

February 10, 2020 COR-20-023 **Via Electronic** 

Alaska Department of Environmental Conservation Division of Water, Compliance Program 555 Cordova Street Anchorage, AK 99501

Re: Northern Star (Pogo) LLC 2019 Annual Activity and Monitoring Report

To whom it may concern:

Enclosed is the Northern Star (Pogo) LLC 2019 Annual Activity and Monitoring Report. This report is prepared to fulfill the requirements of the Alaska Department of Natural Resources (ADNR) Pogo Mine Millsite Lease ADL416949, Alaska Department of Environmental Conservation (ADEC) APDES Permit AK0053341, and ADEC Waste Management Permit 2018DB0001. This report covers the period from January 1, 2019 through December 31, 2019.

If you have any questions, please contact Katie Schumacher, Environmental Engineer, at (907) 895-2730 or <a href="mailto:kschumacher@nsrltd.com">kschumacher@nsrltd.com</a>. Or you may contact me at 907-895-2879 or <a href="mailto:jladegard@nsrltd.com">jladegard@nsrltd.com</a>.

Sincerely,

Jillian Ladegard, P.E. Environmental Manager

Enclosure: 2019 Annual Activity and Monitoring Report, Northern Star (Pogo) LLC

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# 2019 ANNUAL ACTIVITY AND MONITORING REPORT NORTHERN STAR (POGO) LLC

# Submitted To:

Alaska Department of Conservation Division of Water, Compliance Program 555 Cordova Street Anchorage, Alaska 99501

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February 11, 2020

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[SUBMITTED ELECTRONICALLY VIA ALASKA ZENDTO (STATE OF ALASKA)]

# Acronyms

AAC: Alaska Administrative Code

ADEC: Alaska Department of Environmental Conservation

ADNR: Alaska Department of Natural Resources

APDES: Alaska Pollutant Discharge Elimination System

BOD: Biological Oxygen Demand

CIP: Carbon-in-Pulp

DSTF: Dry Stack Tailings Facility

DMR: Discharge Monitoring Report

MDL: Method Detection Limit

ML: Method Limit



MWTP#3: Mine Water Treatment Plant #3

ORTW: Off-River Treatment Works

QAP: Quality Assurance Plan RTP: Recycle Tailings Pond

SCW: Seepage Collection Wells
STP: Sewage Treatment Plant
TSS: Total Suspended Solids
TDS: Total Dissolved Solids

WAD: Weak Acid Dissociable
WQS: Water Quality Standards



# 1. Introduction

Northern Star (Pogo) LLC prepared this report to fulfill the requirements of the Alaska Department of Environmental Conservation (ADEC) APDES Permit AK0053341 (7/27/17), Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2018DB0001 (5/24/2018), Alaska Department of Natural Resources (ADNR) Pogo Mine Millsite Lease ADL416949, and ADNR Plan of Operations Approval F20189500 (5/24/2018). This report addresses activities executed during the 2019 calendar year from January 1, 2019 through December 31, 2019. A General Location Map can be found in Figure 1, Appendix A. Graphs were streamlined and updated to show data plotted on a log-scale axis. This presentation defines individual data sets and their relation to the detection limits and the ADEC Water Quality Standards (WQS). The past six years of data are included in the graphs.

# 2. 2019 MONITORING

A prescriptive environmental monitoring program is performed in accordance with State of Alaska permits and Pogo's approved Pogo Mine Monitoring Plan and Quality Assurance Plan (QAP).

The objectives of Pogo's monitoring programs are:

Tailings Facility (DSTF).

To monitor the water quality of the effluent discharged from the facility,
 To monitor water quality changes in the Goodpaster River and in the groundwater below the facility that may occur as a result of mining activities or discharges from the facility,
 To monitor the Carbon-in-Pulp (CIP) tailings processes associated with the underground paste backfill, and;

☐ To monitor the flotation tailings and the materials placed in the Drystack

Samples collected from the Mine Water Treatment Plant #3 (MWTP#3), groundwater stations, surface water stations, the Sewage Treatment Plant (STP) and the Off-River Treatment Works (ORTW) effluent were submitted to Energy Laboratories, Inc., and



Pollen Environmental. Samples collected from PC002, monitoring mineralized waste rock, and PC003, monitoring floatation tailings, were analyzed by ALS Chemex. Annual Whole Effluent Toxicity (WET) Test samples were submitted to TRE Environmental and Eurofins Test America Laboratory. Annual fish tissue samples were analyzed by Test America Laboratory, Seattle. An Annual Verification of Laboratory Specific Method Detection Limit (MDL) Study was required under ADEC Waste Management Permit 2011DB0012 but is no longer required under the current ADEC Waste Management Permit 2018DB0001. This information is available in the 2018 Annual Monitoring Report or upon request.

### 2.1 SUMMARY

A summary of the 2019 monitoring results shows:

### **APDES Permit:**

Outfall 011: Pogo reported no exceedances at Outfall 011 during the year. Refer to Section 2.2.1 for more detail.
<b>Outfall 001:</b> Pogo reported no exceedances at Outfall 001. All WAD cyanide analytical results for Outfall 001 during the year were less than 10 ug/L. Refer to <b>Section 2.2.2</b> for more detail.
<b>Outfall 002:</b> Pogo reported no exceedances at Outfall 002 during the year. Refer to <b>Section 2.2.3</b> for more detail.
<b>Surface Water:</b> No adverse trends were observed for the year. Refer to <b>Section 2.3</b> for more detail.
<b>Whole Effluent Toxicity:</b> WET testing took place in June. Chronic bioassays were conducted by two laboratories concurrently. All final test results were within the permit limits. Refer to <b>Section 2.3.2</b> for more detail.
<b>Fish Tissue:</b> Annual fish tissue sampling was completed in September. No adverse trends were observed. Refer to <b>Section 2.3.3</b> for more detail.

# **Waste Management Permit:**

# **Ground Water**

■ 2011 Series Wells: Two wells are located below the Drystack Tailings Facility: MW11-001A and MW11-001B. The wells monitor groundwater downstream of the DSTF and upstream of the Recycled Tailings Pond (RTP). MW11-001A was



dry for all four quarters of 2019. Nitrates and TDS remain above ADEC WQS in MW11-001B. Refer to **Section 2.4.1** for more detail.

- 500 Series Wells: Three wells are located below the RTP Dam: MW12-500, MW12-501, and MW12-502. The wells monitor groundwater downstream of the RTP seepage collection well (SCW) system. Chloride, nitrate, and sodium levels were detected above trigger limits, but below WQS. Sodium has an increasing trend over the sampling period 2014-2019. Refer to Section 2.4.3.1 for more detail.
- □ 2018 Series Wells: To support a corrective action investigation associated with the seepage collection wells, four new wells were placed along Leise Creek: MW18-001, MW18-002, MW18-003A, and MW18-003B. The 2018 Series wells were installed in late October 2018 and are sampled quarterly, with the exception of MW18-001 which is sampled monthly. Chloride, nitrate, and sodium are above the trigger limits in MW18-001 and MW18-002. MW18-003A and MW18-003B were installed as a nested pair of wells at the end of Liese Valley. Copper and manganese were above WQS in MW18-003A, and iron and manganese were above WQS in MW18-003B. Refer to Section 2.4.3.2 for wells MW18-001 and MW18-002, and to Section 2.4.4.2 for wells MW18-003A and MW18-003B.
- 200 Series Wells: Two wells, MW04-213 and MW11-216, are located downgradient of the ore body to monitor groundwater quality. No adverse trends were observed; however, MW04-213 was dry during all 2019 sampling events. These wells are sampled semi-annually. Refer to Section 2.4.4.1 for more detail.
- □ LL Series Wells: LL04-031 and LL04-032 are located downgradient of the ORTW to monitor groundwater between the ORTW and Goodpaster River. Samples were collected during the 2nd quarter. The wells are sampled annually. No adverse trends were observed. Refer to Section 2.4.5 for more detail.
- **2012 Series Wells:** To support hydrogeological studies, two wells are located adjacent to the Pogo Airstrip, MW12-001A and MW12-001B. No adverse trends were observed. Refer to **Section 2.4.6** for more detail.

### **Process Control**

□ PC001: PC001 monitors CIP tails prior to use in paste backfill. All samples are



within limits and conditions set forth within the permit. Refer to **Section 2.5.3** for more detail.

- □ PC002 and PC003 Solids: PC002 samples monitor mineralized waste rock that is placed within the DSTF. PC003 Solids samples monitor floatation tailings that are placed within the DSTF. No adverse trends were observed. Refer to Sections 2.5.4 and 2.5.5 for more detail.
- □ PC003 Liquid: PC003 Liquid samples monitor interstitial water pressed from the flotation tailings prior to placement within the DSTF. Mercury remains elevated, and an internal investigation is underway. Refer to Section 2.5.6 for more detail. A discussion of the results for each sampling program is provided below. Time series graphs of analytes for each monitoring location are provided in Appendix C.

# 2.2 TREATED EFFLUENT MONITORING

ADEC APDES AK0053341 (8/1/17), Appendix A, 3.0

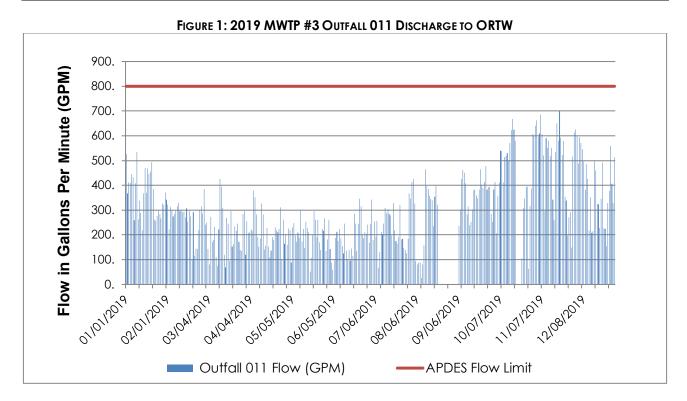
Treated effluent data are submitted to ADEC monthly via the Discharge Monitoring Reports (DMRs) under the APDES Permit. The monitoring locations for treated effluent are shown on **Figure 2 in Appendix A**, as Outfall 011, 001, and 002.

### 2.2.1 Outfall 011 – Treated Effluent from Mine Water Treatment Plant

ADEC APDES AK0053341 (8/1/17), 1.4

Groundwater and drill water collected from the underground workings are sent to MWTP#3 (located near the 1525 portal). The treated effluent is returned for use underground, sent to the mill to be used as process water, or discharged to the ORTW. Surface runoff and groundwater are collected in the RTP. RTP water and mine water are sent to MWTP#3, treated, and then discharged to the ORTW, or directed to the mill through the RTP head tank for use as process water. Treated effluent was discharged to the ORTW throughout the year at an average of 285.7 gpm. The volume of water discharged from Outfall 011 during 2019 is shown below in **Figure 1.** 





Continuous pH data is collected at Outfall 011 along with weekly laboratory samples of Weak-Acid Dissociable (WAD) cyanide and quarterly laboratory samples for metals (arsenic, cadmium, copper, iron, lead, manganese, mercury, selenium, zinc), total suspended solids (TSS), hardness, and sulfate. All results are within the limits and conditions set forth in the permit. Outfall 011 has two continuous pH meters; pH readings taken during the year show compliance with permit limits. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.

# 2.2.2 Outfall 001 – Discharge from Off River Treatment Works

ADEC APDES AK0053341 (8/1/17), 1.3

Treated effluent from MWTP#3 is sent to the ORTW. After mixing in the ORTW, water flows over the weir of Pond 2 (Outfall 001) into the Goodpaster River at an average of 12,435 gpm throughout 2019. The sampling location is at the weir. **Figure 2** presents the gallons per minute flow from Outfall 001 for 2019.



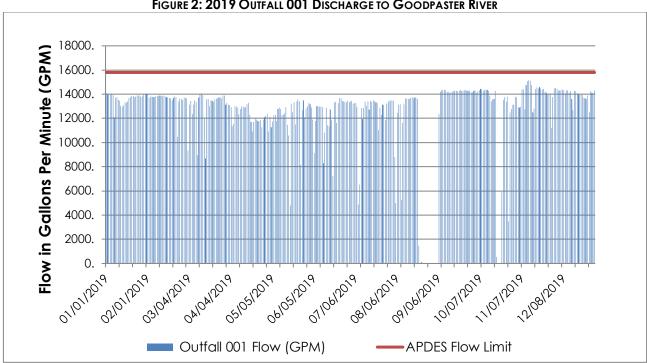


FIGURE 2: 2019 OUTFALL 001 DISCHARGE TO GOODPASTER RIVER

Continuous turbidity data and twice-daily pH readings are collected along with weekly laboratory samples for copper, lead, manganese, WAD cyanide, pH, and temperature at Outfall 001. Monthly samples required by the permit include cadmium, mercury, zinc, hardness and lab turbidity. All WAD cyanide analytical results for Outfall 001 during the quarter were less than 10 ug/L. None of the analytical results for WAD cyanide fell between the facility specific method limit (ML) of <20 ug/L and the facility specific method detection limit (MDL) of <10 ug/L.

All other results are within the limits and conditions set forth within the permit. Time series graphs are provided in Appendix C. Monitoring data is provided in Appendix E.

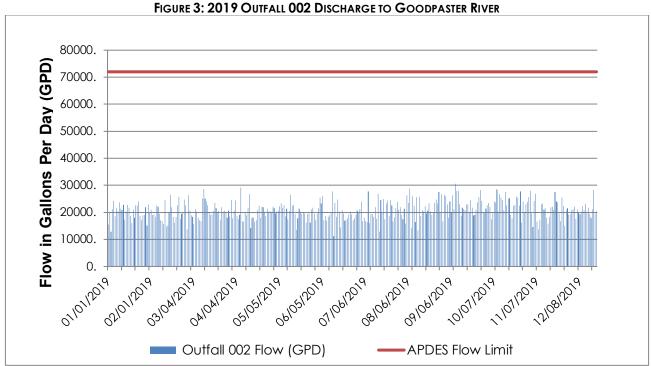
# 2.2.3 Outfall 002 – Treated Effluent from Sewage Treatment Plant

ADEC APDES AK0053341 (8/1/17), 1.5

The STP operated throughout the year with flows ranging between 11,187 and 30,572 gallons per day. The average flow at Outfall 002 for 2019 was 20,821 gallons per day. Daily field parameters were collected to assess quality of treated effluent. Monthly samples were also collected for metals (arsenic, cadmium, copper, lead, manganese, mercury, and zinc), biological oxygen demand (BOD<sub>5</sub>), total



suspended solids (TSS), fecal coliform, and nitrate/nitrite. **Figure 3** presents the gallons per day flow from Outfall 002 for 2019.



Influent data from STP002 were collected for BOD<sub>5</sub> and TSS on a quarterly basis to determine percent removal. All results were within the limits and conditions set forth within the permit. Time series graphs are provided in **Appendix C**. Monitoring data

# 2.3 SURFACE WATER MONITORING

# 2.3.1 Goodpaster River

is provided in **Appendix E.** 

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.6.2; ADEC APDES AK0053341 (8/1/17), 1.8; Pogo Mine Monitoring Plan (7/18) 6.0

Six surface water stations are monitored to evaluate water quality along the Goodpaster River: SW01 and SW49 are located upstream of the Pogo Mine, SW41 is located downstream of Outfall 001, SW42 is downstream of Outfall 002, and SW15 and SW12 are located downstream from all Pogo facilities. Surface water samples are analyzed six times a year for total metals (antimony, arsenic, cadmium, copper,



iron, lead, manganese, mercury, nickel, selenium, silver, and zinc) and WAD cyanide. Physical and aggregate properties of alkalinity, conductivity, hardness, nitrite plus nitrate, pH, total dissolved solids (TDS), turbidity, and temperature are also measured.

Surface water samples were collected on March 3<sup>rd</sup>, May 13<sup>th</sup>, June 24<sup>th</sup>, August 20<sup>th</sup>, September 27<sup>th</sup>, and December 18<sup>th</sup>. All results were within the limits and conditions. No other adverse trends were observed. The locations of the surface water monitoring stations are shown in **Appendix A**, **Figure 2**. Time series graphs are provided in **Appendix C**. Results of the fish tissue sampling are provided in the **Section 2.3.3**. Monitoring and historic data is provided in **Appendix E**.

# 2.3.2 Whole Effluent Toxicity

ADEC APDES Permit AK0053341 (8/1/17), 1.7

The annual WET test was conducted June 24 through June 28, 2019 by TRE Environmental Strategies in Fort Collins, Colorado. A split of the same sample was also sent to Test America in Corvallis, Oregon. Results from both laboratories are presented in **Table 1**. All results were within the limits and conditions set forth within the permit. Laboratory reports are provided in **Appendix D**.

Laboratory	Species	No Observed Effect Concentration (%)	Low Observed Effect Concentration (%)	Inhibition Concentration 25%	Toxicity Units Chronic	Was Toxicity Demonstrated TUc value > 2.0
TRE	Pimephales promelas	100	>100	>100	<1	No
TEST AMERICA	Pimephales promelas	50	>100	>100	<1	No

### 2.3.3 Fish Tissue

ADEC APDES Permit AK0053341 (8/1/17), 1.8.8

In order to assess long term trends in Goodpaster River quality, annual whole-body analyses of juvenile Chinook Salmon are required at monitoring sites both upstream (SW01) and downstream (SW12) from the project facilities. Juvenile Chinook salmon were collected from these two stations on September 27, 2019. Metals analysis was conducted on individual Chinook and a composite sample of fish for each location.



Traps were set in slimy sculpin habitat, but because only one was caught, it was released, and the analysis was only conducted on Chinook. As required by **Fish Resource Permit SF2019-233**, a report of collection activities and a data submission form was submitted to ADF&G on January 12, 2020.

All results are consistent with historical data. Time series graphs are provided in **Appendix C**. Monitoring and historic data are provided in **Appendix E**.

# 2.4 GROUNDWATER QUALITY MONITORING

Groundwater samples are analyzed for WAD cyanide, major cations and anions, total metals, dissolved metals, physical and aggregate properties of ammonia, conductivity, hardness, nitrates, pH, TDS, TSS, and temperature. The locations of the groundwater monitoring stations are shown in **Appendix A**, **Figure 2**.

# 2.4.1 Downgradient of DSTF

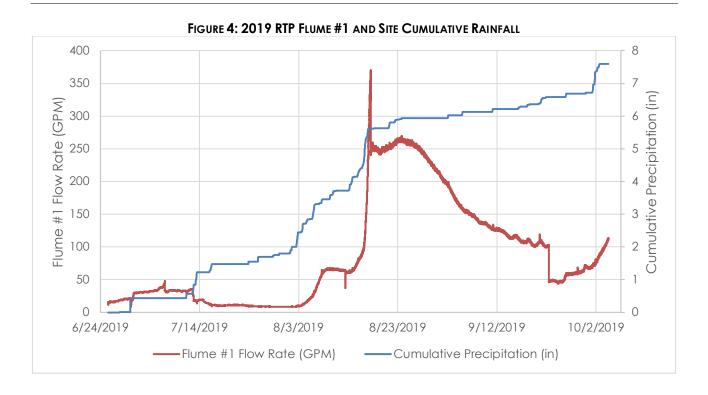
ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.1.4, 1.2.6, 1.2.7, 1.5.4; Pogo Mine Monitoring Plan (7/18), 7.0

MW11-001A and MW11-001B provide information on water quality trends downgradient from the DSTF and up-gradient of the RTP. MW11-001A is an alluvial well and MW11-001B is a bedrock well. Samples were collected from MW11-001B on March 17, May 25, and July 24, 2019. Attempted sampling of MW11-001B occurred on October 4, 2019 and again on December 29, 2019 after replacement of cracked tubing, but the sample was unable to be collected due to equipment failure. MW11-001A was dry for all four quarters of 2019 and no samples were collected. MW11-001A and MW11-001B are located within a process facility, therefore nitrate and TDS concentrations above the WQS are under observation. WQS are shown on the graphs for reference purposes only. No other adverse trends were observed. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.

# 2.4.2 Liese Creek Flumes

Four flumes were installed in Liese Creek in 2012. **Figure 4** provides flow data for Flume #1 (near the toe of the DSTF) versus precipitation rate in 2019.





# 2.4.3 Downgradient of RTP Dam

# 2.4.3.1 MW12-500, 501, 502 WELLS

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.1.4, 1.2.6, 1.2.7, 1.5.4; Pogo Mine Monitoring Plan (7/18), 7.0

Three wells located below the RTP Dam, MW12-500, MW12-501, and MW12-502, monitor groundwater downstream of the RTP seepage collection system. Samples were collected quarterly throughout 2019 (when there was available water). Trigger limits for groundwater monitoring at these locations are set forth in Pogo's ADEC Waste Management Permit 2018DB0001.

Four sampling events occurred in 2019 for MW12-500, MW12-501, and MW12-502. Chloride, nitrate, and sodium levels are detected above the trigger limits, but below WQS in these wells. Sodium concentrations have an increasing trend over the sampling period of 2014-2019. Dam containment of the RTP water is under evaluation as part of a current corrective action investigation with ADEC. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.



### 2.4.3.2 MW18-001 AND MW18-002

Two wells located below the RTP Dam near Liese Creek Flumes #2 and #3, MW18-001 and MW18-002, monitor groundwater downstream of the RTP seepage collection system. Samples were collected monthly for MW18-001 and quarterly for MW18-002. Well placement was designed to monitor changes in water quality parameters through the Liese Creek Valley and help identify SCW bypass flow.

MW18-001 (near Flume #2) indicates arsenic, copper, and nitrate above WQS. Arsenic and nitrate have remained above WQS since the well was established in October 2018. Chloride, nitrate, and sodium are above the trigger limits set forth in Pogo's ADEC Waste Management Permit 2018DB0001.

MW18-002 (near Flume #3) indicates nitrate above WQS and chloride, nitrate, and sodium above the trigger limits. Nitrates increased to 14.6 mg/L in October to above WQS after a decrease in Q3 to 3.29 mg/L. Dam containment of the RTP water is under evaluation as part of a current corrective action investigation with ADEC.

Except as noted above, all results are within the limits and conditions set forth within the permit. Time series graphs are provided for the MW18 series wells in **Appendix C**. Monitoring data is provided in **Appendix E**.

# 2.4.4 Downgradient of Ore Zone

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.1.4, 1.2.6, 1.2.7, 1.5.4; Pogo Mine Monitoring Plan (7/18), 7.0

### 2.4.4.1 MW04-213 AND MW11-216

Monitoring wells MW04-213 and MW11-216 provide information on water quality trends down-gradient from the ore zones. Samples are collected semi-annually at MW04-213 and MW11-216. MW04-213 was dry on April 20 and September 14, 2019 when sampling was attempted, and no sample was collected during this reporting period. Elevated arsenic levels have been reported in MW04-213 since 2012 and were above WQS in October 2018 when the well was last sampled. On October 1, MW18-003B replaced MW04-213 and is sampled quarterly. MW11-216 was sampled on March 17, and September 15, 2019. All results are below ground water quality limits at MW11-216. Piezometer well MW99-216 collects data continuously, and is verified quarterly for water elevation.



### 2.4.4.2 MW18-003A AND MW18-003B

MW18-003A and MW18-003B were installed in 2018 to further evaluate groundwater downstream of the seepage collection well system. These wells may also provide information on water quality trends down gradient from the ore zones.

MW18-003A is located near the end of Liese Valley below the Liese Bridge. Copper and manganese are above WQS, but manganese has shown a decrease in concentration since March 2019. Copper has been slightly increasing since March 2019. The sample results in March were 1.2 ug/L and 3.9 ug/L in October.

MW18-003B is located next to MW-003A near the bottom of Liese Valley. Results in October 2019 indicate that iron and manganese concentrations are above WQS. Iron showed a slight decrease from 3760 ug/L in August to 2650 ug/L in October. Manganese concentrations have been above WQS since the well was first developed in October 2018. These results, and high hydraulic conductivity indicate a reducing environment is present around the well. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.

# 2.4.5 Downgradient of ORTW

The following information is supplied as part of a previous study and is not required by permit.

Monitoring stations LL04-031 and LL04-032 are sampled annually and provide information on ground water quality trends between the ORTW and the Goodpaster River. A sample from LL04-031 was collected on June 10, 2019 and from LL04-032 on June 14, 2019.

Data from these locations will continue to be collected but will not be included in future reports. The data will be made available upon request by any state agency. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.



# 2.4.6 Goodpaster River Area

The following information is supplied as part of a previous study and is not required by permit.

MW12-001A and MW12-001B were established to support a hydrogeologic study initiated in 2012. Samples were collected on March 3, April 8, and December 1, 2019 at both wells. A sample was also taken on July 29, 2019 at MW12-001A, but not at MW12-001B due to an equipment issue. No adverse trends were observed.

Data from these locations will continue to be collected but will not be included in future reports. The data will be made available upon request by any state agency. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.

# 2.5 PROCESS CONTROL MONITORING

Process facilities are monitored as described below.

### 2.5.1 Water Balance

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.5.2.4; Pogo Plan of Operations (6/18), 8.0; Water Rights LAS 24616

At the beginning of 2019, the RTP reservoir volume was observed at 13.0 million gallons. At the end of 2019, the RTP volume was recorded at 8.8 million gallons.

# Water Added to RTP

- 71.7 million gallons of runoff and seepage water was collected in the RTP
- 42.6 million gallons of treated water was recycled to the RTP distribution system

# Removed from RTP distribution system

- 54.3 million gallons were pumped from the RTP for underground process water
- 53.4 million gallons were pumped from the RTP to the mill process
- 7.0 million gallons were pumped from the RTP to MWTP#3

# Recycled Treated Water

- 30.4 million gallons were recycled at the Mill
- 42.5 million gallons were recycled to the RTP distribution system



# Discharge to ORTW

• 149.7 million gallons were treated and discharged to the ORTW

# 2.5.2 Permits to Appropriate Water and Temporary Water Use Permit Summary

Pogo utilizes the following ADNR Permits to Appropriate Water: LAS 32225, 32229, 24613, 24611, 24612; and ADNR Temporary Water Use Authorization TWUP F2011-131, F2016-104, F2016-109, Condition 14. A summary of water usage for Permits to Appropriate Water and Temporary Water Use Permits is provided in **Table 2** and **Table 3**.

Table 2: Permits to Appropriate Water 2019 Monthly Total Flows

Month	LAS 32225 Surface Water Collected in Recycle Tailings Pond (RTP)	LAS 32229 Groundwater from Underground Mine Discharged to ORTW and Recycled Underground	LAS 24613 Goodpaster River ORTW Influent	LAS 24611 Drinking Water Wells DW02 & DW03	LAS 24612 Gravel Pit Pond*
	(gallons)	(gallons)	(gallons)	(gallons)	(gallons)
January	2,423,877	21,849,645	594,011,028	757,637	0
February	837,782	20,257,334	538,827,992	636,080	0
March	1,562,574	20,127,307	572,452,467	692,409	0
April	1,385,652	20,258,144	524,287,631	644,873	0
May	3,283,706	18,953,531	528,132,647	678,133	733,160
June	2,963,903	18,870,394	525,077,155	639,186	1,593,080
July	3,779,439	20,080,874	550,719,944	693,361	605,270
August	14,907,327	15,541,548	362,885,307	672,442	683,494
September	11,585,675	19,117,764	502,932,604	716,092	0
October	11,947,286	23,629,527	497,970,729	723,266	0
November	6,248,022	25,026,320	581,585,823	668,349	0
December	8,531,531	36,310,190	608,275,997	667,290	0
Total (gallons)	69,456,773	260,022,578	6,387,159,325	8,189,118	3,615,004
Total in Acre-ft	213.15	797.97	19,601.29	25.13	11.09
Permit Limit Acre-ft	580.68	1,604.81	24,195.11	81.77	241.95

<sup>\*</sup>includes water used for Mill make-up and for road dust control



Table 3: Temporary Water Use Permits 2019 Monthly Total Flows

Month	TWUP F2011-131 RTP Seepage Collection System Wells	TWUP F2016-104 Rosa Creek, Caribou Creek, Gilles Creek, Shaw Creek	TWUP F2016-109 Diversion Ditches	TWUP F2013-023 Underground Water Recycle
	(gallons)	(gallons)	(acre-feet)	(gallons)
January	3,313,162	0		21,849,645
February	2,236,621	0		20,257,334
March	1,932,115	0		20,127,307
April	1,709,090	0		20,258,144
May	1,488,432	778,500		18,953,531
June	1,340,769	562,500	Annual	18,870,394
July	1,806,654	531,000	Calculated Amount	20,080,874
August	2,183,607	94,500		15,541,548
September	2,246,519	72,000		19,117,764
October	3,082,597	0		23,629,527
November	3,055,092	0		25,026,320
December	2,929,227	0		36,310,190
Total Gallons	27,323,884	2,038,500	297,487,001	260,022,578
Total Acre-feet	84	6	913	798
Permit Limit	1,945,000,000 gals	48,180,000 acre-ft	1460 acre-ft	1613.3 acre-ft

# 2.5.3 Carbon-In-Pulp (CIP) Tailings Cyanide Destruction

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.2.3, 1.5.2.3; Pogo Mine Monitoring Plan (7/18), 5.2

After cyanide destruction, the CIP tailings are stored in the CIP tank prior to being mixed with cement and used as backfill in the mine. Pogo's Mine Monitoring Plan requires grab samples at station PC001 (CIP Stock Tank), which is located directly after the cyanide destruction circuit. Pogo collects a daily sample during each paste pour. The Waste Management Permit 2018DB0001 requires that samples contain less than 10 mg/kg of WAD cyanide as a monthly average and none of the samples can contain more than 20 mg/kg of WAD cyanide. During 2019, all PC001 sample results were below 10 mg/kg of WAD cyanide. Time series graphs are provided in **Appendix C**. Monitoring data is provided in **Appendix E**.



# 2.5.4 Mineralized Development Rock Geochemistry

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.2.1, 1.5.2.6; Pogo Mine Monitoring Plan (7/18) 5.0, Appendix C

Samples of whole rock materials placed in the DSTF (PC002) are collected monthly and composited to form a quarterly sample for analysis. Arsenic was elevated during the first quarter at 1984 mg/kg in contrast to the other three quarters which had arsenic levels of 930, 412, and 314 mg/kg. The composite sample showed no adverse trends. **Appendix B**, **Table 1**, shows selected parameters for PC002 whole rock monitoring. Monitoring data is provided in **Appendix E**.

# 2.5.5 Flotation Tailings Geochemistry

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.5.4; Pogo Mine Monitoring Plan (7/18) 5.0

Flotation tailings geochemistry solid samples were collected on March 10, June 15, September 15, and December 1, 2019 at PC003, the underflow of the filter-feed tank at the end of the mill circuit, prior to disposal on the DSTF. No adverse trends were observed. **Appendix B, Table 2**, shows selected parameters for the PC003 Solid, flotation tailings samples. Monitoring and historic data are provided in **Appendix E**.

# 2.5.6 Flotation Tailings Interstitial Water Chemistry

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.5.4; Pogo Mine Monitoring Plan (7/18) 5.0

The interstitial water from the tailings samples was collected at PC003 on March 10, June 15, September 15, October 20, November 25, and December 1, 2019. Due to an elevated WAD cyanide concentration above the Target Operating Range in September, samples were taken monthly for the fourth quarter. WAD cyanide concentrations for October, November, and December were all below the Target Operating Range, suggesting potential sample equipment contamination from other sampling events. Mercury concentrations remain elevated above the Target Operating Range, presented in Table 5.4 of the Pogo Mine Monitoring Plan, and an



internal investigation is underway to determine the cause. Time series graphs are provided in **Appendix C**. Monitoring and historic data are provided in **Appendix E**.

# 2.6 VISUAL MONITORING

# 2.6.1 Facility Inspection

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.5.2.1, 1.5.9.3, 1.5.9.4; Pogo Mine Monitoring Plan (7/18) 3.0, 3.1; Pogo RTP Operating and Maintenance Manual (7/18), 3.0

Weekly visual inspections of the DSTF, RTP Dam, and monitoring wells were completed throughout the year. No cracking, bulging, settlement, geotechnical concerns, erosion or damage was observed. The Fifth Period Safety Inspection (PSI) of the Recycle Tailings Pond (RTP) Dam occurred from July 9-11, 2019. Based on the 2019 PSI findings, the RTP Dam is considered to be in "satisfactory condition", as defined by the National Inventory of Dams (NID) Data Dictionary.

# 2.6.2 Biological Survey

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.5.2.5; Pogo Mine Monitoring Plan (7/18) 3.4

The objective of the visual biological survey program is to monitor wildlife interaction with the surface waste disposal facilities. On May 21, 2019, a dead cow moose with scratch marks was discovered in the South Diversion Ditch above the DSTF. This was reported in the 2019 Second Quarter Monitoring Report.

# 2.6.3 Invasive Weed Control

An invasive weed study was not performed on-site in 2019. Observations from previous years can be found in the 2018 Annual Monitoring Report.



# 2.7 DEVELOPMENT ROCK SEGREGATION AND STORAGE

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.2.1, 1.5.2.6; Pogo Mine Monitoring Plan (7/18), 5.1.1, Appendix C

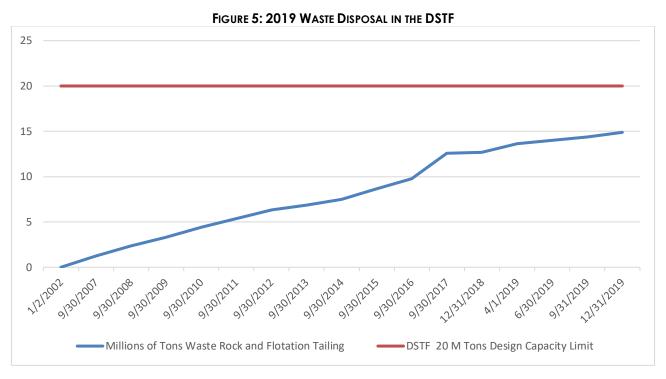
During 2019, 2036 rounds were blasted underground and sampled; 262 rounds (12.9%) of the rounds exceeded either the arsenic threshold of 600 mg/l or the sulfide threshold of 0.5% and these were encapsulated in the DSTF. A total of 940 were not sampled due to operational challenges; all were placed internally in the DSTF. Approximately 834 rounds (41.0%) of non-mineralized development rock was used to build drains, shells, line the edge of the DSTF. This material was also used as road surfacing and backfill material.

# 2.8 WASTE DISPOSAL

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.2.1, 1.4.4

During 2019, 970,396 dry tons of flotation tailings, 292,275 tons of mineralized rock, and 254,983 tons of non-mineralized rock, were placed in the DSTF. Approximately, 75,353 dry tons of flotation tails and 145,535 dry tons of CIP tailing were placed underground as paste backfill in 2019. Site survey using a WingtraOne drone on April 1, 2019 indicated 13.6 M tons of material were contained in the DSTF, representing 68% of the 20 M ton design capacity. Based on truck load counts, a total of 14.9 M tons was placed in the DSTF through 2019, filling 74% of the available capacity. Approximately 5.1 M tons of capacity remains. **Figure 5** presents the approximate total waste disposal within the DSTF and indicates remaining design capacity.





The approximate quantities of miscellaneous waste materials placed either into the DSTF or underground during the year are shown in **Table 4**.

Table 4: Miscellaneous Waste Disposal in DSTF and Underground in 2019

Material	Disposal Location	Approximate Quantity	Unit
Water Treatment Plant 3 Filter Cake Sludge	DSTF	1620	tons
Hay bales	DSTF	600	lbs
Conveyor belt	DSTF	1200	ft
CB02 Belt	DSTF	4192	lbs
Assay Lab XRF Wafers	DSTF	41.1	lbs

# 2.9 GEOTECHNICAL MONITORING

ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.4.3, 1.4.3.4; Pogo Mine Plan of Operations (6/18) Appendix F: Pogo DSTF Construction and Maintenance Plan (7/18)

Shell construction took place on Shell 1 of the DSTF during the quarter. Geotechnical monitoring occurred on July 8 and July 9, 2019. Tailings in the general placement area were tested by onsite staff within 24 hours of compaction using a Humboldt Electrical Density Gauge. The dry density and standard proctor both met the compaction requirements. Piezometers on the DSTF were downloaded at quarterly



intervals and data was reviewed.

A geotechnical investigation was performed on the DSTF, with field operations conducted on-site between October 16 and 29. The investigation included the following:

- 7 standard penetration test (SPT) borings
- Cone penetration test (CPT) soundings
- Field testing on tailings samples for visual classification of fine-grained soils, approximate unconfined compressive strength, and field total density
- 2 piezometer installations
- Laboratory tests on select samples for index testing (grain size distribution, moisture content, and Atterberg Limits), strength testing (triaxial compression testing), and compaction testing
- Geotechnical analysis and report

Findings from the geotechnical report included recommendations to monitor moisture content, which appeared elevated in comparison to the 2012 geotechnical investigation and perched water conditions. The report confirmed that static liquefaction of the DSTF tailings is not likely a concern. NSR plans to update the DSTF Construction and Maintenance Plan in 2020 with recommendations from the 2019 geotechnical investigation. Additional geotechnical investigations are planned for 2020 in preparation for potential future expansion of the DSTF.

# 2.10 SPILL REPORTING

ADEC APDES AK0053341 (8/1/17), Appendix A, 1.14; ADEC Waste Management Permit 2018DB0001 (5/24/2018), 1.4.10

During 2019, there were a total of 227 reportable spills reported. Refer to **Figure 6**, 2019 Pogo Spill Reporting.





# 3. AS-BUILT REPORTS AND MAPS

The Pogo Mine Site 2019 as-built maps are presented in **Appendix A. Figure 2** provides an overview of all facilities within the Pogo Millsite lease boundary at the end of 2019. **Figures 3a** through **3d** provide additional detail for the major areas of the mine.

# 4. RECLAMATION AND FINANCIAL RESPONSIBILITY

ADEC Waste Management Permit 2018DB0001 (5/24/18), 1.11, 3. ADNR Plan of Operations Approval F20189500 (5/24/2018), pg. 3, 9; ADNR Pogo Mine Millsite Lease ADL416949 (3/9/04), Section 8

The Pogo Mine reclamation and closure bond including the road/transmission line is currently \$71.91 million (refer to **Table 5**). The road/transmission line reclamation and closure cost estimate is currently at \$7.08 million (**Table 6**).

In 2016, SRK consulting was contracted to convert the current bond to a Standardized Reclamation Cost Estimator (SRCE) model for the renewal of the previous ADEC Waste Management Permit 2011DB0012 and ADNR Plan of Operations Approval F20129500. The SRCE model was submitted with the renewal applications in 2018 with no changes made.



Table 5: Summary of Mine Reclamation and Closure Cost Estimates as of 2017

Summary of Estimated Reclamation and Closure Costs		
Item Description		
Earthwork/Recontouring		
Subtotal	8,526,670	
Revegetation/Stabilization		
Subtotal	3,694,623	
Detoxification/Water Treatment/Disposal of Wastewater		
Subtotal	5,669,769	
Structure, Equipment and Facility Removal		
Subtotal	10,402,219	
Monitoring		
Subtotal	2,369,650	
Construction Management and Support		
Subtotal	1,093,448	
Closure Planning		
Subtotal	16,663,398	
Subtotal Operational and Maintenance Costs		
Subtotal	48,419,777	
Indirect Costs		
Subtotal	18,161,463	
Total Direct and Indirect	66,581,240	
Inflation Proofing	5,326,499	
Grand Total	71,907,739	

Table 6: Summary of Pogo Access Road/Transmission Line Reclamation and Closure Cost Estimates as of 2017

Summary of Estimated Right of Way Closure Cost	'S
Item Description	
Earthwork/Recontouring	
Subtotal	646,544
Revegetation/Stabilization	
Subtotal	1,554,352
Detoxification/Water Treatment/Disposal of Wastewater	
Subtotal	0
Structure, Equipment and Facility Removal	
Subtotal	1,451,958
Monitoring	
Subtotal	0
Construction Management and Support	
Subtotal	400,440
Closure Planning	
Subtotal	726,229



Subtotal Operational and Maintenance Costs	
Subtotal	4,779,523
Indirect Costs	
Subtotal	1,784,132
Total Direct and Indirect	6,563,655
Inflation Proofing	525,092
Grand Total	7,088,747

# 4.1 REVEGETATION STUDY

The purpose of this study was to fulfill the requirements set forth in the Pogo Mine Plan of Operations Approval (F20189500) Project-Specific Stipulations under the Pogo Reclamation and Closure Plan Stipulation 3 (page 9). The 3-year program of revegetation test trials, based on the outline described in the Pogo Mine Reclamation and Closure Plan, was established to determine the best, most cost-effective, use of material and resources to achieve the stated reclamation goals. This study was presented in the 2018 Annual Monitoring Report.

# 5. PERMIT ACTIVITIES

# 5.1 2019 PERMIT ACTIVITIES

During 2019 many permits and activities were conducted. Major permitting activities completed in 2019 are included below.

- **Minor Modification:** Pogo submitted a Minor Modification to the Plan of Operations for reagent changes in the Mine Water Treatment Plan 3 reactor tanks on January 22, 2019. The request was approved on January 23, 2019.
- Minor Modification: Pogo submitted a Minor Modification to the Plan of Operations for Pogo Mine Food Waste Storage on April 8, 2019. The request was approved by the Division of Mining, Land, and Water (DMLW) on April 12, 2019.
- Addition of Claims to Upland Mining Lease: Pogo requested the addition of claims to Upland Mining Lease ADL 674057 on April 24, 2019. Pogo received the approved Upland Mining Lease on September 20, 2019.
- Toxic Release Inventory (TRI) Report: Pogo submitted the report under the Emergency Planning and Community Right to Know Act on June 21, 2019.



- Nationwide Permit #44 Preconstruction Notification: On July 6, 2019, Pogo submitted a Preconstruction Notification Application to the US Army Corps of Engineers to expand the laydown area around the 1875 portal.
- Certificate of Approval to Operate a Dam: Pogo submitted the RTP Dam EAP Orientation on August 31, 2019 and the Final PSI Report for the RTP Dam on November 11, 2019. The Certificate of Approval to Operate a Dam was issued on November 22, 2019.
- **Minor Modification:** Pogo submitted a Minor Modification to include the STP discharge line in the Plan of Operations on September 12, 2019. The request was approved on October 3, 2019.
- ROW Lease Renewal Submittal: On September 19, 2019, Pogo submitted a lease renewal for ADNR Right-Of-Way of the Pogo Mine Access Road to ADNR. On September 25, 2019 Pogo submitted a lease renewal for Right-Of-Way for the transmission line to ADNR.
- **USACE NWP 18 Exemption:** Pogo received an NWP 18 exemption to disturb wetlands for the D Wing Expansion Project on December 2, 2019.
- **Air Permitting:** Pogo submitted several air reports throughout 2019 for Air Permit No. AQ0406TVP02 and No. AQ0406MSS07.
  - 2018 Annual Report CISWI Unit ID 412: This report was submitted on January 24, 2019.
  - Annual Compliance Certification: This report was submitted on March 1, 2019.
  - Notice of Intent (NOI) and Performance Test Plan Mercury Performance Testing: This report was submitted on June 10, 2019.
  - NESHAP Subpart EEEEEEE, Mercury Performance Testing Results and Annual Compliance Notification: This report was submitted on October 12, 2019.

