NIBLACK EXPLORATION PROJECT
Waste Management Permit 2013DB0001

2020 Annual Report

Prepared for

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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
AKWQC	Alaska Water Quality Criteria
ANDR	Alaska Department of Natural Resources
APDES	Alaska Pollutant Discharge Elimination System Permit
BMP	best management practice
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
LAD	land application/dispersion
MDL	method detection limit
MRL	method reporting limit
MS/MSD	matrix spike/matrix spike duplicate
NAG	non-acid-generating
NOAA	National Oceanic and Atmospheric Administration
NPLLC	Niblack Project LLC
NTU	nephelometric turbidity units
PAG	potentially acid-generating
PARCC	precision, accuracy, representativeness, completeness, and comparability
Permit	State of Alaska's Waste Management Permit 2013DB0001
PQL	practical quantification limit
QA/QC	quality assurance and quality control
QAPP	quality assurance project plan
RPD	relative percent difference
SWPPP	stormwater pollution prevention plan
TDS	total dissolved solids
TSS	total suspended solids
WQS	Alaska water quality standards

1 INTRODUCTION

This report is submitted in accordance with annual reporting requirements for the Niblack Exploration Project Waste Management Permit 2013DB0001. The Niblack Exploration Project is a copper-gold-zinc-silver prospect located off Moira Sound on southeastern Prince of Wales Island, approximately 27 miles southwest of the city of Ketchikan (Figure 1-1). The property is located at Section 34, T. 78 and 79 S., R. 88 E., Copper River Meridian; Latitude 55º 03' 53", Longitude -132º 08' 48". The property is composed of 17 patented claims, 298 staked federal lode claims, and 7 Alaska State tideland claims. All claims are owned by Niblack Project LLC (NPLLC).

The Niblack area has been explored for minerals since the initial copper discovery at Niblack Anchorage in 1899. A detailed history of site ownership and project activities, including tons of ore produced and dates of operation, is presented in the *Reclamation and Closure Plan 2017 Post-Construction Update* (Niblack 2017). NPLLC acquired 100 percent ownership interest in the Niblack Exploration Project in early 2012. Modern day underground development on the Niblack Exploration Project was initiated by previous owners, Niblack Mining Corporation, on September 21, 2007, and was completed on July 12, 2008.

Alaska Department of Environmental Conservation (ADEC) Waste Management Permit 2013DB0001 (hereinafter the Permit; ADEC 2013) incorporates by reference supporting documents, which may also be referenced in this report:

- *Niblack Reclamation and Closure Plan 2017 Post-Construction Update (Niblack 2017; updated 2012)*
- *Niblack Water Quality Monitoring Plan, 2012 Post-Construction Update (the Plan; Integral 2013a)*
- *Niblack Mining Corporation, Quality Assurance Project Plan (QAPP; Integral 2013b)*

A renewal for the Permit (ADEC 2013) was submitted to ADEC February 8, 2018 and an administrative extension was granted February 23, 2018 to allow for ADEC review; the site continues to operate under the Permit (ADEC 2013).

On July 31, 2015, ADEC issued Alaska Pollutant Discharge Elimination System (APDES) AK0053708 to NPLLC. This permit allows for the construction and operation of an outfall in Niblack Anchorage to discharge water from the main settlement ponds to the marine environment in lieu of discharge to the currently approved land application dispersion (LAD) system and will be monitored and reported under the Permit. Entry Authorization Easement #ADL 108261 for the outfall pipe was granted by ADNR August 26, 2016 (ADNR 2016). Construction of the outfall and associated works has not begun at the time of this report.

As described in Section 2.4, during most of 2020 the Niblack Exploration Project was in a period of Suspension of Operations with a modified Plan (Niblack 2013; Evans 2014; Collingwood 2016). Annual reports submitted to ADEC, from prior years up to the *Niblack Exploration Project 2016 Annual Report* contain all historical data, including pre-construction.

2 SUMMARY OF ACTIVITIES

Activities related to site development and maintenance to support monitoring activities are presented in this section. In 2020, staff were on site for approximately 70 days, performing limited surface exploration drilling, field parameters and permit monitoring, activating pumps in the underground development to discharge mine water through the settlement ponds, undertaking routine maintenance and remedial reclamation, in addition to performing safety checks, ensuring agency compliance and site security.

2.1 UNDERGROUND DEVELOPMENT

There was no underground development or additional volumes of NAG or PAG/ML rock in 2020. Existing underground development and NAG and PAG/ML rock storage is shown on the as-built maps in Figures 2-1 and 2-2.

2.1.1 SURFACE DISTURBANCE

There was no additional surface disturbance at the project site in 2020 and the total disturbed surface area remains at 13.5 acres. Existing surface disturbance is shown on the as-built maps in Figures 2-1 and 2-2.

There were no observed impacts to vegetation in the LAD and wetlands areas in 2020.

2.1.2 WATER DISCHARGE

Water balance data for the project in 2019 are included in Table 2-1. Owing to the loss of recorded data, no water balance data are available for 2020. In 2019, an estimated total of 78.5 million gallons of water was discharged to the LAD system; this is comparable to the total volume discharged each year during the period from 2012 to 2019. Monthly discharge rates averaged 152 gallons per minute (gpm) and never exceeded the permitted 300 gpm discharge limit. It is assumed that annual discharge rates in 2020 are similar to rates from 2012 to 2019.

Land application of wastewater occurred upgradient of surface water monitoring stations WQ-04, WQ-06, and WQ-10, and groundwater monitoring stations MW-02, MW-03, and MW-04. There was no land application of wastewater upgradient of Unnamed Creek #2 and surface water station WQ-13, or upgradient of groundwater station MW-01.

2.1.2.1 SITE TEMPERATURE AND PRECIPITATION

Precipitation data is presented to indicate the amount of effluent discharge to the LAD system that is attributable to rainfall or snowfall. Temperature data is presented as wintertime minimum temperatures indicate the potential for freeze-up of the LAD system.

Figure 2-4 presents available long-term (1910–2016) average temperature and precipitation data for Ketchikan, Alaska, from the Western Regional Climate Center (http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak4590). Typical temperatures for the region average 45°F and range from -2°F to 89°F. Total precipitation averages 154 inches annually, and is generally greatest from September through

February. Due to the mild temperatures, most precipitation falls as rain, with less than 40 inches of annual snowfall on average.

Average air temperature and precipitation from January through December 2020 is presented on Figure 2-5 (upper plot). The onsite weather station was not available for 2020 due to instrument malfunction; data from the National Oceanic and Atmospheric Administration (NOAA) Metlakatla Airport Station No. USW00025381 were used as representation of 2020 weather at the project site. Precipitation in 2020 totaled approximately 118 inches, lower than average, and daily temperatures ranged from 11 to 80°F, with an average or 46°F. Visual observations when staff was on site in 2020 found the NOAA weather data generally comparable to onsite conditions.

Figure 2-5 (lower plot) displays observed daily onsite minimum temperatures for the Metlakatla station. Despite low temperatures in January, the LAD system did not experience any freezing in 2020.

2.2 Exploration Drilling

2.2.1 Underground Exploration Drilling

No underground drilling has occurred since 2012.

2.2.2 Surface Drilling

During 2020, Niblack completed 10 diamond drill holes with a cumulative total of 5,815 feet. That drill program is described in more detail in the 2020 Niblack Annual Report for Reclamation Plan Approval RPA-J20182711RPA submitted to ADNR February 11, 2021.

2.3 Reclamation

The various reclamation activities, as described in the *Niblack Reclamation and Closure Plan 2017 Post-Construction Update* (Niblack 2017), are summarized below.

2.3.1 Construction Reclamation

There was no construction reclamation in 2020.

2.3.2 Stormwater Management

Efforts to manage stormwater include maintaining stormwater best management practices (BMPs) at the site. Erosion and sedimentation control features were maintained under BMPs and in accordance with the Multi-Sector General Permit for stormwater in 2020.

2.3.3 Surface Drilling Reclamation

Immediately following drilling activities in 2011 and 2012, all surface drill sites were reclaimed according to the standards for state or federal land. Reclamation activities in 2020 included filling hand-dug drill water sumps at three drill site utilized in 2020. Since the drills were track mounted there was only minimal disturbance at these sites and they are fully reclaimed.

2.4 SUSPENSION OF OPERATIONS

In 2020, the Niblack Exploration Project was in a period of Suspension of Operations approved by ADEC June 29, 2016 (Collingwood 2016), but site activities increased temporarily in November and December. In 2020, monitoring frequency under the Modification of Suspension of Operation Plan is as follows:

- Daily LAD flow meter readings while personnel are on the project site and it is safe to do so
- Visual inspection of the LAD once per month during non-freezing conditions
- Monthly water quality field parameters of monitoring sites EFF1 and PAG facility
- Monthly visual site inspections
- Monthly SWPPP inspections.

Per the Modifications of the Suspension of Operations Plan, the monitoring and reporting frequency occurs annually – during late summer or early fall, when concentrations of metals exhibit seasonal highs – at the following locations:

- Surface water quality sites WQ-04, WQ-06, WQ-10, and WQ-13.
- Groundwater quality sites MW-01, MW-02, MW-03, and MW-04.
- PAG/ML site underdrain and the PAG/ML pond.
- Effluent to the LAD system from the mine dewatering treatment pond, site EFF1

During Suspension of Operations, the site has been maintained in accordance with all operating permits, and environmental monitoring and facility maintenance continues on a regular basis. Water has continued to be routinely pumped from the underground sumps. As water flow is significantly reduced and will not accumulate in the drift, a major dewatering program is not anticipated upon reopening of the drift.

Niblack is likely to be more active starting in 2021 and as a result it has taken the unilateral decision to increase water quality sampling frequency to quarterly, rather than annual. Niblack is working with regulatory agencies to transition out of Suspension of Operations.

2.5 WORK PROPOSED FOR 2021

The Niblack site will become more active in 2021. A limited underground drill program is planned for Quarter 1, 2021. That plan may be expanded pending the results of the Quarter 1 program. Surface exploration may be expanded to a relatively large area along the southwest coast of Niblack Anchorage on USFS lands. However, these activities do not fall with the boundaries of the patented Niblack claims. Niblack may also elect to construct a marine outfall authorized under APDES AK0053708 during 2021.

3 WATER QUALITY REPORTING

This section summarizes the water quality monitoring conducted in 2020 and validation in accordance with the requirements of the Permit.

3.1 WATER MONITORING LOCATIONS

Water quality monitoring stations are shown on Figure 3-1, with active Permit compliance stations shown in blue. Surface water stations (WQ-04, WQ-06, WQ-10, and WQ-13) and groundwater wells (MW-01, MW-02, MW-03, and MW-04) are downstream and downgradient from the water discharge LAD system.

Runoff from the PAG/ML material is monitored through PAG/ML pond. The LAD system is monitored through station EFF1, at the outflow of the main settlement ponds. Figure 3-2 shows the main settlements ponds collection of PAG/ML water and discharge from the main exploration drift.

Table 3-1 presents all station coordinates, descriptions, activity status, and purpose.

3.1.1 WATER SAMPLING

The modified Plan stipulates the sampling event for annual water quality monitoring for analytical chemistry should occur during late summer or early fall, and sampling was conducted October 1-2, 2020. Field parameters at PAG/ML pond and EFF1 were monitored monthly, other than December, in 2020. Table 3-2 summarizes all sampling events in 2020.

Results from 2020 water quality monitoring are discussed in Section 4.

Field quality assurance and quality control (QA/QC) samples were collected during the sampling event in 2020, as summarized in Tables 3-6a-b. The QA/QC samples included a field replicate each for surface water station WQ-13 and groundwater station MW-01, as well as field blanks for all analytes including total and dissolved metals. The water quality and field QA/QC samples for the 2020 sampling event were analyzed for the parameters identified in the Permit. An evaluation of field replicate samples collected in 2020 is presented in Section 3.2.1.2.

3.2 DATA QUALITY EVALUATION

The QAPP (Integral 2013b) identifies the following two data quality objectives (DQOs) to ensure that data of adequate quantity and quality are generated to support the requirements of the Permit:

> DQO 1—Surface Water Quality. The DQO for surface water quality is to ensure that data of sufficient quantity and quality are collected to determine whether concentrations of water quality parameters in designated surface water monitoring locations meet water quality standards in 18 AAC 70 (ADEC 2020), and/or are within site-specific natural conditions. The site-specific natural conditions for surface water will be established by the combined data set from surface water monitoring conducted at pre-project reference

> locations before exploratory activity and from ongoing monitoring of upstream reference locations.
>
> DQO 2—Groundwater Quality. The DQO for groundwater quality is to ensure that data of sufficient quality and quantity are collected to determine whether concentrations of water quality parameters in designated forest floor wells conform to site-specific facility threshold values. The threshold values will be determined based on comparison of background (pre-activity) groundwater well concentrations to wastewater discharge concentrations, and non-acid generating material content.

Measurement quality objectives evaluate and control the data collection process to ensure that measurement uncertainty is within an acceptable range to meet DQOs. Measurement quality objectives define the acceptable quality of field and laboratory data for the project, in terms of data quality indicators, such as the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters (USEPA 2002). PARCC parameters are commonly used to assess the quality of environmental data. These parameters, as well as analytical sensitivity (i.e., detectability), were used to assess conformance of surface water, groundwater, and effluent data with quality control criteria, as detailed in the following sections.

As specified in the QAPP (Integral 2013b), a readiness review was conducted on the entire set of water quality data collected in 2020. This review assures that all data underwent complete quality assurance review and validation and that all qualifiers assigned during validation were entered into the database and verified.

3.2.1 Data Validation and Detectability

As specified in the QAPP (Integral 2013b), a quality assurance review of the laboratory data from chemical analyses of surface water and groundwater samples was conducted for all water quality sampling events conducted in 2020. Laboratory analytical data were validated according to the data validation procedures in the U.S. Environmental Protection Agency (EPA) guidance for inorganic data review (USEPA 2010). Data that did not meet the applicable laboratory or data validation quality control limits were qualified as undetected (assigned a *U* qualifier), estimated (assigned a *J* qualifier), or rejected (assigned an *R* qualifier) during the quality assurance review. The analytical summary data presented in Section 4 also present the data validation qualifiers assigned to the project data.

Detectability refers to the ability of the analytical method to reliably measure a concentration above background. Two components are used to define detectability: the method detection limit (MDL) and the practical quantitation limit (PQL) or method reporting limit (MRL).

- The MDL is the minimum value that the instrument can discern above background, but with no certainty to the accuracy of the measured value. For field measurements, the manufacturer's listed instrument detection limit can be used.
- *The PQL or MRL is the minimum value that can be reported with confidence.*

Sample data measured below the MDL were reported as nondetect. Sample data measured ≥MDL but ≤PQL or MRL were reported as estimated data (assigned a *J* qualifier). Sample data measured above the PQL or MRL were reported as reliable data unless otherwise qualified per the specific sample analysis.

Field data were verified during preparation of samples and again during data entry. After field data were entered into the project database, field staff conducted 100 percent verification of the entries to ensure the accuracy and completeness of the database.

3.2.1.1 PRECISION

Precision reflects the reproducibility between individual measurements of the same property. Surface water and groundwater field replicates were collected to assess the precision of the project results. Field replicate samples were generated using a peristaltic pump to collect water from one location into two separate sets of bottles at approximately the same time; the two sets of bottles were labeled as representing two separate sample locations in order to "blind" the replicate relationship at the analyzing laboratory.

The comparability of the field replicate results was assessed by calculating the relative percent difference (RPD) and sample difference (replicate sample – normal sample) of the results, as presented in Tables 3-6a-b. Results for normal/replicate sample pairs were evaluated against a control limit of ±50 RPD, as specified in the QAPP (Integral 20013d). Greater variability is expected for results near or below the reporting limit because the background signal variations (i.e., "noise") are greater relative to the analyte levels.

As shown in Tables 3-6a-b, the surface water and groundwater normal/replicate pairs collected in 2020 had zero RPD below the control limit (RPD = ±50). However, sulfate for surface water was measured at non-detect and the replicate sampled measure 3.51mg/L whereas the opposite held true for the pair for groundwater, 3.64mg/L for the sample and non-detect for the replicate. Neither comparison was flagged as RPD is not calculated where one or more concentrations were below reporting limits. Initial analysis could indicate a sample swap of the surface and groundwater replicates for sulfate concentrations.

There were no control limit exceedances in 2020 for surface water or groundwater.

3.2.1.2 ACCURACY

Accuracy (bias) represents the degree to which a measured concentration conforms to a reference value. Matrix spike/matrix spike duplicate (MS/MSD) samples and field blanks were analyzed to assess the data accuracy. The accuracy of the results was assessed by calculating the percent recovery for the MS/MSD samples and results for all analyses conducted by ALS Environmental had an RPD of 2% or less. The data for 2020 is considered accurate.

3.2.2 REPRESENTATIVENESS

All samples collected in 2020 were collected according to QAPP protocols (Integral 2013b); no discrepancies were noted. All samples were properly handled (i.e., proper preservation and shipping temperature) during collection and receipt by the laboratory, unless stated otherwise below.

3.2.3 COMPLETENESS

Data completeness refers to the amount of usable data collected. Percent completeness by parameter group was calculated for all samples collected in 2020, summarized in Table 3-7. No data for 2020 were rejected during data validation and review and completeness was 100 percent.

3.2.4 COMPARABILITY

Comparability is the qualitative similarity of one data set to another (i.e., the extent to which different data sets can be combined for use). EPA analytical methods were used by the laboratory to analyze all 2020 samples, as noted in Table 3-5. No discrepancies were noted between methods used by the laboratory and those listed in the QAPP (Integral 2013b).

4 MONITORING RESULTS

This section summarizes the results of water quality monitoring conducted in 2020. Specific parameters and station analyses are discussed in Section 5 for surface water and groundwater and Section 6 for PAG/ML and effluent water.

Tabulated surface water and groundwater quality monitoring results for 2020 are provided in Tables 4-1a-c, which includes results for all stations and parameters identified in Table A of the Permit. MDLs for all stations are provided in Tables 4-2a-b.

Field parameters for stations PAG/ML pond and EFF1 were monitored monthly, January-November, in 2020 and the annual water quality monitoring and sample collection for all active stations occurred October 1-2, 2020. Field parameters for station EFF1 are included in this report. The PAG underdrain was not sampled in 2020 as it was dry. No voluntary onsite or offsite surface water samples were collected in 2020.

4.1 COMPARISON TO WATER QUALITY STANDARDS

Surface water temperature, pH, and TDS were compared to Alaska water quality standards (WQS) criteria specified in 18 AAC 70 (ADEC 2020) for fresh water uses. No applicable screening criteria exist for hardness, conductivity, nitrate and nitrite, or sulfate.

All applicable field parameters and general chemistry measured at surface water stations were within water quality criteria ranges in 2020.

Surface water metals concentrations are screened against WQS found in 18 AAC 70 (ADEC 2020) and specified in the *Alaska Water Quality Manual for Toxic and Deleterious Organic and Inorganic Substance*s.

Surface station WQ-10 had WQS exceedances of chronic aquatic life criteria for dissolved cadmium, as well as WQS exceedances of acute and chronic aquatic life criteria for dissolved copper and dissolved zinc. These exceedances are described in Section 5.

Groundwater measurements are screened against the groundwater threshold values in Table B of the Permit. There were no exceedances of Permit groundwater threshold values in 2020.

Tables 4-3a-b present station-specific screening results for individual surface water and groundwater samples.

5 ANALYSIS – SURFACE WATER AND GROUNDWATER

Data from samples collected and analyzed in 2020 are presented in tabulated format in Table 4-1a-c. WQS or threshold exceedances are reported in Table 4-3a and 4-3b and discussed specifically in the sections below.

5.1 TIME SERIES ANALYSIS

Figures 5-1 through 5-21a-c. present time series graphs for field parameters, general chemistry and metals concentrations at surface water and groundwater stations.

5.1.1 FIELD PARAMETERS AND GENERAL CHEMISTRY

No consistent changes in patterns or trends in water quality are evident for any field parameters or chemistry in surface water or groundwater stations (Figures 5-1 through 5-9).

5.1.1.1 FIELD PARAMETERS

Surface water pH values were generally circumneutral at all stations in 2020, with values between 7.07 and 7.47, following comparability over time and within the water quality standards range of 6.5 to 8.5. Groundwater pH values, between 5.58 and 6.87, are within trends.

Conductivity at surface and groundwater stations has generally decreased since 2017, with a slight increase in surface water stations in 2020 compared to 2019.

Surface water and groundwater temperature results show clear and consistent seasonal fluctuations at all monitoring stations. Surface water stations temperatures were below WQS aquatic life criteria of 13°C for spawning areas.

Surface water and groundwater sulfate levels continue to be well below drinking water standards of 250mg/L.

5.1.1.2 GENERAL CHEMISTRY

Hardness levels returned to normal levels at surface water locations in 2020, following extremely low levels in 2019. There is a decreasing trend over time at all surface water stations, particularly WQ-10 which had hardness-based WQS exceedances in 2020. Groundwater levels of hardness maintained normal levels in 2020.

Nitrate and nitrite concentrations remained low (> 0.2mg/L as N) across all surface water and groundwater sampling sites through 2020.

No patterns are evident in TDS data, with surface water and groundwater results covering a seasonal range with results consistently below WQS of 1000mg/L.

5.1.2 Metals

Time series graphs at surface water and groundwater stations for all metals listed in Table A of the Permit are presented as Figures 5-10 through 5-21a-c.

2020 concentrations of metals in surface water and groundwater samples are generally comparable to time-series trends, with specific exceptions discussed below. No consistent changes in patterns or trends in water quality are evident for any metals in surface water or groundwater, other than cadmium, copper and zinc at surface water station WQ-10.

5.1.2.1 Aluminum

There were no exceedances of WQS for total aluminum in 2020. Total aluminum concentrations measured at surface water stations ranged from 52.4 to 63.6µg/L, which were below 2019 concentrations.

Total aluminum concentrations measured at groundwater stations ranged from 109 to 613µg/L. Station MW-02 indicates a decreasing trend and other stations remain relatively consistent over time.

5.1.2.2 Arsenic

There were no exceedances of WQS for total arsenic in 2020. Arsenic concentrations at surface water and groundwater stations have remained low over time, including 2020 with all surface water concentrations non-detect.

5.1.2.3 Cadmium

Concentrations for total cadmium at surface water and groundwater stations have been > 0.1µg/L over time, apart from surface water station WQ-10. This station has shown previous fluctuations, with results near 0.25µg/L, including 2020 with a result of 0.21µg/L.

Surface station WQ-10 had a WQS exceedance of chronic aquatic life criteria for dissolved cadmium in 2020; the hardness-based criteria was 0.08µg/L and dissolved cadmium measured at 0.21µg/L. Concentrations of dissolved cadmium at WQ-10 show an increase 2016 to 2017, decreasing in 2018 to non-detect. It is not apparent if results of dissolved cadmium in 2020 are indicative of a rising trend at this station. The concentration in 2019 was slightly higher than non-detect results in 2018 and results in 2020 were slightly higher than 2017 results of 0.19µg/L. Hardness at station WQ-10 decreased steadily from 2016 through 2019 and increased in 2020.

Concentrations for dissolved cadmium at other surface water stations were below WQS and comparative to concentrations over time.

There were no Permit threshold exceedances in 2020 at groundwater stations for dissolved cadmium. All groundwater stations had 2020 concentrations of < 0.01µg/L for total and dissolved cadmium.

5.1.2.4 Chromium

There were no Permit threshold exceedances in 2020 at groundwater stations for total chromium.

Total chromium concentrations at surface water and groundwater stations in 2020 were comparative with results over the time series.

Total chromium concentrations in all groundwater stations were compared to the unfiltered chromium (VI) WQS of 50µg/L, per Table B in the Permit and there were no exceedances.

5.1.2.5 COPPER

The concentration of total copper at surface water station WQ-10 was 4.39µg/L in 2020, the highest result at this station over the time series. Concentrations for total copper at all other surface and groundwater stations show no indication of changing trends over time.

Surface station WQ-10 had WQS exceedances of chronic and acute aquatic life criteria for dissolved copper in 2020. The hardness-based result for chronic criteria was 2.19µg/L, for acute criteria was 2.84µg/L, and dissolved copper was measured at 3.70µg/L. Concentrations of dissolved copper at WQ-10 have been generally comparable, with results < 2.0µg/L over time.

There were no exceedances of WQS for dissolved copper at any other surface water stations and 2020 results for dissolved and total copper were comparable to time-series trends.

There were no Permit threshold exceedances in 2020 at groundwater stations for dissolved copper. The concentration of dissolved copper at groundwater station MW-01 of 2.46µg/L was below the groundwater threshold of 2.61µg/L in the Permit. Following a threshold exceedance in 2017, results for dissolved copper at this station have been higher than normal but under the threshold limit. A replicate sample was taken from this MW-01 in 2020, with a dissolved copper concentration of 2.56µg/L, also below the Permit threshold.

Dissolved copper concentrations in 2020 were < 2.0µg/L at all other groundwater stations.

5.1.2.6 LEAD

Concentrations of total lead at surface and groundwater stations have remained low over time and through 2020.

5.1.2.7 MERCURY

There were no exceedances of WQS for total mercury in 2020. Concentrations of total mercury in both surface water and groundwater stations were non-detect in 2020, apart from MW-02 which had an approximate result of 0.02µg/L.

5.1.2.8 SELENIUM

There were no exceedances of WQS for total selenium in 2020. Concentrations of total selenium in all surface water and groundwater stations were non-detect in 2020.

5.1.2.9 ZINC

The concentration of total zinc at surface water station WQ-10 was 62.1µg/L in 2020, the highest result at this station over the time series. Total zinc concentrations at this station were showing an increasing trend through 2016 and 2017 before dropping significantly in 2018 and increasing moderately in 2019.

Surface station WQ-10 had WQS exceedances of chronic and acute aquatic life criteria for dissolved zinc in 2020. The hardness-based result for chronic criteria was 29.18µg/L, acute criteria was 28.95µg/L, and dissolved zinc was measured at 59.9µg/L. Similar to total zinc, dissolved zinc concentrations at this station were showing an increasing trend through 2016 and 2017 before dropping significantly in 2018 and increasing moderately in 2019. There was a prior WQS exceedance at this station in 2019, when non-detect hardness resulted in uncharacteristically low acute and chronic aquatic life criteria.

There were no exceedances of WQS for dissolved zinc at any other surface water stations and 2020 results for dissolved and total zinc were comparative with results over time.

Total zinc concentrations at all groundwater stations in 2020 were comparative with previous results. After a significant increase of total zinc in 2019 at groundwater station MW-04, results in 2020 decreased to 3.9µg/L, which is comparative to previous results and the highest of all groundwater stations in 2020.

There were no Permit threshold exceedances in 2020 at groundwater stations for dissolved zinc. Following increasing trend in 2017 through 2019 of dissolved zinc at groundwater station MW-04, results in 2020 decreased to 4.6µg/L, the highest of all groundwater stations.

5.2 CONCLUSION

Field parameters and general chemistry parameters at surface water and groundwater monitoring stations generally show expected seasonal fluctuations and comparability over time. Sulfate concentrations identified in previous reports as increasing at some surface water and groundwater stations have exhibited a decreasing trend since 2018 through 2020.

There were no surface water WQS exceedances in 2020 at any stations other than WQ-10. All groundwater metals concentrations were below Permit groundwater thresholds during 2020.

NPLLC will continue to closely monitor cadmium, copper, lead and zinc concentrations at surface water station WQ-10. As results decreased from 2017 to 2018 and increased moderately in 2019, more data is required to establish if this is a statistically valid trend. Corrective action was identified in 2019 to monitor and regulate use of LAD system zones 4 and 5, which are upgradient of WQ-10, to validate if increasing metals concentrations are a natural condition or correlated to LAD discharge. Immediate corrective action will be to again discontinue use of LAD Zones 4 and 5 temporarily and monitor WQ-10 for any natural attenuation.

Any activity will continue to be avoided in the NAG site to determine a correlation with increased copper levels at station MW-01.

6 ANALYSIS – PAG/ML AND EFFLUENT WATER

Figure 3-1 shows the sample locations of mine discharge water at the outlet to the LAD system (station EFF1, at the outflow of the settlement ponds) and PAG/ML rock runoff (station PAG/ML pond, at the PAG/ML pond). The PAG/ML area monitoring program is designed to inform site water and waste rock management decisions; these waters are not subject to aquatic life or site-specific standards.

6.1 BACKGROUND AND MONITORING LOCATION DESCRIPTIONS

The development of a 2,800-ft exploration drift, completed June 2008, along with construction of a variety of supporting infrastructure (Figure 2-2), has provided materials for geochemical characterization to determine the potential for acid rock drainage on the Niblack Exploration Project site. Each drift excavation blast round was subjected to analysis to determine if the rock was PAG, following the specifications outlined in the *Niblack Project Underground Exploration Plan of Operations. Revision 1*. A storage facility was constructed onsite (Figure 6-1) for the temporary storage of PAG blast rock.

Of the approximately 286 blast rounds completed, 43 were determined to comprise mainly PAG rock. Of the 43 "PAG rounds," 4 rounds were considered to be "well mineralized" and were placed in a small stockpile located just east of the PAG storage facility, on a layer of geo-membrane, and subsequently covered by geo-membrane to prevent weathering (Figure 2-2). The remaining 39 rounds (approximately 9,000 tons), primarily sulfide-bearing Lookout rhyolite, were placed in the temporary PAG storage facility, which is also referred to as the PAG pile (Figure 6-1).

Based on QA/QC verification test work conducted as a part of the operational characterization plan, the material in the PAG pile is anticipated to average ~1 percent total sulfur, predominantly as sulfide-sulfur, with low neutralization potentials, <~20 kg $CaCO_3$/t equivalent, and corresponding neutralization potential ratios of <0.5 (MESH Environmental 2009).

Figure 3-2 displays how water from the PAG rock pile accumulates in the PAG/ML pond before discharging into the two main settlement ponds which also receive water from the exploration drift. The main ponds allow for passive treatment and settlement as the waters comingle and receive direct rainfall before discharging to the LAD system.

6.1.1 PAG/ML POND

Station PAG/ML pond is located in the PAG/ML pond (Figure 3-1). Runoff water from the PAG/ML waste rock pile is collected for sampling using a peristaltic pump. PAG/ML pond was monitored on a monthly basis for field parameters in 2020 and the annual water quality monitoring sample was collected Oct 2, 2020.

6.1.2 MAIN SETTLEMENT PONDS (EFF1)

Station EFF1 is located in the site settlement ponds (Figure 3-1) near the outlet pipe and is representative of water discharged from the LAD system. EFF1 was monitored on a monthly basis for field parameters in 2020 and the annual water quality monitoring sample was collected Oct 2, 2020.

6.2 TIME SERIES ANALYSIS

Figures 6-1 through 6-21 present time series graphs for field parameters and general chemistry and trace element (Figures 6-10 through 6-17).

6.2.1 FIELD PARAMETERS AND GENERAL CHEMISTRY

Figures 6-1 through 6-21 present time series graphs for field parameters, general chemistry and metals concentrations at stations PAG/ML pond and EFF1.

6.2.1.1 FIELD PARAMETERS

pH values at PAG/ML pond have followed seasonal patterns with lower values in the summer months, with an apparent overall decreasing trend since 2017. In 2020 there was a notable increase to relatively neutral value of 6.26 in November, up from a low of 3.48 in July. Levels at EFF1 show some seasonal fluctuations and remain circumneutral with pH ranging from 6.45 to 7.7 in 2020.

Conductivity at PAG/ML pond is more variable than EFF1 and typically shows seasonal fluctuations PAG/ML pond, where low values at EFF1 show no seasonal patterns. Conductivity decreased at the end of 2020 at PAG/ML pond to 331 µS/cm, the lowest value over the time series.

Turbidity and Dissolved Oxygen are not required monitoring parameters and are included as part of complete field parameter data collection. Turbidity is generally low (<10 nephelometric turbidity units [NTU]) in the PAG/ML pond and EFF1. No clear seasonal or temporal pattern exists for dissolved oxygen at the PAG/ML pond or EFF1.

Temperature shows strong seasonal fluctuation in the PAG/ML pond and the settlement ponds (EFF1), which continued through 2020.

Sulfates are monitored at PAG/ML pond and EFF1 as part of complete field parameter data collection, and field tests at the project site cannot measure values > 200mg/L or < 50mg/L. Values at PAG/ML pond are generally > 200mg/L and annual samples collected for laboratory analysis result in higher levels, 910mg/L in 2020. Sulfate values in PAG/ML pond have not translated to higher concentrations in EFF1 or discharge to the LAD; EFF1 concentrations are consistently lower and less variable. In 2020, most field sulfate measurements at EFF1 were < 150mg/L, comparative to concentrations over time and the 2020 lab analysis result of 38mg/L.

6.2.1.2 General Chemistry

Hardness in the PAG/ML pond fluctuates over the time series, with decreasing trend since 2018 to 110mg/L $CaCO_3$ in 2020. EFF1 hardness remains consistent over time with levels near 2020 value of 109mg/ L $CaCO_3$.

Nitrate and nitrite concentrations (Fig 6-8) in PAG/ML pond have decreased steadily since 2016 to non-detect values in 2019 and 2020. EFF1 has shown consistent values over time with concentrations near 2020 of 0.027mg/L as N.

TDS shows an increasing trend over time to 1510mg/L. TDS at EFF1 was 153mg/L and comparative to time series levels. TDS concentrations at EFF1 are generally significantly lower than the concentrations observed in the PAG/ML pond.

6.2.2 Metals

Figures 6-10 through 6-21 present time series graphs at PAG/ML pond and EFF1 stations for metal parameters identified in Table A of the Permit.

There are no WQS criteria or Permit thresholds for PAG/ML pond or EFF1 stations. Most metal concentrations are indicating an increasing trend over time, particularly PAG/ML pond. Increases in PAG/ML pond are not directly comparative to concentrations at EFF1 or discharge to the LAD system.

6.2.2.1 Aluminum

Total aluminum concentrations have been significantly lower at EFF1 than PAG/ML pond, and both stations indicate increasing trends over time. Total aluminum in 2020 at PAG/ML pond was the highest value over time at 15,700µg/L. EFF1 total aluminum concentration was also up over time to 228µg/L in 2020, though down from 2018 peak concentration.

6.2.2.2 Arsenic

Total arsenic concentrations have been increasing from non-detect in 2016 to 1.05µg/L in 2020 at PAG/ML pond. Total arsenic at EFF1 has been consistent over time and comparative to the 2020 result of 0.4µg/L.

6.2.2.3 Cadmium

At both PAG/ML pond and EFF1, total and dissolved cadmium concentrations show an overall trending increase, with a decrease since 2018. A steep rise from 2016 to 2018 was followed by a drop in 2019 for both stations. Total and dissolved cadmium concentrations at PAG/ML pond increased in 2020 to 137µg/L and 136µg/L respectively, both lower than 2017 results. Results in 2020 at EFF1, 4.13µg/L total and 4.04µg/L dissolved cadmium, are comparative to 2019.

6.2.2.4 Chromium

Total chromium concentrations have increased at PAG/ML pond over time, with a 2020 concentration of 7.15µg/L. The unfiltered total chromium value remains below the chromium (VI) WQS of 50µg/L, stated in the Permit to determine if samples of dissolved chromium (VI) may be requested by ADEC. Total chromium concentrations at EFF1 have been flat over time and comparative to the 2020 result of 0.53µg/L.

6.2.2.5 COPPER

Similar to cadmium, total and dissolved copper concentrations at PAG/ML pond and EFF1 (Figure 6-15 and 6-16) show an overall trending increase, with a decrease since 2018. Time-series analyses compare copper to cadmium patterns, with total (5520µg/L) and dissolved (5260µg/L) copper at PAG/ML pond up from 2019 and total (124µg/L) and dissolved (79.6µg/L) copper at EFF1 comparative to 2019 results.

6.2.2.6 LEAD

Total lead concentrations have increased at PAG/ML pond over time, with a 2020 concentration of 108µg/L. Total lead concentrations at EFF1 have decreased 2018 through 2020, which had a concentration of 1.72µg/L.

6.2.2.7 MERCURY

Total mercury was not detected in 2020 at the PAG/ML pond or EFF1.

6.2.2.8 SELENIUM

Concentrations of total selenium have shown modest fluctuations over time at PAG/ML pond, with 2020 results of 0.7µg/L equal to results in 2016. At EFF1, concentrations of total selenium have increased slightly over time, from non-detect in 2016 to 0.4µg/L in 2020.

6.2.2.9 ZINC

Total and dissolved zinc concentrations at PAG/ML pond and EFF1 have followed similar time-series patterns as cadmium and copper. In 2020, total and dissolved zinc concentrations at PAG/ML pond were 37,100µg/L and 37,300µg/L, both higher than 2019. Total and dissolved zinc concentrations at EFF1 were 974µg/L and 933µg/L, both comparative to 2019.

6.3 CONCLUSIONS

Field parameters and general chemistry have remained stable within annual or seasonal fluctuations indicating some changes in system dynamics in the PAG/ML pond but little changes in EFF1. PAG/ML pond and EFF1 pH levels show seasonal patterns, with a potential acidic trend in PAG/ML pond during the summer not correlating to EFF1 levels, which have been circumneutral. There has been a steady decrease in nitrate and nitrite concentrations since 2016, particularly in PAG/ML pond, which could indicate that nitrogen from blasting has been flushed from the PAG waste rock. Results indicate concentrations of sulfate have shown increases in the summer months relative to winter, suggesting seasonal trends in sulfide oxidation.

Compared to PAG/ML pond, EFF1 results are more consistent and lack indications of significant change in field parameters or general chemistry in waters discharging to the LAD system.

Total chromium concentrations have been increasing in the PAG/ML pond since 2016. Results remain lower than the chromium (VI) WQS of 50µg/L, and at this time does not indicate a necessity to request samples of dissolved chromium.

The rising trend in total and dissolved cadmium, copper and zinc concentrations in PAG/ML and EFF1 from 2016 to 2018 reversed in 2019 and slightly increased at PAG/ML and remained comparative at EFF1 in 2020. However, there is an overall trend of rising concentrations and, though not as steep as 2016-2018 results indicated, could be a result of PAG weathering. The concentrations at EFF1 are significantly lower than PAG/ML, reflecting the passive treatment and settling of solids in the main settlement ponds. As discussed in Section 5, these trends have not translated to increases observed in monitoring of downgradient groundwater or surface water stations, other than WQ-10 which monitors LAD Zones 4 and 5 and corrective action is discussed in Section 5.

NPLLC will continue to monitor water quality at all other stations.

7 DISCHARGE EVENTS

There was no discharge of treated or untreated wastewater, sludge, or other materials to the lands or waters of the state, nor any other discharge events in 2020 out of compliance with the Permit.

8 ADEQUACY OF FINANCIAL RESPONSIBILITY

ADNR Reclamation Plan Approval #J20182711RPA includes a financial responsibility cost estimate of $1,264,412. Reclamation cost estimates were based on as-built acreage disturbance estimates and current reclamation costs. There have been no changes to the disturbance at site or the site facilities including the waste rock storage facilities that are included in the approved reclamation plan for the site. As a result, the $1,264,412 reclamation cost estimate remains valid.

