabulated value is zero if less than the Method Detection Limit (MDL) or the value of MDL if less than the Minimum Level of Quantification (ML)

3 - AWQS are from the Alaska Department of Conservation "ALASKA WATER QUALITY CRITERIA MANUAL FOR TOXIC AND OTHER DELETERIOUS ORGANIC AND INORGANIC SUBSTANCES" as amended through December 12, 2008

4 - S = Storm water, RU = Receiving water upstream, RD = Receiving water downstream

3.1 Storm Water Outfall 003 – Hawk Inlet

Outfall 003, a culvert pipe located adjacent to the North Cannery Building, drains the storm water runoff from a small area approximately 0.2 acres in size (Figure 2). Outfall 003 discharges directly into Hawk Inlet, and therefore there is only one associated receiving water monitoring site (Site 529). The lead concentration in the June sample from the outfall exceeded the chronic AWQS (Table 7) but the lead concentration in the receiving Hawk Inlet water was well below the marine chronic aquatic life criteria due to low discharge rate through the outfall and the immense dilution volume of Hawk Inlet.

3.2 Storm Water Outfall 004 – Pit 7

Outfall 004 is located downgradient of a constructed wetlands that receives runoff from Pit 7 (Figure 3), which is a former rock quarry and current reclamation material storage pile. Flow has not been observed at this outfall during storm events since 2012, and there was no flow observed during the storm event monitoring conducted during this reporting period. There was no activity at Pit 7 during the reporting period, and no signs of erosion from the reclamation material stockpile.

3.3 Storm Water Outfall 005.2 – Zinc Creek Bridge

Outfall 005.2 is located near the bottom of the north abutment, upstream side, of the Zinc Creek Bridge located at 3.0-mile on the B-Road (Figure 4). The drainage area for this outfall, approximately 0.6 acres in size, captures runoff from a short section of road and a portion of the abutment. Receiving water monitoring is performed at Site 371 (upstream) and Site 368 (downstream) in Zinc Creek.

Storm event monitoring data for 2018 show that the storm water effluent is weakly acidic and contains concentrations of lead and zinc that exceed AWQS (Table 7). In samples collected from the receiving water, pH is near neutral and metal concentrations are below standards. This demonstrates that the low volume of storm water runoff through this outfall is not having an adverse impact on the water quality of Zinc Creek.

3.4 Storm Water Outfall 005.3 – Site E

Outfall 005.3 is located in a small drainage that runs between the B-Road and inactive waste rock Site E (Figure 5). The drainage area contributing to the outfall location is approximately 6.8 acres. The drainage flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at Site 595 (upstream) and Site 591 (downstream).

Water quality at the outfall is influenced by the Site E waste rock and has exhibited highly variable lead and zinc concentrations throughout its monitoring history (Attachment A). Samples collected during the reporting period show that monitored constituent concentrations are within the normal range of historical fluctuation, but both lead and zinc exceed AWQS (Table 7). The lead concentration in the upstream receiving water also exceeded the chronic lead standard, but concentrations of lead and zinc were below standards in the downstream receiving water sample.

In 2008, HGCMC initiated a program of removing Site E waste rock for co-disposal in the tailings facility. Through 2018, over 121,000 cubic yards of material were removed. The water quality at Outfall 005.3 is expected to show gradual improvement as the waste rock removal activities progress.

3.5 Storm Water Outfall 005.4 – Pit 6

Outfall 005.4 is the discharge location for runoff from a reclamation material storage area in an old road construction quarry called Pit 6 (Figure 5). The catchment area draining to the outfall is approximately 0.9 acres in size. There has been no activity in Pit 6 since 2009 and the area is stabilized and vegetated. Storm water runoff flows into Greens Creek approximately one-half mile from the outfall location. Receiving water monitoring is performed in Greens Creek at Site 595 (upstream) and Site 591 (downstream).

Water quality at Outfall 005.4 is excellent, with lead and zinc concentrations consistently below the Alaska Water Quality Standards since 2009.

3.6 Storm Water Outfall 005.5 – 7.8 Mile B-Road Culvert

Outfall 005.5 is a culvert that drains a portion of the B-Road surface above mile 7.8 (Figure 6). The catchment area draining to the culvert is approximately 5.3 acres, most of which is undisturbed forest on the uphill side of the road. Discharge from the culvert is to a forested hillside, approximately 200 feet from Greens Creek. Flows through the culvert during storm event monitoring have been low and typically less than 10 gpm. As a result, the drainage infiltrates into the forest duff and a point source discharge to Greens Creek has not been observed.

Access to this section of Greens Creek below the culvert is challenging, particularly during storm events. Therefore, the sites for the upstream and downstream receiving water monitoring were chosen to address safety concerns while also satisfying the intent of the Permit. Site 6, which is also sampled on a monthly basis under the Fresh Water Monitoring Program (FWMP), was selected as the upstream receiving water site. Site 590, located below mile 7.6, was selected as the downstream site.

2018 storm event monitoring data show a decrease in suspended solids concentrations compared to 2017 samples (Attachment A), indicating the BMPs implemented in autumn of 2017 were successful in reducing sediment load. However, concentrations of lead and zinc remain high and exceed AWQS (Table 7). Because of the low flow rate from the outfall and infiltration into the forest duff there is minimal influence on Greens Creek water quality. There were no exceedances of standards in receiving water samples and metal concentrations do not appear to be influenced by the outfall.

3.7 Storm Water Outfall 006 – Pond D Overflow

Pump systems maintain a low water level in Pond D and route storm water to treatment facilities or for use in the mill. There were no storm water discharges through Outfall 006 in 2018. If a discharge were to occur, receiving water monitoring in Greens Creek would be performed at Site 6 for the upstream site and at Site 590 for the downstream site (Figure 6).

3.8 Storm Water Outfall 007 – Pond C Overflow

The Pond C system, consisting of an upper and lower pond, collects storm water runoff from an inactive waste rock storage area and a section of the B-Road (Figure 7). Due to the potential for sediment laden runoff from the catchment area, Hecla's standard practice is to pump accumulated storm water from the upper Pond C to water treatment facilities and not routinely discharge storm water through Outfall 007. Should discharge from Outfall 007 occur, designated receiving water monitoring locations in Greens Creek are Site 1 (the 920 weir) for the upstream site and at Site 6 for the downstream site.

There were no storm water discharges through Outfall 007 in 2018. However, a frozen pipeline in late December 2017 resulted in a non-routine discharge through the outfall on the evening of January 2, 2018. The incident was reported and documented with a noncompliance notification. In accordance with Permit AK0043206 Part 1.3.1 and Table 3, water quality samples were collected from Outfall 007 and the receiving water (Greens Creek) upstream and downstream from the outfall on Wednesday, January 3. For this special sampling event, the upstream sample was collected as close to the outfall discharge location as possible and the sampling location was designated as GC-860 (Figure 7; Tables 6 and 7).

Lead and zinc concentrations exceeded AWQS in the outfall sample. In the downstream receiving water sample, the lead concentration was slightly above the chronic aquatic life fresh water criteria but well below the acute criteria (Table 7). The elevated lead concentration was a short-term impact to the receiving stream.

3.9 Storm Water Outfall 008 – 960 Site

Outfall 008 is the discharge location (Figure 8) for runoff from a former waste rock storage pile placed during initial development of the 920 mine portal. The majority of the waste rock was removed in 2005. The catchment area contributing runoff to the outfall is approximately 0.7 acres. Since removal of the waste rock material the water quality at the outfall has consistently met the AWQS for lead and zinc.

3.10 Storm Water Outfall 009 – 1350 Site

Outfall 009 monitors the runoff quality from an inactive waste rock pile that was placed during the development of the 1350 adit (Figure 9). Between 2005 and 2015, over 80 percent of the waste rock was removed for disposal in the underground mine. The catchment area contributing runoff to the outfall is approximately 3.3 acres in size. Receiving water monitoring is performed in Greens Creek at Site 48 (upstream) and Site 1 (downstream). Site 48, also sampled monthly as part of the FWMP, is located upstream of all mining activity and represents natural background quality for Greens Creek.

Zinc concentrations in the outfall samples collected during the reporting period exceeded AWQS (Table 7). Concentrations in the receiving water, however, were well below standards indicating no substantial impact from the outfall.

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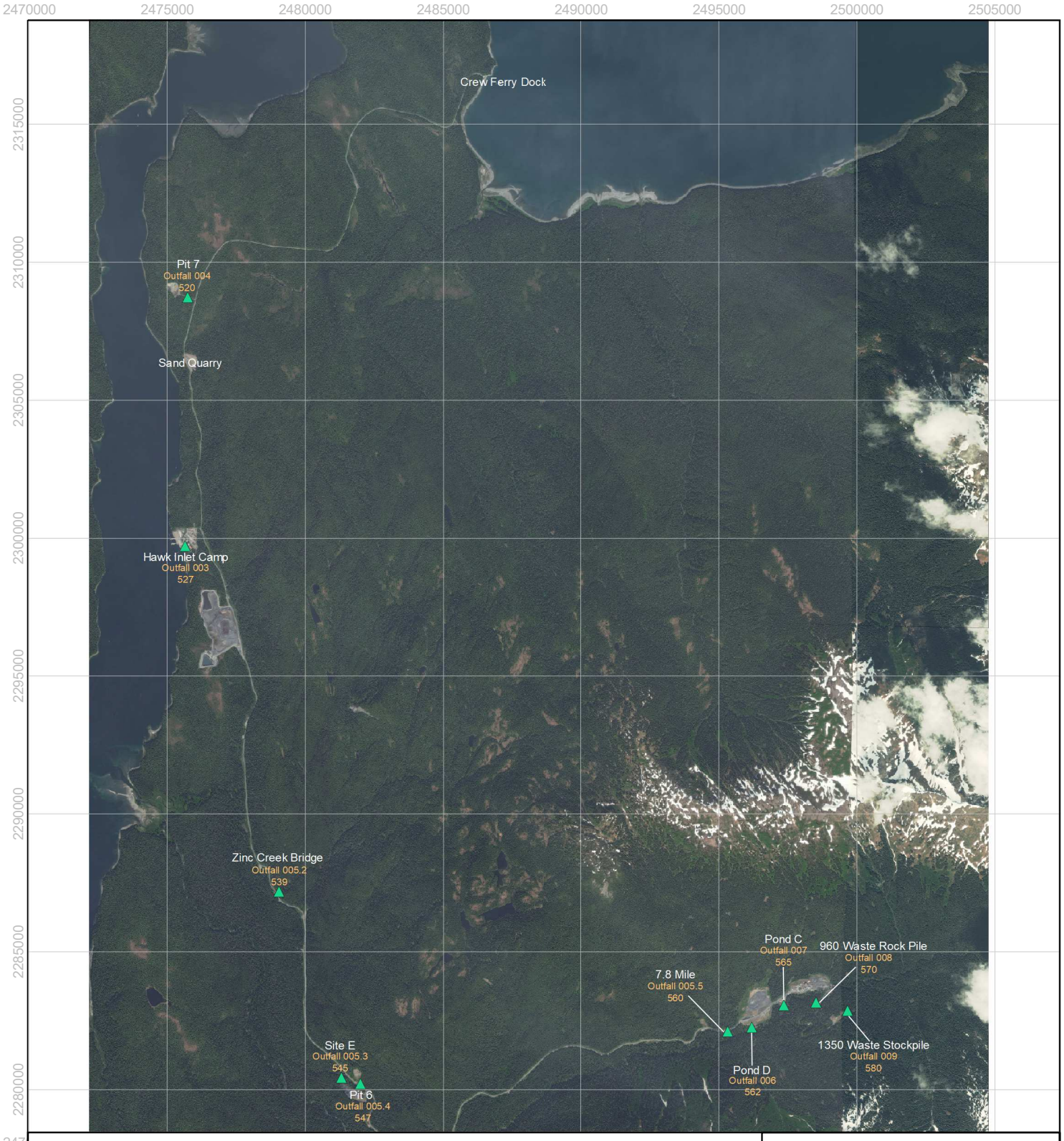


Legend

▲ APDES Outfall

N

2500 0 2500 5000 ft

Outfall Locations

Hecla MINING COMPANY

FIGURE 1

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

EDE

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:60,000
DATE: 02/15/2019
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

LEGEND

- APDES Outfall
- Storm Water Site
- Hawk Inlet Runoff Area

N

100 0 100 ft

APDES Outfall 003 Monitoring Locations
Hawk Inlet

Hecla MINING COMPANY

FIGURE 2

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

EDE

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:1,200
DATE: 02/19/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

LEGEND

- APDES Outfall
- Storm Water Site
- Pit 7 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 004 Monitoring Locations
Pit 7

FIGURE 3

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:1,500
DATE: 02/19/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY

LEGEND

- APDES Outfall
- Storm Water Site
- Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 005.2 Monitoring Locations
Zinc Creek Bridge

FIGURE 4

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:2,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY

LEGEND

- APDES Outfall
- Storm Water Site
- Site E Runoff Area
- Pit 6 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 005.3 and 005.4 Monitoring Locations
Site E and Pit 6