# 5.2 FUTURE PERMIT ACTIVITIES

The following permit activities are planned for 2020:



- APDES Discharge Permit Minor Modification: Pogo is planning to increase the APDES Individual Discharge Permit limits from 800 gpm to 1,000 gpm. This minor modification is for APDES Permit No. AK0053341.
- Certificate of Approval (COA) to Modify a Dam (NID ID#AK00304): Pogo is
  planning to submit a COA for storage of low-grade ore on the DSTF bench. A
  geotechnical investigation and stability analysis were completed in OctoberNovember of 2019.
- DSTF Expansion Project: Pogo will begin preliminary permitting activities for potential expansion of the DSTF. Appropriate communications and submittals will be completed for the Pogo Mine Waste Management Permit (Permit No. 2018DB0001), dam modifications for NID ID#AK00304, and any other applicable permits.
- Mill Expansion Project: Pogo is currently in the process of expanding its mill.
   Necessary requirements from the following permits will be completed as the project progresses.
  - Waste Management Permit No. 2018DB0001
  - Air Quality Minor Permit No. AQ0406MSS07
  - Air Quality Operating Permit Title V No. AQ0406TVP02
  - o SPCC No. 2047048401
  - o Plan of Operations No. F20189500



# APPENDIX A - MAPS

FIGURE 1: GENERAL LOCATION MAP

FIGURE 2: 2019 POGO MINE MONITORING LOCATIONS

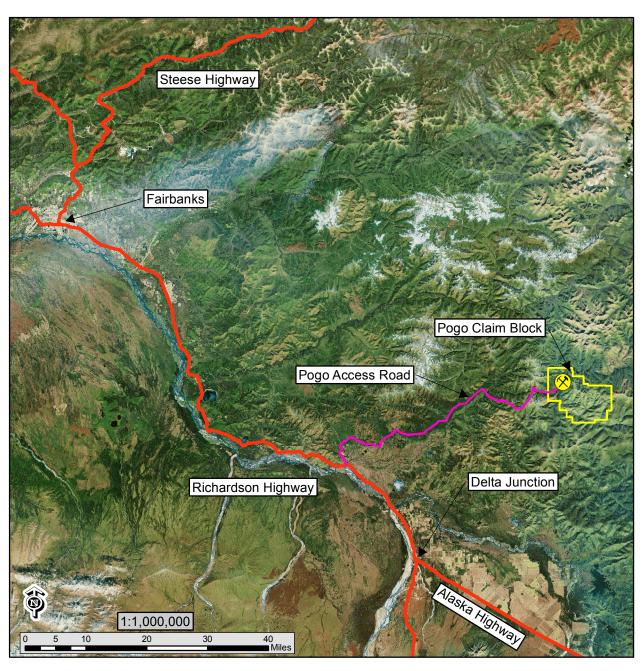
FIGURE 3: POGO MINE AS BUILT

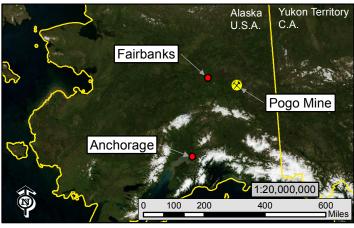
FIGURE 3A: 1525 PORTAL AREA AND LOWER CAMP AS BUILT

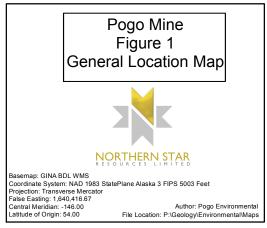
FIGURE 3B: AIRSTRIP AREA AS BUILT

FIGURE 3C: MILL AND PERMANENT CAMP BENCH AS BUILT

FIGURE 3D: RTP & DRY STACK AREA



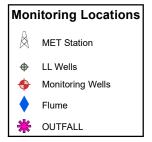






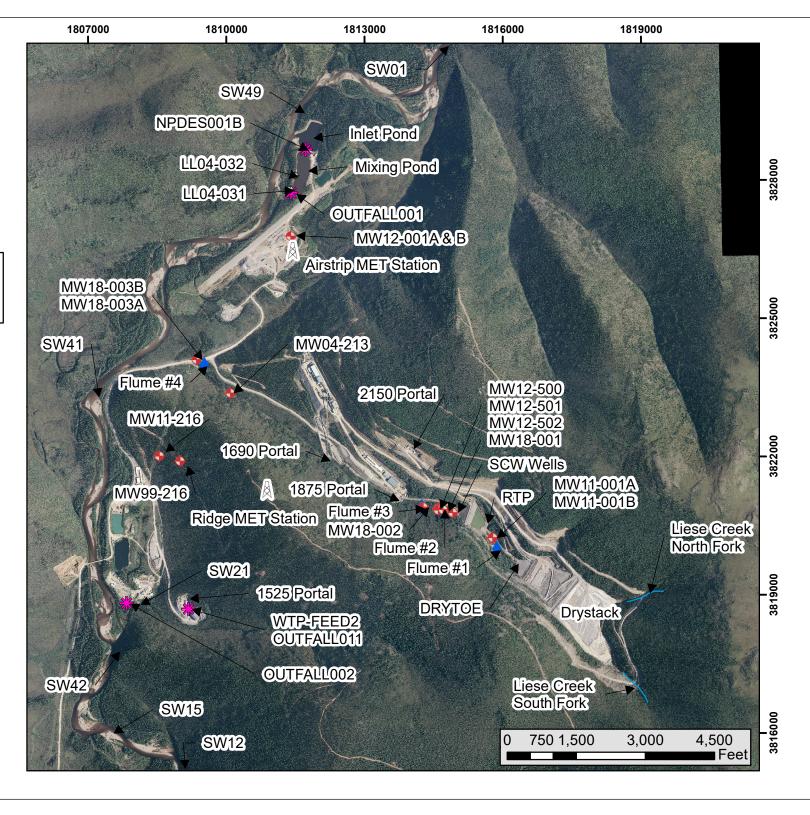
# Figure 2 2019 Monitoring Locations Pogo Mine

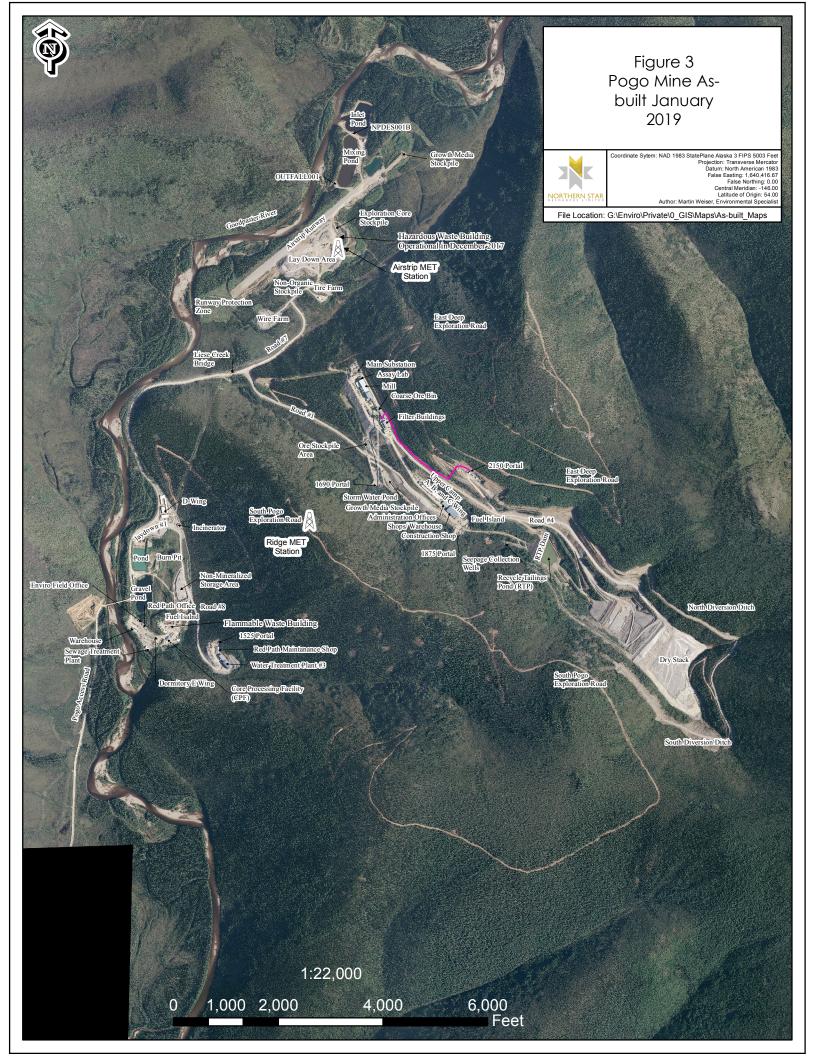
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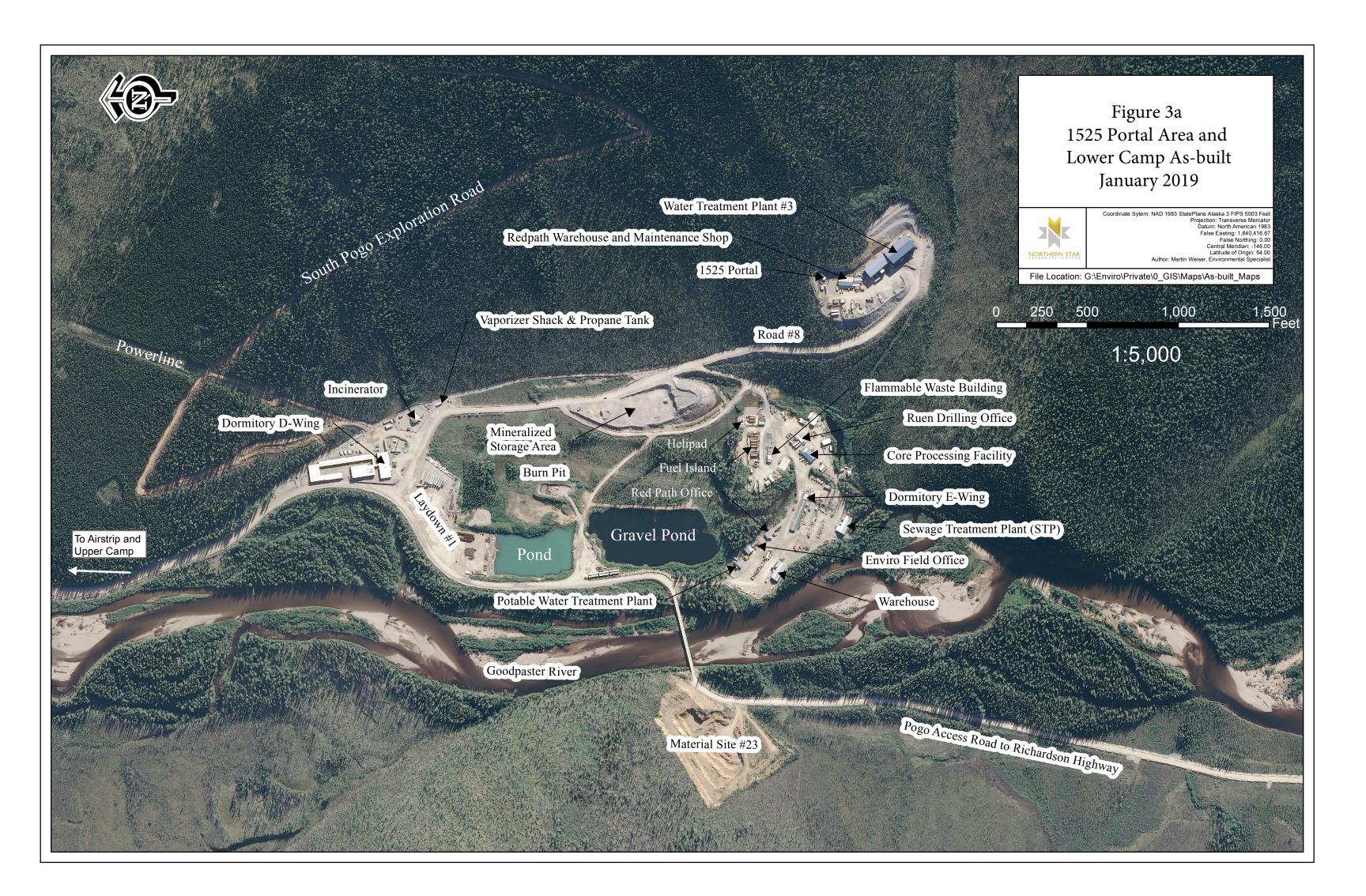


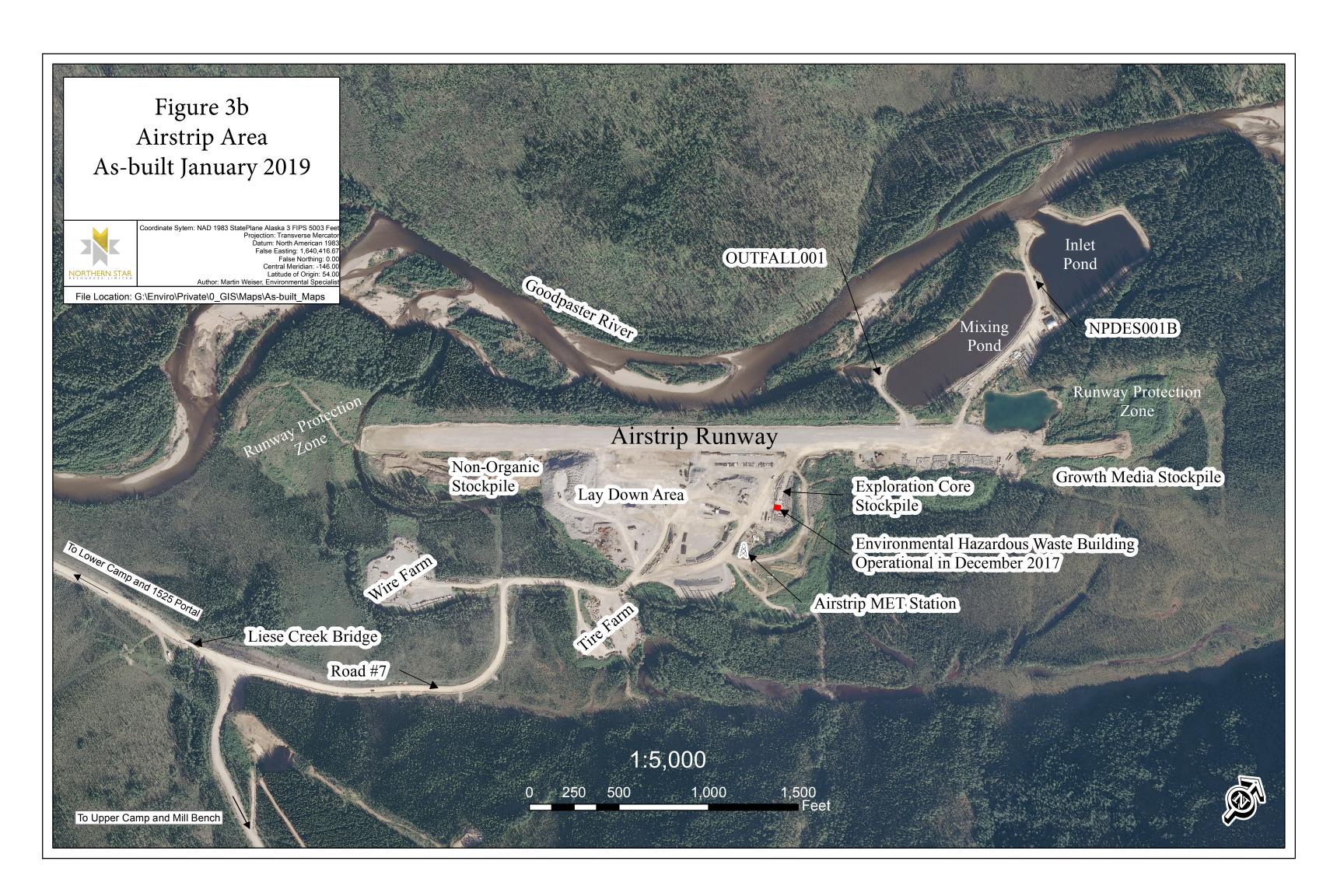
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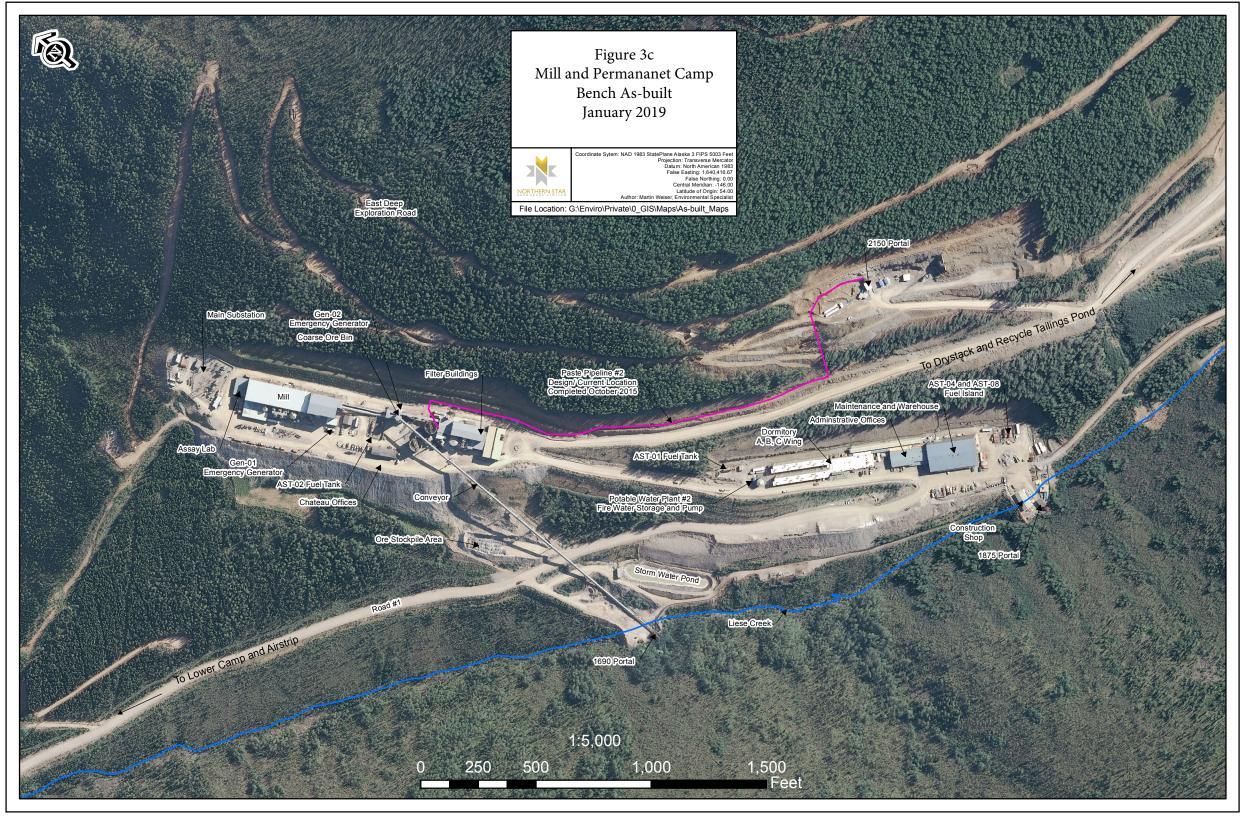


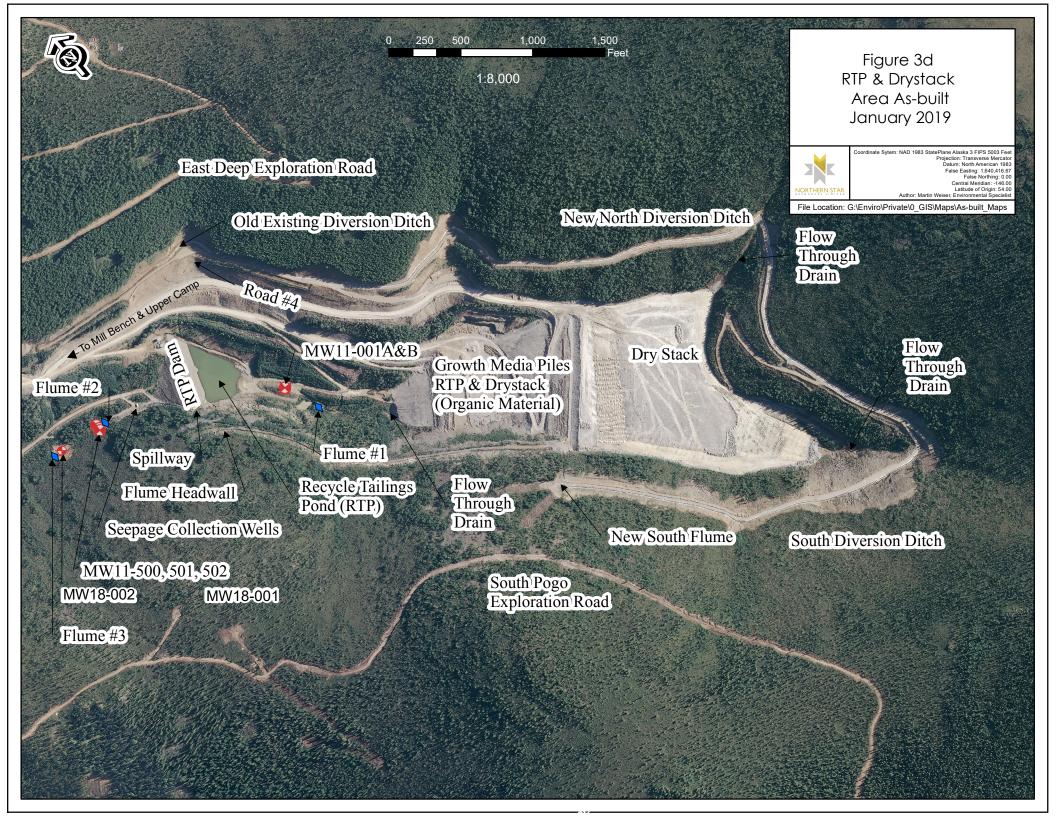














#### APPENDIX B – WASTE ROCK GEOCHEMISTRY AND FLOTATION TAILINGS SOLIDS CHEMISTRY

Appendix B. Table 1. Whole Rock Geochemistry for Rock placed into Drystack 2019

PC002 units	1st Quarter	2nd Quarter		4th Quarter
Antimony, Total mg/kg	1.71	3.57	2.49	1.72
Arsenic, Total mg/kg	1985	930	412	314
Carbon %	0.49	0.91	0.51	0.53
Copper, Total mg/kg	33.6	52	34.4	44.8
Inorganic Carbon %	1.8	3.30	1.9	2.0
Iron, Total mg/kg	36,200	37,800	44,600	40,000
Lead, Total mg/kg	15.8	23.6	13.8	15.3
Maximum Potential Acidity tCaCO3/1000t	13.8	8.1	12.5	15
Net Neutralization Potential tCaCO3/1000t	35	72	47	29
pH, Paste pH units	8.8	8.6	8.5	8.5
Potassium, Total mg/kg	24,700	27,100	19,600	23,800
Ratio (NP/MPA) su	3.56	8.86	3.76	2.93
Selenium, Total mg/kg	1	1	1	1
Sodium, Total mg/kg	14,900	10,000	10,900	10,700
Sulfate Sulfur (CO $_3$ Leach) $\%$	<0.01	<0.01	<0.01	<0.01
Sulfate Sulfur (HCL Leach) %	0.04	<0.01	0.01	0.06
Sulfide Sulfur (Calculated) %	0.44	0.26	0.4	0.48
Sulfur, Total (LECO) %	0.44	0.26	0.4	0.48
Zinc, Total mg/kg	50	61	50	87

Appendix B. Table 2. Geochemistry of Flotation Tailings Solids placed into Drystack 2019

PC003 Solid units	1st Quarter	2nd Quarter	3rd Quarter	
Antimony, Total mg/kg	1.73	2.11	2.91	1.47
Arsenic, Total mg/kg	517	321	1240	644
Carbon %	0.44	0.53	0.57	0.58
Copper, Total mg/kg	46.5	35.1	89.7	51.1
Inorganic Carbon %	1.8	1.90	2.1	2.1
lron, Total mg/kg	25,700	25,500	32,900	30,000
Lead, Total mg/kg	11.1	10.2	16.9	11.8
Maximum Potential Acidity tCaCO3/1000t	3.4	2.8	8.1	4.7
Net Neutralization Potential tCaCO3/1000t	34	40	45	40
pH, Paste pH units	8.3	8.4	8.2	8.3
Potassium, Total mg/kg	22,700	23,000	23,700	23,800
Ratio (NP/MPA) su	10.76	15.29	6.52	9.60
Selenium, Total mg/kg	1	1	1	1
Sodium, Total mg/kg	7,700	4,600	9,000	6,100
Sulfate Sulfur (CO <sub>3</sub> Leach) %	0.02	<0.01	0.04	<0.01
Sulfate Sulfur (HCL Leach) %	0.02	<0.01	0.03	0.02
Sulfide Sulfur (Calculated) %	0.09	0.09	0.22	0.15
Sulfur, Total (LECO) %	0.11	0.09	0.26	0.15
Zinc, Total mg/kg	25	21	50	25

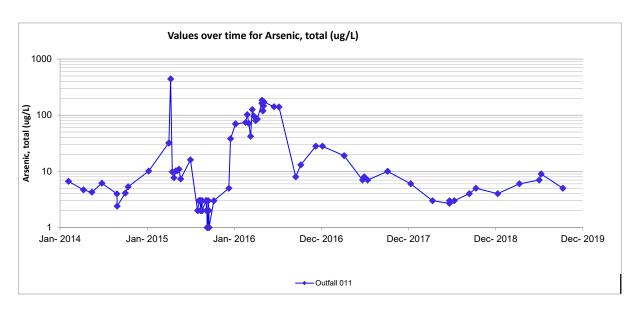
Note: 2018 PC002 and PC003 Solids Data can be found in the 2018 Pogo Annual Activity and Monitoring Report.

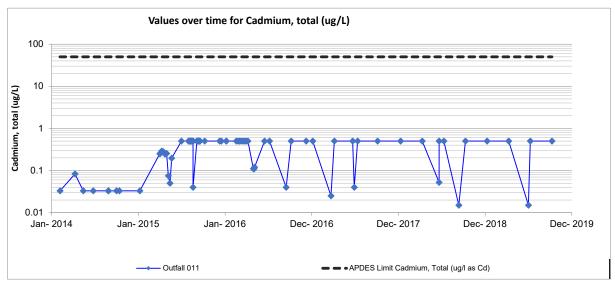


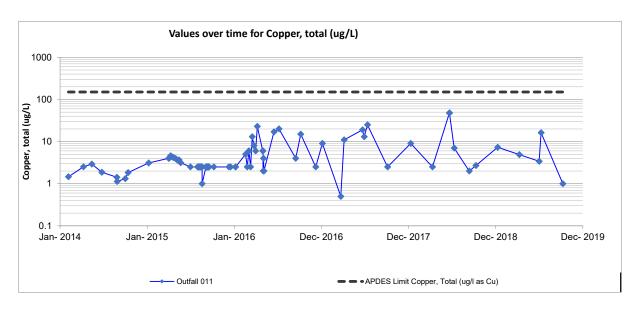
#### APPENDIX C – TIME SERIES GRAPHS OF MONITORING DATA