9 REFERENCES

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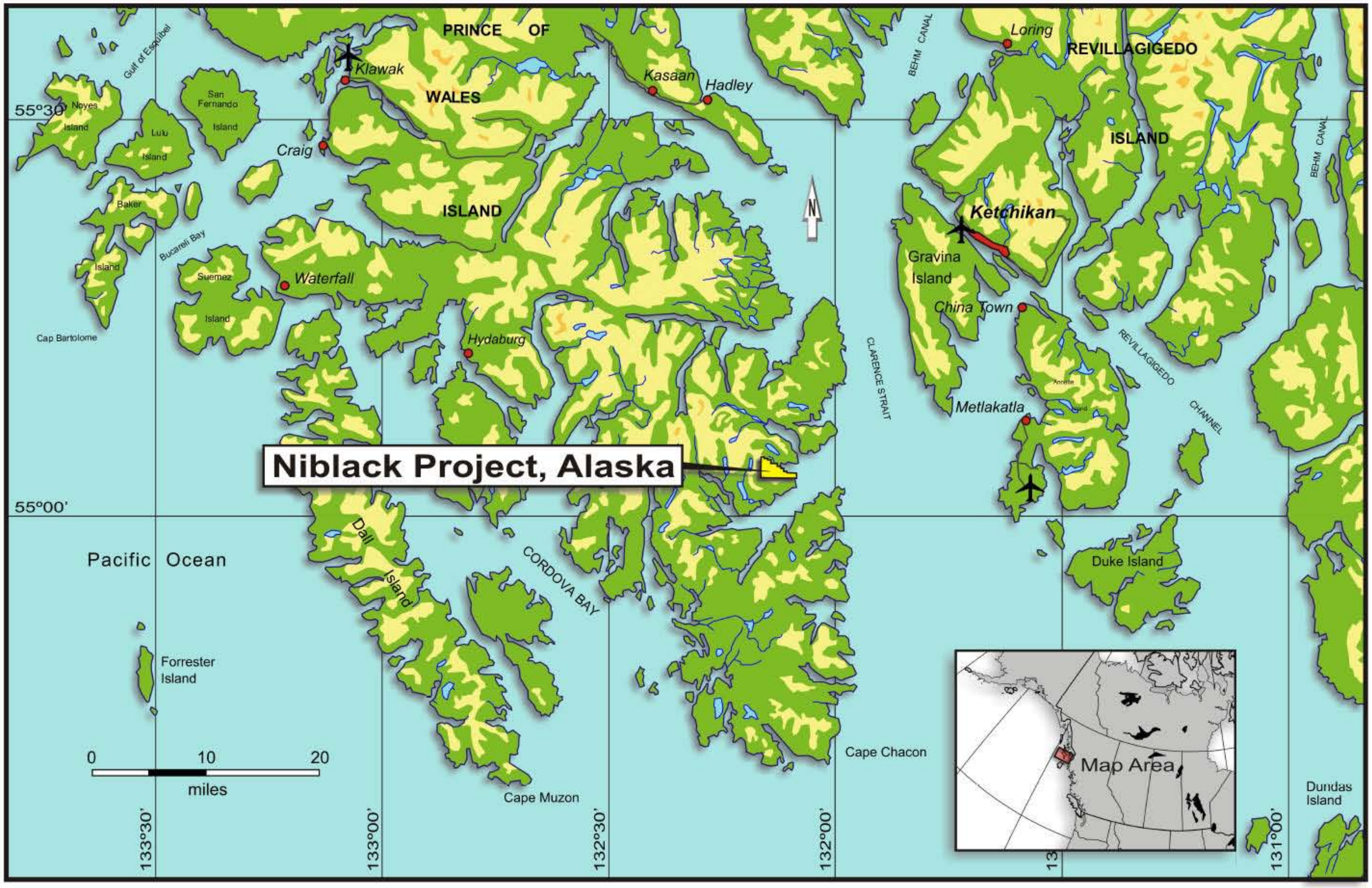
FIGURES



Niblack Project Location Map

May, 2006

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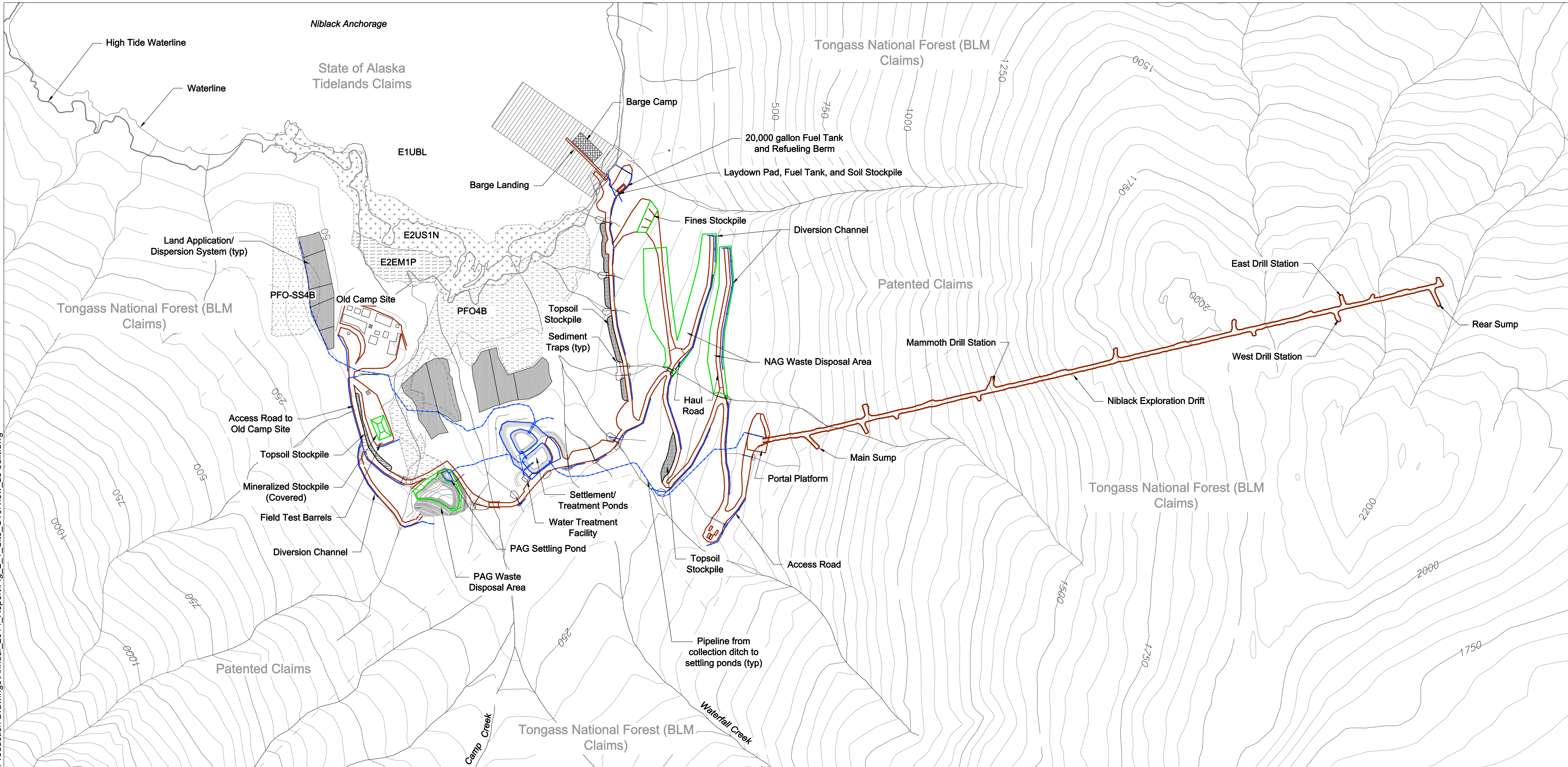
Figure 1-1
Niblack Project Location Map
Niblack Exploration Project
2020 Annual Report



LEGEND

- E1UBL Estuarine - Subtidal
- E2US1N Estuarine - Unvegetated Intertidal
- E2EM1P Estuarine - Emergent Intertidal
- PFO-SS4B - Needleleaf Forest/Scrub - Shrub Wetland
- PFO4B - Needleleaf Forest Wetland
- Land Application Areas
- Tideland Lease Area
- Property/Patented Claim Boundary
- Waste Rock Storage Facilities
- Water Management Features
- Roads and Exploration Access Drift

NOTE

1. All dimensions and elevations are in feet unless otherwise noted

SOURCES

1. As-built drawings provided by Niblack Project LLC (2011)
2. Land application area boundaries from Turner (2009, personal communication)

N:\GIS\Projects\C384_NiblackAK\CAD\Production Drawings\Annual_2014_Report\Fig_2_1_Site_Overview_as-built.dwg

NIBLACK PROJECT LLC

0 200 400 Feet

N

Figure 2-1.
General Site Plan
Niblack Exploration Project
2020 Annual Report

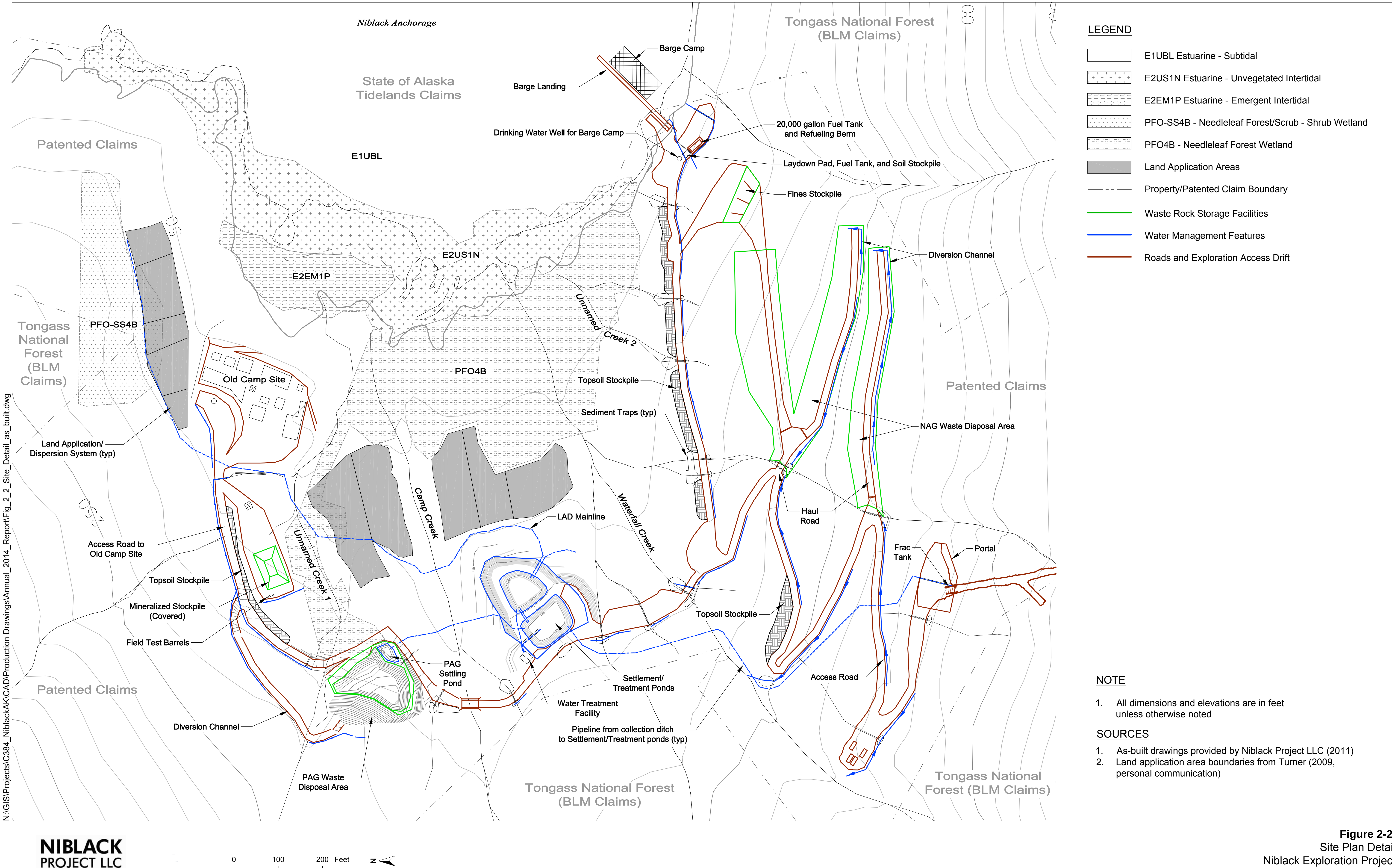


Figure 2-2.
Site Plan Detail
Niblack Exploration Project
2020 Annual Report

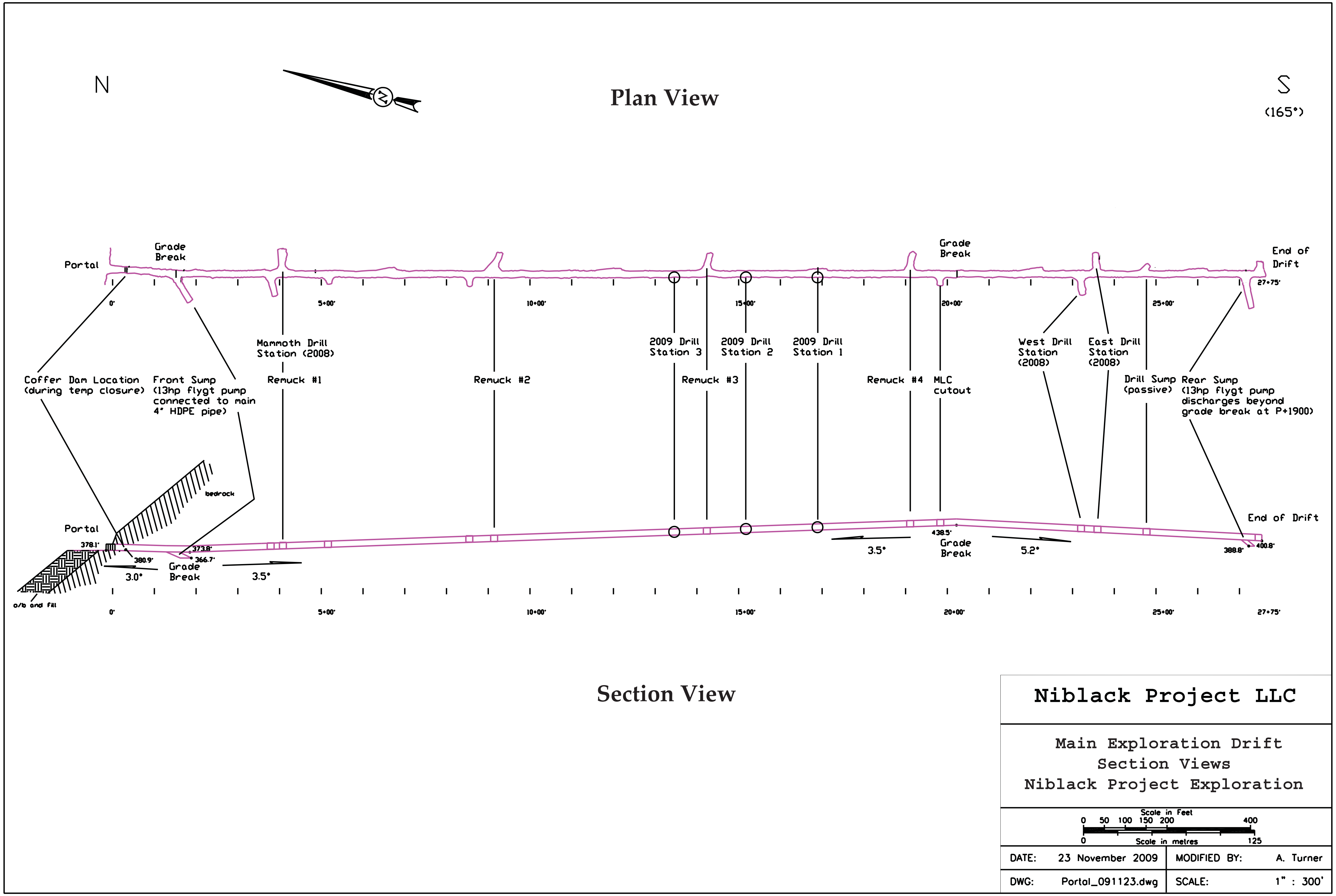


Figure 2-3
2020 Annual Report

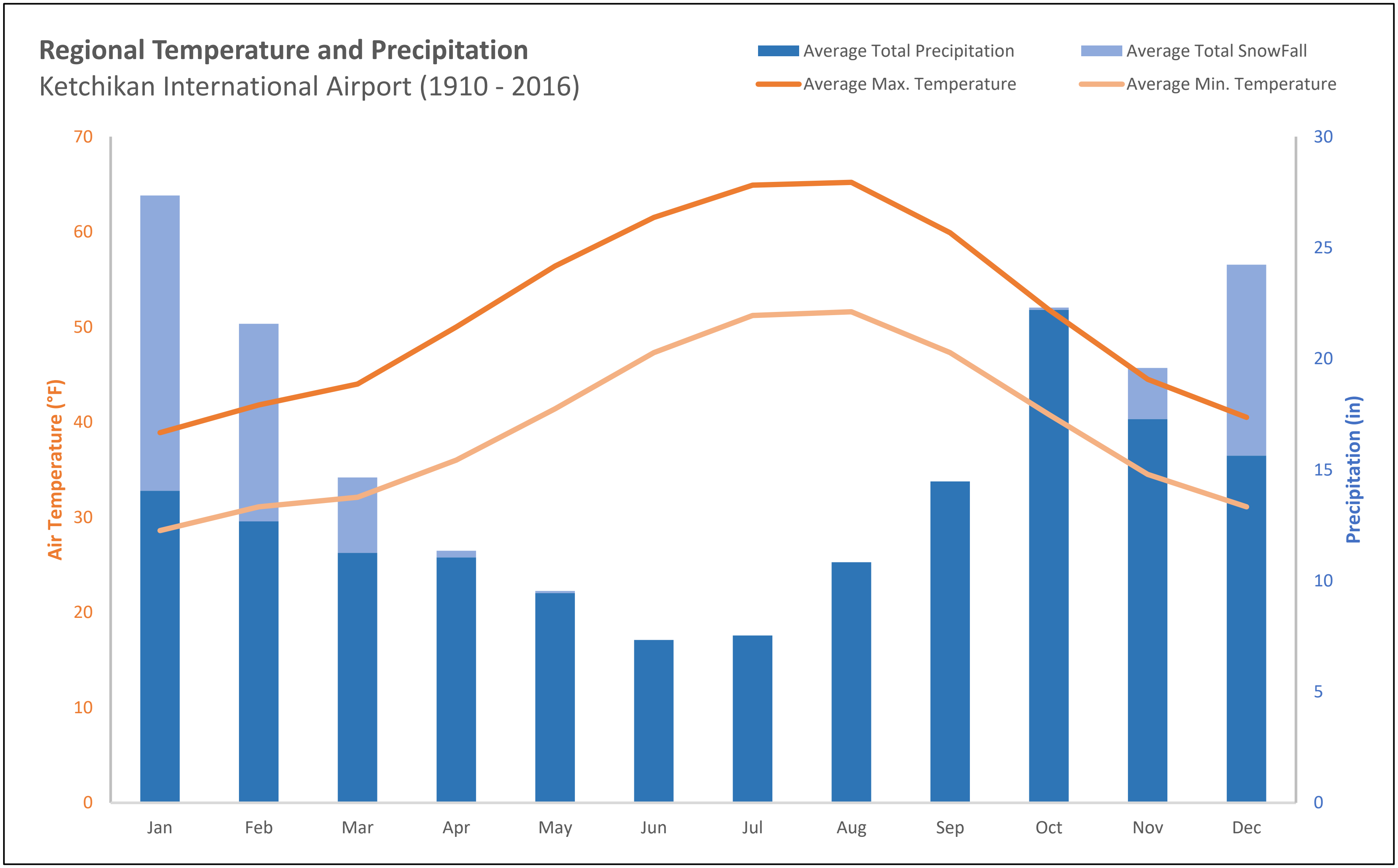


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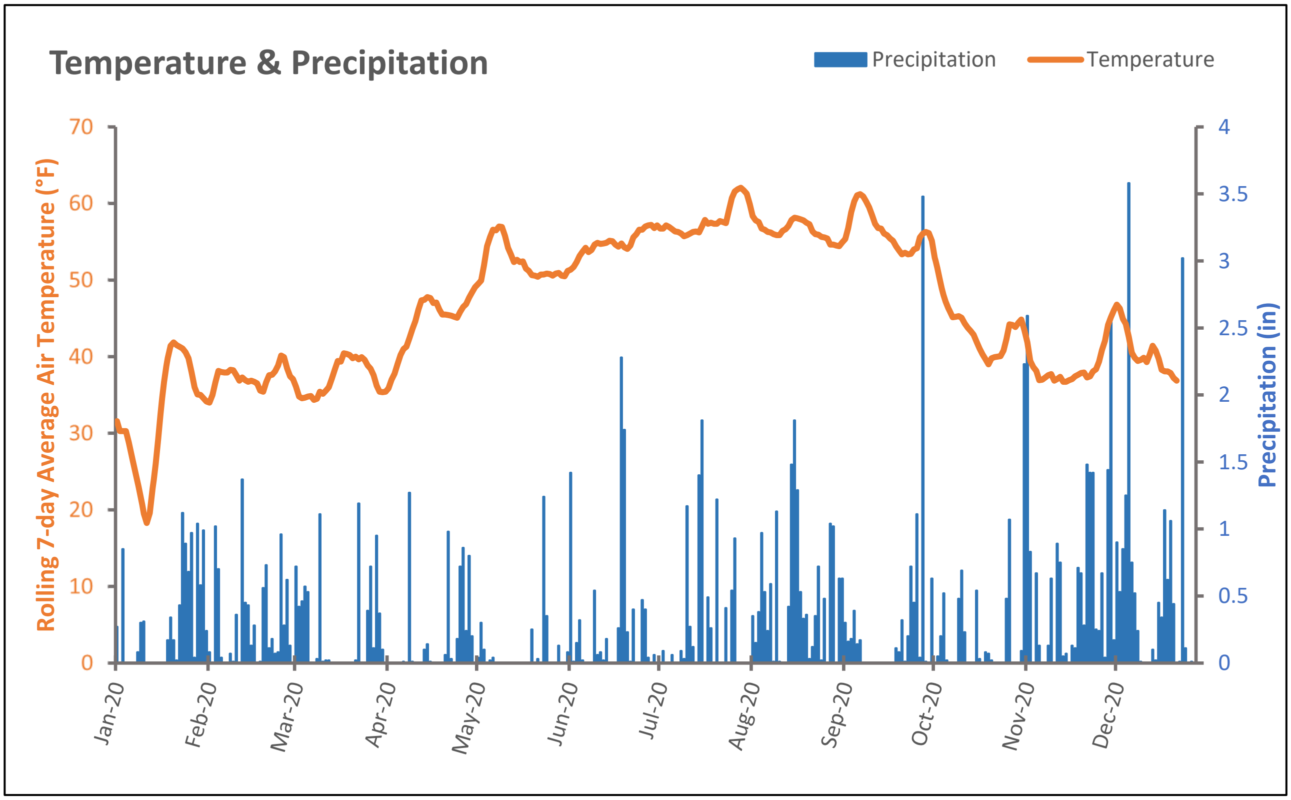
Figure 2-4
Time Series Graphs:
Temperature & Preciptiation



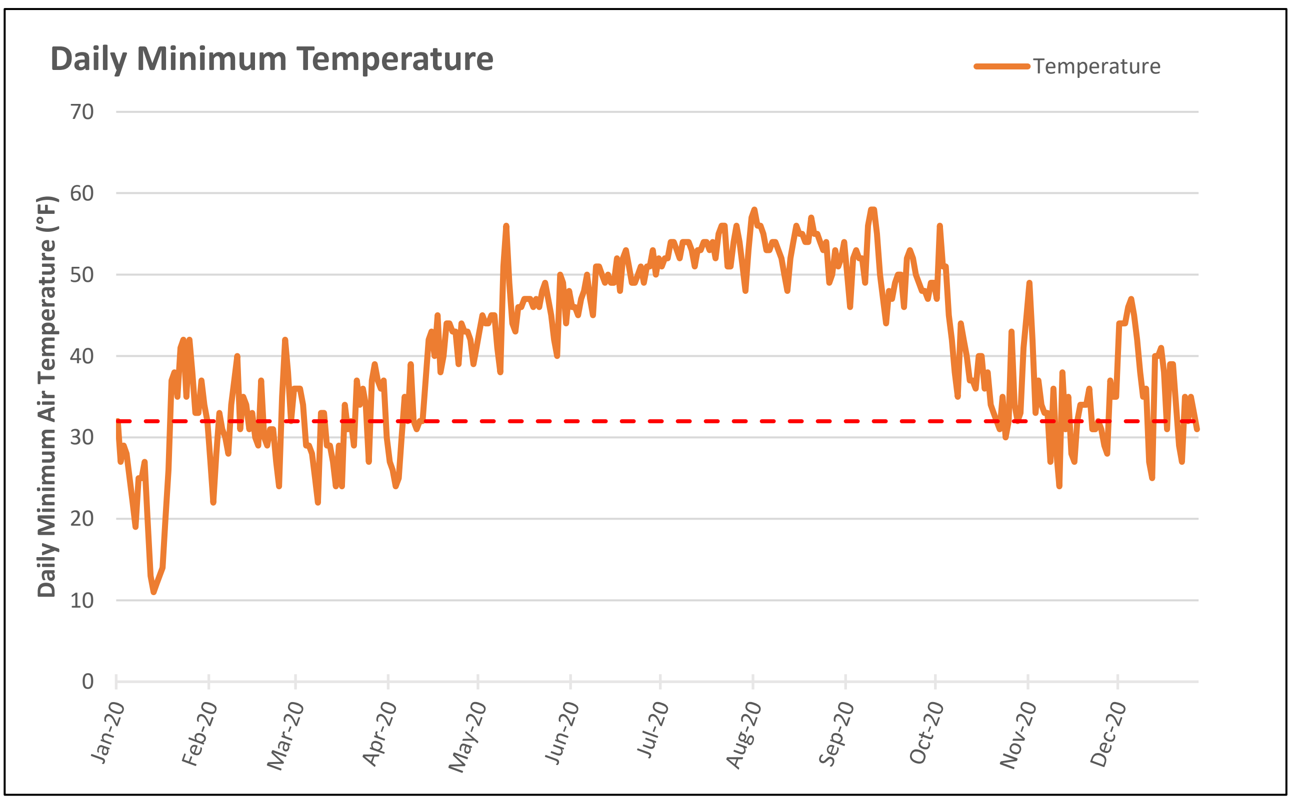


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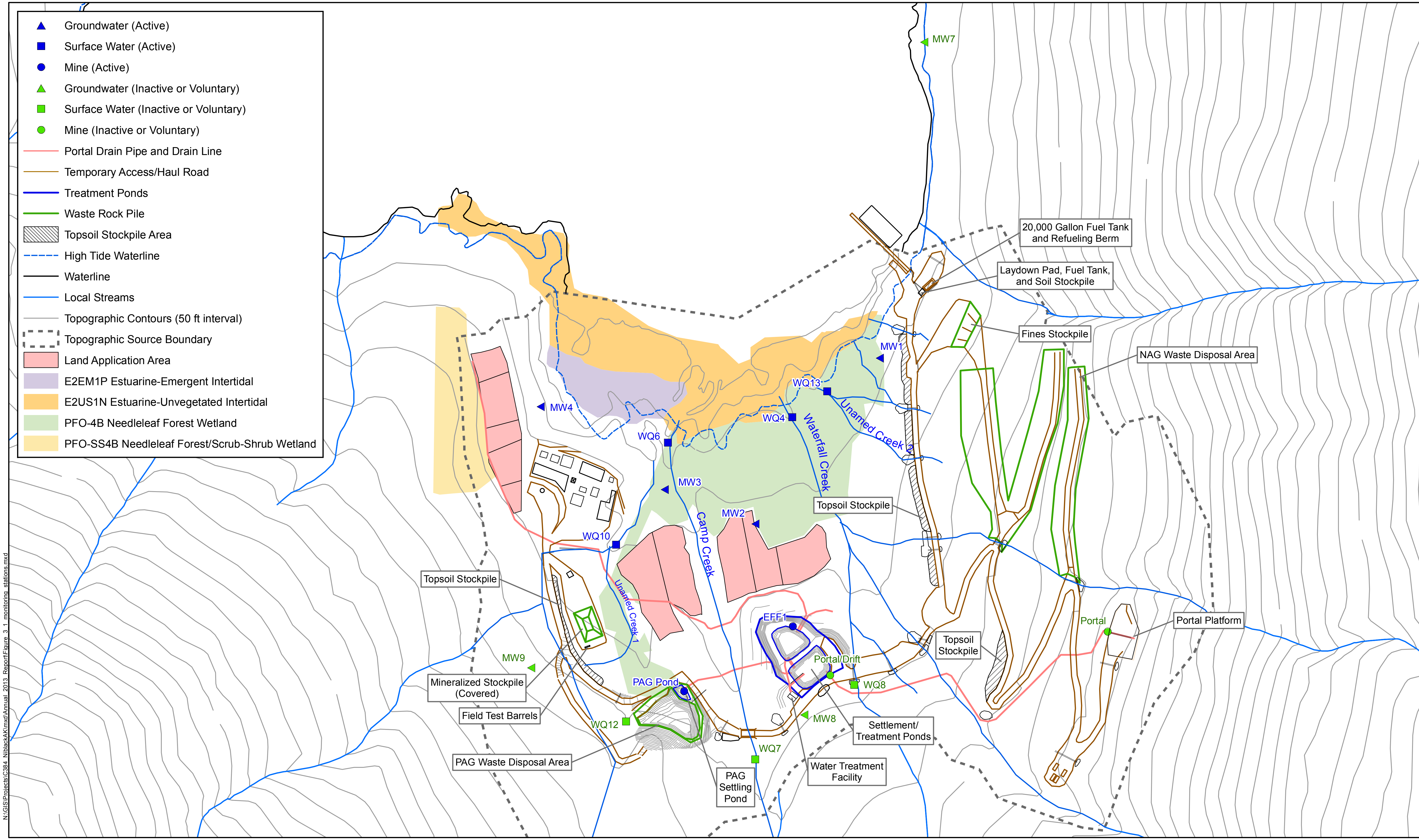
Figure 2-5
Time Series Graphs:
Temperature & Precipitation



NIBLACK PROJECT LLC

0 125 250 500 Feet N

Feature Sources:
Base layers from Knight Piesold, 2007. Water Quality Baseline and Site Monitoring Plan.
Land Application Area from Turner, 2009. Personal communication.
Waste rock areas, portal drains, roads, and ground cover zones from Niblack Project LLC.

Figure 3-1
Water Quality Monitoring Stations
Niblack Exploration Project
2020 Annual Report

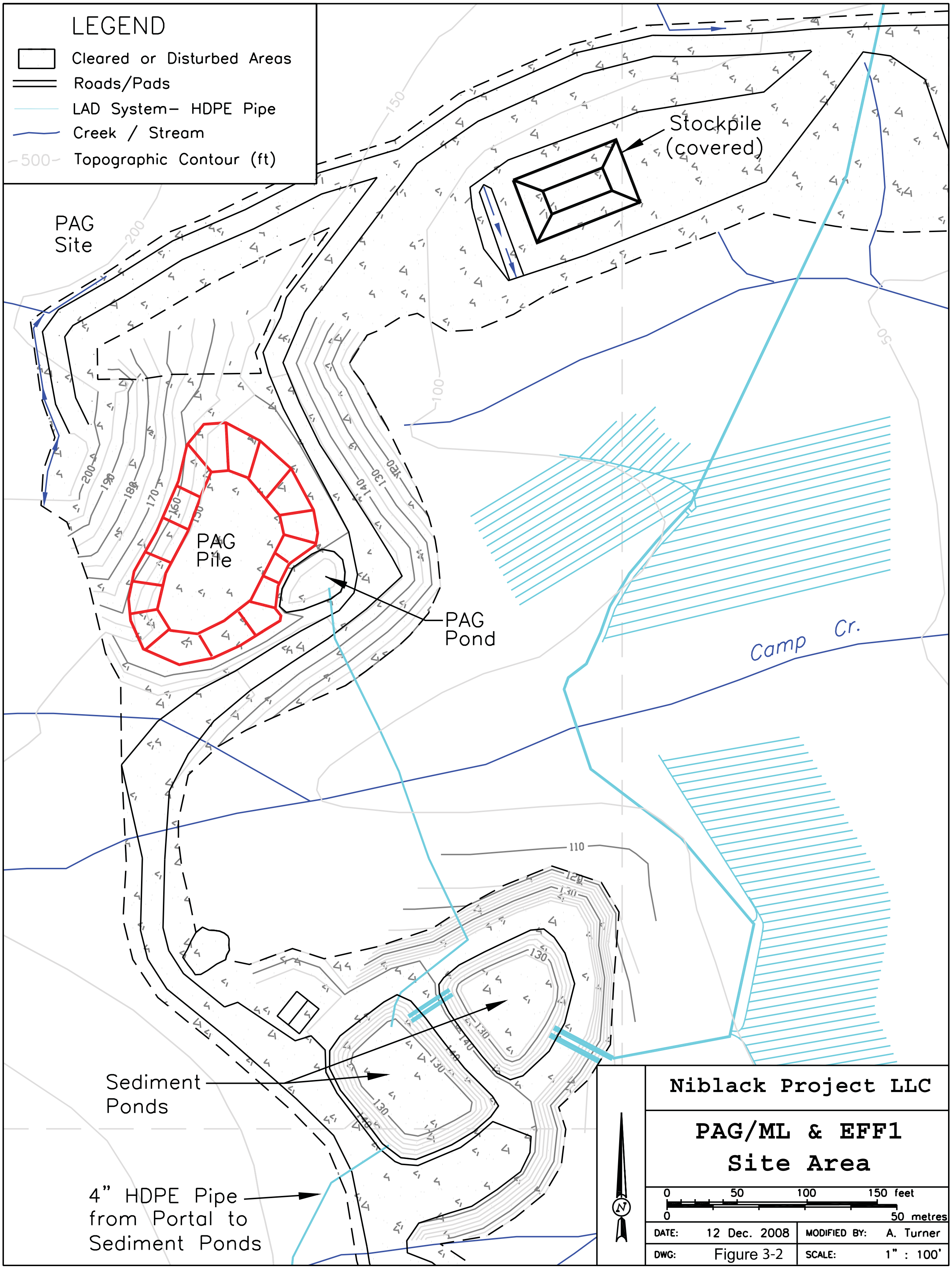


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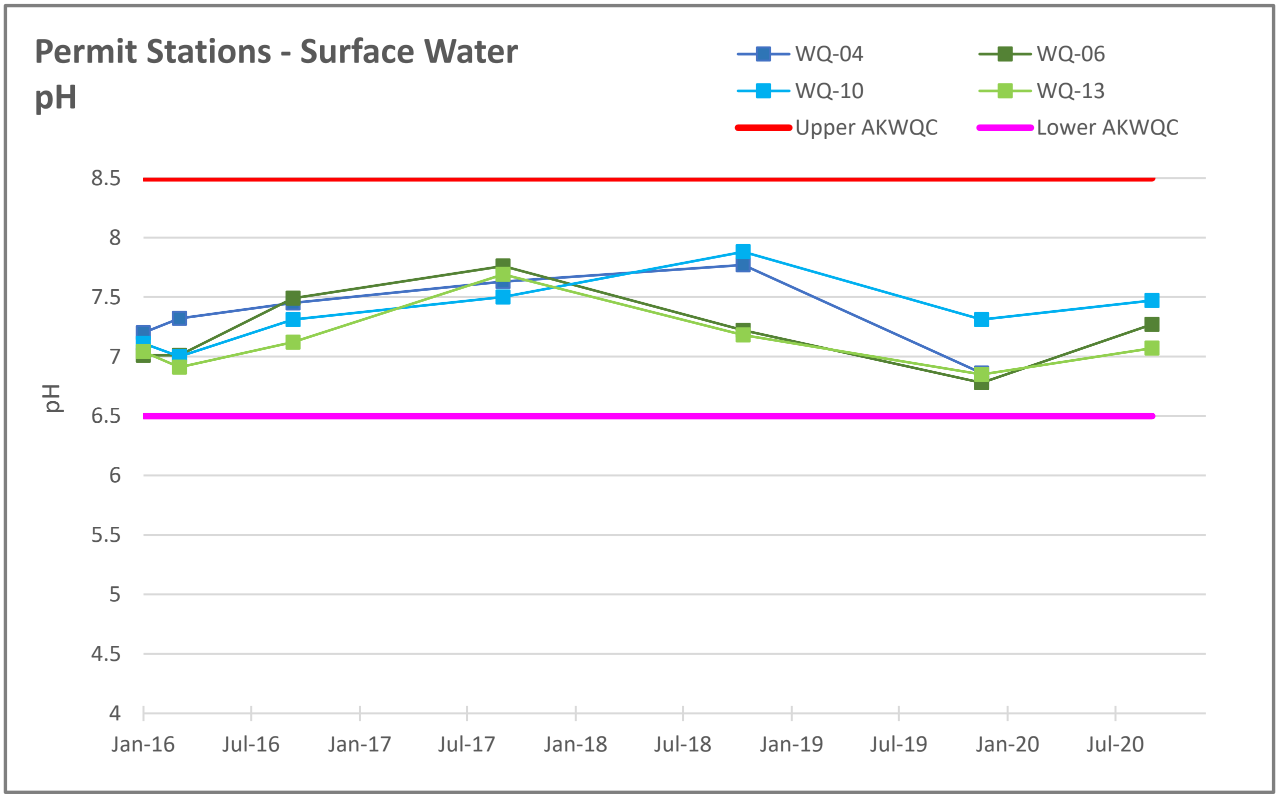
Figure 3-2