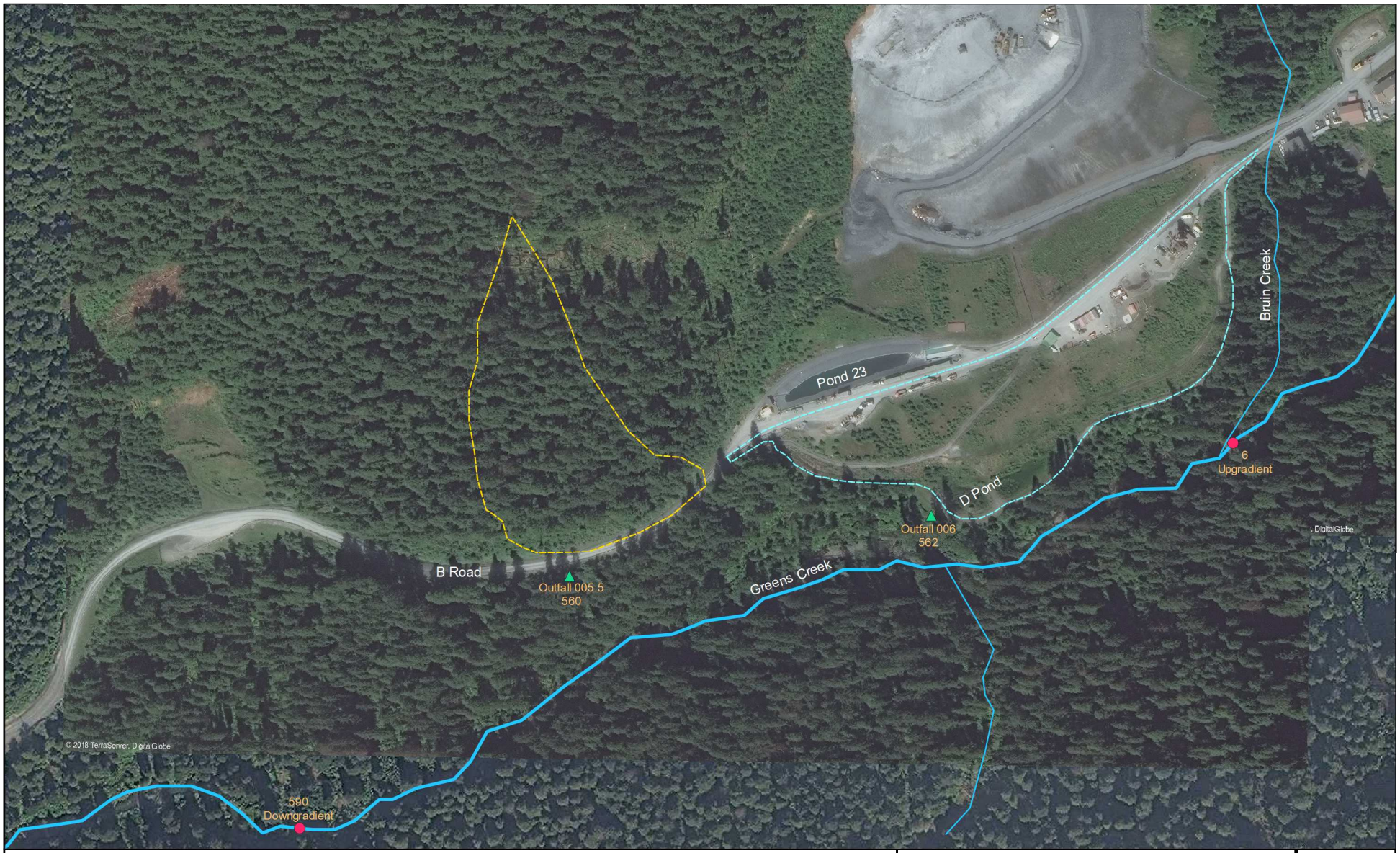
FIGURE 5

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:6,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 7.8 Mile Runoff Area
- Pond D Runoff Area

N

100 0 100 200 300 ft

APDES Outfalls 005.5 and 006 Monitoring Locations
7.8 Mile B-Road Culvert and Pond D Overflow

FIGURE 6

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:4,000
DATE: 02/15/19
PROJECTION: AK State Plane NAD83 feet
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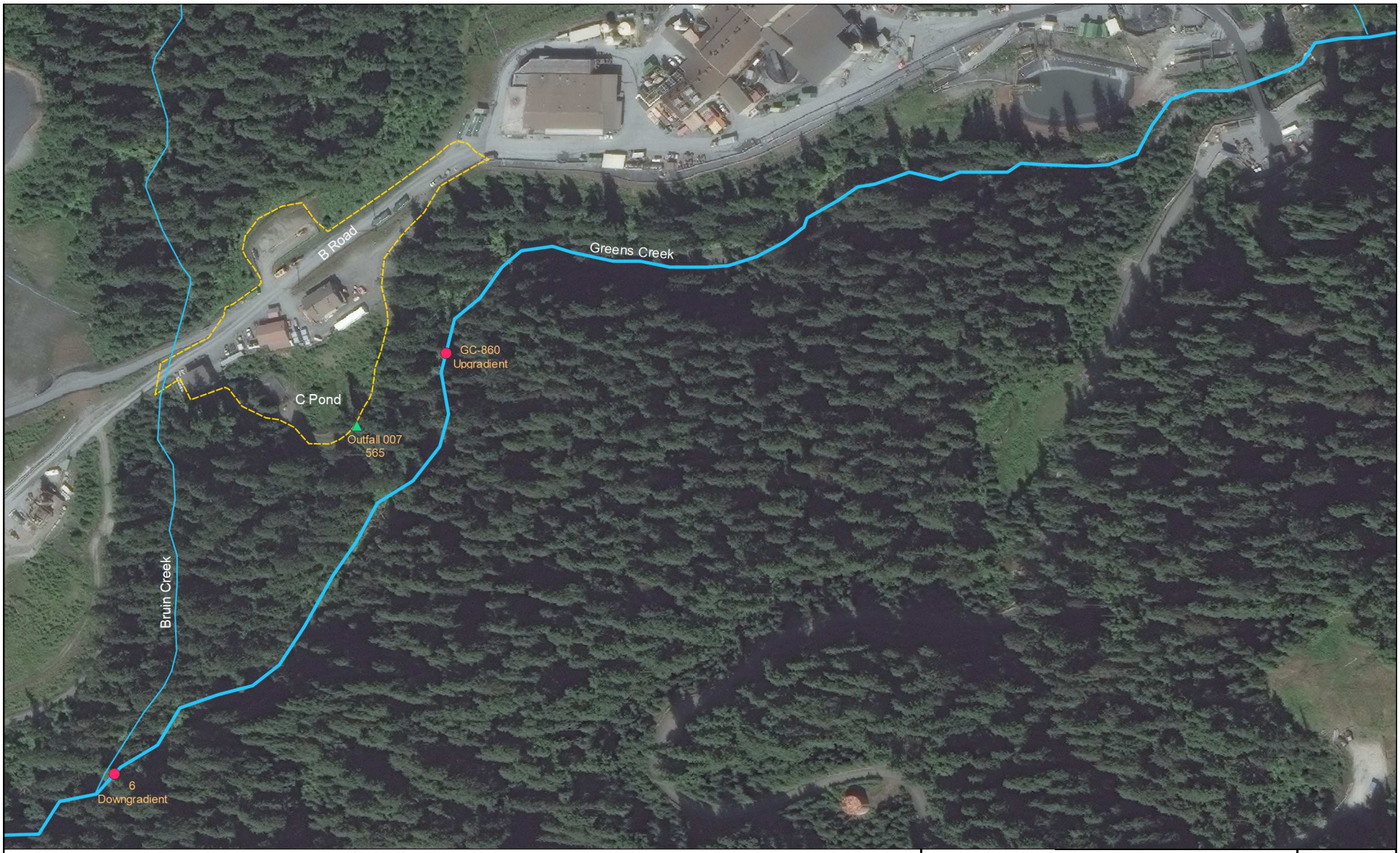
EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- Pond C Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 007 Monitoring Locations
Pond C Overflow

FIGURE 7

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
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DATE: 02/14/19
PROJECTION: AK State Plane NAD83 feet
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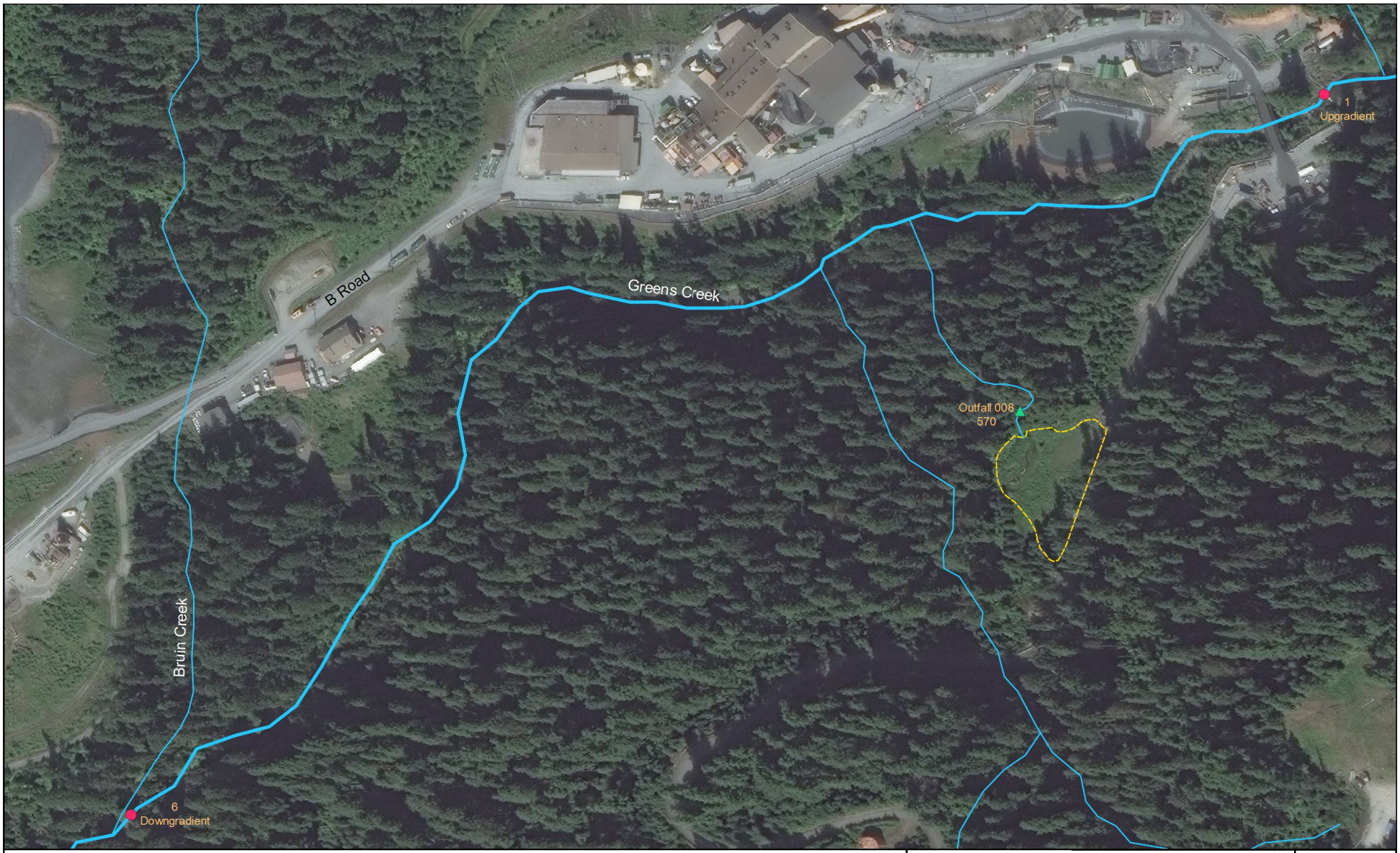
EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 960 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 008 Monitoring Locations
960 Site

FIGURE 8

Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
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DATE: 02/20/19
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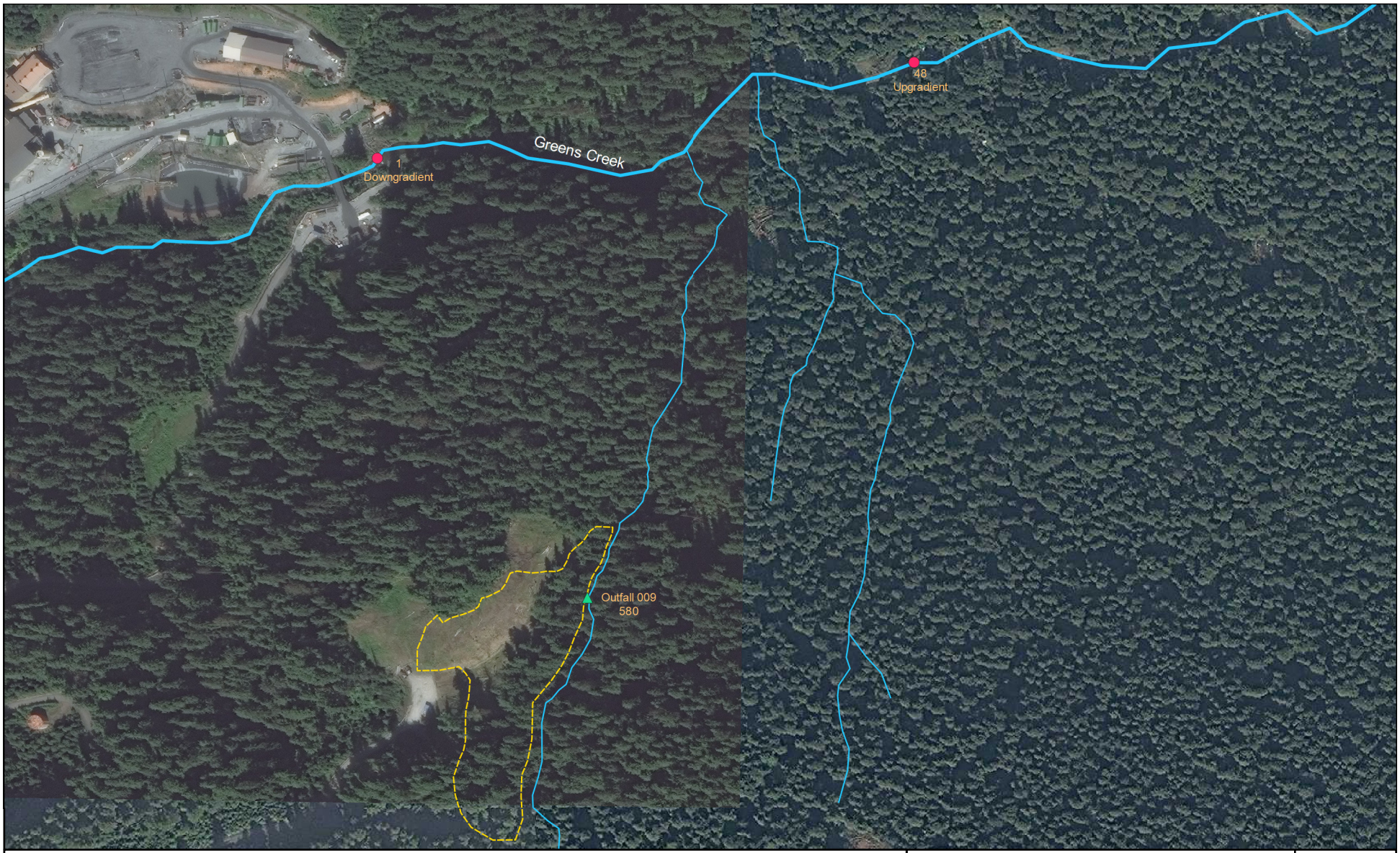
EDE