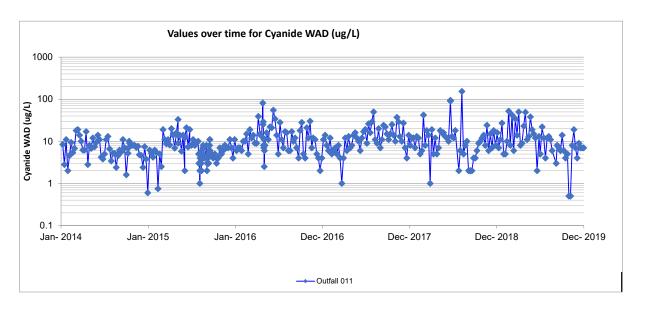


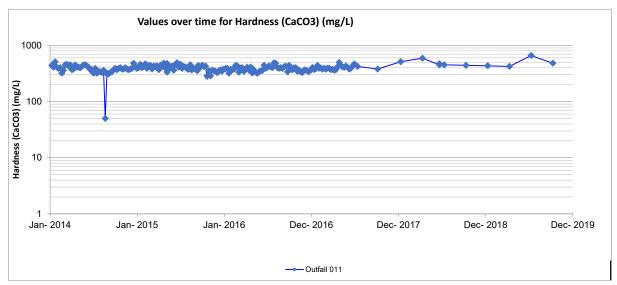
## APPENDIX C – Outfall011 Graphs

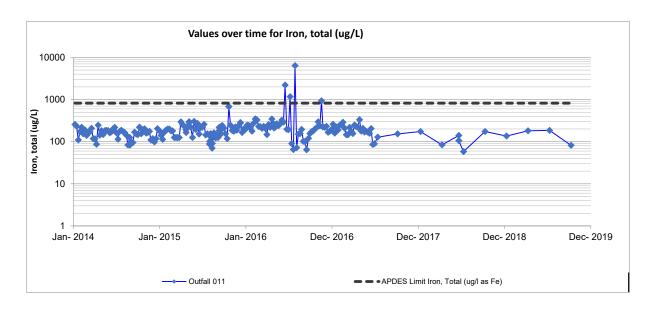


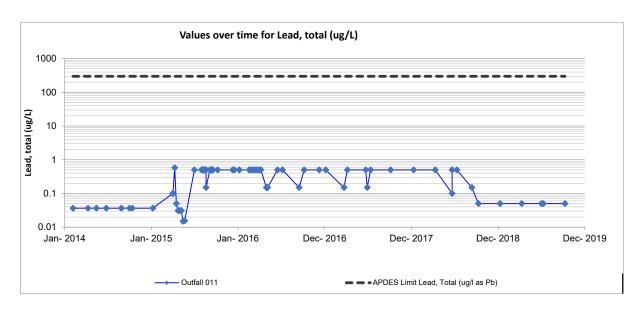


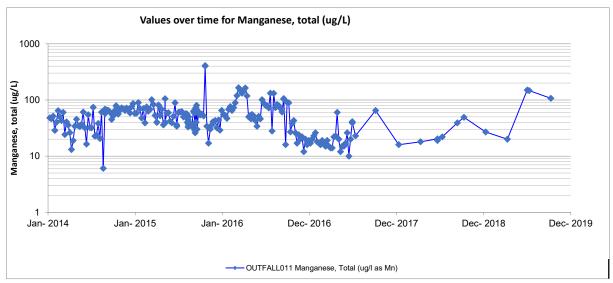


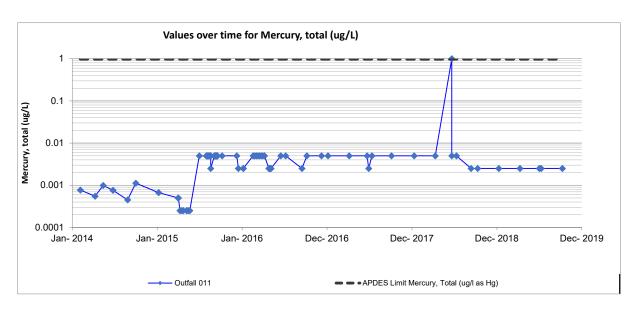


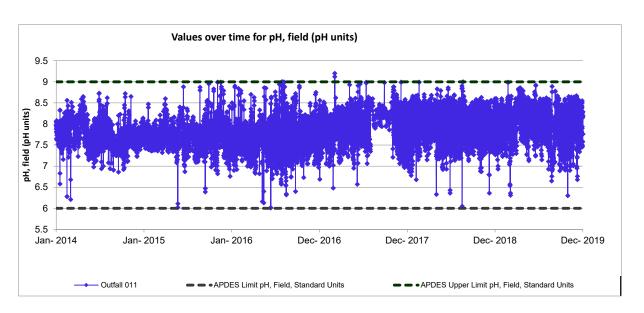


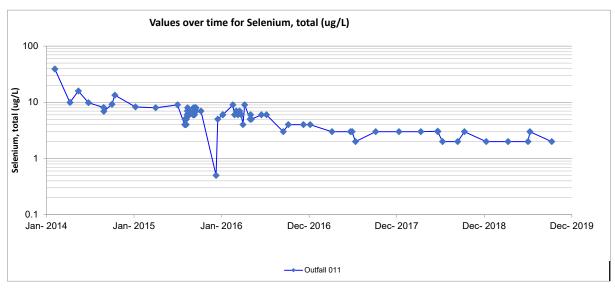


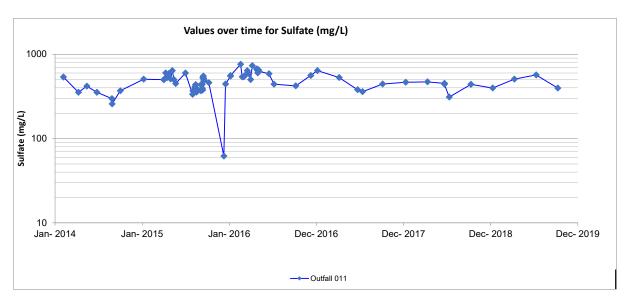


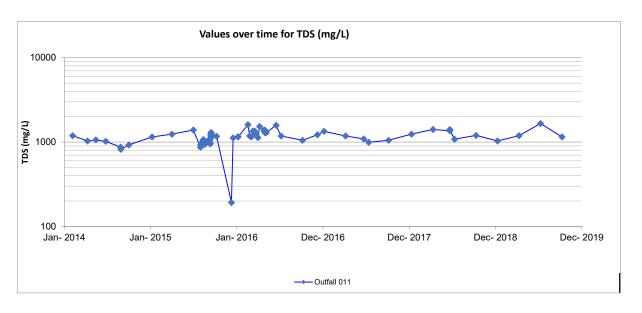


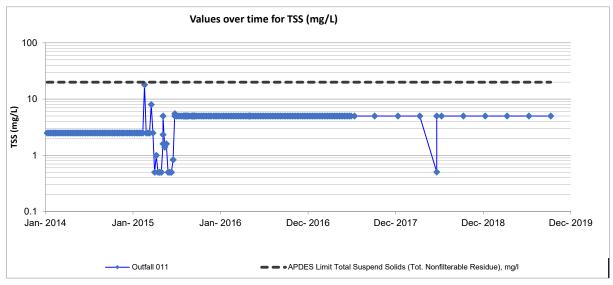


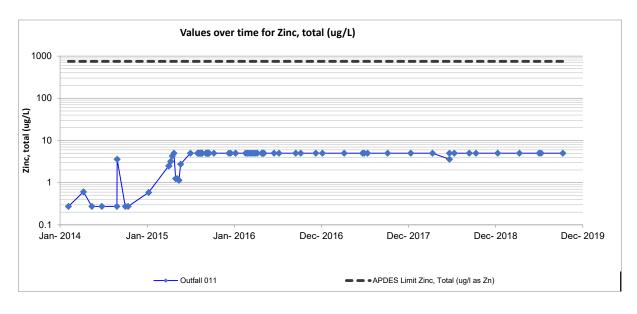






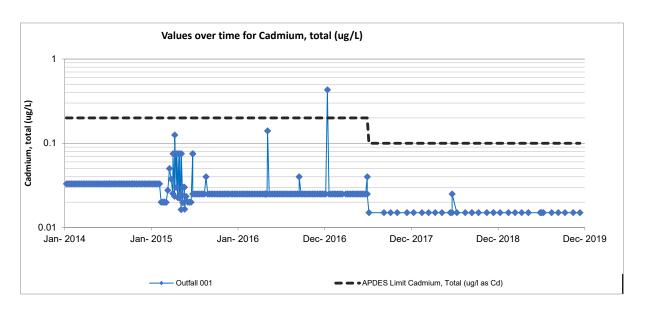


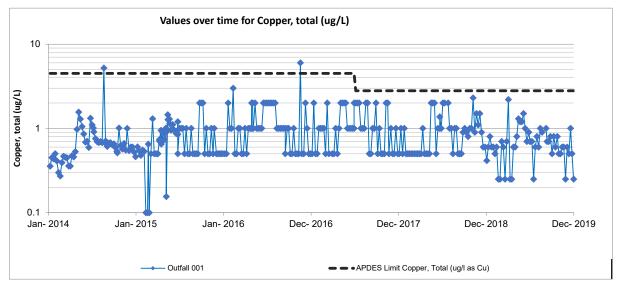


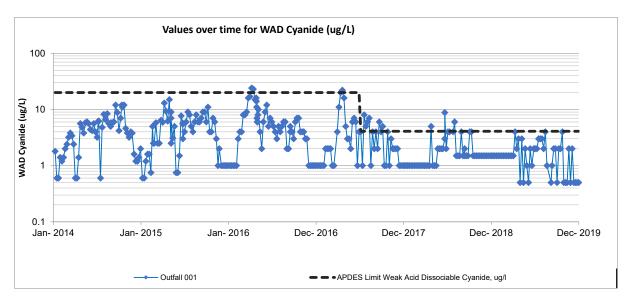


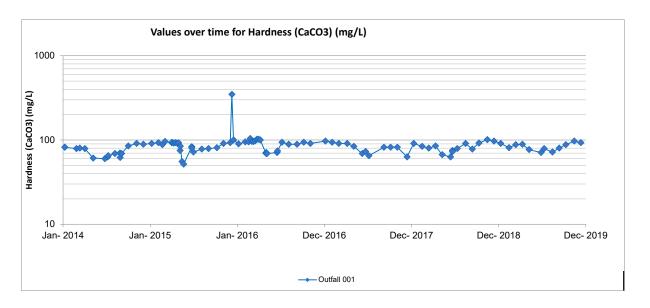


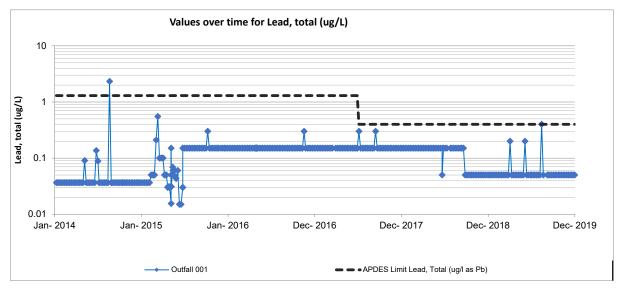
# APPENDIX C – Outfall 001 Graphs

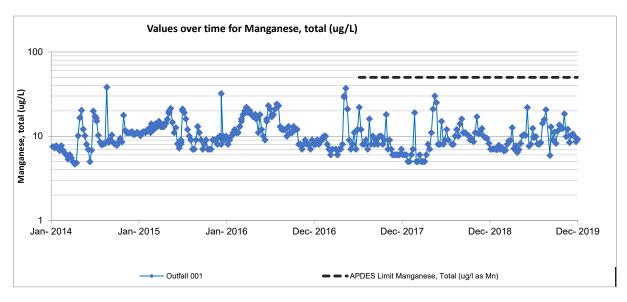


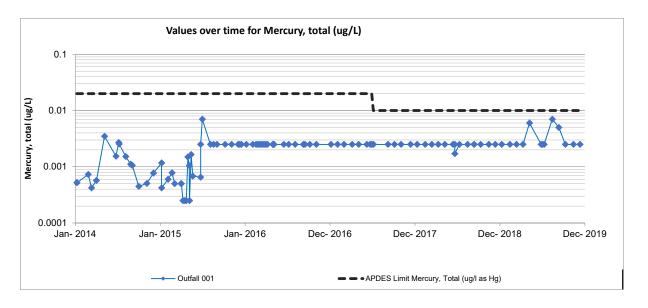


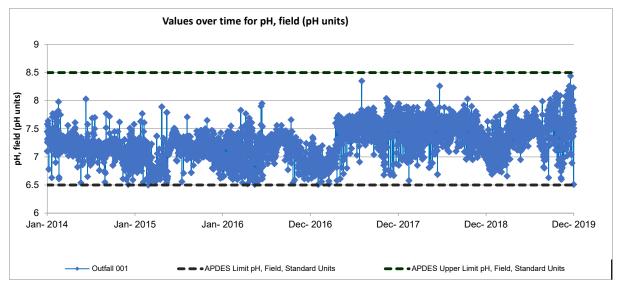


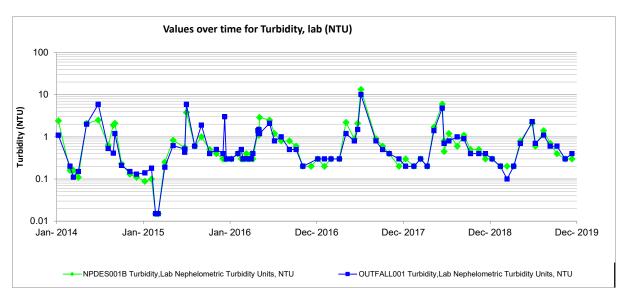


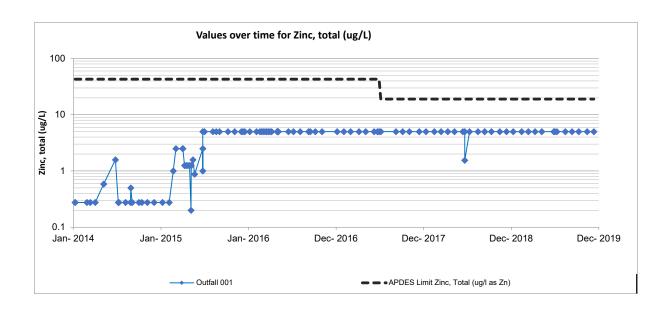






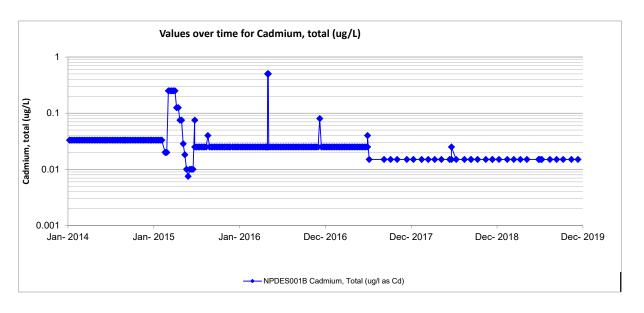


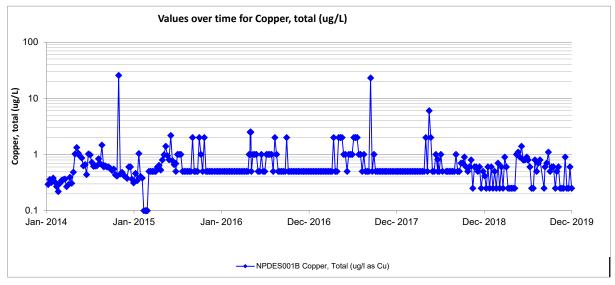


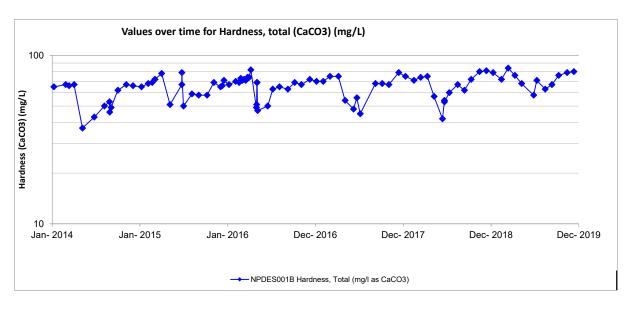


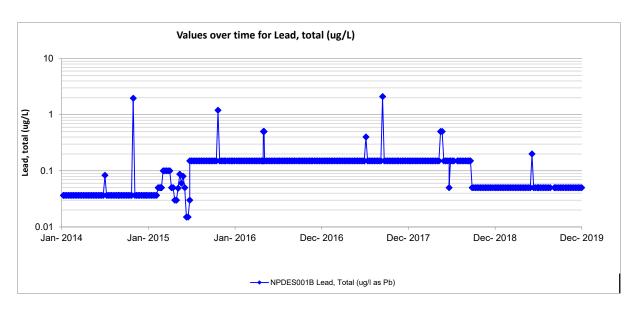


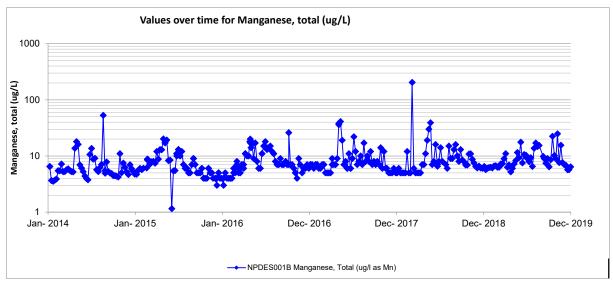
## APPENDIX C – NPDES001B Graphs

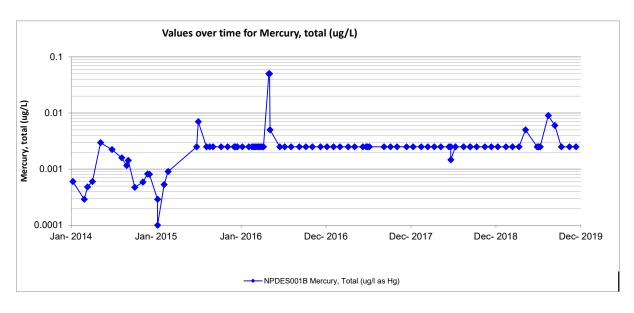


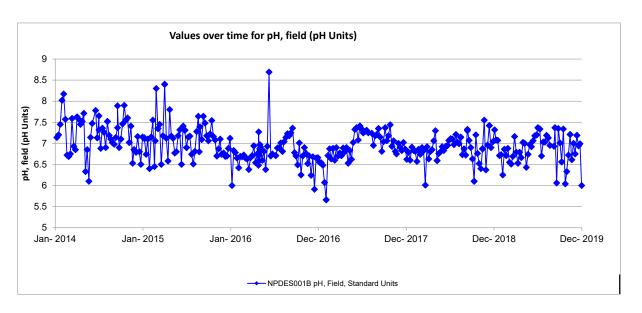


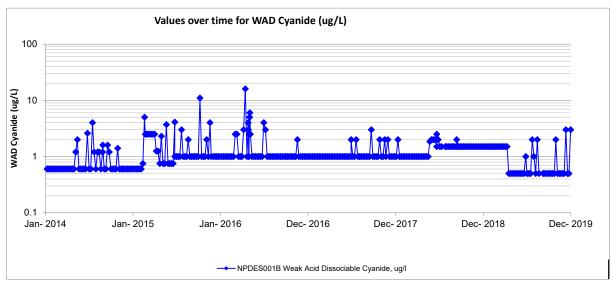


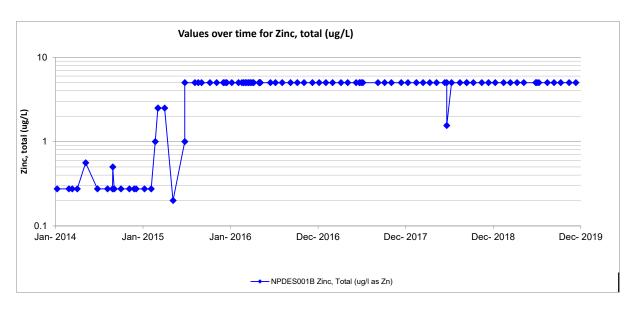






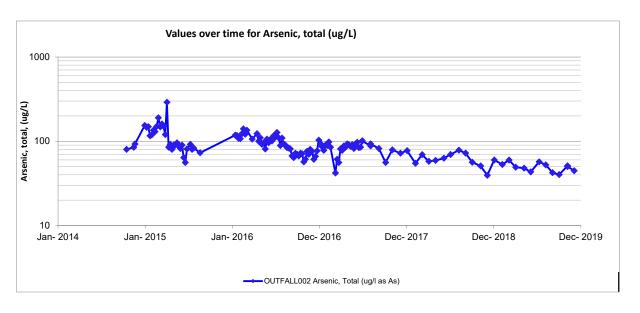


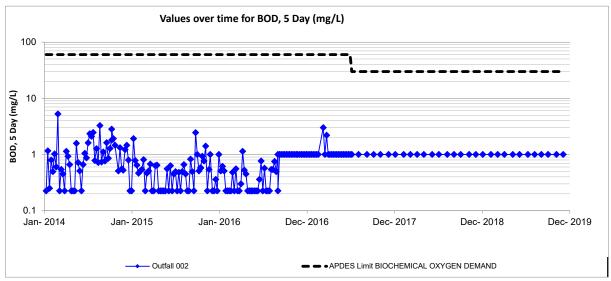


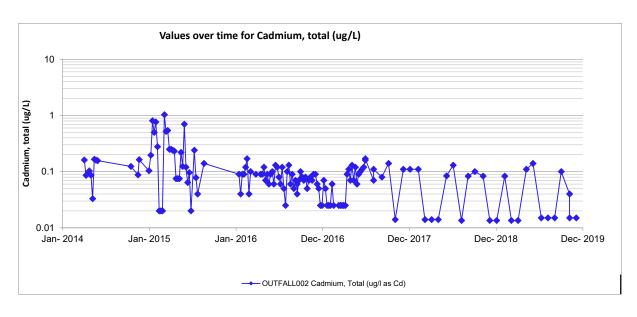


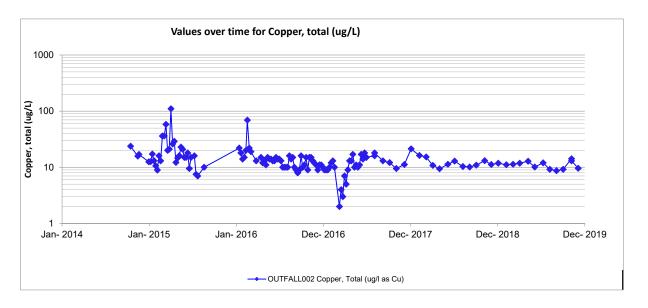


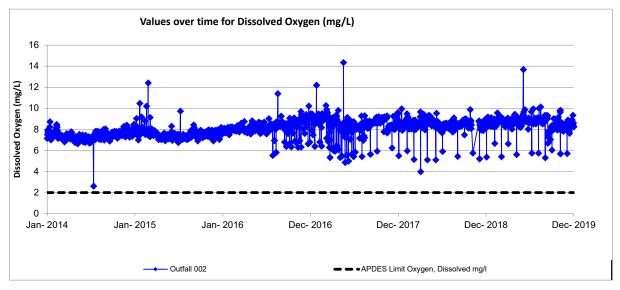
## APPENDIX C – Outfal002 Graphs

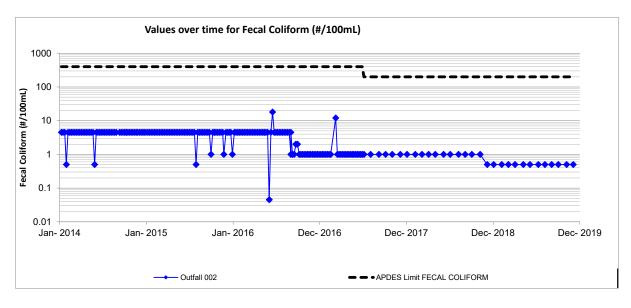


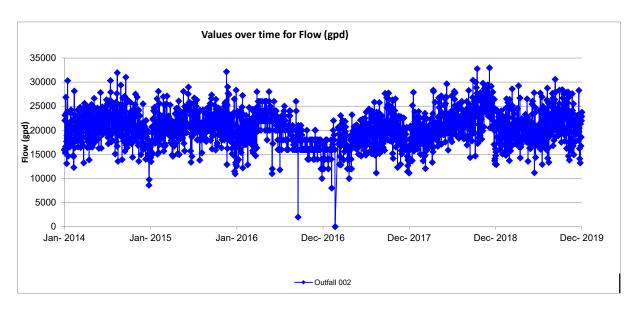


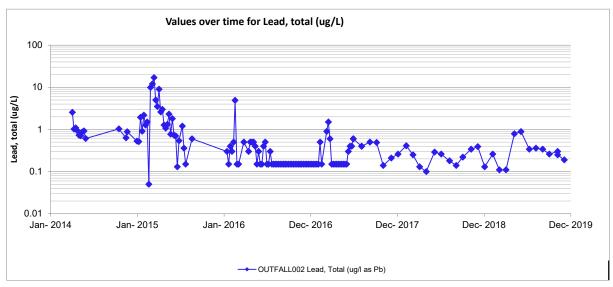


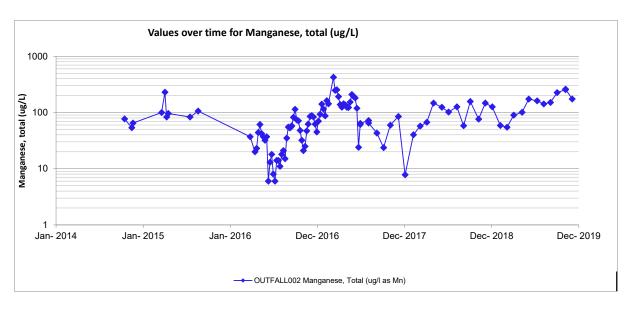


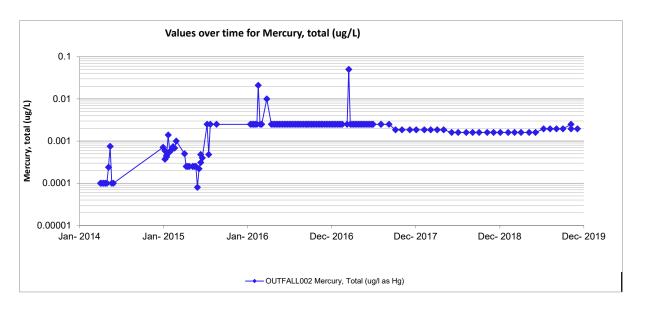


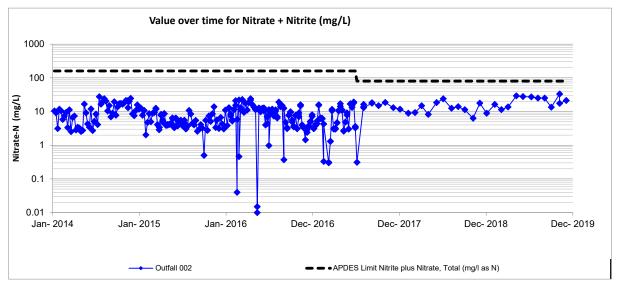


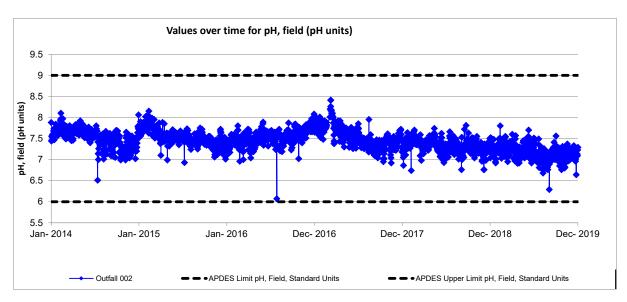


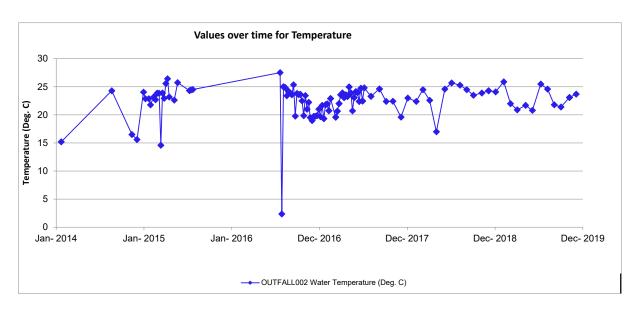


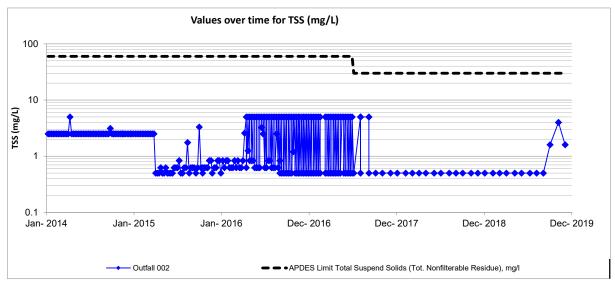


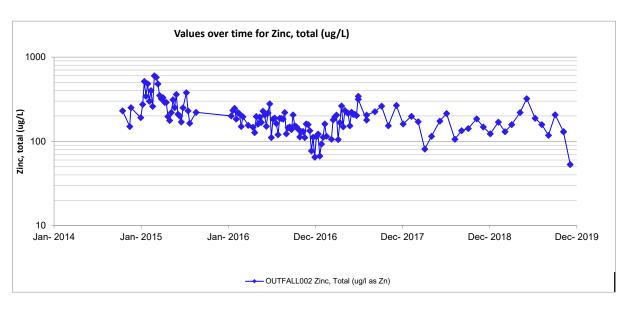






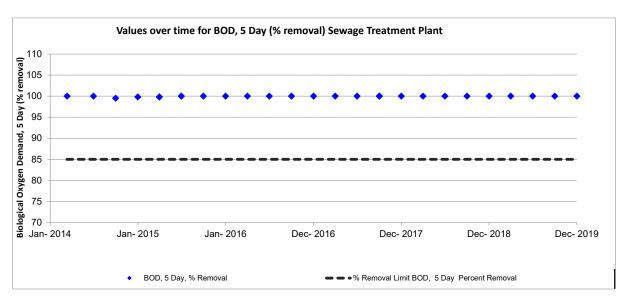


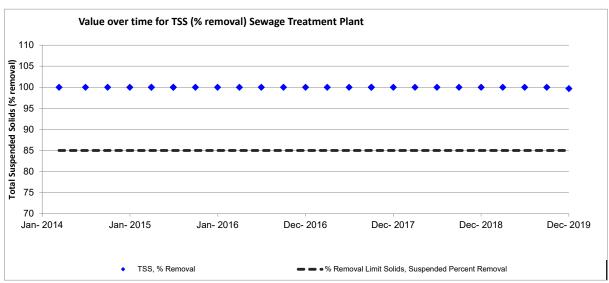






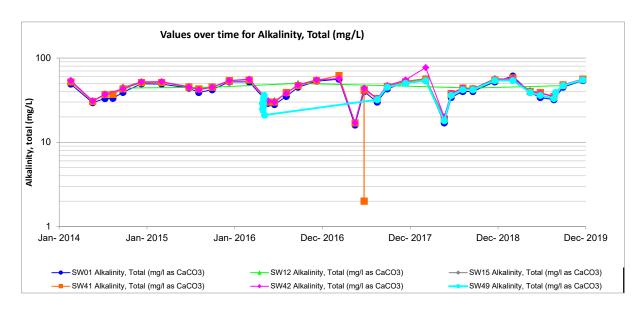
## APPENDIX C – STP Graphs

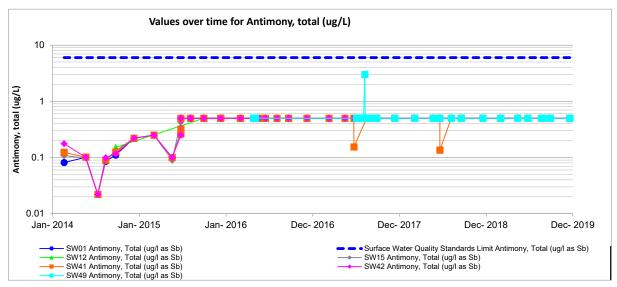


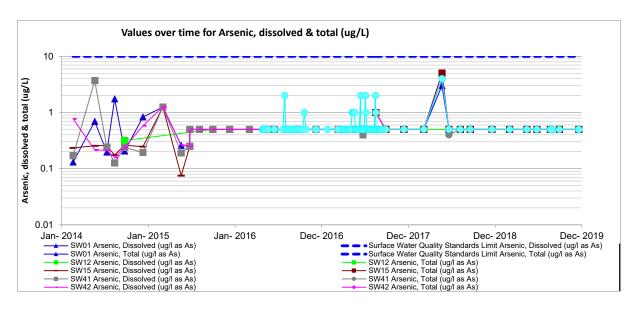


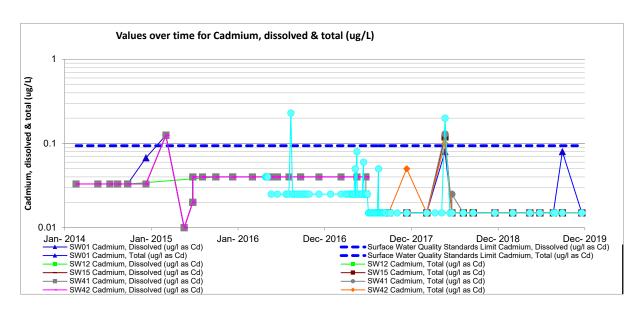


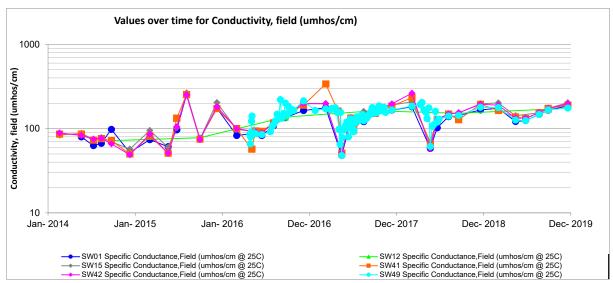
# APPENDIX C – Surface Water Graphs

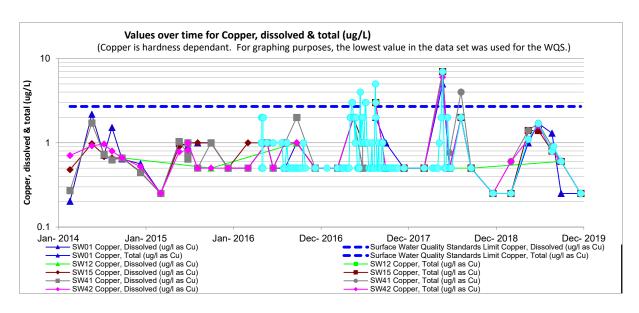


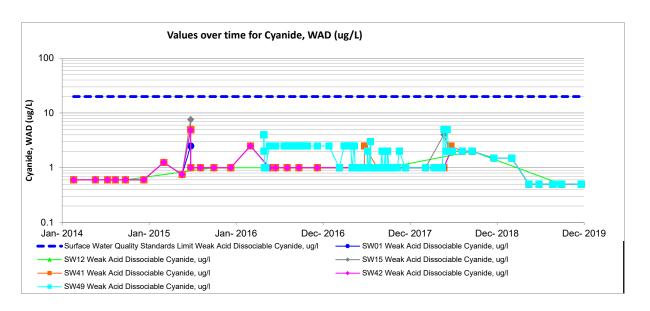


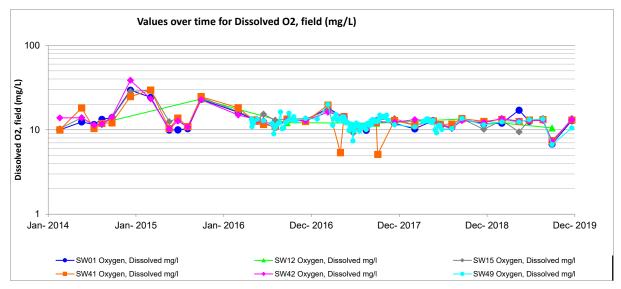


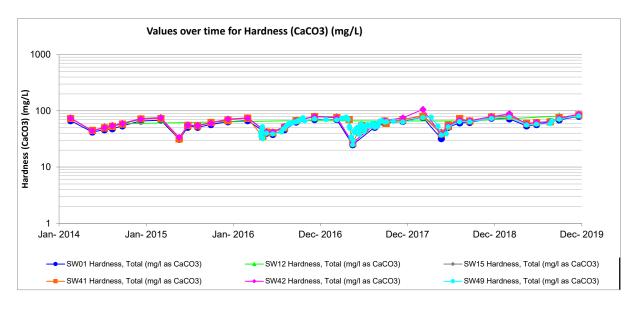


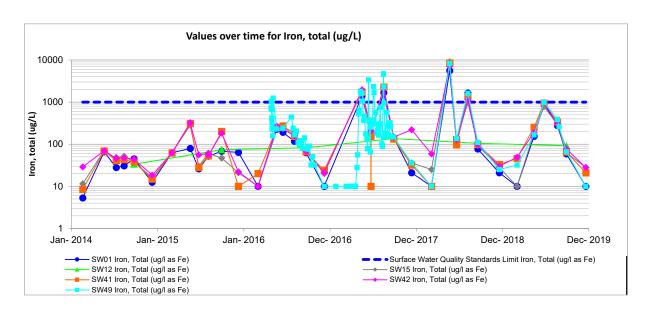


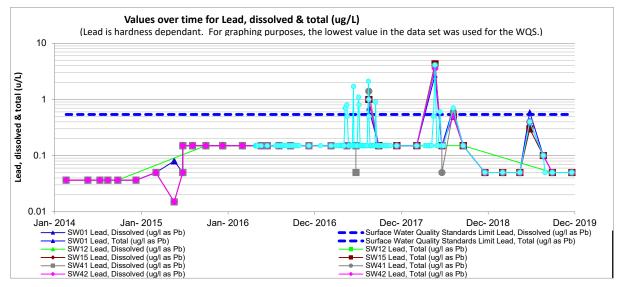


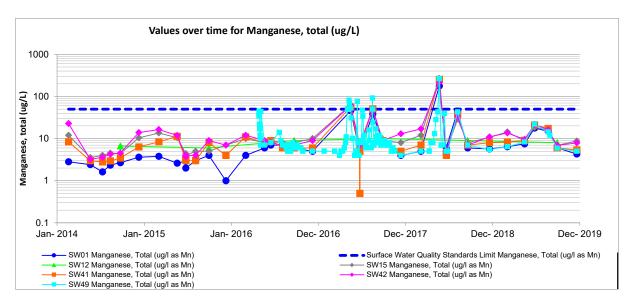


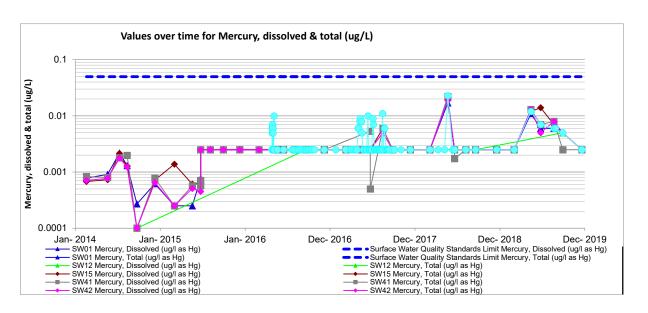


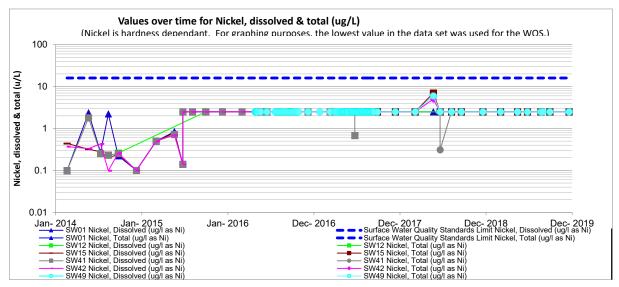


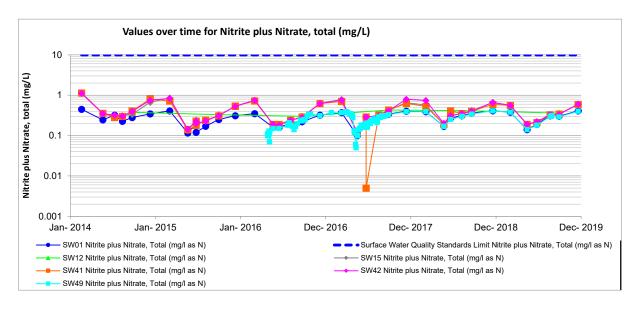


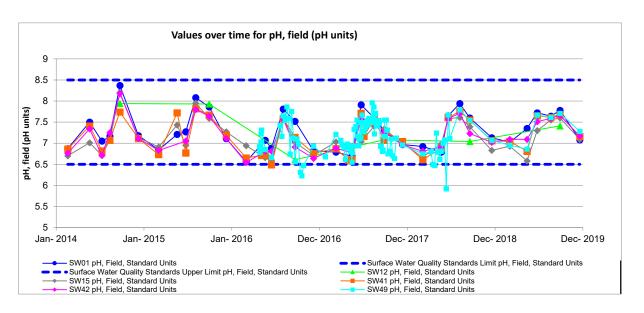


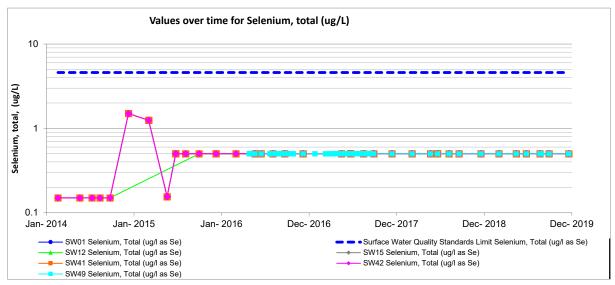


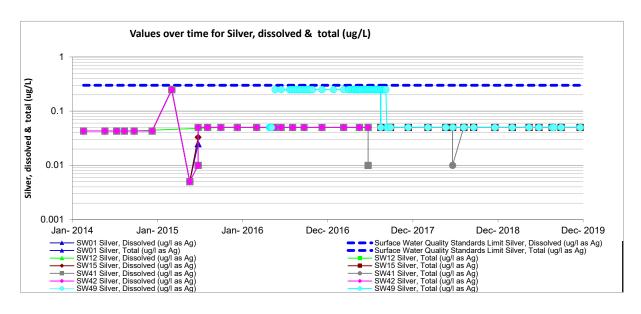


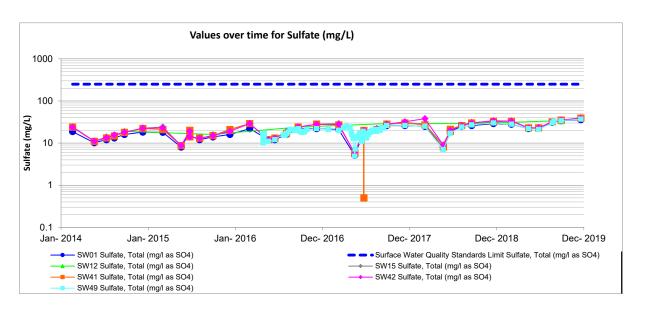


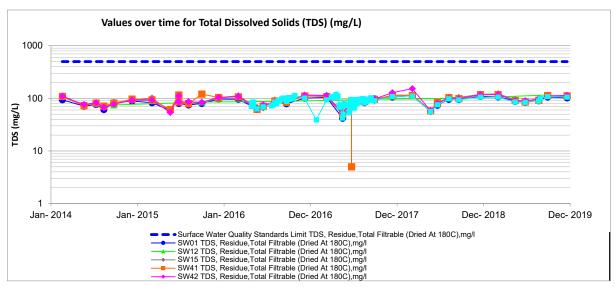


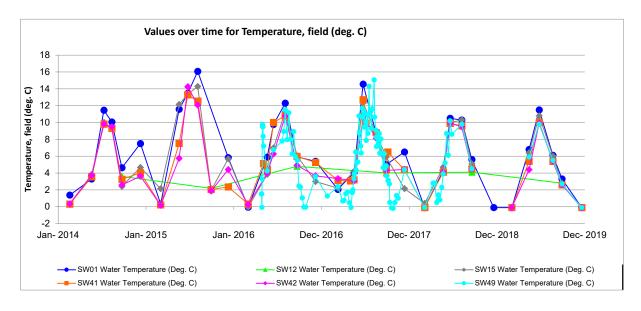


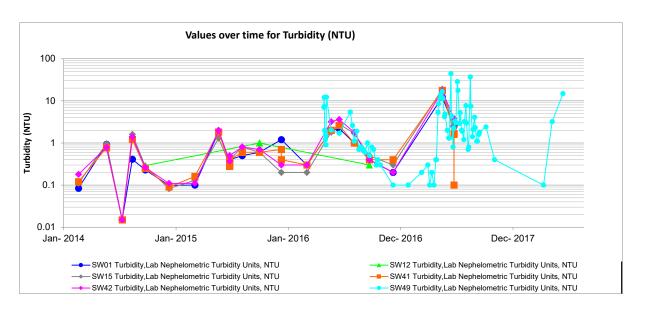


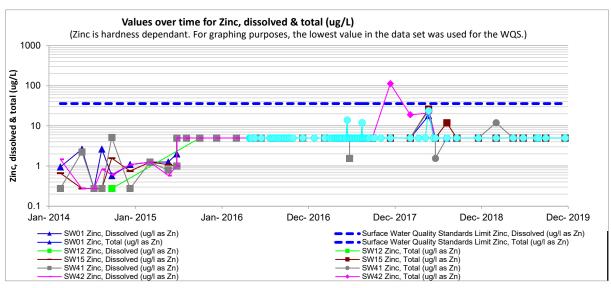






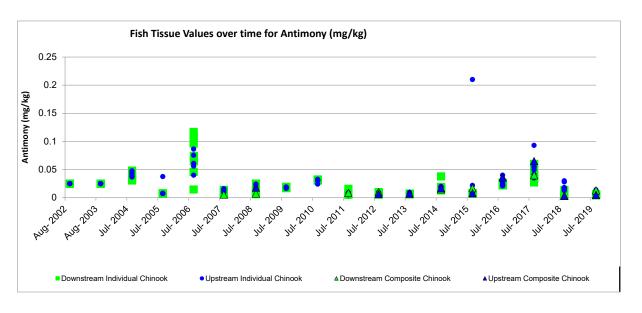


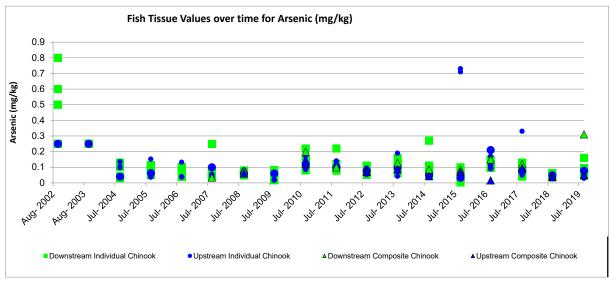


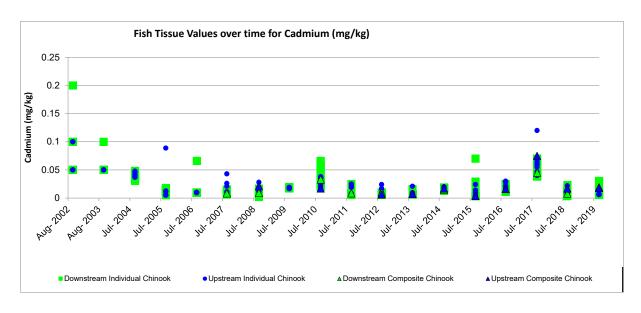


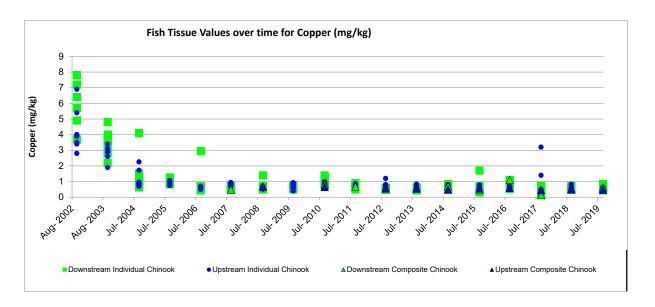


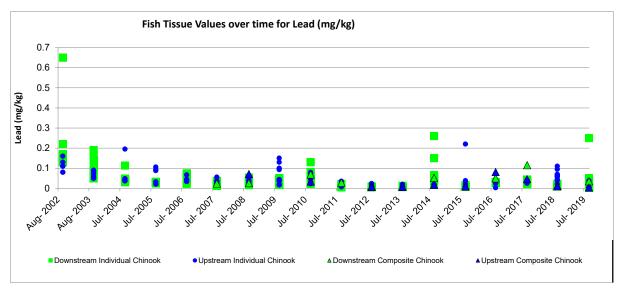
### APPENDIX C – Fish Tissue Data Graphs

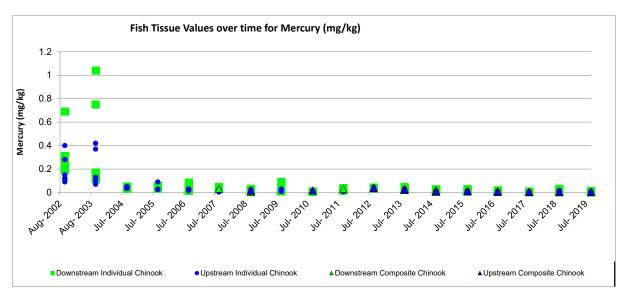


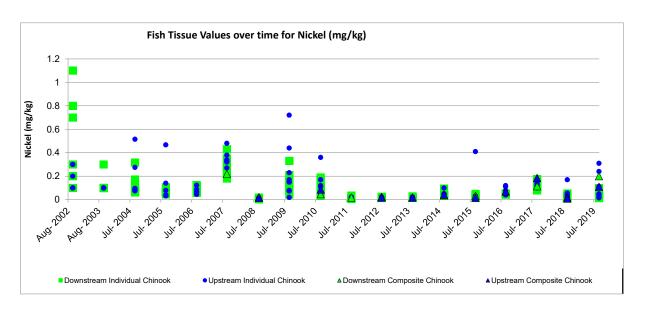


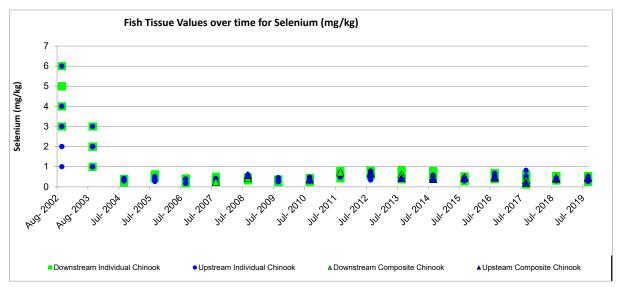


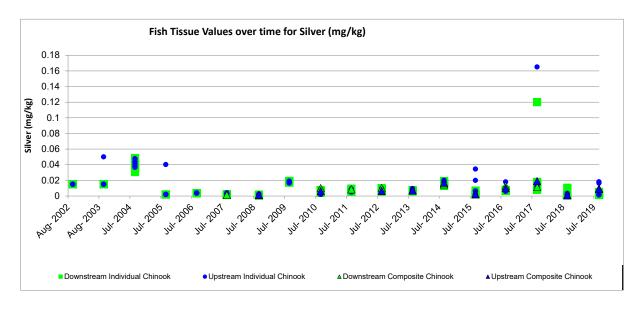






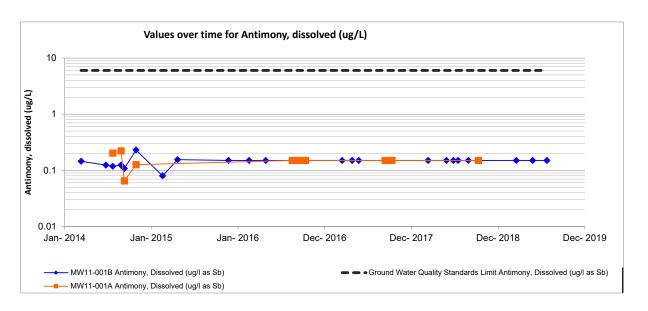


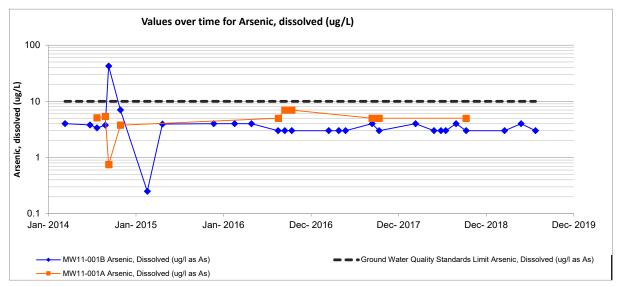


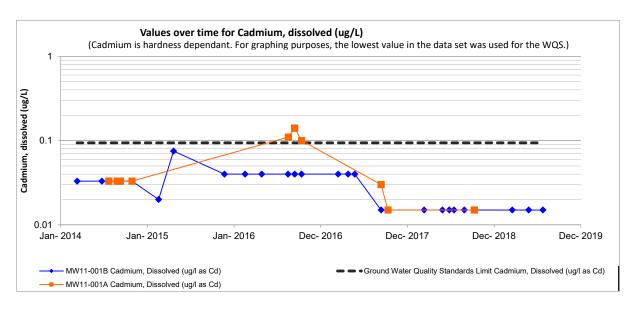


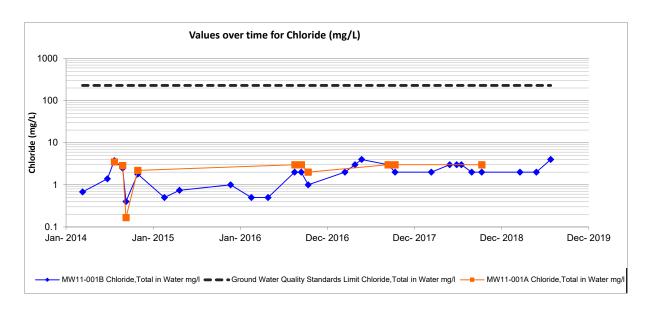


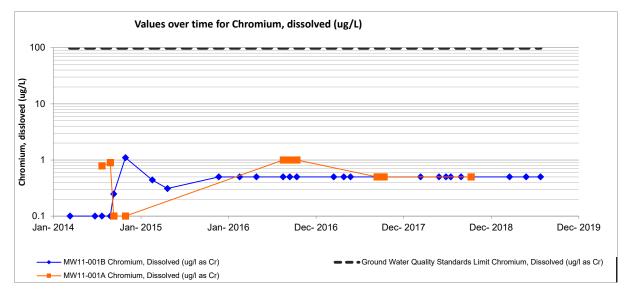
# APPENDIX C – MW11-001A and MW11-001B Well Graphs

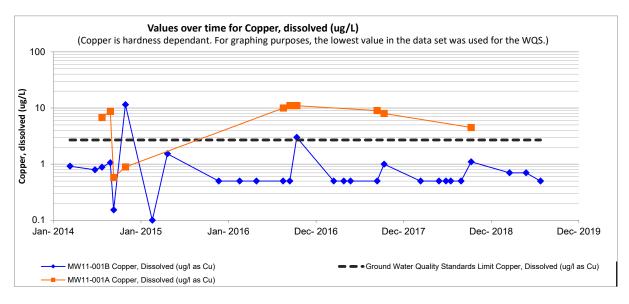


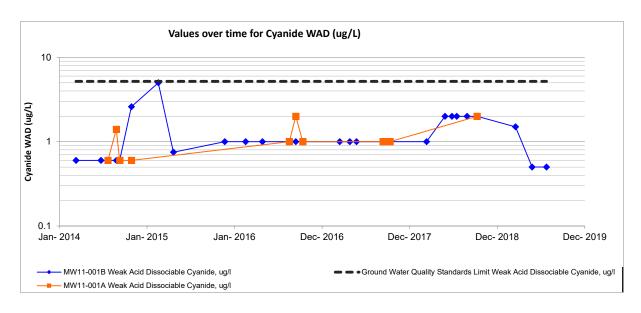


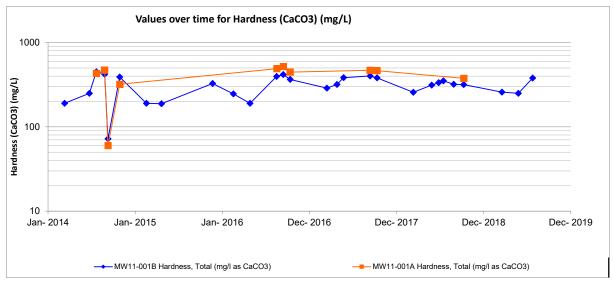


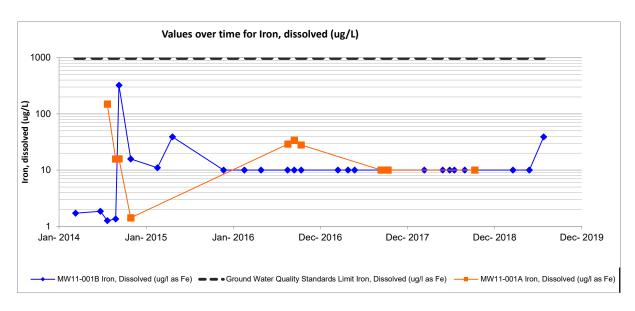


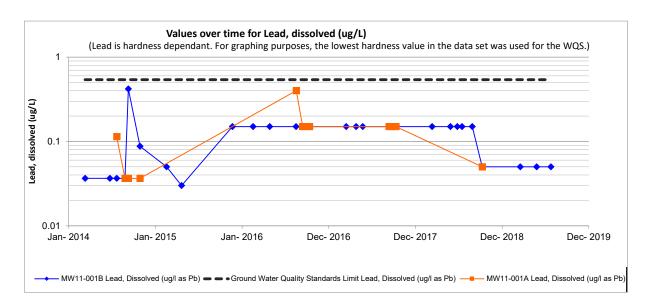


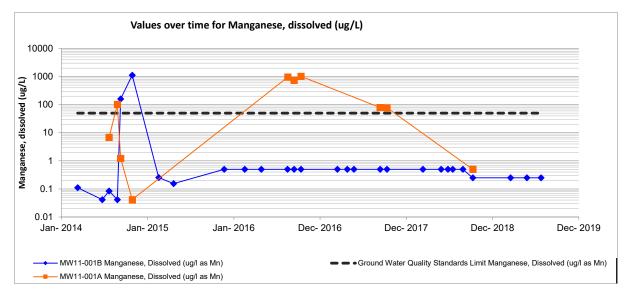


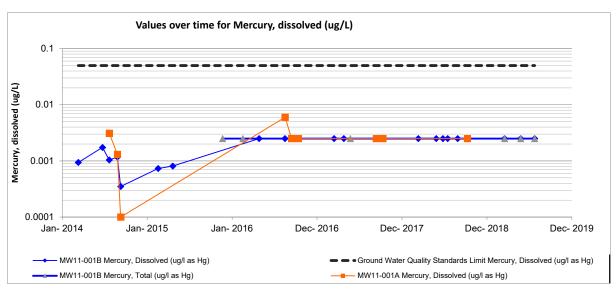


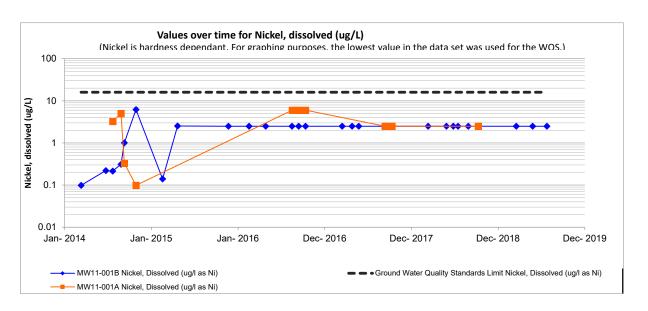


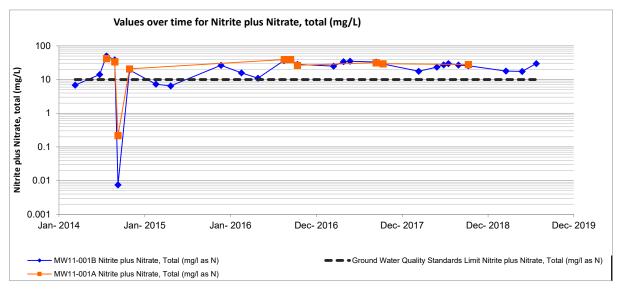


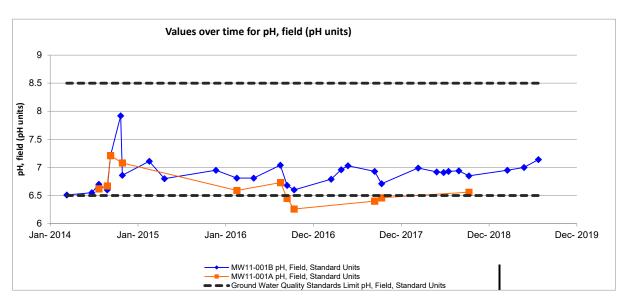


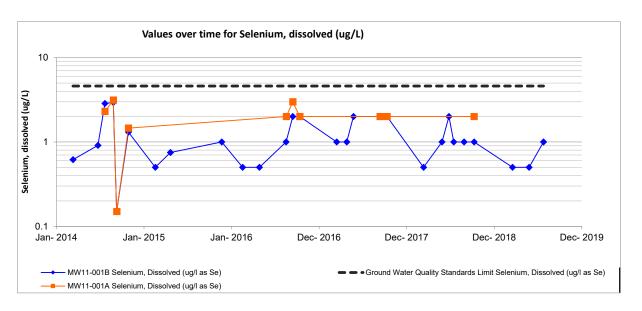


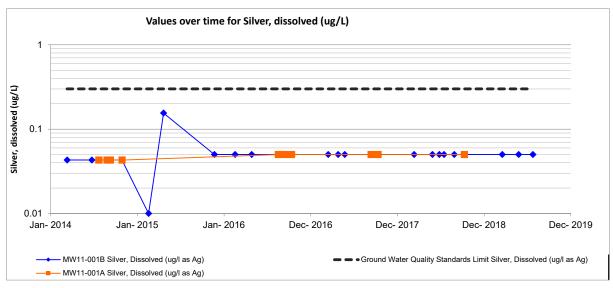


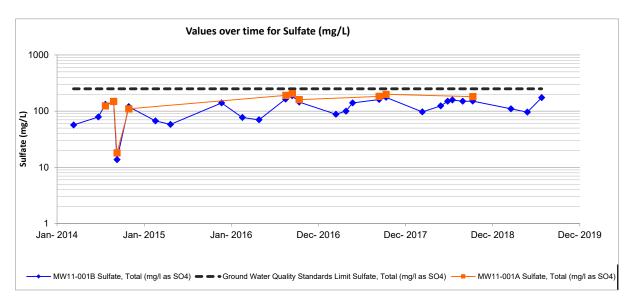


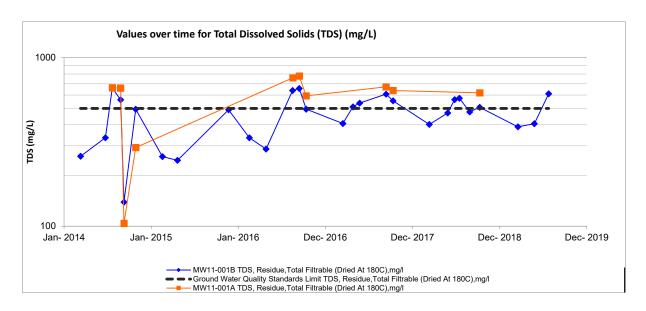


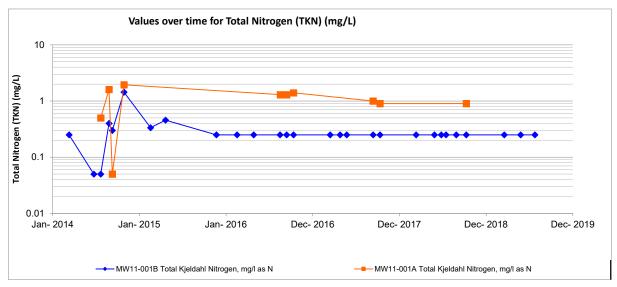


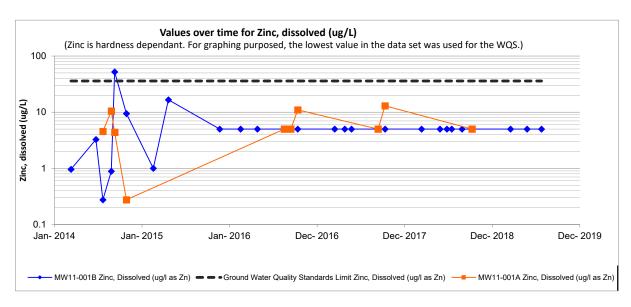






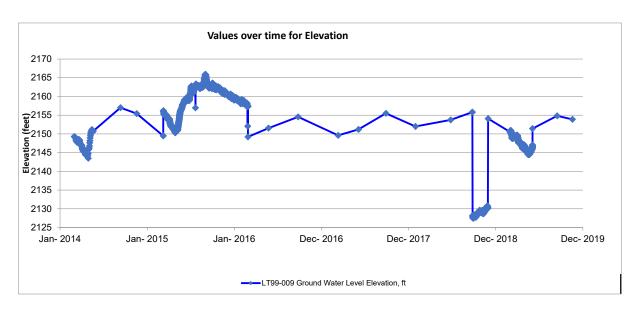


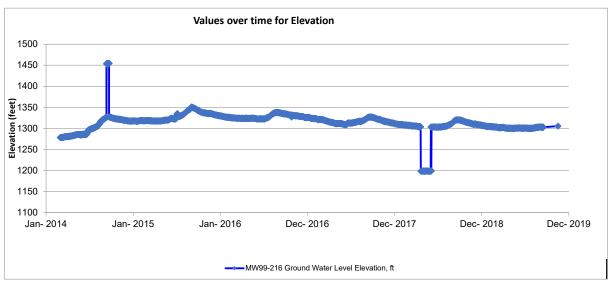






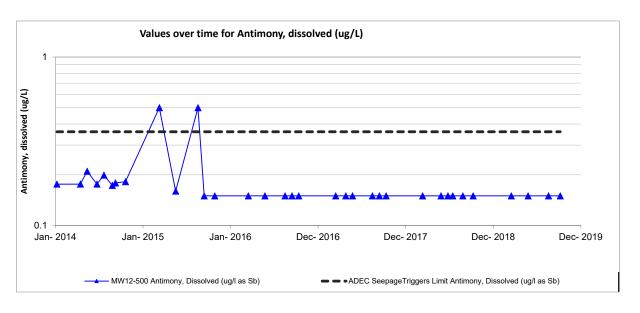
# APPENDIX C – MW99-216 and LT99-0099 Groundwater Elevation Graphs