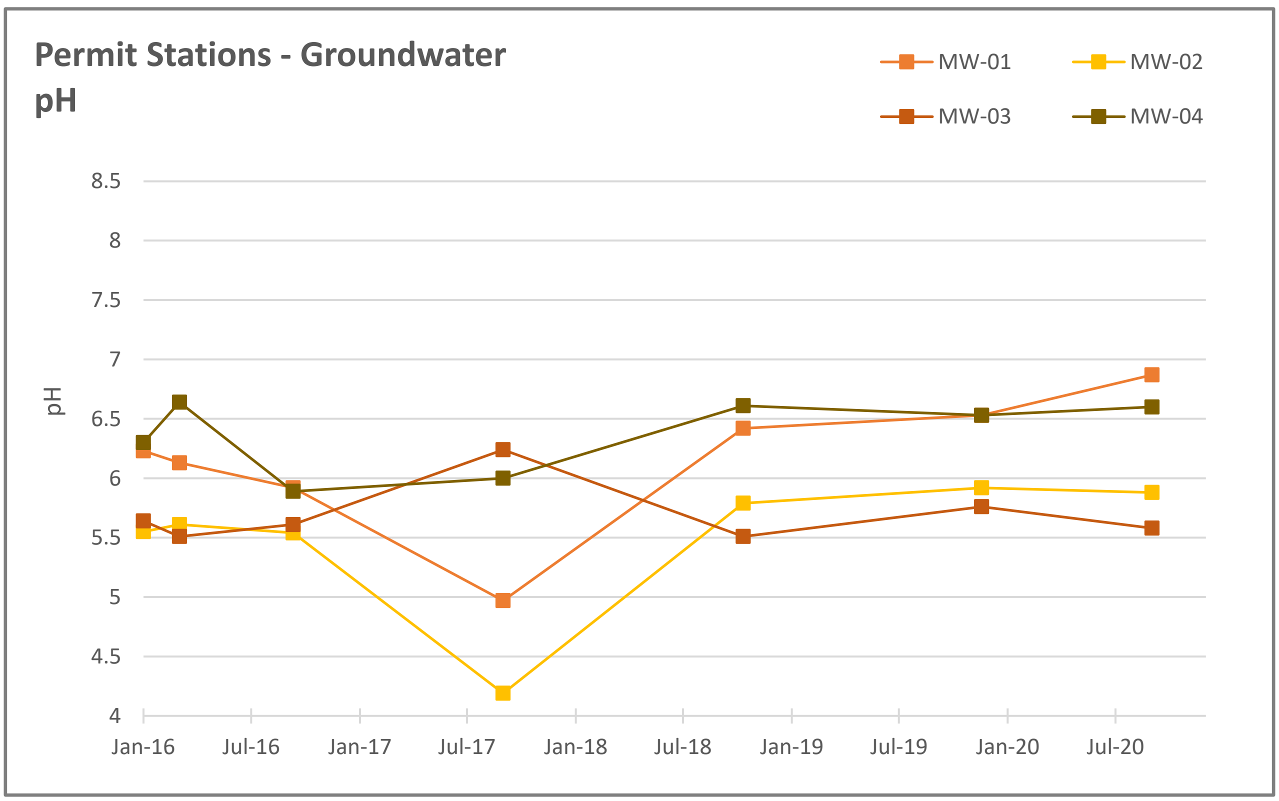


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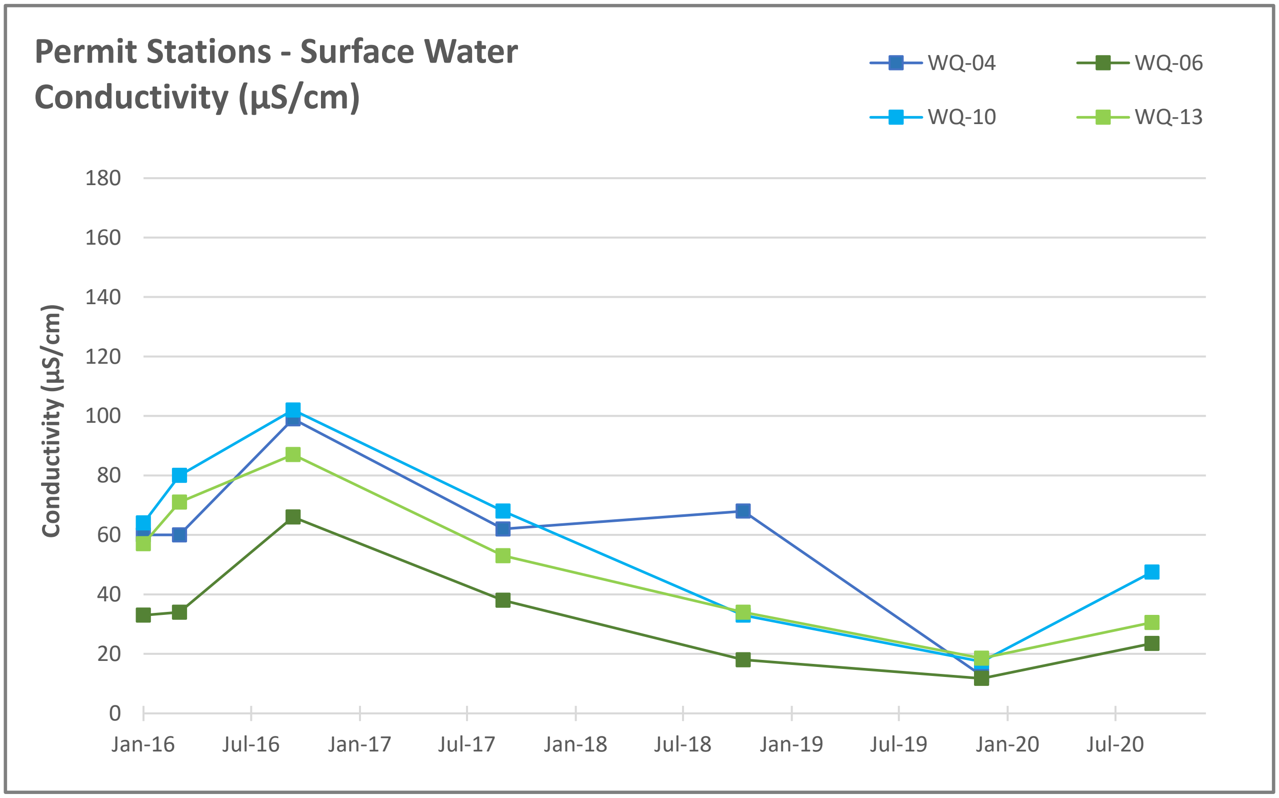
Figure 5-1
Time Series Graphs: pH
Surface and Ground Water



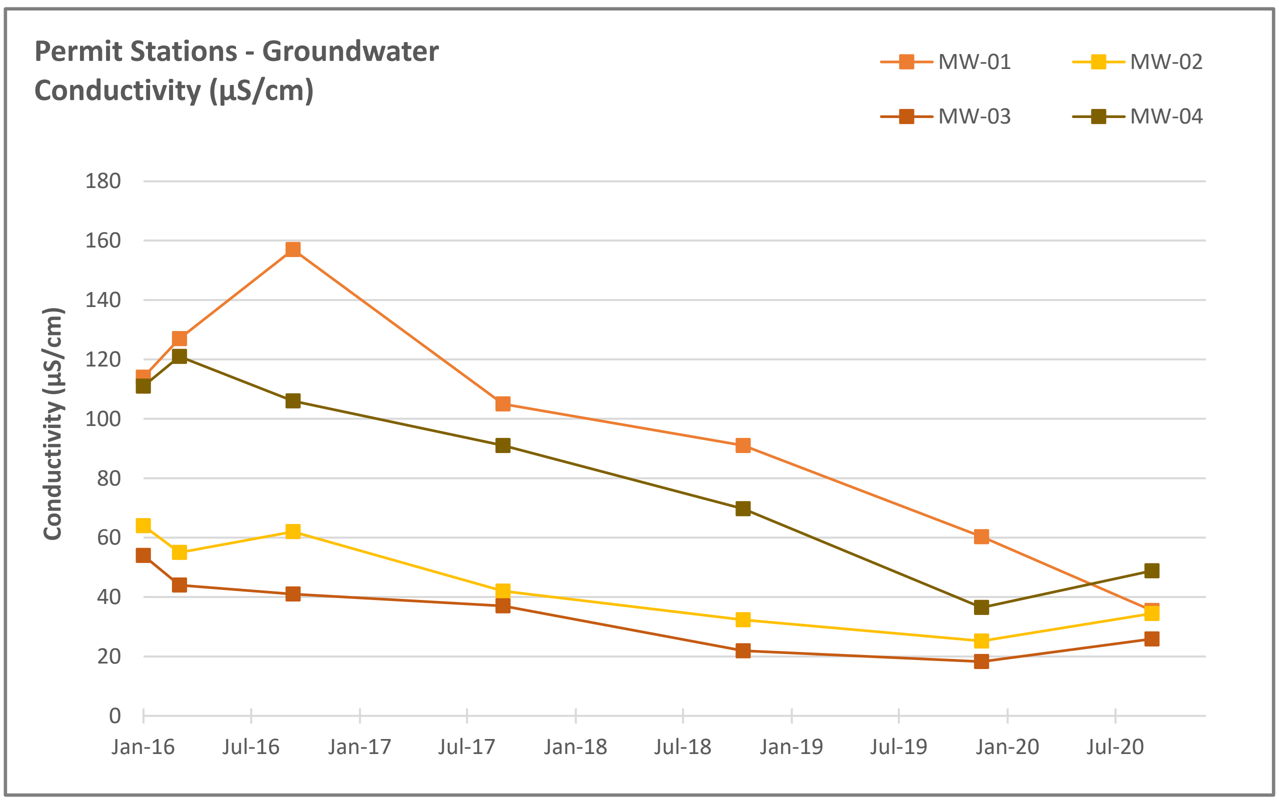


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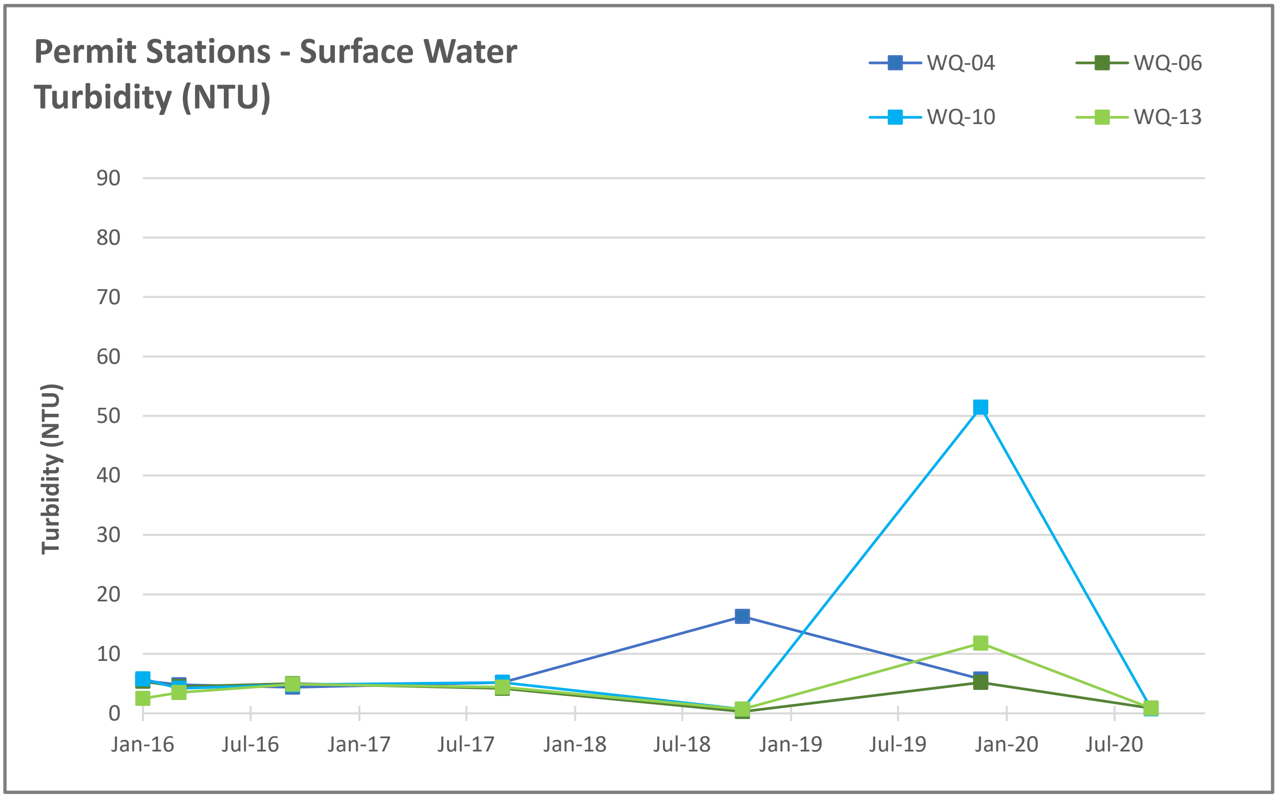
Figure 5-2
Time Series Graphs: Conductivity
Surface and Ground Water



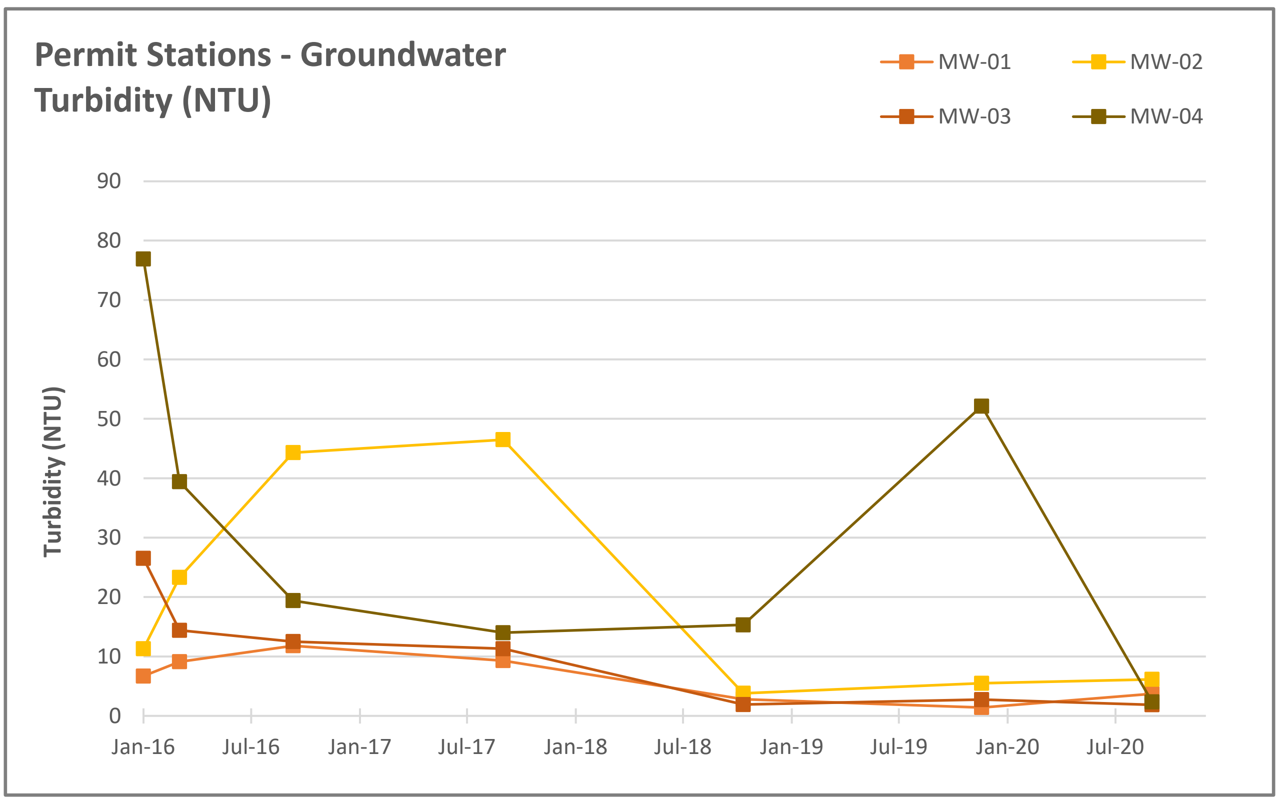


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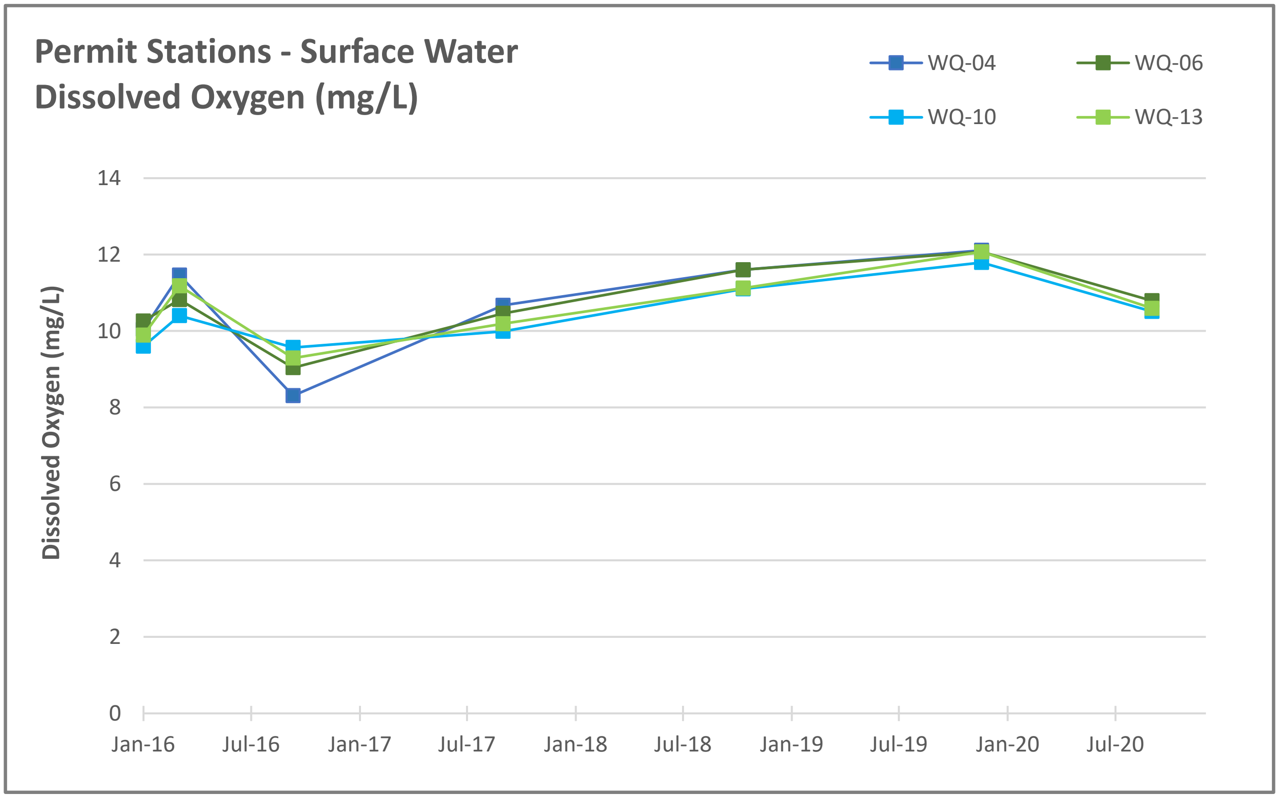
Figure 5-3
Time Series Graphs: Turbidity
Surface and Ground Water



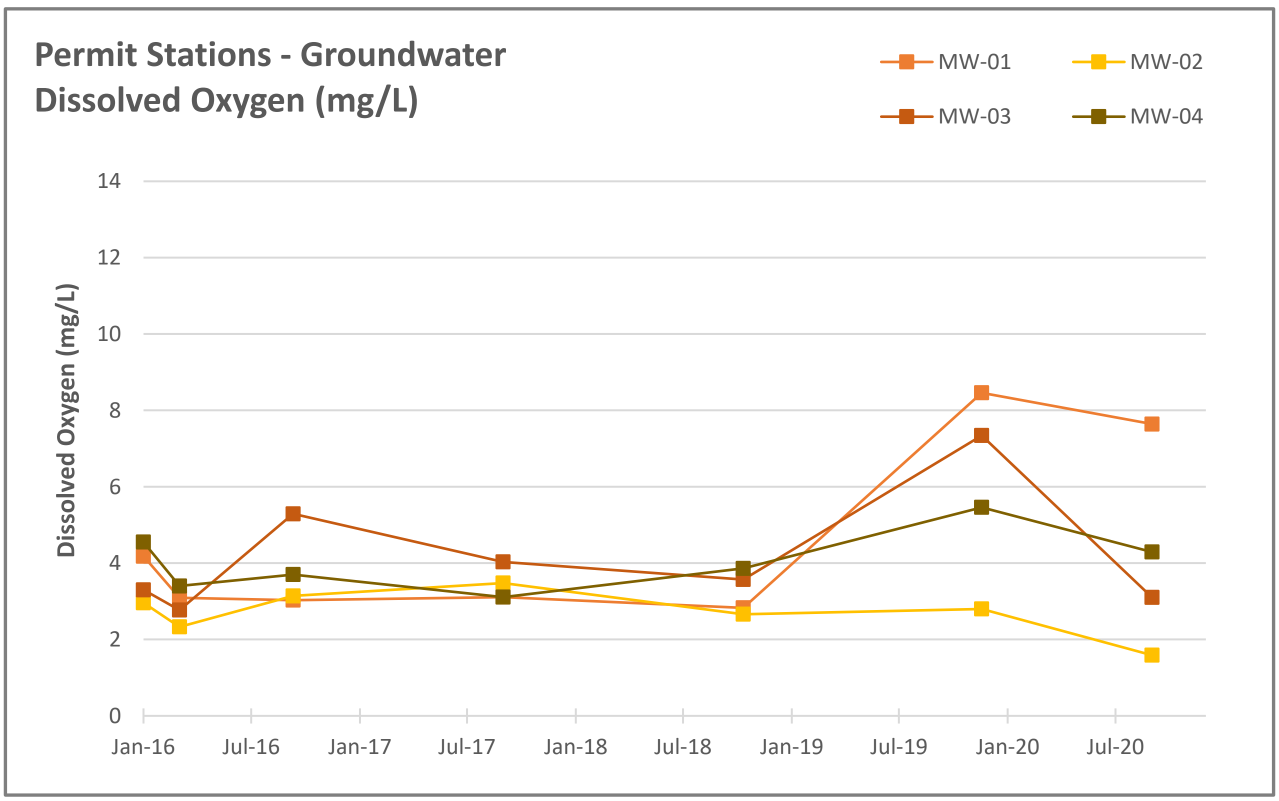


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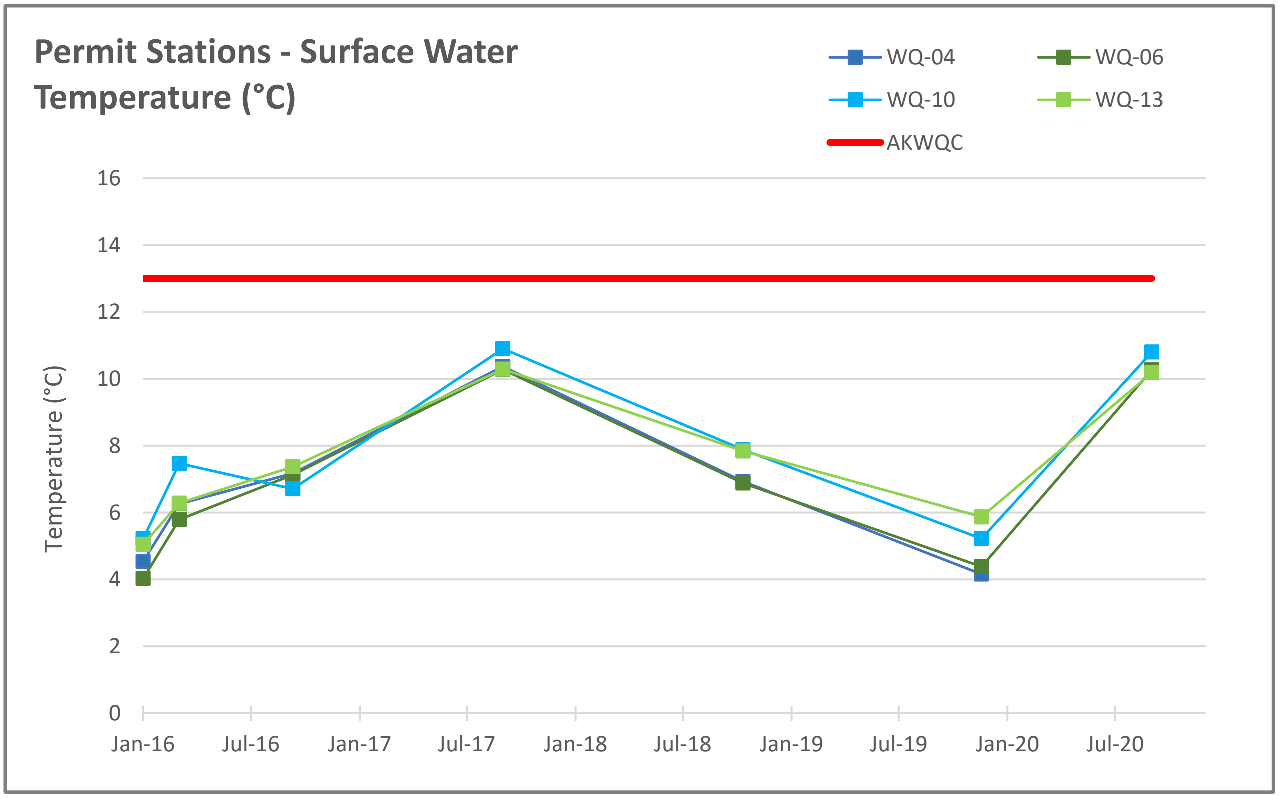
Figure 5-4
Time Series Graphs: Dissolved Oxygen
Surface and Ground Water



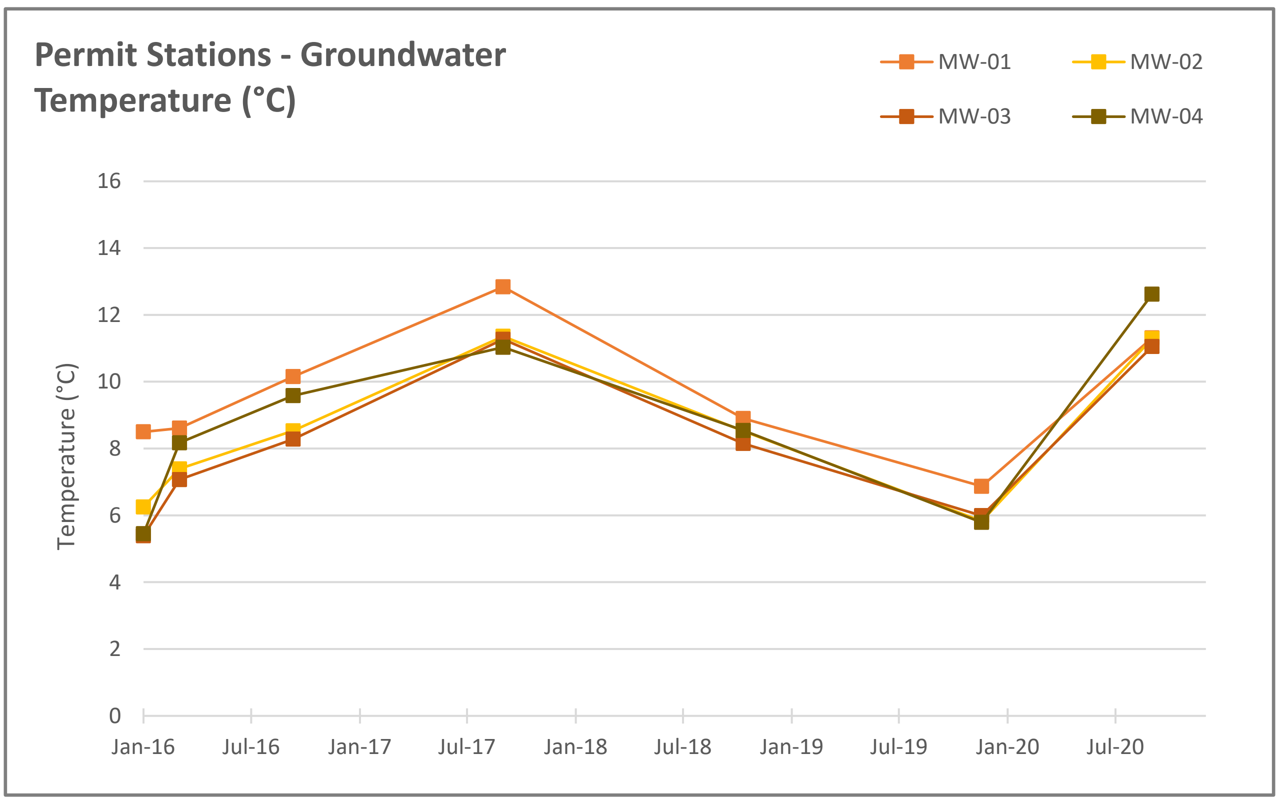


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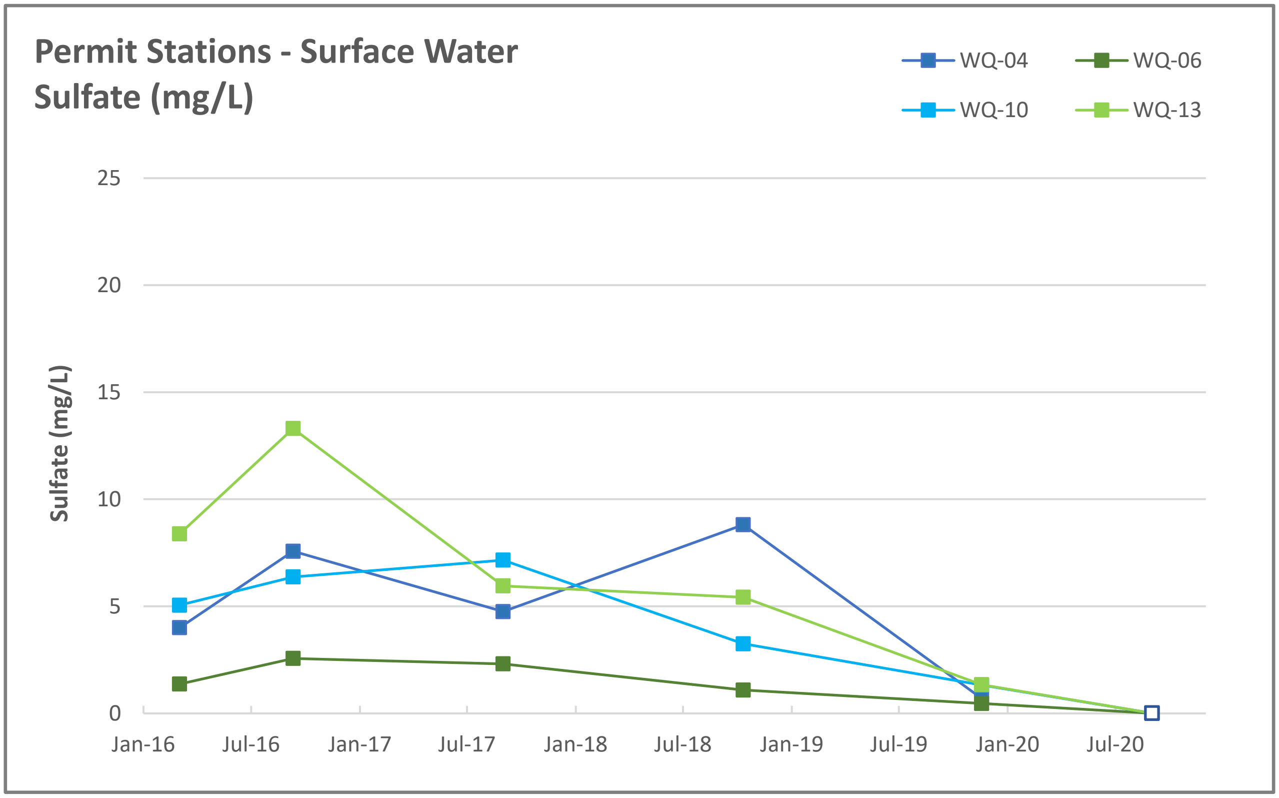
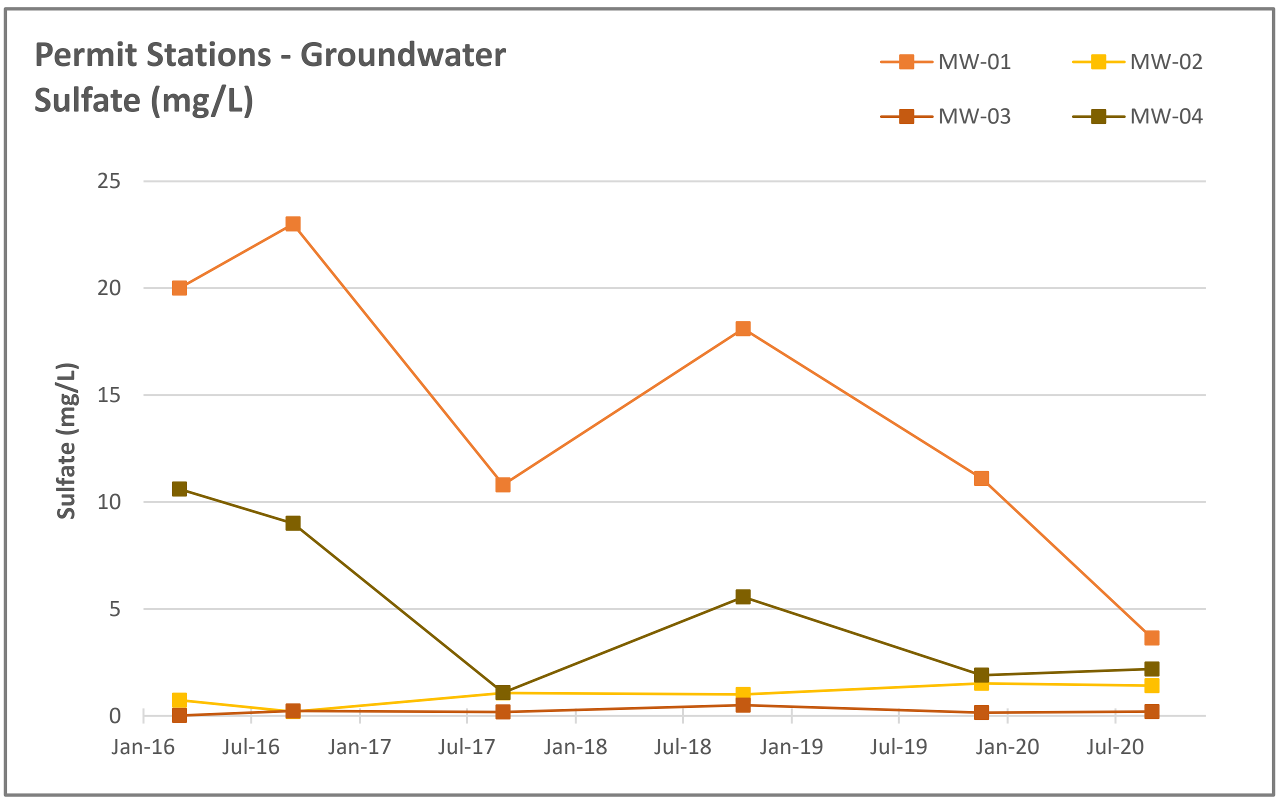
Figure 5-5
Time Series Graphs: Temperature
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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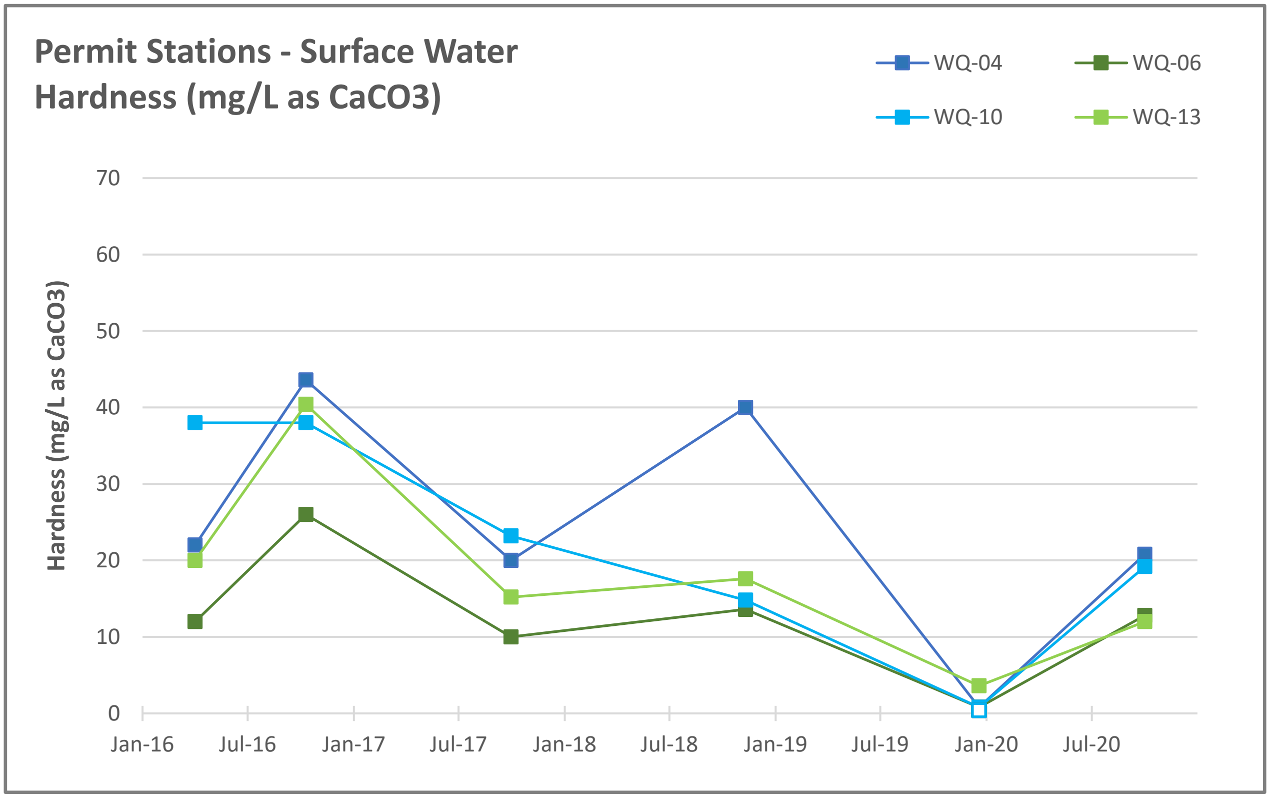
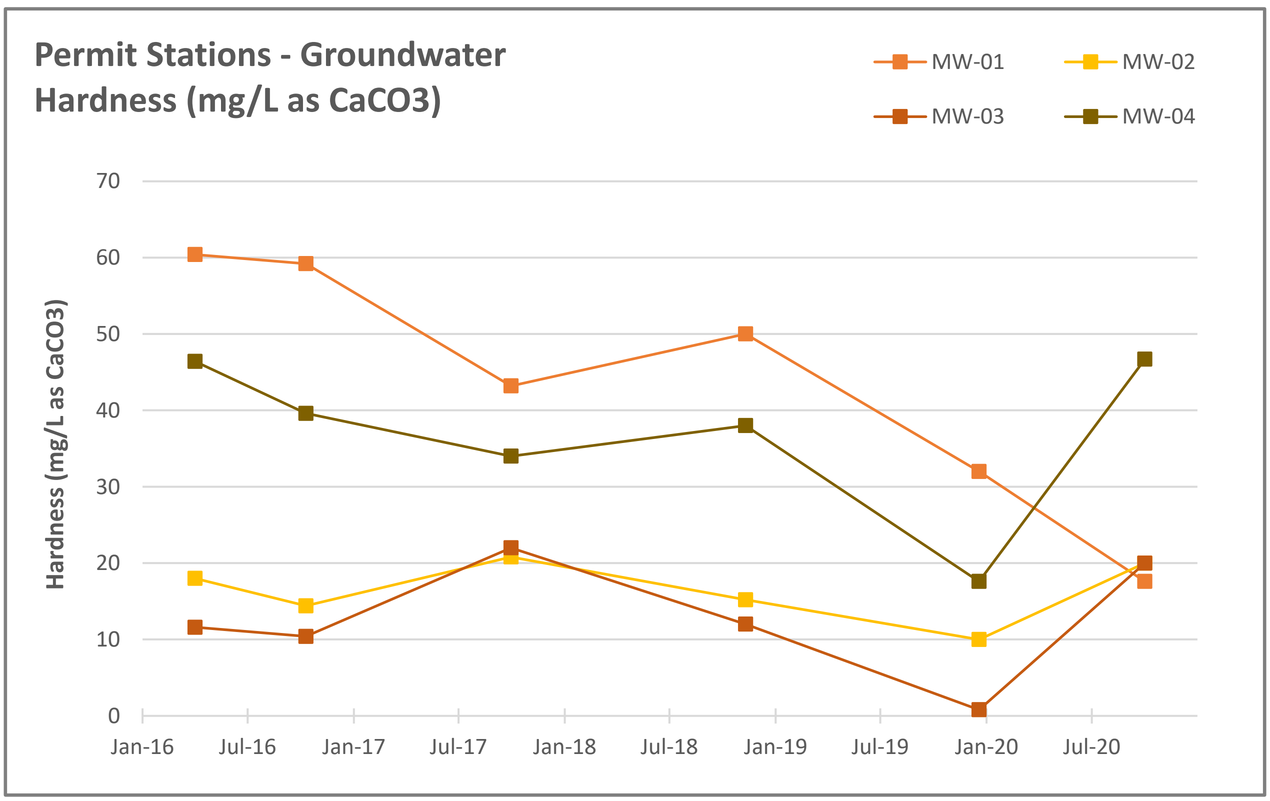
Figure 5-6
Time Series Graphs: Sulfate
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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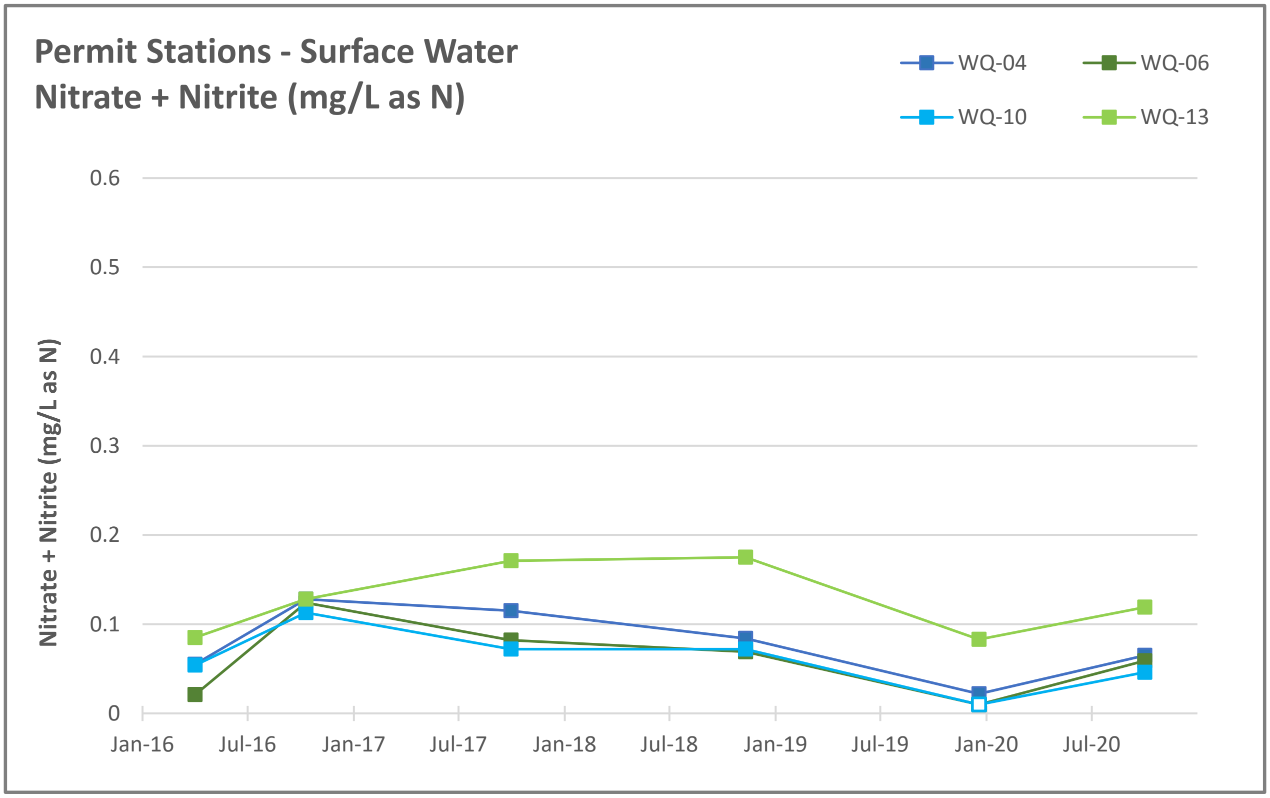
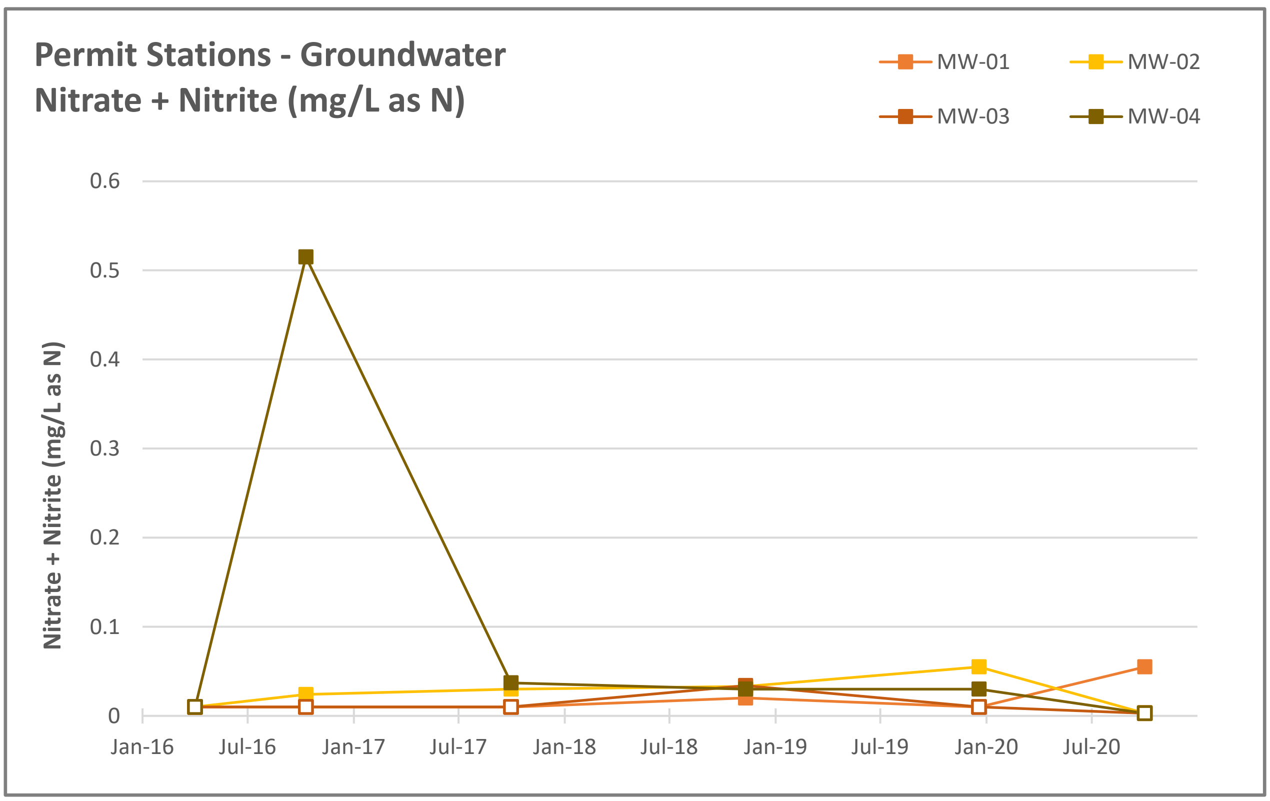
Figure 5-7
Time Series Graphs: Hardness
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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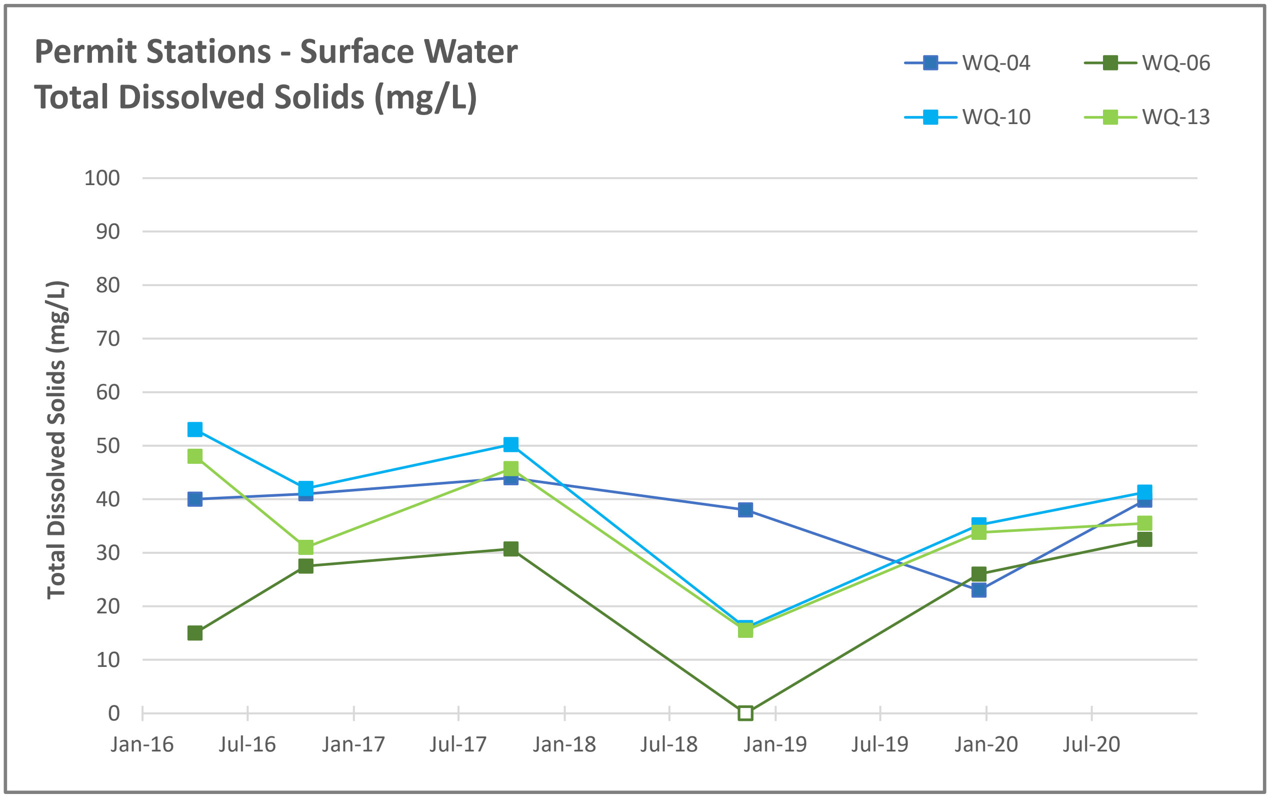
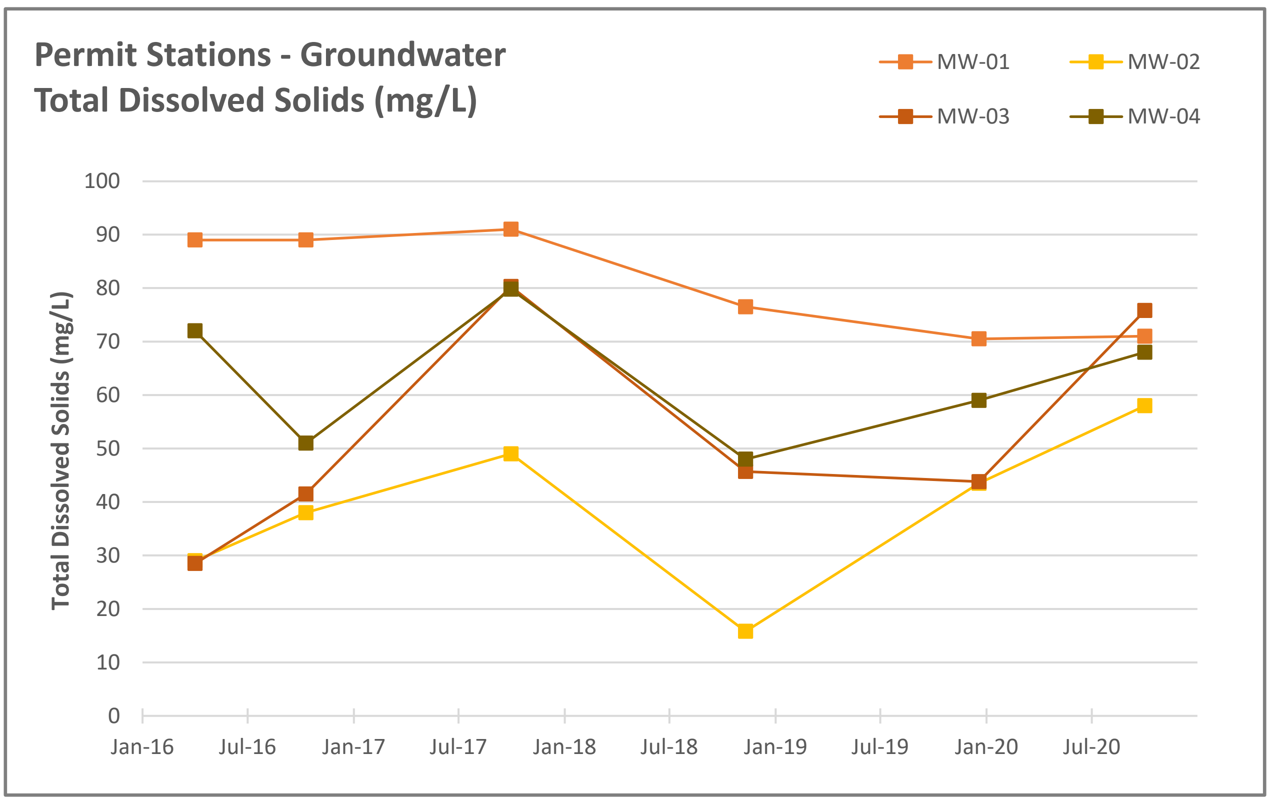
Figure 5-8
Time Series Graphs: Nitrate + Nitrite
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as 0 as there is no detection limit for TDS

