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March 20, 2020

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Email
Mr. Daryl Reed, State Project Officer
Mine Flooding CERCLA Site
Montana Department of Environmental Quality
Remediation Division
P.O. Box 200901
Helena, Montana 59620-0901

Re: Submittal of Quarterly Pilot Project Report Fourth Quarter 2019

Dear Mr. Greene and Mr. Reed:

Atlantic Richfield Company (Atlantic Richfield) and Montana Resources, LLP (MR), jointly as the Settling Defendants (SDs) for the Butte Mine Flooding Operable Unit (BMFOU), continue to implement the Berkeley Pit and Discharge Pilot Project (Pilot Project) as described in the Draft Berkeley Pit and Discharge Pilot Project Work Plan. The attached report presents relevant Pilot Project data and information collected during the fourth quarter of 2019 from October 1 to December 31. Additionally, September 2019 data has been included within this report as there were several operating days in September (September 26 to September 30) for the Horseshoe Bend (HsB) Capture System and the Berkeley Pit pumping system, and the Polishing Facility was discharging treated water beginning on September 30, 2019.

Please contact us if you would like to discuss this Pilot Project Quarterly Report.

On behalf of the Settling Defendants,

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Vice President of Environmental Affairs
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Attachments:
Silver Bow Creek/Butte Area NPL Site Butte Mine Flooding Operable Unit, Berkeley Pit and Discharge Pilot Project - Quarterly Pilot Project Report Fourth Quarter 2019

SILVER BOW CREEK/BUTTE AREA NPL SITE
BUTTE MINE FLOODING OPERABLE UNIT

Berkeley Pit and Discharge Pilot Project

Quarterly Pilot Project Report
Fourth Quarter 2019

March 2020

SILVER BOW CREEK/BUTTE AREA NPL SITE
BUTTE MINE FLOODING OPERABLE UNIT

Berkeley Pit and Discharge Pilot Project

Quarterly Pilot Project Report
Fourth Quarter 2019

Prepared by:

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Montana Resources, LLP
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March 2020

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ACRONYMS AND ABBREVIATIONS

Atlantic Richfield	Atlantic Richfield Company
BMFOU	Butte Mine Flooding Operable Unit
BPPS	Berkeley Pit Pumping System
BPSOU	Butte Priority Soils Operable Unit
BTC	Blacktail Creek
Ca	calcium
$CaCO_3$	calcium carbonate
CD	Consent Decree
cfs	cubic feet per second
DEQ	Montana Department of Environmental Quality
DMR	Data Monitoring Report
DQO	Data Quality Objective
EoR	Engineer of Record
EPA	U.S. Environmental Protection Agency
HsB	Horseshoe Bend
HsBWTP	Horseshoe Bend Water Treatment Plan
LSI	Langelier Saturation Index
MBMG	Montana Bureau of Mines and Geology
MGD	million gallons per day
mg/L	milligrams per Liter
MR	Montana Resources, LLP
NGVD 29	National Geodetic Vertical Datum of 1929
OAP	Operations and Assurance Plan
POC	Points of Compliance
RO	reverse osmosis
SAP	Sampling and Analysis Plan
SDs	Settling Defendants
SO_4	sulfate
USGS	U.S. Geological Survey
WET	whole effluent toxicity
YDTI	Yankee Doodle Tailings Impoundment

1.0 INTRODUCTION

Atlantic Richfield Company (Atlantic Richfield) and Montana Resources, LLP (MR), jointly as the Settling Defendants (SDs) for the Butte Mine Flooding Operable Unit (BMFOU), continue to implement the Berkeley Pit and Discharge Pilot Project (Pilot Project) as described in the *Draft Berkeley Pit and Discharge Pilot Project Work Plan* (Pilot Project Work Plan) (SDs, 2019a). This quarterly Pilot Project report presents relevant Pilot Project data and information collected during the fourth quarter of 2019 from October 1 to December 31. Additionally, September 2019 data have been included within this quarterly Pilot Project report as there were several operating days in September (September 26 to September 30) for the Horseshoe Bend (HsB) Capture System and the Berkeley Pit pumping system. The Polishing Facility started discharging treated water on September 30, 2019.

The Pilot Project develops additional information regarding remedy management and optimization. The Pilot Project Data Quality Objectives (Pilot Project DQOs) are presented in Table 3A of the *Final Pilot Project Sampling and Analysis Plan* (Pilot Project SAP) (Atlantic Richfield Company, 2019a). The Pilot Project Work Plan was structured to systematically determine if the Pilot Project meets the following objectives:

1. Berkeley Pit Inflow Control.
2. Points of Compliance (POCs) Connectivity.
3. Off-Site Discharge.
4. Horseshoe Bend Water Treatment Plant (HsBWTP) Optimization.
5. Yankee Doodle Tailings Impoundment (YDTI) Treatment.
6. Incorporation of Treated Berkeley Pit Water into the Active Mining Operation.
7. Active Mine Water Reduction Effort.

This report is intended to provide a quarterly update on the information and data collected to inform these Pilot Project objectives which were further defined in the Pilot Project DQOs. The scope of this document is limited to information collected as part of the Pilot Project and relevant to the Pilot Project SAP(s) and DQOs. Much of the data and information within this report is provided as preliminary with the intent to provide timely data to the U.S. Environmental Protection Agency (EPA) and Montana Department of Environmental Quality (DEQ), collectively referred to as the Agencies. Data and information provided herein is generally limited to Steps 1 through 3 of the DQO process. Additional DQOs to support the Pilot Project objectives are being developed within the following documents:

- The *Draft Final Downstream SAP Addendum to the Pilot Project SAP* (Downstream SAP Addendum) (Atlantic Richfield Company, 2019b).
- The forthcoming *Draft On-Site Water Management SAP Addendum to the Pilot Project SAP* (On-Site Water Management SAP Addendum) (MR, pending).

The Downstream SAP Addendum was submitted on November 14, 2019 and the associated crosswalk was submitted on January 2, 2020. The SDs are currently in the process of reviewing and addressing the comments provided by the Agencies on February 3, 2020. As these

additional DQOs are developed, additional data and information may be added to the quarterly Pilot Project report.

1.1 Pilot Project Work Plan Status

The Draft Pilot Project Work Plan and corresponding attachments and documents are in varying stages of the preparation process, including review by the Agencies and response from the SDs. A summary of the status of the Pilot Project documents is provided in Attachment A.

2.0 BERKELEY PIT INFLOW CONTROL

The Pilot Project Work Plan identified the following objective for the Berkeley Pit Inflow Control:

> *"The Pilot Project will evaluate the effectiveness of controlling the Berkeley Pit water level rise by removal of water directly from the Pit."*

The study objective for the Berkeley Pit Inflow Control, as described in DQO Step 2 in Table 3A of the Pilot Project SAP, is as follows:

> *"Identify the required pumping rate in the Berkeley Pit to control the water level (i.e., stop the rise) and maintain a net infilling rate near 0 million gallons per day (MGD)."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project SAP to evaluate the Berkeley Pit Inflow Control objectives. These information inputs are discussed in Section 2.1.

2.1 Berkeley Pit Inflow Control Information Inputs

Data collected by MR, Montana Bureau of Mines and Geology (MBMG) contractors, and Atlantic Richfield contractors are used to evaluate the effectiveness of controlling the water level in the Berkeley Pit. Table 2-1 lists the information inputs identified in the Pilot Project SAP DQOs, as well as additional informational inputs that were not previously identified to evaluate this objective, and includes the current status and a summary of information collected in the fourth quarter of 2019. During the fourth quarter of 2019, the average pumping rate from the Berkeley Pit was 3.4 million gallons per day (MGD) and the net water level change in the Berkeley Pit was +0.09 feet (this being the elevation difference between water level surveys conducted on October 4, 2019 and January 6, 2020).

Table 2-1: Berkeley Pit Inflow Control Fourth Quarter Status

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Data Summary**
Berkeley Pit Pumping System flow	The Berkeley Pit Pumping System (BPPS) pumping rate and volumes were reported by MR in the following monthly reports: • *BMFOU Monthly Pilot Project Pumping Update* for October was submitted on November 12, 2019. The October report included the September pumping flows (September 26 to 30, 2019). • *BMFOU Monthly Pilot Project Pumping Update* for November was submitted on December 23, 2019. • *BMFOU Monthly Pilot Project Pumping Update* for December was submitted on January 29, 2020.	From September 26 through December 31, 2019, a total of 328.8 million gallons were pumped from the Berkeley Pit with an average pumping rate of 3.4 MGD.
Offspec/Backwash Line flow	All Polishing Facility off-spec and backwash flow was directed to MR's Dredge Pond and incorporated into the mining circuit, where possible. These volumes are measured by Atlantic Richfield's contractors and reported in the Pilot Project Discharge Monitoring Reports (DMRs) (SDs, 2019b and SDs, 2019c).	A total of 27 million gallons were discharged to the Dredge Pond. This includes approximately 3.1 million gallons for the multimedia filtration backwash and 23.9 million gallons for off-spec discharge.
RO Reject Line flow	The reverse osmosis (RO) system was not used as part of the Polishing Facility operations during this quarter. Once operating, these volumes will be measured by Atlantic Richfield's contractors and reported in the Pilot Project DMRs (SDs, 2019b and SDs, 2019c).	No RO reject was discharged to the Berkeley Pit.
Dredge Pond outfall flow	The Dredge Pond has an outfall structure that would direct flows to the Berkeley Pit if the water cannot be managed at the Dredge Pond.	No bypass to the Berkeley Pit from the Dredge Pond outfall structure was observed or noted in this quarter.

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Data Summary**
Berkeley Pit water level measurement	MBMG contractors continued to survey the Berkeley Pit water level elevation monthly. The MBMG reported these data as part of the Consent Decree (CD) monthly reporting requirements (MBMG, 2019a, MBMG, 2019b, and MBMG, 2020). Elevation data are reported in National Geodetic Vertical Datum of 1929 (NGVD 29).	Surveyed Berkeley Pit Water Surface Elevations: • 10/04/2019 = 5,356.05 feet • 11/06/2019 = 5,356.06 feet • 12/11/2019 = 5,356.01 feet • 1/6/2020 = 5,356.14 feet
HsBWTP sludge discharge	MR continued to monitor and the SDs report the HsBWTP sludge discharge as part of the BMFOU Quarterly Report (SDs, 2020).	During the quarter, 27.0 million gallons of sludge was discharged to the Berkeley Pit.
McQueen ditch flows to Berkeley Pit	The McQueen Booster Station (for tailings) continued normal operations, consistent with experience to date, with no unexpected overflows to the Berkeley Pit via the McQueen Ditch.	Flows to the Berkeley Pit from the McQueen Ditch in this quarter were observed minimal and consistent with routine operations.
HsB bypass to Berkeley Pit	MR continued to monitor and the SDs report the HsB bypass to the Berkeley Pit as part of the BMFOU Quarterly Report (SDs, 2020).	During the quarter, an estimated 8.7 million gallons were bypassed to the Berkeley Pit.
Butte Priority Soils Operable Unit (BPSOU) Storm Water to the Berkeley Pit via the Belmont Storm Water Diversion[2]	The Belmont Storm Water Diversion reports to the Berkeley Pit.	Flows to the Berkeley Pit from the Belmont Storm Water Diversion were considered consistent with experience to date for the reporting period.
BPSOU Storm Water to the Berkeley Pit via the Kelley Storm Water Diversion[2]	The Kelley Storm Water Diversion reports to the Berkeley Pit.	Flows to the Berkeley Pit from the Kelley Storm Water Diversion were considered consistent with experience to date for the reporting period.