Hecla MINING COMPANY



LEGEND

- APDES Outfall
- Storm Water Site
- 1350 Runoff Area

N

100 0 100 200 300 ft

APDES Outfall 009 Monitoring Locations
1350 Site

FIGURE 9

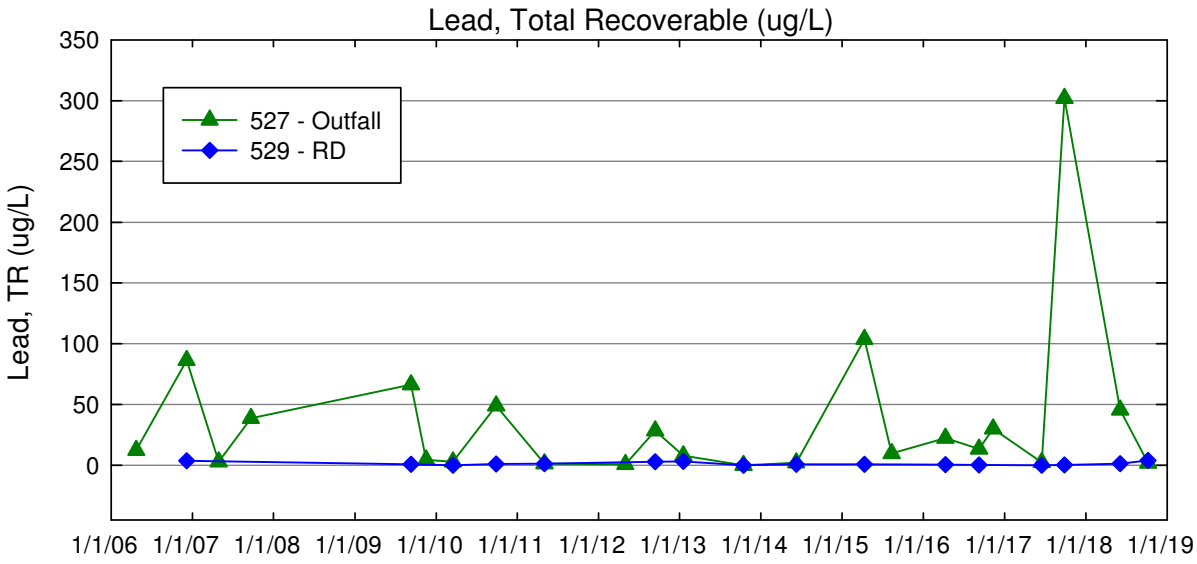
Hecla Greens Creek Mining Company
Admiralty Island, Alaska

DWG FILE: GCM_2018_Annual_Report.qgs
SCALE: 1:4,000
DATE: 02/20/19
PROJECTION: AK State Plane NAD83 feet
DRAWN: MNN

EDE

Hecla MINING COMPANY

OUTFALL 003


Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
350
300
250
200
150
100
50
0
527 - Outfall
529 - RD
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
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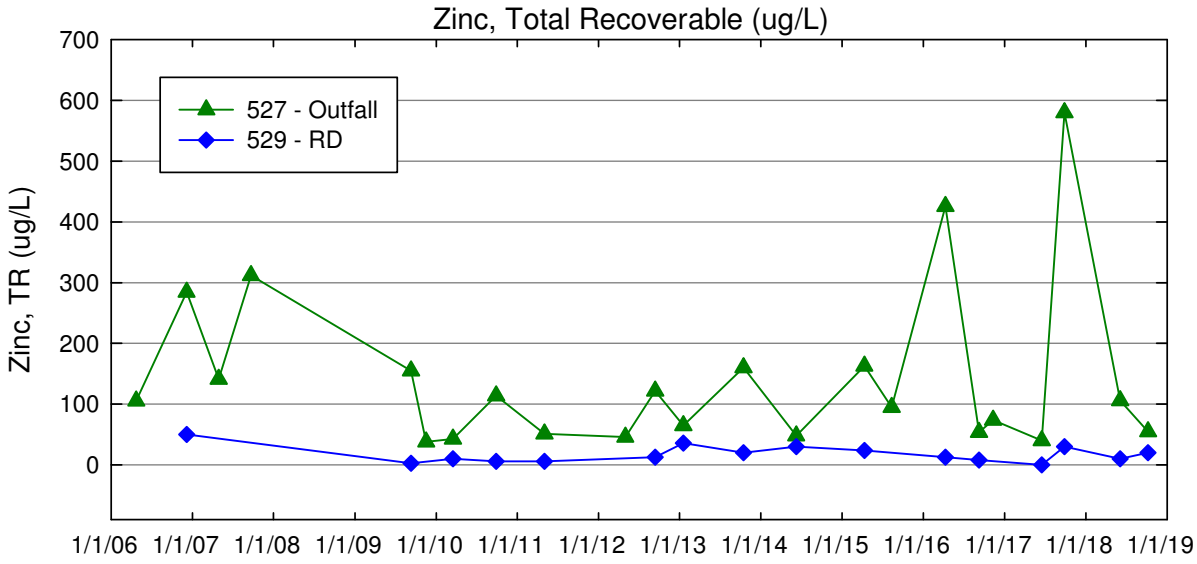
1/1/16
1/1/17
1/1/18
1/1/19


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
700
600
500
400
300
200
100
0
527 - Outfall
529 - RD
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
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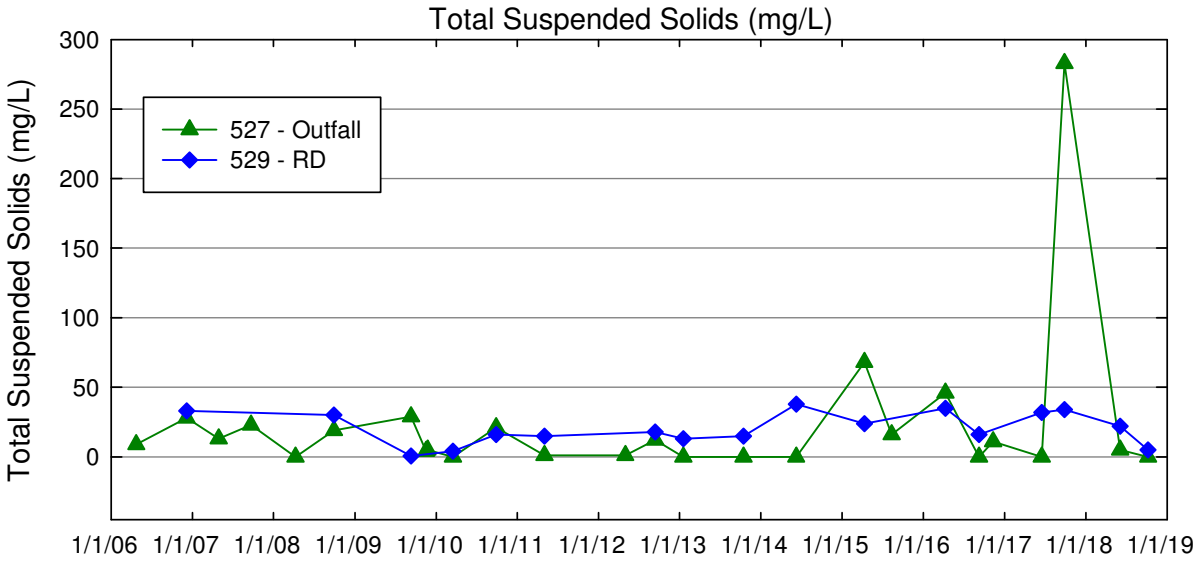
1/1/16
1/1/17
1/1/18
1/1/19


Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
300
250
200
150
100
50
0
527 - Outfall
529 - RD
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
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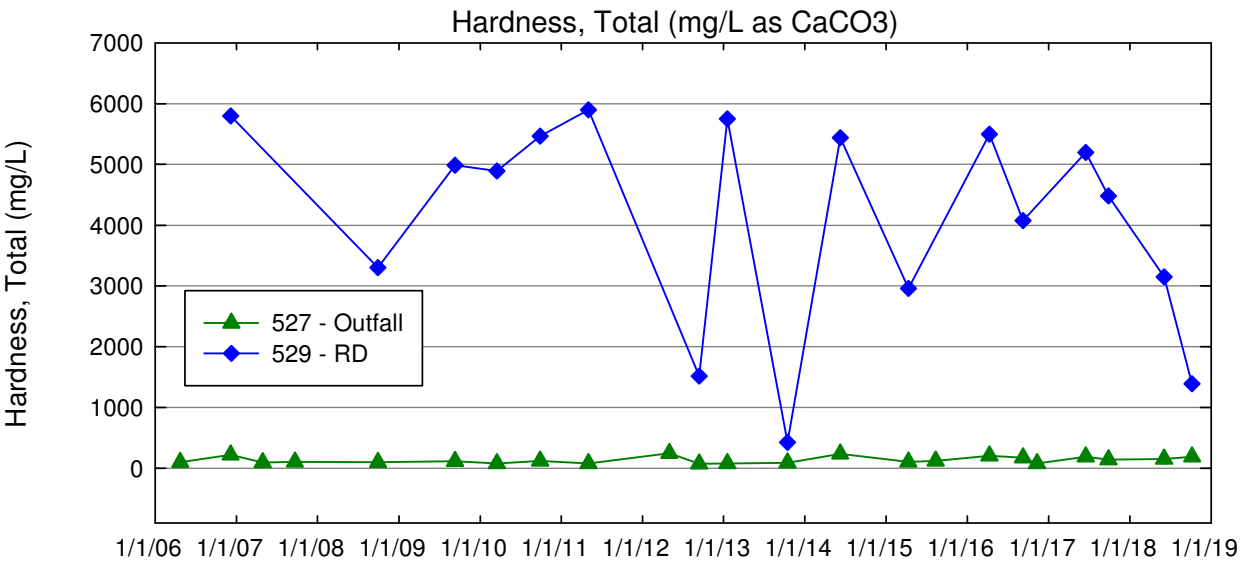
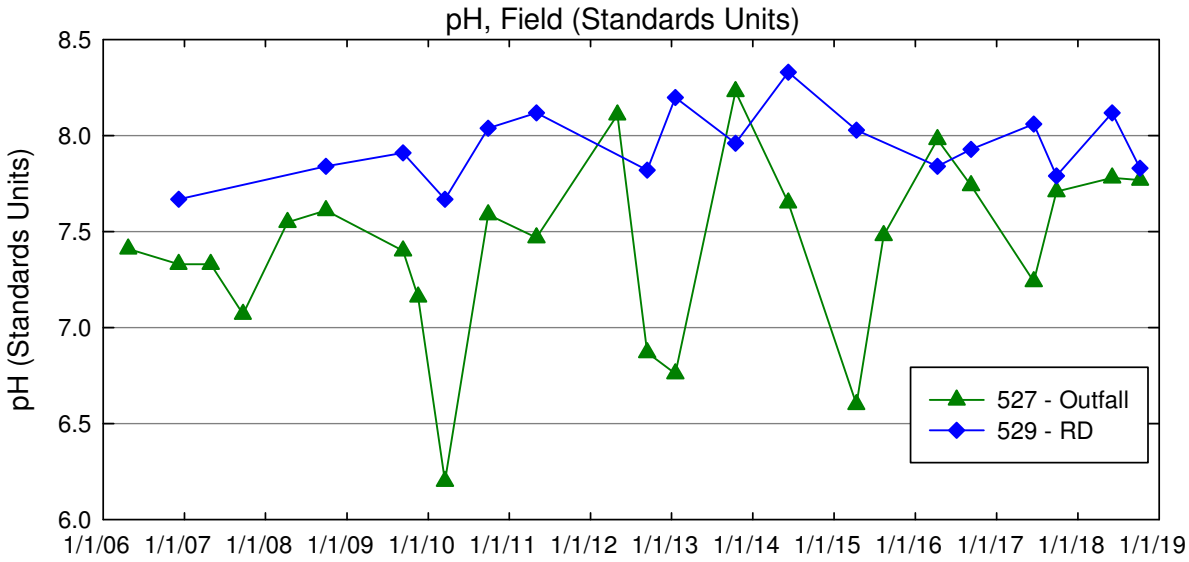
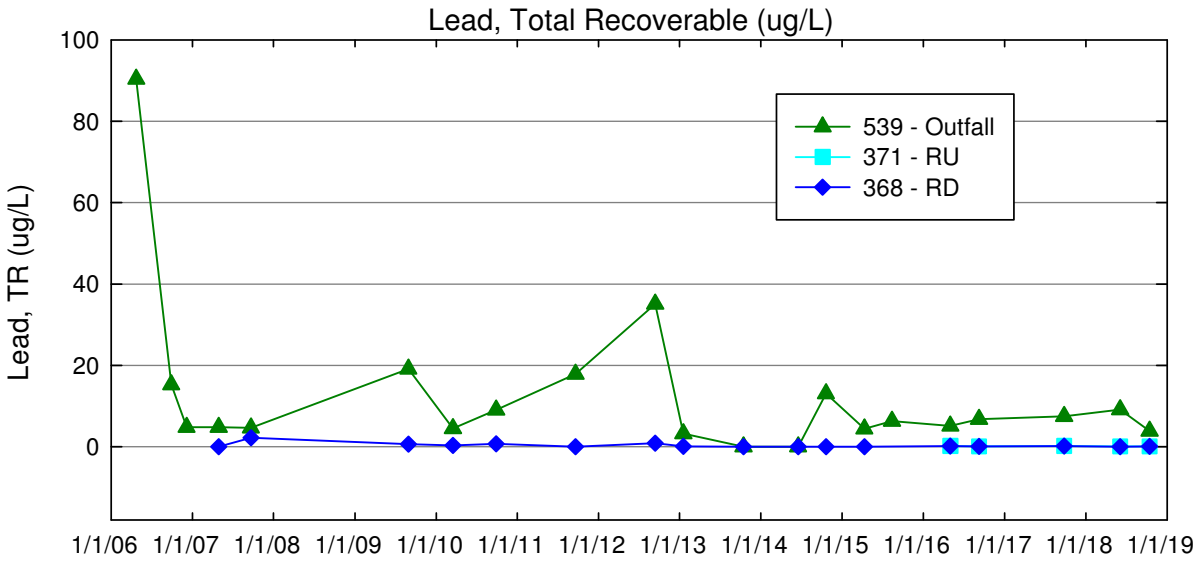
1/1/16
1/1/17
1/1/18
1/1/19