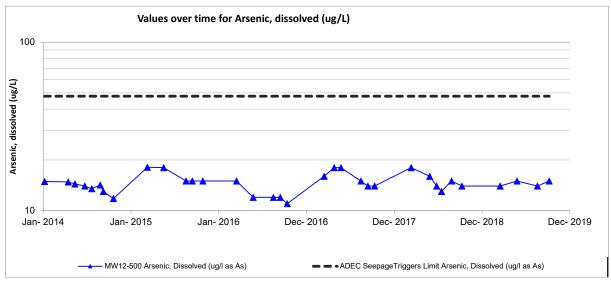


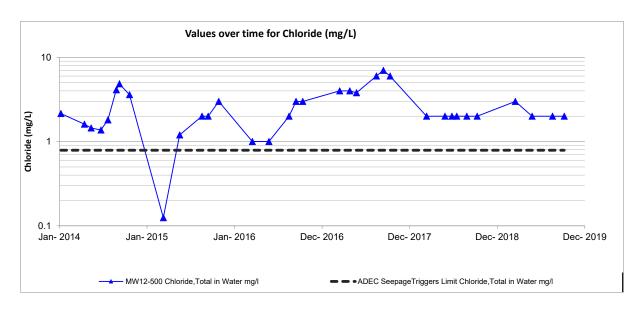


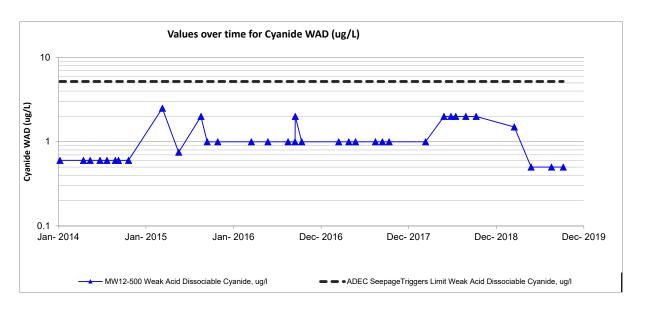


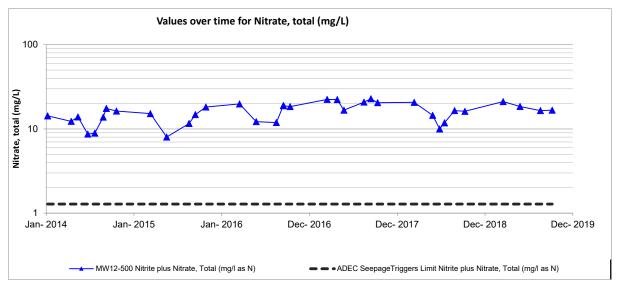
# APPENDIX C – MW12-500 Well Graphs with Seepage Trigger Limits

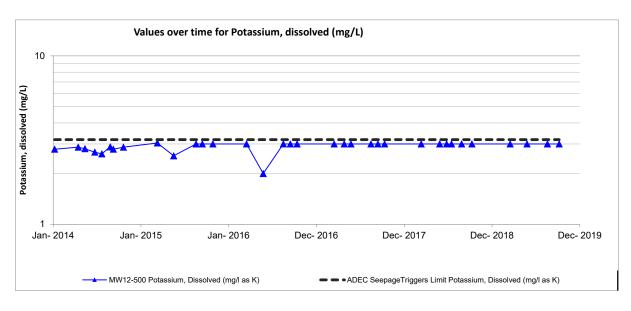


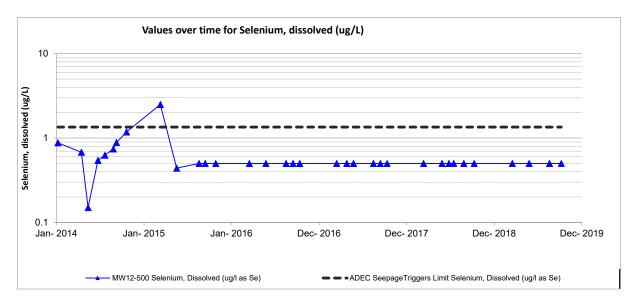


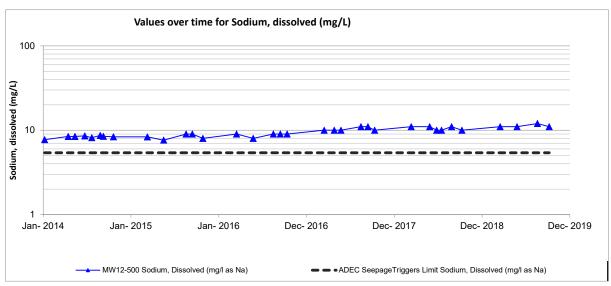






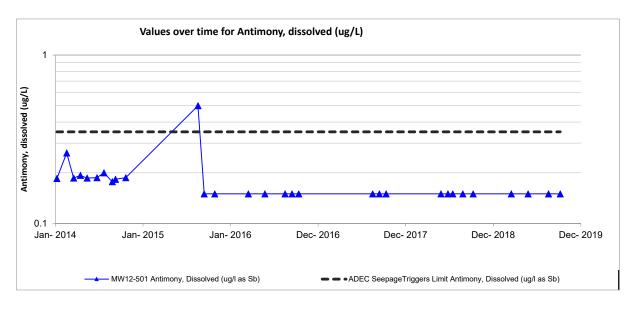


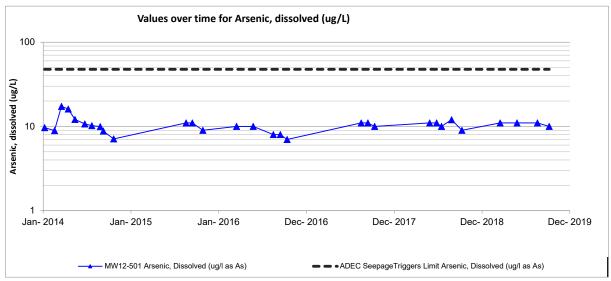


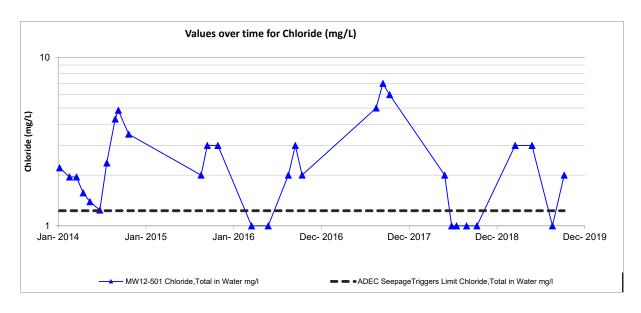


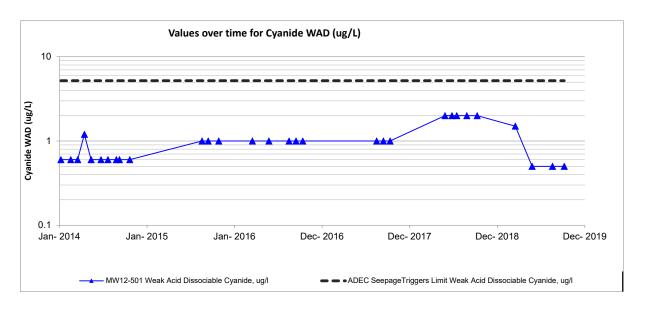


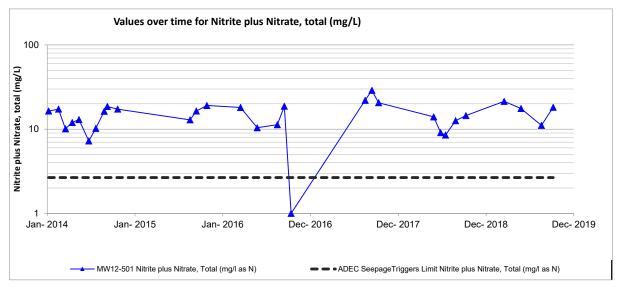
# APPENDIX C – MW12-501 Well Graphs with Seepage Trigger Limits

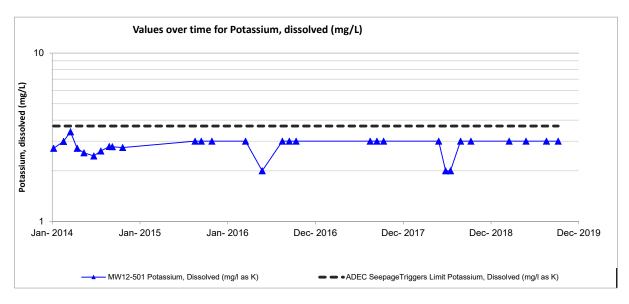


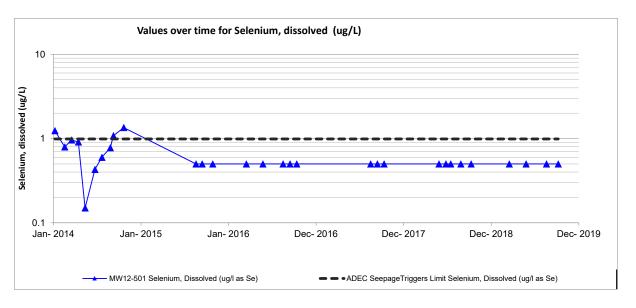


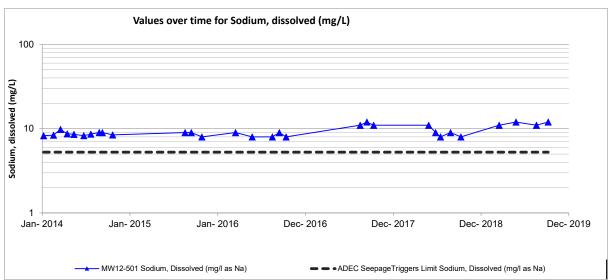






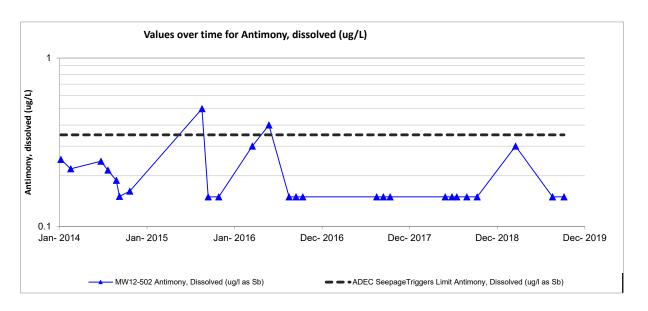


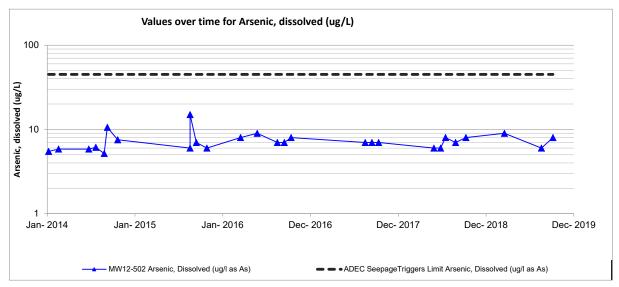


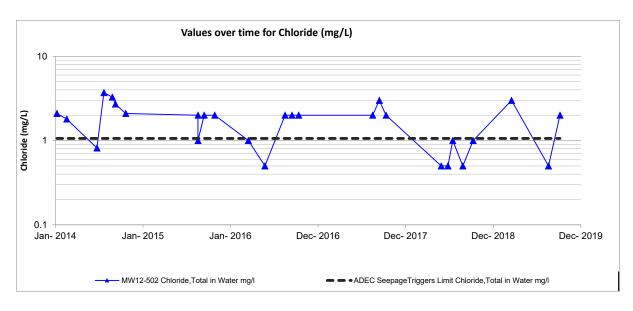


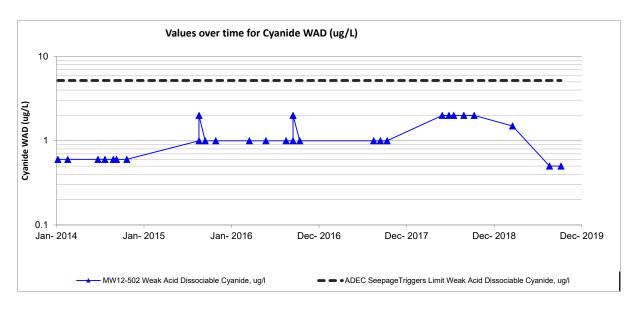


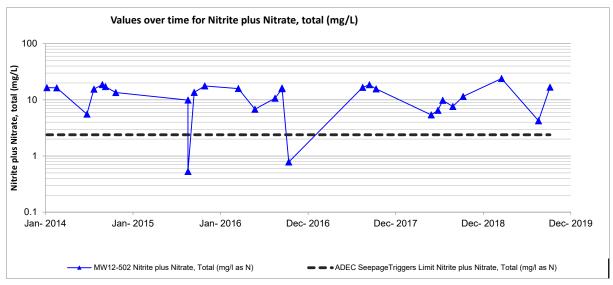
# APPENDIX C – MW12-502 Well Graphs with Seepage Trigger Limits

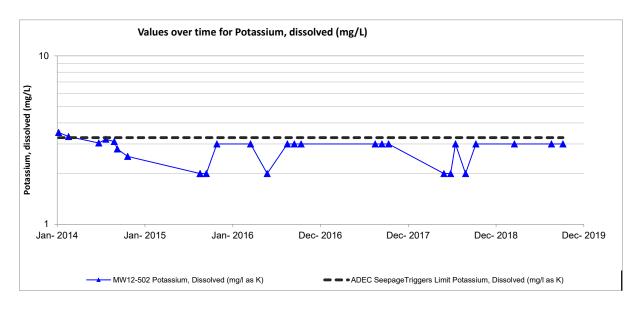


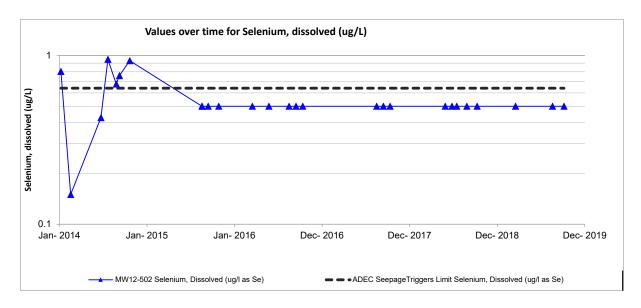


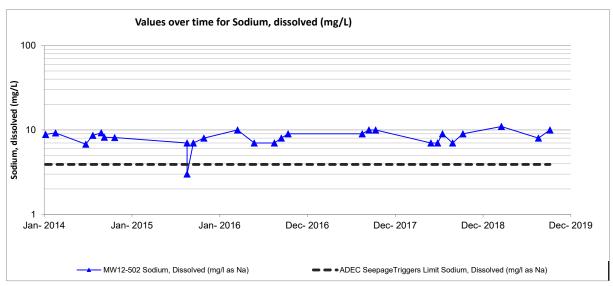






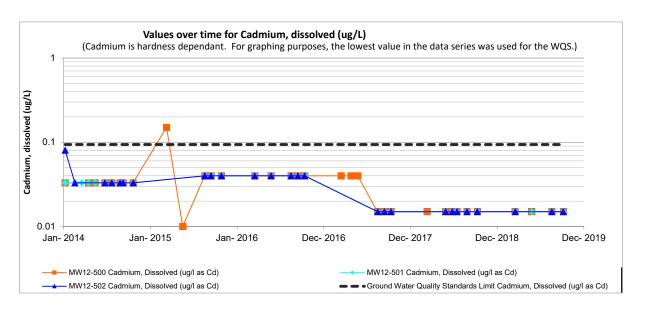


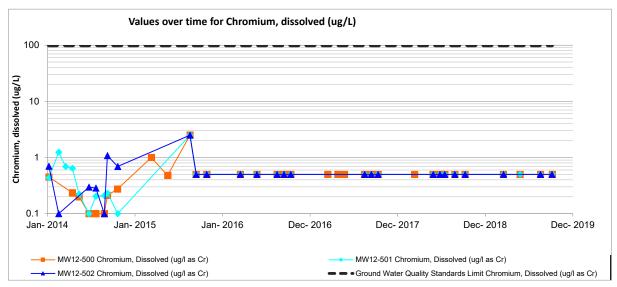


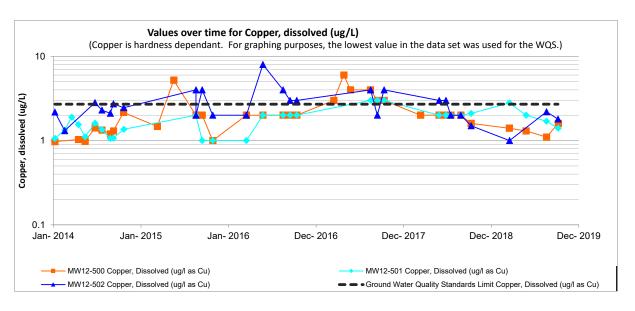


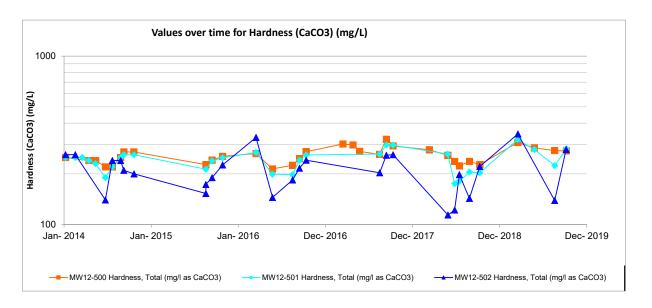


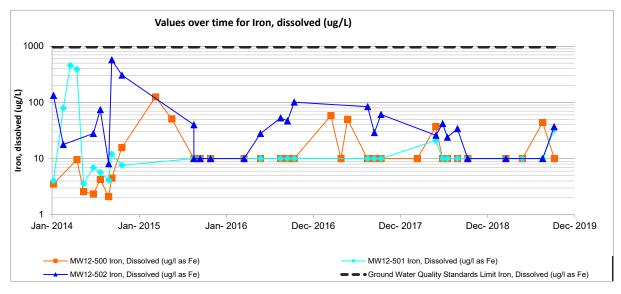
# APPENDIX C – MW12-500 Wells Graphs with WQS

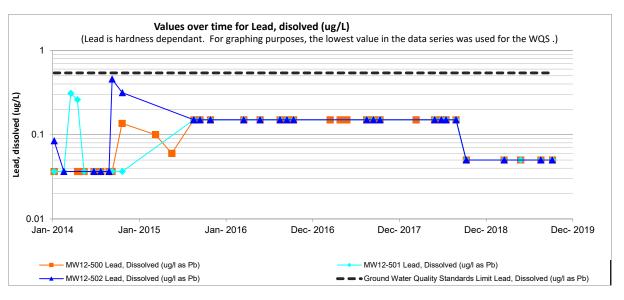


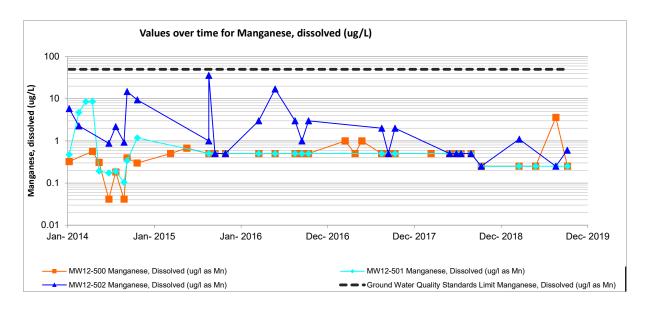


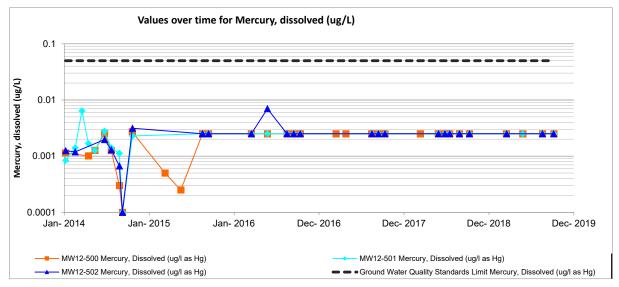


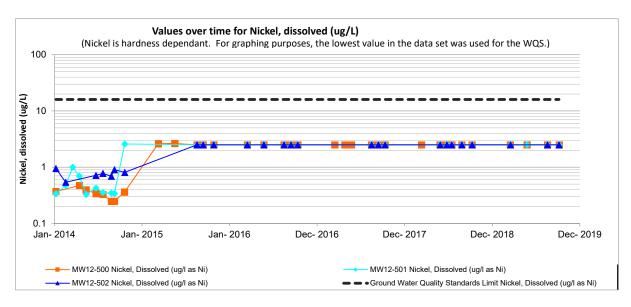


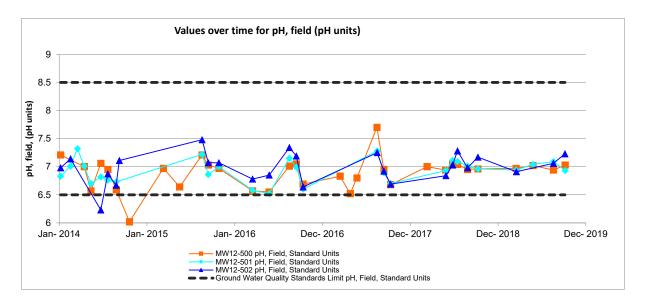


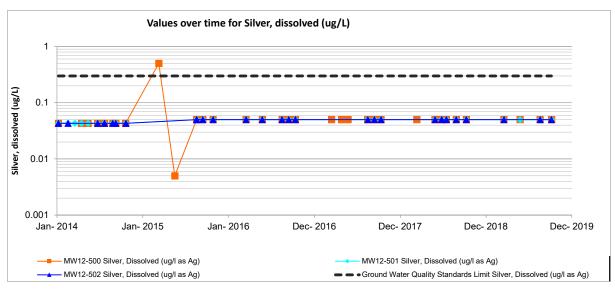


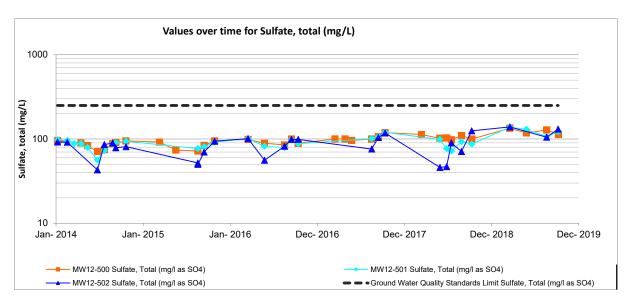


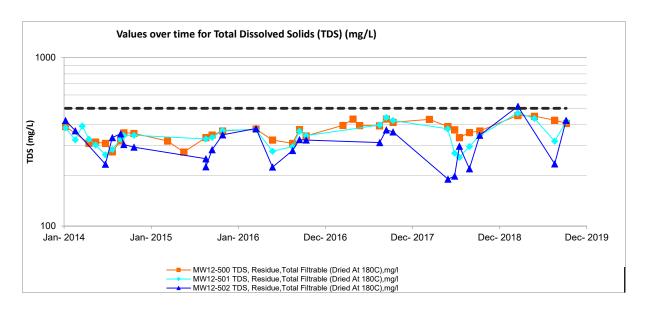


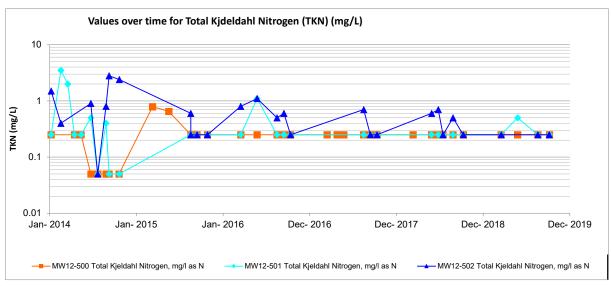


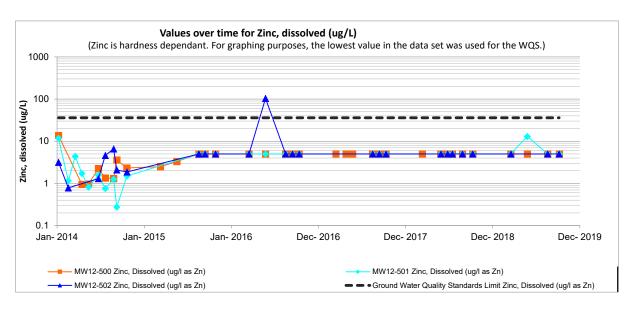






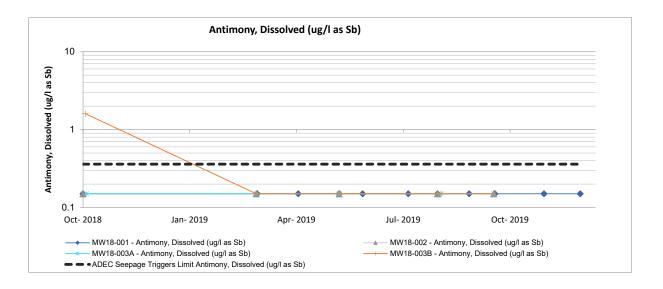


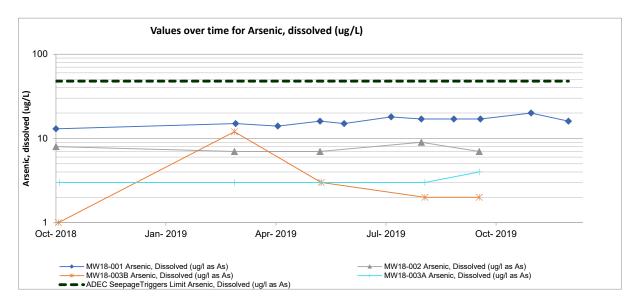


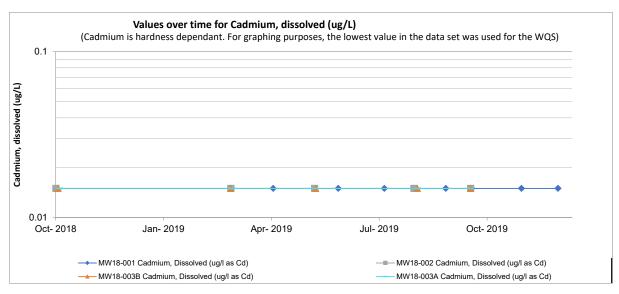


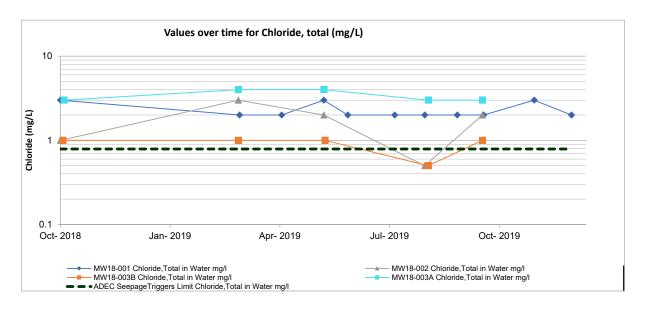


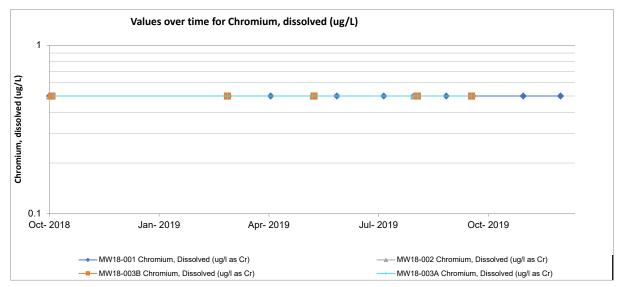
# APPENDIX C – MW 18 Wells Graphs with Seepage Trigger Limits

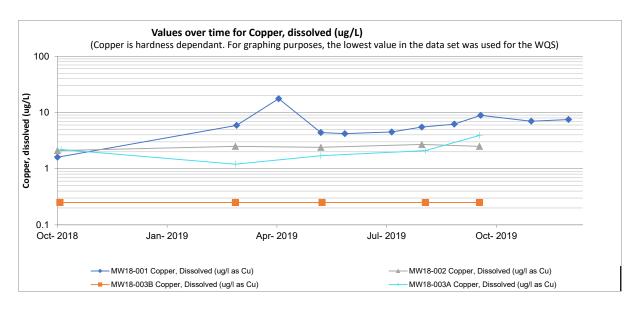


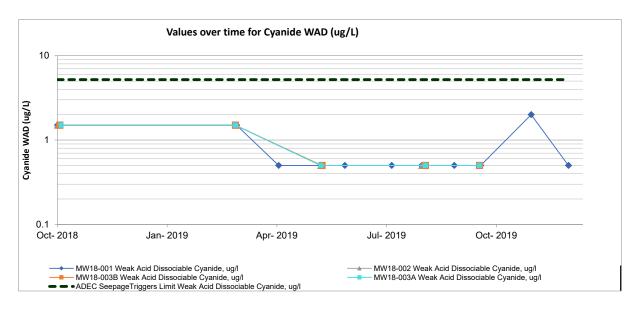


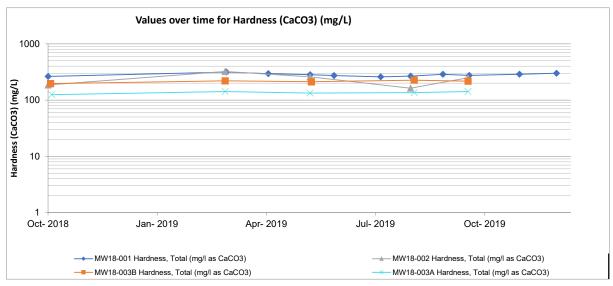


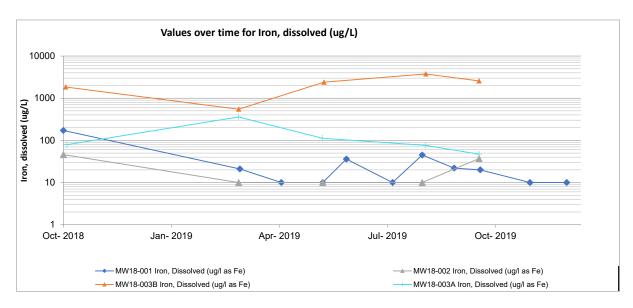


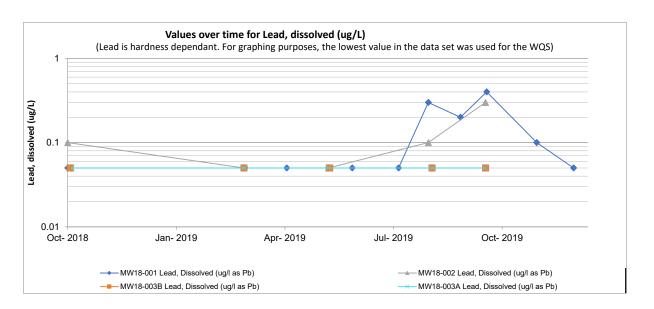


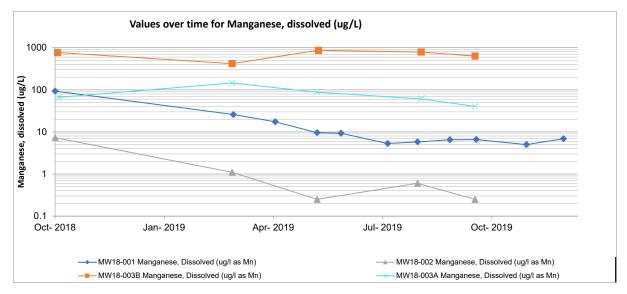


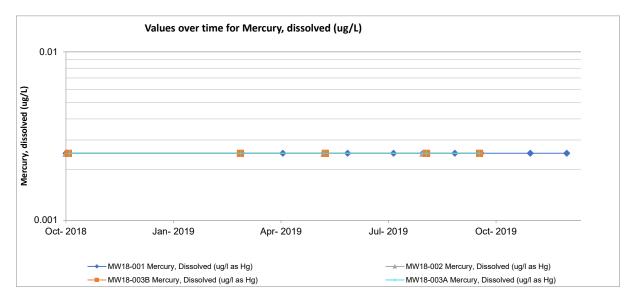


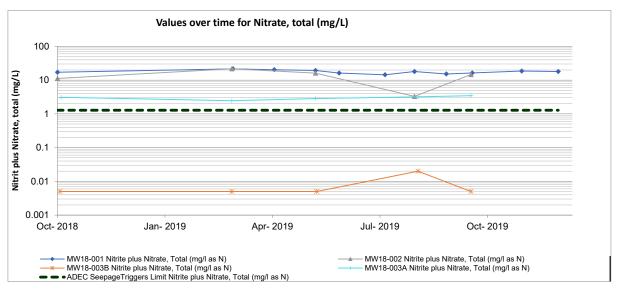


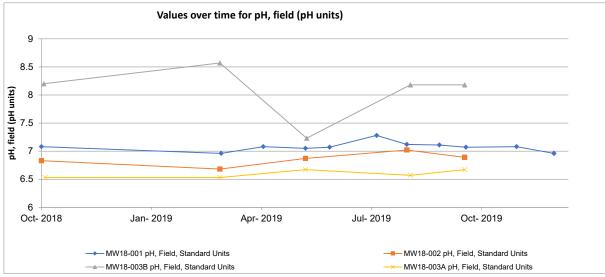


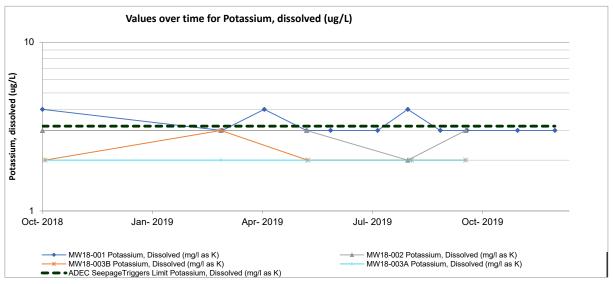


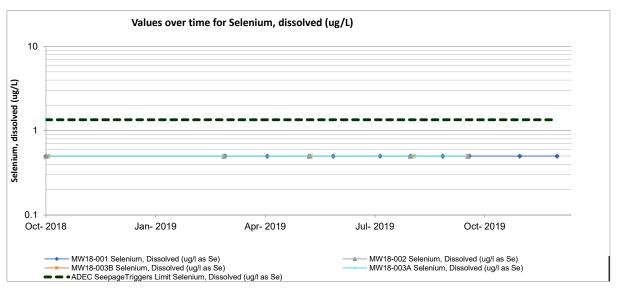


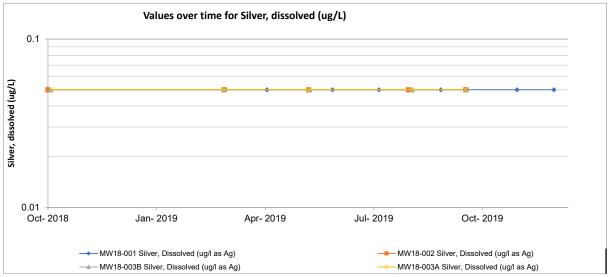


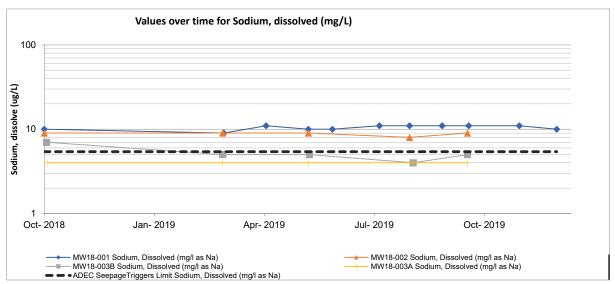


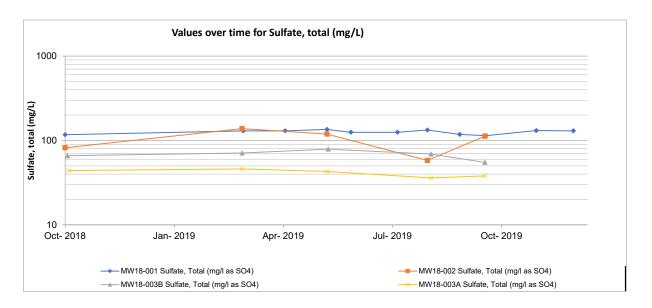


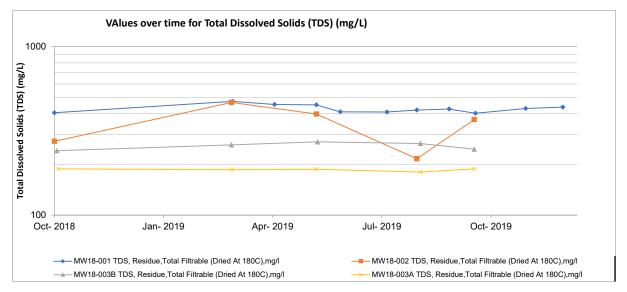


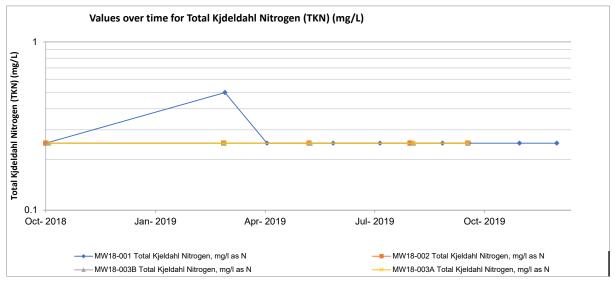


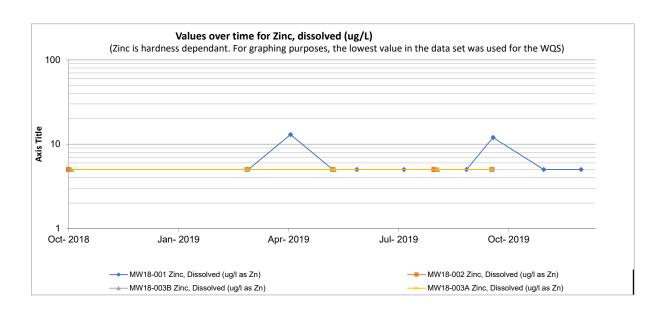






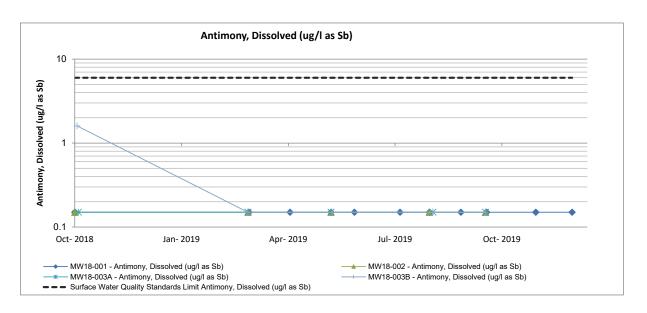


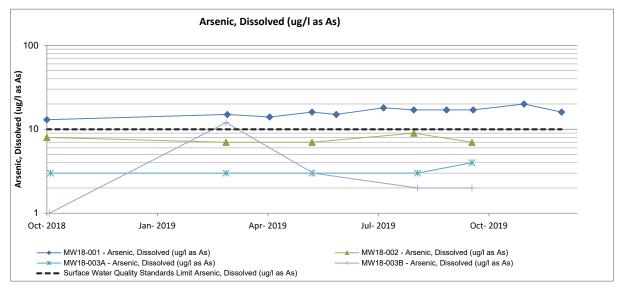


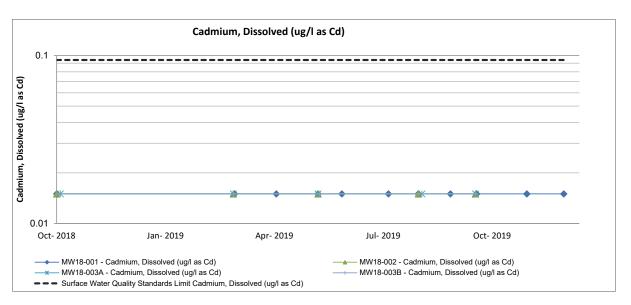


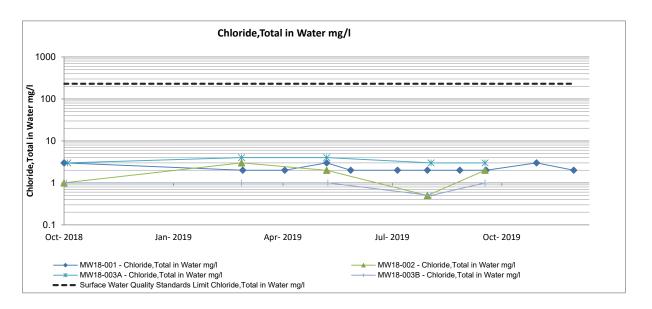


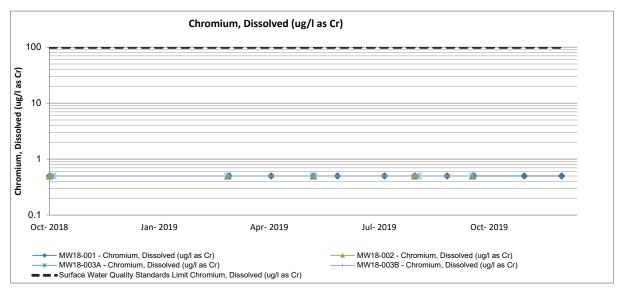
## APPENDIX C – MW18 Wells Graphs with WQS