[1]Pilot Project SAP, Table 3A (Step 3).
[2] BPSOU storm water rows in Table 2-1 were omitted as inflows to the Berkeley Pit in the original Pilot Project SAP Table 3A (therefore are not italicized text). It is anticipated they will be added in the subsequent annual SAP update.

3.0 POINTS OF COMPLIANCE CONNECTIVITY

The Pilot Project Work Plan identified the following objective for the POC Connectivity:

> *"The Pilot Project is evaluating the hydraulic connectivity of the Berkeley Pit to the outlying POCs by monitoring the impact of the Pilot Project on slowing, or stopping, the rise of groundwater in the outlying POCs."*

The study objectives for the POC Connectivity, as described in DQO Step 2 in Table 3A of the Pilot Project SAP are:

- *"Identify the impacts of pumping from the Berkeley Pit on water levels in the East Camp POCs.*
- *Identify the required pumping rate in the Berkeley Pit to control (i.e., stop the rise) groundwater in the POCs to be used to support and supplement the final BMFOU remedy."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project Work Plan to evaluate the POC connectivity objectives. These information inputs are discussed in Section 3.1.

3.1 Point of Compliance Connectivity Information Inputs

Data collected by the MBMG are used to evaluate the hydraulic connectivity of the Berkeley Pit to the outlying POCs by monitoring the impact of pumping from the Berkeley Pit for the Pilot Project on slowing, or stopping, the rise of groundwater in the outlying POCs. The Information Inputs used to evaluate this objective are reported monthly by the MBMG as part of the CD monthly reporting requirements. Table 3-1 is a summary of the water level elevation changes reported in the monthly reports during the fourth quarter of 2019 (MBMG, 2020).

Table 3-1: Point of Compliance Change in Water Elevation Summary (NGVD 29)

Compliance Point	September 2019	December 2019	Quarter 4 2019 Change in Water Elevation (feet)	Previous Quarter (Quarter 3 2019) Change in Water Elevation (feet)
Anselmo Mine	5,377.25	5,376.95	-0.30	+1.21
Steward Mine	5373.59	5373.40	-0.19	+1.57
Kelley Mine	5,368.81	5,368.72	-0.09	+1.46
Belmont Well #2	5,367.97	5,367.95	-0.02	+1.16
Pilot Butte Mine	5,382.19	5,382.08	-0.11	+1.36
Well J	5359.07	5359.07	0.00	+1.20
Lexington Mine	5376.96	5377.03	+0.07	+1.31
Well D2	5364.70	5365.18	+0.48	+1.42
Well A	5,368.18	5,368.42	+0.24	+1.38

Compliance Point	September 2019	December 2019	Quarter 4 2019 Change in Water Elevation (feet)	Previous Quarter (Quarter 3 2019) Change in Water Elevation (feet)
Well D1	5365.35	5365.83	+0.48	+1.46
Well C	5,360.86	5,361.74	+0.88	+1.30
Well G	5,370.79	5,371.72	+0.93	+4.86[1]
Granite Mtn. Mine[2]	NR	NR	NA	NA

[1] Value inadvertently influenced by pumping drawdown associated with MBMG sampling event in Well G.
[2] Due to safety concerns and an obstruction, no water level monitoring is currently occurring in the Granite Mountain mine shaft.

4.0 OFF-SITE DISCHARGE

The Pilot Project Work Plan identified the following objective for the off-site discharge:

> *"The Pilot Project will test different off-site discharge scenarios using existing, new, and temporary discharge infrastructure over a period of 2-4 years, treating varying water flow rates and qualities, and discharging during varying seasonal fluctuations of the receiving water."*

The study objectives for off-site discharge, as described in DQO Step 2 in Table 3A of the Pilot Project SAP are as follows:

- *"Identify the ability of the Discharge System to meet the CD Discharge Standards.*
- *Evaluate the feasibility of using multimedia filtration and RO in the final remedy.*
- *Evaluate potential for scaling in the Discharge System effluent piping and Silver Bow Creek.*
- *Monitor and evaluate the Pilot Project effects on the downstream operable units.*
- *Evaluate polishing treatment to ensure reliable cadmium compliance (from 2011 5-Year Review).*
- *Additional performance testing to evaluate supersaturation of gypsum and scaling in the polishing plant and effluent to Silver Bow Creek (from 2011 5-Year Review).*
- *Perform* whole effluent toxicity (*WET*) *testing on effluent representative of current influent water quality and operating conditions (from 2011 5-Year Review).*
- *Use WET results to revise operational levels for calcium (Ca) and sulfate (SO_4) if warranted.*
- *Continual evaluation of effectiveness of aluminum removal by two-stage filtration."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project SAP to evaluate the off-site discharge objectives. These information inputs are discussed in Section 4.1. Additional information inputs not included in the Pilot Project SAP along with the information inputs described in the Downstream SAP Addendum Table 1 are discussed in Section 4.2. Not all of the study objectives for off-site discharge are included in this report. Some study objectives (e.g., evaluating the feasibility of RO in the final remedy) will require continued operation of the Pilot Project to collect the information inputs identified in the Pilot Project SAP DQOs.

4.1 Off-Site Discharge Information Inputs

Data collected by Atlantic Richfield's contractors are used to evaluate the off-site discharge study objectives. Table 4-1 lists the information inputs identified in the Pilot Project SAP DQOs to evaluate the off-site discharge and includes the current status and a summary of information collected in the fourth quarter of 2019. Additional and/or supplemental information inputs related to the off-site discharge objective are provided in Section 4.2.

Table 4-1: Off-Site Discharge Fourth Quarter Status

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Current Summary**
Polishing Facility effluent flow and water quality	Polishing Facility effluent flow and water quality was reported to the Agencies in the BMFOU Pilot Project monthly DMRs (SDs, 2019b and SDs, 2019c).	The Polishing Facility discharged 447 million gallons at an average monthly flow rate of 4.8 MGD. Additional details on the Polishing Facility effluent flow and water quality is provided in Sections 4.2.1 and 4.2.2.
Polishing Facility influent flow and water quality	Polishing Facility influent flow and water quality was reported to the Agencies in the BMFOU Pilot Project monthly DMRs (SDs, 2019b and SDs, 2019c).	Detail on the Polishing Facility influent is provided in Section 4.2.1.
Silver Lake water to Flow Augmentation	Silver Lake water effluent flow augmentation usage was reported to the Agencies in the BMFOU Pilot Project monthly DMRs (SDs, 2019b and SDs, 2019c).	Silver Lake water was added for approximately 12 days with a total of 16.3[2] million gallons of Silver Lake water used for effluent flow augmentation as shown on Figure 4-1.
Silver Bow/Blacktail Creek flows	Blacktail Creek flows measured at U.S. Geological Survey (USGS) Station SS-04 were observed to be impacted by backwater from the Pilot Project. Modifications to the monitoring program were made as described in Section 4.2.1.	The receiving water had an average flow rate of 10.5 MGD or 16.2 cubic feet per second (cfs) as shown in Figure 4-1.
Offspec/Backwash line flow	Polishing Facility off-spec and backwash flow was reported to the Agencies in the BMFOU Pilot Project monthly DMRs (SDs, 2019b and SDs, 2019c).	A total of 23.9 million gallons were discharged as off-spec to MR's Dredge Pond. A total of 3.1 million gallons of multimedia filter backwash was discharged to MR's Dredge Pond.

Information Input[1]	Quarter 4 2019	
	Information Input Status	Current Summary
RO Reject Line flow	RO was not used as part of the Polishing Facility operations during this quarter.	No RO reject was discharged to the Berkeley Pit.

[1]Pilot Project SAP, Table 3A (Step 3).
[2]16.3 Million gallons is the sum of volumes reported in the monthly DMRs in the fourth quarter and tabulated based on measured flows from the Silver Lake Flow Augmentation meter. Since these flows were reported in the DMR, the SDs have recognized a more accurate method of measuring Silver Lake Flow Augmentation volumes by totalizing the meter readings. Based on totalizer volumes, Silver Lake volume added in the fourth quarter was 17.1 million gallons. Starting in the first quarter, 2020 Silver Lake flow augmentation water volumes will be reported using the more accurate totalizer method.

4.2 Additional Off-Site Discharge Information Inputs

Additional study objectives for off-site discharge are described in DQO Step 2 in Table 1 of the Downstream SAP Addendum. These study objectives are summarized below:

- Temperature monitoring in Yankee Doodle Tailings Pond, the treatment and conveyance systems, and Blacktail Creek.
- Identify the extent of, and changes to, the mixing zone within Silver Bow Creek related to seasonal changes in base flow and potential changes in Pilot Project discharge flow rates.
- Characterize extent and magnitude of backwater effects in Blacktail Creek to plan for possible relocation of USGS gaging station 12323240 (SS-04).

Section 4.2.1 through Section 4.2.8 provide relevant information in addition or supplemental to the information inputs identified in the Section 4.1 above, and generally consist of current available information collected to support DQO inputs identified in the Downstream SAP Addendum DQO tables.

4.2.1 Polishing Facility Off-Site Discharge Summary

The Polishing Facility was operated during the fourth quarter using single-stage multimedia filtration with no RO (Operation Mode 1A) with an average discharge flow rate of 4.8 MGD. The two-stage multimedia filtration and RO operating modes were not used during the fourth quarter. During the quarter, a maximum receiving stream flow rate of 15.3 MGD and a minimum receiving water flow rate of 7.8 MGD were measured, for an average monthly flow rate of 10.5 MGD. Silver Lake water effluent flow augmentation was used for approximately 12 days during the fourth quarter. From December 9, 2019 through December 16, 2019, Silver Lake water effluent flow augmentation was discharged to Silver Bow Creek at approximately 2 MGD; the effluent flow augmentation was reduced on December 16, 2019 to approximately 0.5 MGD until it was stopped on December 20, 2019. The Polishing Facility off-site discharge, Silver Lake water effluent flow augmentation, and receiving stream flow rates are shown on Figure 4-1.

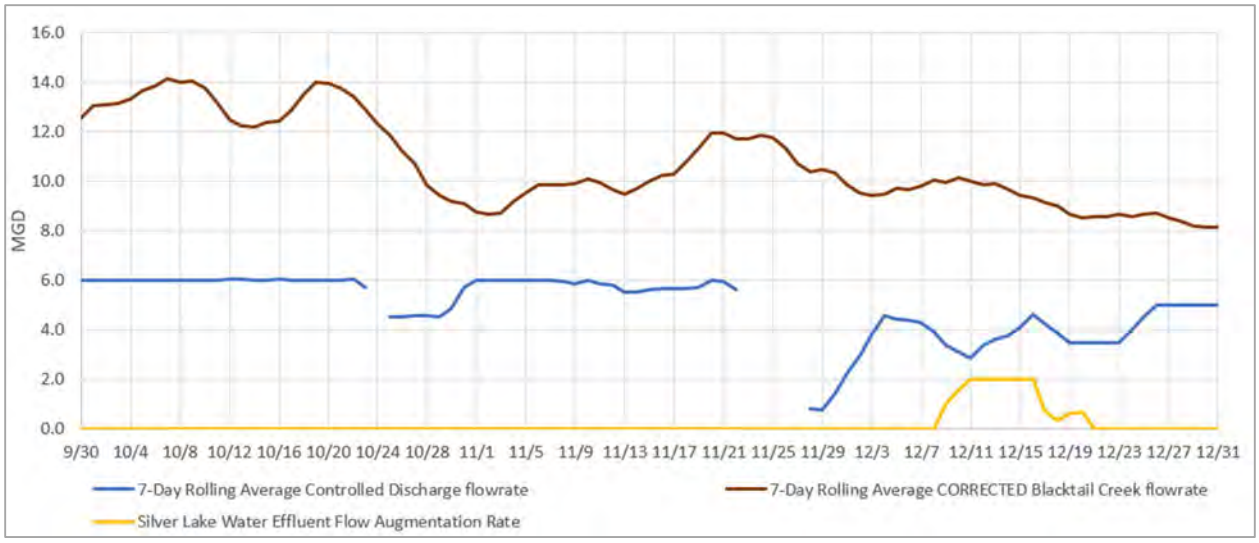

Figure 4-1: Polishing Facility Off-Site Discharge, Silver Lake Water Effluent Flow Augmentation, and Receiving Stream Flow Rate Summary

As described in the Draft Downstream SAP Addendum, backwatering was noted in Blacktail Creek at USGS gaging station 12323240 (monitoring location "SS-04") during commissioning of the Discharge Structure in September 2019. To avoid the backwater effects, Silver Bow Creek monitoring location "SS-05" was used to estimate the receiving water flow rate beginning on November 1, 2019. The receiving water flow rate was estimated by collecting daily staff gauge measurements at SS-05 and subtracting the Pilot Project discharge flow rate from the manual flow measurement collected at SS-05. This method will continue until a permanent solution is implemented. The backwatering effects of the Pilot Project will continue to be monitored as described in Section 4.2.8.