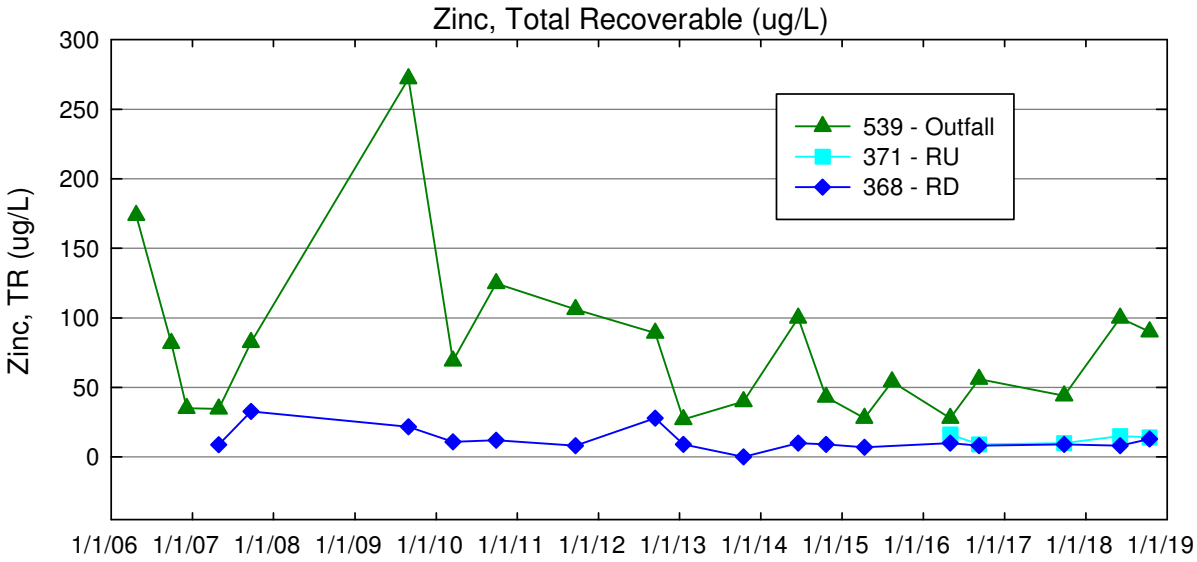
OUTFALL 003

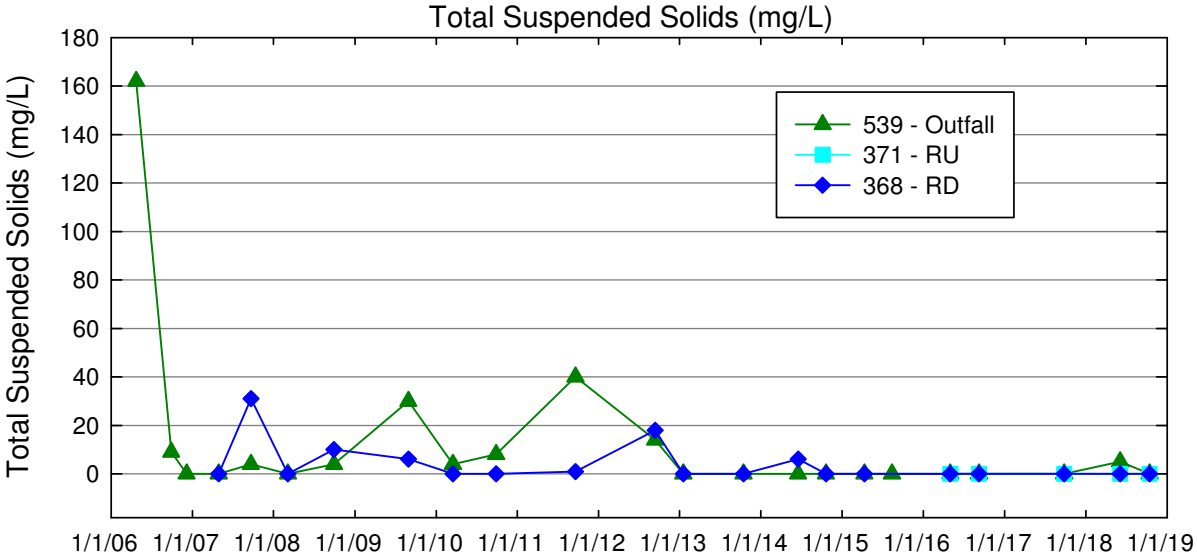

Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
7000
6000
5000
4000
3000
2000
1000
0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19


pH, Field (Standards Units)
pH (Standards Units)
8.5
8.0
7.5
7.0
6.5
6.0
527 - Outfall
529 - RD
1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12 1/1/13 1/1/14 1/1/15 1/1/16 1/1/17 1/1/18 1/1/19

OUTFALL 005.2







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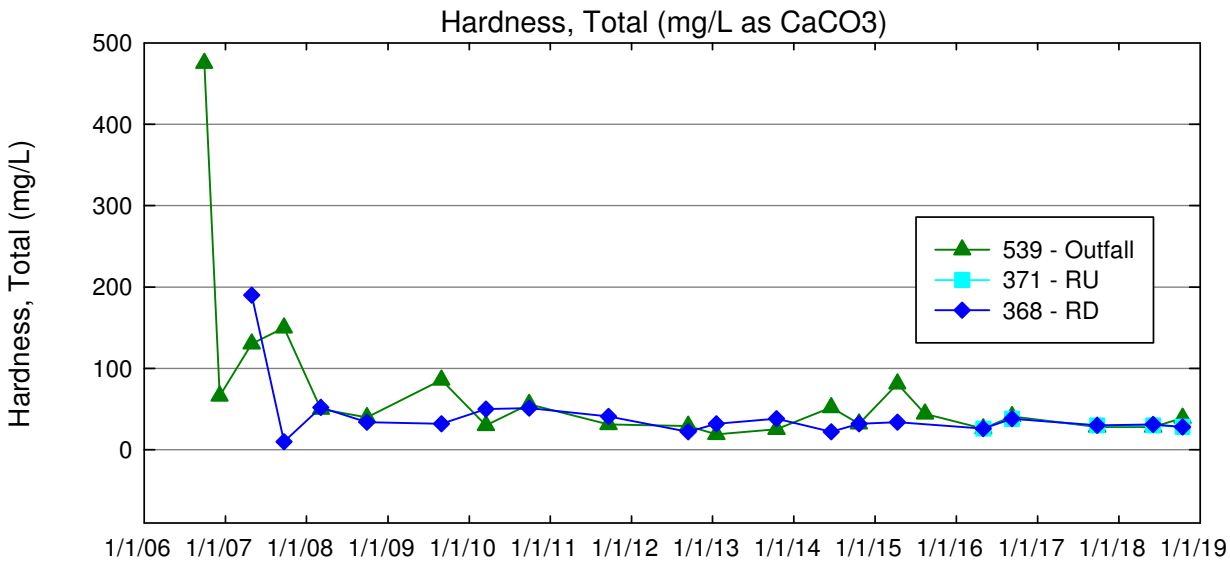
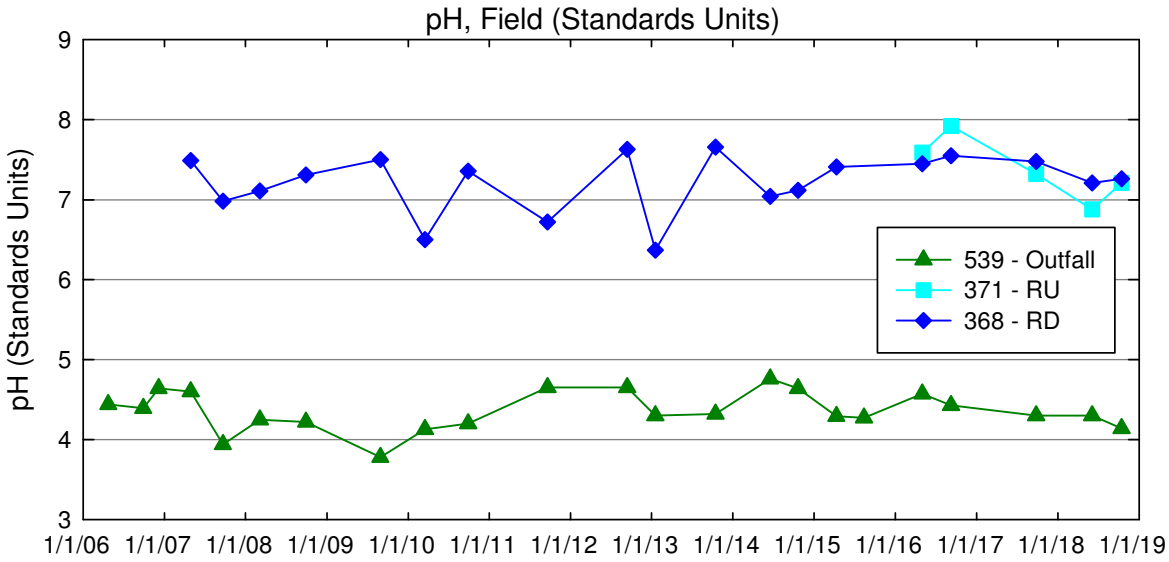
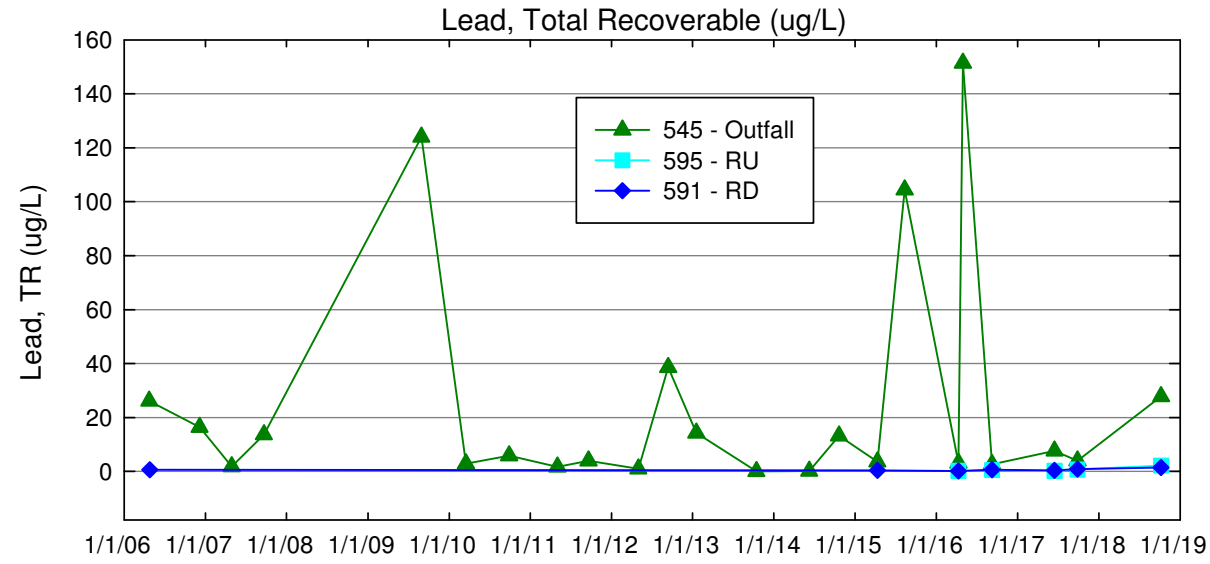
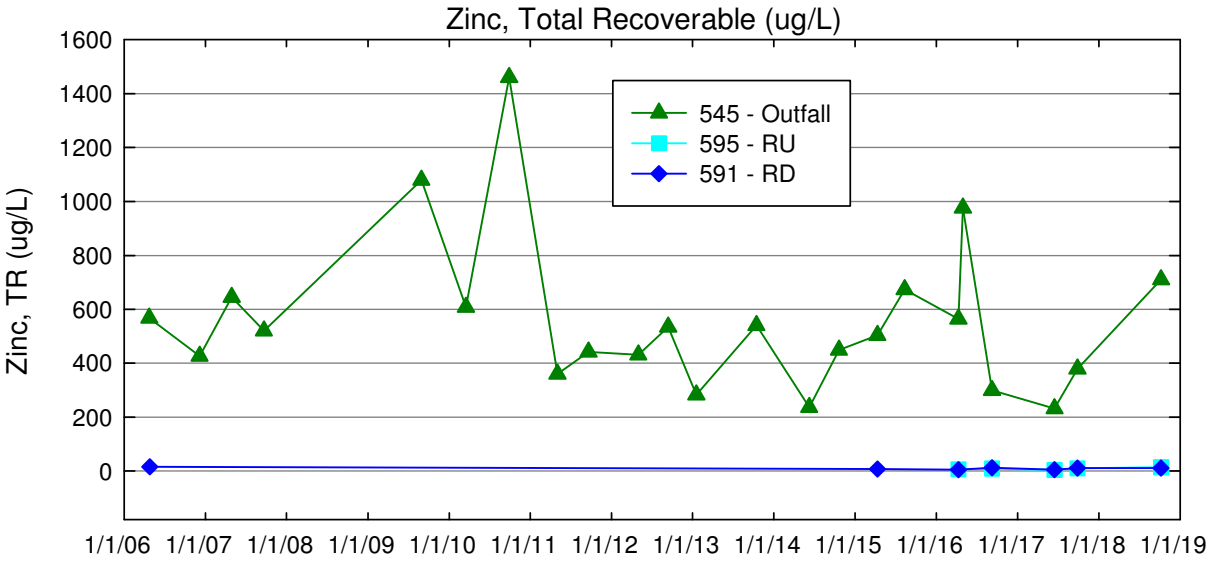
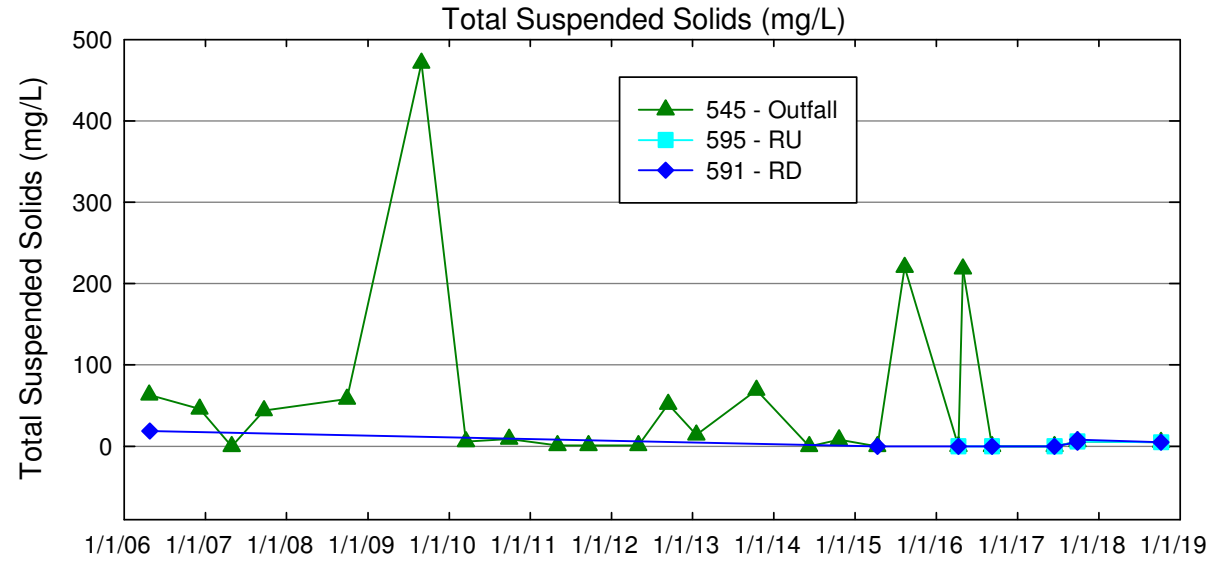