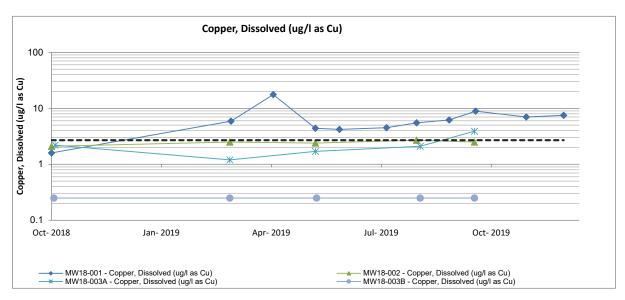


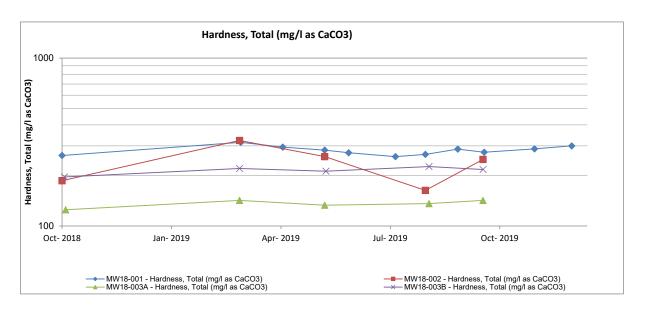


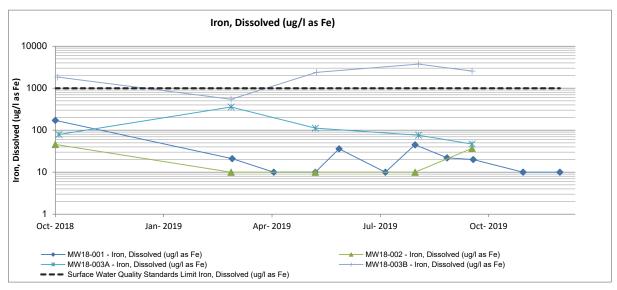


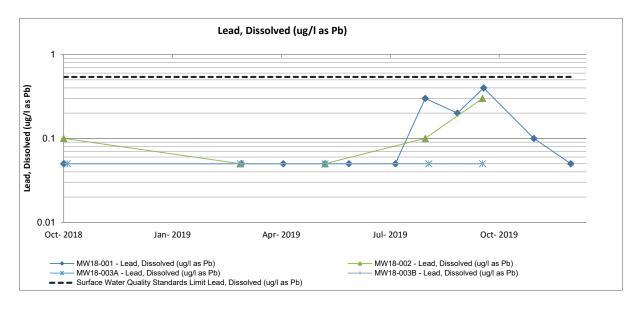


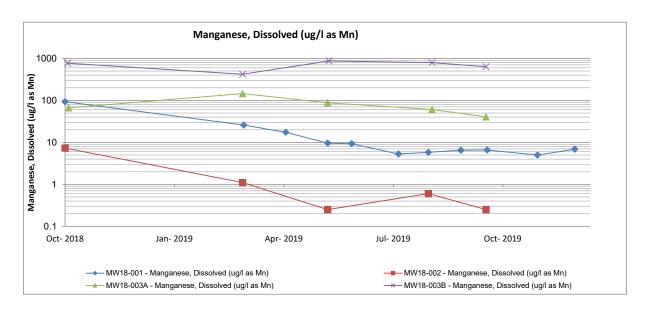


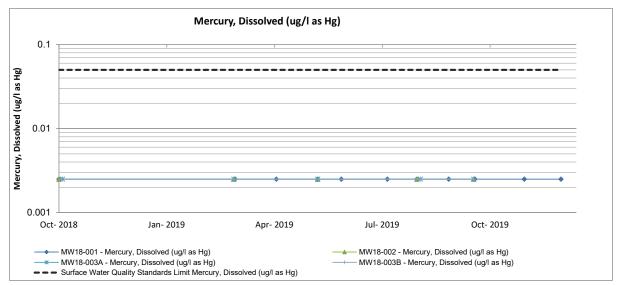


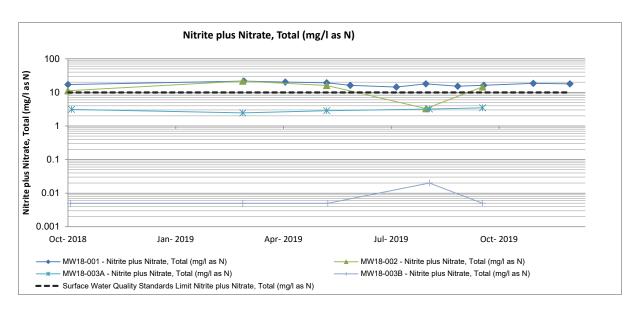


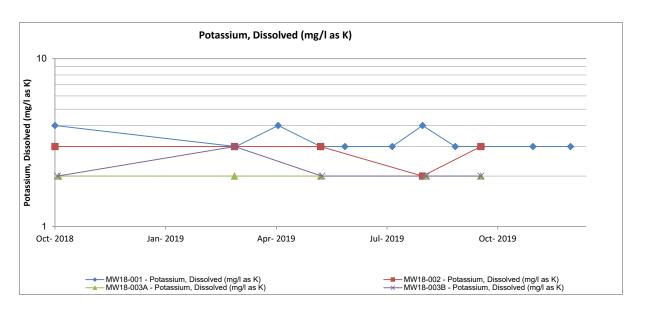


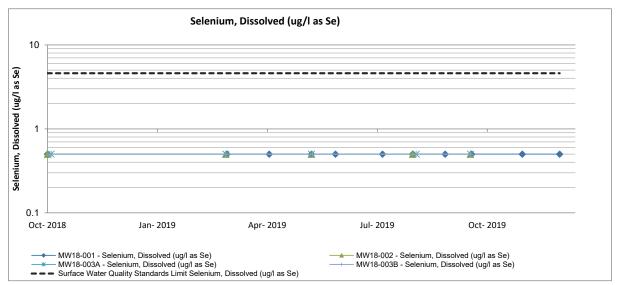


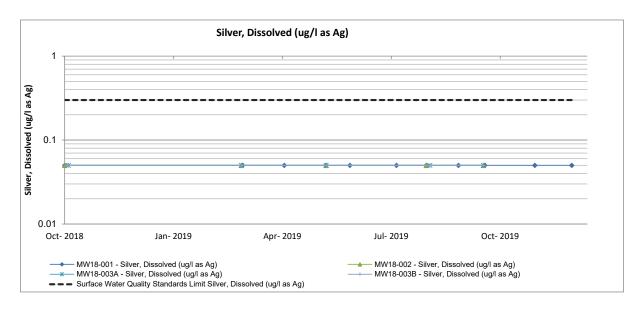


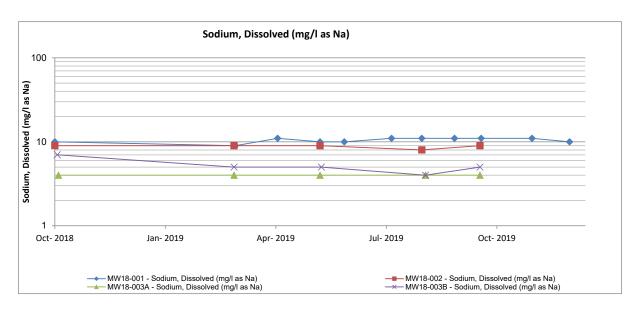


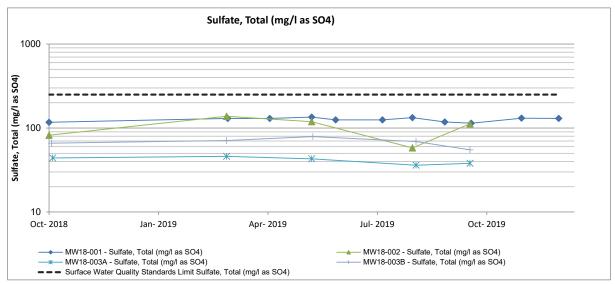


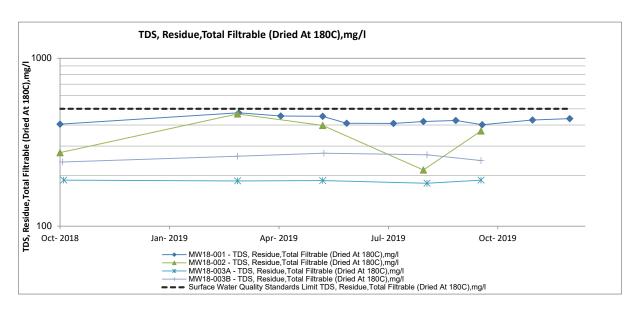


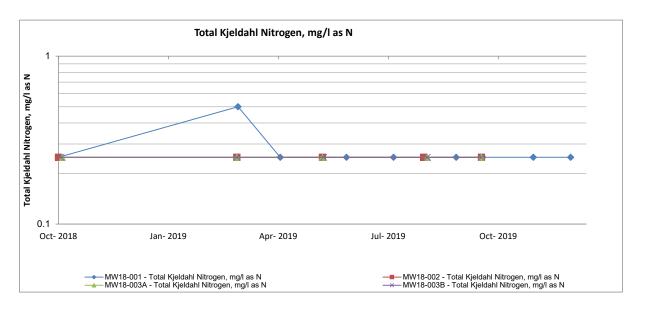


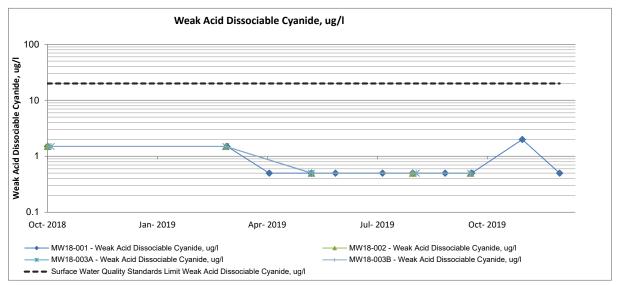


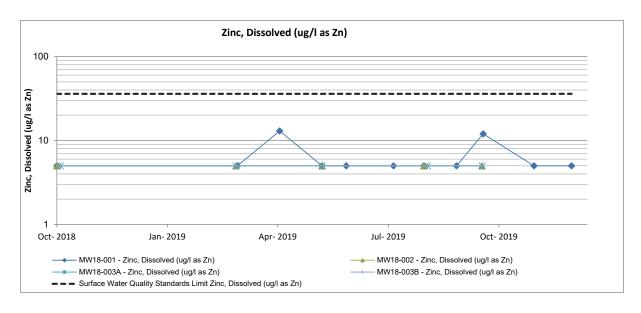






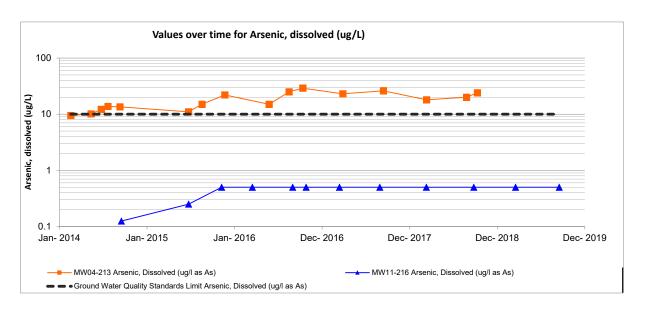


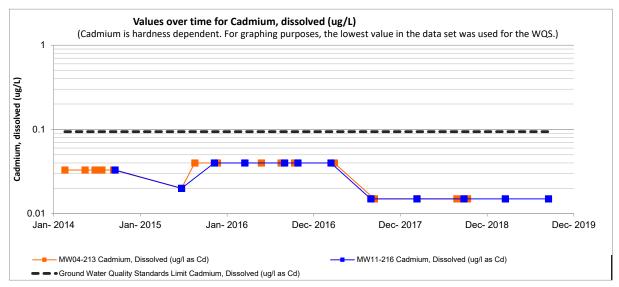


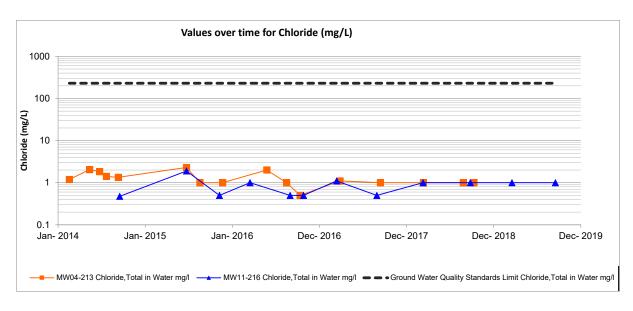


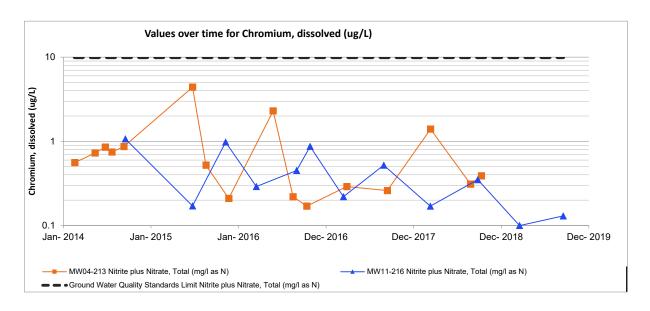


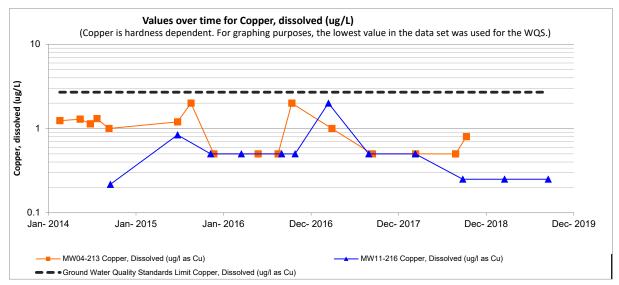
## APPENDIX C – MW04-213 and MW11-216 Wells Graphs

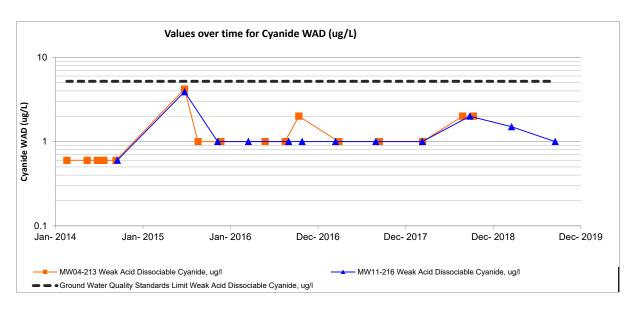


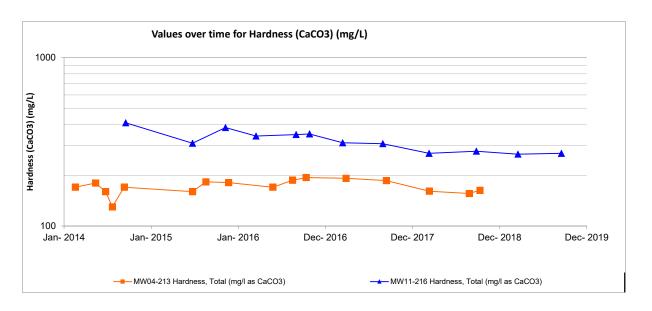


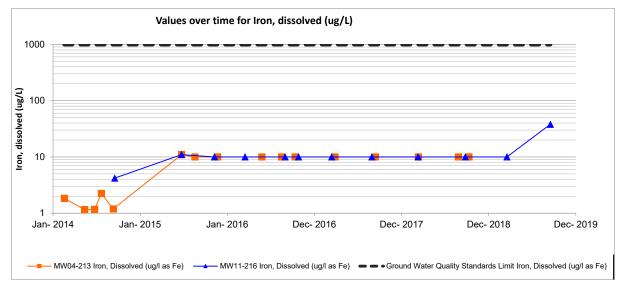


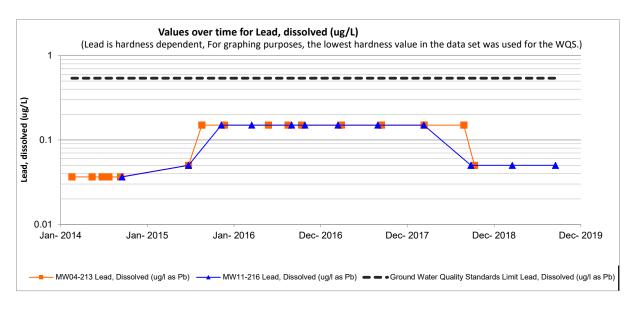


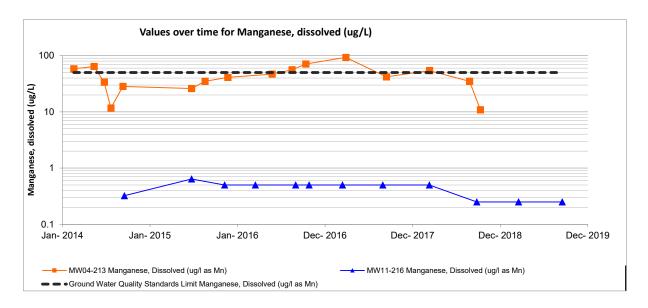


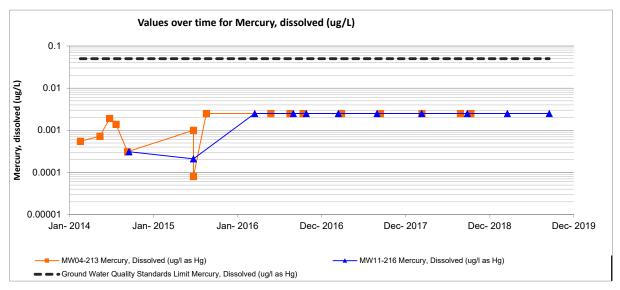


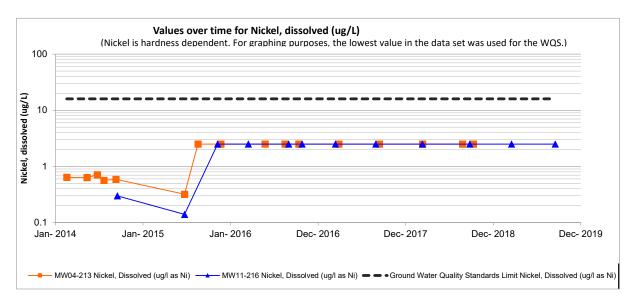


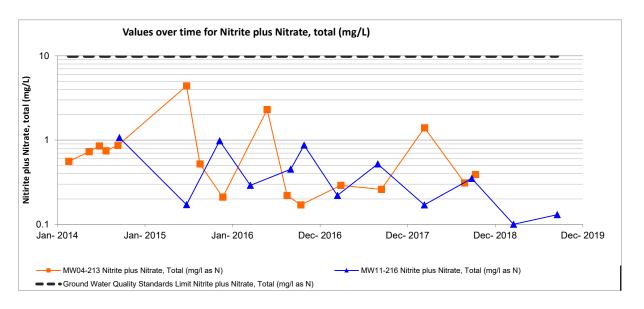


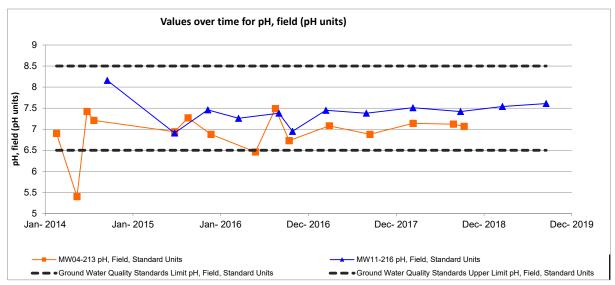


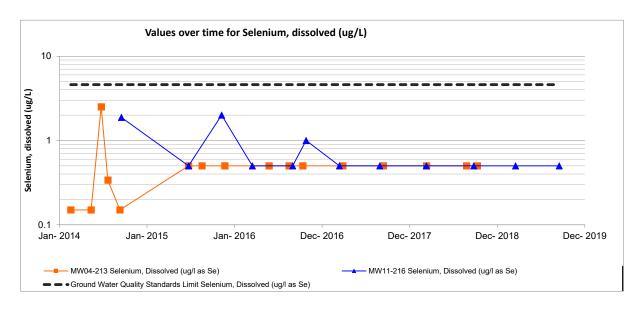


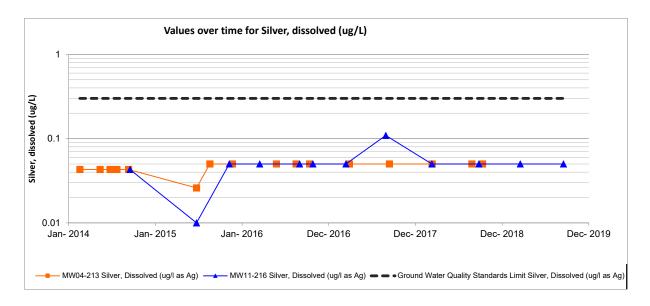


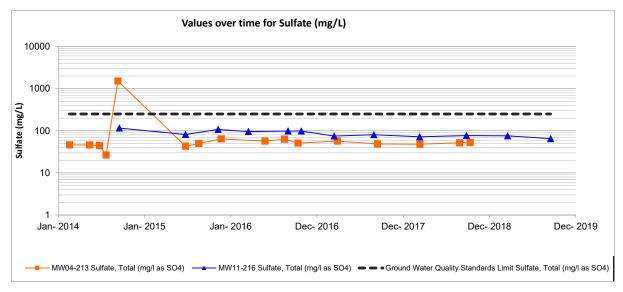


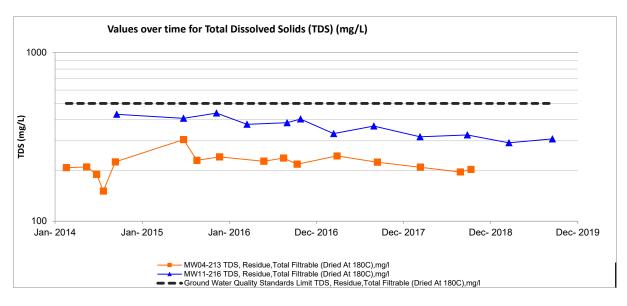


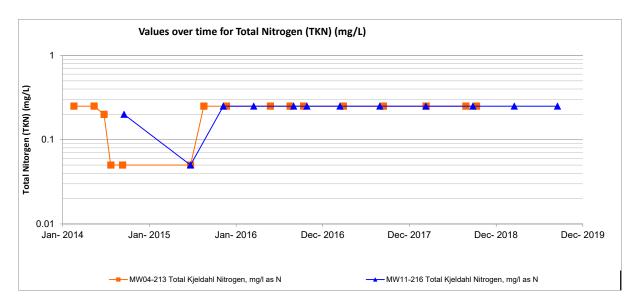


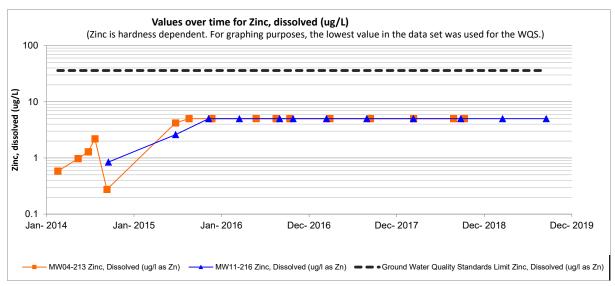






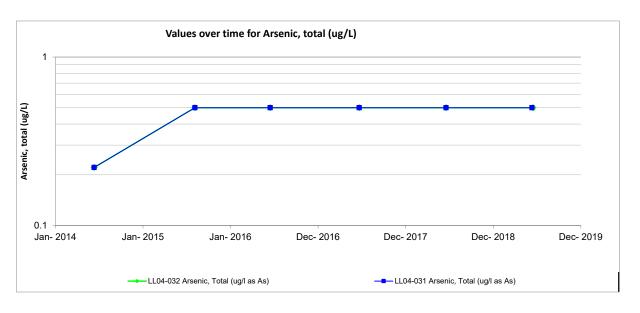


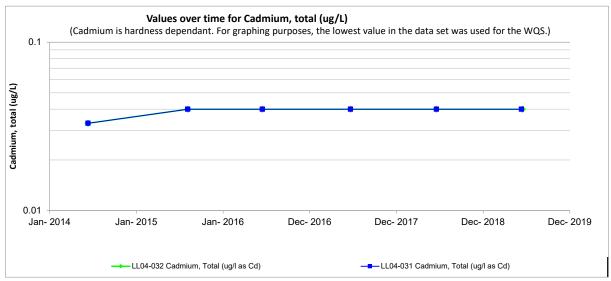


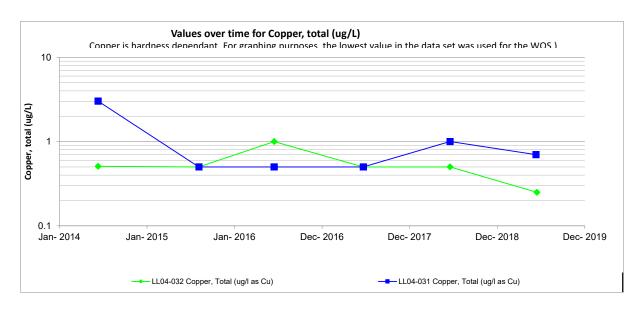


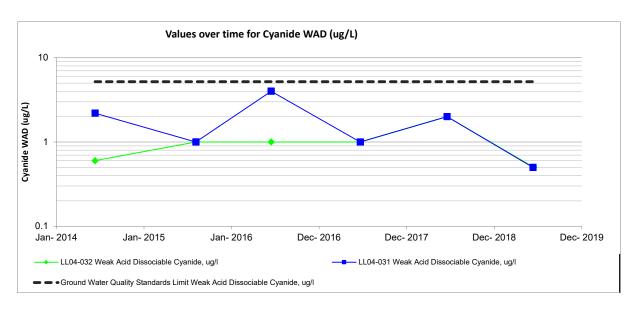


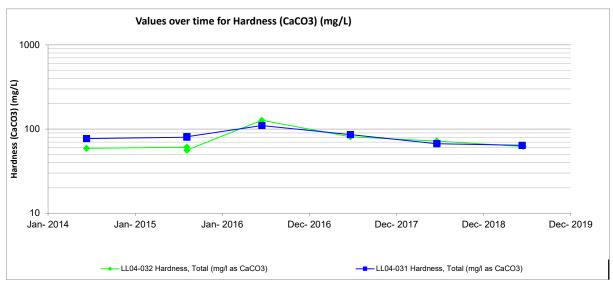
## APPENDIX C – LL04-032 and LL04-031 Well Graphs

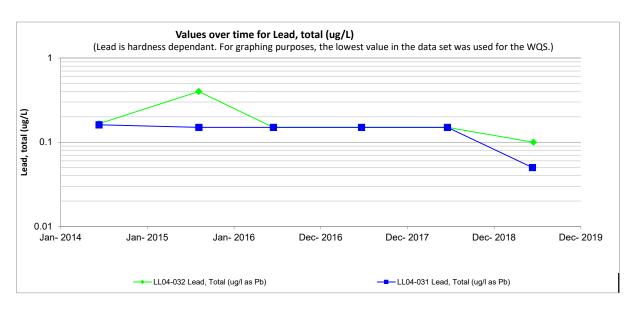


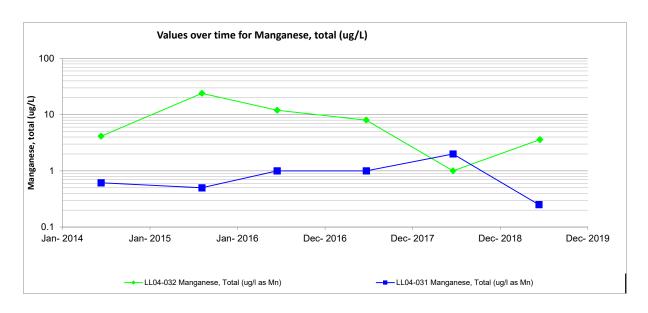


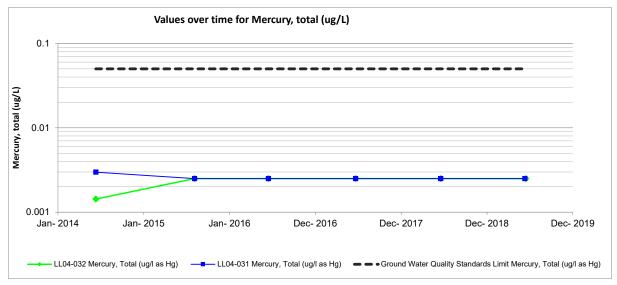


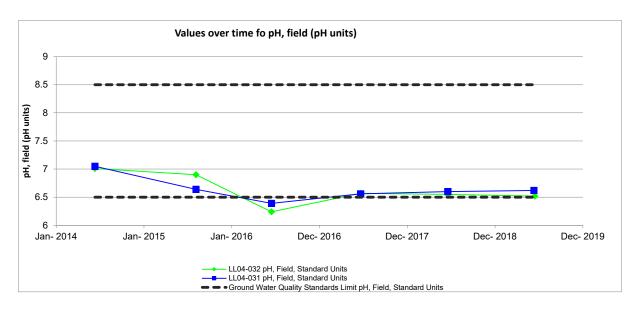


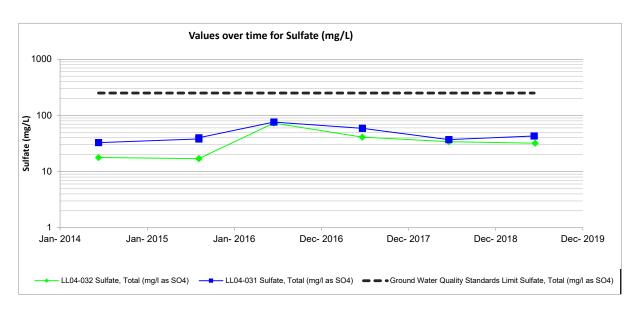


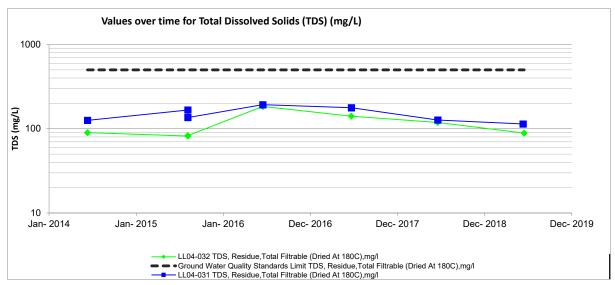


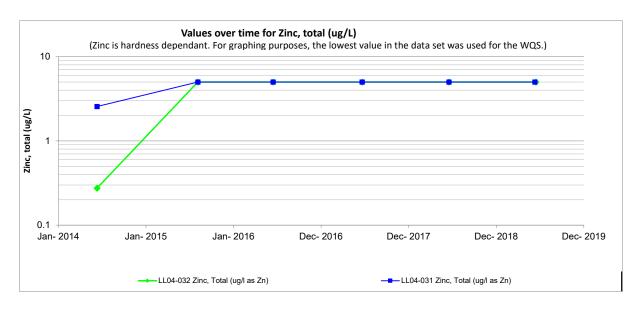






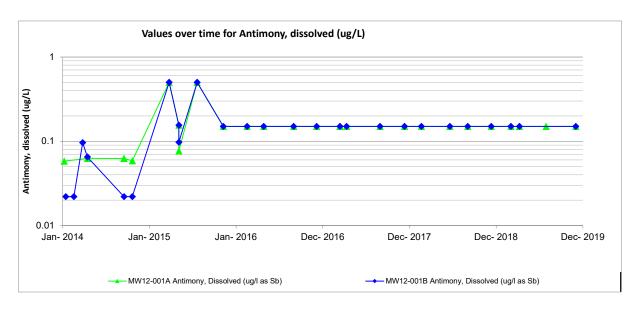


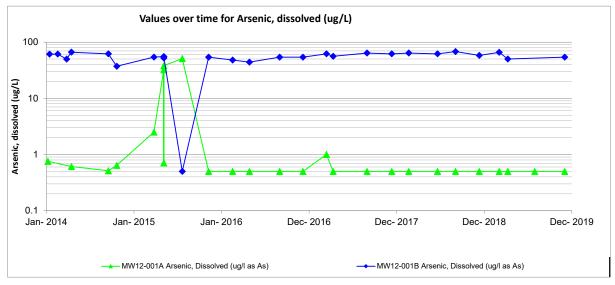


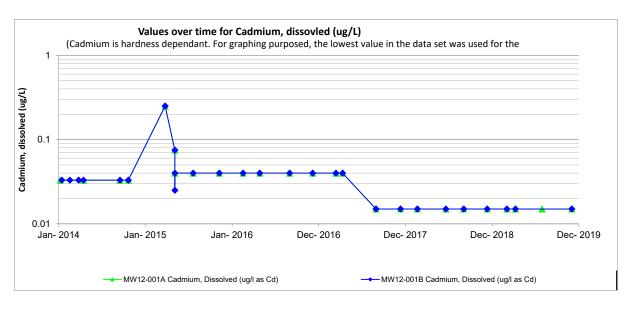


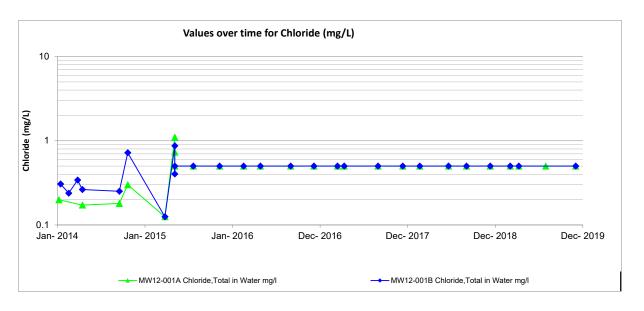


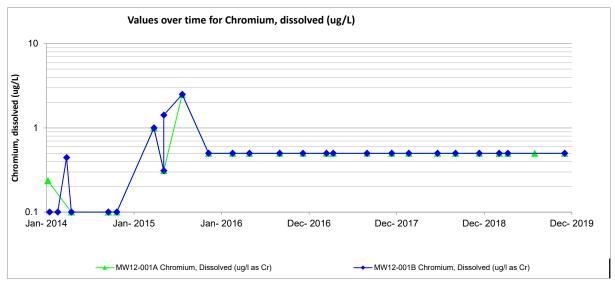
## APPENDIX C – MW12-001A and MW12-001B Wells Graphs