The Discharge System water quality and flow rate data were used to perform daily mass balance calculations and estimate receiving stream calcium (Ca) and sulfate (SO_4) concentrations. The results of mass balance calculations were compared to the Ca and SO_4 chronic toxicity threshold values to determine if the Polishing Facility effluent would be anticipated to meet chronic whole effluent toxicity (WET) testing requirements when mixed into the receiving stream as described in the *Final Pilot Project Operations and Assurance Plan* (Pilot Project OAP) (SDs, 2019d). In the fourth quarter, the Ca and SO_4 chronic toxicity thresholds were updated to include Single-Stage Discharge Demonstration WET results from August 2019 and the WET compliance results from October 2019. The Ca and SO_4 chronic toxicity threshold values were increased from 346 to 349 milligram per Liter (mg/L) and 939 to 965 mg/L, respectively. Figure 4-2 and Figure 4-3 show the estimated receiving stream Ca and SO_4 concentrations compared to the chronic toxicity threshold values.

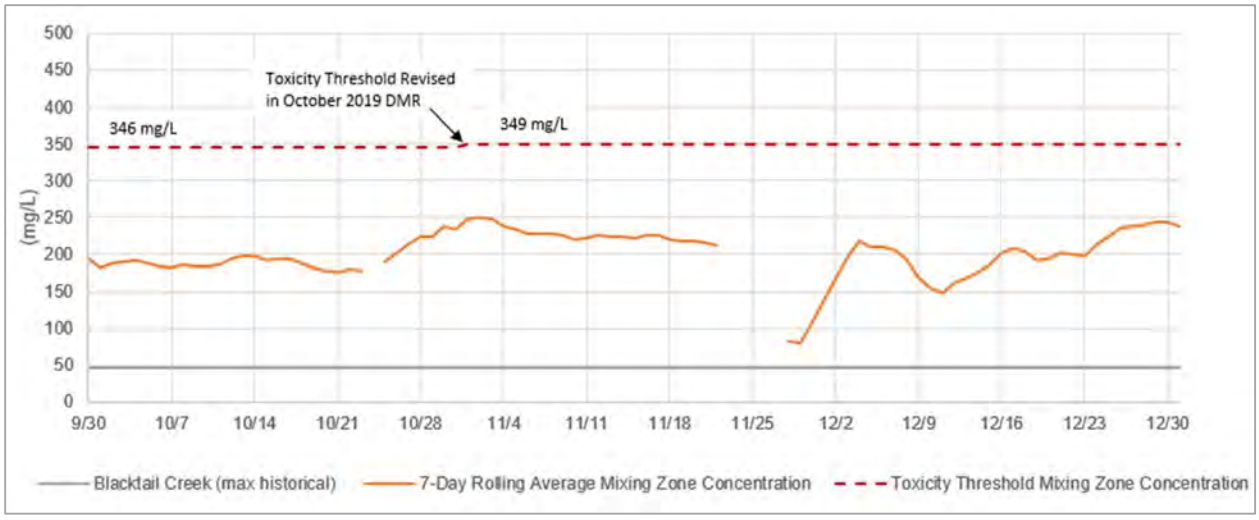

Figure 4-2: Estimated Calcium Concentration in the Receiving Stream

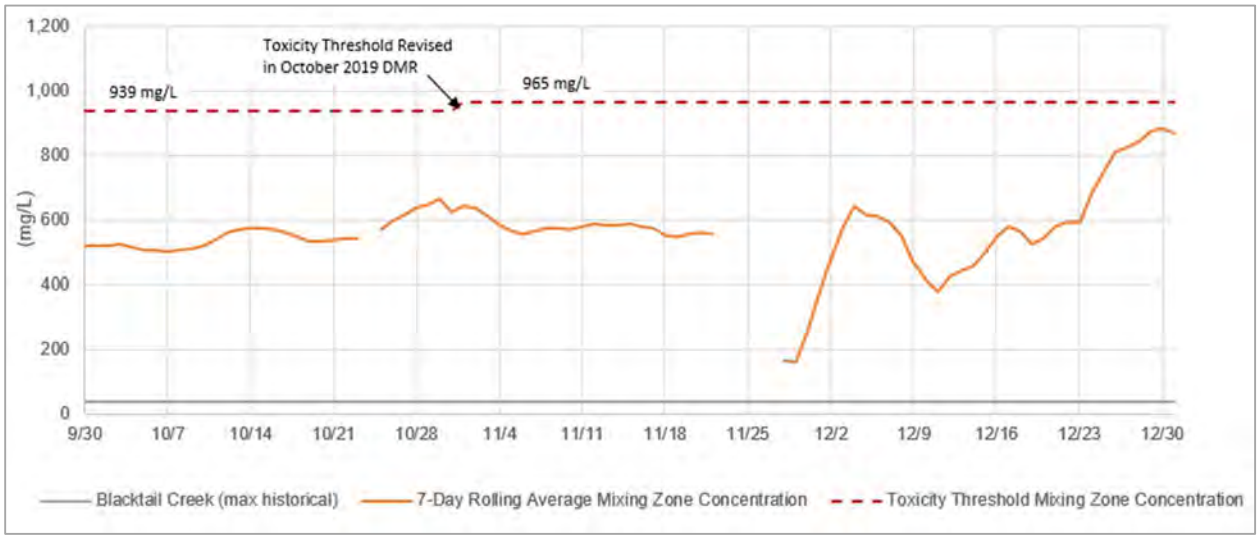

Figure 4-3: Estimated Sulfate Concentration in the Receiving Stream

The Pilot Project OAP included three additional, non-compliance based WET tests using Blacktail Creek water for dilution to further evaluate potential chronic toxicity within the receiving stream. The WET samples for the first series of this additional, non-compliance based WET testing were collected on October 7 through 11, 2019, eight days after the Pilot Project began off-site discharge. The first series of these additional WET tests were conducted in accordance with the Pilot Project SAP and the split WET tests were performed by a laboratory using moderately hard laboratory water and Blacktail Creek water, respectively. The results of these additional, non-compliance based WET tests will be provided to the Agencies in letter reports.

4.2.2 Polishing Facility Water Quality Trends

The Discharge System met the Interim CD Discharge Standards for off-site discharge in the fourth quarter of 2019 as described in the BMFOU Pilot Project monthly Data Management Reports (DMRs). The Polishing Facility influent and effluent water quality trends are shown on Figure B-1 and Figure B-2 provided in Attachment B.

Between early November 2019 and mid-December 2019, abnormalities were identified in the Polishing Facility influent and effluent water quality trends for SO_4. Further evaluation identified that the cation/anion balance was becoming increasingly out of balance during this period. The analyzing laboratory performed a corrective action investigation, and in late December 2019, the laboratory removed the respective instrument from service. The SO_4 data quality concerns have been resolved but will continue to be monitored by the SDs. Additional detail on the laboratory corrective actions are included in the *Discharge System 2019 Data Quality Assessment* (Atlantic Richfield Company, 2020).

4.2.3 Discharge System Temperature Monitoring

A proposed temperature monitoring program for the discharge system was included in the Draft Downstream SAP Addendum. Once the Downstream SAP Addendum has been approved by the Agencies, the SDs will begin including the results from this effort as part of the quarterly reports.

Although the On-Site Water Management SAP Addendum has not been completed, available preliminary data are included in this report as requested by the Agencies via a letter dated August 21, 2019 and titled, *Comments on Draft Technical Evaluation of Temperature Impacts to Discharge from the Berkeley Pit and Discharge Pilot Project, dated July 17, 2019*. Figure B-3 in Attachment B shows the preliminary data collected at various depths in the YDTI supernatant pond below the pumping barge for the Return Line from September 2019 through October 2019.

Figure B-4 in Attachment B shows the preliminary data collected at the Polishing Facility influent, Product Tank, and Discharge Structure from September 2019 through December 2019. The temperature data collected in the fourth quarter 2019 includes temperature anomalies during Polishing Facility commissioning and shutdown periods. Several examples are shown on Figure B-4 in Attachment B.

4.2.4 Blacktail Creek Temperature Monitoring

A proposed temperature monitoring program for Blacktail Creek was included in the Draft Downstream SAP Addendum. Once the Downstream SAP Addendum has been approved by the Agencies, the SDs intend to begin including the results from this effort as part of the quarterly reports.

4.2.5 Discharge System Langelier Saturation Index and Scale Monitoring

Per the Pilot Project OAP, the Discharge System is using a Langelier Saturation Index (LSI) operational target of less than zero in the Polishing Facility off-site discharge as a management tool. The calculated Polishing Facility off-site discharge LSI values for the fourth quarter are shown on Figure 4-4. The 7-day rolling average LSI values for the Polishing Facility off-site discharge were consistently negative values, with the exception of December 17, 2019 when a 7-day rolling average result of 0.020 (potentially scale forming) was calculated during a period when Silver Lake water was used for effluent flow augmentation and potential pH monitoring anomalies at the discharge structure. The effluent flow augmentation flows were reduced, and operational changes were made to maintain the calculated LSI below zero. The pH monitoring methods at the Discharge Structure are currently being verified and evaluated to verify pH instrumentation.

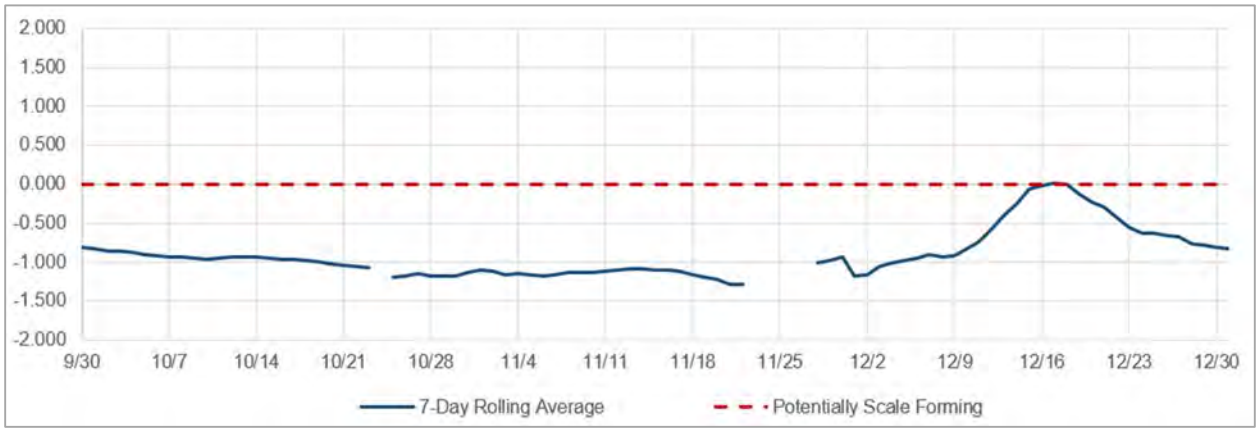

Figure 4-4: Calculated Polishing Facility Off-Site Discharge System LSI Values

Scale coupons were installed within the Product Tank and Discharge Structure to evaluate the potential for scaling in the Polishing Facility and Discharge System effluent piping. Monitoring of the Polishing Facility scale coupons will be reported in subsequent quarterly reports. Additionally, Polishing Facility components were inspected for scale formation during maintenance activities. On November 13, 2019, pH control irregularities were observed and during the troubleshooting of one of the in-line carbon dioxide diffusers, precipitate was observed. The precipitate was removed from the diffuser and sampled. Analyses of the sample showed the precipitate to be primarily composed of Ca and SO_4 compounds. The observation of scale on the carbon dioxide diffuser is believed to be limited to an isolated area at the interface between the influent water and the carbon dioxide.