OUTFALL 005.3







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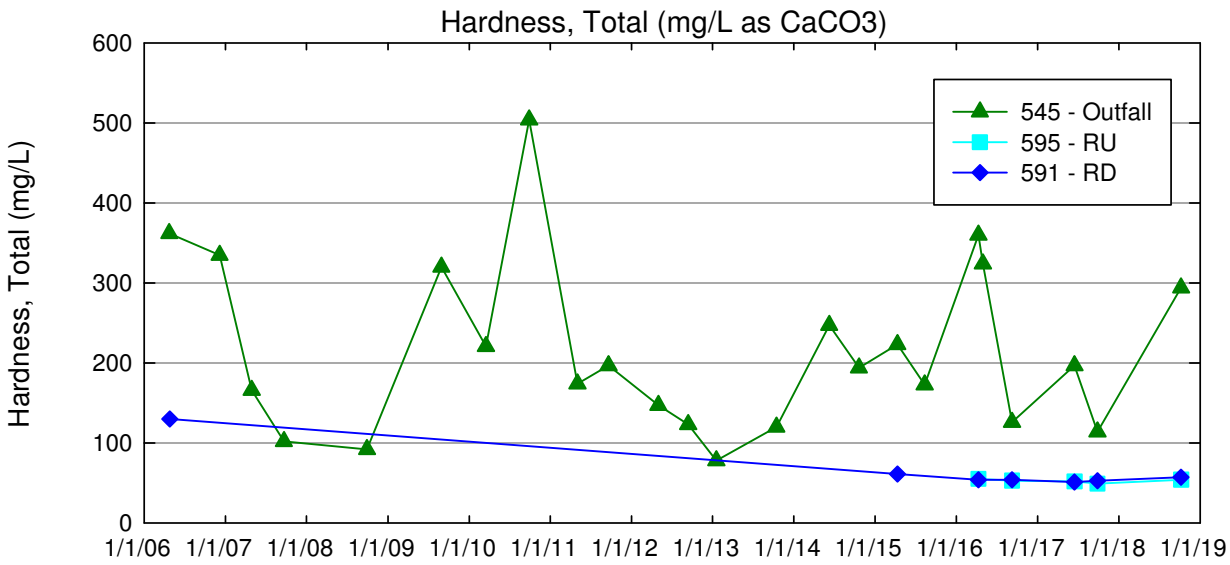
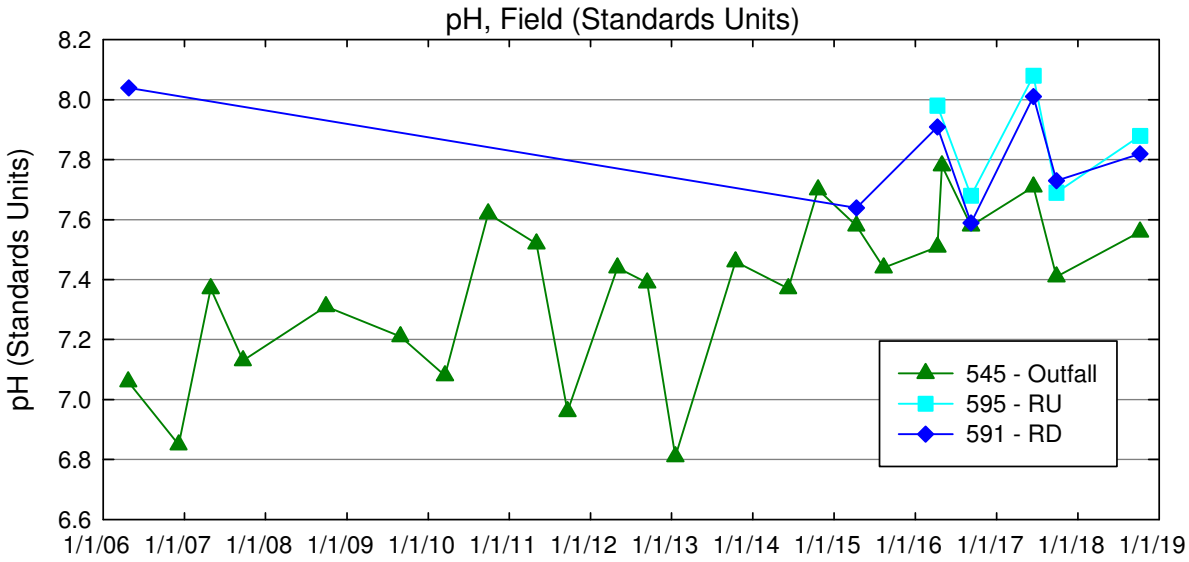
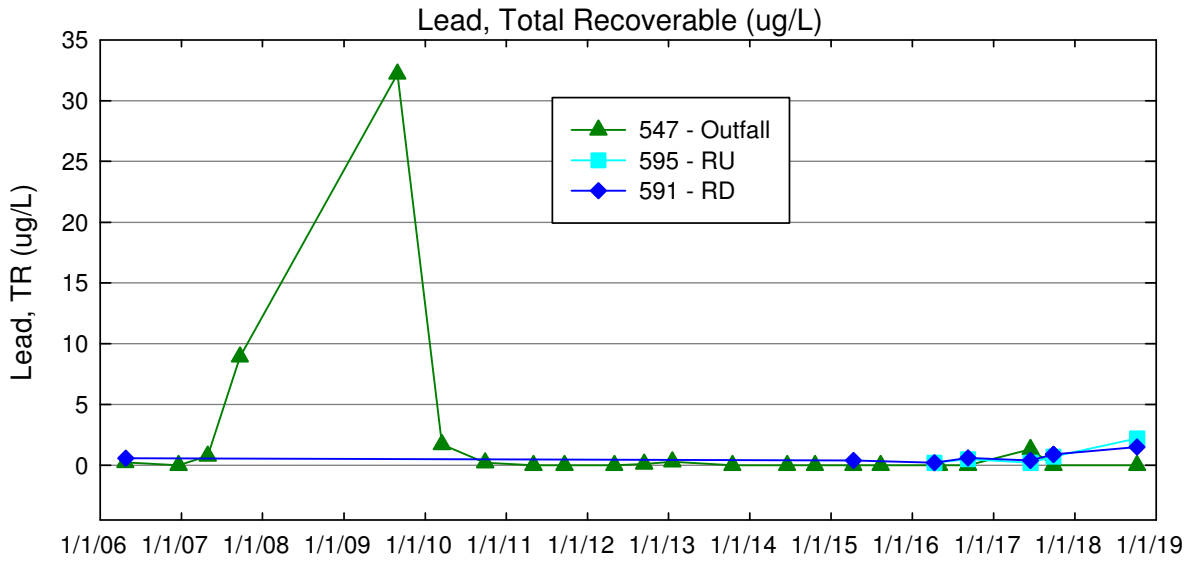
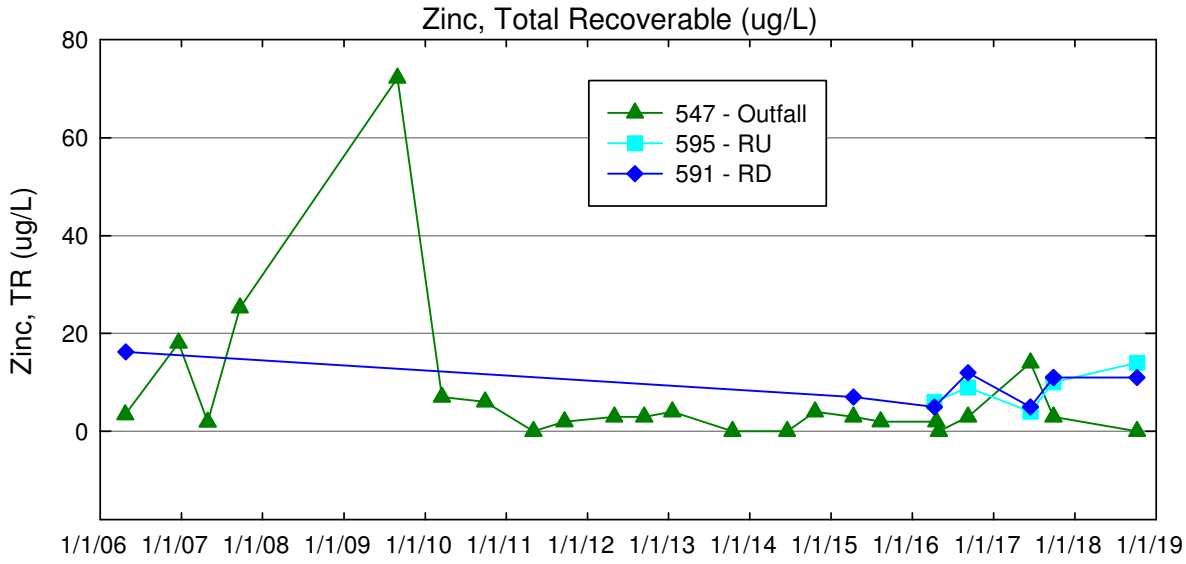
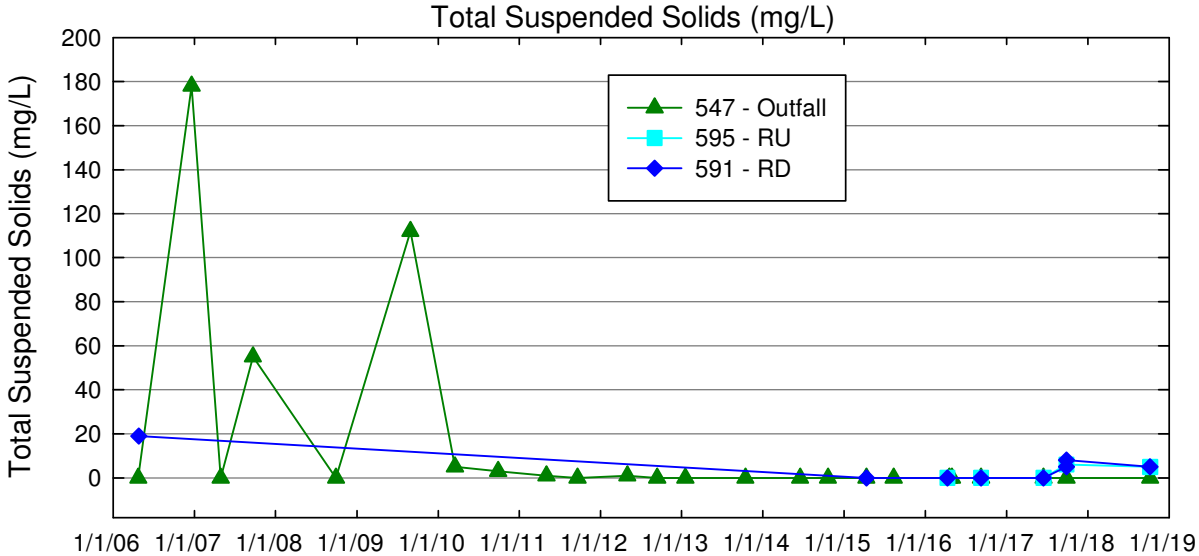