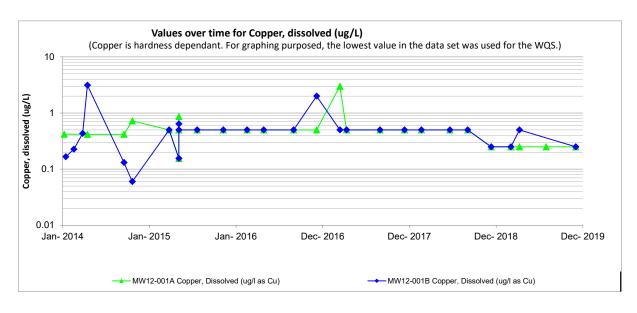


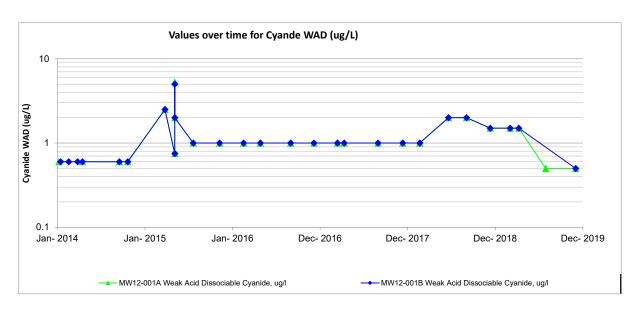


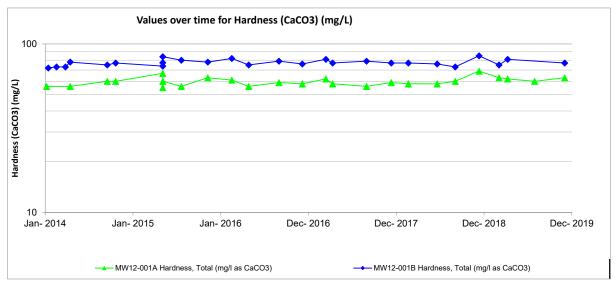


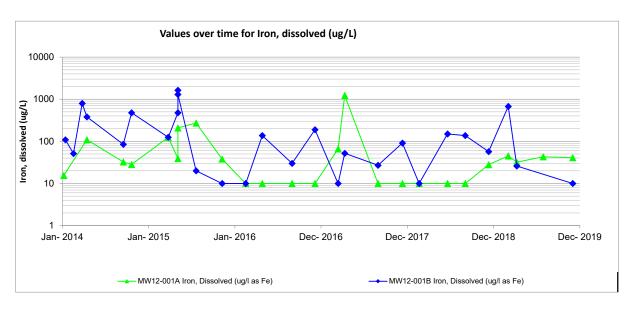


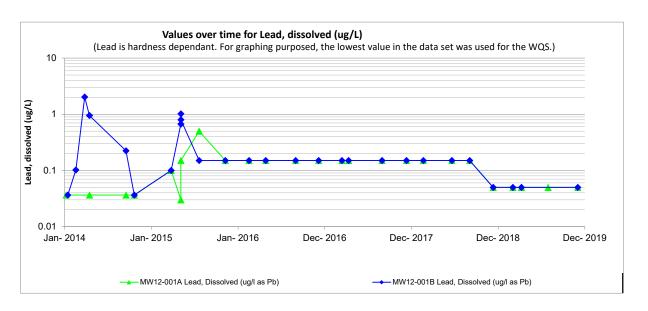


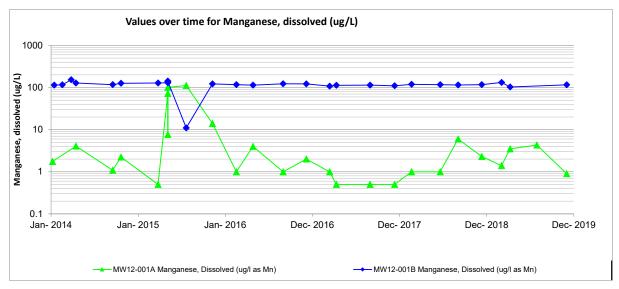


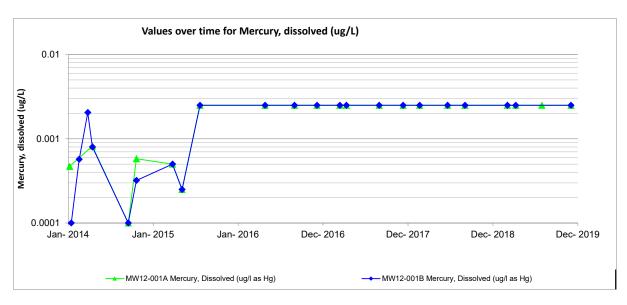


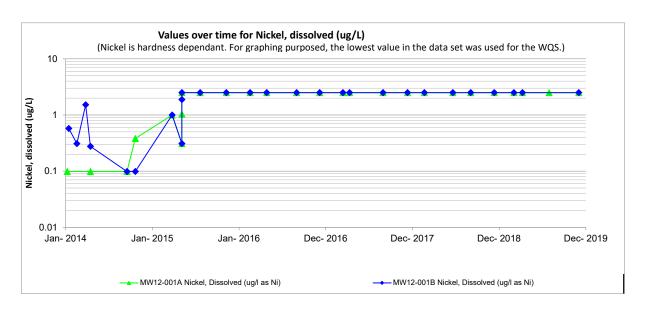


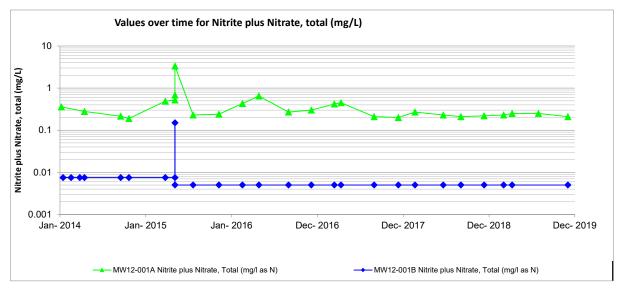


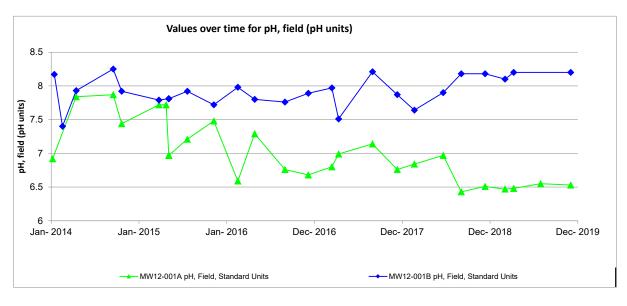


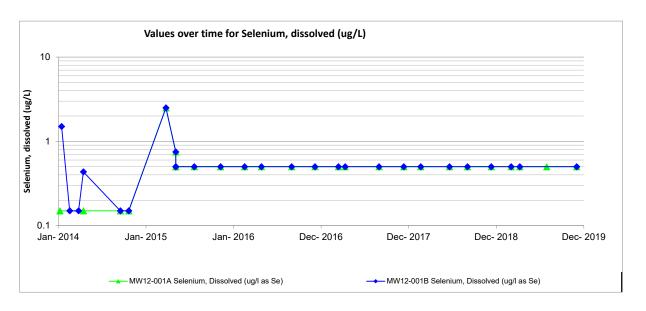


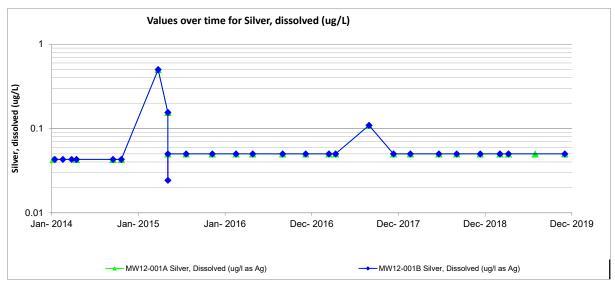


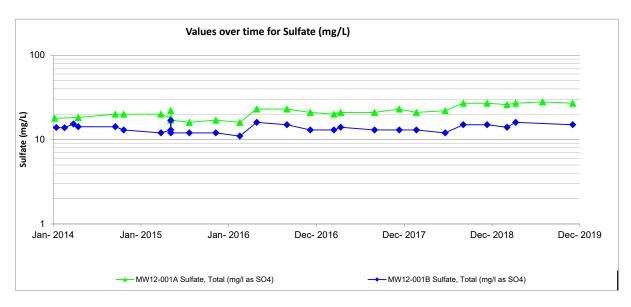


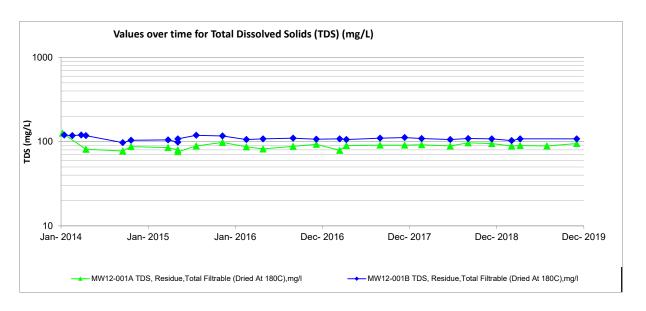


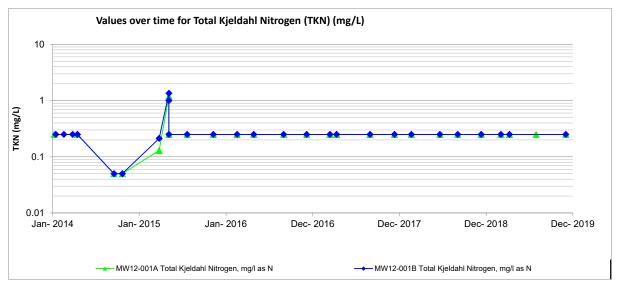


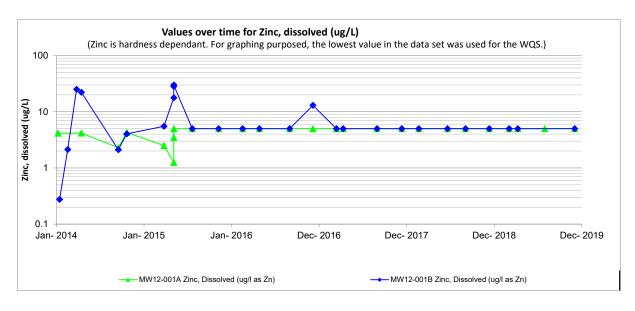






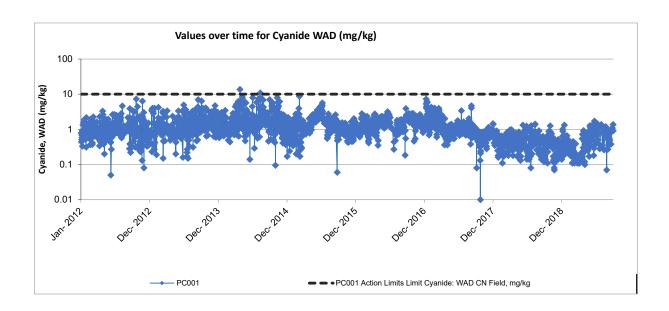






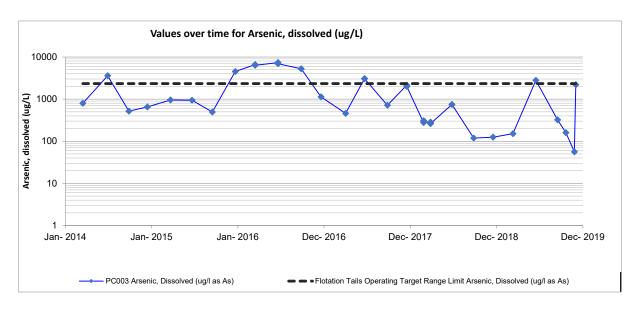


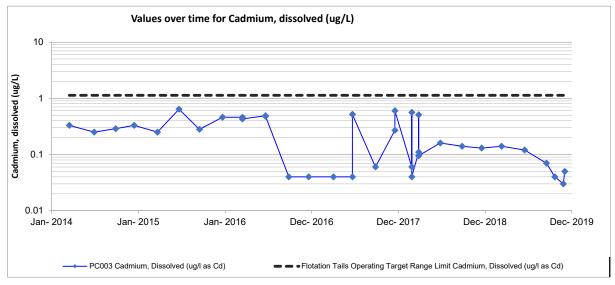
# APPENDIX C – PC001 Graph

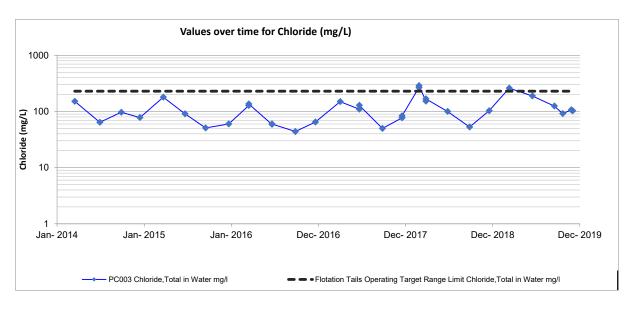


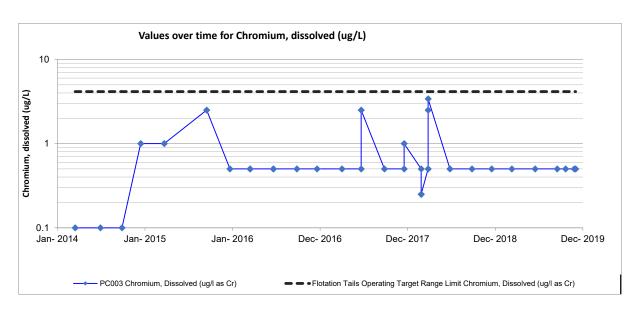


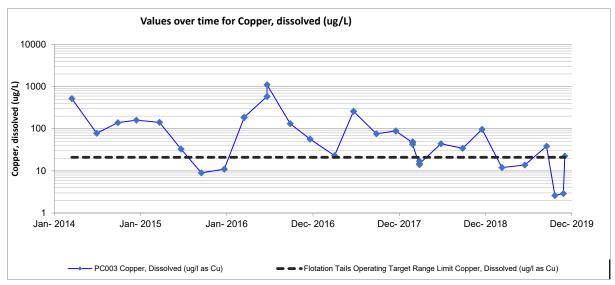
# APPENDIX C – PC003 Interstitial Water Graphs

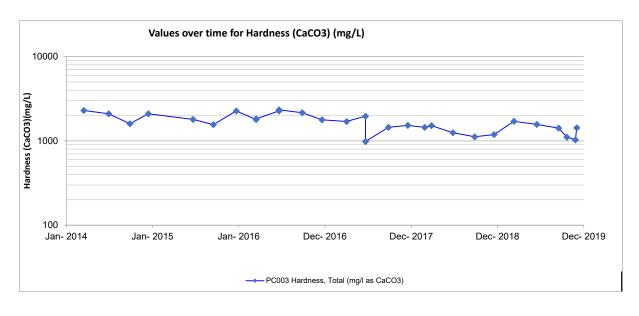


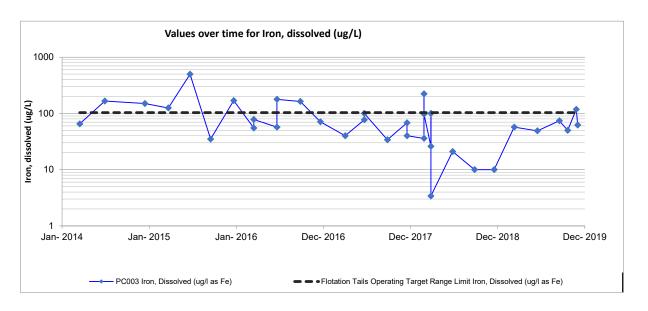


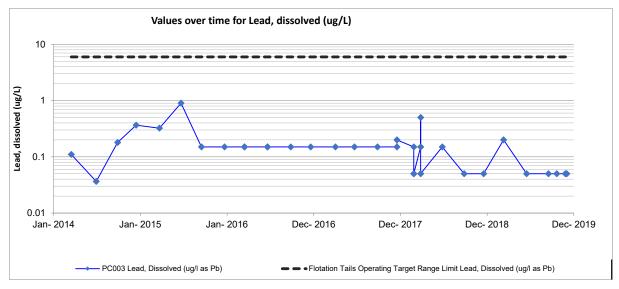


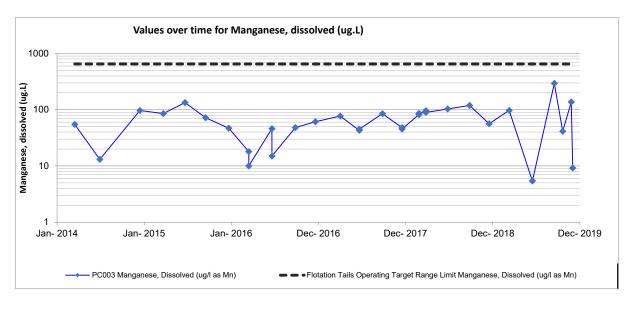


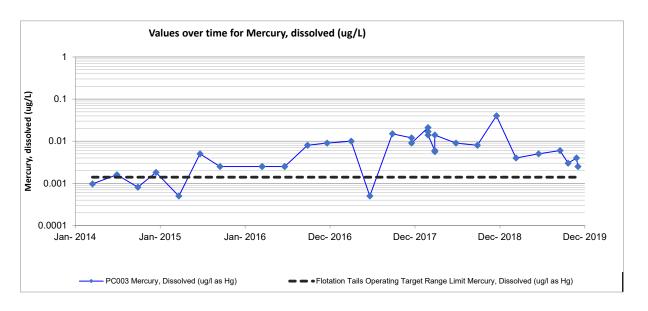


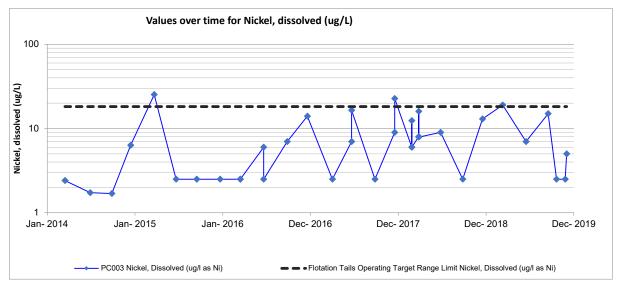


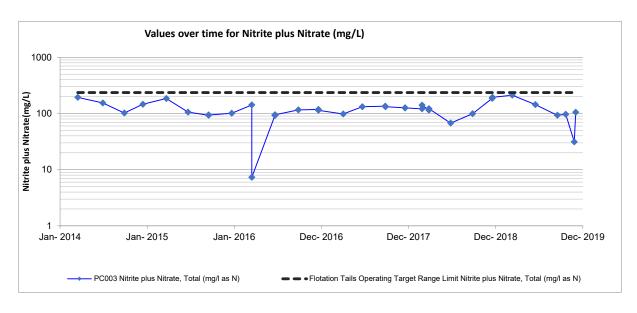


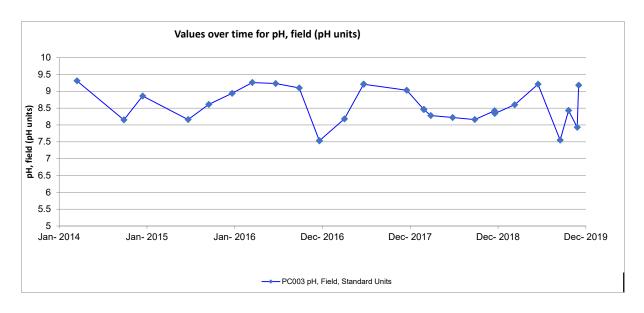


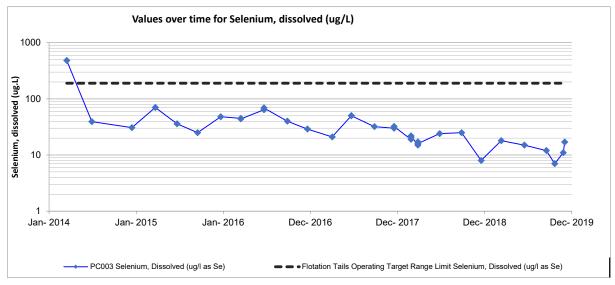


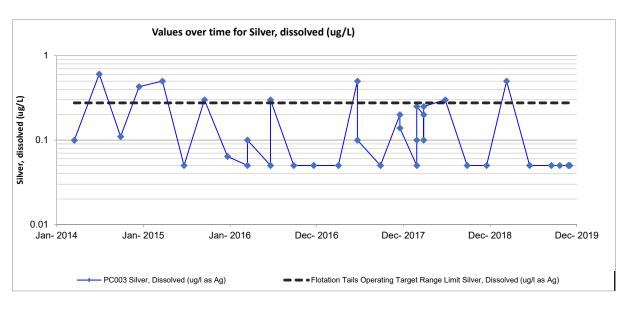


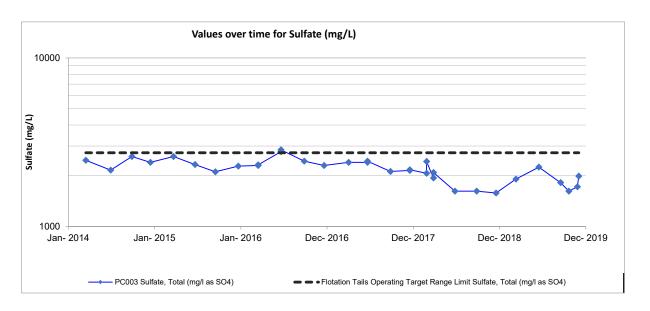


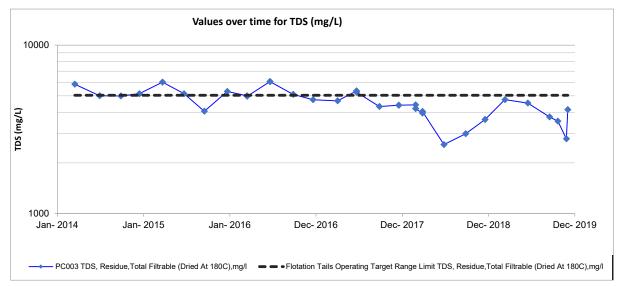


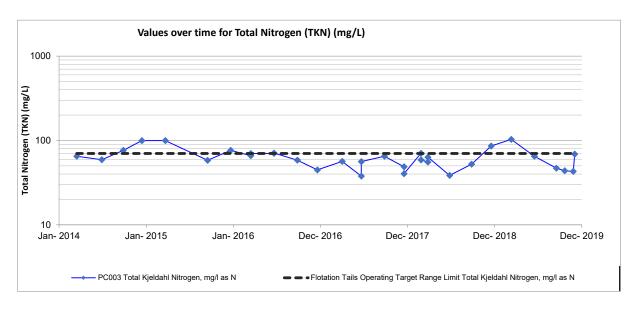


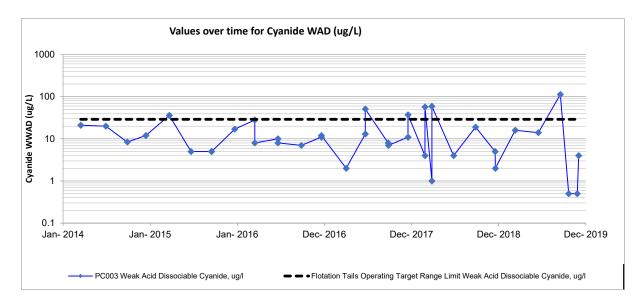


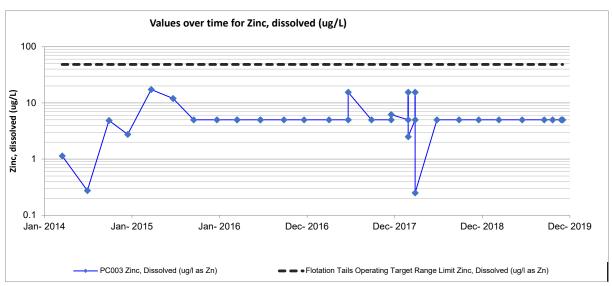














# APPENDIX D 2019 WHOLE EFFLUENT TOXICITY TESTING WET LABORATORY REPORTS



# **AQUATIC TOXICOLOGY REPORT**

Project Name: NORTHERN STAR (POGO) LLC

<u>Location</u>: DELTA JUNCTION, ALASKA

Prepared by: Eurofins TestAmerica - Corvallis

1100 NE Circle Boulevard, Suite 310 Corvallis, Oregon 97330 541-243-6137



Oregon Environmental Laboratory Accreditation Program #OR100022 (NELAP) State of Washington DOE Environmental Laboratory Accreditation Program, Lab ID C556 California State Environmental Laboratory Accreditation Program, Certificate No.: 1726

Report Date: July 16, 2019 Released by: Michelle Bennett

Eurofins TestAmerica – Corvallis Lab I.D. No. B4383

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#### INTRODUCTION

Eurofins TestAmerica – Corvallis (ET-C) Aquatic Toxicology Laboratory conducted toxicity testing on samples from Northern Star (Pogo) LLC .

Testing was initiated on: June 25, 2019

The test was conducted using:

• the fathead minnow (*Pimephales promelas*)

# **OVERVIEW OF REGULATORY GUIDANCE**

The following provides an overview and excerpts of applicable permit specifics, regulatory guidance, and other relevant information. This is intended only as a helpful guide, from a laboratory perspective, for understanding test outcomes. The final responsibility for interpretation of results remains with the client and/or regulatory agency.

The following guidance is taken from ET-C reading of the NPDES permit for Northern Star-Pogo (permit #AK0053341, effective July 1, 2017, expires June 30, 2022).

# **Whole Effluent Toxicity Testing (WET) Requirements:**

- "1.7.2 Chronic toxicity testing must be conducted on grab sample of effluent."
- "1.7.3 Chronic Test Species and Methods"
  - o "1.7.3.1 For Outfall 001, chronic tests must be conducted annually prior to August 1."
  - o "1.7.3.2 ... using the fathead minnow, *Pimephales promelas*."
  - o "1.7.3.3 The presence of chronic toxicity must be determined as specified in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, Fourth Edition (EPA/821-R-02-013, October 2002)."
  - o "1.7.3.4 Results must be reported in TUc, where TUc = 100/IC25."
- 1.7.4 Quality Assurance
  - o 1.7.4.3.1 If organisms are not cultured in-house, concurrent testing with reference toxicants must be conducted. If organisms are cultured in-house, monthly reference toxicant testing is sufficient. Reference toxicant tests must be conducted using the same test conditions as the effluent toxicity tests.
- "1.7.5 A trigger for chronic toxicity of 2 TUc shall apply for the purposes of determining compliance with Permit Part 1.7.6 [accelerated testing] and 1.7.7 [TIE/TRE]."

### SUMMARY OF TEST RESULTS

Exhibit 1 provides a summary of the final test results.

EXHIBIT 1
Summary of Chronic Test Results

Species	NOEC (%)	LOEC (%)	IC <sub>25</sub> (%)	TUc	Was chronic toxicity demonstrated (a TUc value > 2.0)?
P. promelas	50	100	> 100	< 1	No

Note: acronyms are as defined below.

From the NPDES permit - Chronic Toxicity Trigger: "Toxicity Triggers. Since data does not exist to support the development of a WET limit at this time, a target level for chronic toxicity of 2 TUc shall apply ..."

More detailed information is provided in the Results and Discussion section.

# **ACRONYM DEFINITIONS (from EPA guidance):**

NOEC = No Observed Effect Concentration: The highest test concentration that causes no observable adverse effects on the test organisms (i.e. no statistically significant reduction from the control).

LOEC = Low Observed Effect Concentration: The lowest test concentration that does cause an observable adverse effect on the test organisms (i.e. is statistically significant reduction from the control).

 $IC_{25}$  = Inhibition Concentration (25%): A point estimate of the test concentration that would cause a 25 percent reduction of a non-quantal biological measurement (i.e. growth, reproduction, etc.) for the test population.

TUc = Toxic Units (Chronic): Calculated as 100% sample divided by the chronic  $IC_{25}$  value.

# **METHODS AND MATERIALS**

## **TEST METHODS**

The chronic test methods were performed according to: Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition, (EPA 2002), EPA-821-R-02-013.

Additional guidance was provided by:

• *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing* (40 CFR Part 136), (EPA August 2000), EPA 821-B-00-004.

# **DEVIATIONS FROM PROTOCOLS**

Deviations from <u>required</u> procedures in the test methods:

• Due to lab error, the test organisms in the laboratory control were pooled across all replicate test chambers. Therefore, while the survival counts are accurate to the replicate level, the weights obtained cannot be said to accurately represent the individual replicate data. However, the overall average weight in the controls is accurate. Overall variation within the test is typical for the method, test sensitivity is moderate to high, and the data shows increasing test organism weights in all test concentrations at or below the level of regulatory concern (50% effluent)

Deviations from recommended procedures in the test methods:

• None noted.

# **TEST DESIGN**

The following summarizes the conditions used for both overall testing and the specifics for each test (observations and notations can be found on the datasheets in Appendix A):

### Overall Test Design:

Chronic tests: 6.25, 12.5, 25, 50, and 100 percent sample + dilution water for the control.

# **Test Organism Conditions:**

All organisms tested were fed and maintained during culturing, acclimation, and testing as prescribed by the EPA (2002).

The test organisms appeared vigorous and in good condition prior to testing.

# P. promelas chronic test:

- Source: Aquatox Inc., Hot Springs, Arkansas
- Age: Less than 48 hours old and within an 24 hour age range

- Design: Four test vessels per concentration, ten organisms per vessel
- Test Solution Renewal: Daily
- Monitoring:
  - o Daily: Survival
  - o Daily: DO and pH in pre and post-renewal solutions, all concentrations
  - o Daily: Temperature in pre-renewal solutions, all concentrations
  - With each new sample: Conductivity in post-renewal solutions, control and highest sample concentration
- Termination: 7 days after test initiation.
- Endpoints: Survival and Growth (average dry weight per organism added @ initiation)
- Acute Dual-Endpoint: 48 hour Survival (from the 2 day chronic exposure data)

# DILUTION WATER

The dilution water used was the standard culture water used by ET-C:

• Reconstituted, moderately hard water (as per EPA protocol) with a total hardness of 75 to 105 mg/L as CaCO<sub>3</sub> and an alkalinity of 50 to 75 mg/L as CaCO<sub>3</sub>.

### SAMPLE COLLECTION AND STORAGE

Samples were collected by Northern Star (Pogo) LLC personnel. The samples were accepted as scheduled by ET-C. Chain of Custody and Sample Receipt Records are provided in Appendix C.

- All samples were received within the EPA recommended 0 to 6 °C range.
- All samples were initially used for test initiation or test solution renewal within the EPA recommended maximum holding time of 36 hours of sample collection.
- All subsequent uses of a sample occurred within the EPA recommended maximum holding time of 72 hours past the time of initial use of that sample.
- Following receipt, the samples were stored in the dark at 0 to 6 °C until test solutions were prepared and tested.

# SAMPLE PREPARATION

Samples used during these tests were:

• Temperature adjusted prior to test initiation and each daily renewal.

### **DATA ANALYSIS**

The statistical analyses performed for the chronic test were those outlined in *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*, USEPA Office of Water, Fourth Edition (EPA 2002), EPA-821-R-02-013, CETIS.

- The specific statistical analysis and CETIS version used for each endpoint evaluation is listed with the statistical outputs included with each test in Appendix A.
- If any additional analysis methods were also used, an explanation of the rationale and reference to the source method is included with the presentation of those results below.

# **RESULTS AND DISCUSSION**

The raw data sheets for all tests are presented in Appendix A.

# **CHRONIC BIOASSAY**

Table 1 summarizes the survival and reproduction data for the *P. promelas* chronic test.

Su	Table 1 mmary of Chronic Re <i>P. promelas</i>	sults
Sample Concentration (%)	Percent Survival	Mean Dry Weight per Organism Added (mg)
Control	92.5	0.801
6.25	97.5	0.810
12.5	100	0.820
25.0	97.5	0.826
50.0	100	0.921
100	95.0	0.699 <sup>a</sup>
<sup>a</sup> Indicates a statistically sign	nificant difference from	the control at alpha = $0.05$ .

Statistical analysis in accordance with the EPA protocol results in:

- NOEC = 50.0 %
- LOEC = 100 %
- $IC_{25} > 100 \%$
- TUc < 1

From the NPDES permit - *Chronic Toxicity Trigger*: "Toxicity Triggers. Since data does not exist to support the development of a WET limit at this time, a target level for chronic toxicity of 2 TUc shall apply ..."

• The TUc (calculated as =  $100/IC_{25}$ ) did not exceed 2.0.

Note: Due to lab error, the test organisms in the laboratory control were pooled across all replicate test chambers. Therefore, while the survival counts are accurate to the replicate

level, the weights obtained cannot be said to accurately represent the individual replicate data in the controls. However, the overall average weight in the controls is accurate and useful as a baseline for the test. Overall variation within the test is typical for the method (as measured by CV%), test sensitivity is moderate to high (as measured by PMSD), and the data shows increasing test organism weights in all test concentrations at or below the level of regulatory concern (50% effluent). It is ET-C's professional opinion that the data is of sufficient quality to indicate compliance with the permit toxicity trigger.

The dissolved oxygen levels in the chronic tests remained above 4.0 mg/L. Test temperatures remained at  $25\pm1$  °C.

The test meets Test Acceptability Criteria (TAC) for a minimum 80 percent control survival and a minimum weight of 0.250 mg per surviving control organism. Except as referenced above, the *P. promelas* chronic test proceeded without any noted deviations or interruptions that could have affected test results. The testing should be considered "conditionally acceptable".

### REFERENCE TOXICANT TESTS

Reference toxicant (reftox) testing is performed to document both initial and ongoing laboratory performance of the test method(s). While the health of the test organisms is primarily evaluated by the performance of the laboratory control, reftox test results also may be used to assess the health and sensitivity of the test organisms. Reftox test results within their respective cumulative summary (Cusum) chart limits are indicative of consistent laboratory performance and normal test organism sensitivity.

The results of the reftox tests indicate that the test organisms were within their respective cusum chart limits based on EPA guidelines. This demonstrates ongoing laboratory proficiency of the test methods and suggests normal test organism sensitivity in the associated client testing.

The *P. promelas* reftox test was conducted using potassium chloride. The data sheets for the reference toxicant tests are provided in Appendix B.

Table 2 summarizes the reference toxicant test results and Cusum chart limits.

Tal	ole 2	
Chronic Reference	<b>Toxicant Tests</b>	(g/L)
Species	IC <sub>25</sub>	Cusum Chart Limits
P. promelas (survival)	0.61	0.56 to 0.67
P. promelas (growth)	0.57	0.45 to 0.73

# APPENDIX A RAW DATA SHEETS

# FRESHWATER TOXICITY TEST: SAMPLE AND DILUTION WATER DATA

Client	Northern Star	Northern Star	L	#SOS	10770		SDG# B UZ&Z	~	Test Initiation:		Date	61367	0	
Contact	S	Stacy Staley 1.907.895.2761	07.895.276	51		1 1			Test Termination:		Date	17.19		
		Č	1	f										
Sample ID		Date	Collected ate Time		Time	Temp ပြ	Lotal Residual Chlorine (mg/l)	Ammonia	Hardness	Alkalinity	DO (mad)	Hq	Cond.	mn 09
Number	Field ID	(mm/dd/yy)		(mm/dd/yy)	( Pacific		Dechlorination allowed		CaCO <sub>3</sub>	CaCO <sub>3</sub>	(T/Sm)		(cm)	nitered prior to
			Zone)		Zone)	as Rc'vd	as Rc'vd / after Dechlor.	as Rc'vd	as Rc'vd	as Rc'vd	as Rc'vd	as Rc'vd	as Rc'vd	use?
(34383-01 Outfall 001	Outfall 001	612419	19 08:45	61/22/9	11 30	9.0	- 1-20.0	2200	67					<u>\$</u>
-02	-02 Outfall 001	61/92/9	19 08:30	p1/22/9	13:00	4,4	- 1500	25.0	6.2			1		>
-03	-03 Outfall 001	6 128/19	19 09:35	6 129 113	50: 1	90	0.03/ -	0,39	00		6.01	7.1	187	Þ
							/							
							/							
							/							
							/							
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							/							
							/							
							/							
				Reporting Limits:		na	0.02 mg/L	0.10 mg/L	5 mg/L	5 mg/L	na	na	na	na
	Note: "-" Indicates data collection or dechlorination not needed.	data collection or	dechlorination	n not needed. An	y other adju	ustments to	Any other adjustments to samples prior to use are documented in Comments below or on Dilutions page.	documentec	l in Comme	nts below o	or on Dilutic	ons page.		
		Hardness Alkal	Alkalinity Comments:	D	s the action	was taken	Indicates the action was taken, ( $\square$ = action not taken):		# - # = Sa	mple not de	chlorinated	= sample not dechlorinated, or analyte not collected/needed.	not collecte	d/needed.
Dilution Water	#01	mg/l as mg/l as CaCO <sub>3</sub>	l as											
Recon MH (FHM)	M) 4887	9 28												
	4888	967												
			+											
			+											
		Water Q	Water Quality Meters Used/ID#:		Dissolved Oxygen	П	1 # Hd h#	Conductivity	tivity	#				

<b>TestAmerica</b>	1
--------------------	---

# FRESHWATER TOXICITY TEST: TEST ORGANISM INFORMATION

Client	<del>.</del>	Northern Star	 Sample	Designation (SDG): B	4383
Tost Sp	ecies Information	FHM # 20 SZ Pimephales			_
1 est op	ectes information	promelas Chronic			
Organisı	m Age at Initiation	<48 hrs, all within a 24 hour window			
Test	Container Size	400 ml			
Т	est Volume	500 ml			
Feeding:	Type and Amount	0.15 ml <i>Artemia</i> , 2 x Daily			
Aeration:	nbers via Slow Bubble :	None Prior to use  @ hrs			
	imation Period	□ @ hrs <24 hrs			
	anism Source	Aquatox			
	Size	THURSDA -			
Lo	oading Rate	-			
Dissolved Oxy,  Test(s):	gen aeration justification	ns (in test chambers):			

Comments:

# Test Solution Preparation and Dilution Record

Fathead minnow - Chronic

Client: Northern Star

Note: 🗆 Indicates task not done, 🗹 Indicates task was done. Temp adj. = Temperature adjusted to ambient or test temp Ditto marks (''') indicate that the same SDG, batch of dilution water, or food as the previous day's entry was used.

er Date	,	6 /25/2019	1	7 604.19	6 /28/19	02.10	7/2/1/2	188	
Dilution Water	Osed	「大名がず日	日# 7000	日 第 <b>200</b>	D# H D8	10# Z	10% 70% 70% 70% 70% 70% 70% 70% 70% 70% 7	D# 7 * 43	
Daily Sample Preparation	(prior to dilution)	☐ Temp adi, ☐ Aerated	☐ Temp adj, ☐ Acrated	→ ☐ Temp adj, ☐ Aerated	☐ Temp adj, ☐ Aerated	☐ Temp adj, ☐ Aerated	☐ Temp adj, ☐ Aerated	☐ Temp adj, ☐ Aerated	
Sample ID	Osed	BH383-01	B 4383. 01	B438407	B4383-02	B 1 62	B 8	B	
Test	Day	0 (Initiation)	1	2	m	4	5	9	
Final	Volume	(mls)	2000	2000	2000	2000	2000	2000	3875 mls
			1	1	1	1	1	1	day =
Sample	Volume	(mls)	0.00	125	250	200	1,000	2,000	needed per
Test	Concentration	(%)	Control	6.25	12.5	25	50	100	Total Sample volume needed per day =
									Tot

Initials		#	-00	
Time	17:05	200	12 25	00:01
Date	6/2/2019	6 126"19	10.00 TA	7/1/19
Dilution Water Used	日#4887 日本4887	D# 4887	1D# 4888	D# 4%%
_				

	ndom Template Used: 6 conc. x 4 reps. # 10	Waterbath/incubator Used:	Date Initiated 6 /	727	_Time_ <u>14</u>	: 50
minai sa	mple ID B 4383-01 -	#	Date Terminated 7 /	2 /20 19	_Time <b>q</b>	:20
Client	Northern Star		Sample Description	Outfall	001	
Tech:	Day 0 TA Day 1 TA Day 2 TA D	Day 3 TA Day 4 TA Day	5 MB Day 6 MB	Day 7 TA		
Time	Day 0 14:50 Day 1 14:00 Day 2 15:06 Day	Day 3 14 , 60 Day 4 13:30 Day	5 1235 Day 6 1320	Day 7 9'.20		

Tech:	Day 0	<b>TA</b> Day	1 TA Da	y 2 TA	Day 3 TA	_ Day 4	Day 5 1	AB Day 6	MB Day	7 <b>TA</b>		
Time	Day 0	14: SO Day	1 14:00 Da	y 2 15:06	Day 3 14 ! 6	Day 4 13:	30 Day 5 12	35 Day 6 \	320 Day	7 9:20		
Conc.				ive Organisms			plved O <sub>2</sub>	7		Temp.	ID#	Conductivity
or	Day		Trainiber of E	TVC Organishis		(1	mg/1)		pH 	(°C)	m. II	(μS)
Percent		A	В	С	D	Pre	Post	Pre	Post	Pre	Therm.	Post (1st use)
	0	10	10	10	10		8.0		8.1		251	303
1	1	10	10	10	10	6.9	7.7	7.6	7.7		251	
ृत	2	10	9	9	9	7.3	8.0	7.7	7.9	25.0	254	304
Control	3	10	a	9	9	7.4	8.0	7.5	7.7		254	
ඊ	5	10	9	9	9	7.2	7.9	7.5	7.8	-9	254	317
	6	10	9	9	9	7.0	7.5	7.4	7.9		251	
	7	10	9	a	9	70	-	7.2	7.4	24.9	251	
	0	10	10	10	10		8.	1	8.2	Post: 24.9	_	
	1	10	10	10	10	6.8	7.9	7.6	7.9	25.0	_	
	2	10	10	9	10	73	8.1	7.7	8.0	25.0		
ا % %	3	10	15	9	10	7.4	8.1	7.5	7.8	24.9		
6.25 %	4	10	iO	9	10	7.1	8.0	7.5	7.9	24.9		
	5	10	10	9	10	7.1	77	7.4	18	24.7	$\neg$	
	6	10	10	9	(0	4-9	7.8	7.0	7.5	24.7		
	7	10	10	9	10	7.0		73		24.7		
	0	10	10	10	10		8.3	, , , , , , , , , , , , , , , , , , ,	82	Post: 24-8		
	1	10	10	10	/0	7.0	8.0	7.6	7.9	24.8		18814
%	3	15	10	10	10	7.2	8:1	7.7	8.0	24.9	_	
12.5	4	10	10	10	10	7.3	8.2	7.5	7.8	24.9	_	
=	5	10	10	10	10	7.2	- 2	7.5	7.9	25.1	$\dashv$	
	6	10	70	10	100	0.9	7.8	7.4	7.9	24-8	$\dashv$	
	7	10	10	10	10	7.0	(-0	737-5	1-0	24.9	$\dashv$	
	0	10	10	10	10		8.5	COUNTY	181	Post: 24.7	┪	
	1	10	10	10	10	7.0	8.2	7.6	7.9	24.9	$\dashv$	
	2	10	10	10	10	7.1	8.3	77	8.0	25.0	$\dashv$	
%	3	10	io	i o	1 0	73	8.3	76	7.8	24.9	$\dashv$	
25	4	16	10	10	1.0	7-1	8.3	7.5	7.9	25.1	$\neg$	
1 1	5	10	10	10	10	71	7.9	7.4	79	249		
1 1	6	10	10	10	9	6.9	40	7.0	7-6	25,0		
-	7	10	16	10	9	7.1	2.2	7.6		24.9	4	
l t	1	10	10	10	10	7.	89	/	7.9	Post: 24-5	4	
l t	2	10	10	10	/0	7.1	8.3	7.6	7.8	25.0	4	
%	3	10	10	10	10	72	82	7.7	8.0	25.0 25.1	+	
02	4	10	10	1.0	10	71	80	7.5	78	25.1	$\dashv$	
	5	16	10	0	10	7.	8.0	7.4	7.9	74.9	$\dashv$	
1 [	6	10	10	(0)	10	6.9	8.2	7.0	7-6	25.0		
	7	10	10	10	10	71		7.6		24.9		
	0	10	10	10	10		9.6	NATION OF STREET	7.6	Post: 24.3	Ť	190
	1	10	10	10	10	6.9	9.3	7.5	7.5	25.0	1	
。 -	2	10	10	9	10	7.1	8.3	7.7	7.8	25.0		201
100 %	3	/ 10	10	9	10	72	8.1	7.4	7.5	25.0		
=	4	10	10	9	10	7.1	82	7.5	7.5	25.0	1	187
-	6	13	9	GI	19	1.1	83	7.4	77	24.8	1	
	7	10	9	9	10	78	7.9	7-0	7.5	24.9		https://photoscooloomics
		(0		9	Į0	7.0		76		27.7		

 $<sup>\</sup>checkmark$  Indicates one organism inadvertently poured off during solution renewal, replaced into container.

Day 0 Temperatures = Post-renewals Therm ID# = Thermometer ID used for all measurements that day.

Aeration in test chambers begun @ (Note observations on Test Organism Info sheet)

Or we do not know if the fishes in a particular tin for the entrols are not from that particular tin.

The 12/2019 = Temp. out of recommended range 23.8

Sumitomo Pogo Mine - FHM chronic Doc Control ID: ASL899-0917

\* Control fishes have been dumped into water bucket before collecting them in this; EE

Pre =Pre-renewal solutions. Post =Post-renewal solutions. "M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.

<sup>&</sup>quot;F" = fungus noted on dead organisms.