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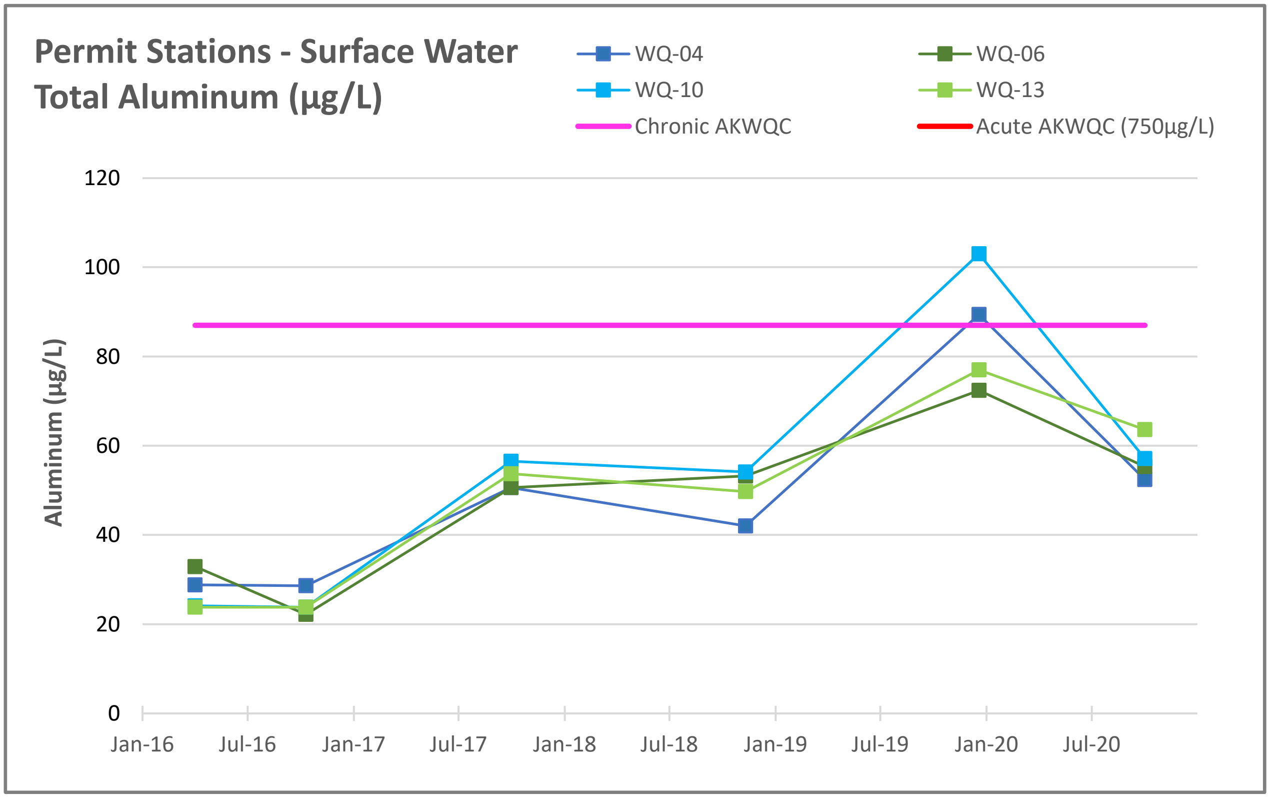
Figure 5-9

Time Series Graphs: Total Dissolved Solids Surface and Ground Water



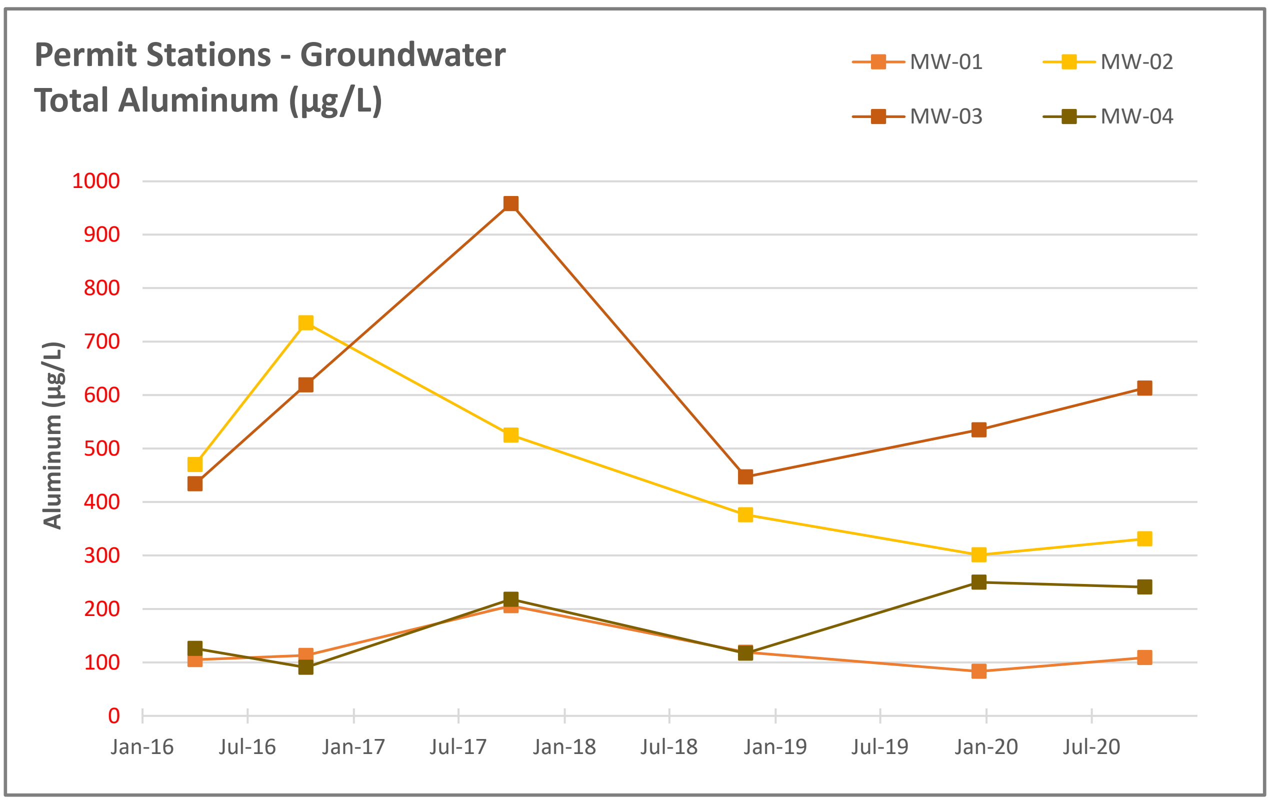


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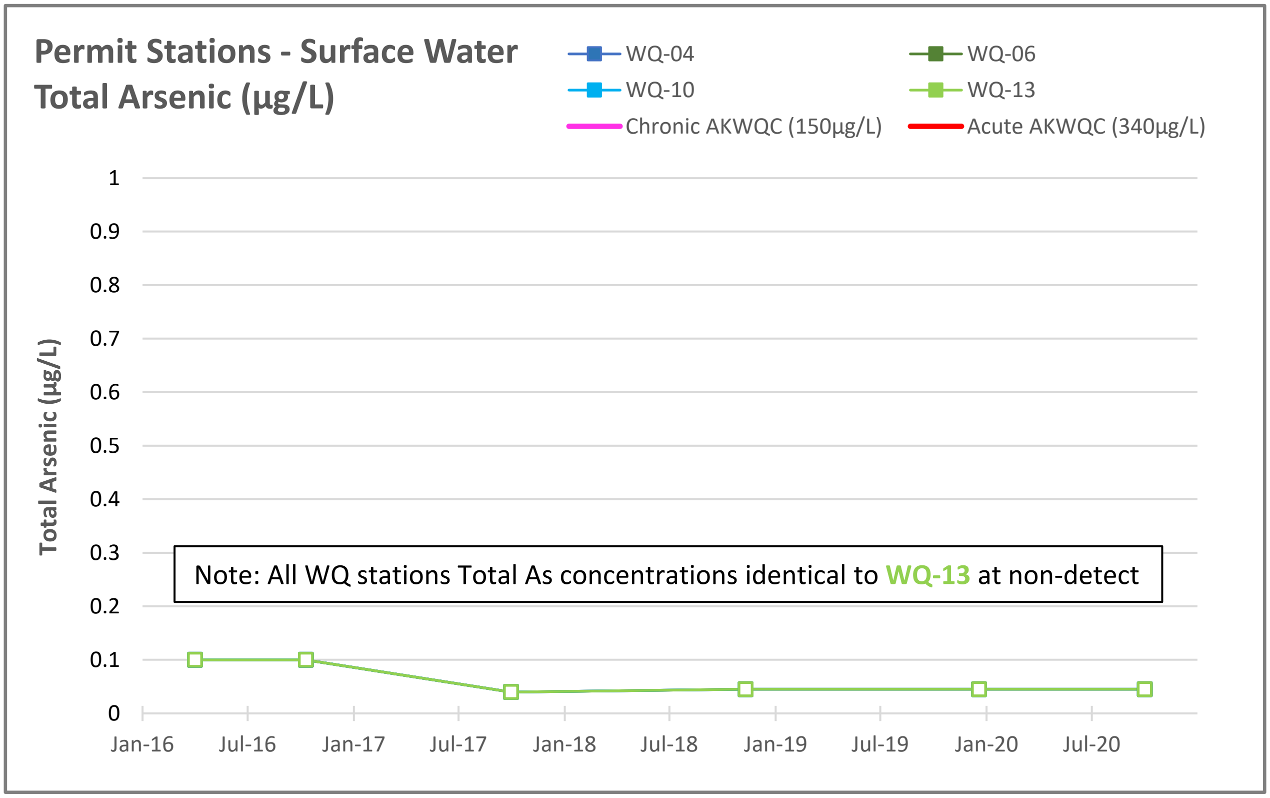
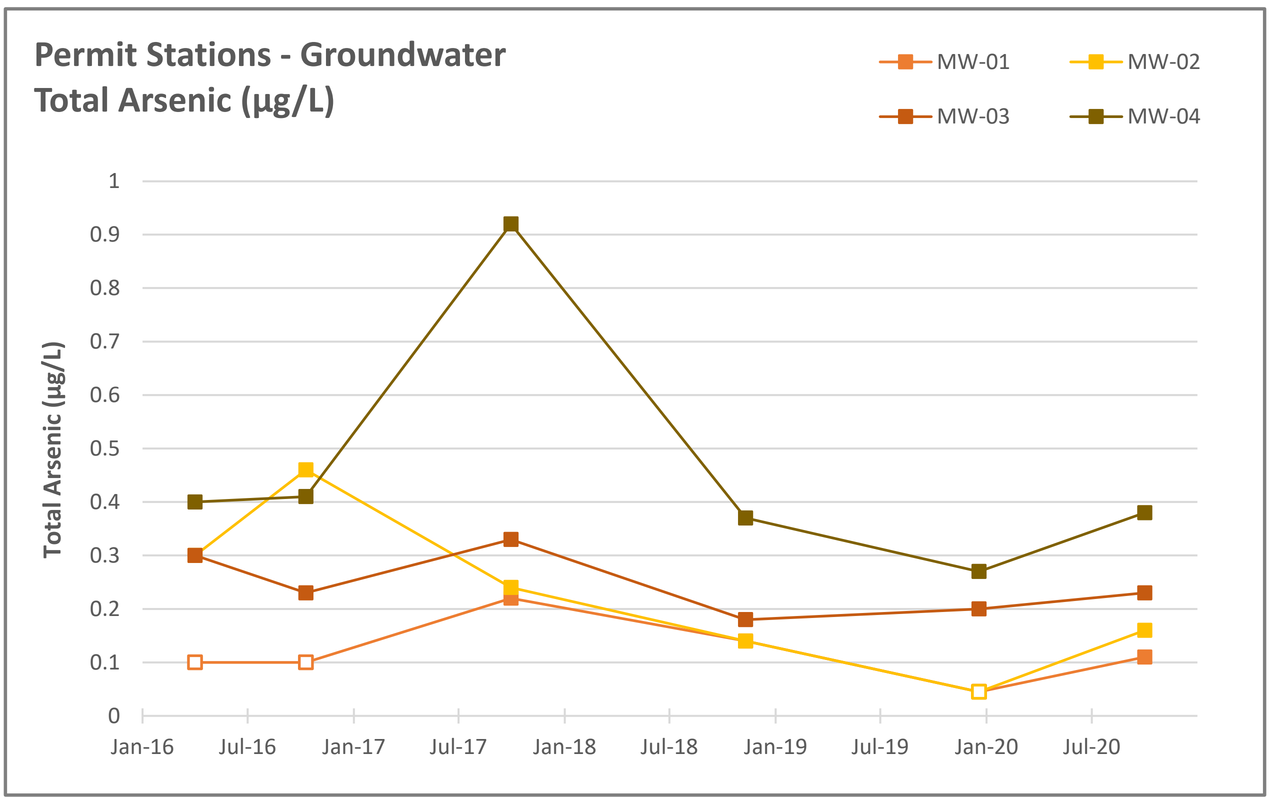
Figure 5-10
Time Series Graphs: Total Aluminum
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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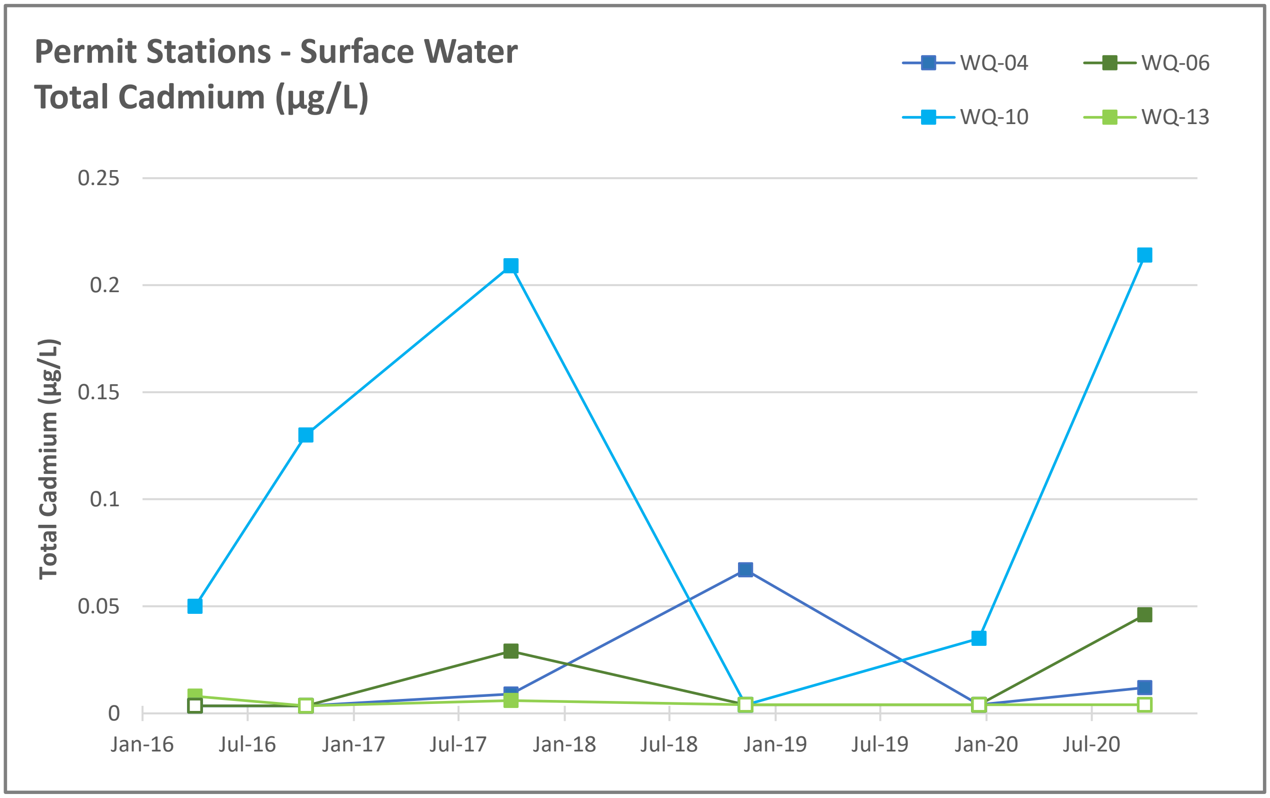
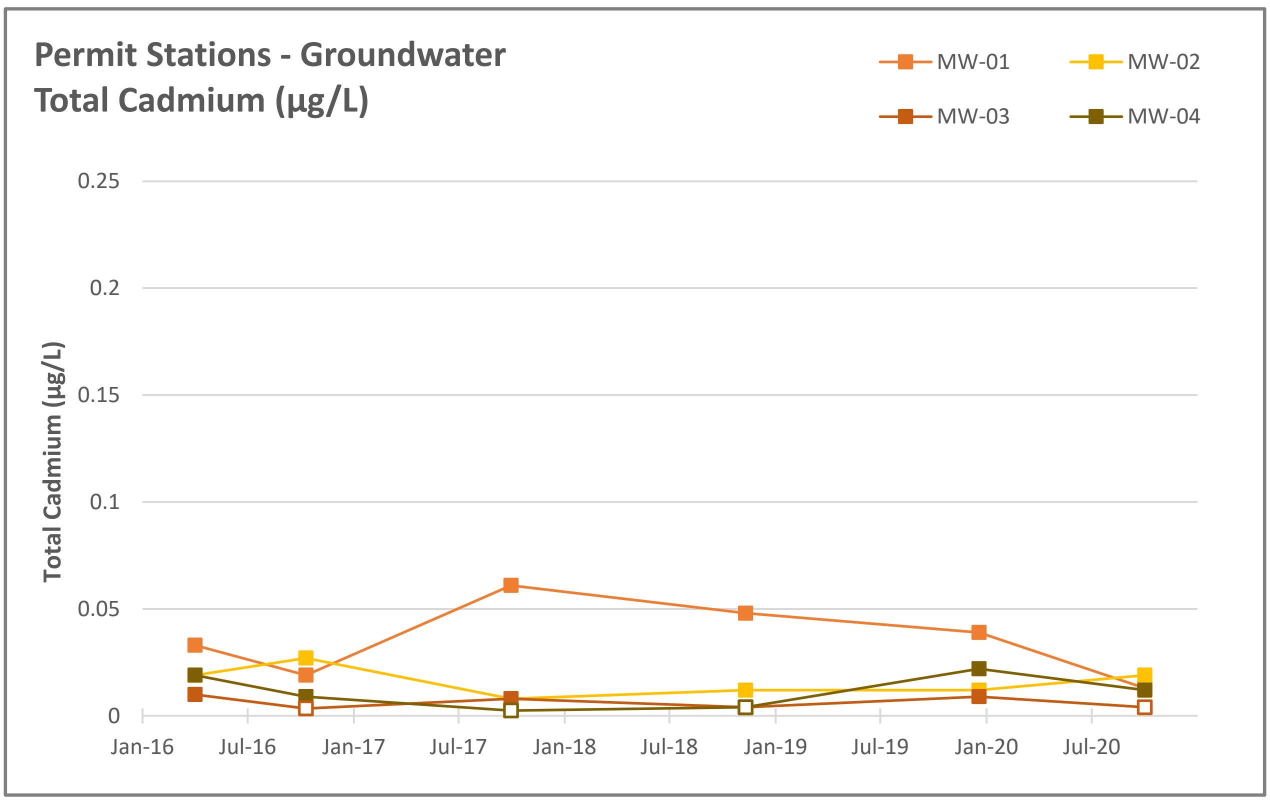
Figure 5-11
Time Series Graphs: Total Aresnic
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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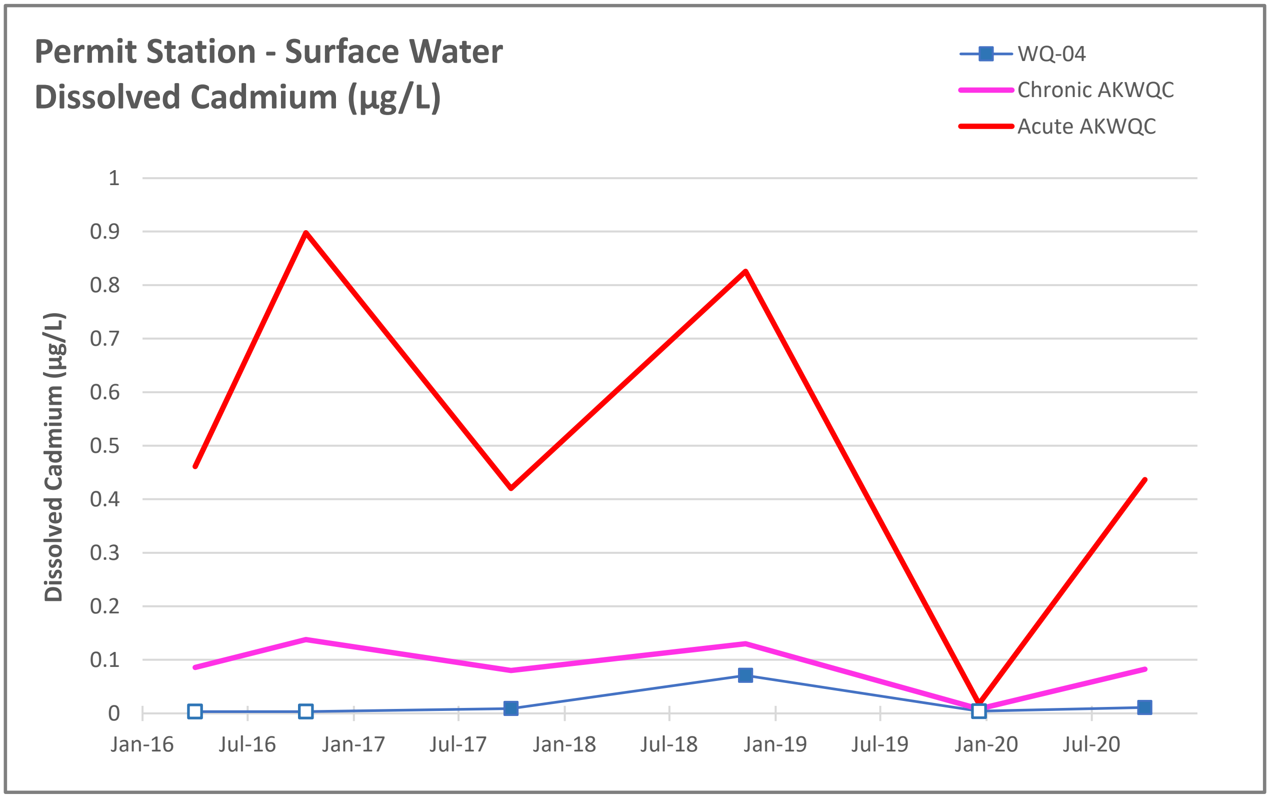
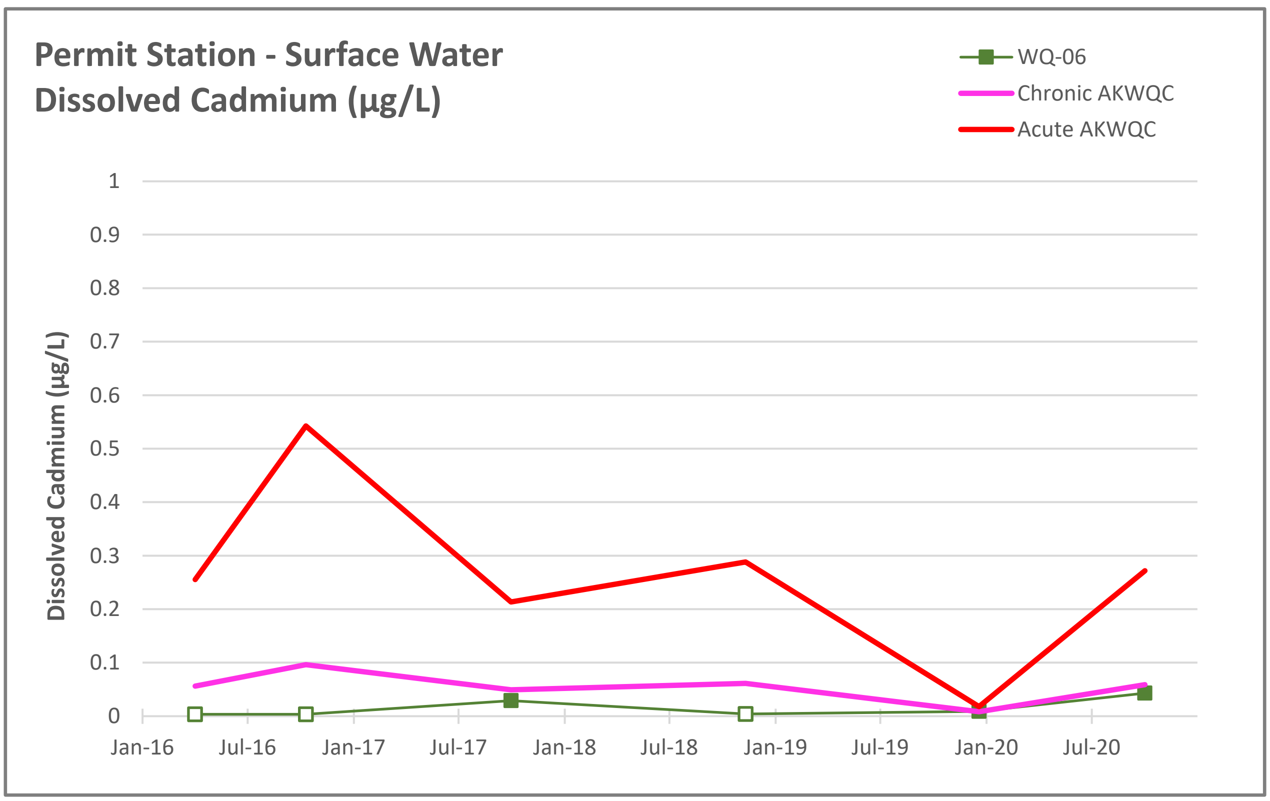
Figure 5-12
Time Series Graphs: Total Cadmium
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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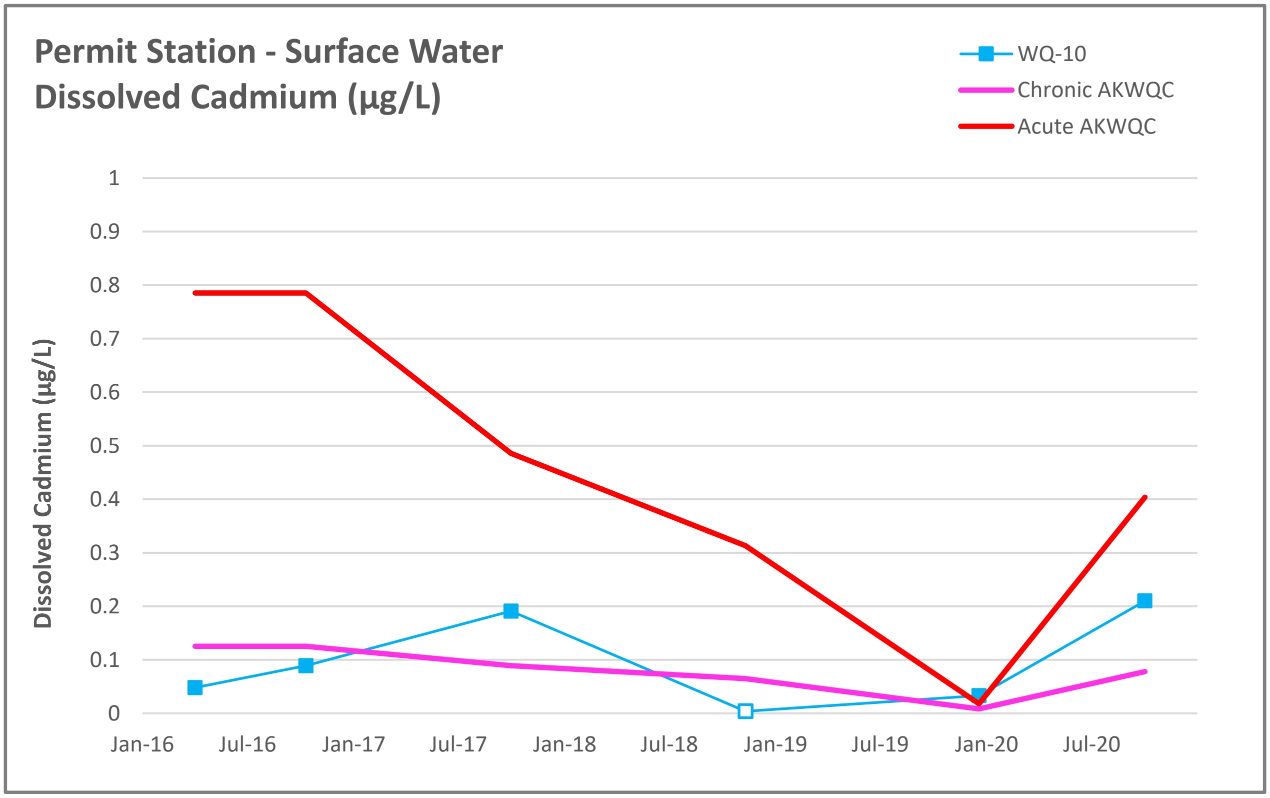
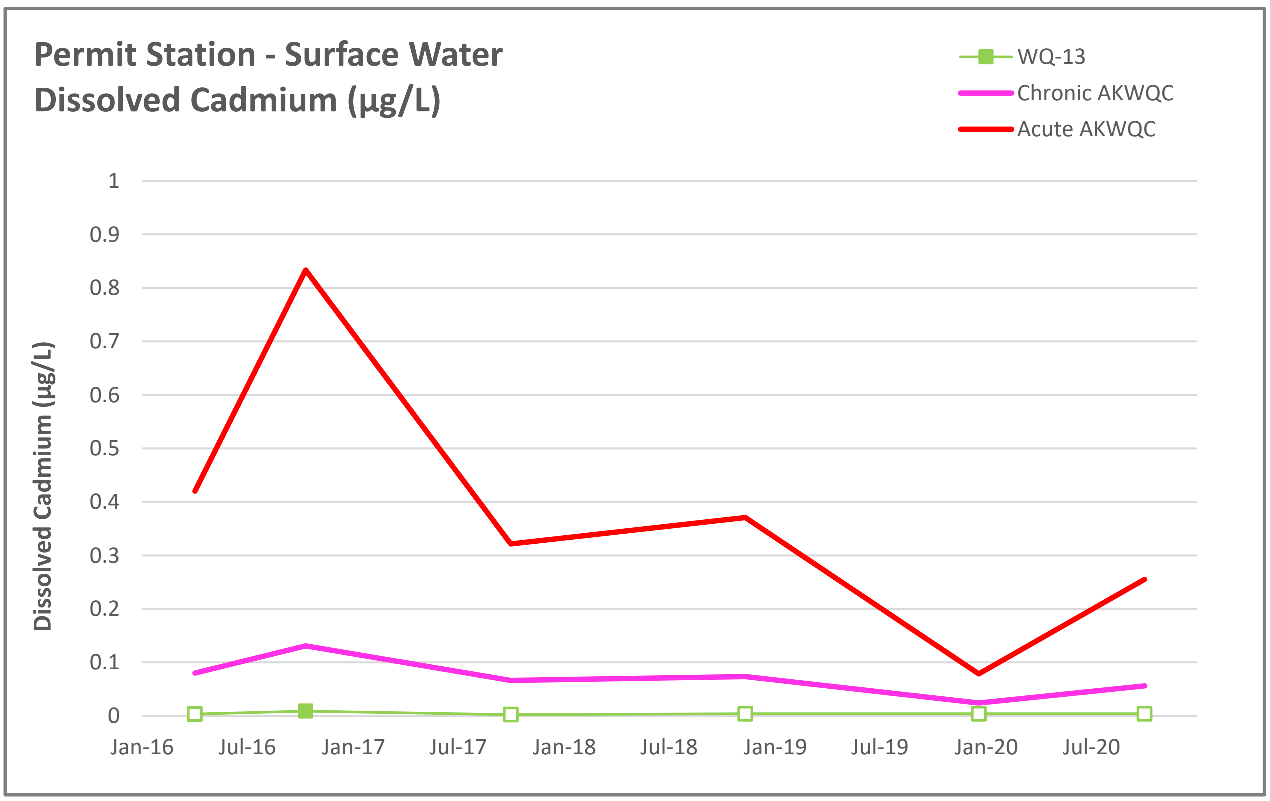
Figure 5-13a
Time Series Graphs: Dissolved Cadmium
Surface Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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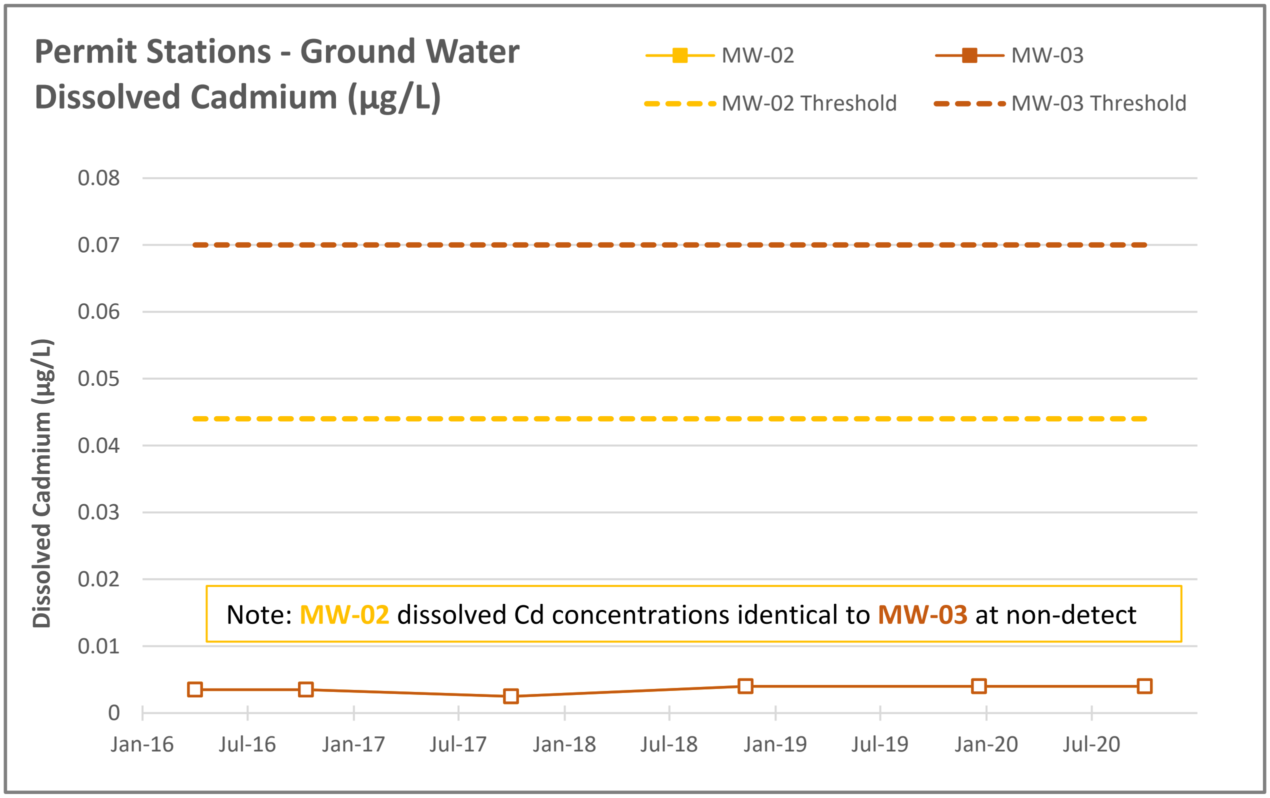
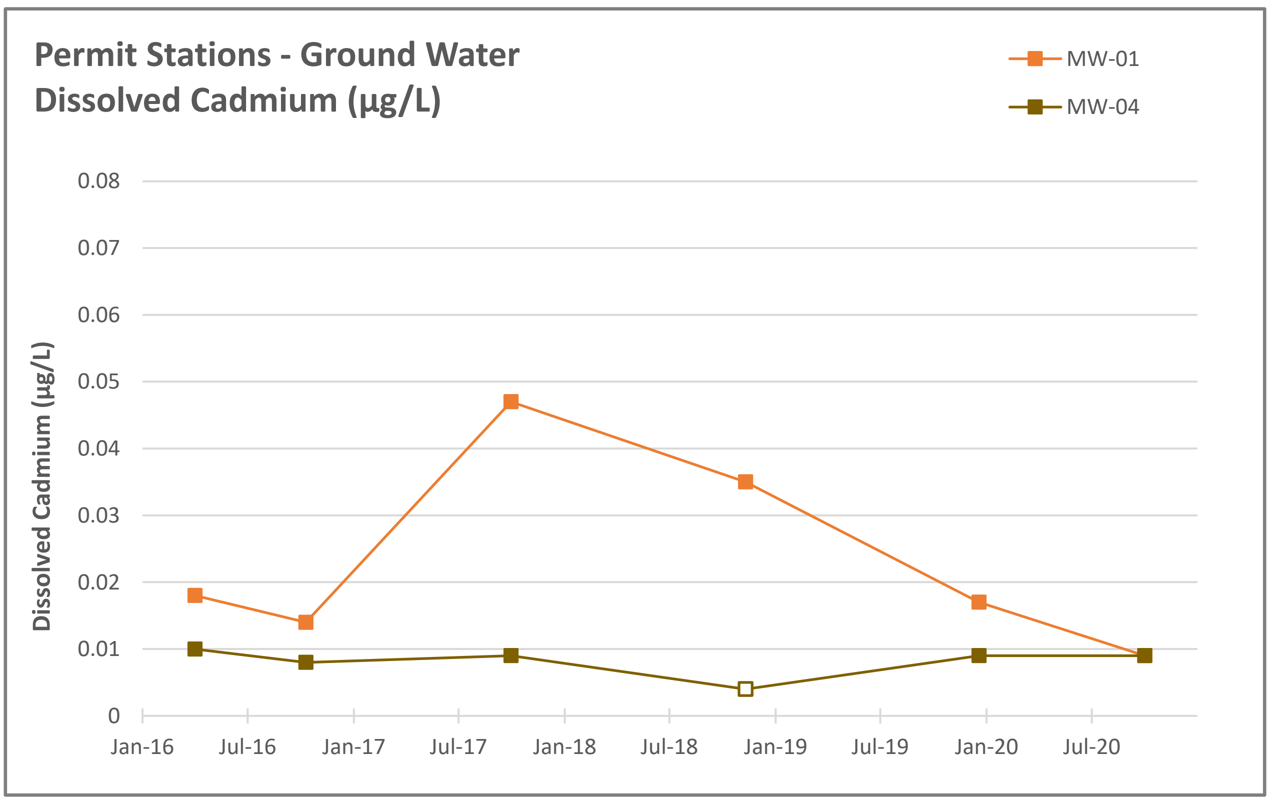
Figure 5-13b
Time Series Graphs: Dissolved Cadmium
Surface Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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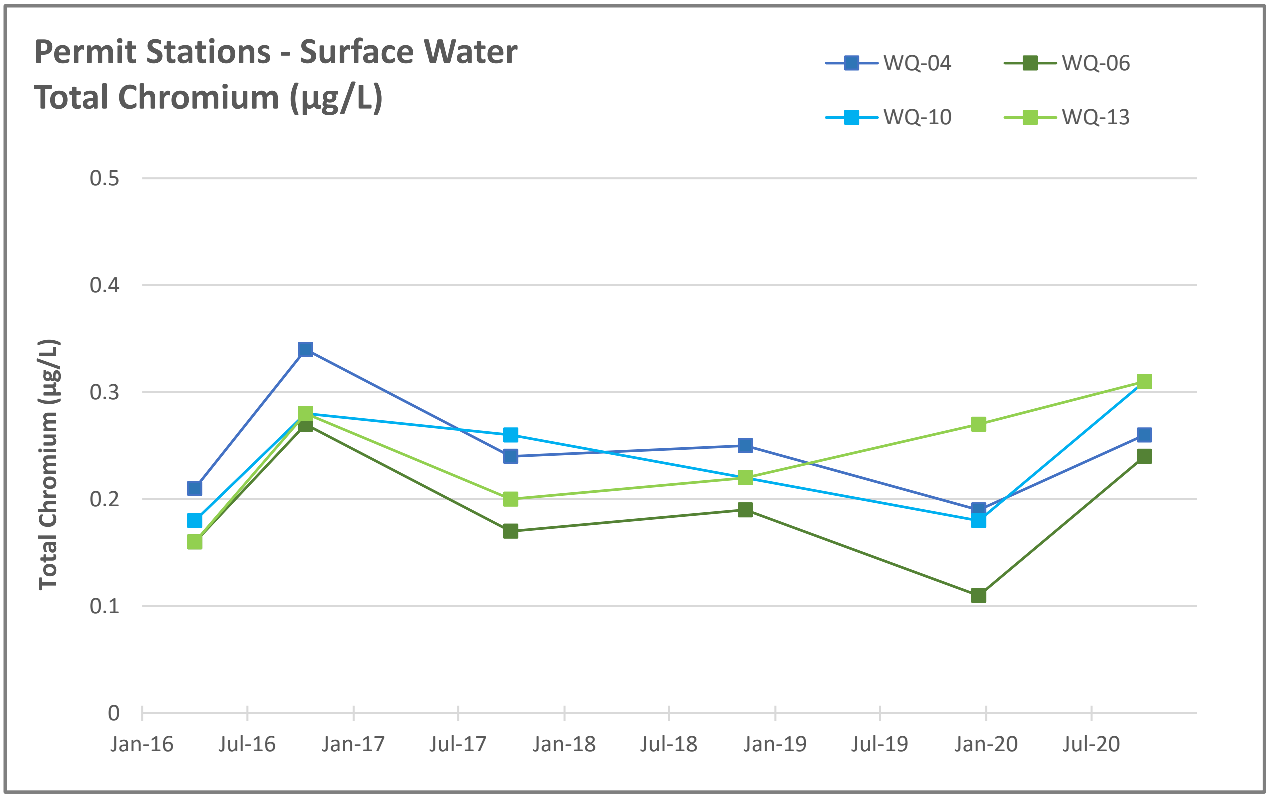
Figure 5-13c
Time Series Graphs: Dissolved Cadmium Ground Water