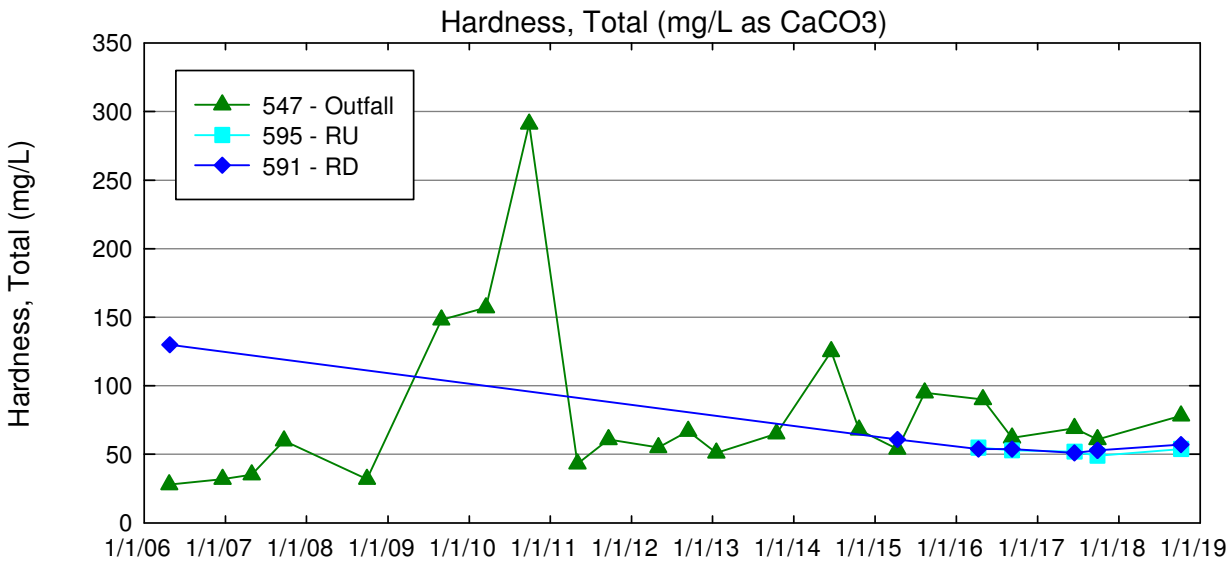
OUTFALL 005.4

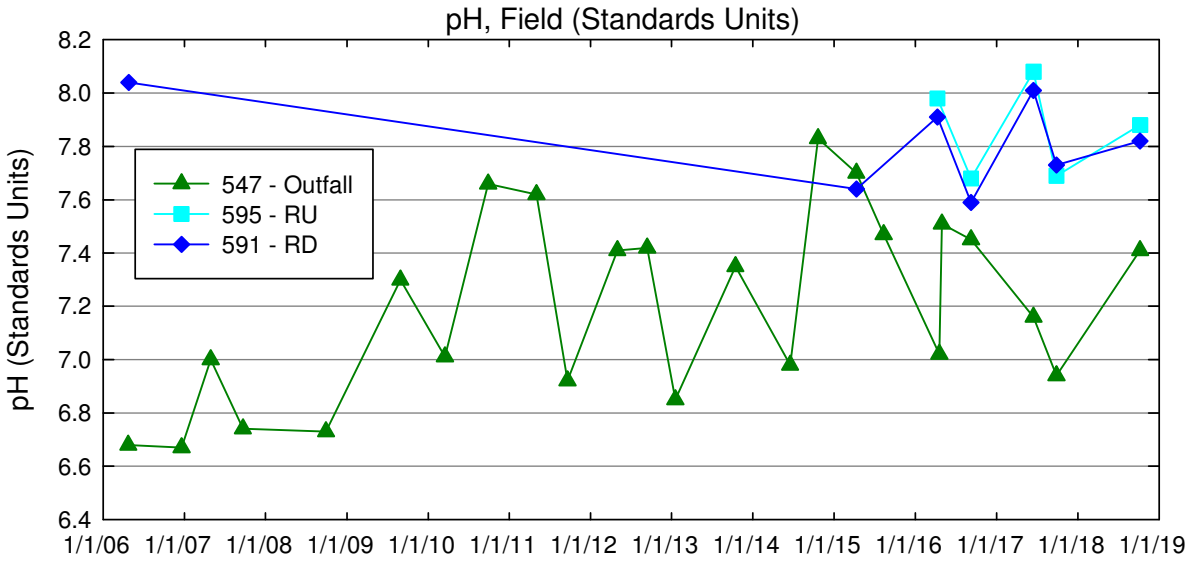




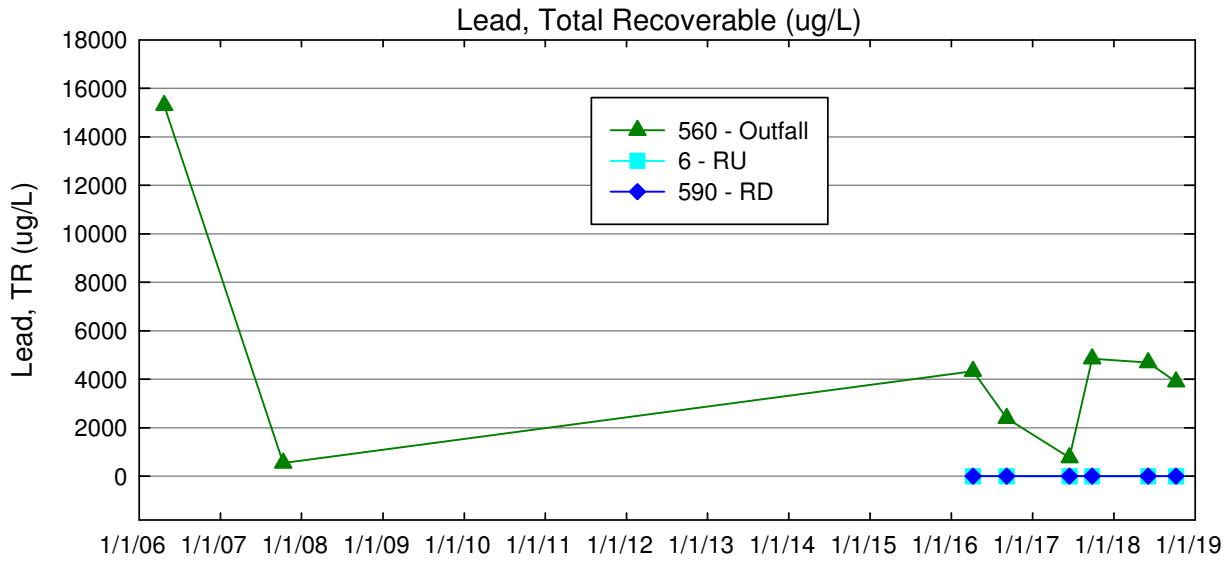


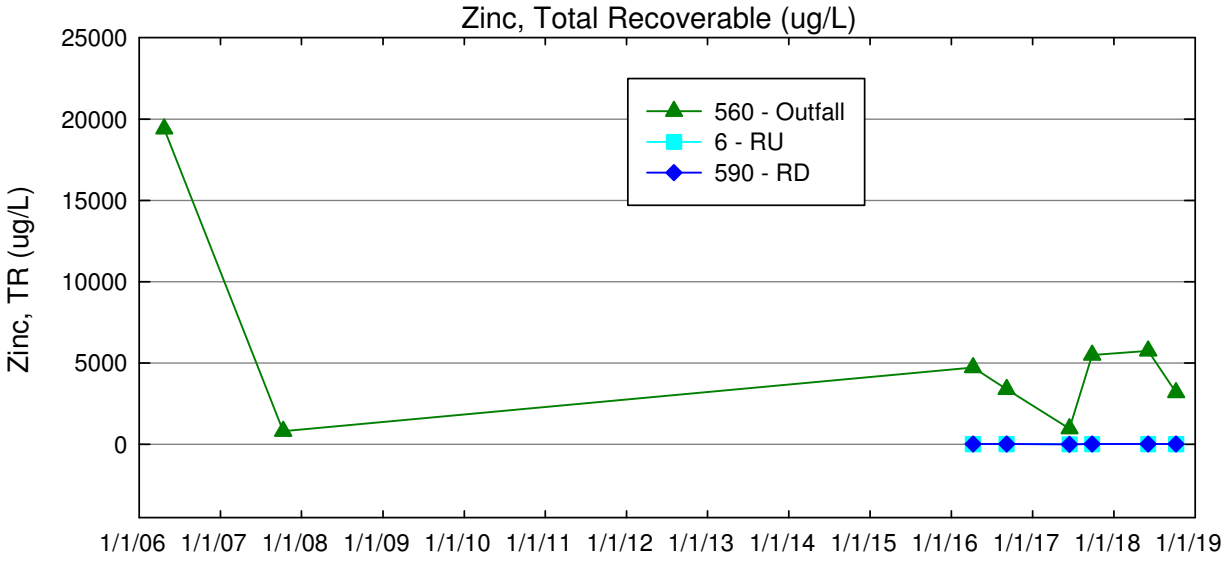
OUTFALL 005.4

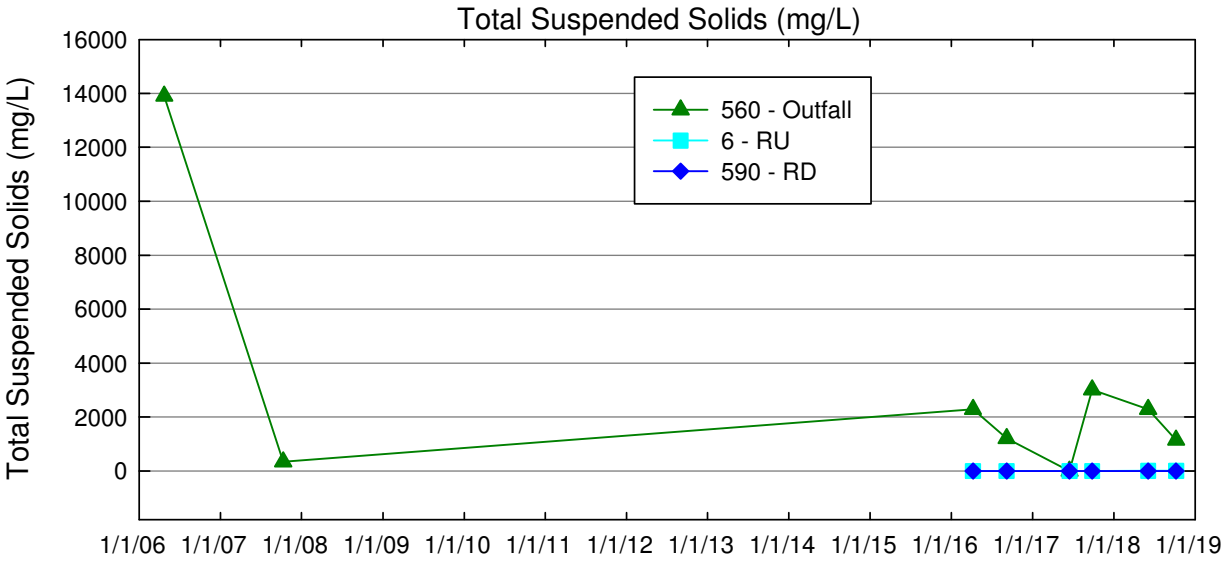




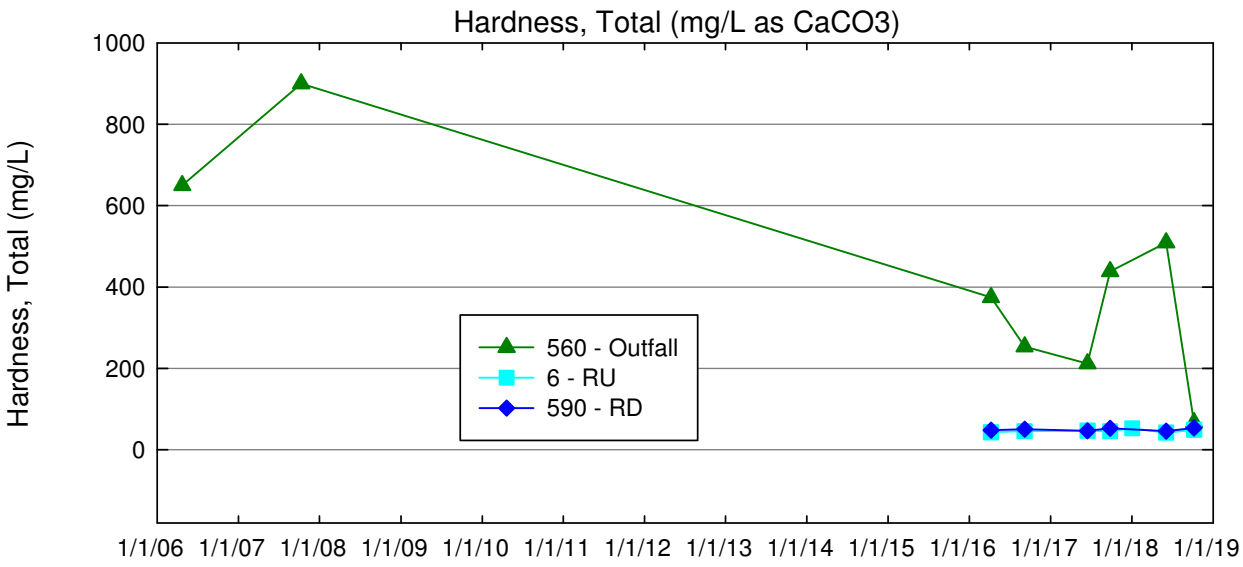
OUTFALL 005.5

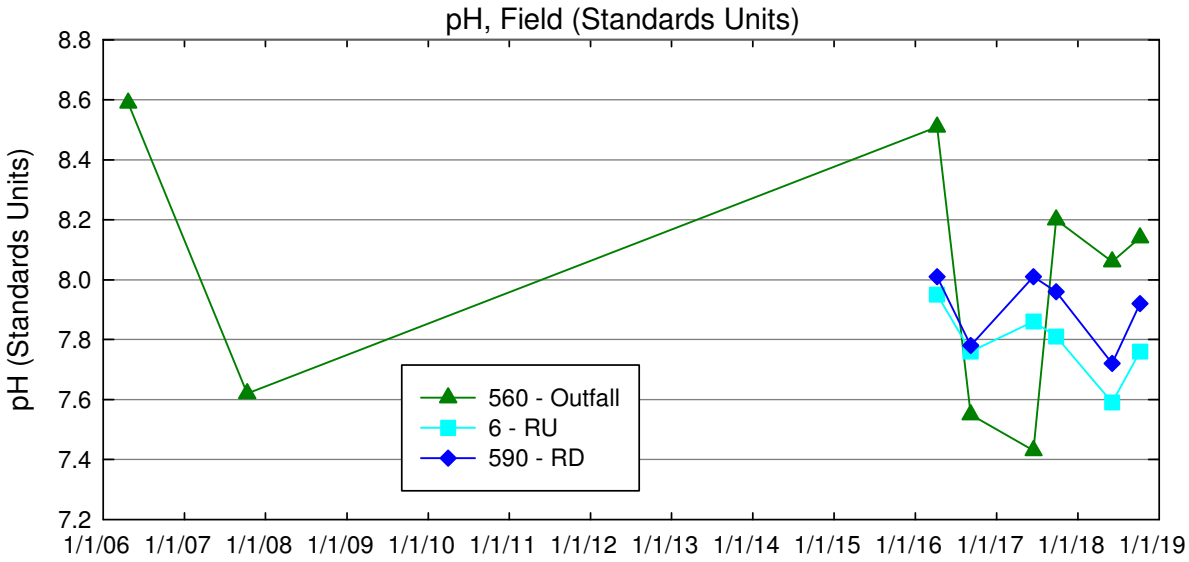




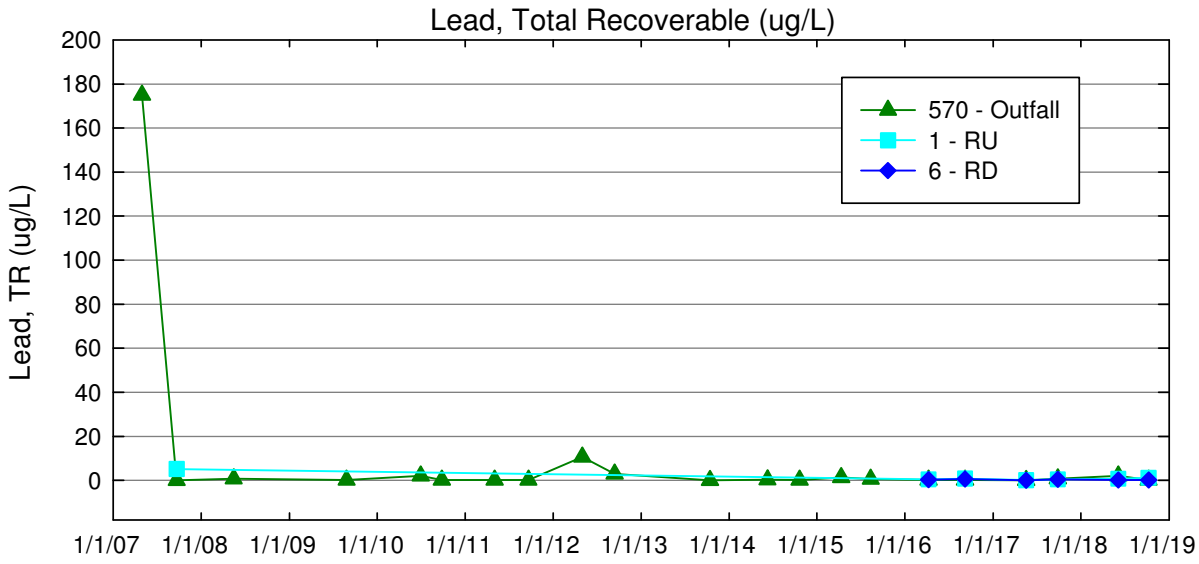


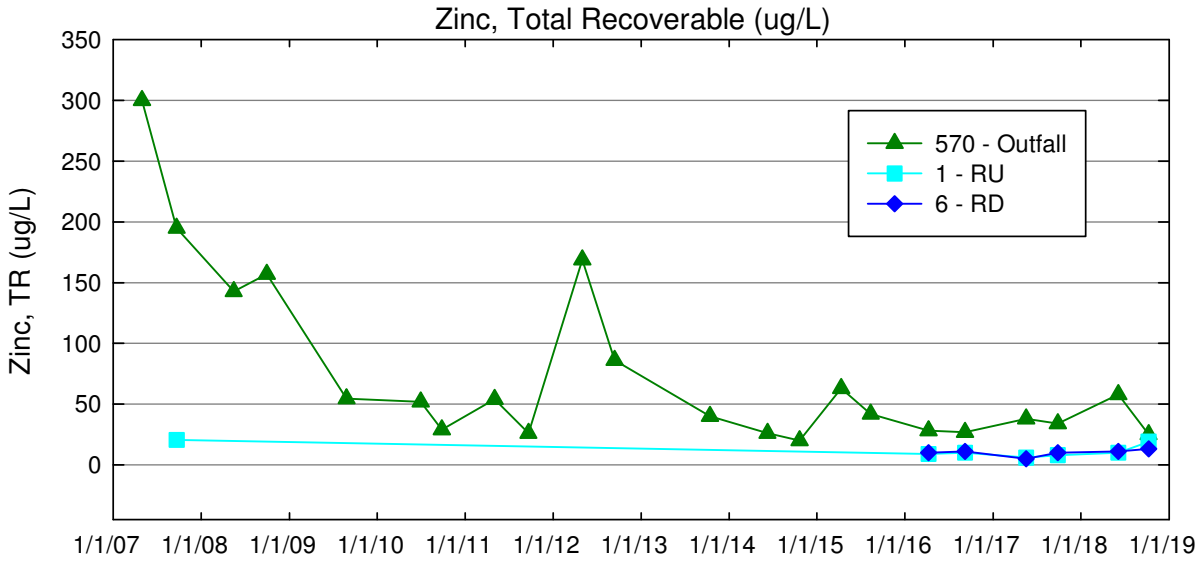