4.2.6 In-Stream Scale Monitoring

As described in the Downstream SAP Addendum, the Pilot Project includes assessment activities in Silver Bow Creek and Blacktail Creek for validation of the LSI values and to monitor for in-stream calcite scale formation.

4.2.6.1 Instream LSI Projections

The scaling potential was measured in the receiving stream as described in the Pilot Project Downstream SAP Addendum. Water quality samples were collected upstream and downstream of the Pilot Project discharge point and used to calculate the LSI and other relevant saturation indices of the receiving stream. The LSI for each creek location and the Polishing Facility discharge were calculated on the days base flow data were collected from Silver Bow Creek and Blacktail Creek. The LSI values are presented on Figure B-5 provided in Attachment B.

The LSI values calculated from monthly creek base flow data for 2017 and 2018 demonstrate the natural seasonal variations in the stream. The Silver Bow Creek and Blacktail Creek December 2019 LSI values are derived from preliminary analytical data. The December 2019 Polishing Facility off-site discharge LSI represents the combination of Polishing Facility effluent and Silver Lake water effluent flow augmentation discharged into Silver Bow Creek.

4.2.6.2 Instream Substrate Monitoring

Substrate monitoring was conducted in Blacktail Creek and Silver Bow Creek at the locations shown on Figure 4-5.

Figure 4-5: Silver Bow Creek and Blacktail Creek Substrate Monitoring Locations

The substrate monitoring was conducted twice prior to Polishing Facility discharge and twice after discharge started in 2019. The pre-discharge substrate monitoring was conducted on August 29 and 30, 2019 and September 9 to 13, 2019. Significant calcite scale was observed in Reach 3 just prior to Slag Canyon during the September 9 to 13, 2019 event and therefore, a new reach (Reach 2.5) was added downstream of Slag Canyon. Reach 2.5 was monitored on September 18, 2019. The pre-discharge monitoring events observed calcite scale in multiple locations within Reaches 2, 2.5, and 3, and one calcite scale observation was recorded in Reach 5. In addition to the calcite scale observed at the designated transects, calcite scale was observed from the streambank along portions of Reaches 2.5 and 3.

Post-discharge substrate monitoring was conducted from October 7 to 11, 2019, and again from October 21 to 25, 2019. Calcite scale was observed in the same reaches as noted in the pre-discharge monitoring with multiple observations in Reaches 2, 2.5 and 3, and two calcite scale

observations in Reach 5. Similar observations of calcite scale were made from the streambank in Reaches 2.5 and 3. The only noted difference in scale observations from pre- to post-discharge was the observation within Reach 3 of an evaporative salt rind on a rock above the waterline. Although the salt rind strongly effervesced with 10% hydrochloric acid and indicated calcite, the rind washed off the rock with a splash of water from the stream.

The calcite scale observations that were recorded in 2019 are summarized on Figure 4-6. Note that the figure only represents observations recorded at the pre-determined transect locations, and observations of calcite scale outside of these locations are not included in the data. Although no calcite scale observations were recorded during the first monitoring event (August 29 and 30, 2019), subsequent calcite scale observations prompted a review of photographs taken during the first substrate monitoring event. Review of these photographs indicated that calcite scale was present in Reach 3 during the first monitoring event.

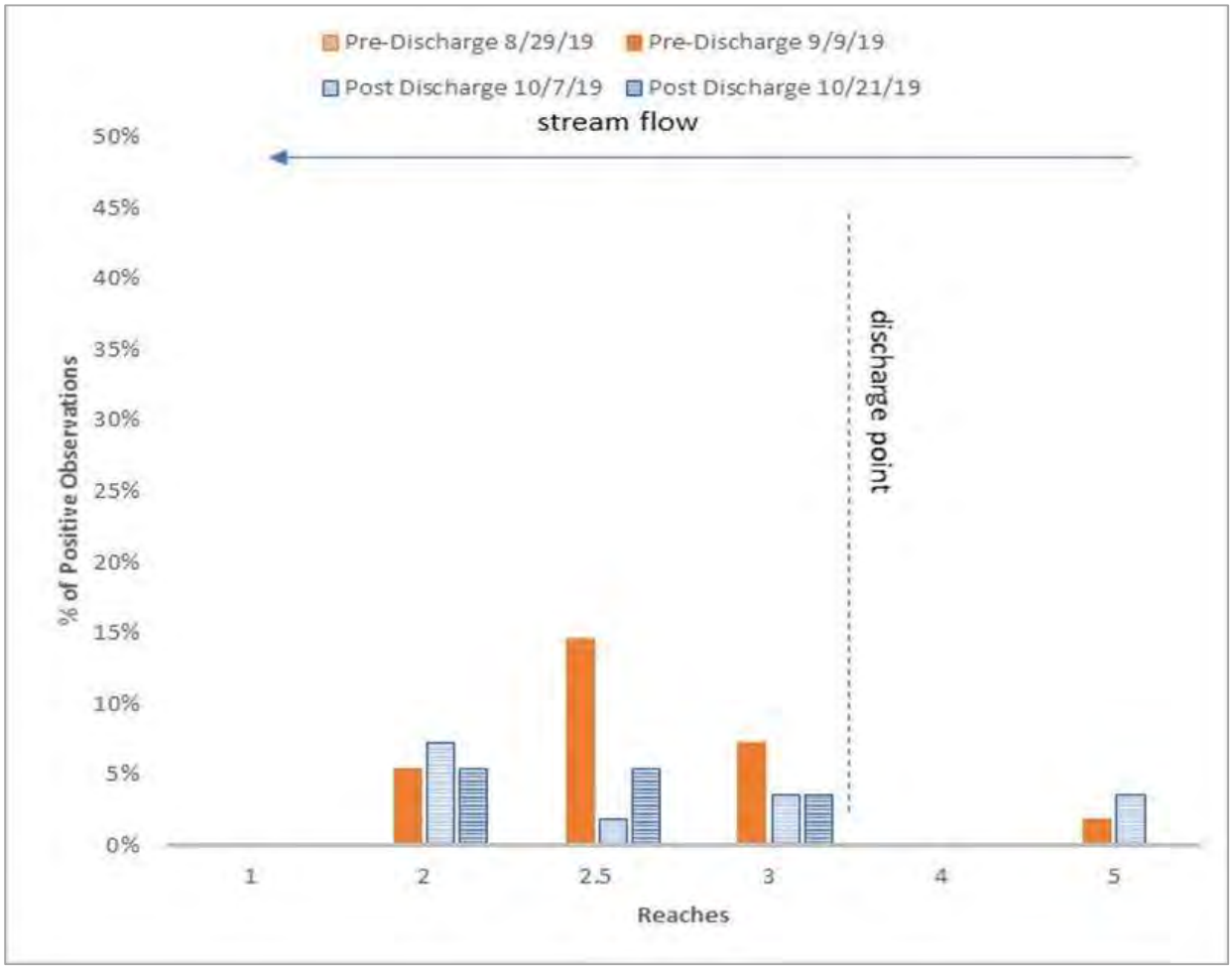

Figure 4-6: Percent of Monitoring Points where Calcite Scale was Observed and Recorded During Pre- and Post-discharge 2019 Substrate Monitoring Events

Also of note, a large storm event occurred immediately prior to the second pre-discharge monitoring event. During the storm event, the stream flow increased from 13 to 15 cfs to a peak of 113 cfs. This increase in flow likely displaced sediment that was covering some pre-existing

calcite scale, which could explain the increase in calcite scale observations after the first substrate monitoring event. In-stream monitoring will continue to be evaluated as part of the Pilot Project to determine if there are seasonal trends in the in-stream substrate monitoring events.

4.2.7 Effluent Mixing Zone Monitoring and Assessment

A proposed monitoring program to delineate the mixing zone below the Discharge Structure of the Polishing Facility was included in the Downstream SAP Addendum. Once the Downstream SAP Addendum has been approved by the Agencies, the SDs intend to begin including the results from this effort as part of the quarterly reports.

Prior to the approval of the Downstream SAP Addendum, the SDs began the proposed monitoring program at the locations shown on Figure 4-7.

Figure 4-7: Effluent Mixing Zone Monitoring Locations

Table 4-2 and Table 4-3 summarize preliminary field measurements for specific conductance, pH, and temperature collected during two events in the fourth quarter of 2019, prior to the approval of the Downstream SAP Addendum.

Table 4-2: Field Parameters Measured at Mixing Zone Monitoring Locations (11/18/2019)

Location	Distance from Discharge Structure (feet)	Transect ID	Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
Blacktail Creek (BTC) above Discharge (Background)	-330	DME-1	SC (µS/cm)	309	309	309	309	309
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	4.88	4.88	4.88	4.88	4.88
BTC above Discharge (Background)	-115	DME-2	SC (µS/cm)	309	309	309	309	309
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	4.90	4.90	4.90	4.90	4.90
Upper Silver Bow Creek (uSBC) above Discharge	-340	DME-3B	SC (µS/cm)	1939	2058	2061	2051	2022
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	6.93	7.25	7.19	7.32	7.31
uSBC below Discharge	+10	DME-3A	SC (µS/cm)	2529	2527	2526	2531	2533
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.79	5.8	5.8	5.8	5.8
Silver Bow Creek (SBC)	+210	DME-4	SC (µS/cm)	895	1340	1291	1088	974
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.14	5.36	5.32	5.24	5.19
SBC	+355	DME-5	SC (µS/cm)	1157	1177	1167	1156	1137
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.30	5.31	5.30	5.29	5.29
SBC	+515	DME-6 @SS-05	SC (µS/cm)	1157	1163	1165	1143	1144
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.29	5.3	5.3	5.28	5.29
SBC	+675	DME-7	SC (µS/cm)	1157	1157	1153	1150	1149
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.29	5.29	5.29	5.29	5.29
SBC	+830	DME-8 @SBC-SED-B8	SC (µS/cm)	1162	1158	1154	1151	1152
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.28	5.28	5.28	5.28	5.28
SBC	+995	DME-9	SC (µS/cm)	1159	1156	1155	1153	1154
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.23	5.23	5.22	5.22	5.22
SBC	+1495	DME-10 @SS-05.7	SC (µS/cm)	1157	1157	1157	1157	1156
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.09	5.1	5.11	5.11	5.11
SBC	+1615	DME-11 @SS-05.9	SC (µS/cm)	1155	1155	1154	1154	1154
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	5.00	5.02	5.03	5.03	5.04

Notes: NM= not measured; SC = specific conductance; µS/cm = microSiemens per centimeter; SU = standard unit; Temp = temperature; Deg C = degrees Celsius

Table 4-3: Field Parameters Measured at Mixing Zone Monitoring Locations (12/10/2019)