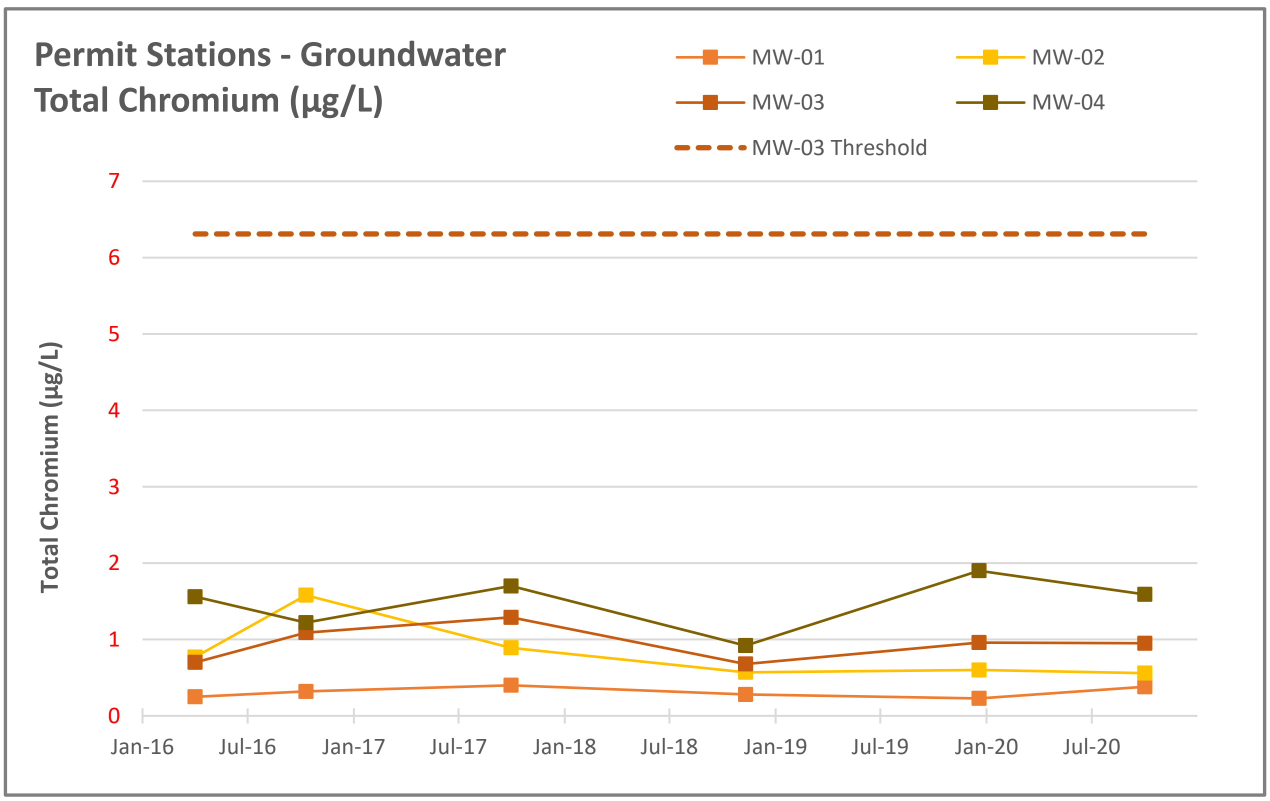


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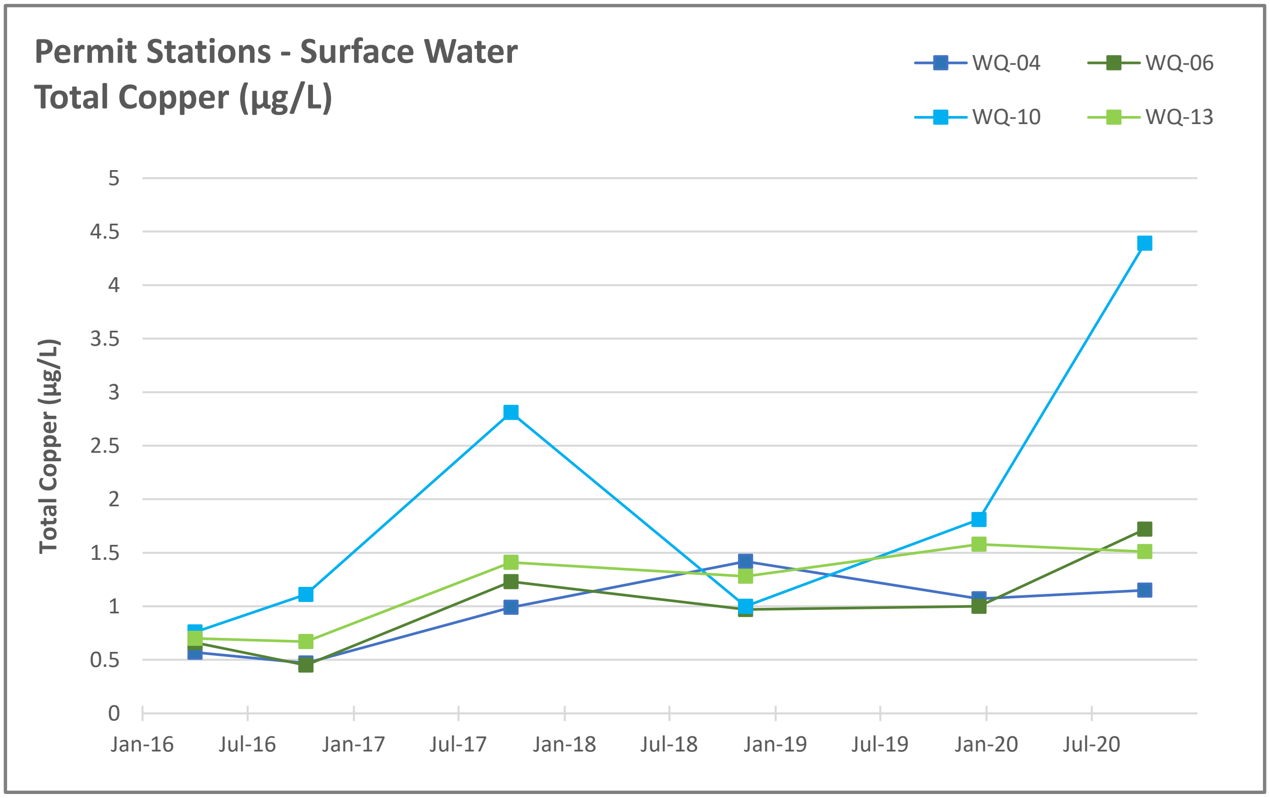
Figure 5-14
Time Series Graphs: Total Chromium
Surface and Ground Water



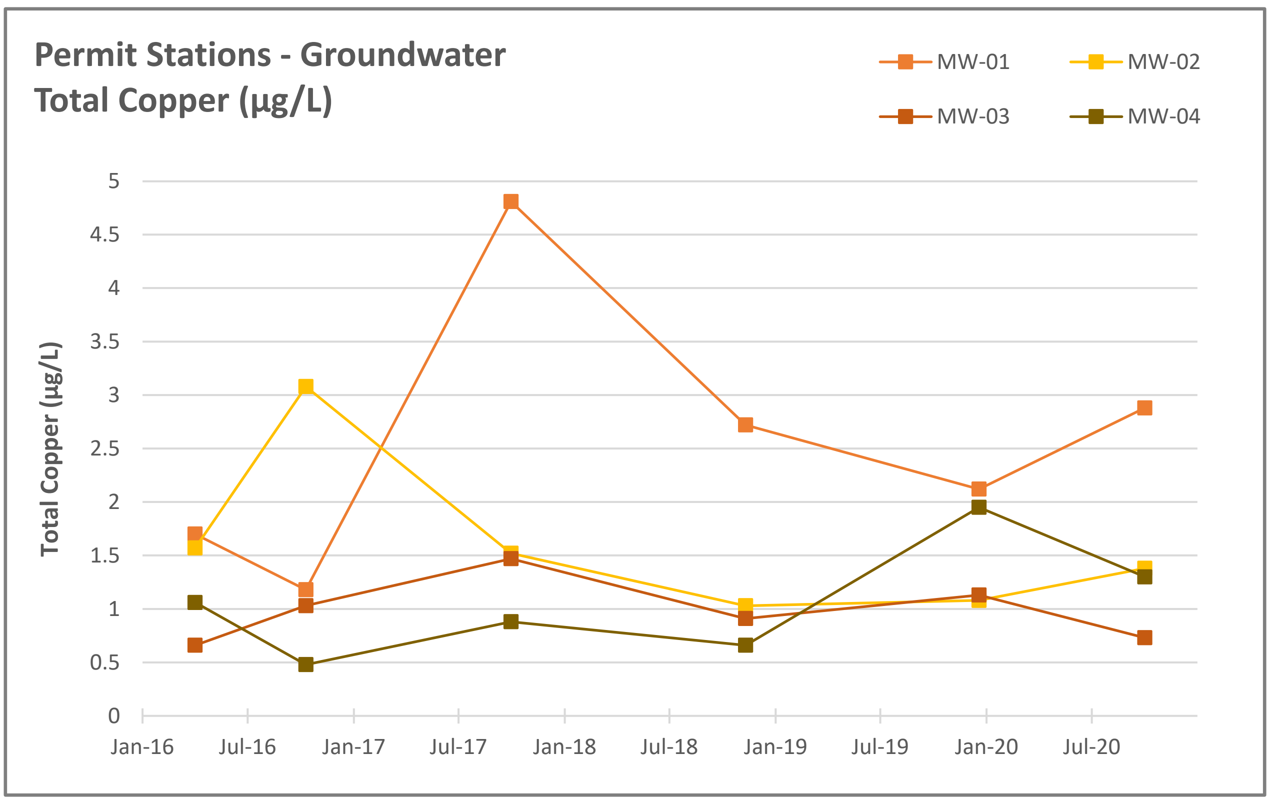


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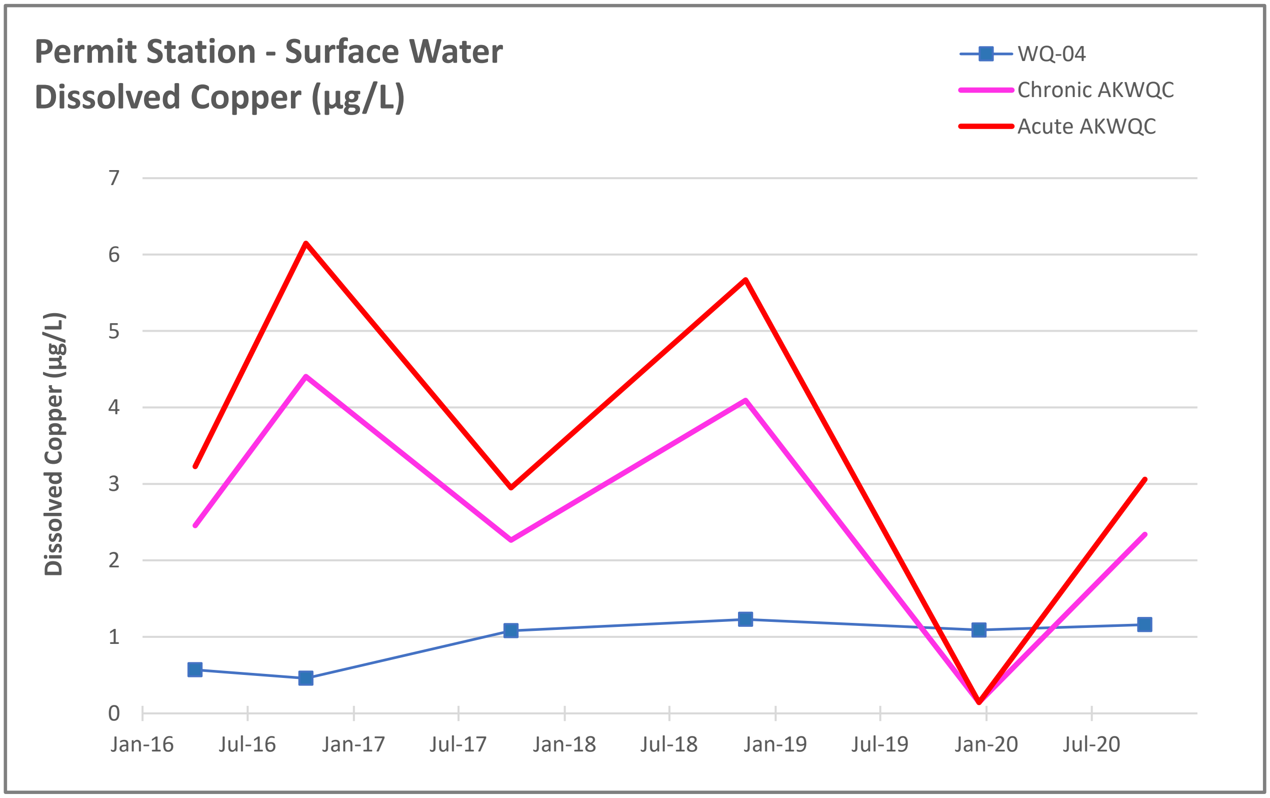
Figure 5-15
Time Series Graphs: Total Copper
Surface and Ground Water



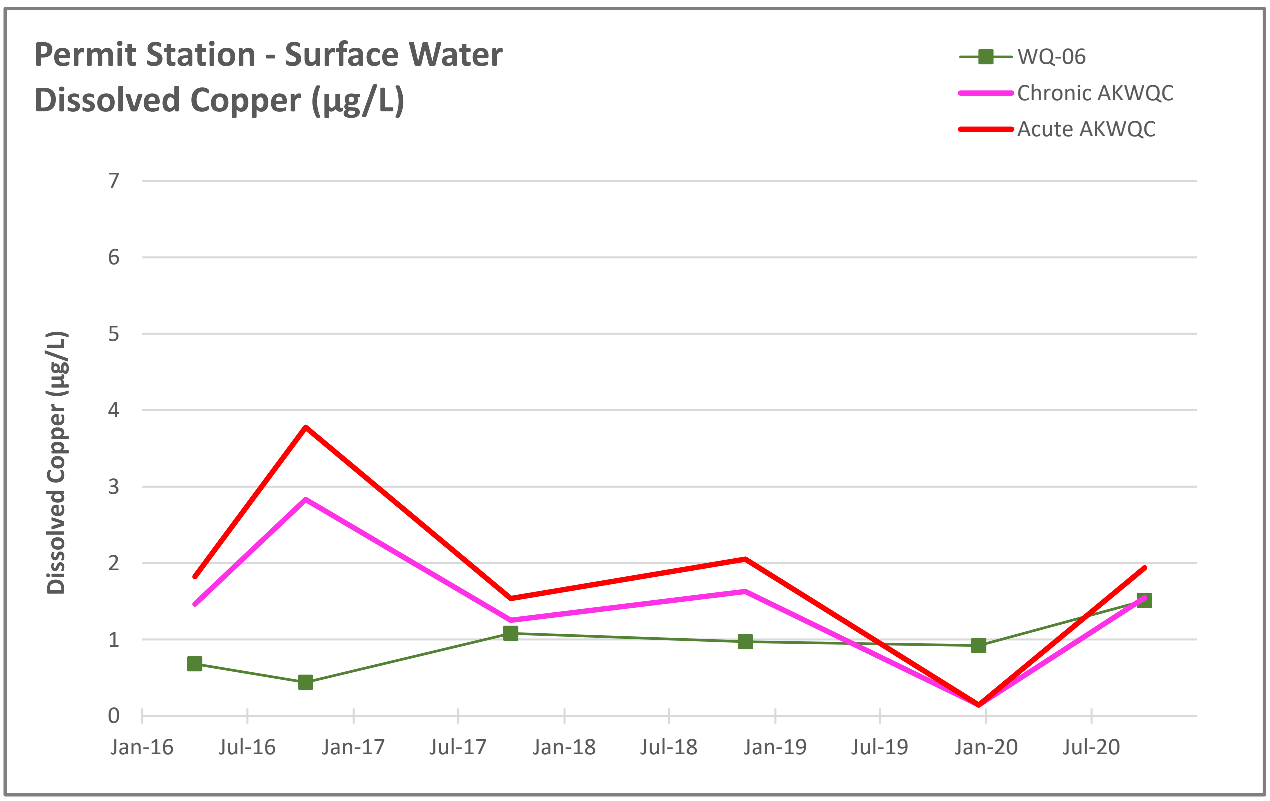


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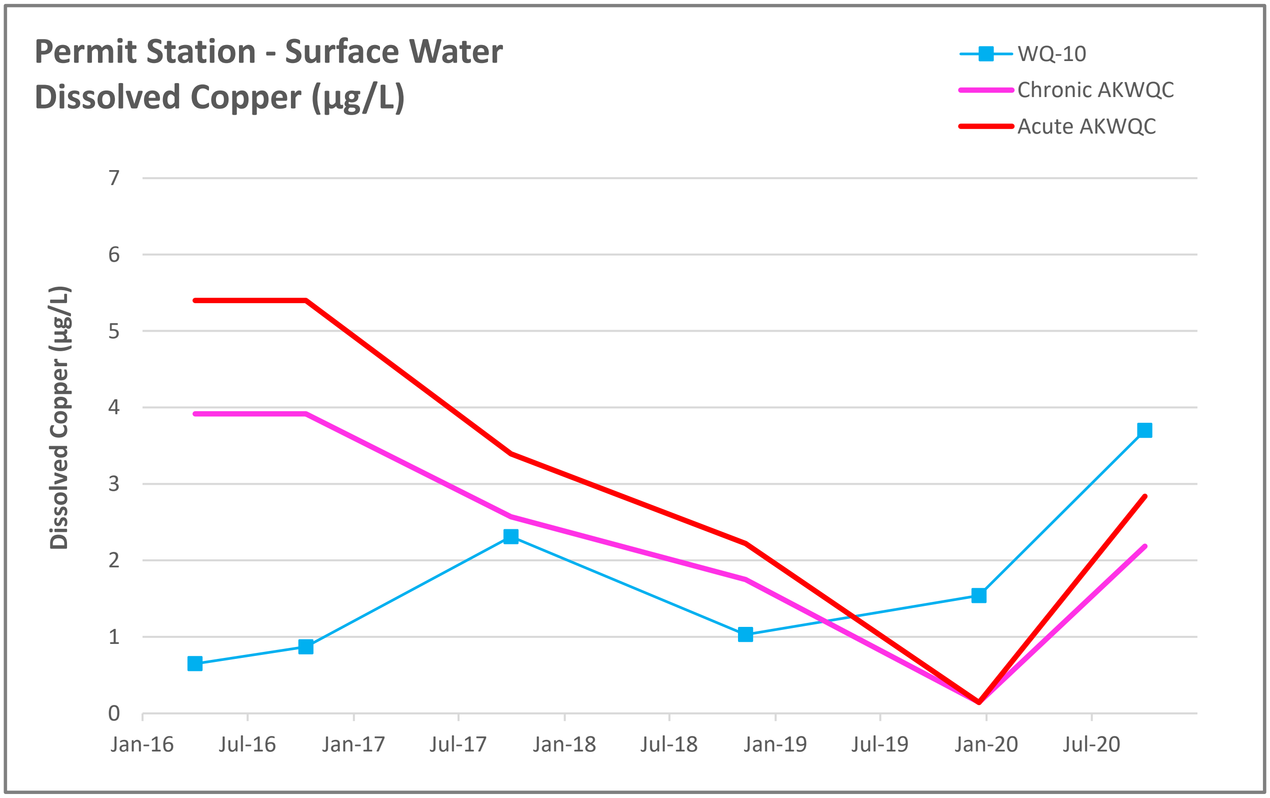
Figure 5-16a
Time Series Graphs: Dissolved Copper
Surface Water



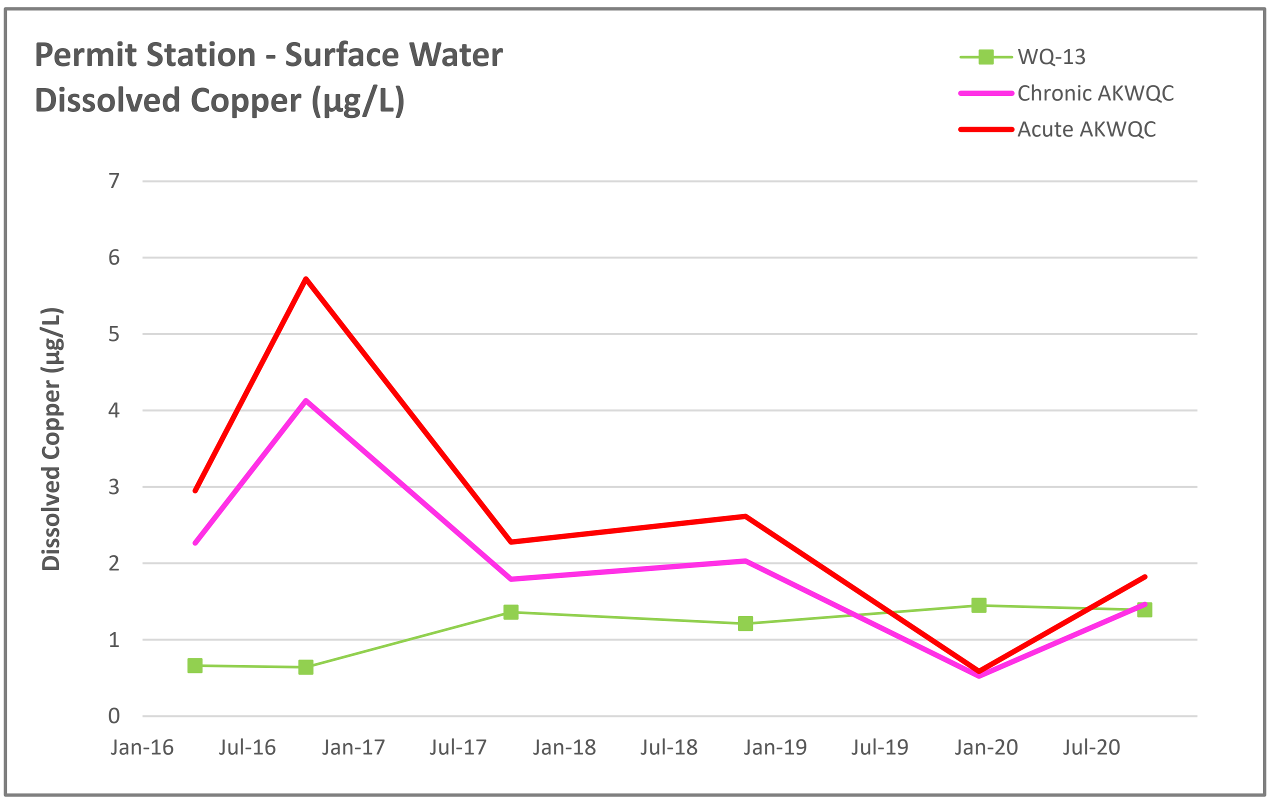


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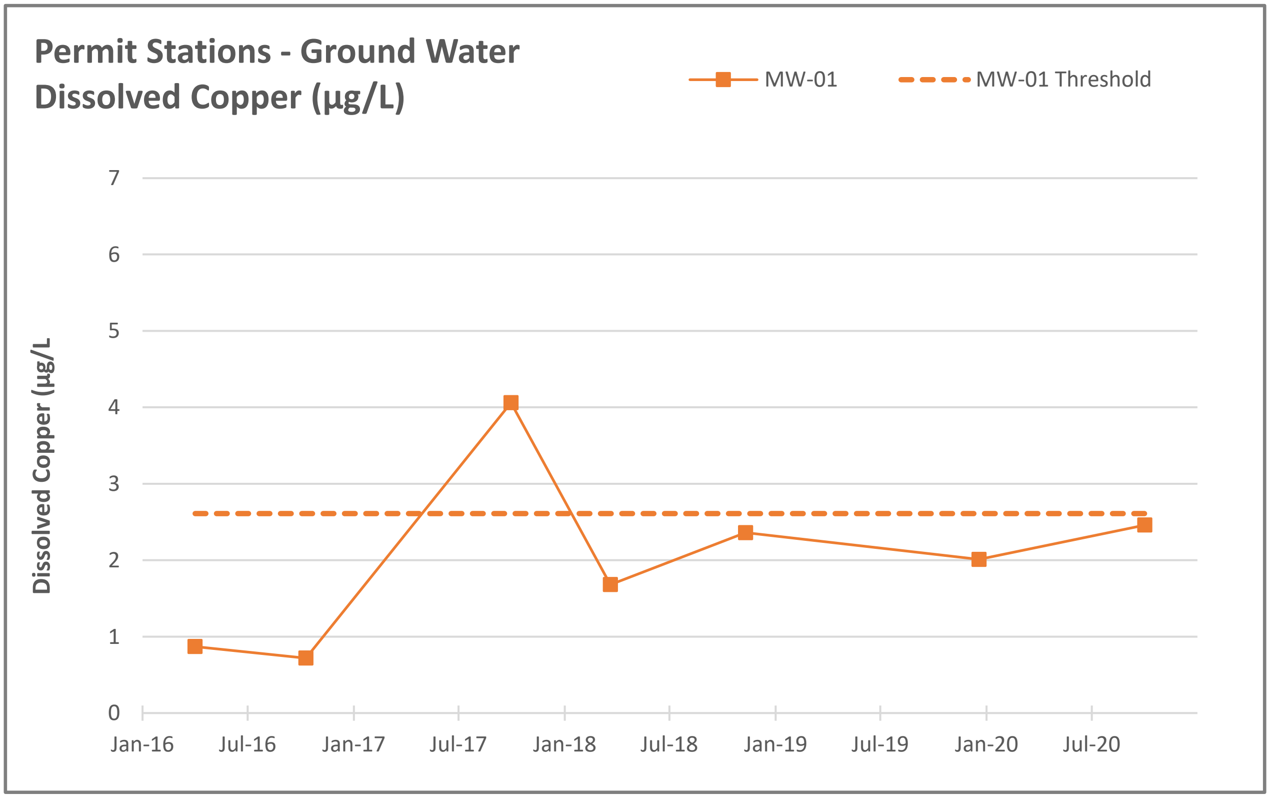
Figure 5-16b
Time Series Graphs: Dissolved Copper
Surface Water