OUTFALL 005.5

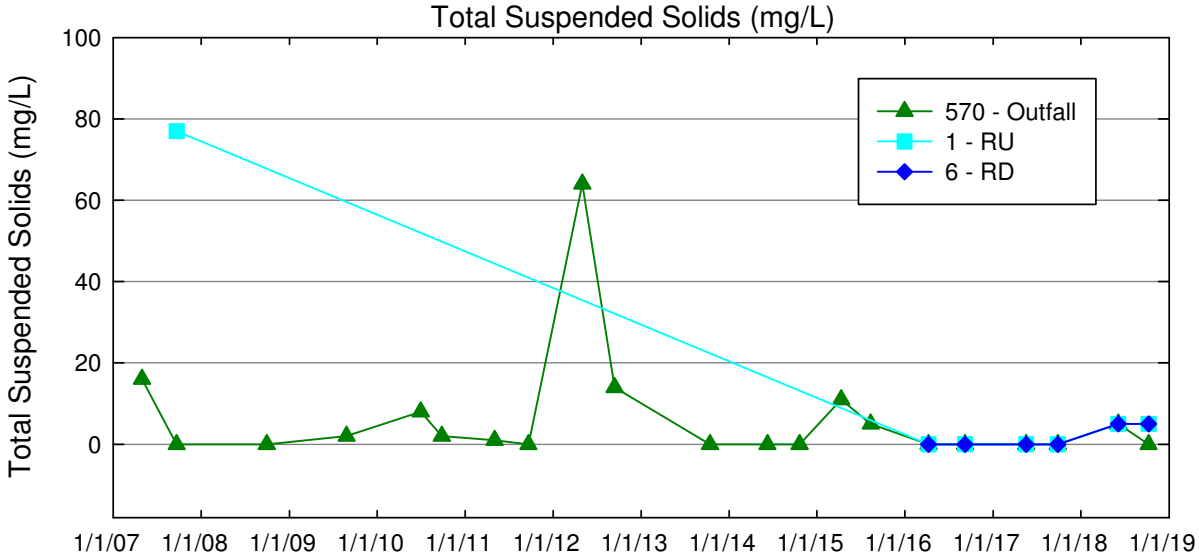




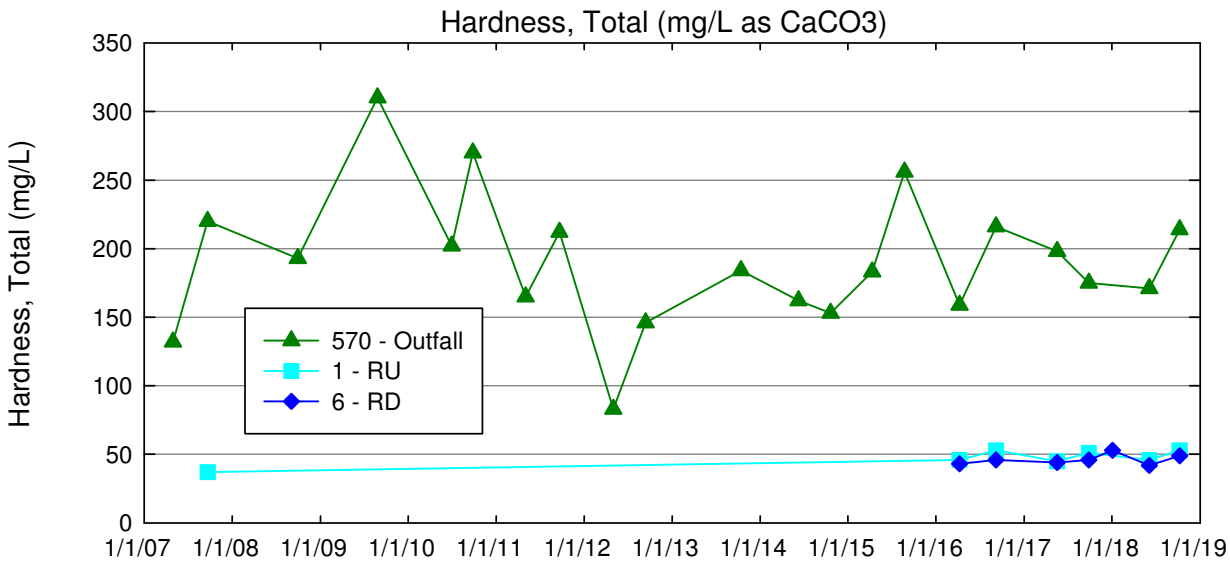
OUTFALL 008

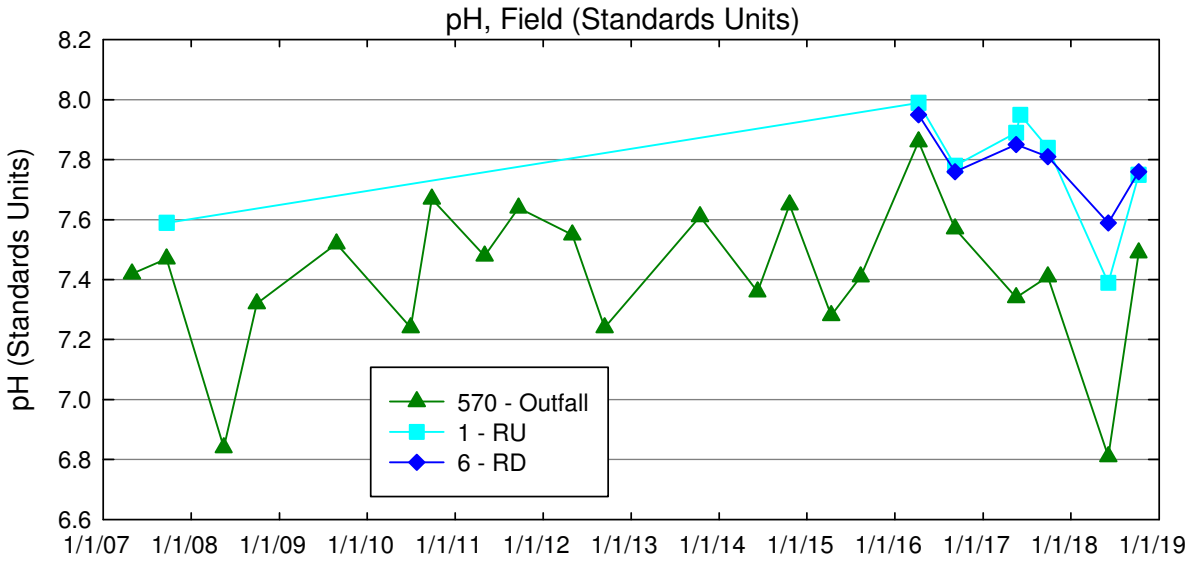

Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
200
180
160
140
120
100
80
60
40
20
0
570 - Outfall
1 - RU
6 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
350
300
250
200
150
100
50
0
570 - Outfall
1 - RU
6 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19