# FATHEAD MINNOW 7-DAY GROWTH DATA

Client		Northern Star		_ Tins Labeled As:	Sumitomo
Lab ID:		B4383		Start Date:	6/25/2019
Sample De	escription:				
		Technician:		JSJ	
		Date:		7/1/2019	_
		Balance Serial #:	B328543647	B328543647	
			Total	Tare	No. of

	Balance Serial #:	B328543647	B328543647	
Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
	A		1092.74	10
Control	В		1116.25	9
Control	C		1072.89	9
	D		1072.17	9
	A		1083.20	10
6.25 %	В		1097.76	10
	C		1111.53	9
	D		1089.33	10
	A		1080.89	10
12.5 %	В		1084.61	10
	C		1080.73	10
	D		1113.49	10
	A		1098.82	10
25 %	В		1093.73	10
	C		1116.17	10
	D		1090.17	9
	A		1098.03	10
50 %	В		1102.22	10
	C		1066.57	10
	D		1080.78	10
	A		1109.08	10
100 %	В		1108.01	9
ļ	С		1109.02	9
	D		1080.60	10
	A			
3	В			
t	C			
ľ	D			

weigh to 0.01 mg

# FATHEAD MINNOW 7-DAY GROWTH DATA

Client	Northern Star		Tins Labeled As:	Sumitomo
Lab ID:	B4383		Start Date:	6/25/2019
Sample Descript	ion:			
	Technician:	JSJ	JSJ	
	Date:	7/3/2019	7/1/2019	
	Balance Serial #:	B328543647	B328543647	

	Balance Senai #:	B328343047	B328343647	
Percent	Replicate	Total Weight (mg)	Tare Weight (mg)	No. of Fish
	A	1100.57	1092.74	10
Control	В	1124.76	1116.25	9
	C	1080.82	1072.89	9
	D	1079.94	1072.17	9
	A	1091.85	1083.20	10
6.25 %	В	1105.70	1097.76	10
	С	1119.37	1111.53	9
	D	1097.31	1089.33	10
	A	1088.40	1080.89	10
12.5 %	В	1092.28	1084.61	10
	С	1089.32	1080.73	10
	D	1122.52	1113.49	10
	A	1107.54	1098.82	10
25 %	В	1102.58	1093.73	10
	C	1124.01	1116.17	10
	D	1097.78	1090.17	9
	A	1106.54	1098.03	10
50 %	В	1112.19	1102.22	10
	C	1075.71	1066.57	10
	D	1089.98	1080.78	10
	A	1116.17	1109.08	10
100 %	В	1114.40	1108.01	9
	C	1115.61	1109.02	9
	D	1088.49	1080.60	10
	A			
	В			
	C			
	D .			

weigh to 0.01 mg

# **CETIS Summary Report**

Report Date:

15 Jul-19 14:22 (p 1 of 2)

Test Code:

B438301ppc | 03-4223-4720

									1000 00001	2.00	oo.po	
Fathead Minn	ow 7-d Larval S	Survival	and Gro	owth	Test					Eurofins Te	stAmerica	- Corvallis
Batch ID:	19-8115-4530		Test Ty	pe: C	Growth-Surviva	ıl (7d)			Analyst: Bre	ett Muckey		
Start Date:	25 Jun-19 14:5	i0 I	Protoco	ol: E	EPA/821/R-02-	013 (2002)			Diluent: Mo	d-Hard Synt	hetic Wate	٢
Ending Date:	02 Jul-19 09:20	) ;	Species	: F	oimephales pro	omelas			Brine:			
Duration:	6d 19h		Source:	P	Aquatox, AR				Age:			
Sample ID:	21-2668-0797	- (	Code:	Е	34383-01				Client:			
Sample Date:	24 Jun-19 08:4	5 I	Material	l: N	Mining Dischar	ge/Runoff			Project:			
Receive Date:	25 Jun-19 11:2	0 :	Source:		Northern Star (	Pogo) LLC (	AK0053341	)				
Sample Age:	30h		Station:									
Comparison S	Summary											
Analysis ID	Endpoint		NC	DEL	LOEL	TOEL	PMSD	TU	Method			
01-3105-1461	7d Survival Rat	te	10	0	>100	NA	8.2%	1		Multiple Com	-	
01-3824-2614	Mean Dry Biom	nass-mg	50		100	70.71	12.2%	2	Dunnett I	Multiple Com	parison Te	st
Point Estimate	e Summary		·Managan									
Analysis ID	Endpoint		Le	vel	%	95% LCL	95% UCL	TU	Method			
11-9468-9418	Mean Dry Biom	nass mg	IC	25	>100	N/A	N/A	<1	Linear Int	erpolation (I	CPIN)	
Test Acceptab	ility											
Analysis ID	Endpoint		Att	tribut	te	Test Stat	TAC Limi	ts	Overlap	Decision		
01-3105-1461	7d Survival Rat	te	Co	ntrol	Resp	0.925	0.8 - NL		Yes		cceptability	Criteria
01-3824-2614	Mean Dry Biom	nass-mg	Co	ntrol	Resp	0.801	0.25 - NL		Yes		cceptability	
11-9468-9418	Mean Dry Biom	nass-mg	Co	ntrol	Resp	0.801	0.25 - NL		Yes		cceptability	OTILOTIC
01-3824-2614	Mean Dry Biom	nass-mg	PΝ	/ISD		0.1219	0.12 - 0.3		Yes	Passes A	cceptability	Criteria
7d Survival Ra	ate Summary											
	Control Type	Count		an	95% LCL	95% UCL	Min	Max		Std Dev	CV%	%Effect
	Dilution Water	4		925	0.8454	1	0.9	1	0.025	0.05	5.41%	0.0%
6.25		4		975	0.8954	1	0.9	1	0.025	0.05	5.13%	-5.41%
12.5		4	1		1	1	1	1	0	0	0.0%	-8.11%
25		4		975	0.8954	1	0.9	1	0.025	0.05	5.13%	-5.41%
50		4	1		1	1	1	1	0	0	0.0%	-8.11%
100		4	0.9	95	0.8581	1	0.9	1	0.02887	0.05774	6.08%	-2.7%
Mean Dry Bior	mass-mg Summ	nary										
	Control Type	Count		an	95% LCL	95% UCL	Min	Max		Std Dev	CV%	%Effect
	Dilution Water	4	0.8		0.7469	0.8551	0.777	0.85		0.03398	4.24%	0.0%
3.25		4		3103	0.7514	0.8691	0.784	0.86		0.03697	4.56%	-1.16%
12.5		4	0.8		0.7039	0.9361	0.751	0.90		0.07298	8.9%	-2.37%
25		4		3255	0.7266	0.9244	0.761	0.88		0.06215	7.53%	-3.06%
50		4	0.9	205	0.8254	1.016	0.851	0.99	7 0.02989	0.05979	6.5%	-14.92%
										0.0000	0 = 00/	40 700/

G small, but 7 low PMSD

12.73%

9.56%

0.06683

0.699

0.5927

0.8054

0.639

0.789

0.03342

100

# **CETIS Summary Report**

Report Date: Test Code: 15 Jul-19 14:22 (p 2 of 2)

B438301ppc | 03-4223-4720

						rest Code:	643630 Ippc   03-4223-4720
Fathead	Minnow 7-d Larval S	Survival a	nd Growth	Гest			Eurofins TestAmerica - Corvallis
7d Surviv	/al Rate Detail						
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4		
0	Dilution Water	1	0.9	0.9	0.9		
6.25		1	1	0.9	1		
12.5		1	1	1	1		
25		1	1	1	0.9		
50		1	1	1	1		
100		1	0.9	0.9	1		
Mean Dry	Biomass-mg Detail	ı					
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4		
0	Dilution Water	0.783	0.851	0.793	0.777		
6.25		0.865	0.794	0.784	0.798		
12.5		0.751	0.767	0.859	0.903		
25		0.872	0.885	0.784	0.761		
50		0.851	0.997	0.914	0.92		
100		0.709	0.639	0.659	0.789		
7d Surviv	al Rate Binomials						
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4		
0	Dilution Water	10/10	9/10	9/10	9/10		
6.25		10/10	10/10	9/10	10/10		
12.5		10/10	10/10	10/10	10/10		
25		10/10	10/10	10/10	9/10		
50		10/10	10/10	10/10	10/10		

Analyst: 3~ QA:\_\_\_\_

100

10/10

9/10

9/10

10/10

Report Date:

15 Jul-19 14:22 (p 1 of 4)

Test Code:

B438301ppc | 03-4223-4720

Fathead Minn	now 7-d Larval S	Survival	and Growth	Test					Eurofins T	estAmeric	a - Corval
Analysis ID:	01-3105-1461		Endpoint:	7d Survival Ra	te		CE	ΓIS Version:	CETISV	1.8.8	
Analyzed:	15 Jul-19 14:2	1 .	Analysis:	Parametric-Co	ntrol vs Trea	atments	Offi	cial Results	: Yes		
Batch ID:	19-8115-4530		Test Type:	Growth-Surviva	al (7d)		Ana	lyst: Bre	t Muckey		
Start Date:	25 Jun-19 14:5	50 I	Protocol:	EPA/821/R-02-	013 (2002)		Dilu	ent: Mod	d-Hard Synt	hetic Wate	r
Ending Date:	02 Jul-19 09:2	0 :	Species:	Pimephales pro	omelas		Brir	ne:			
Duration:	6d 19h	;	Source:	Aquatox, AR			Age	:			
Sample ID:	21-2668-0797		Code:	B4383-01			Clie	nt:			
Sample Date:	24 Jun-19 08:4	5 I	Material:	Mining Dischar	ge/Runoff		Pro	ject:			
Receive Date:	: 25 Jun-19 11:2	20 \$	Source:	Northern Star (	Pogo) LLC	(AK0053341	l)				
Sample Age:	30h		Station:								
Data Transfor	m	Zeta	Alt Hy	p Trials	Seed		PMSD	NOEL	LOEL	TOEL	TU
Angular (Corre	ected)	NA	C > T	NA	NA		8.2%	100	>100	NA	1
Dunnett Multi	ple Comparisor	n Test									
Control	vs C-%		Test St	at Critical	MSD DE	P-Value	P-Type	Decision(	α:5%)		
Dilution Water	6.25		-1.664	2.407	0.118 6	0.9975	CDF	Non-Signi	ficant Effec	t	
	12.5		-2.496	2.407	0.118 6	0.9998	CDF	Non-Signi	ficant Effec	t	
	25		-1.664	2.407	0.118 6	0.9975	CDF	•	ficant Effec		
	50		-2.496	2.407	0.118 6	0.9998	CDF	_	ficant Effec		
	100		-0.8321	2.407	0.118 6	0.9731	CDF	Non-Signi	ficant Effec	t	
ANOVA Table											
Source	Sum Squ	ares	Mean S	Square	DF	F Stat	P-Value	Decision(			
Between	0.045372	19	0.0090	74438	5	1.892	0.1458	Non-Signi	ficant Effec	t	
Error	0.0863178	33	0.00479	95435	18						
Total	0.13169				23						
Distributional	Tests										
Attribute	Test			Test Stat		P-Value	Decision	<del></del>			
Variances	Mod Leve	ene Equa	ality of Variar	ice 1.133	4.248	0.3786	Equal Va				
Variances	Levene E	quality o	f Variance	5.933	4.248	0.0021	Unequal '	Variances			
Distribution	Shapiro-\	Nilk W №	lormality	0.9428	0.884	0.1880	Normal D	istribution			
7d Survival Ra	ate Summary										
	Control Type	Count		95% LCL			Min	Max	Std Err	CV%	%Effec
)	Dilution Water	4	0.925	0.8454	1	0.9	0.9	1	0.025	5.41%	0.0%
3.25		4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	-5.41%
12.5		4	1	1	1	1	1	1	0	0.0%	-8.11%
25		4	0.975	0.8954	1	1	0.9	1	0.025	5.13%	-5.41%
50		4	1	1	1	1	1	1	0	0.0%	-8.11%
		4	0.95	0.8581	1	0.95	0.9	1	0.02887	6.08%	-2.7%
Angular (Corre	ected) Transfor								A 1	O1 /0/	0/ = 44
Angular (Corre	Control Type	Count	Mean	95% LCL		Median	Min	Max	Std Err	CV%	
Angular (Corre		Count 4	<b>Mean</b> 1.29	1.16	1.419	1.249	1.249	1.412	0.04074	6.32%	0.0%
Angular (Corre	Control Type	Count 4 4	Mean 1.29 1.371	1.16 1.242	1.419 1.501	1.249 1.412	1.249 1.249	1.412 1.412	0.04074 0.04074	6.32% 5.94%	0.0% -6.32%
Angular (Corre	Control Type	Count 4 4 4	Mean 1.29 1.371 1.412	1.16 1.242 1.412	1.419 1.501 1.412	1.249 1.412 1.412	1.249 1.249 1.412	1.412 1.412 1.412	0.04074 0.04074 0	6.32% 5.94% 0.0%	0.0% -6.32% -9.48%
C-% 0 6.25 12.5 25	Control Type	4 4 4 4	Mean 1.29 1.371 1.412 1.371	1.16 1.242 1.412 1.242	1.419 1.501 1.412 1.501	1.249 1.412 1.412 1.412	1.249 1.249 1.412 1.249	1.412 1.412 1.412 1.412	0.04074 0.04074 0 0.04074	6.32% 5.94% 0.0% 5.94%	0.0% -6.32% -9.48% -6.32%
Angular (Corre C-% 0 6.25 12.5	Control Type	Count 4 4 4	Mean 1.29 1.371 1.412	1.16 1.242 1.412	1.419 1.501 1.412	1.249 1.412 1.412	1.249 1.249 1.412	1.412 1.412 1.412	0.04074 0.04074 0	6.32% 5.94% 0.0%	%Effec 0.0% -6.32% -9.48% -6.32% -9.48% -3.16%

Report Date:

15 Jul-19 14:22 (p 2 of 4)

Test Code:

B438301ppc | 03-4223-4720

Fathead Minnow	7-d Larval	Survival an	d Growth Test
I atticate milition	/ -u Lai vai	Dui vivai ali	a Olowill lest

**Eurofins TestAmerica - Corvallis** 

Analysis ID:	01-3105-1461	Endpoint:	7d Survival Rate	<b>CETIS Version:</b>	CETISv1.8.8

Analyzed:	15 Jul-19 14:21	Analysis:	Parametric-Control vs Treatments	Official Results: Yes

# 7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	0.9	0.9	0.9
6.25		1	1	0.9	1
12.5		1	1	1	1
25		1	1	1	0.9
50		1	1	1	1
100		1	0.9	0.9	1

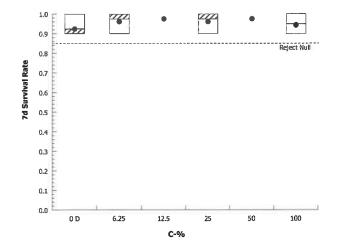
# Angular (Corrected) Transformed Detail

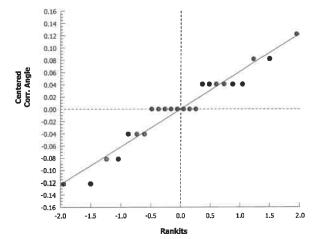
C-%	<b>Control Type</b>	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1.412	1.249	1.249	1.249
6.25		1.412	1.412	1.249	1.412
12.5		1.412	1.412	1.412	1.412
25		1.412	1.412	1.412	1.249
50		1.412	1.412	1.412	1.412
100		1.412	1.249	1.249	1.412

# 7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	9/10	9/10	9/10
6.25		10/10	10/10	9/10	10/10
12.5		10/10	10/10	10/10	10/10
25		10/10	10/10	10/10	9/10
50		10/10	10/10	10/10	10/10
100		10/10	9/10	9/10	10/10

# Graphics





Report Date:

15 Jul-19 14:22 (p 3 of 4)

Test Code:

B438301ppc | 03-4223-4720

Fathead Min	now 7-d Larval	Survival	and Growt	h Test					Eurofins T	estAmeric	a - Corvallis
Analysis ID: Analyzed:	•			•	•			ETIS Version: CETISv1.8.8  ficial Results: Yes			
Batch ID:	19-8115-4530		Test Type:	Growth-Surviv	al (7d)		Ana	l <b>yst:</b> Br	ett Muckey		
Start Date:	25 Jun-19 14:	50	Protocol:	otocol: EPA/821/R-02-013 (2002)			Dilu	ient: Mo	od-Hard Syn	thetic Wate	er
Ending Date:	: 02 Jul-19 09:2	20 :	Species:	Pimephales promelas			Brir	ne:			
Duration:	6d 19h		Source:	Aquatox, AR			Age	:			
Sample ID:	21-2668-0797		Code:	B4383-01			Clie	nt:			
Sample Date	: 24 Jun-19 08:	45 I	Material:	Mining Dischar	rge/Runoff		Pro	ject:			
	: 25 Jun-19 11:	20 \$	Source:	Northern Star (	(Pogo) LLC	(AK005334	1)				
Sample Age:	30h		Station:								
Data Transfo		Zeta	Alt H	p Trials	Seed		PMSD	NOEL	LOEL	TOEL	TU
Untransforme	d	NA	C > T	NA	NA		12.2%	50	100	70.71	2
Dunnett Mult	iple Compariso	n Test									
Control	vs C-%		Test S	tat Critical	MSD DI	F P-Value	P-Type	Decisio	n(α:5%)		
Dilution Water			-0.228	1 2.407	0.098 6	0.8917	CDF	Non-Sig	nificant Effec	t	
	12.5		-0.468	5 2.407	0.098 6	0.9351	CDF	Non-Sigr	nificant Effec	:t	
	25		-0.604	2.407	0.098 6	0.9526	CDF	Non-Sigr	nificant Effec	t	
	50		-2.946		0.098 6	1.0000	CDF	Non-Sigr	nificant Effec	t	
	100*		2.514	2.407	0.098 6	0.0408	CDF	Significa	nt Effect		
ANOVA Table	<b>:</b>										
Source	Sum Squ	ares	Mean	Square	DF	F Stat	P-Value	Decision	η(α:5%)		
Between	0.099631	73	0.0199	2635	5	6.053	0.0019	Significa	nt Effect		
Error	0.059256	59	0.0032	92033	18	_					
Total	0.158888	3			23						
Distributional	I Tests										
Attribute	Test			Test Stat		P-Value	Decision	(α:1%)			
Variances			f Variance	2.384	15.09	0.7938	Equal Var				
Distribution	Shapiro-	Wilk W N	ormality	0.9319	0.884	0.1074	Normal D	istribution			
Mean Dry Bio	mass-mg Sumr	nary									
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Dilution Water	4	0.801	0.7469	0.8551	0.788	0.777	0.851	0.01699	4.24%	0.0%
6.25		4	0.8103		0.8691	0.796	0.784	0.865	0.01849	4.56%	-1.16%
12.5		4	0.82	0.7039	0.9361	0.813	0.751	0.903	0.03649	8.9%	-2.37%
25		4	0.8255		0.9244	0.828	0.761	0.885	0.03107	7.53%	-3.06%
		4	0.9205	0.8254	1.016	0.917	0.851	0.997	0.02989	6.5%	-14.92%
				0.5007	0.00=4	0.004					12.73%
100		4	0.699	0.5927	0.8054	0.684	0.639	0.789	0.03342	9.56%	
100 Mean Dry Bio	mass-mg Detail	4		0.5927	0.8054	0.684	0.639	0.789	0.03342	9.56%	
100 Mean Dry Bio C-%	Control Type	4 Rep 1	0.699 <b>Rep 2</b>	Rep 3	Rep 4	0.684	0.639	0.789	0.03342	9.56%	
100 Mean Dry Bio C-%	_	Rep 1 0.783	0.699 <b>Rep 2</b> 0.851	Rep 3 0.793	Rep 4	0.684	0.639	0.789	0.03342	9.56%	
Mean Dry Bio C-% 3.25	Control Type	Rep 1 0.783 0.865	0.699  Rep 2  0.851  0.794	Rep 3 0.793 0.784	<b>Rep 4</b> 0.777 0.798	0.684	0.639	0.789	0.03342	9.56%	
100 Mean Dry Bio C-% 0 6.25 12.5	Control Type	Rep 1 0.783 0.865 0.751	0.699  Rep 2  0.851  0.794  0.767	Rep 3 0.793 0.784 0.859	Rep 4 0.777 0.798 0.903	0.684	0.639	0.789	0.03342	9.56%	
Mean Dry Bio C-% 0 6.25 12.5	Control Type	Rep 1 0.783 0.865 0.751 0.872	0.699  Rep 2  0.851  0.794  0.767  0.885	Rep 3 0.793 0.784 0.859 0.784	Rep 4 0.777 0.798 0.903 0.761	0.684	0.639	0.789	0.03342	9.56%	
50 100 <b>Mean Dry Bio</b> <b>C-%</b> 0 6.25 12.5 25 50	Control Type	Rep 1 0.783 0.865 0.751	0.699  Rep 2  0.851  0.794  0.767	Rep 3 0.793 0.784 0.859	Rep 4 0.777 0.798 0.903	0.684	0.639	0.789	0.03342	9.56%	

Report Date:

15 Jul-19 14:22 (p 4 of 4)

**Test Code:** B438301ppc | 03-4223-4720

# Fathead Minnow 7-d Larval Survival and Growth Test

**Eurofins TestAmerica - Corvallis** 

Analysis ID: Analyzed:

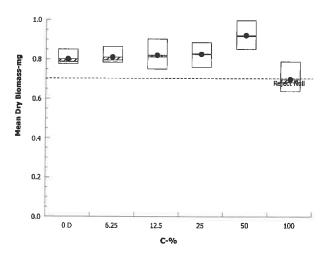
01-3824-2614 15 Jul-19 14:21 Endpoint: Mean Dry Biomass-mg

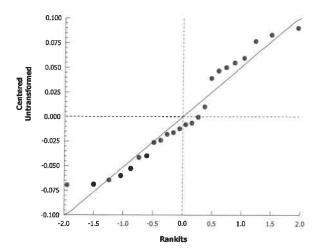
Analysis: Parametric-Control vs Treatments

**CETIS Version:** Official Results: Yes

CETISv1.8.8

# Graphics





Report Date:

15 Jul-19 14:22 (p 1 of 1)

Test Code:

B438301ppc | 03-4223-4720

Fathea	d Minn	ow 7-d Larval S	urvival an	d Growt	h Test					E	urofins TestAmerica - Corvallis
Analysis ID: 11-9468-9418 End		dpoint:	nt: Mean Dry Biomass-mg				CETIS Version: CETISv1.8.8				
Analyz	ed:	15 Jul-19 14:2°	1 An	alysis:	Linear Interpola	ation (ICPIN	1)		Official Re	sults:	Yes
Batch	ID:	19-8115-4530	Tes	t Type:	Growth-Surviva	al (7d)			Analyst:	Brett	Muckey
Start Date: 25 Jun-19 14:50 Prot			tocol:	EPA/821/R-02-013 (2002)				Diluent: Mod-Hard Synthetic Water			
Ending	Ending Date: 02 Jul-19 09:20 Spe		ecies:	Pimephales promelas				Brine:			
Duratio	on:	6d 19h	So	ırce:	Aquatox, AR				Age:		
Sample	e ID:	21-2668-0797	Co	de:	B4383-01				Client:		
Sample	e Date:	24 Jun-19 08:4	5 Ma	erial:	Mining Dischar	ge/Runoff		ı	Project:		
Receiv	e Date:	25 Jun-19 11:2	O <b>So</b> i	ırce:	Northern Star (	Pogo) LLC	(AK005334	41)			
Sample	e Age:	30h	Sta	tion:							
Linear	Interpo	lation Options									
X Trans	sform	Y Transform	See	d	Resamples	Exp 95%	CL Me	thod			
Log(X+	1)	Linear	214	3973	200	Yes	Two	o-Point Ir	terpolation		
Point E	stimate	s									
Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL					
IC25	>100	N/A	N/A	<1	NA	NA					
Mean D	ry Bion	nass-mg Summ	агу			Cal	culated V	ariate			
C-%	Co	ontrol Type	Count	Mean	Min	Max	Std Err	Std D	ev CV%		%Effect
0	Di	lution Water	4	0.801	0.777	0.851	0.01699	0.033	98 4.249	6 (	0.0%
6.25			4	0.8103	0.784	0.865	0.01849	0.036	97 4.56%	6 .	-1.16%
12.5			4	0.82	0.751	0.903	0.03649	0.072	98 8.9%		-2.37%
25			4	0.8255	0.761	0.885	0.03107	0.062	15 7.53%	6 -	-3.06%
50			4	0.9205	0.851	0.997	0.02989	0.059	79 6.5%	-	-14.92%

# Mean Dry Biomass-mg Detail

_C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.783	0.851	0.793	0.777
6.25		0.865	0.794	0.784	0.798
12.5		0.751	0.767	0.859	0.903
25		0.872	0.885	0.784	0.761
50		0.851	0.997	0.914	0.92
100		0.709	0.639	0.659	0.789

4

0.699

0.639

0.789

0.03342

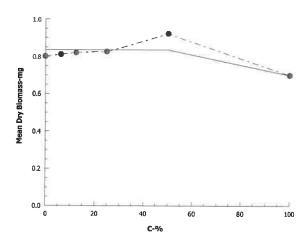
0.06683

9.56%

12.73%

# Graphics

100



# APPENDIX B REFERENCE TOXICANT DATA SHEETS

	T										
	IOST/	America		FATHEAD I	MINNOW 7-DAY	Y SURVIVAL A	ND WATER Q	UALITY DATA			RAG TAG
R	andom '	Template Used:	6 сопс. х 4 гер:	s.# 3	Wa	terbath/incubator	Used:	Date Initiated	le 1251	20   Tim	· 15:50
		28076				# 7		Date Terminated	7/2/	20 19 Tim	e 11 :05
		FHM 205			_	Te	- st Container Size	e: 800 ml	Sol	lution Volume / rep	: 500 ml
Client			QA/Q	- C - Ref	Гох		Si	ample Description	=0 1	KCl (50 g/L stock	)
Dl.	D- 0	70 0	700	170 p	1 (TA)	170		Day 6 TKAC Day 6	β <sub>Dau</sub> 7 37Δ		,
Fech:	Day 0	Day	Day	2 <u>         </u>	ay 3 11 11 D	12'24 1	Day 3 MO	delice 1215 Mile	Sau 7 II' D	5	
Conc.	Day	Day Day	117.20 Day	2 [3, 20]	ay 3 17.75 L	Diag 4 12.00 1	lved O <sub>2</sub>	Day 0 13 13 141	Day / VI. V	T *	Conductivity
OF	Day		Number of L	ive Organisms		50	ng/l)	I	Н	Temp.	(µS)
Percent		A	В	С	D	Pre	Post	Pre	Post	Pre 🛱	Post (daily)
	0	10	10	10	10		8.		7.3	Post: 25 · 1 254	
-	1	10	10	10	10	7.2	8.0	*	7.9	24.8 253	
-	2	10	10	10	/0	7.4	7.9	7.7	7.7	24.3 253	
Control	3	10	10	10	10	7.6	7.9	7.7	7.8	24-3 253	
වී	4	10	10	10	10	7.5	8.0	7.7	7.9	24.2 253	
	5	10	10	10	10	7.6	7.9	177	80	24.2 253	316
	6	ĮD.	1.0	10	10	7.3	8.0	7.8	7.9	24   253	316
	7	10	10	10	10	7-2		7.3		24.2 253	
	0	10	10	10	10	7.0	8.		8.1	Post: 25-1	820
	_1	10	7.0	16	10	7.2	8.0	*-	8.2	24.5	791
g/L	2	10	10	10	10	7.3	8.0	7.7	8.1	24.4	809
80	3	10	10	9	10	7.4	7.9	7:7	8.0	24.3	821
0.25	4	10	10	G G	10	7.2	79	7.8	8.2		799
-	5	10	10	9	10	7.6	77	> >	7.9	24.6	800
-	7	10	10	9	10	7.1		7.5		24.3	000
-	$\rightarrow$	10			10		8.	7-5	8.3	Not: 25.2	1261
}	0	10	10	10	10	7.1	8.0	*	82	24.4	1283
ł	2	10	10	10	10	73	8.0	7.7	8.2	24.6	1261
g/L	3	10	10	10	10	75	8.0	78	8.1	24.6	1251
0.50	4	10	16	10	10	73	8.0	78	83	24.2	1264
0	5	4	10	10	10	7.4	8.0	78	8 3	24.2	1255
ŀ	6	a	10	61	1	7.4	7.8	7.7	8.0	24.4	1231
ŀ	7	9	10	10	10	71	HERE, IA WEST	7.6	THE STEEL	24.3	
	0	10	10	10	10		81		8.4	Post 25,3	2210
ŀ	1	-	3	L	TO EST OF A	7.1	9:0	×	0.2	244	2200

80

8.0

8.0

8.0

7 2

71

7.3

✓ Indicates one organism inadvertently poured off during solution renewal, replaced into container.

"M" = organism missing, start count reduced. "Inj" = organism injured, remove from stats.

3

10

0

10

ō

10

0

10

10

0

10

O

Pre =Pre-renewal solutions. Post =Post-renewal solutions.

"F" = fungus noted on dead organisms. Endpoint

2

3

4 5

6

7

0

2

0

1

2

0

10

0

10

0

1.0 g/L

2.0 g/L

4.0 g/L

Survival - EC<sub>25</sub> Growth - IC25

0.61

**Cusum Chart Limits** 

Day 0 Temperatures = Post-renewals

24.5

24.3

24.8

24.4

25.3

24.5

= 25.3

24.3

200

3990 3910

7510 7270

Therm ID# = Thermometer ID used for all measurements that day.

23.8

Task Manager

8.5

8.5

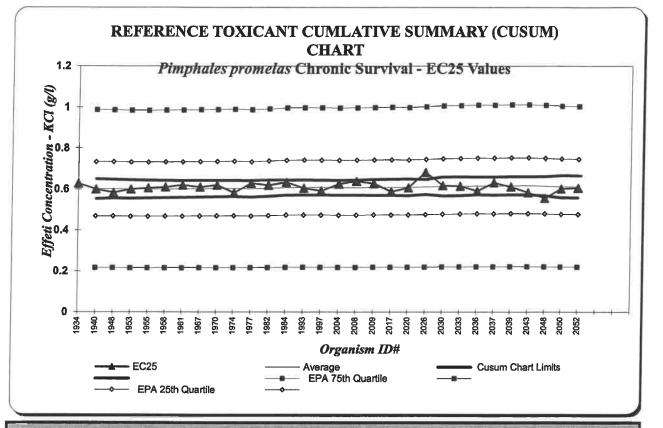
Project Manager

¥

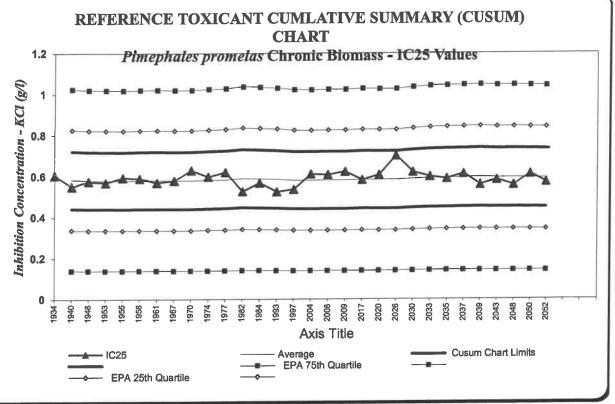
75

QA Officer REFTOX - FHIM

= Temp. out of recommended range Ahmed



Pimeph	ales prom	elas - Chron	nic (EPA Te	st Method	1000.0)					
POTASS	IUM CHLO	ORIDE (g/L)				From I	EPA 833-R-00	0-003:		
Endpoint:	Chronic Sur	vival			10th Quartile CV (control limit) = 0					
Stats Meth	od: Linear I	nterpolation			25th Quartile CV (warning limit) = 0.1					
Test Condi	tions: Recor	MH, 25-oC			75th Quartile CV (warning limit) = 0,3					
					90th Quartile CV (control limit) =					
T* # \$2%	a zirre 💝	് പൂർ ഗ <b>ുത്</b> രി വ		Zorost 1 o						
Intraja			Warning limits		A STATE OF THE			THE WASHINGTON		
			EPA Control li							
Event	FHM	Test Start	EC25	Running				Intralab		
上 推出。	ID#	Date	LALVIN T	Average	SD	AVG-2SD	AVG+2SD	CV		
28	2008	10/2/2018	0.638	0.6	0.02	0.571	0.644	0.03		
29	2009	10/4/2018	0.63	0.6	0.02	0.57	0.65	0.03		
30	2017	11/6/2018	0.59	0.6	0.02	0.57	0.65	0.03		
31	2020	12/4/2018	0.61	0.6	0.02	0.57	0.65	0.03		
32	2026	1/15/2019	0.68	0.6	0.02	0.57	0.65	0.04		
33	2030	1/29/2019	0.62	0.6	0.02	0.57	0.66	0.04		
34	2033	2/12/2019	0.62	0.6	0.02	0.57	0.66	0.04		
35	2036	3/5/2019	0.59	0.6	0.02	0.57	0.66	0.04		
36	2037	3/14/2019	0.63	0.6	0.02	0.57	0.66	0.04		
37	2039	3/26/2019	0.61	0.6	0.02	0.57	0.66	0.04		
38	2043	4/16/2019	0.58	0.6	0.02	0.57	0.66	0.04		
39	2048	5/30/2019	0.56	0.6	0.02	0.57	0.66	0.04		
40	2050	6/11/2019	0.60	0.6	0.03	0.56	0.67	0.04		
41	2052	6/25/2019	0.61	0.6	0.03	0.56	0.67	0.04		
42										
43										



POTASSIUM CHLORIDE (g/L)	From EPA 833-R-00-0	03:
Endpoint: Chronic Growth (Biomass)	10th Quartile CV (control limit) =	0.12
Stats Method: Linear Interpolation	25th Quartile CV (warning limit) =	0.24
Test Conditions: Recon MH; 25°0C	75th Quartile CV (warning limit) =	0:38.
	90th Quartile CV-(control limit)=	0.45

Event	FHM	Test Start	- L. A.A.	Running	Running	Cusum Cl	nart Limits	Intralab	
s. #	ID.#	Date	IG25	Average	SD	AVG-2SD	AVG+2SD	CY	
28	2008	10/2/2018	0.61	0.58	0.03	0.44	0.72	0.05	
29	2009	10/4/2018	0.62	0.58	0.03	0.44	0.72	0.05	
30	2017	11/6/2018	0.58	0.58	0.03	0.44	0.72	0.05	
31	2020	12/4/2018	0.61	0.58	0.03	0.44	0.72	0.05	
32	2026	1/15/2019	0.70	0.58	0.03	0.44	0.72	0.07	
33	2030	1/29/2019	0.62	0.59	0.04	0.45	0.73	0.07	
34	2033	2/12/2019	0.60	0.59	0.04	0.45	0.73	0.07	
35	2035	3/5/2019	0.59	0.59	0.04	0.45	0.74	0.07	
36	2037	3/14/2019	0.61	0.59	0.04	0.45	0.74	0.07	
37	2039	3/26/2019	0.56	0.60	0.04	0.45	0.74	0.07	
38	2043	4/16/2019	0.58	0.59	0.04	0.45	0.74	0.07	
39	2048	5/30/2019	0.56	0.59	0.04	0.45	0.74	0.07	
40	2050	6/11/2019	0.61	0.59	0.04	0.45	0.74	0.07	
41	2052	6/25/2019	0.57	0.59	0.04	0.45	0.73	0.07	
42								THE WHI	
43									

### APPENDIX C CHAIN OF CUSTODY



TestAmerica			Sample Rece	eipt Record
Batch Number: 34383-01 Client/Project: Northen Star (Page 1)	90)	Date Received:	BAUN	6-25-19
Were custody seals intact?			Yes [	No N/A
Packing Material:			Ice Blue	e Ice Box
Temp OK? (<6°C) Therm ID: Third Expires: 7/12	/ 2019 Observed: 4.1	°C, Actual Temp: 4.	o°C X Yes □ I	No N/A
Was a Chain of Custody (CoC) Provided?			Yes 🗌 1	No N/A
Was the CoC correctly filled out? (If No, document t	below)		Yes 🗌 I	No N/A
Were the sample containers in good condition (not bro	oken or leaking)?		Yes 🗌 1	No N/A
Are all samples within 36 hours of collection?			Yes 🗆 1	No N/A
Method of Shipment: Hand Delivered,	FedEx, UPS,	Greyhound,	Other: City Octive	sy N/A
Sample Exception	on Report (The followi	ing exceptions were note	ed)	
Client was notified on: Client c	ontact:			
Resolution to Exception:				

## CHAIN OF CUSTODY RECORD - FOR AQUATIC TOXICITY TESTING

eurofins ...

Client Northan Stan De Sancos Pol NPDES# AKOOS 334 Address 10 Box

Delta Tunchan - Nh 9973

Total Hours-Contact Person: Datham

Phone:

#0d

Composite Sample Information Volume/Sample-Total Volume -Time Chilled During Collection Date Initiated: Date Samples/Hour-Ended:

### **Environment Testing TestAmerica**

Ship Samples to:

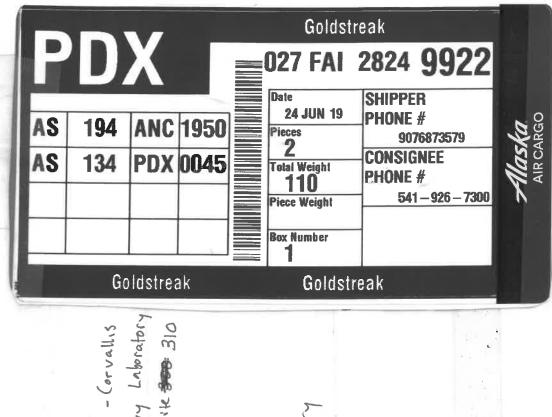
Eurofins TestAmerica - Corvallis

Attention: Aquatic Toxicology Laboratory 1100 NE Circle Blvd, Suite 310

Corvallis, OR 97330

Phone: 541.243.6137

ments	Concentration and/or	Comments	1 5 C S C S C S C S C S C S C S C S C S C	B4383-01					Date/Time	Je.	Date/Time	Shipping #		22 Doc Control ID: ASL612-0519	
Analysis Required / Comments	hronic Acute Chronic	Trout SHM MPS MPS MPS MPS MPS MPS MPS MPS MPS MP						6	hed By (Please sign and print name)	(Please s	ned By (Please sign and print name)	Via	Bus Fed-Ex Hand Other	25 gallon & For In ea	
	of ainer sad Acute sad Chronic Acute	Cont	_						Date/Time Relinquished By	Date/Time Relinquished By	Date/Time Relinquished By	Date/Time Shipped Via	UPS	Remarks 2. Cochens - w/	
C10011-0475	Sample Type	le Comp. Grab	1 34						(Please sign and print name)	(Please sign and print name)	Please sign and print name)	(Please sign and print name)		(Please sign and print name)	
Project Code C.		Sample ID Date Time	Juttailod 6-24-19 0848						ampled By & Title (Please sign a		Received By GMw-XMI	Received By (Please		Work Authorized By (Please	



Eurofins Test-America - Corvallis
Attn: Aquatic Toxicology Laboratory
1100 NE Cirde Blud. Suite 800 310
Corvallis, OR 97330
(541) 243 - 6137

(s41) 926-7300

Northern Ster (Pego) LLC 3204 International St. Fairbunts, AK 99701

П				9-00		uoiusii	eak	
	F	U	X		027	FAI	2824	9922
П					Date		SHIPPE	R
П	AS	194	ANC	40E0	24 .	JUN 19	PHONE	#
Н	MO	194	ANU	1950	Pieces		907	76873579
II	AS	134	DDV	0045	Z		CONSIG	
I	NO	104	LDV	0045	Tetal W	reight O	PHONE	
I					Discuss 1	U	5/1	"   <b>- 926 - 73</b> 00
ı					Piece V	veignt	- 04	- 320 - 7300
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L		1						
		G	oldstrea	ak	(	Goldstr	eak	
1000		G	oldstrea	ak	2	JUN 19 Veight Weight mber	l eak	

Executed On (Date)

at (Place)

Signature of Issuing Carrier or its Agent

027-2824 9922



### **Sample Receipt Record**

Batch Number: B4383 - Bt 02 6-27-19  Client/Project: Novahern Star	Date Received: (a-27-19  Received By: US
Were custody seals intact?	Yes No N/A
Packing Material:	Ice Blue Ice Box
Temp OK? (<6°C) Therm ID+11173 Expires: 7 / 12 / 20 (CObserved: 4.7)	°C, Actual Temp: 4 4 °C S Yes No N/A
Was a Chain of Custody (CoC) Provided?	Yes No N/A
Was the CoC correctly filled out? (If No, document below)	Yes No N/A
Were the sample containers in good condition (not broken or leaking)?	Yes No N/A
Are all samples within 36 hours of collection?	Yes No N/A
Method of Shipment:	Greyhound, Other: Ostybelveny N/A
Sample Exception Report (The followin	a exceptions were noted)
Client was notified on: Client contact:	
Resolution to Exception:	

## CHAIN OF CUSTODY RECORD - FOR AQUATIC TOXICITY TESTING

S
-
$\subseteq$
<b>3</b>
<i>—</i>
60.0
100
10 (0)

**Environment Testing** 

**TestAmerica** 

Ship Samples to:

Composite Sample Information

NPDES# 1/20053341

Client Morthen Star (Page) LLC

De Ha Trucken

Address 1/0

Volume/Sample-

Samples/Hour-

Total Hours-

Total Volume

Time Time

Date

Ended:

Initiated: Date

Stales

Contact Person: Stack

Phone: 967 895 × 276

Attention: Aquatic Toxicology Laboratory Eurofins TestAmerica - Corvallis 1100 NE Circle Blvd, Suite 310

Corvallis, OR 97330

Phone: 541.243.6137

		Analysis Required / Comments
Chilled During Collection	S2h0'11	
	10017 000 1000 C1001	0

Concentration Comments Date/Time **Haz Waste** Relinquished By (Please sign and print name) SA Haz Waste Algae MYS Chronic **MYS Acute** MB Chronic MB Acute SHM Chronic SHM Acute Frout Acute Saphnia Acute Cerio Chronic Cerio Acute Fathead Chronic Fathead Acute #□ 84383-62 Container B Date/Time K jo # Grab Sample Type Sampled By & Title (Please sign and print name) Comp. 0830 Time 6-26-19 Date 的相对 24+4011001 State Sample ID

25:01	47003					Doc Control ID: ASL612-0519	
6-26-19	Date/Time	Date/Time		Shipping #			
$\overline{}$	Refinduished By (Please sign and print name)	Relinquished By (Please sign and print name)	_	Shipped Via	UPS Bus Fed-Ex Hand Other	pH 759 & Temp 12.90 @ collection	
62.19 16.55	Date/Time	Date/Time	200	Date/ I ime		Remarks pH	
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2 coolers



### **Environment Testing TestAmerica**

### Sample Receipt Record

Batch Number: <u>B</u> 4383-03	Date Received: 6-29-19
Client/Project: Northern Star (Rogs)	Received By: 43
Were custody seals intact?	Yes No N/A
Packing Material:	Ice Blue Ice Box
Temp OK? (<6°C) Therm ID: Expires: / /20 Observed: 4	℃, Actual Temp: 3%°C
Was a Chain of Custody (CoC) Provided?	Yes No N/A
Was the CoC correctly filled out? (If No, document below)	Yes No N/A
Were the sample containers in good condition (not broken or leaking)?	Yes No N/A
Are all samples within 36 hours of collection?	Yes No N/A
Method of Shipment:	Greyhound, Other: Cthy delson N/A
Sample Exception Report (The follo	wing exceptions were noted)
AS 124 SEA 1755 AS 3330 PDX 0600 Client was Resolution  Client was Resolution	9076873579 CONSIGNEE PHONE #

## CHAIN OF CUSTODY RECORD - FOR AQUATIC TOXICITY TESTING

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**Environment Testing TestAmerica** 

Ship Samples to:

Composite Sample Information

NPDES# AK005334

Client Northern Star (Page) LLL

PO BOX 145

Address

Volume/Sample-Total Volume

Samples/Hour-Total Hours-

99737

Delta Junction, AK

Time

Initiated: Date

Eurofins TestAmerica - Corvallis

Attention: Aquatic Toxicology Laboratory 1100 NE Circle Blvd, Suite 310

Corvallis, OR 97330

Phone: 541.243.6137

Analysis Required / Comments Time Chilled During Collection Date Ended: project code: Cloon ou75 Contact Person: Nathan Kehoe Phone: 907-895-2760 PO# 2001125

				_	_	_	_			_	_				_	т	_
Concentration and/or	Comments											Date/Time 66/28/19 10:25	06/xe/19 3:30,pm	Date/Time	Shipping #	COG Bionssov xls	Doc Control ID: ASL 612-0519
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PH- 7.50, temp: 14,8 @ collection



July 10, 2019

Ms. Stacy Staley
Northern Star Resources Limited, Pogo Operations
P.O. Box 145
Delta Junction, Alaska 99737

RE: Results of WET test – July 2019

Dear Ms. Staley,

Attached is a copy of the report for the *Pimephales promelas* (fathead minnow) toxicity test initiated in June 2019 with effluent from your facility.

TRE Environmental Strategies, LLC greatly appreciates this opportunity to provide our services to you. Please do not hesitate to call if you have any questions.

Sincerely,

Whitney Naddy

Report Author

naddywm.tre@gmail.com

Rami B. Naddy, Ph.D.

Manager/Environmental Toxicologist

naddyrb.tre@gmail.com

**Enclosures** 

14001-412-028





### Report of Short-Term Chronic Toxicity Testing using the Fathead Minnow (*Pimephales promelas*)

Project ID: 14001-412-028 June / July 2019

### **Sponsor and Laboratory Information**

	Northern Star Resources Limited
0	Pogo Operations
Sponsor	P.O. Box 145
	Delta Junction, AK 99737
Project Officer	Stacy Staley (907) 895-2761
	TRE Environmental Strategies, LLC
	100 Racquette Drive, Unit A
Testing Facility	Fort Collins, CO 80524
, 551	Fax: (970) 490-2963
	State of Florida NELAP Laboratory ID: E87972
Study Director	Rami B. Naddy, Ph.D. (970) 416-0916 email: naddyrb.tre@gmail.com
	Whitney Naddy (970) 416-0916 email: naddywm.tre@gmail.com
Report Author	William Haday (070) 410 0010 Sillam Haday Wall

### **Test Information**

Test Basis Test Dates and Time Test Length Species Test Material Outfall Permit Number Receiving Stream Dilution Water Test Concentrations	Short-Term Chronic under Static-Renewal Conditions USEPA (2002), method 1000.0 June 25, 2019 @ 1415 to July 2, 2019 @ 1430 7 days Pimephales promelas Effluent (Grab) 001 AK-005334-1 Goodpaster River Moderately Hard Reconstituted Water MH, 12.5, 25, 50, 75, and 100% effluent 100% effluent
Permit Compliance	X_PassFail

- Results described in this report apply only to the samples submitted to the laboratory and analyzed, as listed in the report
- Test results comply with NELAC standards. Reports are intended to be considered in their entirety; TRE is not responsible for consequences arising from use of a partial report
- This report contains 6 pages plus 2 appendices

### **Effluent Collection and Receipt**

Sample	Field No.	Collection Date & Time	TRE No.	Date of Receipt	Temp. at Arrival (°C)	Qual.
No.	NIA.	06/24/19 @ 0835 - 0839	32598	06/25/19	3.9	
1	NA	<del>-</del>	20049	06/27/19	3.5	
2	NA	06/26/19 @ 0820 - 0832	32618	00/2//19		
_		06/28/19 @ 0924 - 0934	32625	06/29/19	2.8	
3	NA	00/20/19 @ 0924 - 0004				

Note: See Appendix A for chain of custody records

### **Effluent Characterization**

Sample No.	рН	Hard. (mg/L) <sup>HA</sup>	Alk. (mg/L) <sup>HA</sup>	Spec. Cond. (µS/cm)	TRC (mg/L) <sup>G</sup>	NH <sub>3</sub> -N (mg/L)
	70	72	42	188	<0.02	<1.0
1	7.8		41	194	<0.02	<1.0
2	7.8	70	42	183	0.02	<1.0
3	7.8	68	4∠	100		

### Initial Dilution/Control Water Characterization

Batch No.	Hq	Hard. (mg/L) <sup>HA</sup>	Alk. (mg/L) <sup>HA</sup>	Spec. Cond.	TRC (mg/L) <sup>G</sup>	NH <sub>3</sub> -N (mg/L)
13673	8.1	90	58	321	<0.02	<1.0

### **Test Conditions**

Type Test Endpoints Test Chambers Test Solution Volume Replicates per Treatment Organisms per Replicate Test Temperature Lighting Chamber Placement Aeration?	Static-Renewal Short-term Chronic Survival and Growth (Dry Weight Per Original Fish) 500-ml plastic cups 250 ml 4 10 25 ± 1°C (≤ 3°C differential) Fluorescent, 16 hours light:8 hours dark Random according to computer-generated chart  X No Yes
Test Solution Renewal	Daily

### **Test Organism**

Species	Pimephales promelas
Age	<24 hours
Source	TRE In-house culture, batch 062519
Acclimation	None
	0.1 ml brine shrimp nauplii per test chamber 3x/day during the test
Feeding	Initiated June 7, 2019 using sodium chloride (NaCl)
Reference Toxicant Testing	Initiated Julie 7, 2013 dailing South Griding (1997)

### **TEST RESULTS**

### **Biological Data**

Treatment		Percen	t Survival	of <i>Pime</i>	phales p	romelas		Mean Dry Weight	Red Rela	ificant uction tive to ntrol?
(% Effluent)	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	(mg) <sup>W1</sup>	Surv.	Growth
O (MILI)	100	100	100	100	100	100	100	0.758	N/A	N/A
0 (MH)	100	100	100	100	100	97.5	97.5	0.700	No	No.V1
12.5				100	100	100	100	0.731	No	No
25	100	100	100					0.698	No	No <sup>V1</sup>
50	100	100	100	100	100	100	100			
75	100	100	100	100	100	100	100	0.734	No	No
100	100	95	95	95	95	95	95	0.734	No	No
	Percent l	Minimum	Significar	nt Differen	ice (Grov	vth)		7.4	L	ow <sup>P1</sup>

Note: See Appendix B for copies of laboratory data sheets

### **Data Analysis and Test Endpoints**

Biological Endpoint	Statistical Endpoint	Value (% Effluent)	Endpoint < IWC?
	NOEC	100	No
Survival	LOEC	>100	
	NOEC	100	No
	LOEC	>100	
Growth	ChV	>100	
(per original fish)	IC <sub>25</sub>	>100	No
	TU <sub>c</sub> (100/IC <sub>25</sub> )	<1.0	

NOEC = No Observed Effect Concentration

LOEC = Lowest Observed Effect Concentration

ChV = Chronic Value

 $IC_{25} = 25\%$  Inhibition Concentration

 $TU_c$  = Chronic Toxic Units

Note: Analyses completed using, where appropriate, CETIS version 1.8.7 (2014).