Location	Distance from Discharge Structure (feet)	Transect ID	Parameter	Station 1	Station 2	Station 3	Station 4	Station 5
Blacktail Creek (BTC) above Discharge (Background)	-330	DME-1	SC (µS/cm)	355	354.79	354.35	354.51	354.5
			pH (SU)	7.88	7.88	7.89	7.89	7.9
			Temp (Deg C)	3.07	3.11	3.13	3.14	3.14
BTC above Discharge (Background)	-115	DME-2	SC (µS/cm)	357.59	357.64	356.48	356.04	355.65
			pH (SU)	7.72	7.76	7.8	7.83	7.85
			Temp (Deg C)	3.03	3.04	3.05	3.07	3.08
Upper Silver Bow Creek (uSBC) below Discharge	-340	DME-3B	SC (µS/cm)	NM	NM	NM	NM	NM
			pH (SU)	NM	NM	NM	NM	NM
			Temp (Deg C)	NM	NM	NM	NM	NM
uSBC below Discharge	+10	DME-3A	SC (µS/cm)	2062.3	2063.3	2057.5	2052.1	2051.7
			pH (SU)	7.67	7.64	7.62	7.6	7.6
			Temp (Deg C)	3.49	3.55	3.55	3.55	3.55
Silver Bow Creek (SBC)	+210	DME-4	SC (µS/cm)	1103.3	1417.1	1176.7	1058.8	827.3
			pH (SU)	7.75	7.69	7.72	7.76	7.8
			Temp (Deg C)	3.1	3.17	3.19	3.14	3.09
SBC	+355	DME-5	SC (µS/cm)	1170.4	1153	1106.4	1083.7	1037.8
			pH (SU)	7.75	7.75	7.75	7.76	7.76
			Temp (Deg C)	2.98	3.04	3.08	3.06	3.05
SBC	+515	DME-6 @SS-05	SC (µS/cm)	1138.4	1134.4	1127	1065	1063.7
			pH (SU)	7.73	7.73	7.73	7.74	7.75
			Temp (Deg C)	2.98	2.99	3.02	3.01	2.98
SBC	+675	DME-7	SC (µS/cm)	1129.5	1123.6	1112.3	1100.7	1092.6
			pH (SU)	7.61	7.66	7.69	7.70	7.71
			Temp (Deg C)	2.97	2.96	2.96	2.97	2.97
SBC	+830	DME-8 @SBC-SED-B8	SC (µS/cm)	1100.3	1089.3	1082.3	1070.6	1070.2
			pH (SU)	7.73	7.74	7.74	7.74	7.74
			Temp (Deg C)	2.88	2.88	2.88	2.88	2.88
SBC	+995	DME-9	SC (µS/cm)	1093.8	1090.9	1084.8	1076.5	1075.4
			pH (SU)	7.71	7.72	7.72	7.72	7.73
			Temp (Deg C)	2.83	2.83	2.83	2.83	2.83
SBC	+1495	DME-10 @SS-05.7	SC (µS/cm)	1091.1	1090.3	1089.4	1088.7	1087.7
			pH (SU)	7.68	7.69	7.7	7.7	7.7
			Temp (Deg C)	2.78	2.78	2.78	2.78	2.78
SBC	+1615	DME-11 @SS-05.9	SC (µS/cm)	1089.5	1092	1090.5	1090.6	1090.6
			pH (SU)	7.54	7.59	7.62	7.64	7.65
			Temp (Deg C)	2.83	2.81	2.81	2.79	2.78

Notes: NM = not measured (channel iced over); SC = specific conductance; µS/cm = microSiemens per centimeter; SU = standard unit; Deg C = degrees Celsius

4.2.8 Blacktail Creek Backwater Monitoring and Assessment

A proposed monitoring program to identify the extent of backwater effects of the Pilot Project discharge on flow measured in Blacktail Creek was included in the Downstream SAP Addendum. Once the Downstream SAP Addendum has been approved by the Agencies, the SDs will begin including the results from this effort as part of the quarterly reports.

Prior to the approval of the Downstream SAP Addendum, the SDs began tracking periodic Polishing Facility shutdowns and the changes in off-site discharge flow rate that are anticipated to occur. Shortly after off-site discharge from the Polishing Facility began, staff gages equipped with stilling wells and transducers were installed in October 2019 at locations along Blacktail Creek to observe water level changes. Table 4-4 is a summary of the monitoring locations established during the fourth quarter. Preliminary stage changes information will be provided in forthcoming Pilot Project Quarterly reports.

Table 4-4: Backwater Monitoring Locations

Station	Station Maintained by	Monitoring Frequency	Date Available	Description and Significance
Pilot Project Discharge Structure	Wood	1-minute	9/30/2019	Located within upper Silver Bow Creek (uSBC). Monitored to compare changes in continuous flow rates to upstream water elevation changes.
USGS 12323240 Blacktail Creek (BTC) at /SS-04 (490 feet above effluent confluence)	USGS/Pioneer	10-minute	Prior to 2019	Co-located with USGS Station 12323240 in BTC, and above the confluence of uSBC and BTC. Downstream of all identified tributaries entering BTC prior to confluence. Monitored to compare changes in continuous flow rates to upstream water elevation changes.
BWE-4 (740 feet above effluent confluence)	Pioneer	10-minute	10/25/2019	Located within BTC and above the confluence of uSBC and BTC. Downstream of all identified tributaries entering BTC prior to confluence. Monitored to compare changes in continuous flow rates to upstream water elevation changes.
BWE-3 (1,040 feet above effluent confluence)	Pioneer	10-minute	10/25/2019	Located within BTC and above the confluence of uSBC and BTC. Downstream of all identified tributaries entering BTC prior to confluence. Monitored to compare changes in continuous flow rates to upstream water elevation changes.
BWE-2 (1,330 feet above effluent confluence)	Pioneer	10-minute	10/25/2019	Located within BTC and above the confluence of uSBC and BTC. Downstream of all identified tributaries entering BTC prior to confluence (approximately 210 feet

Station	Station Maintained by	Monitoring Frequency	Date Available	Description and Significance
				downstream of tributary C-5). Monitored to compare changes in continuous flow rates to upstream water elevation changes.
BWE-1 (2,010 feet above effluent confluence)	Pioneer	10-minute	10/25/2019	Located within BTC and above the confluence of uSBC and BTC. Downstream of tributaries C-9 (Grove Gulch) and C-7.5 (approximately 50 feet downstream), but upstream of tributary C-5. Monitored to compare changes in continuous flow rates to upstream water elevation changes.
SS-01.6 (2,430 feet above effluent confluence)	TREC	15-minute	Prior to 2019	Located within BTC and above the confluence of uSBC and BTC. Downstream of tributary C-9 (Grove Gulch), but upstream of tributaries C-5 and C-7.5. Monitored to compare changes in continuous flow rates to upstream water elevation changes.

Note: Wood = Wood Environment & Infrastructure Solutions, Inc.; Pioneer = Pioneer Technical Service, Inc.; TREC = TREC, Inc.

5.0 HSBWTP OPTIMIZATION

The Pilot Project Work Plan identified the following objective for the HsBWTP optimization:

> *"The Pilot Project will evaluate the ability of the HsBWTP to treat Berkeley Pit water (after being routed through MR's precipitation plant for copper recovery)[1]."*

The study objectives for the HsBWTP optimization, as described in DQO Step 2 in Table 3A of the Pilot Project SAP, are as follows:

- *"Evaluate the ability of the existing HsBWTP infrastructure to treat Berkeley Pit water.*
- *Additional performance testing to evaluate treating Berkeley Pit water (from 2011 5-Year Review)."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project SAP to evaluate the HsBWTP optimization objectives. These information inputs are discussed in Section 5.1.

5.1 HsBWTP Optimization Information Inputs

During the fourth quarter, the HsBWTP acted as a component of the Pilot Project treatment system remedy, including treatment of water from the Berkeley Pit. Table 5-1 lists the

[1] Routing through MR's precipitation plant for copper recovery may not continue for the full duration of the Pilot Project and will depend on economic viability.

information inputs identified in the Pilot Project SAP DQOs to evaluate the HsBWTP optimization and includes the current status and a summary of information collected in the fourth quarter of 2019.

Table 5-1: HsBWTP Optimization Fourth Quarter Status

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Current Summary**
The current HsBWTP monitoring and evaluation will be continued to evaluate HsBWTP Optimization.	The HsBWTP continued to be monitored.	During the fourth quarter of 2019, a total volume of approximately 344.7 million gallons were treated through the HsBWTP.

[1]Pilot Project SAP, Table 3A (Step 3).

Performance of the HsBWTP in the fourth quarter of 2019 and in total for the year was provided in the BMFOU Quarterly Report (SDs, 2020).

6.0 YDTI TREATMENT

The Pilot Project Work Plan identified the following objective for the YDTI treatment:

> *"The Pilot Project will update information previously learned from 1996 to 2000 concerning the capability of the supernatant pond at YDTI to act as a component of the remedy to directly treat the HsB water."*

The study objective for the YDTI treatment, as described in DQO Step 2 in Table 3A of the Pilot Project SAP, is as follows:

- *"Assess water treatment capacity of the YDTI. The Pilot Project will assess the capability of the supernatant pond to act as a component of the remedy."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project SAP to evaluate the YDTI treatment objective. These information inputs are discussed in Section 6.1.

6.1 YDTI Treatment Information Inputs

Data collected by the SDs are used to evaluate the YDTI treatment study objective. Table 6-1 lists the information inputs identified in the Pilot Project SAP DQOs to evaluate the YDTI treatment and includes the current status and a summary of information collected in the fourth quarter of 2019.

Table 6-1: YDTI Treatment Fourth Quarter Status

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Current Summary**
Polishing Facility effluent flow and water quality	The Polishing Facility effluent flow and water quality were monitored as part of the off-site discharge objective.	Details on the Polishing Facility effluent flow and water quality are provided in Section 4.0.
HsB Capture System to YDTI flow	The HsB Capture System was operated and monitored by MR during the fourth quarter. The pumping rate and volumes were reported in MR's on-site water management monthly reports.	From September 26 through December 31, 2019, a total of 295.5 million gallons were pumped through the HsB Capture System with an average daily rate of 3.0 MGD.
Return Water line flow	The Return Water line was operated by MR during the fourth quarter as intended, with no flow changes except additional supply of water to the Polishing Plant.	Details on the Polishing Facility influent flow are provided in Section 4.2.1.
YDTI Supernatant Pond water quality	The YDTI supernatant pond water quality was monitored through the Polishing Facility influent water quality as part of the off-site discharge objective.	Details on the Polishing Facility influent water quality are provided in Section 4.0.
Lime demand associated with HsB Capture System water neutralization	MR continued to operate and monitor the HsB Capture System lime delivery system.	The pH of the YDTI supernatant pond was maintained at target pH levels. Lime usage is not directly measured, but instead is based upon acidity and flow measurements of HsB area water (mixture of HsB Seeps and Berkeley Pit pumping overflow). Acidity[2], as measured by MBMG for the fourth quarter (averaged 3,714 mg $CaCO_3$ per L of water.

1Pilot Project SAP, Table 3A (Step 3).
2 Data provided by MBMG and will be included in subsequent MBMG monthly reports.

During the fourth quarter, the YDTI supernatant pond acted as a component of the Pilot Project treatment system remedy. In addition, the HsB Capture System was operated during most of the fourth quarter, and treated water that was historically treated at the HsBWTP. A total of 270.8 million gallons was treated through the HsB Capture System.