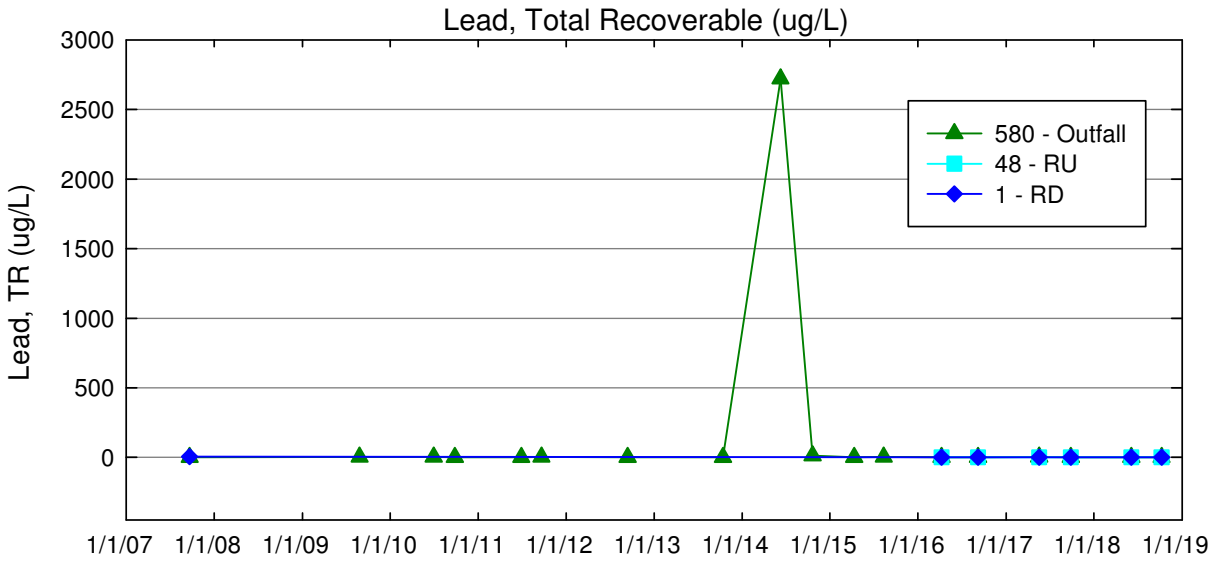

Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
100
80
60
40
20
0
570 - Outfall
1 - RU
6 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19

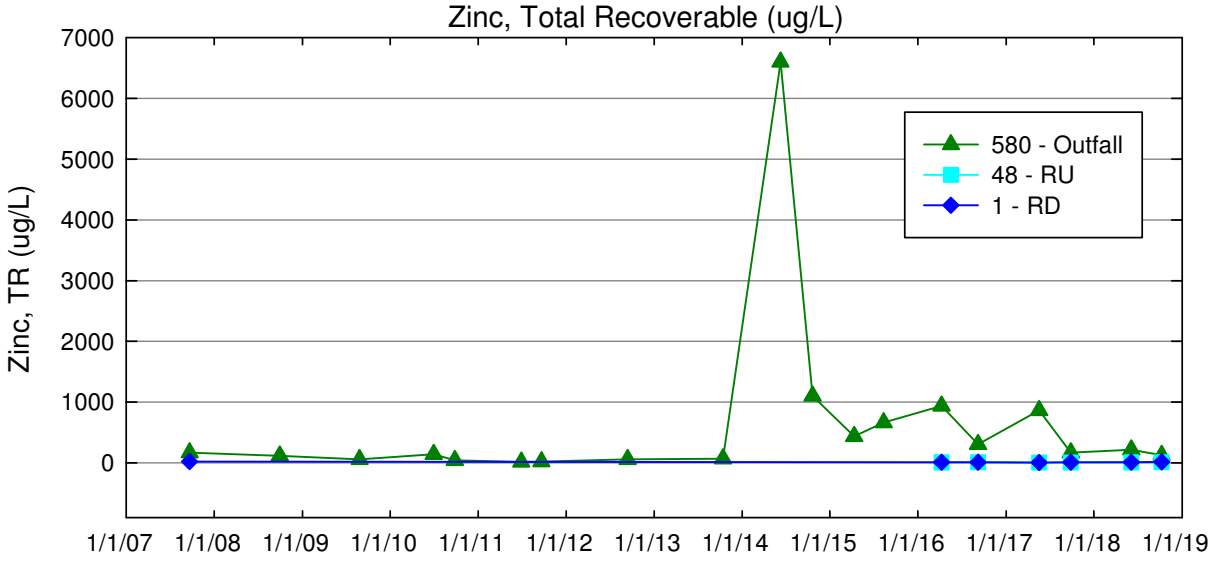
OUTFALL 008

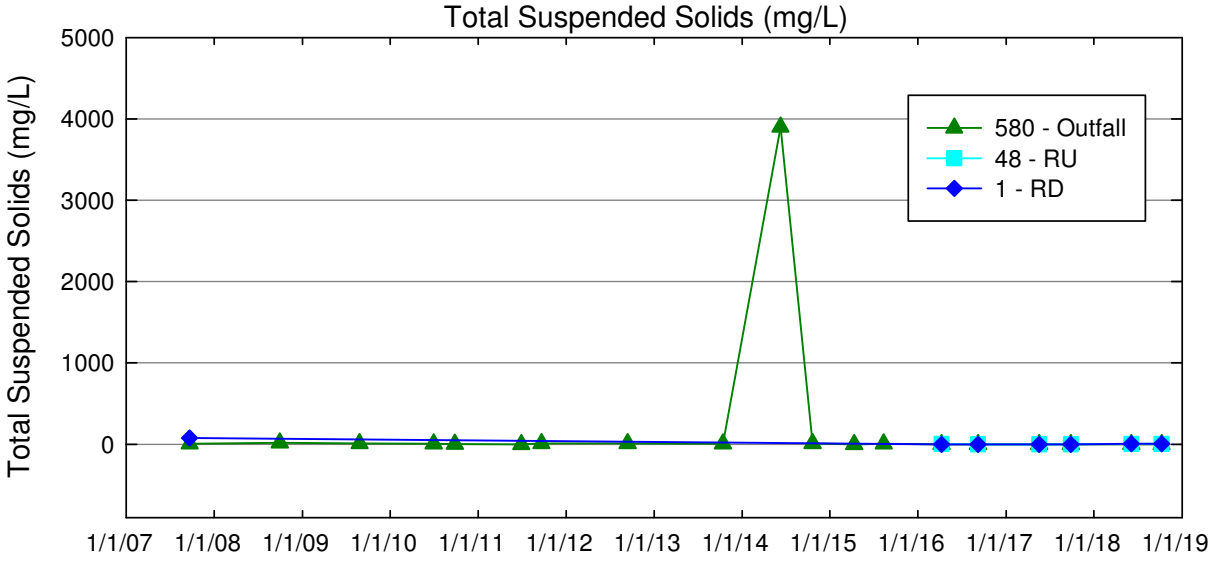

Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
350
300
250
200
150
100
50
0
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19
570 - Outfall
1 - RU
6 - RD


pH, Field (Standards Units)
pH (Standards Units)
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19
570 - Outfall
1 - RU
6 - RD

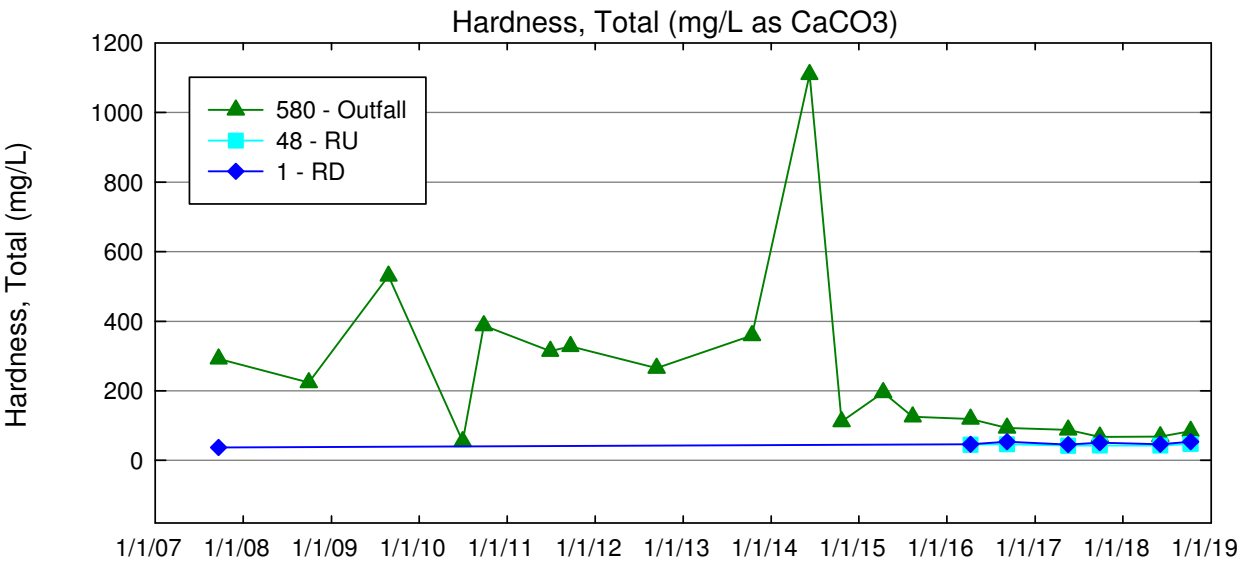
OUTFALL 009

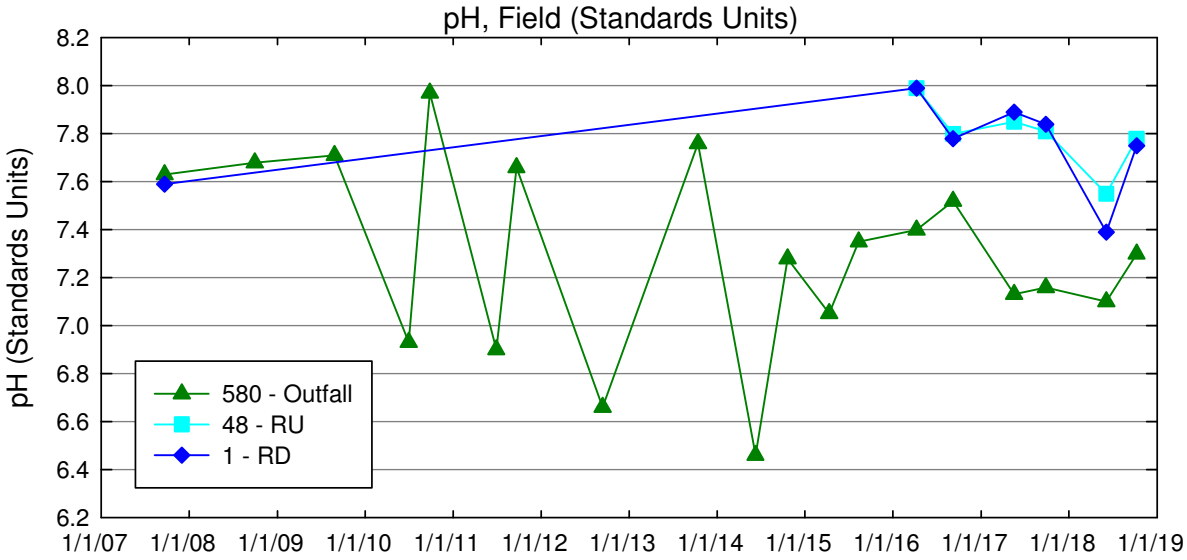

Lead, Total Recoverable (ug/L)
Lead, TR (ug/L)
3000
2500
2000
1500
1000
500
0
580 - Outfall
48 - RU
1 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19


Zinc, Total Recoverable (ug/L)
Zinc, TR (ug/L)
7000
6000
5000
4000
3000
2000
1000
0
580 - Outfall
48 - RU
1 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19


Total Suspended Solids (mg/L)
Total Suspended Solids (mg/L)
5000
4000
3000
2000
1000
0
580 - Outfall
48 - RU
1 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19

OUTFALL 009


Hardness, Total (mg/L as CaCO3)
Hardness, Total (mg/L)
1200
1000
800
600
400
200
0
580 - Outfall
48 - RU
1 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19


pH, Field (Standards Units)
pH (Standards Units)
8.2
8.0
7.8
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
580 - Outfall
48 - RU
1 - RD
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
1/1/18
1/1/19