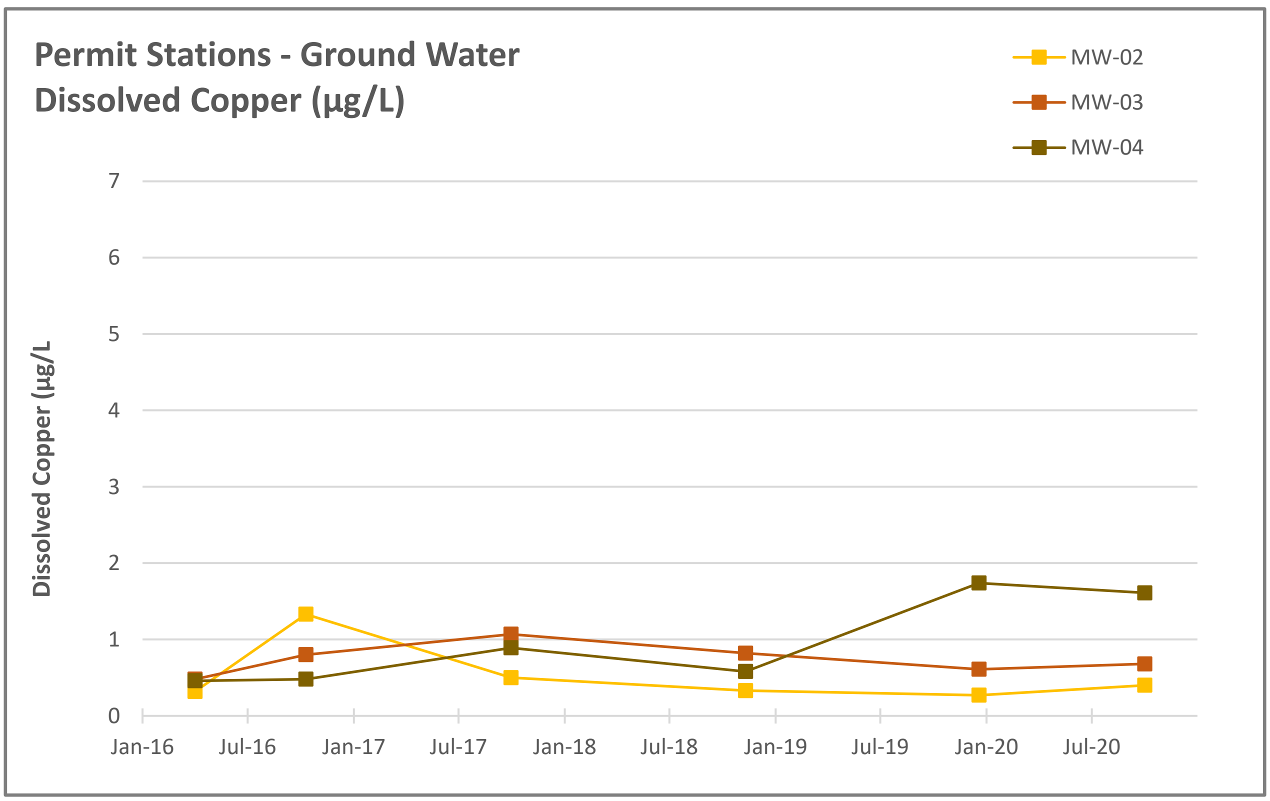


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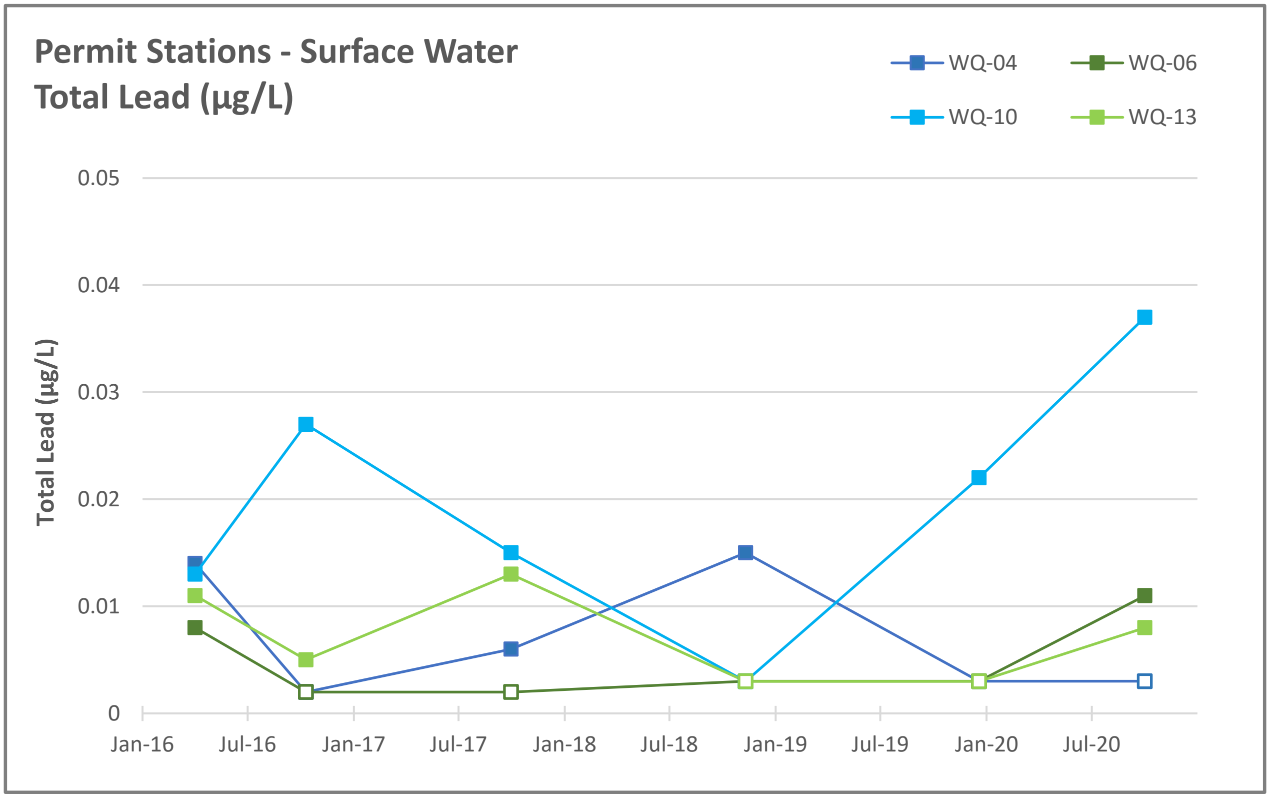
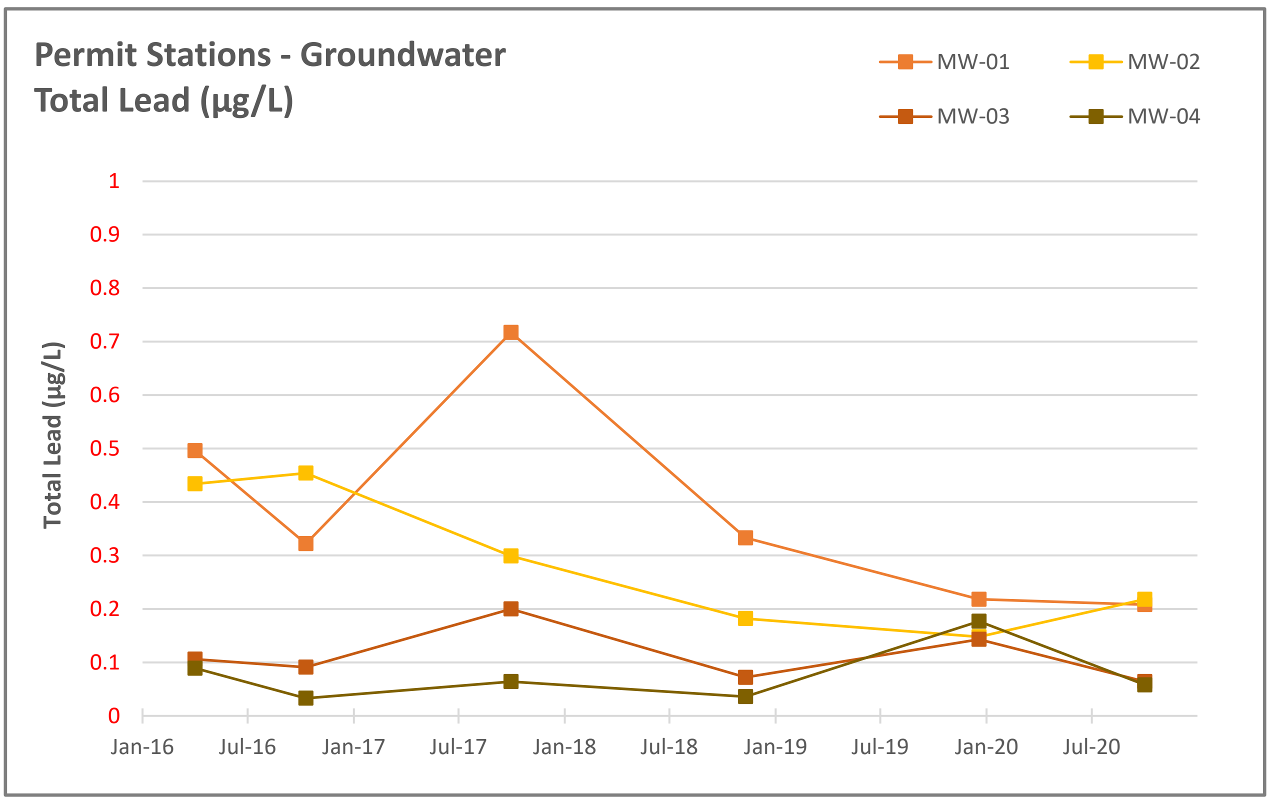
Figure 5-16c
Time Series Graphs: Dissolved Copper Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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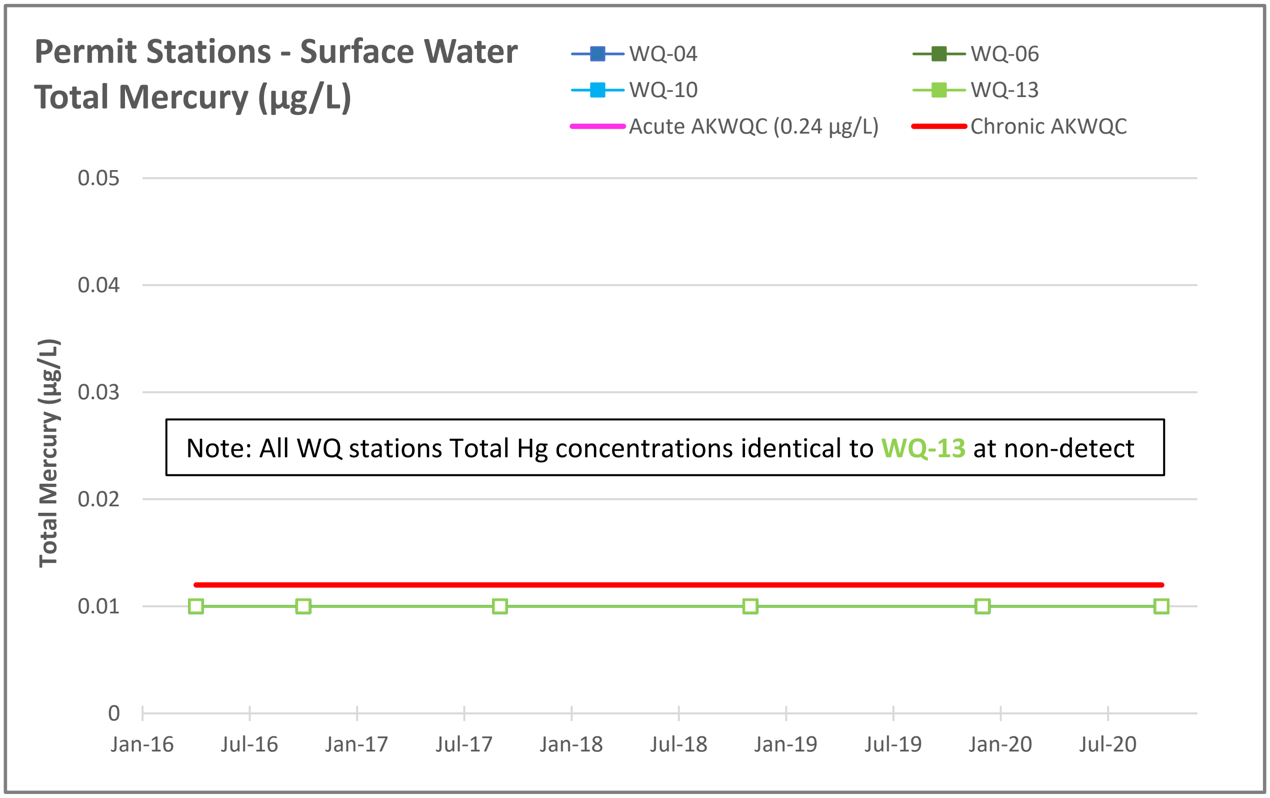
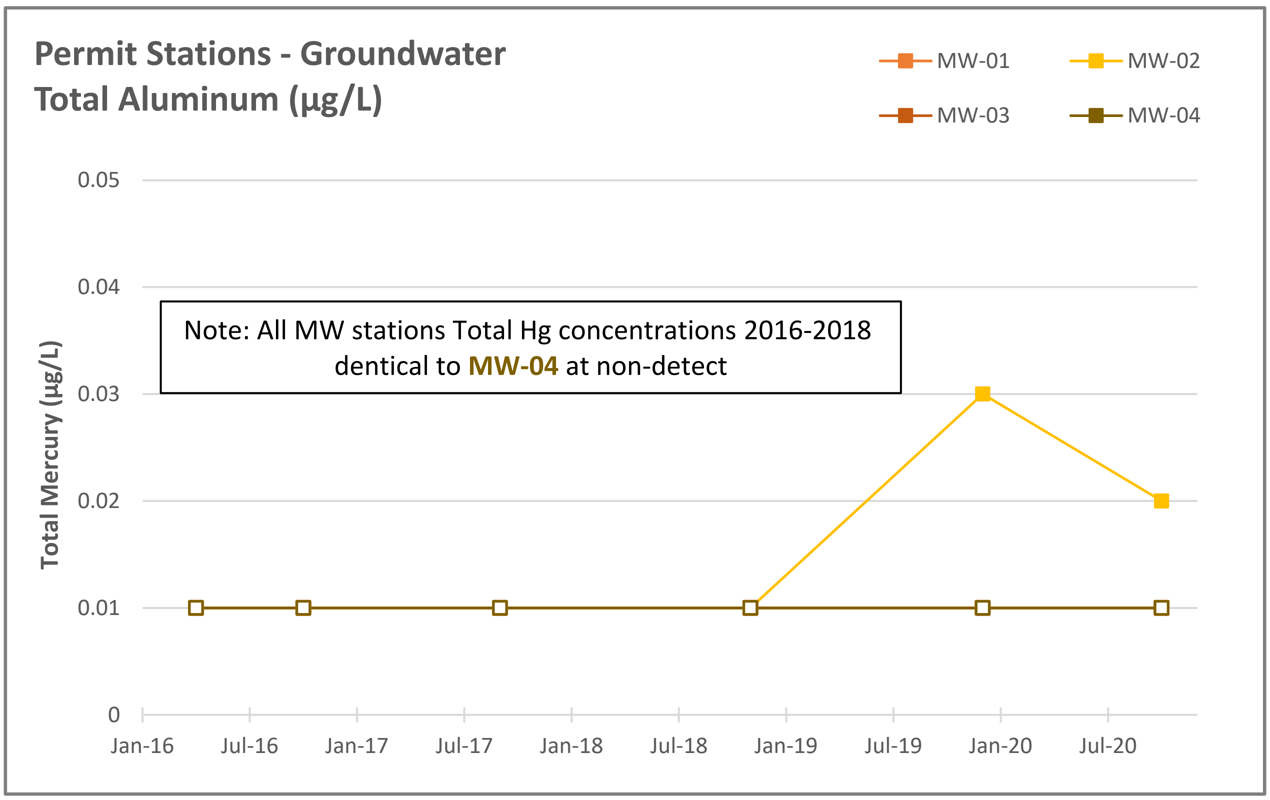
Figure 5-17
Time Series Graphs: Total Lead
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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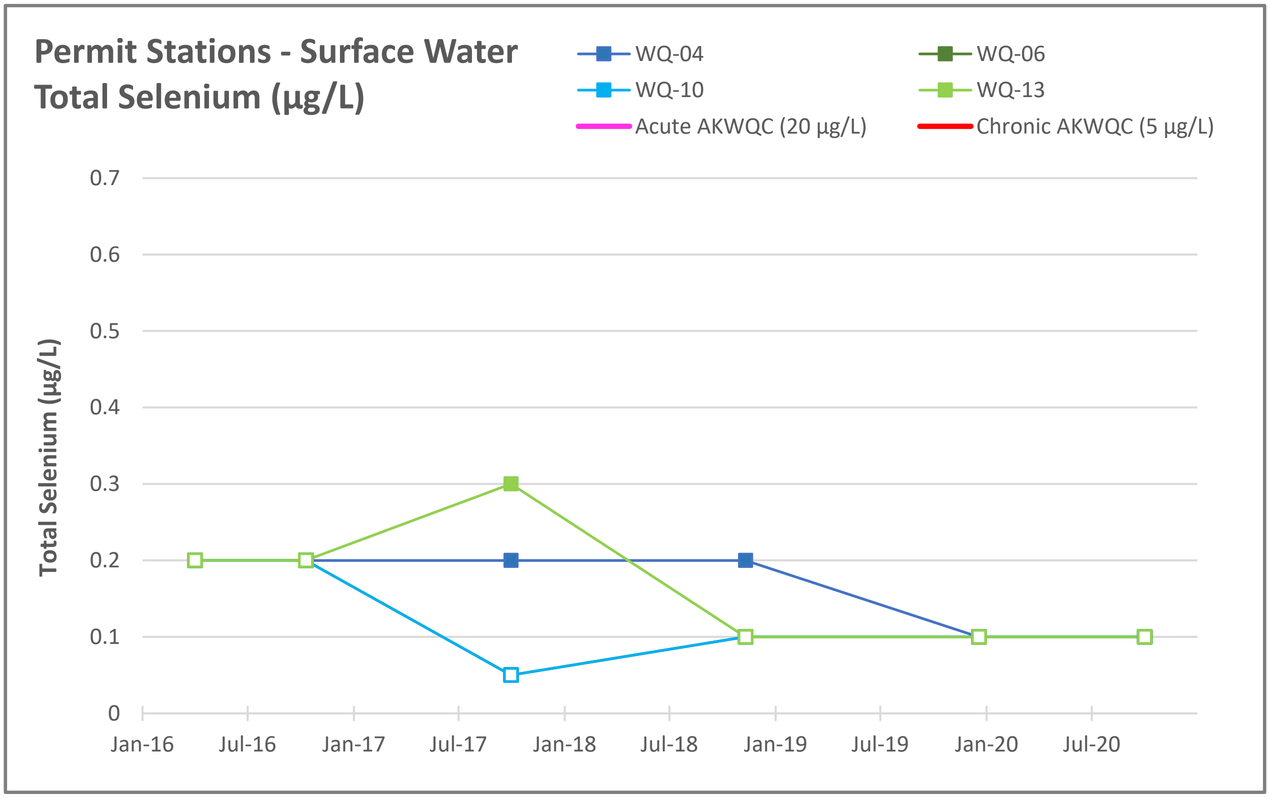
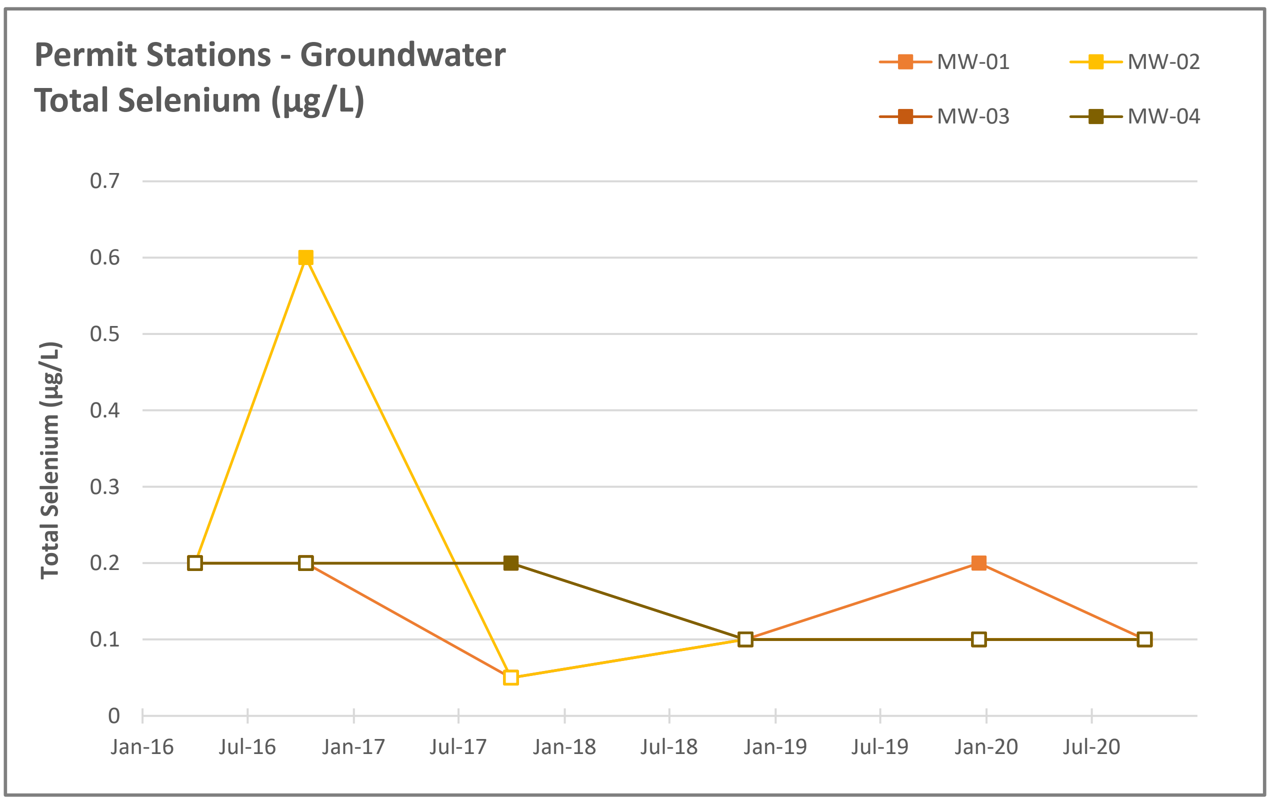
Figure 5-18
Time Series Graphs: Total Mercury
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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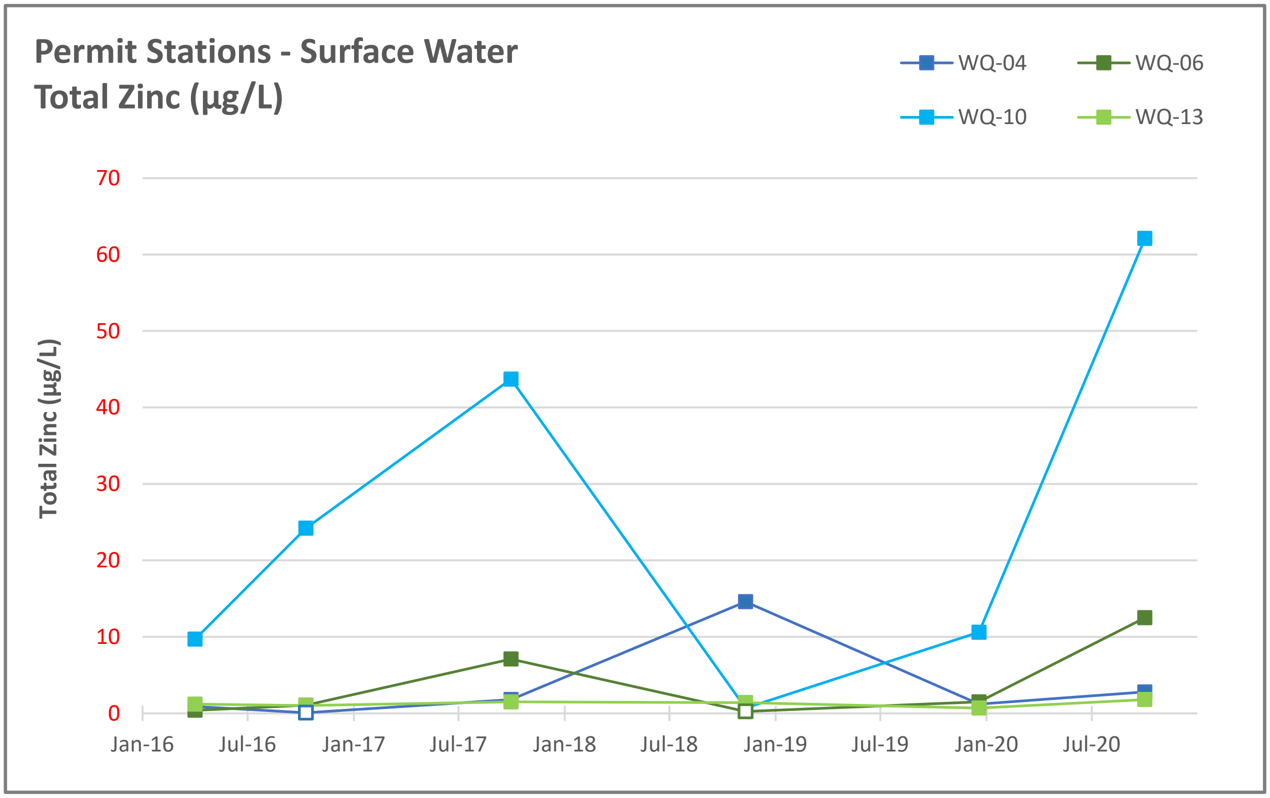
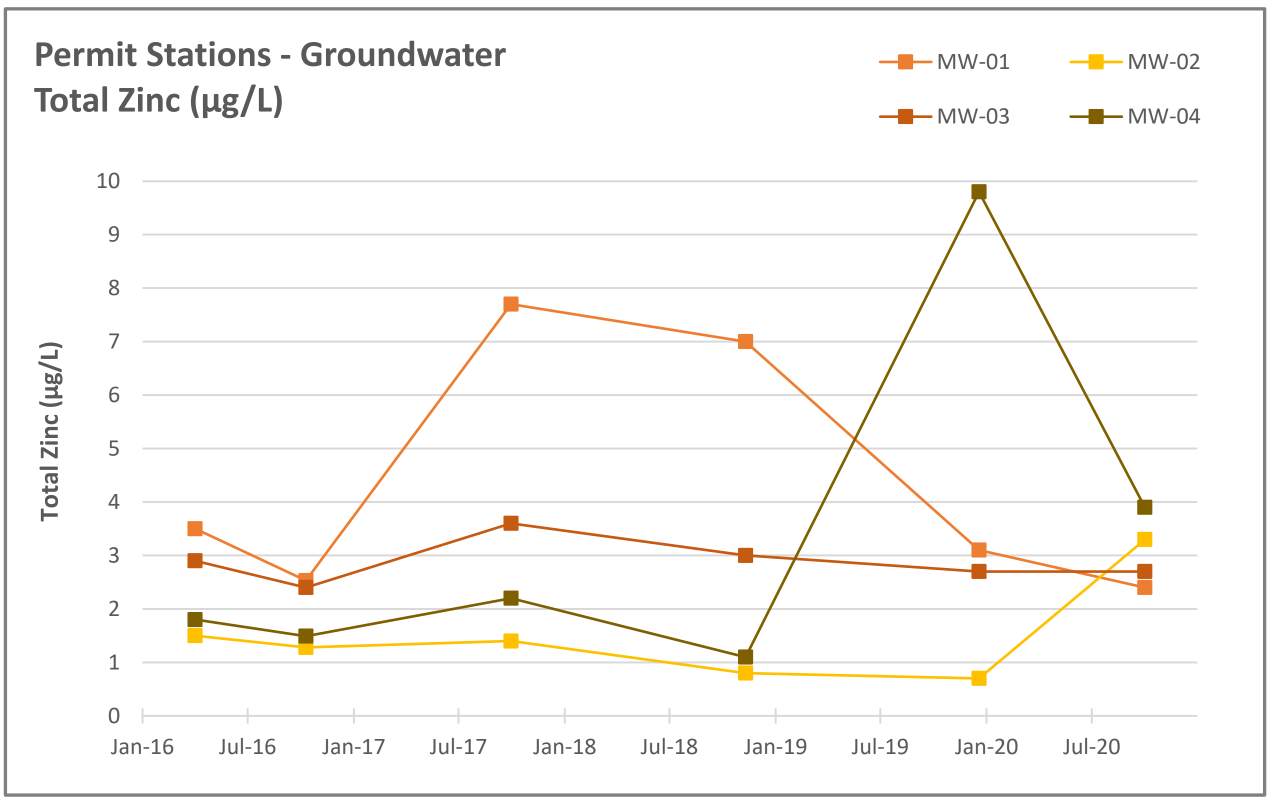
Figure 5-19
Time Series Graphs: Total Selenium
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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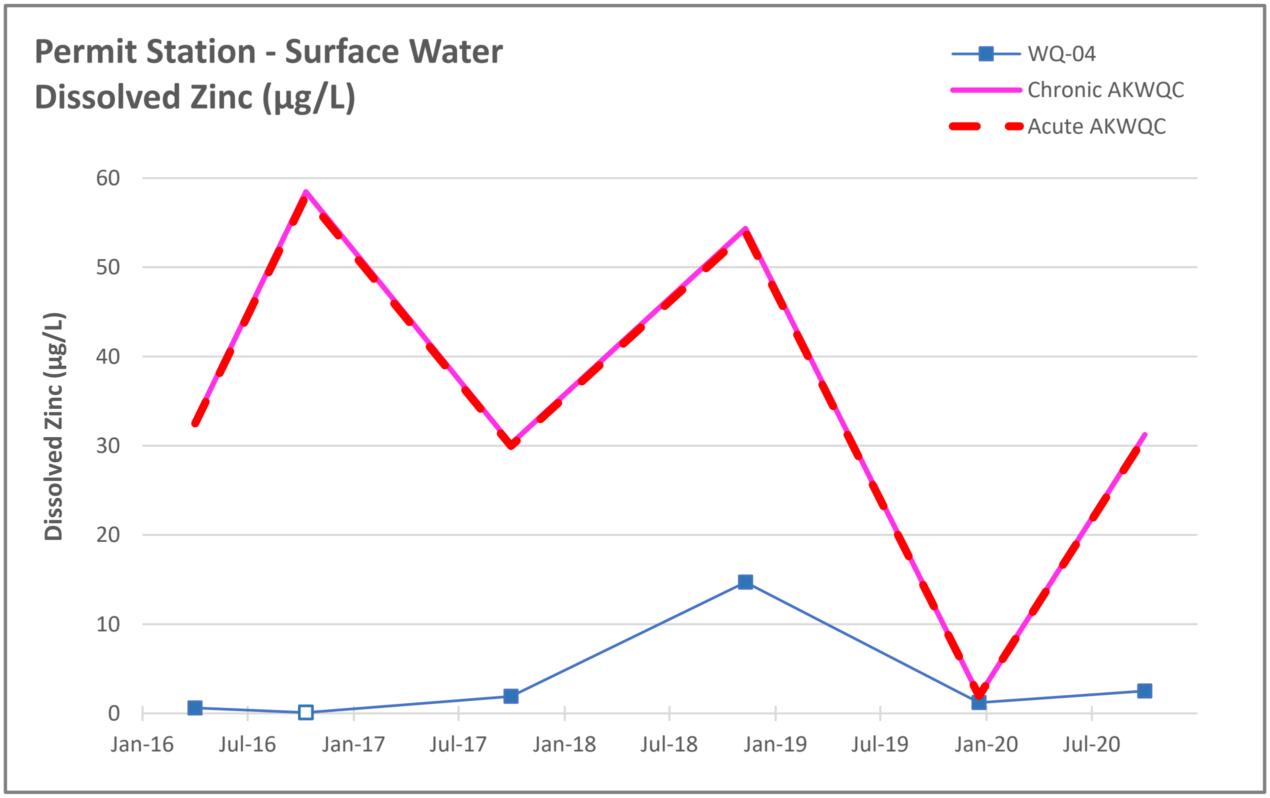
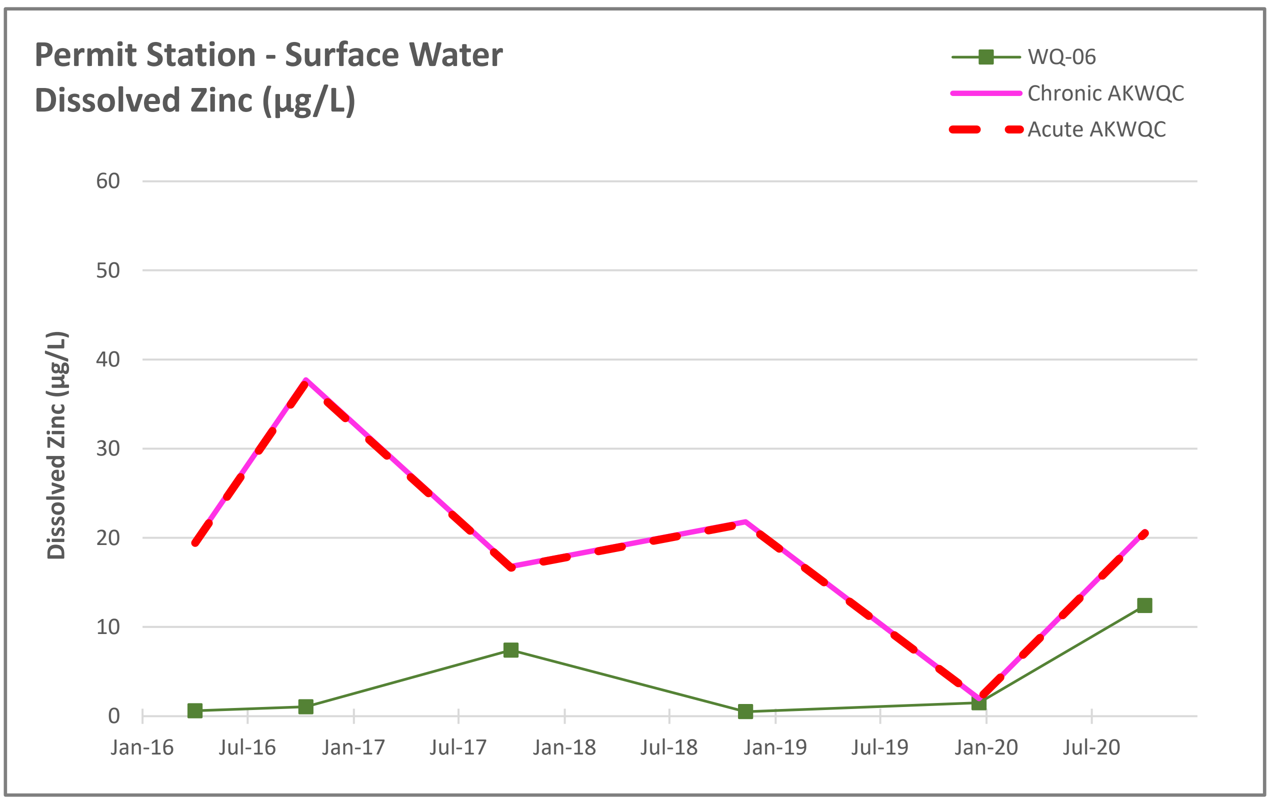
Figure 5-20
Time Series Graphs: Total Zinc
Surface and Ground Water





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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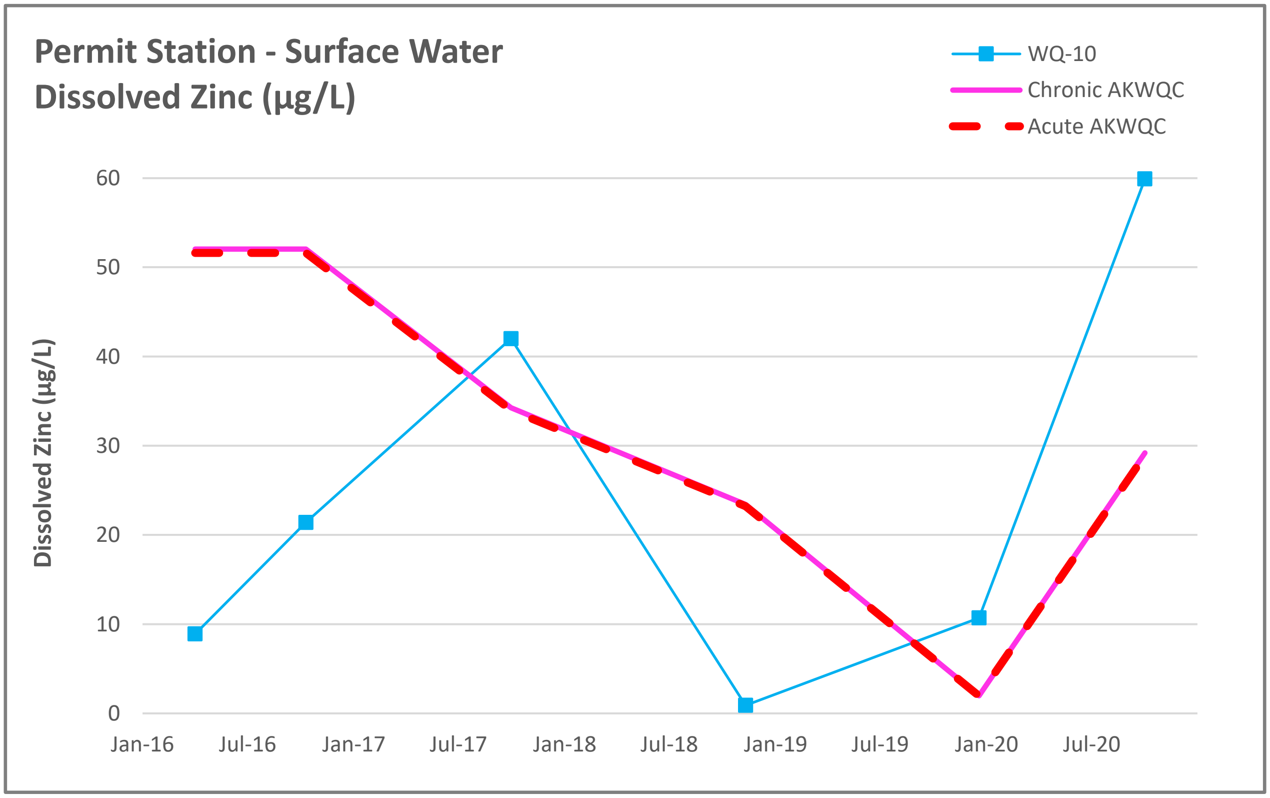
Figure 5-21a
Time Series Graphs: Dissolved Zinc
Surface Water