7.0 INCORPORATION OF TREATED BERKELEY PIT WATER INTO THE ACTIVE MINING OPERATION

The Pilot Project Work Plan identified the following objective for incorporating treated Berkeley Pit Water into the active mining operation:

> *"The Pilot Project will test the feasibility of passing treated water from the Berkeley Pit to MR's mill and ultimately to YDTI, similar to what is currently happening with treated HsB water. This will test the ability of the active mining operation to accept treated water into the future, potentially minimizing off-site discharge requirements while holding the water level in the Berkeley Pit steady."*

The study objectives for incorporating treated Berkeley Pit water into the active mining operation, as described in DQO Step 2 in Table 3A of the Pilot Project SAP, are as follows:

- *"Test the ability of the active mining operation to accept more treated BMFOU water into the future, potentially minimizing or eliminating the need for treated water to be discharged off site, while controlling the water level in the Berkeley Pit to keep it below the CWL.*
- *Identify impacts of using the treated Berkeley Pit water in the active mine circuit.*
- *Determine if incorporation of Berkeley Pit water in the active mine circuit is detrimental to the active mine operations."*

Information inputs were identified in DQO Step 3 in Table 3A of the Pilot Project SAP to evaluate incorporating treated Berkeley Pit Water into the active mining operations objectives. The information inputs are discussed in Section 7.1.

7.1 Incorporation of Treated Berkeley Pit Water into the Active Mining Operation Information Inputs

Table 7-1 identifies the information inputs identified in the Pilot Project SAP DQOs to evaluate the feasibility of incorporating treated Berkeley Pit water into the active mining operations and includes the current status and a summary of information collected in the fourth quarter of 2019.

Table 7-1: Incorporation of Treated Berkeley Pit Water into the Active Mining Operation Fourth Quarter Status

Information Input[1]	Quarter 4 2019	
	Information Input Status	**Current Summary**
HsB Capture System (HsB Seeps to YDTI) flow and water quality	The HsB Capture System was operated and monitored by MR. The pumping rate and volumes were reported in MR's on-site water management monthly reports. The MBMG monitors water quality in the Berkeley Pit, as well as the HsB Area seeps (i.e., the potential feed waters to the HsB Capture System).	Detail on the HsB Capture System flow is described in Section 6.0. HsB area water quality is included in MBMG monthly reports (MBMG, 2019a; MBMG 2019b; MBMG, 2020).
HsBWTP influent flow and water quality	MR measures influent flow at the HsBWTP and Atlantic Richfield contractors sample the influent monthly for water quality. The MBMG monitors water quality in the Berkeley Pit, as well as the HsB area seeps (i.e., the potential feed waters to the HsBWTP). HsBWTP.	The HsBWTP influent flow details have been provided in the BMFOU Quarterly Report (SDs, 2020). Influent water quality sampling was completed by Atlantic Richfield contractors in the fourth quarter and can be made available to the Agencies upon request.
HsBWTP effluent flow and water quality	MR measures effluent flow at the HsBWTP and Atlantic Richfield contractors sample the effluent monthly for water quality.	The HsBWTP effluent flow details have been provided in the BMFOU Quarterly Report (SDs, 2020). Effluent water quality sampling was completed by Atlantic Richfield contractors in the fourth quarter and can be made available to the Agencies upon request.
Return Water Line (YDTI) flow and water quality	The Return Water line was operated by MR. Appropriate flow and water quality information is collected at the Polishing Facility.	Detail on the Polishing Facility influent is provided in Section 4.2.1

[1]Pilot Project SAP, Table 3A (Step 3).

Water from the HsB area and Berkeley Pit was incorporated into the active mining circuit. Assessment of the long-term viability of incorporating additional treated BMFOU water and any impacts to the site water balance will require continued evaluation as part of the Pilot Project. The Pilot Project water management scenario will continue to be monitored.

8.0 ACTIVE MINE WATER REDUCTION EFFORT

The Pilot Project Work Plan identified the following objective for the active mine water reduction effort:

> *"Consistent with the recommendation of the YDTI Engineer of Record, MR is currently reducing the volume of water stored in the YDTI to the minimum amount needed for efficient mining operations. It is presently estimated that the minimum amount of stored water in the YDTI for efficient mining operations is approximately 15,000 acre-feet. The Pilot Project would accelerate the water volume reduction by treating and discharging approximately 7 MGD over the next few years. Once the YDTI target storage volume is reached (15,000 acre-feet), the results of the Pilot Project will be used to evaluate the ability of the mining operations to accept additional treated water without discharge from the site."*

Monitoring this objective will be consistent with recommendations from the YDTI Engineer of Record (EoR).

9.0 REFERENCES

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SDs, 2019c. Butte Mine Flooding Operable Unit Berkeley Pit and Discharge Pilot Project Work Plan – November 2019 Monthly Discharge Monitoring Report. December 20, 2019.

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SDs, 2020. Butte Mine Flooding Site CD, CV 02-35-Bu-RFC, 2019 Fourth Quarter Report. February 14, 2020.

ATTACHMENT A

PILOT PROJECT WORK PLAN DOCUMENT STATUS SUMMARY

PILOT PROJECT WORK PLAN DOCUMENT STATUS – Fourth Quarter 2019	
Berkeley Pit and Discharge Pilot Project Work Plan	The *Draft Berkeley Pit and Discharge Pilot Project Work Plan* (Pilot Project Work Plan) was submitted by the Settling Defendants (SDs) to the Agencies on February 8, 2019. Attachments to the Draft Pilot Project Work Plan were submitted under separate cover to the Agencies and were not included with the work plan submittal. Comments were received from the Agencies in a letter dated March 19, 2019. The SDs are currently addressing the Agency comments in the *Draft Final Berkeley Pit and Discharge Pilot Project Work Plan.* The *Draft Final* Work Plan and a Response to Comments (RTC) table is anticipated to be submitted to the Agencies in March 2020.
Attachment A – On-Site Water Management Work Plan	The *Draft Pilot Project On-Site Water Management Work Plan* (On-Site Water Management Work Plan) was submitted by Montana Resources, LLP (MR) on behalf of the SDs to the Agencies on January 16, 2019. Comments were received from the Agencies in a letter dated March 19, 2019. MR is currently addressing the Agency comments in the *Draft Final* On-Site Management Work Plan. MR is anticipating to submit the work plan and a RTC table to the Agencies in March 2020.
Attachment B.1 - Discharge System Work Plan	The *Draft Pilot Project Discharge System Work Plan* (Discharge System Work Plan) was submitted by Atlantic Richfield Company (Atlantic Richfield) on behalf of the SDs to the Agencies on September 24, 2018. The Discharge System Work Plan submittal included all document appendices except for the Discharge System Operations Assurance Plan (OAP) which was submitted under separate cover. Comments were received from the Agencies in a letter dated December 17, 2018. Based on Agency comments and discussions, the Sampling and Analysis Plan in Appendix F and the OAP in Appendix G of the Discharge System Work Plan were removed as appendices to the Discharge System Work Plan and developed as attachments to the overarching Pilot Project Work Plan. The SDs are currently addressing the Agency comments in the *Draft Final* Discharge System Work Plan. The *Draft Final* Discharge System Work Plan and a RTC table is anticipated to be submitted to the Agencies in March 2020. In addition to the Discharge System Work Plan, Atlantic Richfield prepared and submitted on behalf of the SDs to the Agencies the following Requests for Change (RFCs): • RFC#1 – Modified the existing Horseshoe Bend Effluent Line (HBEL) discharge structure and installed temporary monitoring instrumentation in the discharge structure. Dated and signed by the Agencies with comments on September 24, 2019. • RFC#2 – Modified the existing Butte Priority Soils Operable Unit (BPSOU) manhole MSD-106 to increase its elevation and reduce surface water entering the subdrain. RFC#3 was submitted to the Agencies on December 13, 2019. Comments were received from the Agencies in a letter dated February 3, 2020. A revised RFC#3 address the Agency comments will be submitted in the second quarter of 2020.

	• RFC#3 – Modified the existing Product Tank instrumentation with a flow-through system for pH and SC monitoring. The proposed system was designed to provide more accurate pH measurement of the Polishing Facility effluent stream. Dated and signed by the Agencies with comment on February 25, 2020. • RFC#4 – Modified the existing three CO_2 inline gas diffusers to be retractable and installed three redundant, removable inline gas diffusers to provide the ability to perform CO_2 system maintenance without interruption to the water treatment operations. Dated and signed by the Agencies with comment on February 25, 2020.
Attachment B.2 - Discharge System Conveyance Infrastructure Work Plan	The *Draft Discharge System Conveyance Infrastructure Work Plan* (Discharge System Conveyance Infrastructure Work Plan) was submitted by Atlantic Richfield on behalf of the SDs to the Agencies on April 19, 2019. The Discharge System Work Plan submittal included two of the four document exhibits; the other two exhibits were submitted under separate cover. Comments were received from the Agencies in a letter dated June 11, 2019. The SDs are currently addressing the Agency comments in the *Draft Final* Discharge System Conveyance Infrastructure Work Plan. The *Draft Final* Discharge System Conveyance Infrastructure Work Plan and a RTC table is anticipated to be submitted to the Agencies in March 2020.
Attachment C.1 - Technical Evaluation of Hydraulic Effects to Downstream Operable Units from the Pilot Project	The *Draft Technical Evaluation of Hydraulic Effects to Downstream Operable Units from the Pilot Project* (Hydraulic Effects on Downstream OUs Evaluation) was submitted to the Agencies by Atlantic Richfield on behalf of the SDs on July 9, 2019. Comments were received from the Agencies in a letter dated September 11, 2019. The SDs are currently addressing the Agency comments in the *Draft Final* Hydraulic Effects on Downstream OUs Evaluation. The *Draft Final* Hydraulic Effects on Downstream OUs Evaluation and a RTC table is anticipated to be submitted to the Agencies in March 2020.
Attachment C.2 - Scale Formation Technical Memorandum	The *Draft Scale Formation Technical Memorandum Berkeley Pit and Discharge Pilot Project* (Scale Formation Technical Memo) was submitted to the Agencies by the SDs on July 19, 2019. Comments were received from the Agencies in a letter dated August 21, 2019. The SDs are currently addressing the Agency comments in the *Draft Final* Scale Formation Technical Memo. The *Draft Final* Scale Formation Technical Memo and a RTC table is anticipated to be submitted to the Agencies in March 2020.
Attachment C.3 - Temperature Evaluation	The *Draft Technical Evaluation of Temperature Impacts to Discharge from the Berkeley Pit and Discharge Pilot Project* (Evaluation of Temperature Impacts to Discharge) was submitted to the Agencies by the SDs on July 17, 2019. Comments were received from the Agencies in a letter dated August 21, 2019. The SDs are currently addressing the Agency comments in the *Draft Final* Evaluation of Temperature Impacts to Discharge. The *Draft Final* Evaluation of Temperature Impacts to Discharge and a RTC table is anticipated to be submitted to the Agencies in March 2020.