### **Physical and Chemical Data**

Treatment	p	Н	Dissolved Oxygen (mg/L)				Temperature (°C)		Qual.
(% Effluent)	Low	High	Low	High	Low	High	Low	High	· .
0 (MH)	7.5	8.3	4.4	7.3	318	371	24	25	
100	7.4	7.9	4.4	8.6	183	195	24	25	
					•		24	25	Т3
All Treatments	7.3	8.3	≥4	1.2	N	IA	23	24	T4

### Reference Toxicant Test Results for P. promelas

	TRE Historical 95% Control Limits (mg Cl/L)				
IC <sub>25</sub> (mg Cl <sup>-</sup> /L)	Low	High			
1,348	1,084	1,368			

### References

CETIS. 2014. Comprehensive Environmental Toxicity Information System. User Guide (version 1.8.7). Tidepool Scientific, LLC. McKinleyville, CA.

USEPA. 2002. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to freshwater organisms. Fourth Edition. EPA-821-R-02-013.

### **Explanation of Qualifiers**

Note: study-specific narratives within the body of the report are denoted, if necessary, with the superscript letters **a** - **d**, and associated footnotes. Other qualifications and definitions are defined below.

- S Sample temperature upon receipt was outside the range recommended by USEPA (2002), (i.e., 0 to 6°C or ambient if collected and used on the same day).
- I Ice was present in the sample upon receipt.
- N1 Sample was not used for testing.
- N2 Liquid from container with ice was not used for testing.
- F Sample was filtered to remove indigenous organisms prior to use.
- HT Sample hold time (normally 36 hours) was exceeded.
- HA Hardness and alkalinity concentrations are presented as CaCO<sub>3</sub>.
- G TRC = Total Residual Chlorine
- T1 Temperatures measured in some of the old test solutions were outside the recommended test temperature range but the allowed 3°C differential was not exceeded.
- T2 Temperatures measured in some of the old test solutions were outside the recommended test temperature range and the allowed 3°C differential was exceeded.
- T3 Temperatures measured in test solutions.
- T4 Continuous temperatures measured in the environmental chamber or water bath.
- X1 Mean young per original female. If any 4<sup>th</sup> or higher broods were produced, they were excluded from calculation of mean young per female and statistical analysis of reproduction.
- X2 One or more organisms in this treatment were lost or not found in the test chamber and were excluded from analysis, as the loss was attributed to technician error. See laboratory data sheets for additional detail, as appropriate.
- X3 One or more male *C. dubia* were found in this treatment and were included in analysis of survival but excluded from analysis of reproduction. See laboratory data sheets for additional detail, as appropriate.
- One or more fish were alive at test termination but were lost during the drying/weighing process. These fish were included in analysis of survival but excluded from analysis of growth. See laboratory data sheets for additional detail, as appropriate.
- O1 Dissolved oxygen concentrations were ≤ 4.0 mg/L in one or more treatments during the test; aeration was initiated in all test chambers. See laboratory data sheets for additional detail, as appropriate.
- O2 Dissolved oxygen concentrations ≤ 4.0 mg/L were observed in one or more treatments only at test termination.
- O3 Dissolved oxygen concentrations were ≤ 4.0 mg/L in one or more treatments during the test but aeration was not possible. See laboratory data sheets for additional detail, as appropriate.
- W1 Weight per original number of organisms introduced at test initiation.
- W2 Weight per surviving number of organisms at test termination.
- V1 Value was statistically (α=0.05 or 0.01, as appropriate) reduced relative to the control, but was considered a Type I error (anomalous false positive), and was disregarded. The NOEC was interpreted accordingly.
- V2 Value was not statistically ( $\alpha$ =0.05 or 0.01, as appropriate) less than the control, but was considered a Type II error (anomalous false negative). The NOEC was interpreted accordingly.
- P1 PMSD was below the lower bound indicated by USEPA (2002). A statistically significant reduction for a treatment was disregarded if the RPD for that treatment was less than the lower bound.
- P2 PMSD was above the upper bound indicated by USEPA (2002), and statistically significant reductions in organism performance were detected.
- P3 PMSD was above the upper bound indicated by USEPA (2002), and no statistically significant reductions in organism performance were detected.
- R Monthly reference toxicant test endpoint for this species was outside the 95% control limits for the 20 most recent endpoints.

### **Statement of Quality Assurance**

The test data were reviewed by the Quality Assurance Unit to assure that the study was performed in accordance with the protocol (if applicable) and standard operating procedures, and that the resulting data and report meet the requirements of the NELAC standards. This report is an accurate reflection of the raw data.

### **APPENDIX A**

**Chain of Custody Records** 

### Page 1 of 1

# TRE Environmental Strategies, LLC - Chain of Custody

Phone: (970) 416-0916 Fax: (970) 490-2963 Fort Collins, CO 80524 100 Racquette Drive, Unit A

TRE Environmental Strategies, LLC 27566 Temp Blank? ŝ Lab Sample ID 100 Racquette Drive, Unit A Fort Collins, CO 80524 (970) 490-2963 (FAX) (970) 416-0916 Courier

⊀ THE STATE OF THE S Sample Shipped Via (circle): Sample Temp. Upon Arrival Laboratory (Destination): Received on Ice: UPS FedEx **Test Requested** Time: [[.[Q.m. Date: Oct 24 19 Date: 6125105 Date: 21 (Liq., Soil, Sediment, etc.) Matrix Not Used Preservation (i.e.: 0-6°C) 0-60 Received By: (Print Name/Affiliation), Project #:14001-412 (028) Received By: (Print Name/Affiliation) Volume 2 2.5GW 010011.0475 at collection Received By: (Print N Sample Type Yes Signature: comb<sup>.</sup> Signature: Signature: Grab Signature:\_ 0835 6-24-19 08 39 Intact?(circle): Time Date: 6.24.19 Time: [[][][] /Kasowas **Ending** Client/Project Name. Bank Brock Actor Actor Addition ( Pogo Sample Collection Date Time: Time: Date: Date: Northern Star Sampler (Print/Affiliation): Stack Stalk Time Sample Relinquished By: (Print Name/Affiliation) Sample Refinquished By: (Print Name/Affiliation) Sample Relinquished By: (Print Name/Affiliation) Beginning Chain of Custody Tape #: 48387 6-24-19 Date 10 # 20C Client / Sample ID StaenStakes effective Date: 02/13/19 Comments: Signature: Signature: 5年1年1

Serial No. 04114

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# TRE Environmental Strategies, LLC - Chain of Custody

100 Racquette Drive, Unit A Fort Collins, CO 80524 Phone: (970) 416-0916 Fax: (970) 490-2963

\ \& TRE Environmental Strategies, LLC Temp Blank? ૭ 37966 Lab Sample ID 100 Racquette Drive, Unit A Fort Collins, CO 80524 (970) 490-2963 (FAX) Courier Yes (970) 416-0916  $\chi$ esjJ° (Therm. # ire 4) °C Sample Shipped Via (circle): Sample Temp. Upon Arrival Laboratory (Destination): Received on Ice: UPS FedEx **Test Requested** Date: 06 26 9 Time: [6,55 Date: 6/27/19 Time: 1325 Date: 01 又 X (Liq., Soil, Sediment, etc.) ۷ Matrix Preservation Not Used 2.9-0 (i.e.: 0-6°C) 0-0-0 TRE Project #: 14001-412 (028) Signature: Balled Received By: (Print Name/Affiliathn) Received By: (Print Name/Affiliation) Received By: (Print Name/Affiliation) Amendo Biclack @ collection Volume S 192 2.5GM 7411 Yes) Sample Type dwoo Signature: Signature × Grab Signature:\_ Jamo 12.9 C 0832 92-89 Time Date: 06/06/19 Intact?(circle): Date: 6-26-19 Time: 400 Time: 10:5 Ending Client/Project Name: Stumitonus Metal Himing (Pogd 6-26-19 0828 6-26-19 6-26-19 Sample Collection Date Date: 0850 Stakes -1000 Mass Time northen Star sample Relinquished-By: (Print Name/Affiliation) Sample Relinquished By: (Print Name/Affiliation) Sample Relinquished By: (Print Nange/Affiliation) Beginning Chain of Custody Tape #: 48379 6-26-19 Sampler (Print/Affiliation): Date Stacul Stahen Client / Sample ID signature: Comments: 2#123 11/10 M 2年13日 gnatture: Signature:

Serial No. 04115

### φ

# TRE Environmental Strategies, LLC - Chain of Custody

Phone: (970) 416-0916 Fax: (970) 490-2963 Fort Collins, CO 80524 100 Racquette Drive, Unit A

Northern Star (Pogo) LLC

32028 TRE Environmental Strategies, LLC Temp Blank? ૄે 운 Lab Sample ID 100 Racquette Drive, Unit A Fort Collins, CO 80524 (970) 490-2963 (FAX) (970) 416-0916 Courier Sample Temp. Upon Arrival (Therm. #IM) °C 8.7 Sample Shipped Via (circle): Laboratory (Destination): Other Received on Ice:( (FedEx **Test Requested** Date: 06 38 19 Date: 6/29/19 Time: (0:25 Time: 1800 PH: 7.48, temp = 15.6 °C (a) collection Date:  $\mathcal{U}$ (Liq., Soil, Sediment, etc.) Matrix **Preservation** Not Used (i.e.: 0-6°C) 2.9-0 0-60 Project #: 14001 - 412 (028) Received By: (Print Name/Affiliation) Received By: (Print Name/Affiliation) Received By: (Print Name/Affiliation) astoria Volume 2.5 Gad ž 100x Sample Type られる Yes Signature: Signature: comb<sup>.</sup> Grab × Signature:\_ Time: 3.30pm Intact?(circle): 67:60 Time 09:34 Date: 06/28/19 Date: 6/28/19 Time: (0,35 Client/Project Name: Sumitorno toletal Mining Page Ending 6/28/19 6/28/14 Sample Collection Date Time: Date: Sampler (Print/Affiliation): Nathun Kehne Time 04:30 42:60 Sample Relinquished By: (Print Name/Affiliation) Sample Relinquished By: (Print Name/Affiliation) Sample Relinguished By: (Print Name/Affiliation) Beginning Pogo Mine Chain of Custody Tape #: 48386 6/28/19 Date Client / Sample ID Kekke Comments: 1116h Nathen EFC #3 60 Signature: Signature: # 1343

Effective Date: 02/13/19

Serial No. 04116

**APPENDIX B** 

**Test Data** 

Page 1 of 3 QA Form No. 051 Revision 5 Effective 02/14

### TOXICITY DATA PACKAGE COVER SHEET

owner Hidia

Test Type:	Chronic	Project Number: <u>14001-412-028</u>					
	Effluent-(Outfall 001)	Species: Pimephales promelas					
Test Substance:		Organism Lot or Batch Number: 062519					
Dilution Water Type:	Mod Hard	_					
Concurrent Control Water Typ	oe: NA						
Date and Time Test Began:	6/25/19 @ 1415	Date and Time Test Endour					
Protocol Number:	USEPA 2002, Method 1000.0	nvestigator(s): <u>Re In HK/CN/HM</u>					
Background Information		pH control?: Yes No N/A					
Type of Test:	Static-Renewal	il yes, give % 002.					
Test Temperature:	25 ± 1 °C	Elly. Chilibi/Data w					
Test Solution Vol.:	250 ml	Number of Replicates per Treatment					
Length of Test:	7 days	Number of Organisms per Replicate.					
Photoperiod:	16 h light : 8 h dark	Light Intensity: 50 to 100 ftc.					
Type of Food and Quantity	per Chamber: 0.1 ml B.S.	Feeding Frequency: <u>3 x Daily</u>					
Hardness: <u>Sx Receipt</u>	zation Parameters and Freque Alkalinity: <u>Sx Receipt</u> Conductivity: <u>Daily</u>						
pH: <u>Daily</u>		12.5, 25, 50, 75, and 100%					
Test Concentrations (Volur	ne:Volume): 0 (MH),	12.0, 20, 30, 70, 4					
Agency Summary Sheet(s)	)?: None	- 134×1×1/11					
Reference Toxicant Data	: Test Dates: 310 02 49	to 54 14 19					
Hist. 95% Control Limits:	Hist. 95% Control Limits: 1084 to 1368 Method for Determining Ref. Tox. Value 1044						
Special Procedures and Considerations:							
D. O. weinteined > 4.0 mg/l							
*Conductivity measured in dilution water and 100% effluent at test termination							
If survival in any test char	If survival in any test chamber falls below 50%, reduce feeding in that chamber to 0.05 ml of brine shrimp						
Appropriate correction factors have been applied to all temperatures recorded in this data package							
Study Director Initials:	Date: 6	/25/19					

### TEST SUBSTANCE USAGE LOG

DA new 2/6/19

Project Number:

14001-412-028

	Sample 1	Sample 2	Sample 3	Sample 4
Test Substance Number	32598	32618	32625	
	From: 6124119	@ 0830 @ 0830	From: 6/28/19 @ 0924	From: @
Test Substance Collection  Date and Time	To: ७१३५११९	To: Glacit	To: 6/28/19 @ 0929	To: @
Sample Type (Grab or Comp)	@ 0839 Gnab	Coab	Grab	
Date Test Substance Received	6125/19	<u> </u>	6/29/19	
Dilution Water Number  (RW#) or TRE#, circle one	13673	13679	13679	
Concurrent Control Water RW#	NA	NA (STATE	NA 120 120	
Date(s) Used	6/25/19	6/27/19	6/29/19	
			7/1/19	

Preparation of Test Solutions

Test Substance Conc. (% Effluent)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)	Test Substance Volume (ml)	Dilution Water Volume (ml)	Total Volume (ml)
0 (MH)	0	1000	1000						
12.5%	125	875	1000			<u> </u>			
25%	250	750	1000	<u> </u>		<del> </del>			
50%	500	500_	1000						
75%	750	250	1000				<b> </b>		<u> </u>
100%	1000	0	1000				<del>  </del>		
Total	2625	3375	6000				<del> </del>	<del></del>	
Initials / Date		/19 "  19 "  19 "  2/19 "	H H n			<u> </u>			
Initials / Date Initials / Date Initials / Date	6 - 1	119 "	U						

### FATHEAD MINNOW (PIMEPHALES PROMELAS) CHRONIC BIOLOGICAL DATA

DA was Holly

Project N	lumber:	<u> 14001-</u>	412-028						- <u> </u>	
							Cundida	g Organis	me	
	Test	Day	Day	Day	Day	Day	Day	Day	Day	9\08W
%Conc.	1 11	0	1	2	3	4	5	6	7	Remarks
0 (MH)	А	10	10	iO	10	10	10	10	10	
,	В	10	10	lo	10	10	to	10	10	
	С	[0	10	(0	10	10	10	10	10	
	D	10	10	10	10	10	10	10	10	
12.5%	Α	10	10	10	10	10	10	10	10	
	В	10	10	10	10	10	100	9	9	A I weak org
	С	10	10	10	10	10	10	10	10	0(Xi')
	D	10	10	(0	10	10	10	10	10	
25%	Α	10	IO	10	10	10	10	ìo	0	
	В	10	IO.	10	10	10	10	10	10	100
	С	10	10	lo	10	10	0	10	10	
	D	10	10	10	10	10	10	10	19	
50%	A	10	D	10	10	10	lo	10	10	
	В	10	0	10	10	10	10	10	(0)	100
	С	10	10	io	lo	10	OJ	10	(0)	
	D	10	10	હ	lo	10	10	10	(O	
75%	Α	10	(0)	10	10	10	0	10	(0	
	В	10	w	10	10	10	10	10	(0	100
	С	10	10	10	10	10	10	10	10	
	D	10	10	10	10	ID	10	10	19 (	It I real org /
100%	A	10	10 *	9	9	9	9	9	9	Hara Siphened
	В	10	10	9	9	9	9	9 *	9	* long siphered
	С	10	104	10	10	10	10	10		* 1019 sipores
	D	10	10	10	10	10	10_	10_	10	
	Α									
	В									
	C									
	D									
	Date:	6/25/19	16/26/19	6/27/19	6/28/19	6/29/19	6/30/19	7/1/19	7/2/n	
	Time:	1415	0950	1510	1130	1510	1000	1105	1430	
	Initials:	EUM		æ	શ્હ	НМ	EN	æ	al	

### CHRONIC CHEMICAL DATA (INITIAL)

Qu new Alidia

Project Number: 14001-412-028

Test Species: Pimephales promelas

%	Day	Day	Day	Day	Day	Day	Day	Day	Meter #	Remarks
70	0	1	2	3	4	5	6	7	1 40	
Conc.: 0 (MH	)								All Conc.	
<del></del>	8.1	7.9	8.2	8.2	8.1	7.7	8.3		FM28	
).O. (mg/L)	7.3	7.2	7.0	7.1	7.0	6.9	2-0		17	
emp. (°C)	25	25	25	25	25	25	25		L-34	
Cond. (µS/cm)	321		336 °	335	334	329	371	<u></u>	15	
Hard. (mg/L)	90		96		96		100		Titr.	
Alk. (mg/L)	58		6-1		64		tel		Titr.	
TRC (mg/L) W/15	(0.0)		लिडप्रेप ७.७ <u>२</u>						35	
NH <sub>3</sub> (mg/L)	<1. <i>O</i>		41.0						HAI	
Conc.: 12.5%	6								-	
oH	8.1	8.1	8.2	8.2	8.1	8.1	8.3			
D.O. (mg/L)	7.3	7.3	7.1	7.2	7.1	7.2	7.0			
Temp. (°C)	*	*	*	*	*	*	*		<del>                                     </del>	
Cond. (µS/cm)	307	306	323	320	318	316	336			
Hard. (mg/L)										
Alk. (mg/L)										
TRC (mg/L)										
NH <sub>3</sub> (mg/L)									<u> </u>	<del></del>
Conc.: 25%	6						-			
рН	8.1	8.1	8.2	8.2	8.1	6.1	8.2			
D.O. (mg/L)	7.4	7.4	7.2	7.3	7.2	7.4	7.1	<u> </u>		
Temp. (°C)	*	*	*	*	·* <del>*</del>	*	*		<del> </del>	
Cond. (µS/cm)	290	292	306	303	300	302	318		<del> </del>	
Conc.: 50°	6				ļ		<u> </u>			
рН	8.0	8.0	8.1	8·i	8.0	8.1	B.1	ļ		
D.O. (mg/L)	7.5	7.7	7.5	7.4	7.2	7.49	•	<u> </u>		
Temp. (°C)	*	*	*	*	*	*	*			
Cond. (µS/cm)	257	257	269	270	263		276		_	<u> </u>
Dat	e: 6/25/1	a ldz/19		6/28/19	6/29/1		17/1/19	<u> </u>		<u> </u>
Tim	ie: 1400		1500	1050		0955		<del> </del>		-
Initia	als: Ee	EH	æ	ce	HM	67	re			emistry log

Note: Hardness, alkalinity, TRC, and NH3 data appearing on this page have been transcribed from the wet chemistry log QA Form No. 084.

<sup>\*</sup>Dilution/control water and effluent were brought to 25°C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25°C.

### **CHRONIC CHEMICAL DATA (INITIAL)**

an new Hiding

Project Number:	14001-412-028	
. 10,000		
Test Species:	Pimephales promelas	
Test Species.	Filliephales prometas	

0/		Day	Day	Day	Day	Day	Day	Day	Day	Meter #	Remarks
%		Day 0	1 1	2	3	4	5	6	7		
Conc.:	75%									All Conc.	
	, ,,,	5 0			0 0	70	<del></del>	8.0		00110.	
H		7.9			8.0	7.9	0.8				
).O. (mg/L)		7.7	7.9	7.9	7.8	7.3	7.8	7.5 *			
emp. (°C)		*	*	*	*	*	*				
Cond. (µS/cm)		225	226	235	233	223	225	237			
Conc.:											
э <b>Н</b>											
D.O. (mg/L)											
Геmp. (°С)						<del></del>					
Cond. (µS/cm)										<del></del>	
Conc.:										1	
оН										ļ	
D.O. (mg/L)										<u> </u>	
Temp. (°C)											· -
Cond. (µS/cm	)							<u> </u>		<del> </del>	
Conc.:								ļ			
pH										<del></del>	
D.O. (mg/L)											
Temp. (°C)										<del></del>	
Cond. (µS/cm	)									<del>-                                    </del>	
Conc.:	100%							<del> </del>		<u> </u>	
pH		7.8	7.8	7.8	7.9	7.8	7.8	7.9	<u> </u>		
D.O. (mg/L)		8.1	8.6	8.3	8.3	7.5	8.5	7.8			
Temp. (°C)		25	25	25	25	25	25	25			<del> </del>
Cond. (µS/cm	1)	188	191	194	194	183	184	195			
Hard. (mg/L)		72	0	357	<u> </u>	48	<u> </u>			-	<del> </del>
Alk. (mg/L)		42		41		844	7_			_	
TRC (mg/L)		4002		60.02		0.03	ļ				<del> </del>
NH <sub>3</sub> (mg/L)		41.0		710	<u> </u>	21.0		<del> </del>		1	
	Date:	6/25/19	6/26/19	6/2016				17/1/19	<u> </u>		
	Time:	1400	0945	1600	1050	1445		1100	<u> </u>	<u> </u>	
Note: Hardnes	Initials	82	EN	al	æ	HM	[N	ee	<u> </u>		

Note: Hardness, alkalinity, TRC, and NH3 data appearing on this page have been transcribed from the wet chemistry log QA Form No. 084.

\*Dilution/control water and effluent were brought to 25C prior to making the dilution series. The temperature of resulting effluent dilution is assumed to also be 25C.

our of 08/19,5

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### CHRONIC CHEMICAL DATA (FINAL)

Project Number: 14001-412-028
Test Species: Pimephales promelas

%	Day	Day	Day	Day	Day	Day	Day	Day	Meter#	Remarks
% 	1	2 <u></u>	3	4	5	6	7	8		
Conc.: 0 (MH)							357		All Conc.	* conductivity
pH	7.7	7.5	NR	7.6	7.5	7.6	7.5		FM28	
D.O. (mg/L)	6.1	4.5	NR	4.4	53	5.2	5.6		17	
Temp (°C)	24	24	24	24	24	25	24		L37	
Conc.: 12.5%										
рН	7.7	7.5	NR	7.Le	75	7-6	7.6			
D.O. (mg/L)	5.1	4.5	NR	4.4	50	5.0	4.7			
Temp (°C)	24	24	24	24	24	24	24			
Conc.: 25%										
pН	7.6	7.5	NR	7.5	7.6	7.0	7.5			
D.O. (mg/L)	4.5	4.9	MR	4,7	4.9	4.4	4.6			
Temp (°C)	24	24	24	24	24	24	24			
Conc.: 50%										
pH	75	7.4	NR	7.3	7.6	7.6	7.4			
D.O. (mg/L)	4.8	4.7	NR	4,2	4.8	4.5	4.4			
Temp (°C)	24	24	24	24	24	24	24		<u> </u>	
Conc.: 75%										
рН	7.6	7.4	NR	7.4	7.5	7.5	7.5			
D.O. (mg/L)	5.1	4.5	NR	4.4	4.7	5,0	45			
Temp (°C)	24	24	24	24	24	24	24			
Conc.: 100%							187			* conductivity
рН	7.6	7.4	NR	7.4	7.4	7.5	7.4		<u> </u>	
D.O. (mg/L)	5.7	4.6	NP	4.4	4.9	4-7	4.8			
Temp (°C)	24	24	24	24	24_	24	24			
Conc.:								<u> </u>		
рН										
D.O. (mg/L)										
Temp (°C)						<u> </u>				
Date:	6/26/19	6/27/19	6/28/10	6/29/14	9 6/39/19	7/1/19	7/2/19	<u> </u>		
Time:	0936	1500	1050	1500	0950	1050	1415			
Initials:	EN	re	વ્હ	AM	EN	re	<u>Ee</u>			

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### **DAILY TOXICITY TEST LOG**

Project Number:	14001-412-028	
Test Species:	Pimephales promelas	

General		Feeding	Initials/Date
Comments		0.1 ml B.S.	
	Random Chart: したな Min/Max Therm. #: M~14	3 x Daily	
Test Day 0	Test Solution Mixed at: 1350	Fed @ 1640	El
	Test Organisms Added at: [4]5	Ee	6/25/19
i :			6/25/17
Test Day 1	Real Time Temp= 24 °C Range = 23 -24 °C	Fed @ 0835 #K	EN
		1150 EL	6/24/19
Test Day 2	Real Time Temp= 24 °C Range = 23 - 24 °C	Fed @	
Tool Day 2	24 5 7 24	0910 HM	El
		1145 Ge	6/27/19
		1630 cl	
Test Day 3	Real Time Temp= 24 °C Range = 23 - 24 °C	Fed @ 083000	વ્ય
		1145 HM 1055 HR	
		און פפעון	6/28/19
Test Day 4	Real Time Temp= 24 °C Range = 23-24 °C	Fed @	HM
		0835 HM	1
		1700 HM	6/29/19
Test Day 5	Real Time Temp= クロ °C Range = 23 -24 °C	Fed @	<b>E</b> N
		0826 EN	, , , , , , , , , , , , , , , , , , ,
		1600 EN	6/30/19
Test Day 6	Real Time Temp= 24 °C Range = 23 - 24 °C	Fed @	<del>                                     </del>
lest Day 0	Thear time temp= 24 or range 23 · 2-4	0820ge	Se
		1155 cre	7/1/19
		ialo ae	
Test Day 7	Real Time Temp= 23 °C Range = 13 - 24 °C	NONE	El
			7/2/19
	·		7410
Test Day 8			
L		<u> </u>	

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TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Project 1	Project Number: 14001-412-028	HOO 1-	412-(	028	Test Substance	H	<b>Juent</b>			Comments:	A V	H H	- · · · · · · · · · · · · · · · · · · ·
Species	Species: P DROMELAS	mel	28		Analyst Tare:	AHIO	Analyst Gr	Analyst Gross: HP/ NA		Analytical Balance ID: 27 The Date: 1220 Trime: 1530 Dried in Oven # 2 from Date: 1220 Trime: 1530		te: <u>412/1</u> (Tir	ne: 1530
Date/Tin	Date/Time of Tare Wt.: 7/2/19 @	N.: 7/	2/19 6	0 1115	Date/Time of G	Gross Wt.:	ross Wt.: 7/3/19 12 1530	0 1530			to Da	te: 44/4	me: <u>0822</u>
Boat	Treatment Rep.	Rep.	Length	Weight Type (Circle):	li .	Wet Blot D	Blot Dry (>100°C) \ AFDW (>500°C)	00°C) \ AFD	W (>500°C)		Lot or Batch Number:	Number:	
Ö	V. t		Units:	L	<u></u>	<b>≥ 5</b>	Adjusted Net Weight (g)	No. of Orig.	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	MHR			1,139,15	1.14080 0.00705	0.00745					01		
	MHB			1.13890	1.13890 1.14638 10.00748	0.00748					0)		
	MHC			1.14897	1.14897 1.15470 0.00773	0.00773					9		
	MHD			7.14402	1,14902 0.5442 0.00740	0.00740					0		
	12.5A			1.13010	1,13010 1.13491 0.00681	18000.0					01		
	12.5B			1.13659	1.13659 1,4338 0.00079	0.000079					b		
	12.50			1.15862	1.15862 1.14592 0.00730	0.00730			-		0)		
	125D			1.16439	1.164391.17144 0.00705	0.00705					10		
	25 A			1,15792	1,15792 1.10554 0.00762	0.00762					10	-	
	25 B			1.15938	1.15938 1.14665 0.00727	0.00727			•		10		
	250			1.14954	1,14954 1.15656 0.00702	0.00702					0)		
	<b>Q</b> 97			1.12963	1.12963 1.13693 0.00730	0.00730		·			9		*
Blank				1,14444	1.14444 1.14443 -0.00001	10000.0							
Range										-			
Mean													
Test Sol	Test Solution Volume	iii			-		Loading Rate:						•
Add in	Add in weight loss of blank boat, if appropriate	of blank	boat, if a	ppropriate.									

TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

Droject P	Project Number: 14/01-412-028	M-4	17- N	28	Test Substance	H	Flient			Comments:		¥	
Species:	P prometas	mela			Analyst Tare:	All /100	Analyst Gr	Analyst Gross: HR		Analytical Balance ID: MN 1000 Dried in Oven # 22 from Date: 7/2/10 Time: to Date: 7/3/19 Time:	from Da to Da	1. <del>2/</del> 2/10∓ir te: <del>2/2/1</del> 0∓ir te: <del>2/3/1</del> 9™i	ne: 1530 me: 0835
Date/Tir	Date/Time of Tare Wt.: $7/2/l\% \; \& \; 1115$	1: 7/2/	10 B	1115	Date/Time of Gr	f Gross Wt.:	ross Wt.: 7/3/19 (2/ 1530	v 1530					
Boat	Treatment Rep.	Rep.	ength	Weight Type (Circle):		Wet Blot Dry	ly Dry (>100°C)	0°C) AFD	AFDW (>500°C)		Lot or Batch Number:	Number:	
Ö			Units:	Tare Weight (g)	Tare Gross Weight (g) Weight (g)	Net Weight (9)	Adjusted Net Weight (g)	of ig. iisms	Mean Wt. per Original Organism (mg)	Mean Wt. per Treatment (mg) (Original)	No. of Surv. Organisms	Mean Wt. per Surviving Organism (mg)	Mean Wt. per Treatment (mg) (Surviving)
	8P			1,16091	1.07.4	0.000050					QI		
	<b>30B</b>			1.13499	1.14262	6.00763			-		0)		
	500			1.15990	1.15990 1.14719 0.00729	0.00729					10		
	QOZ			114284	1,14284   1.14932   0.00048	0.00048					01		
	75A			1.16053	1.16053 1.10734 0.00081	0.00081					0)		
	75B			098817	1,13850 1.14007 10,00757	0.00757					10		
	762			SH6H1	14945 1.15710 0.00771	0.00771					0/		
	75D			1.13768	1.13768 1.1490 0:00722	0.00722					10		
	400			1,13665	1,1365 1.13797 0.00742	0.00742			·		6		
	10013			174469	1.14469 11.15200 0.00731	0.00731			•		d		
	- 200I			±16617	1.14917 1.15658 0.00741	0.00741		·			9		
	4001			1.14560	1.14560 1.15276 0.00 HID	0.007HB					9		•
Blank				1.14444	1,14444 1.14443 -0	-0.00001							
Range						٠							
Mean													
Test Sol	Test Solution Volume:						Loading Rate:						,
Add in	Add in weight loss of blank boat, if appropriate	f blank bo	oat, if ap	propriate.									

 $\begin{array}{c} \operatorname{Page} \left( \frac{1}{2} \right) & \text{of } \left( \frac{1}{2} \right) \\ \operatorname{QA Form No. 010a} \\ \operatorname{Revision 1} \\ \operatorname{Effective 02/14} \end{array}$ 

### TEST ORGANISM LENGTHS, WEIGHTS, AND LOADING

14001-412-028 Project Number:

Fathead minnow Species:

									Š		
							Mean Wt./	Mean Wt./		Mean Wt./	Mean Wt./
<del></del> ,					Adjusted		Original	Treatment	Number of	Surviving	Treatment
	Length	Tare	Gross	Net Weight Net Weight		No of Orig. Organisms	Organism (ma)	(mg) (Original)	Surv. Organisms:	Organism (mg)	(mg) (Surviving)
I reatment K		4 4304E	_	0.00765	0.00766	10	0.766	0.7575	92	0.766	0.7575
1	τ α	1 13890		0.00748	0.00749	9	0.749		10	0.749	
	ت اد	1 14897	L	0.00773	0.00774	10	0.774		10	0.774	
1_	Q	1.14902		0.00740	0.00741	10	0.741		10	0.741	
H								0000	Ç	0000	0 7186
	A	1.13010		0.00681	0.00682		0.682	0.6897	2 0	0.002	0.7 100
12 5%	В	1.13659		0.00679			0.000		2	0.733	
ļ	၁	1.15862					0.731		21	0.751	
	D	1.16439	1.17144	0.00705	0.00706	9	0.706		9	0.705	
H				00200	0.000	9,	A 783	A 7249	10	0.763	0.7312
	¥	1.15/92		0.00762			0.700		5 5	0 728	
	В	1.15938		0.00727			0.720		5 5	0.703	
	<u>၂</u>	1.14954		0.00702			0.703		2	0.703	
	D {	1.12963	1.13693	0.00730	0.00731	10	0.731		10	0.731	
										100	7000
	⋖	1.16091	1.16741	0.00650			0.651	0.6985		0.651	0.6985
	В	1.13499	1.14262	0.00763	0.00764	10	0.764		10	0.764	
L	Q	1.15990		0.00729	0.00730	10	0.730		10	0.730	
	D	1.14284		0.00648	0.00649	10	0.649		10	0.649	
<del> </del>											
-	A	1.16053	1.16734				0.682	0.7337	10	0.682	0.7337
<u></u>	В	1.13850					0.758		19	0.758	*
<u>ا</u> چون	U	1.14945	1.15716	0.00771	0.00772	6	0.772		10	0.172	
<u> </u>	0	1.13768	1.14490	0.00722	0.00723	10	0.723		9	0.723	
-										000	
-	A	1.13055	5 1.13797				0.743	0.7335	<b>ာ</b>	0.820	0.7743
<u>L</u>	В	1.14469	1.15200	0.00731			0.732		6	0.813	
 %00. 100.	0	1.14917				10	0.742		10	0.742	
<u>L</u> .,	0	1.14560		0.00716	0.00717	10	0.717		10	0.717	
Blank		1.14444	1.14443	-0.00001							

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QA Form No. 010a

Revision 1

Effective 02/14

EM. NO. 7/2/19

Fathead minnow		>       	%000.0	5.128%	%000.0	0.000%	0.000%	6.077%			)    -	2.001%	3.423%	3.365%	8.261%	5.477%	1.645%		?	اد	2.001%	4.413%	3.365%	8.261%	5.477%	6.864%
		S	0.0000	0.0500	0.0000	0.000	0.0000	0.0577			S	0.0152	0.0239	0.0246	0.0577	0.0402	0.0121	rranism)		8	0.0152	0.0317	0.0246	0.0577	0.0402	0.0532
Species:		Mean	1.0000	0.9750	1.0000	1.0000	1.0000	0.9500		Originary	Mean	0.7575	0.6997	0.7312	0.6985	0.7337	0.7335	. entrywinu i	Series in Series	Mean	0.7575	0.7186	0.7312	0.6985	0.7337	0.7745
		Max	0.1	1.0	1.0	1.0	1.0	1.0	7	fary wither	Max	0.774	0.731	0.763	0.764	0.772	0.743	(der two teach)		Max	0.774	0.756	0.763	0.764	0.772	0.826
14001-412-028	ırvival Data	Min	1.0	0.9	1.0	1.0	1.0	0.0		rowin Data	Min	0.741	0.680	0.703	0.649	0.682	0.717	routh Data	owen Data	<u>=</u>	0.741	0.682	0.703	0.649	0.682	0.717
	stics for Su	Z	4	4	4	4	4	4		ISUCS TOL G	Z	4	ক	4	4	4	4	يمزنهن فهدرج		<b>Z</b>	4	4	4	4	4	4
	Summary Statistics for Survival Data	Treatment	Ψ	12.5%	72%	20%	75%	100%	i	Summary Statistics for Growth Data (any Wilper Original)	Treatment	MH	12.5%	25%	20%	75%	100%	Comment Statistics for Grounth Data (Ary wit nor enryiving Ordanism)	Summary Stat	Treatment	MH	12.5%	25%	20%	75%	100%
Project Number:																										

### **CETIS Analytical Report**

Report Date:

08 Jul-19 12:56 (p 1 of 2)

Test Code:

412-028 | 08-6193-8797
TRE Environmental Strategies

athead Minno	ow 7-d Larval St	ırviva	and Growt	h Tes	st						TRE Envir	onmental S	trategies				
Analysis ID: Analyzed:	14-3795-3909 08 Jul-19 12:56	-4	Endpoint: Mean Dry Biomass-mg Analysis: Parametric-Control vs Treatments						CETIS Version: CETISv1.8.7 Official Results: Yes								
Batch ID:				Test Type: Growth-Survival (7d)							Analyst: Lab Tech						
Start Date: 25 Jun-19 14:15			Protocol:	V821/R-02-0		)		Dilue	Diluent: Mod-Hard Synthetic Water								
	02 Jul-19 14:30		Species:		ephales proi				Brine: Not Applicable								
Duration:					louse Cultur				Age:	Age: <24							
Sample ID:	00-9329-8243		Code:	412	028v			<del>(2),((2),(2),(3),(3),(3),(3),(3),(3),(3),(3),(3),(3</del>	Clier	it: PO	GO						
	24 Jun-19 08:39	3	Material:	Ami	oient Sample	9			Proje		T Annual Co		st				
Receive Date:		-	Source:		charge Monit		or	t	~			· 27.					
Sample Age:			Station:	001	•	. <b>*</b>				(a	NOEC = 1	W 13					
Data Transfor	m	Zeta	Alt H	lyp	Trials	Seed			PMSD	NOEL	LOEL	TOEL	TU				
Untransformed			C > T	•	NA	NA			7.4%	100	>100	NA	1				
Dunnett Multi	ple Comparison	Test							`								
Control	vs C-%		Test	Stat	Critical	MSD C	)F	P-Value	P-Type	Decision	n(a:5%)		7.77				
Dilution Water	12.5*	<del> </del>	2.482	2	2.41	0.056 6		0.0434	CDF	Significa	nt Effect	19 NOTE	17				
	25		1.128	3	2.41	0.056 6		0.3667	CDF		nificant Effect		. ما ر				
	50*		2.535	5	2.41	0.056 6	3	0.0391	CDF	Significa	nt Effect	grove	LIP				
	75		1.021		2.41	0.056 6	3	0.4128	CDF	-	micani eneci						
	100		1.03		2.41	0.056 6	}	0.4081	CDF	Non-Sigr	nificant Effect						
Test Acceptat	oility Criteria		2-4														
Attribute	Test Stat		Limits		Overlap	Decisio	_		0.4-4-			<del></del>					
Control Resp	0.7575		- NL		Yes			ceptability									
PMSD	0.07395	0.12	- 0.3		Yes	Relow A	GC	eptability C	- TILETIA								
ANOVA Table						W.C.		F Stat	P-Value	Decisio	o/a:8%\						
Source	Sum Squ	-	The second second second second	n <b>Sq</b> ı 20647	the state of the s	<b>DF</b> 5	,,,,,,,	1.906	0.1433		nificant Effect	,, <del>, , , , , , , , , , , , , , , , </del>					
Between 0.0103237 Error 0.0194972				10831		18		11822	9111194								
Error Total	0.029820		0.00	1000	10	23											
Distributiona	l Tests				·····	.,		***************************************				, , , , , , , , , , , , , , , , , , , ,					
Attribute	Test				Test Stat	Critical		P-Value	Decision	(a:1%)							
		Equalit	y of Variance	<del></del>	8.637	15.1		0.1244	Equal Va	riances							
•		-Wilk W Normality			0.9756	0.884		0.8031	Normal D	istribution		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·				
Mean Dry Bio	mass-mg Sumr	nary															
C-%	Control Type	Cou		-	95% LCL	All of the last of	:L	Median	Min	Max	Std Err	CV%	%Effect				
0	Dilution Water	4	0.75	75	0.7334	0.7816		0.7575	0.741	0.774	0.007577	2.0%	0.0%				
12.5		4	0.69	98	0.6616	0.7379		0.694	0.68	0.731	0.01197	3.42%	7.62%				
25		4	0.73	13	0.6921	0.7704		0.7295	0.703	0.763	0.0123	3.37%	3.47%				
50		4	0.69	85	0.6067	0.7903		0.6905	0.649	0.764	0.02885	8.26%	7.79%				
75		4	0.73	38	0.6698	0.7977		0.7405	0.682	0.772	0.02009	5.48%	3.14%				
100		4	0.73	35	0.7143	0.7527		0.737	0.717	0.743	0.006035	1.65%	3.17%				
Mean Dry Bio	omass-mg Detai	1															
Ç-%	Control Type	Rep			Rep 3	Rep 4		( <del>)</del>		<del>.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</del>							
0	Dilution Water	0.76			0.774	0.741											
12.5		0.6			0.731	0.706											
25		0.7			0.703	0.731											
50		0.6	51 0.76	4	0.73	0.649											
75	•	0.6	82 0.75	8	0.772	0.723											
100		Q.7	43 0.73	2	0.742	0.717											
-	•												٠. [ م				
													コノン				

### **CETIS Analytical Report**

Report Date:

08 Jul-19 12 412-028 | 08-6193-8797

**Test Code:** 

Fathead Minnow 7-d Larval Survival and Growth Test

TRE Environmental Strategies

Analysis ID: Analyzed:

14-3795-3909 08 Jul-19 12:56 Endpoint: Analysis:

Mean Dry Biomass-mg

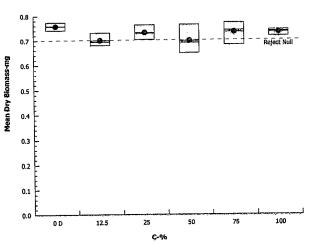
Parametric-Control vs Treatments

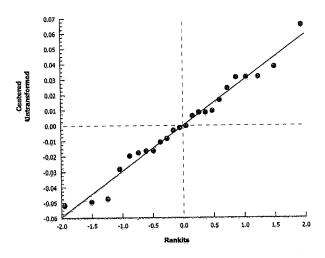
**CETIS Version:** 

**CETISv1.8.7** 

Official Results: Yes

**Graphics** 







### APPENDIX E – ELECTRONIC MONITORING DATA

[SUBMITTED ELECTRONICALLY VIA ALASKA ZENDTO (STATE OF ALASKA)]

2019 MONITORING DATA 2019 QUALIFIED DATA ALL HISTORIC DATA