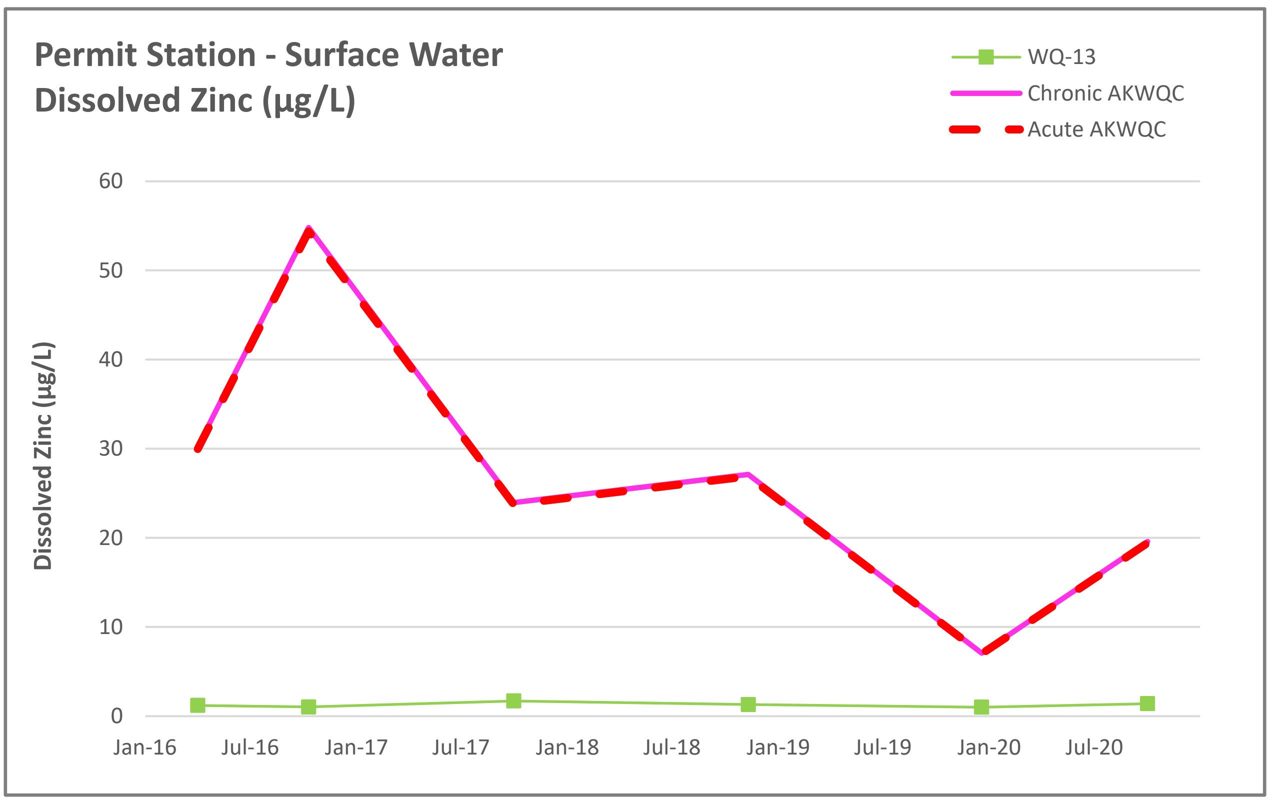


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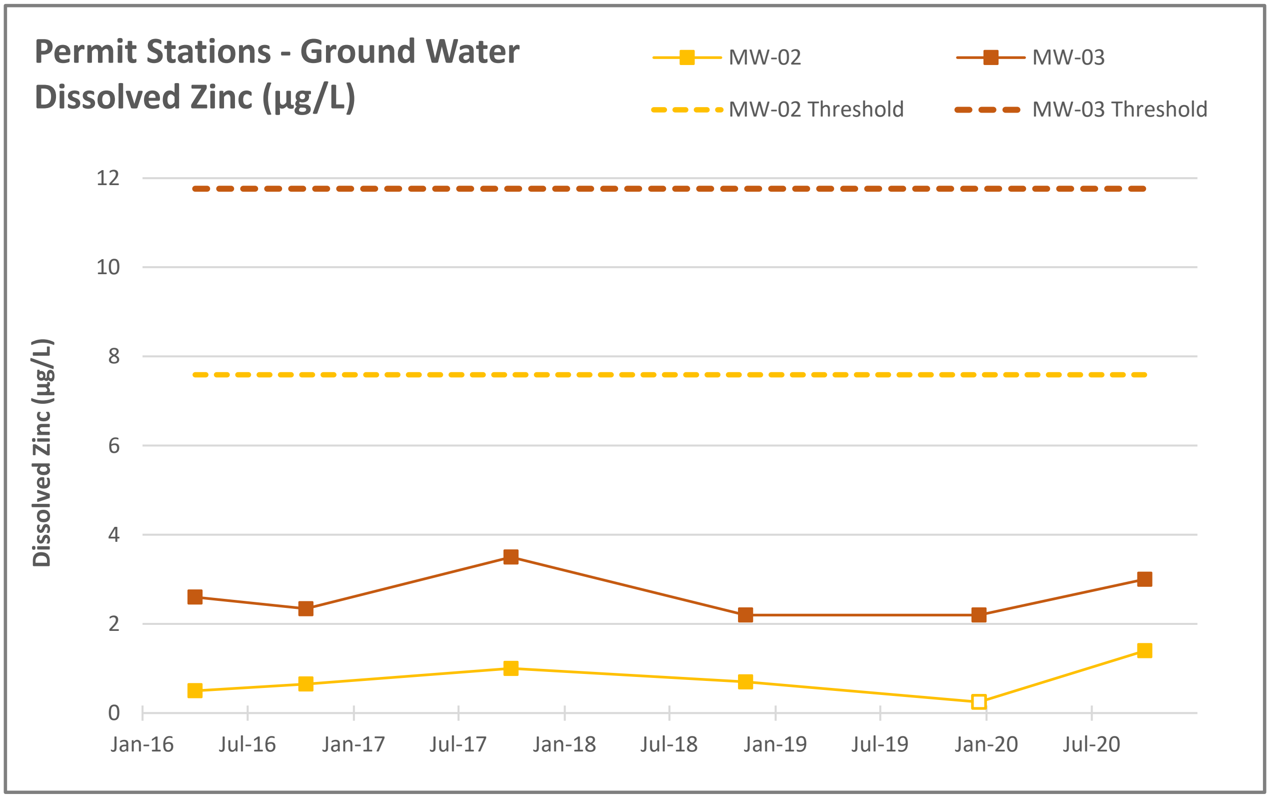
Figure 5-21b
Time Series Graphs: Dissolved Zinc
Surface Water



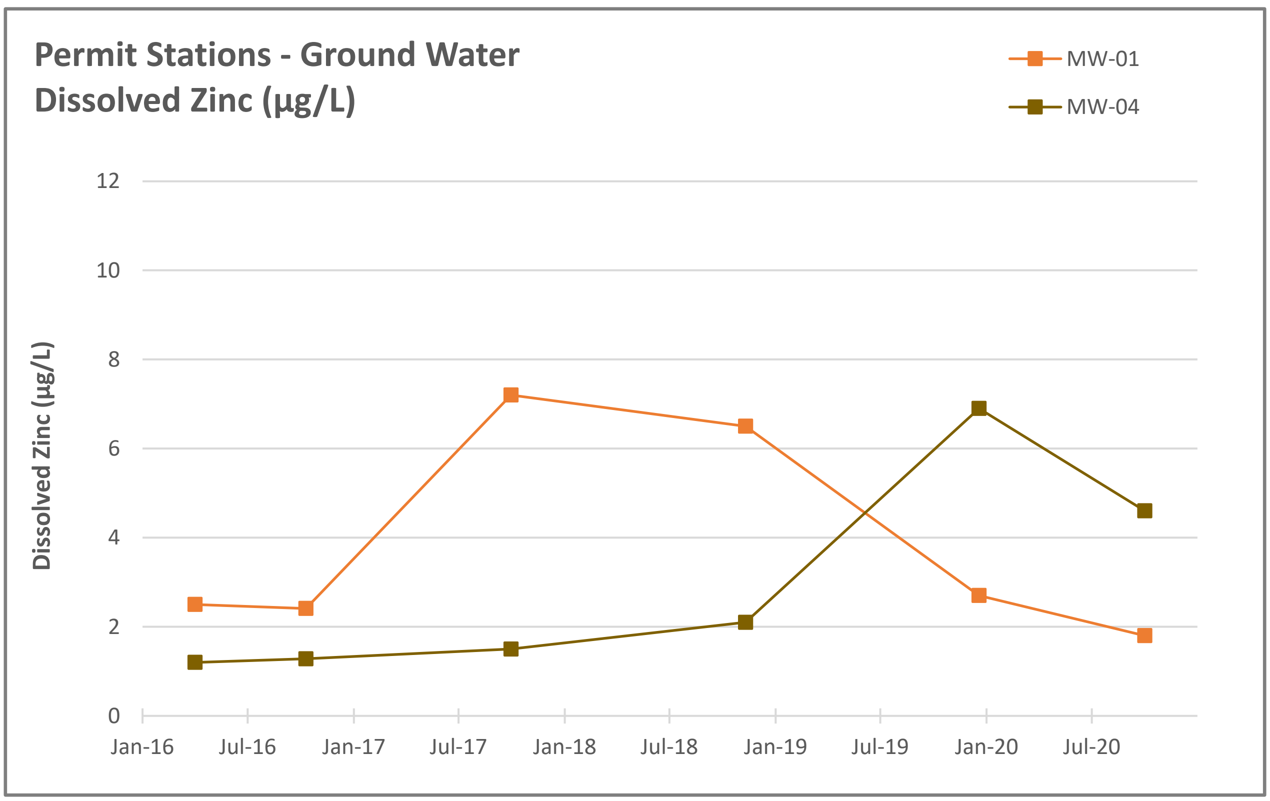


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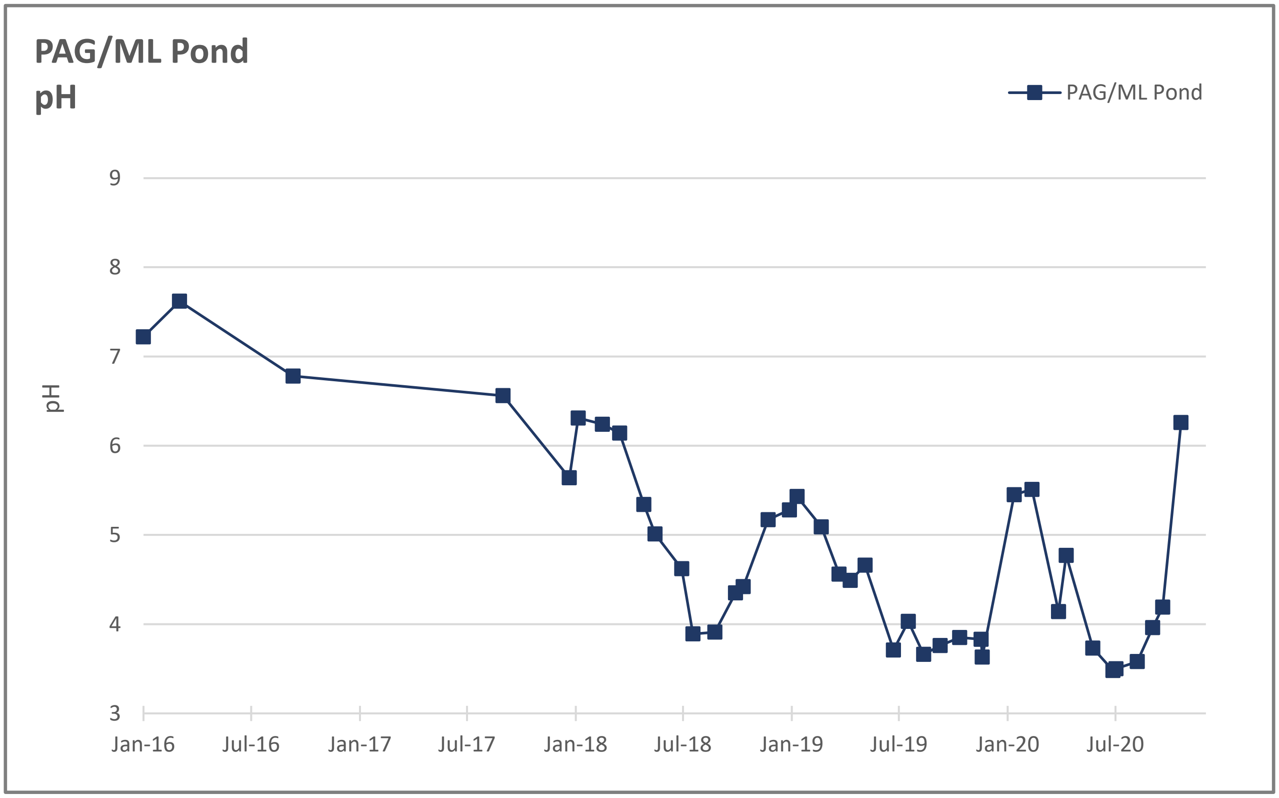
Figure 5-21c
Time Series Graphs: Dissolved Zinc
Ground Water



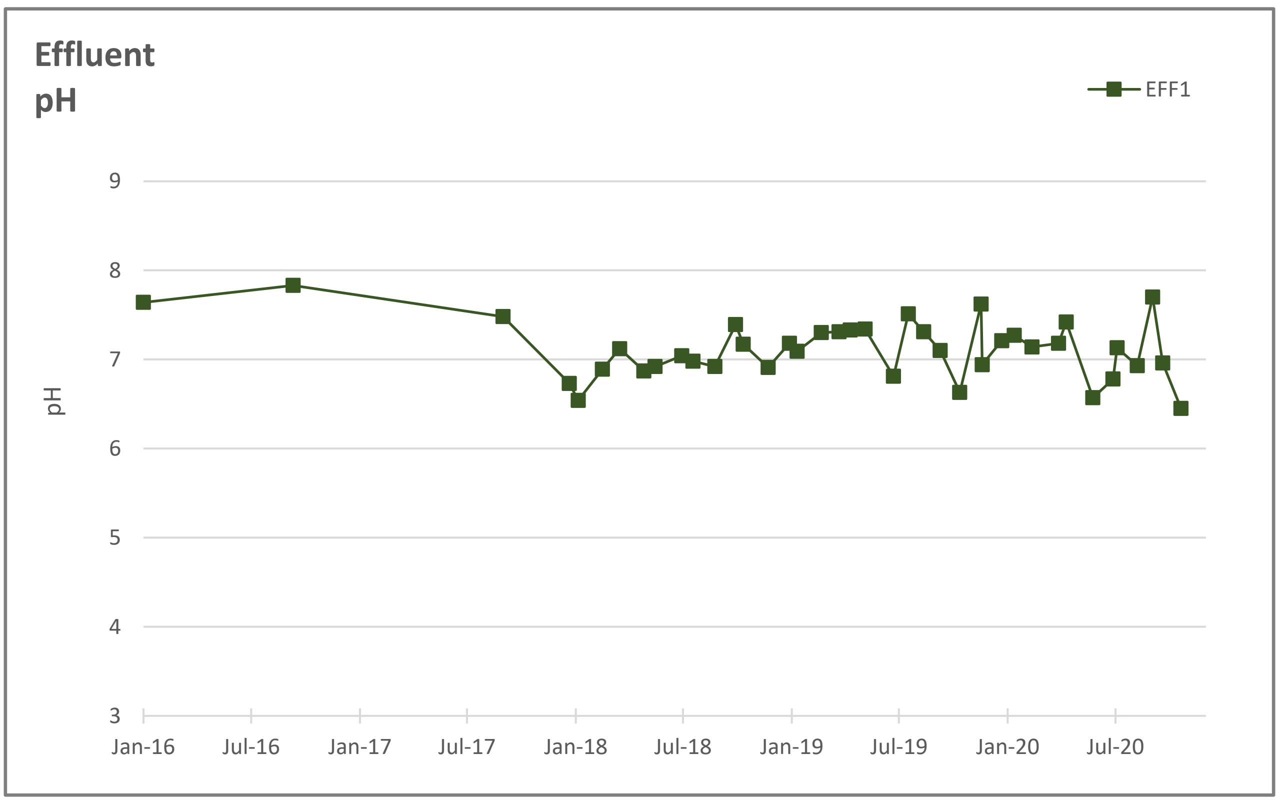


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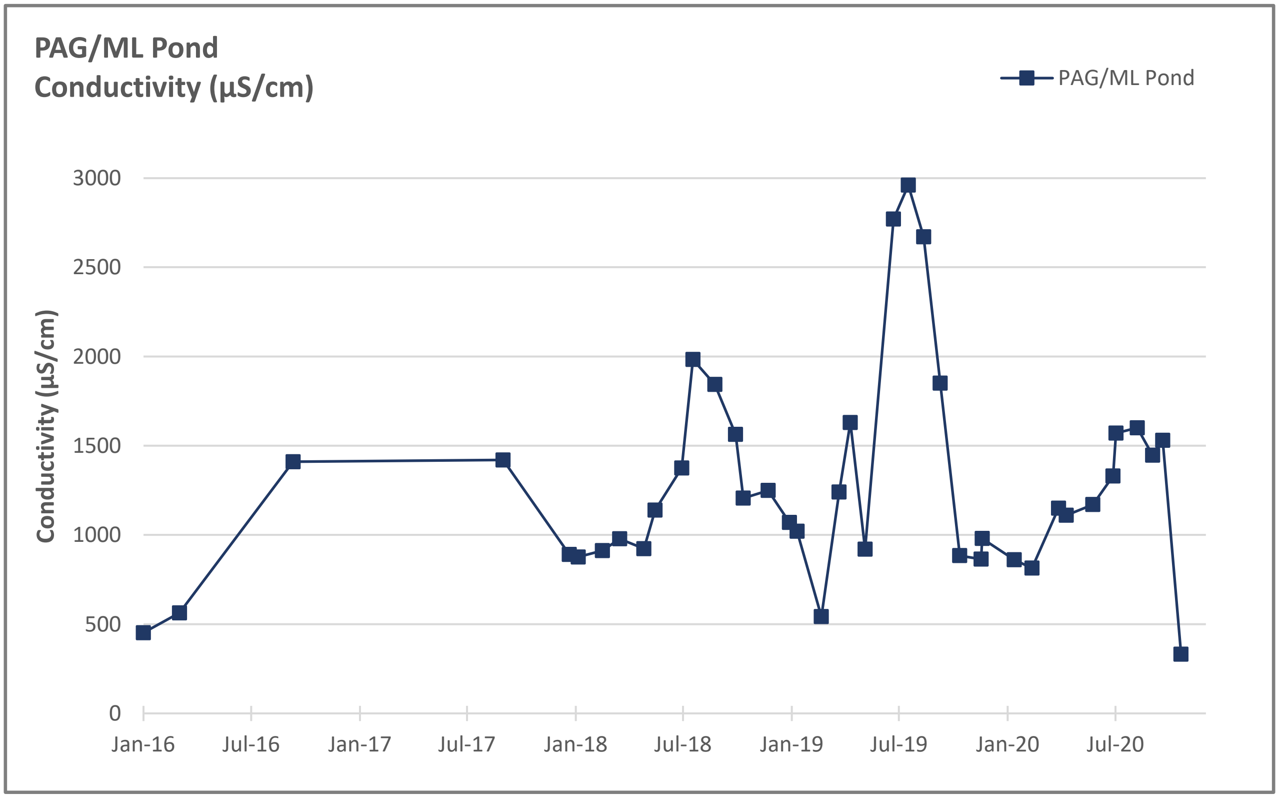
Figure 6-1
Time Series Graphs: pH
PAG Pond and Effluent



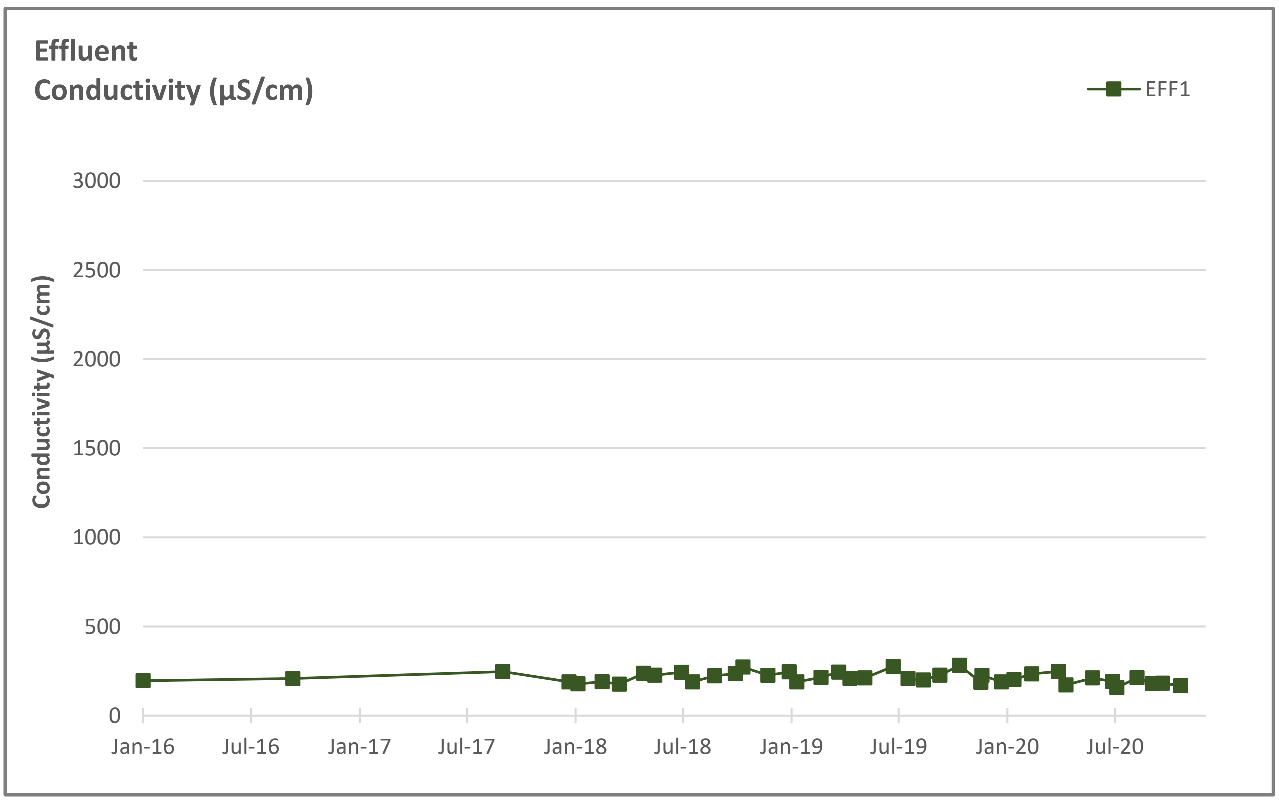


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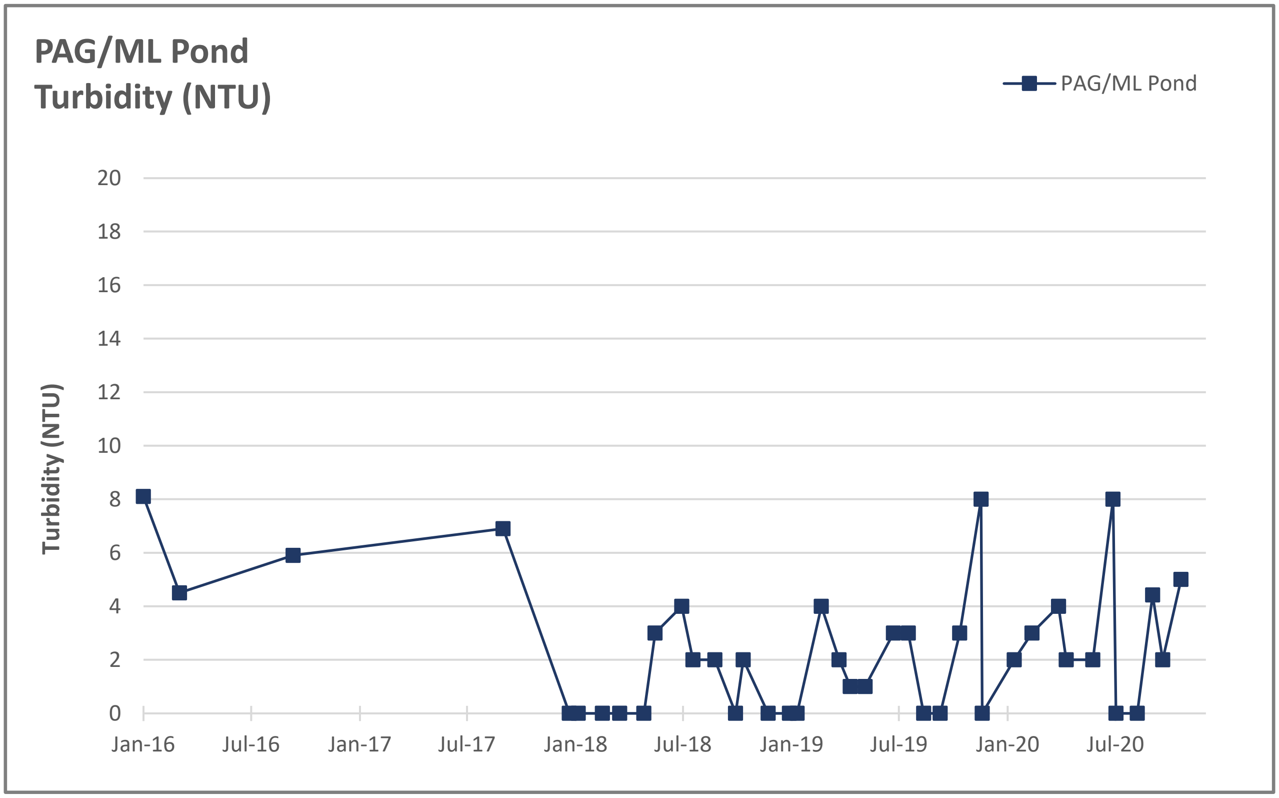
Figure 6-2
Time Series Graphs: Conductivity
PAG Pond and Effluent



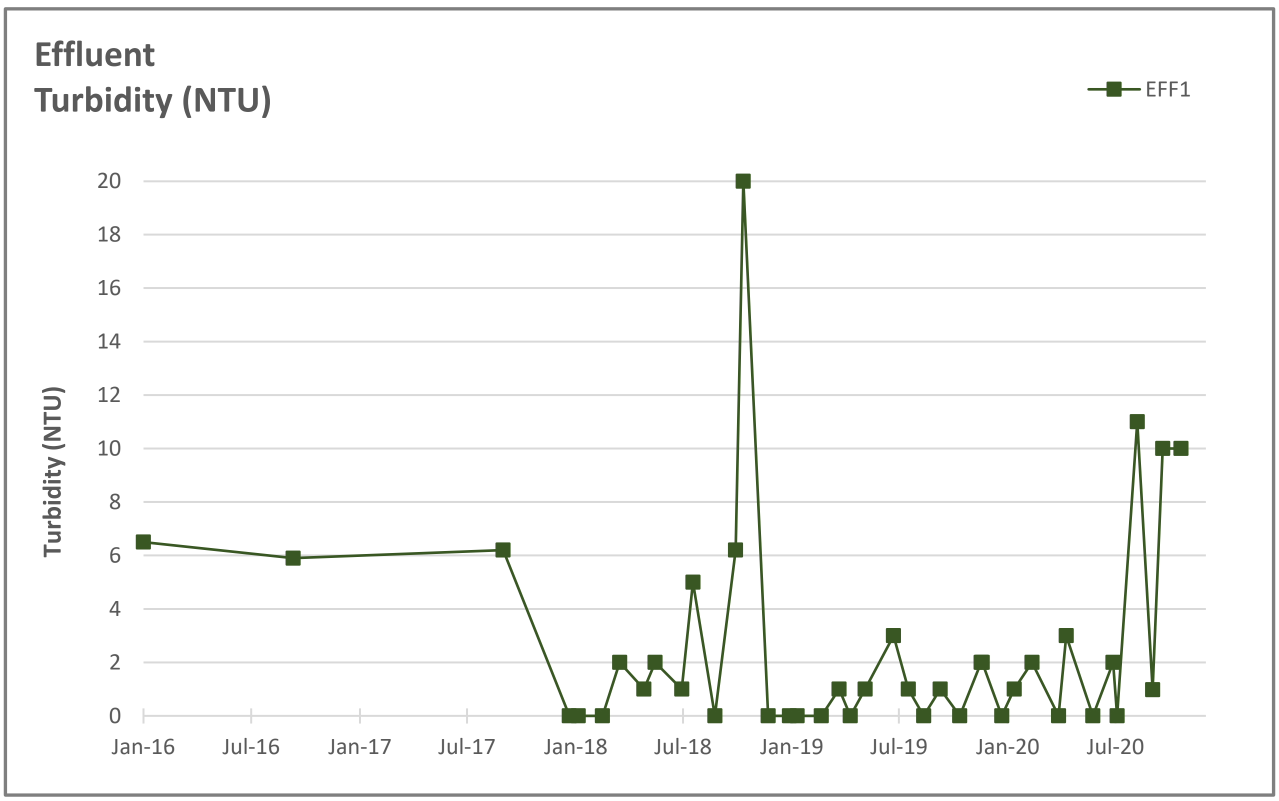


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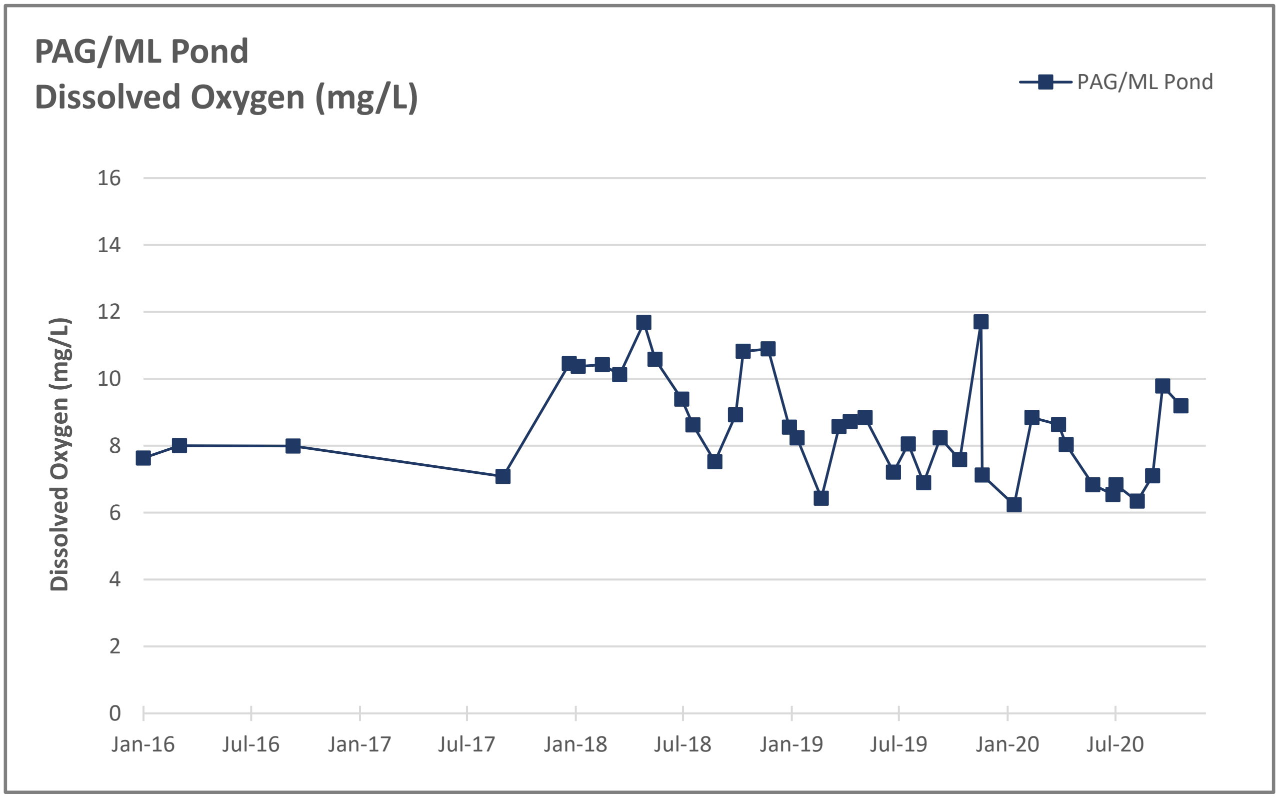
Figure 6-3
Time Series Graphs: Turbidity
PAG Pond and Effluent



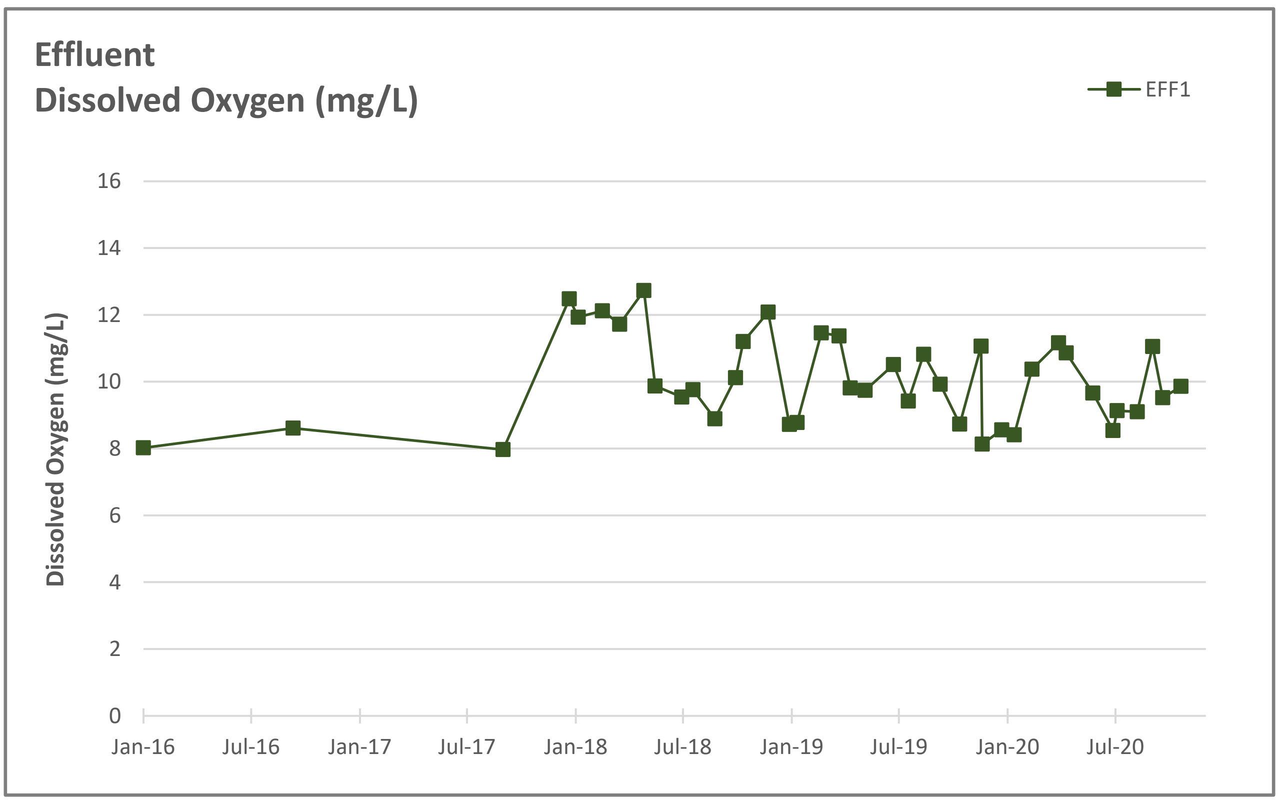


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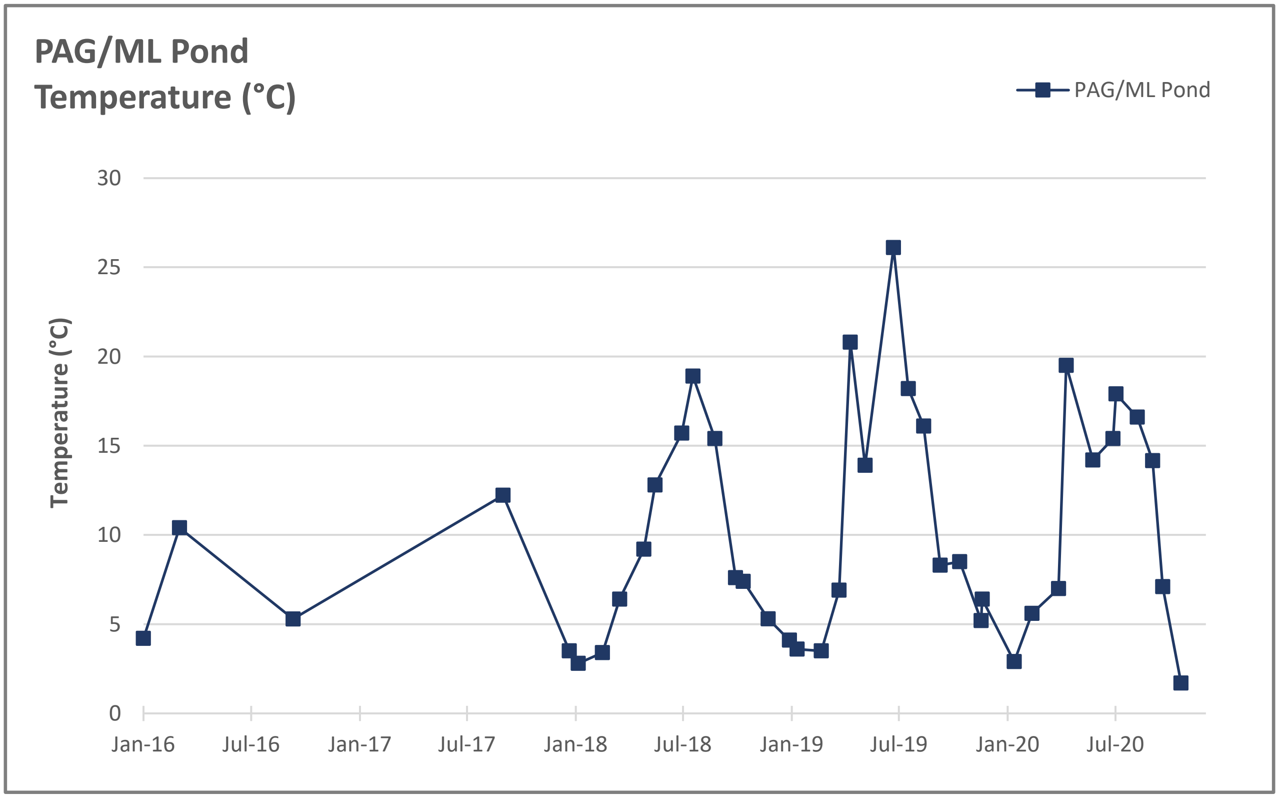
Figure 6-4
Time Series Graphs: Turbidity
PAG Pond and Effluent