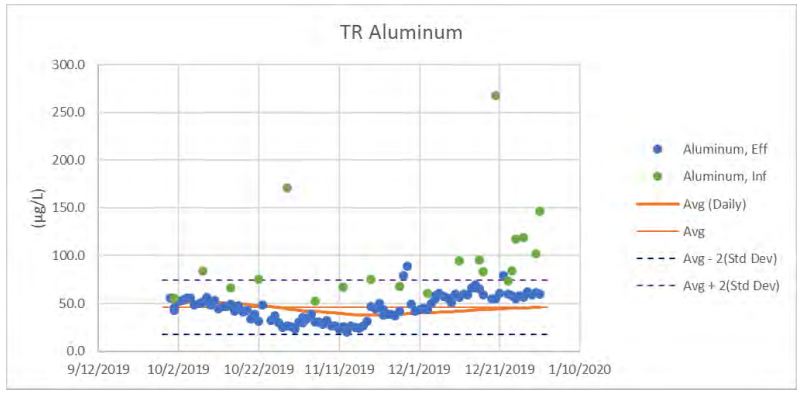
Attachment D.1 - Pilot Project Sampling and Analysis Plan	The *Draft Pilot Project SAP* (Pilot Project SAP) was submitted by the SDs to the Agencies on September 6, 2019. Comments were received from the Agencies in a letter dated October 7, 2019. The Agencies comments were addressed and the *Final* Pilot Project SAP and a composite RTC table was submitted by the SDs on November 21, 2019. In a letter dated February 3, 2020, the Agencies approved the Pilot Project SAP. The *Final* Pilot Project SAP will be reviewed at least annually and revised as necessary.
Attachment D.2 - Downstream SAP Addendum to the Pilot Project SAP	The *Draft Final Downstream SAP Addendum to the Pilot Project SAP* (Downstream SAP Addendum) was submitted by Atlantic Richfield on behalf of the SDs to the Agencies on November 14, 2019. Comments were received from the Agencies on February 3, 2020. The SDs are currently addressing the Agency comments in the Downstream SAP Addendum. The *Final* Downstream SAP Addendum and a RTC table is anticipated to be submitted to the Agencies in the second quarter of 2020.
Attachment D.3 - Onsite Water Management SAP Addendum to the Pilot Project SAP	The *Draft Onsite Water Managment SAP Addendum to the Pilot Project SAP* (Upstream SAP Addendum) is currently being prepared by MR and is anticipated to be submitted on behalf of the SDs to the Agencies in March 2020.
Attachment E – Discharge System Operations Assurance Plan (OAP)	The SDs submitted the *Draft Discharge System* OAP to the Agencies on April 19, 2019. The Agencies provided comments in a letter dated June 18, 2019. Agency comments were addressed and the *Draft Final* Discharge System OAP was submitted by the SDs to the Agencies on September 6, 2019 with a RTC table. A second set of Agency comments were received in a letter dated October 7, 2019. The *Final* Discharge System OAP was submitted by the SDs to the Agencies on November 21, 2019 and included a composite RTC table addressing all OAP-related Agency comments. In a letter dated February 3, 2020, the Agencies approved the Pilot Project OAP. The *Final* Pilot Project OAP will be reviewed at least annually and revised as necessary.

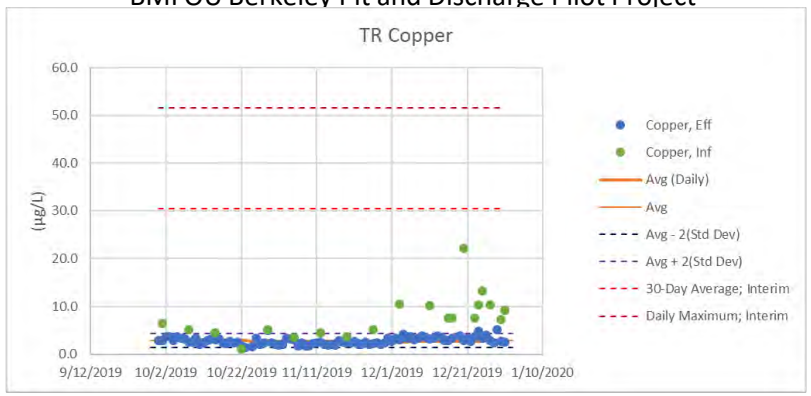
ATTACHMENT B

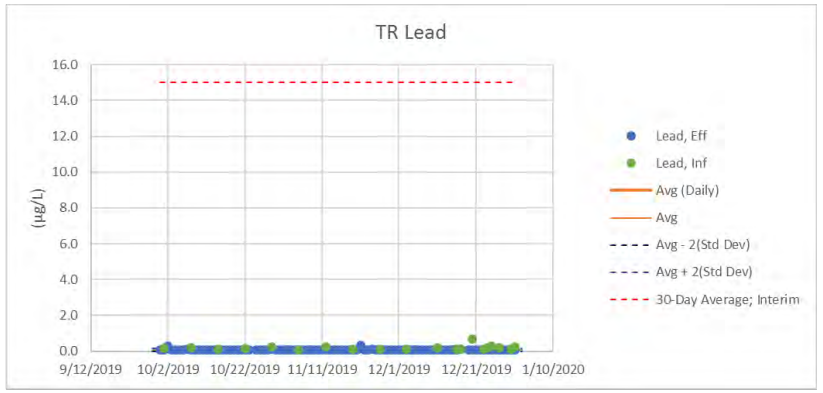
PILOT PROJECT QUARTERLY REPORT FIGURES

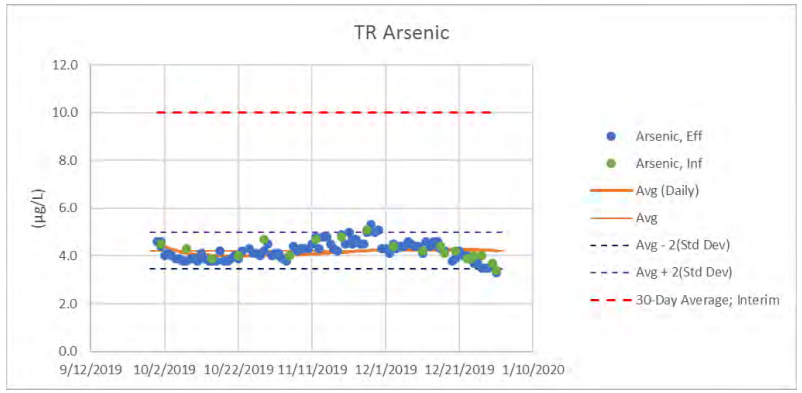
FIGURE B-1: OFF-SITE DISCHARGE EFFLUENT ANALYTICAL TRENDS

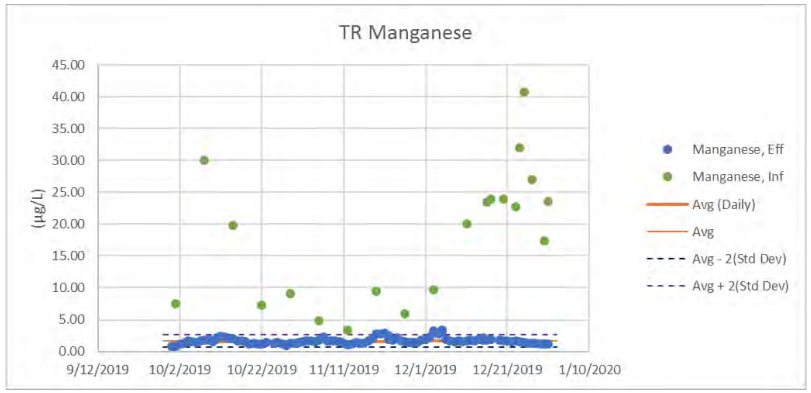
BMFOU Berkeley Pit and Discharge Pilot Project

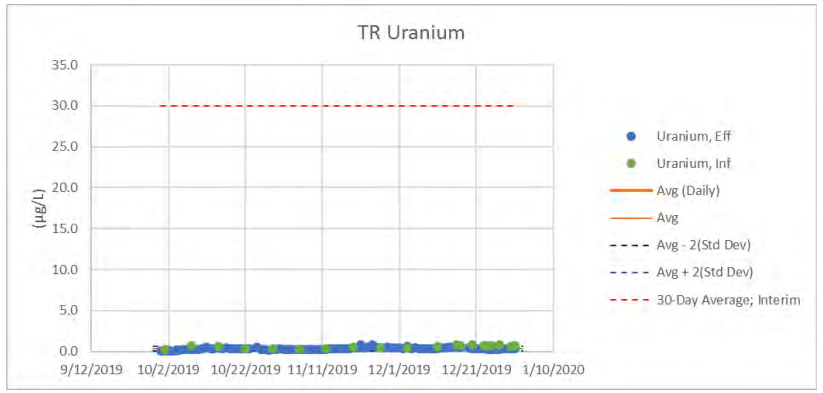


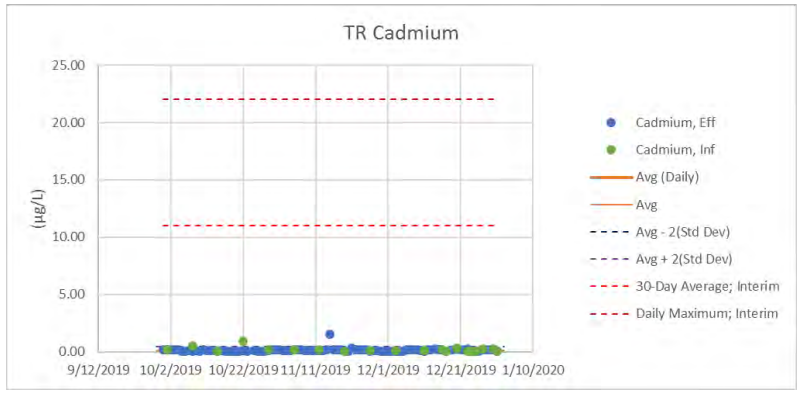


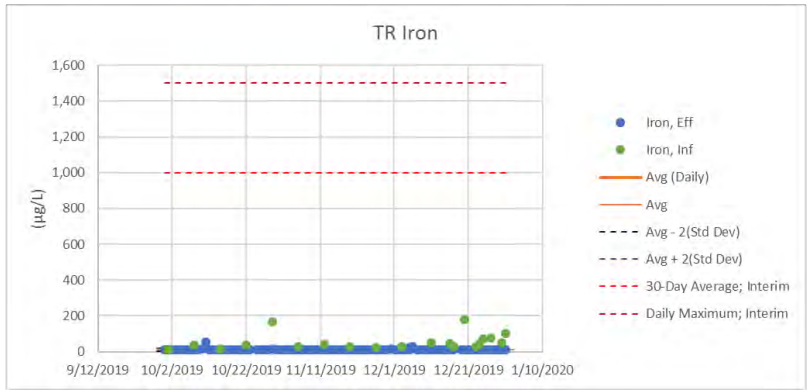


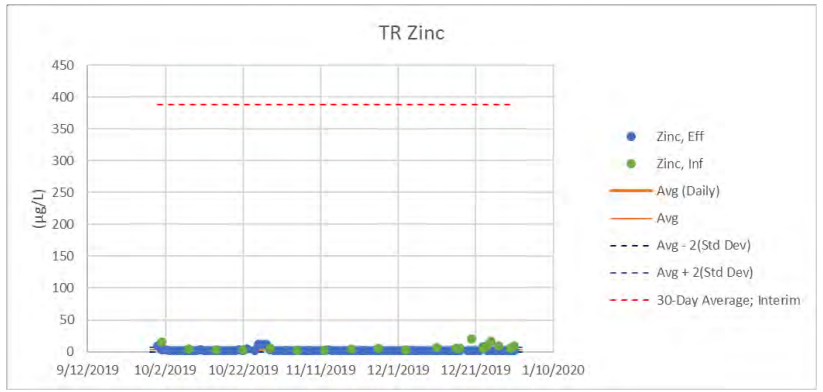












Notes:

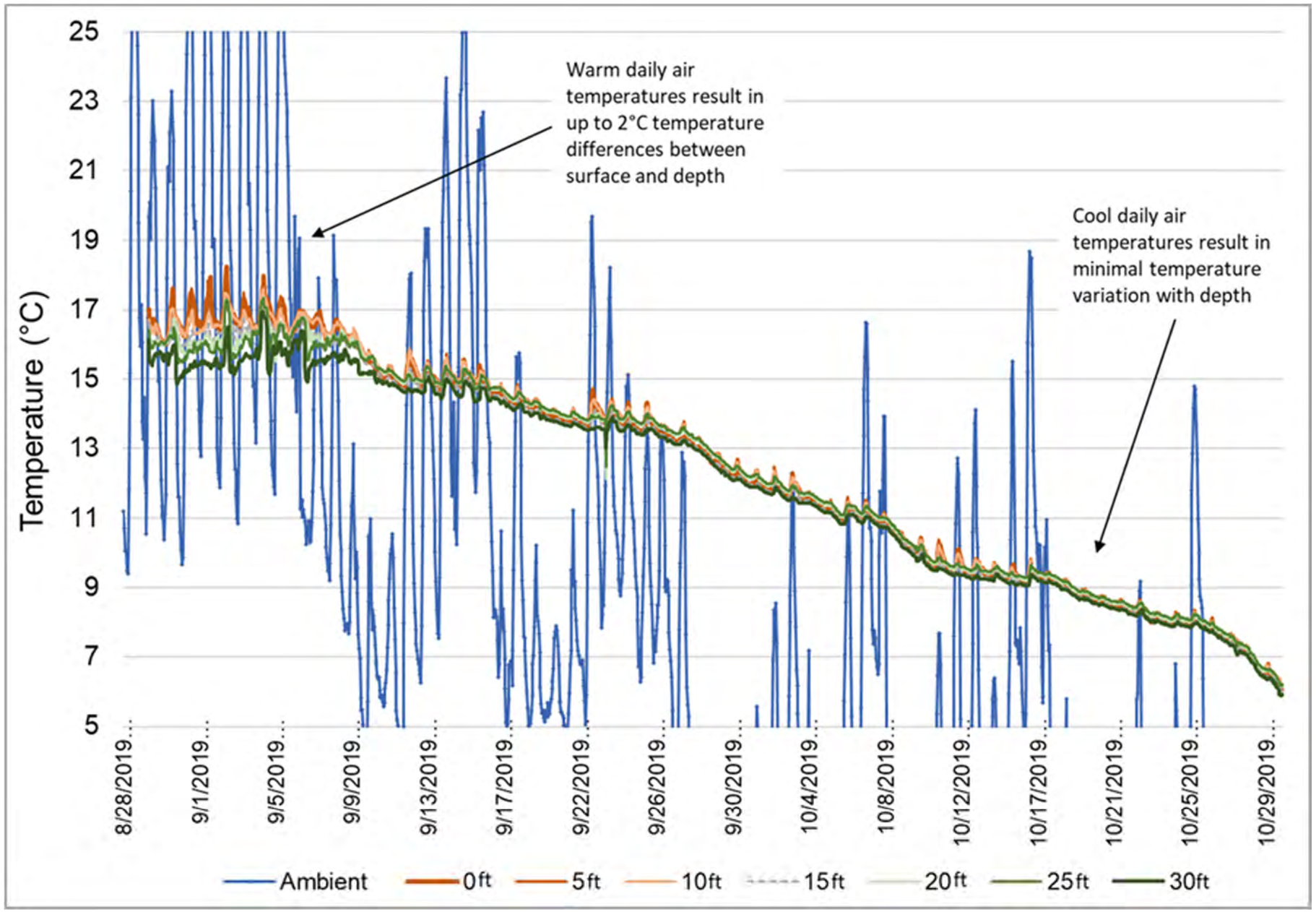
1. All statistical analyses are completed on Effluent data only.
2. Average (Daily) is a rolling average to observe if the average changes over time.
3. Only major constituents with detected values are included in this analysis.

FIGURE B-2: OFF-SITE DISCHARGE EFFLUENT ANALYTICAL TRENDS

BMFOU Berkeley Pit and Discharge Pilot Project

Notes:

1. All statistical analyses are completed on Effluent data only.
2. Average (Daily) is a rolling average to observe if the average changes over time.
3. Only major constituents with detected values are included in this analysis.



Note: Ambient air temperatures were sourced from the MR YDTI meteorological station.

Figure B-3: YDTI Temperature Profile Near the South Barge

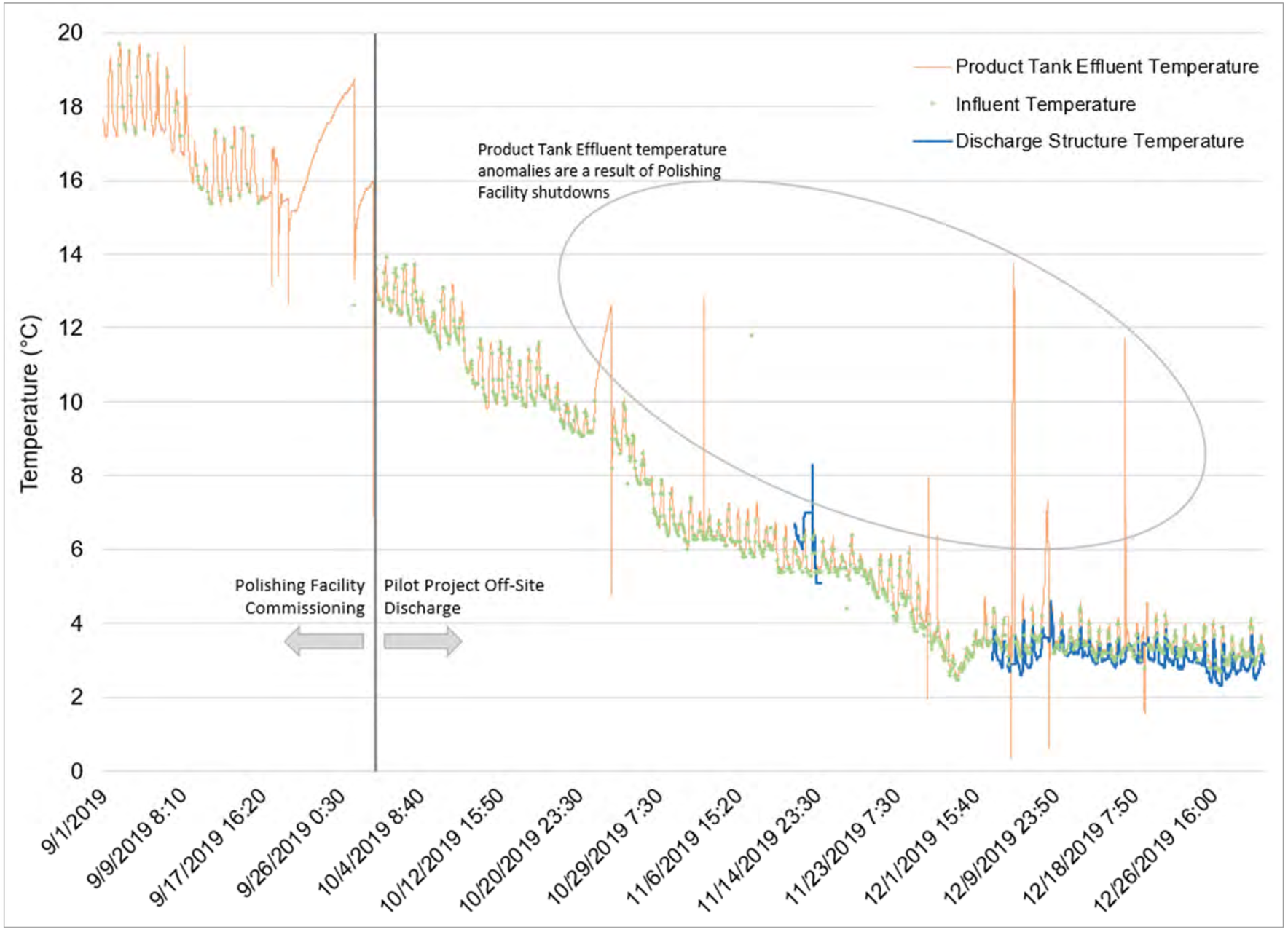


Figure B-4: Polishing Facility Influent and Effluent Temperature Monitoring

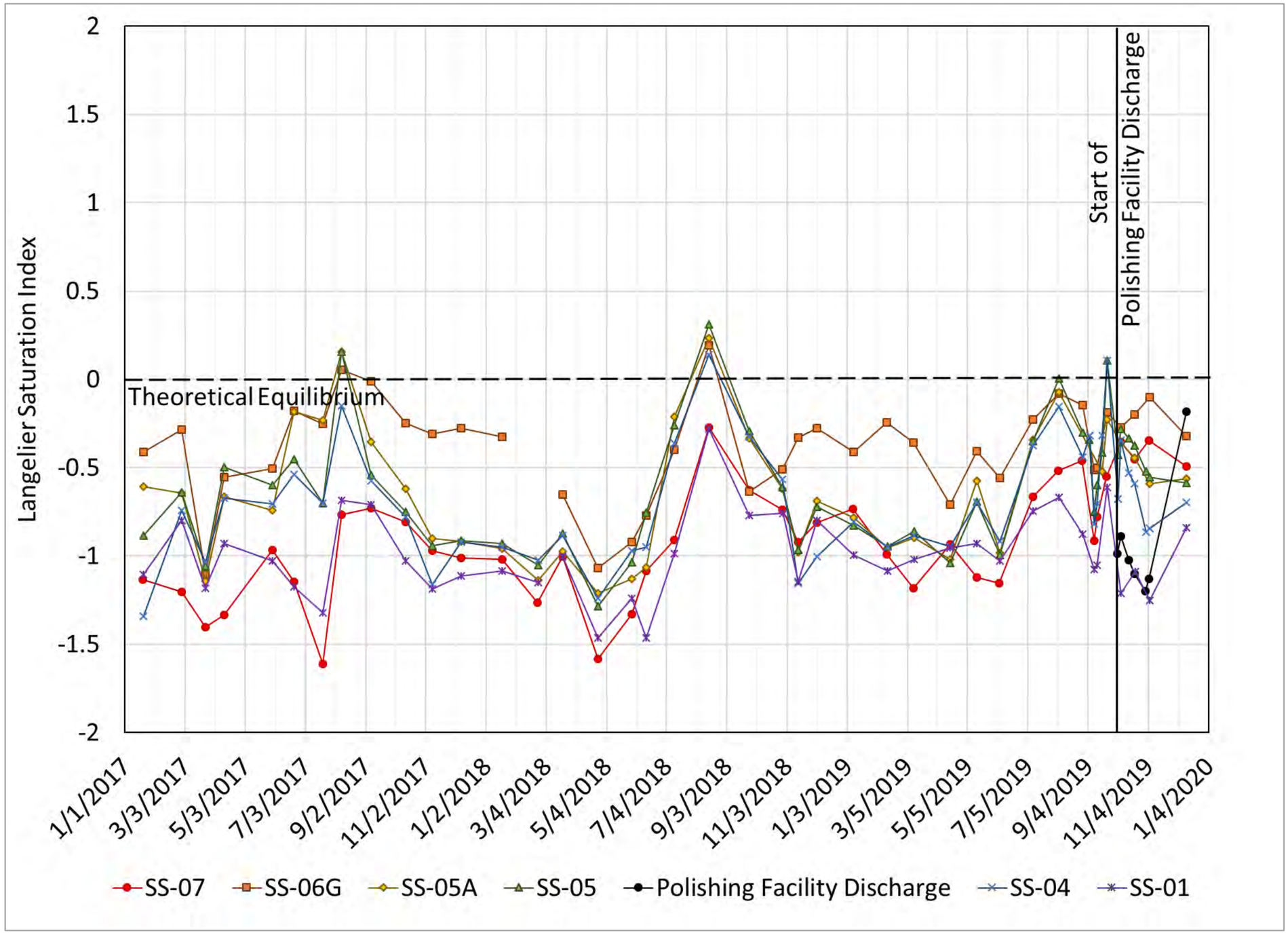


Figure B-5 : LSI Calculations in the Polishing Facility Off-Site Discharge, Blacktail Creek Upstream of the Discharge (SS-01, SS-04), and Silver Bow Creek Downstream of the Discharge (SS-05, SS-05A, SS-06G, SS-07)