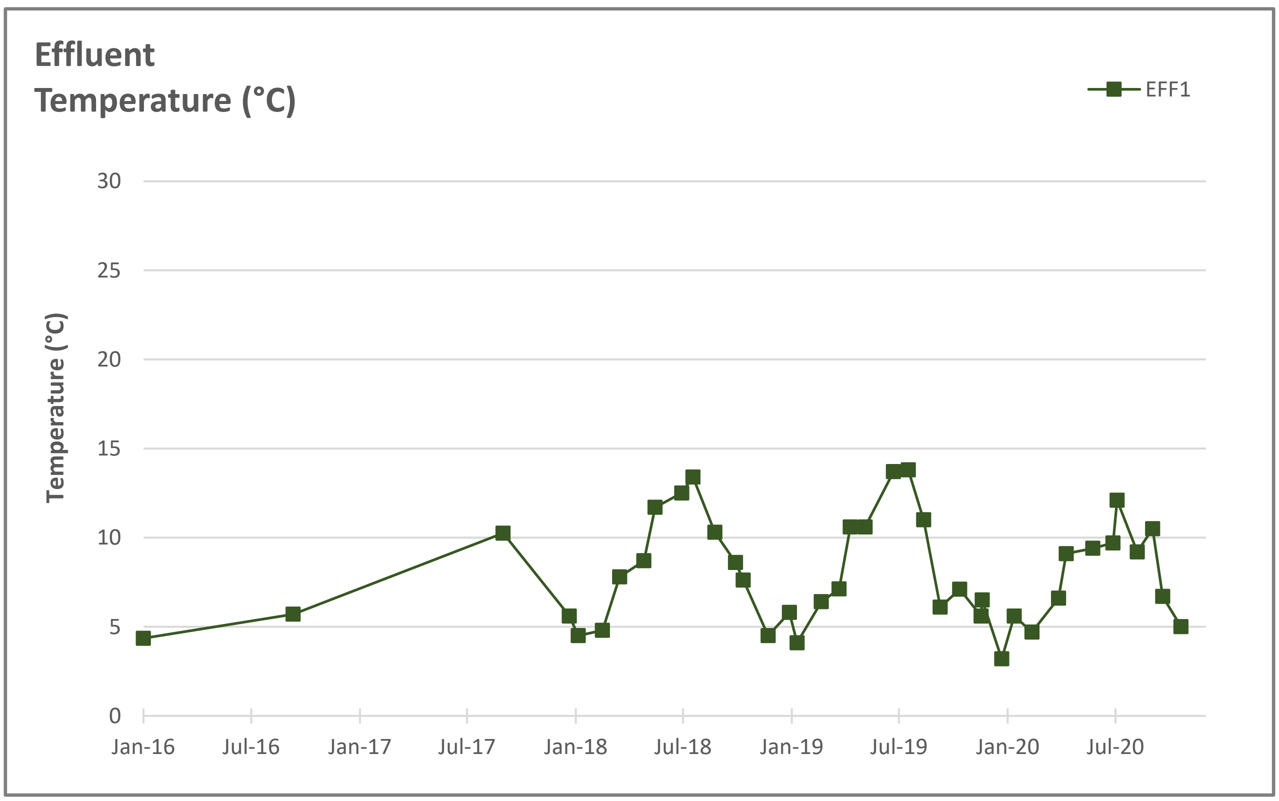


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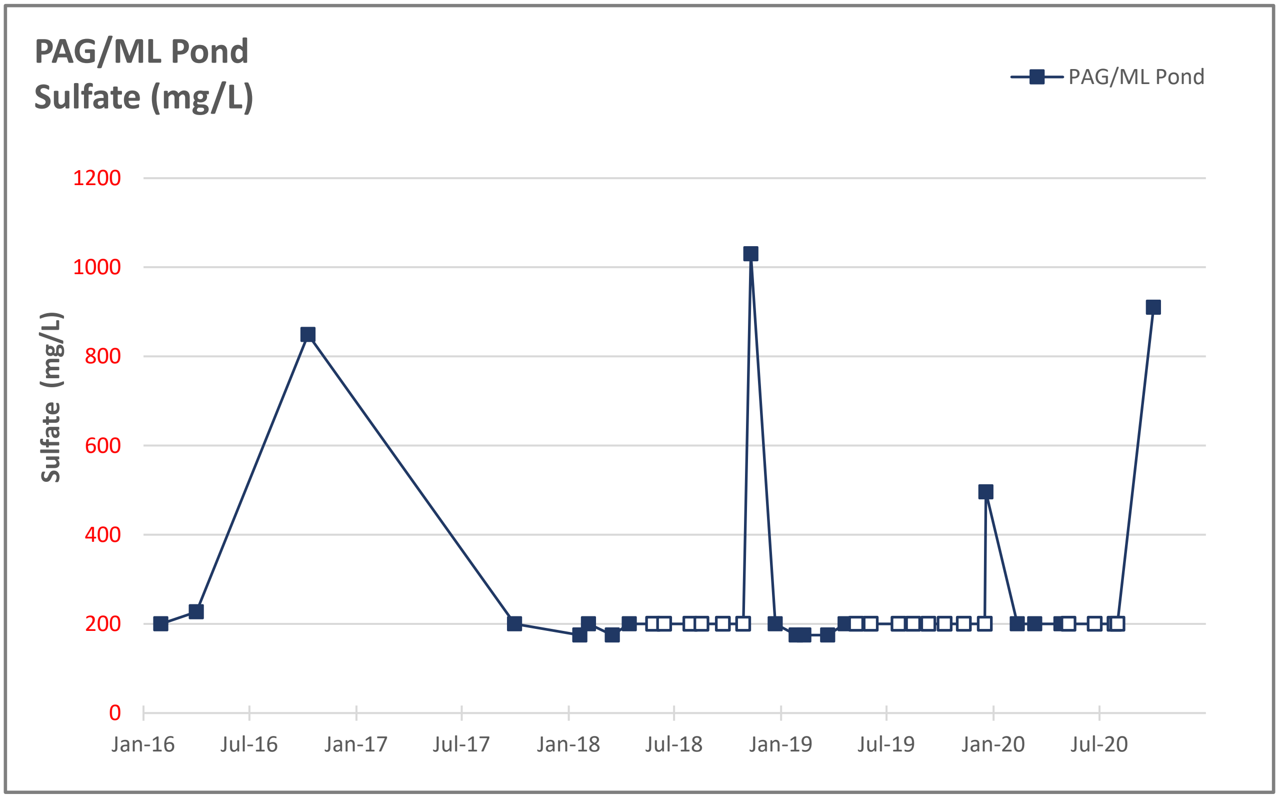
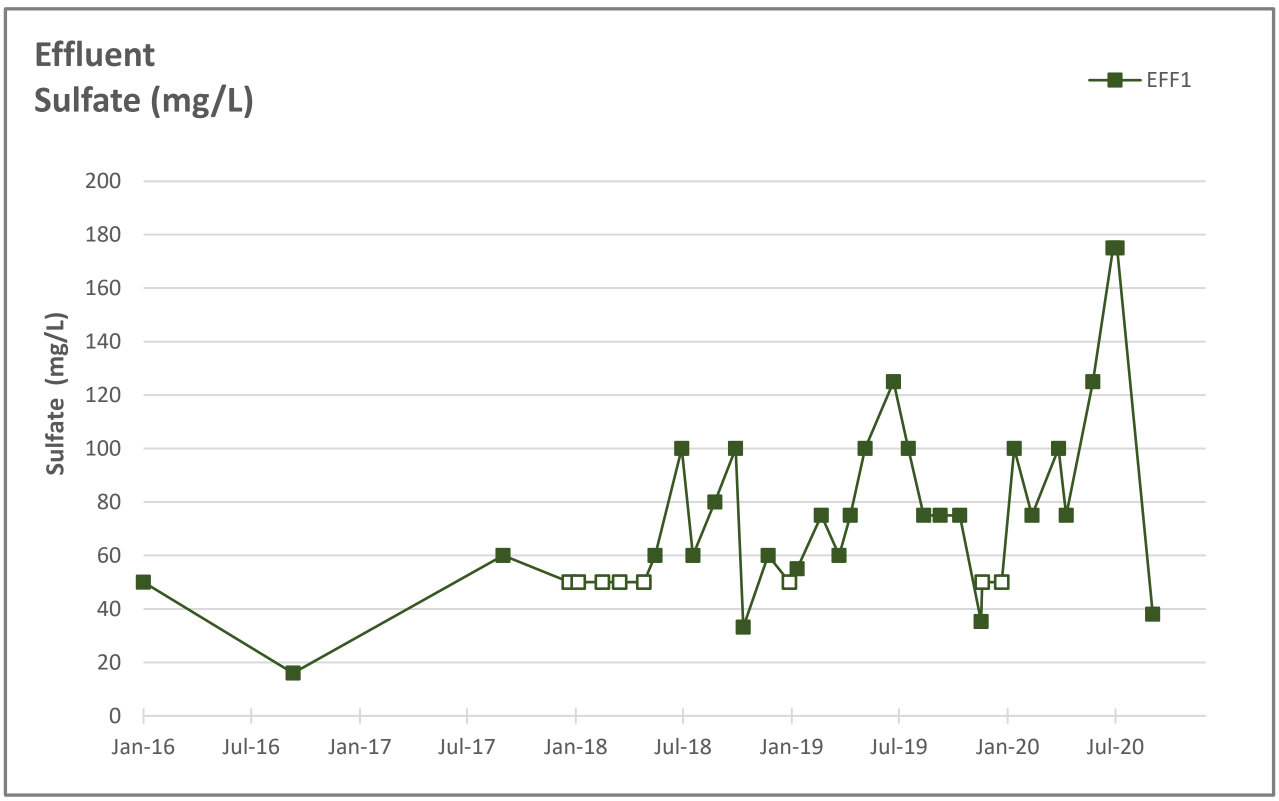
Figure 6-5
Time Series Graphs: Temperature
PAG Pond and Effluent





Note: Field tests only measures 50-200 mg/L and plotted as hollow symbols at limits if beyond; solid symbols beyond limits are lab analysis

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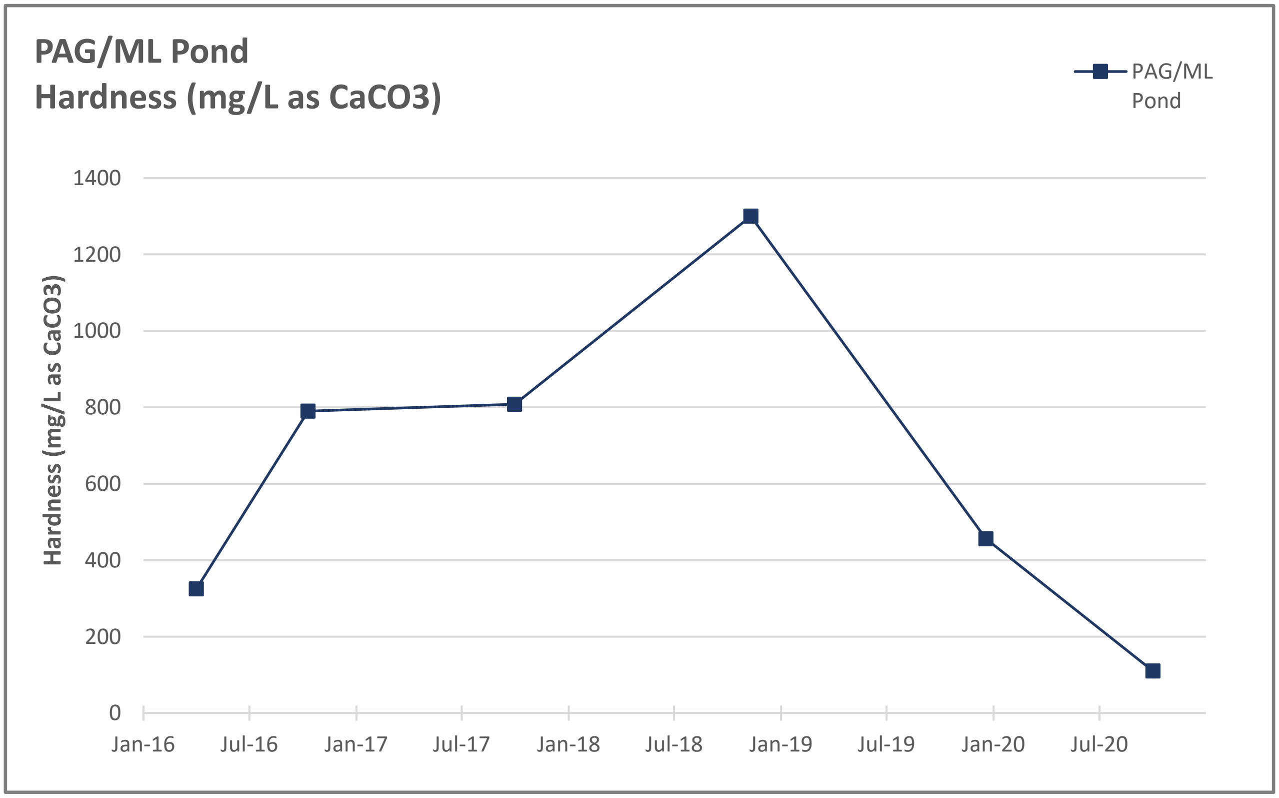
Figure 6-6
Time Series Graphs: Sulfate
PAG Pond and Effluent



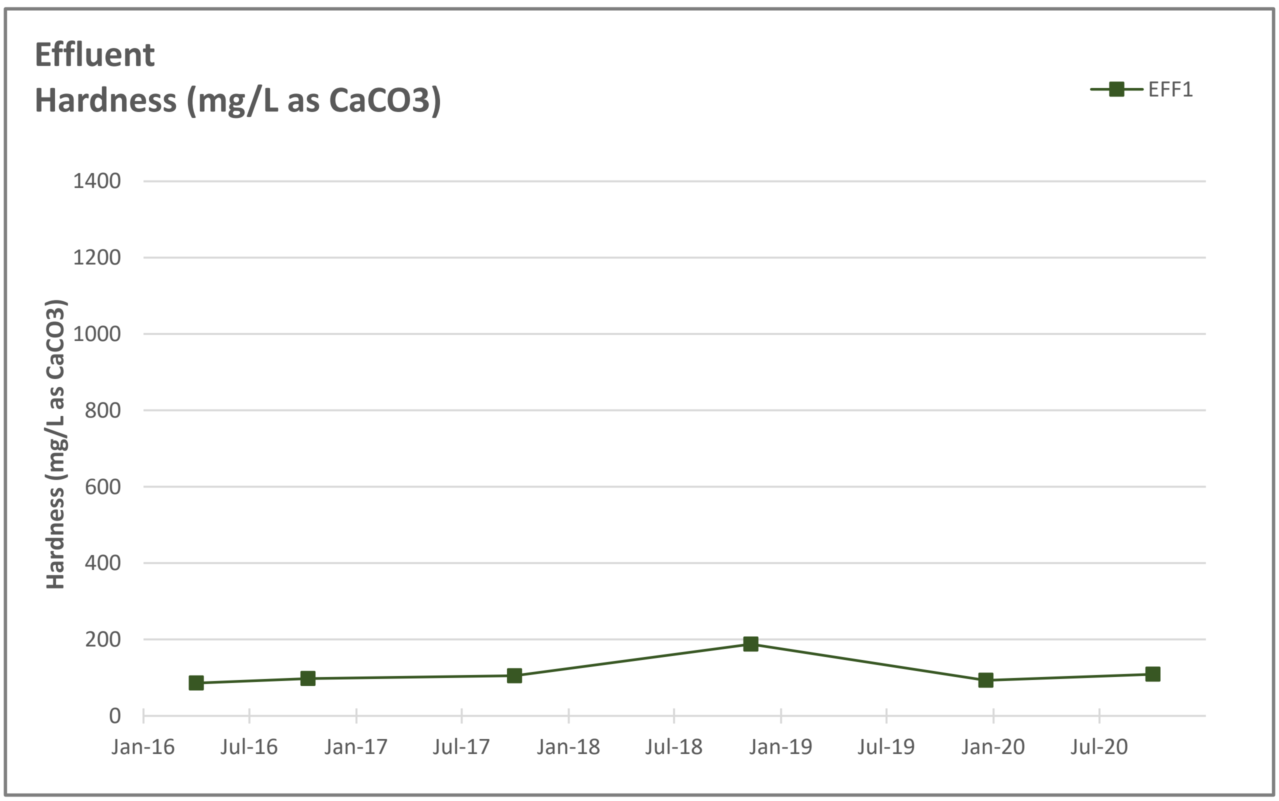


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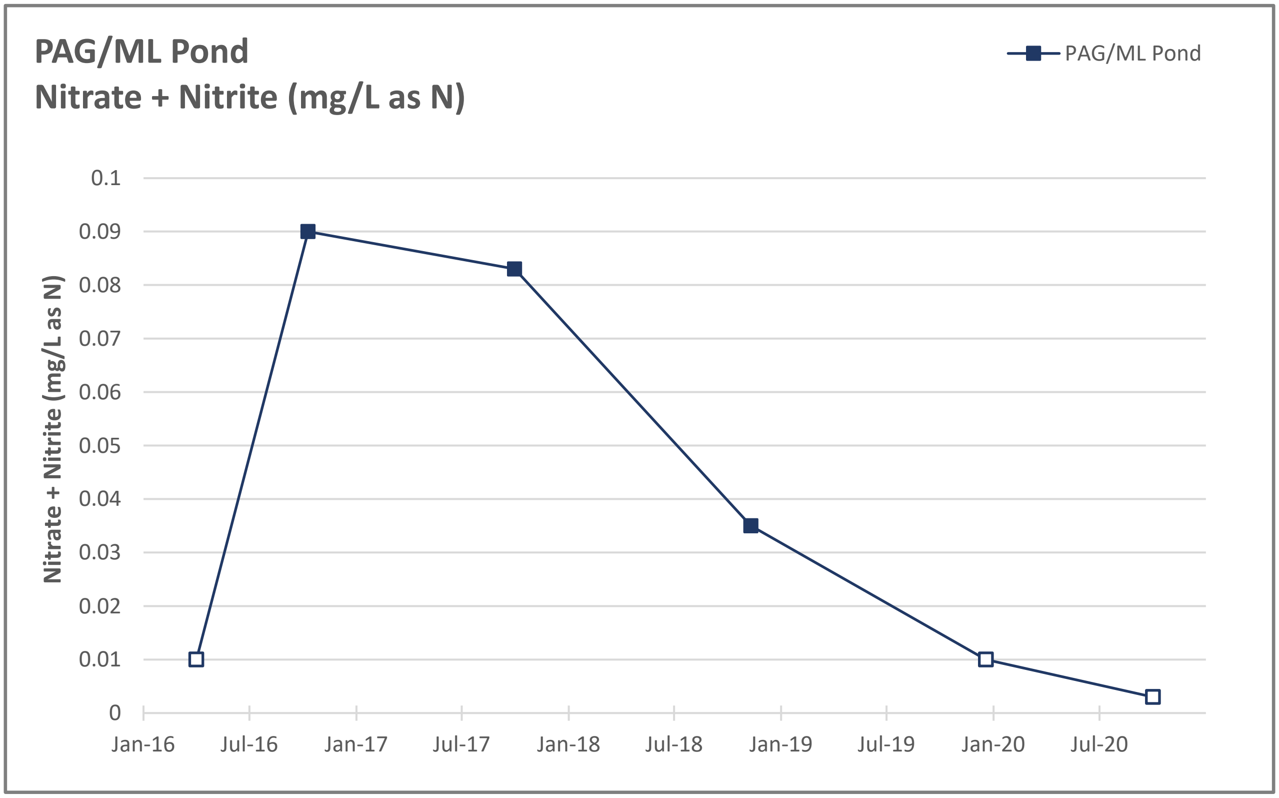
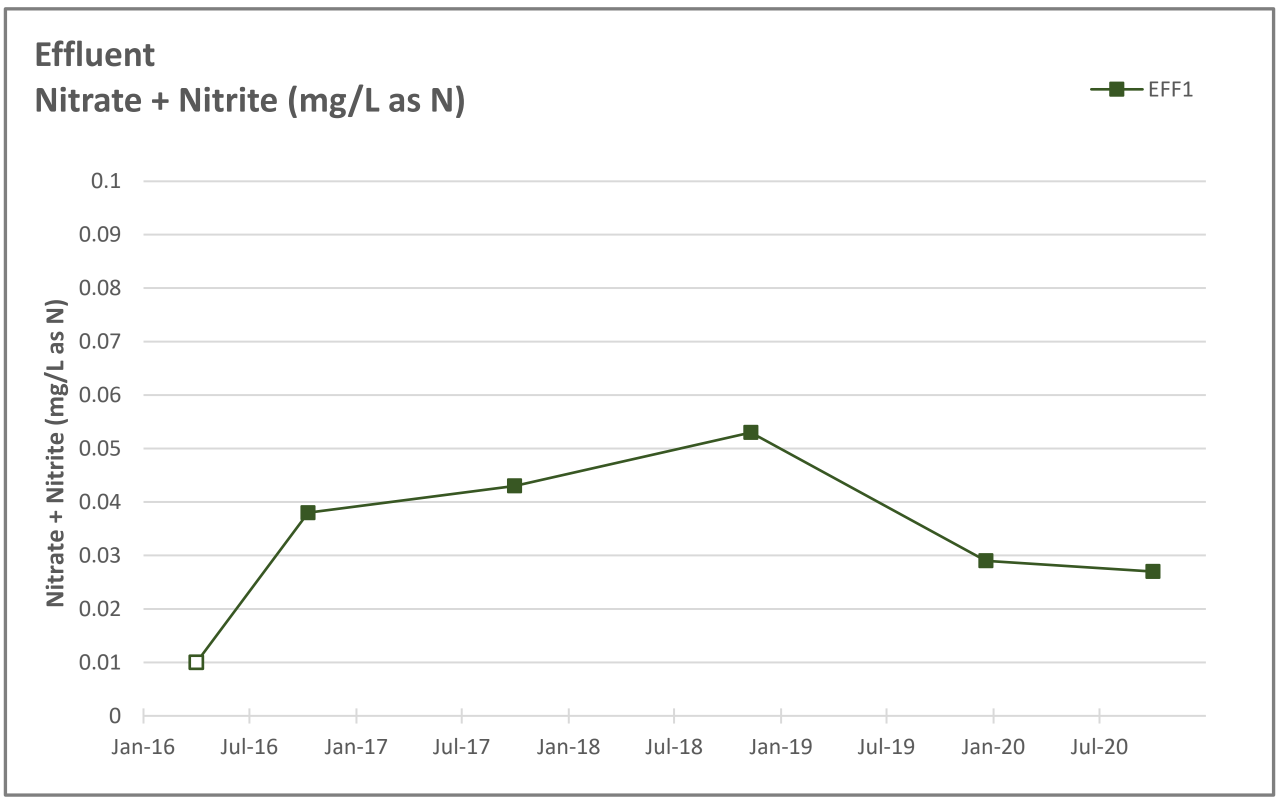
Figure 6-7
Time Series Graphs: Hardness
PAG Pond and Effluent





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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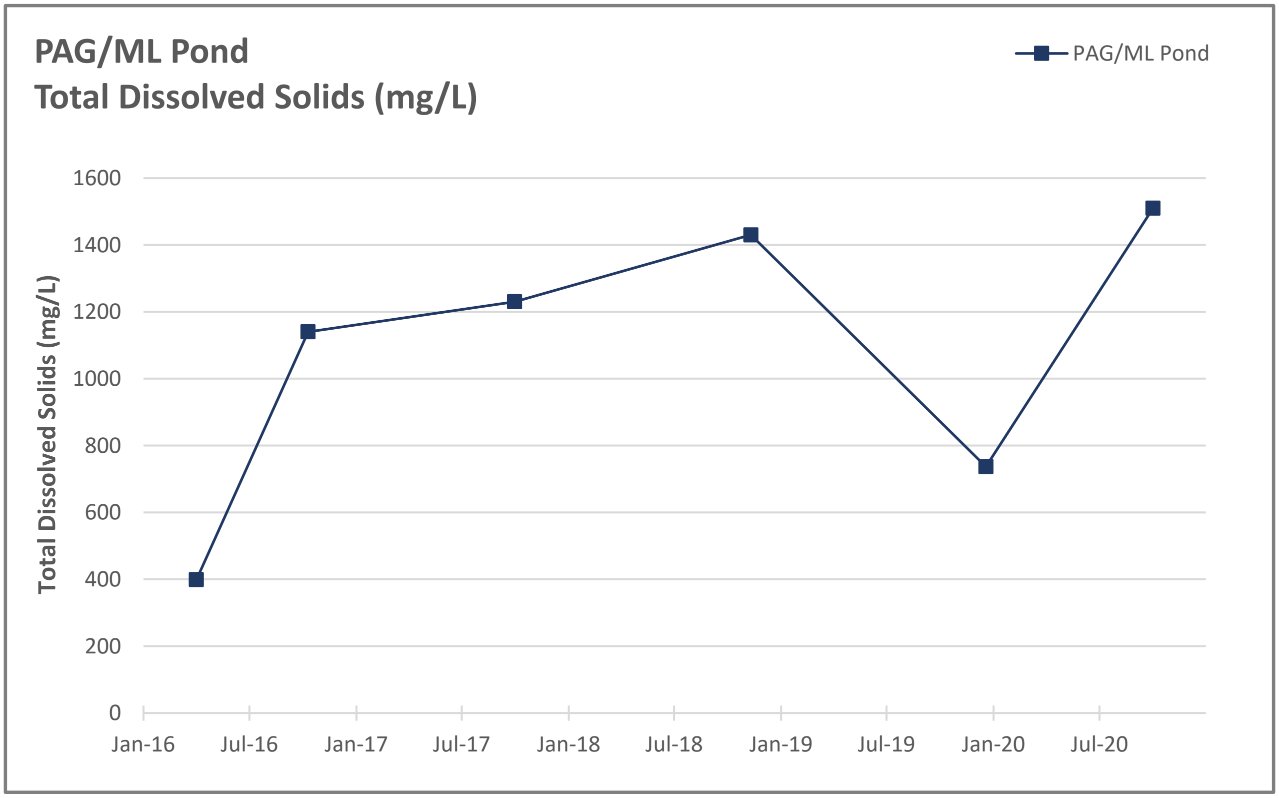
Figure 6-8
Time Series Graphs: Nitrate + Nitrite
PAG Pond and Effluent



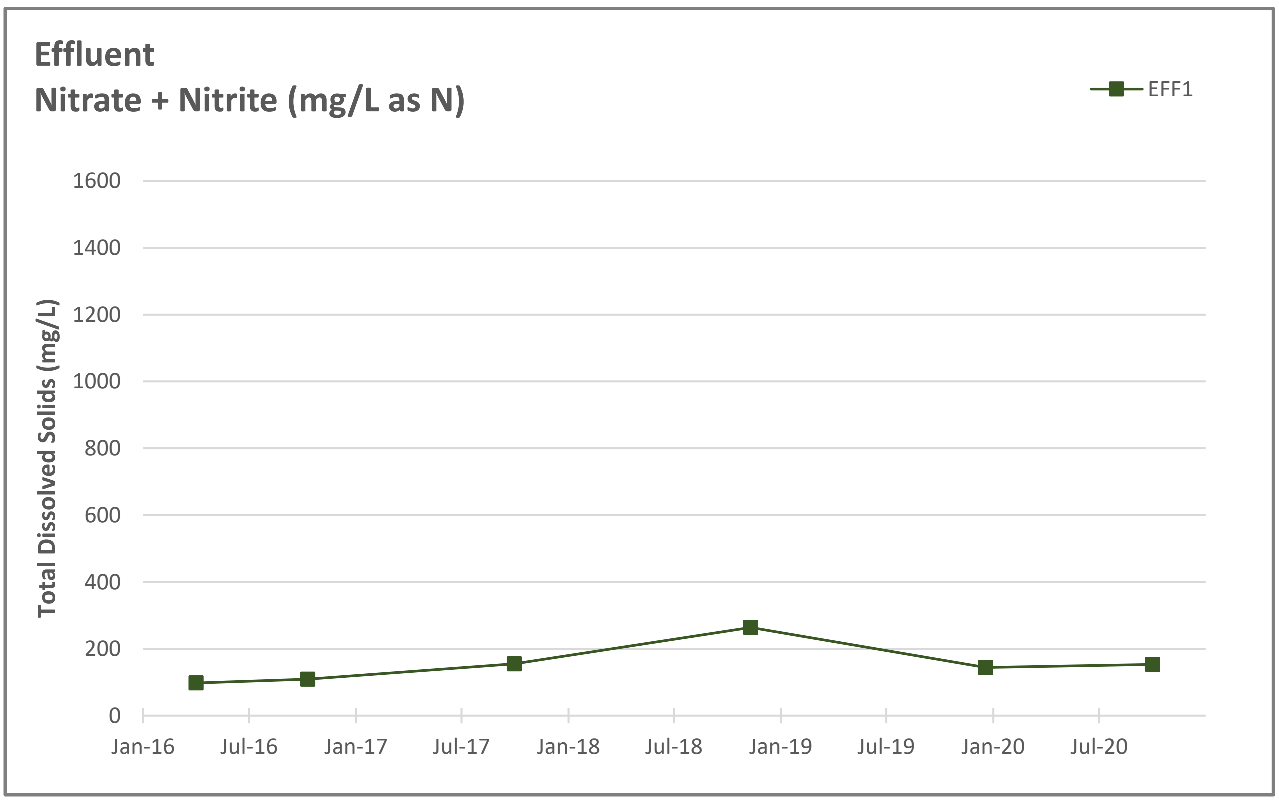


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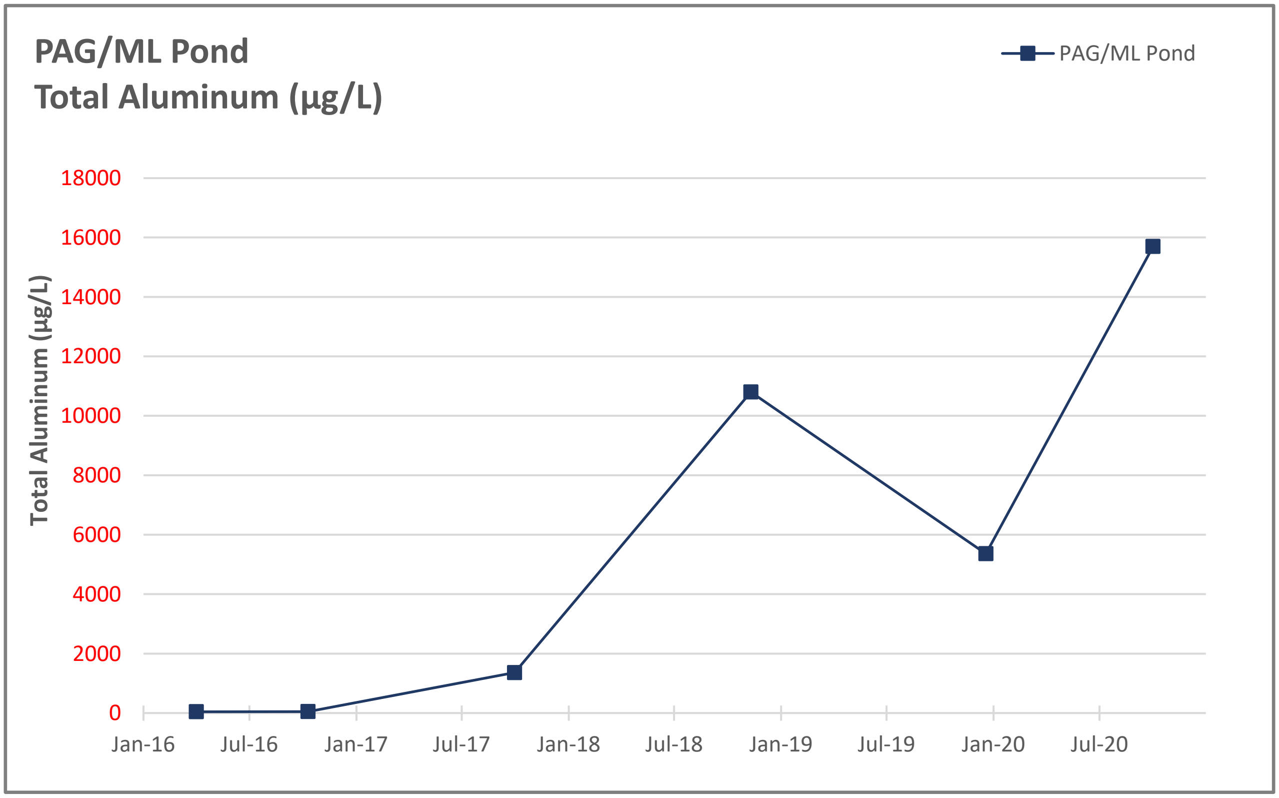
Figure 6-9

Time Series Graphs: Total Dissolved Solids
PAG Pond and Effluent



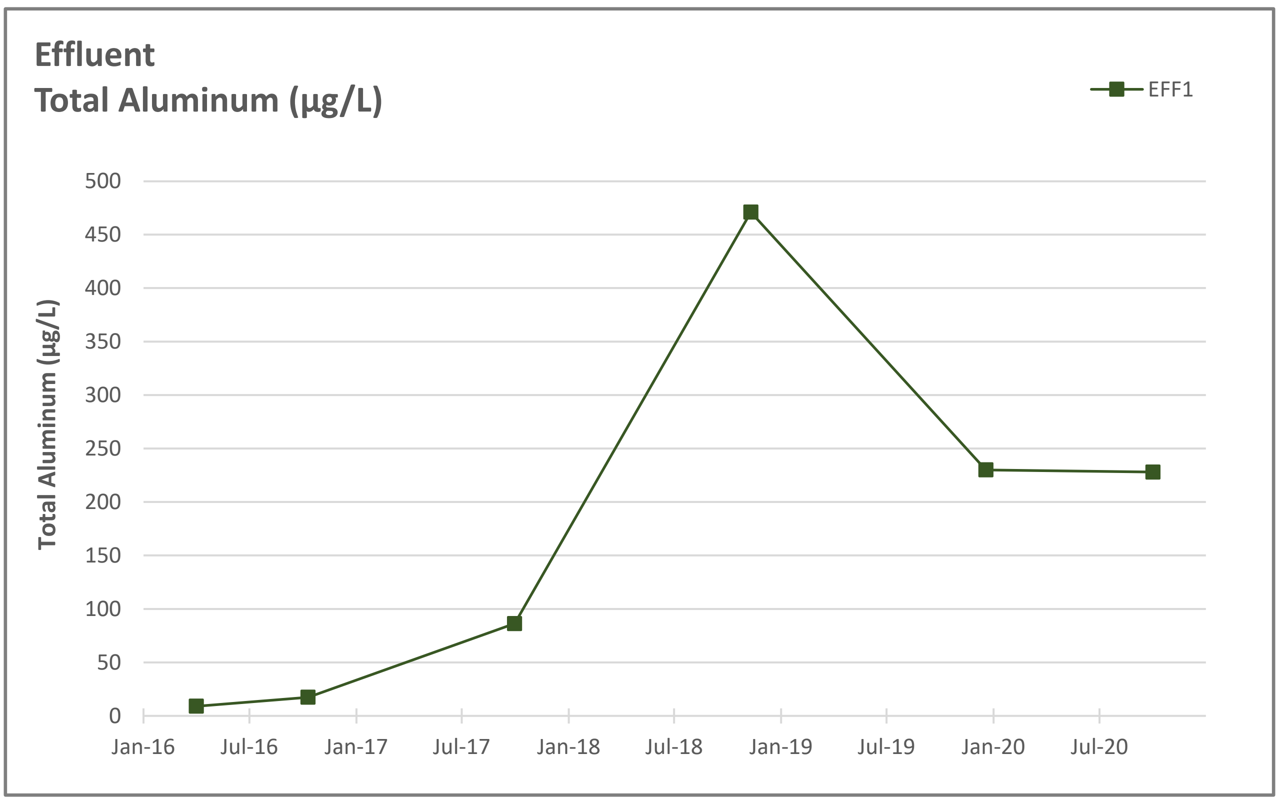


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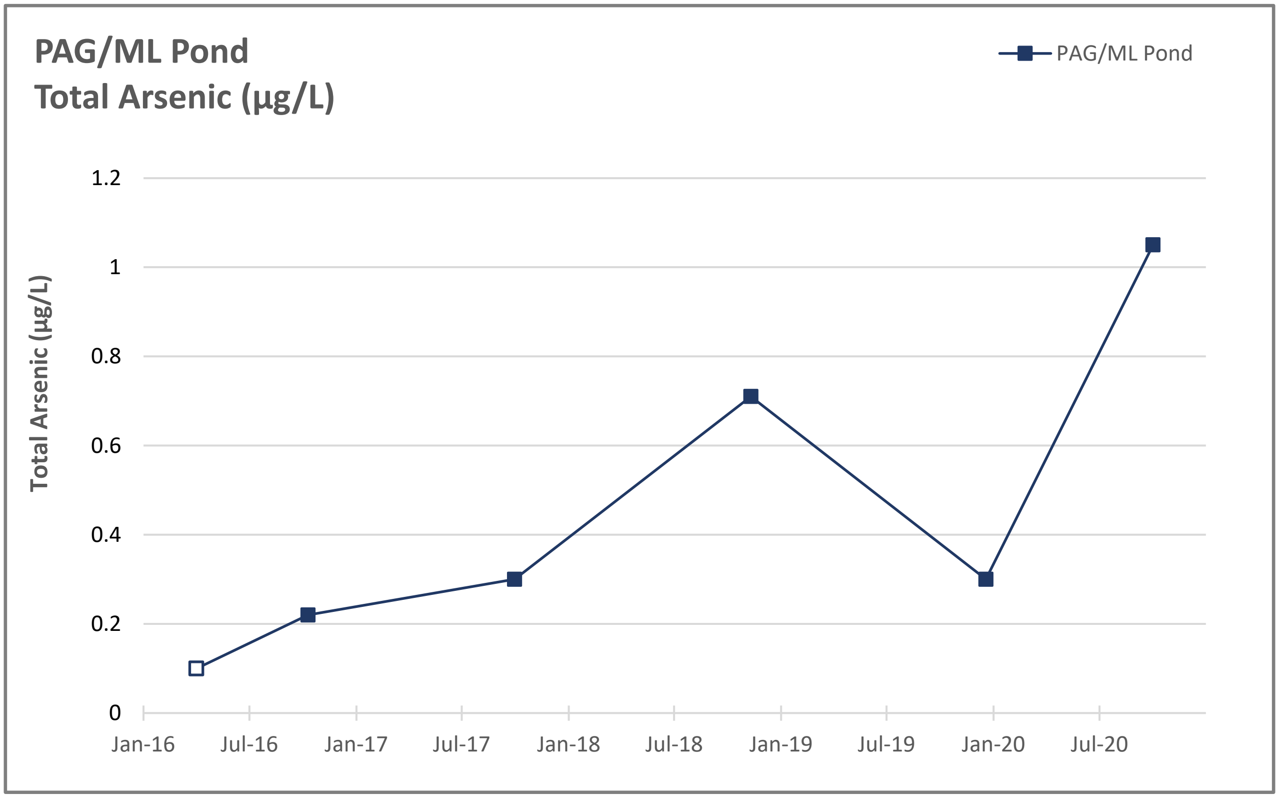
Figure 6-10
Time Series Graphs: Total Aluminum
PAG Pond and Effluent



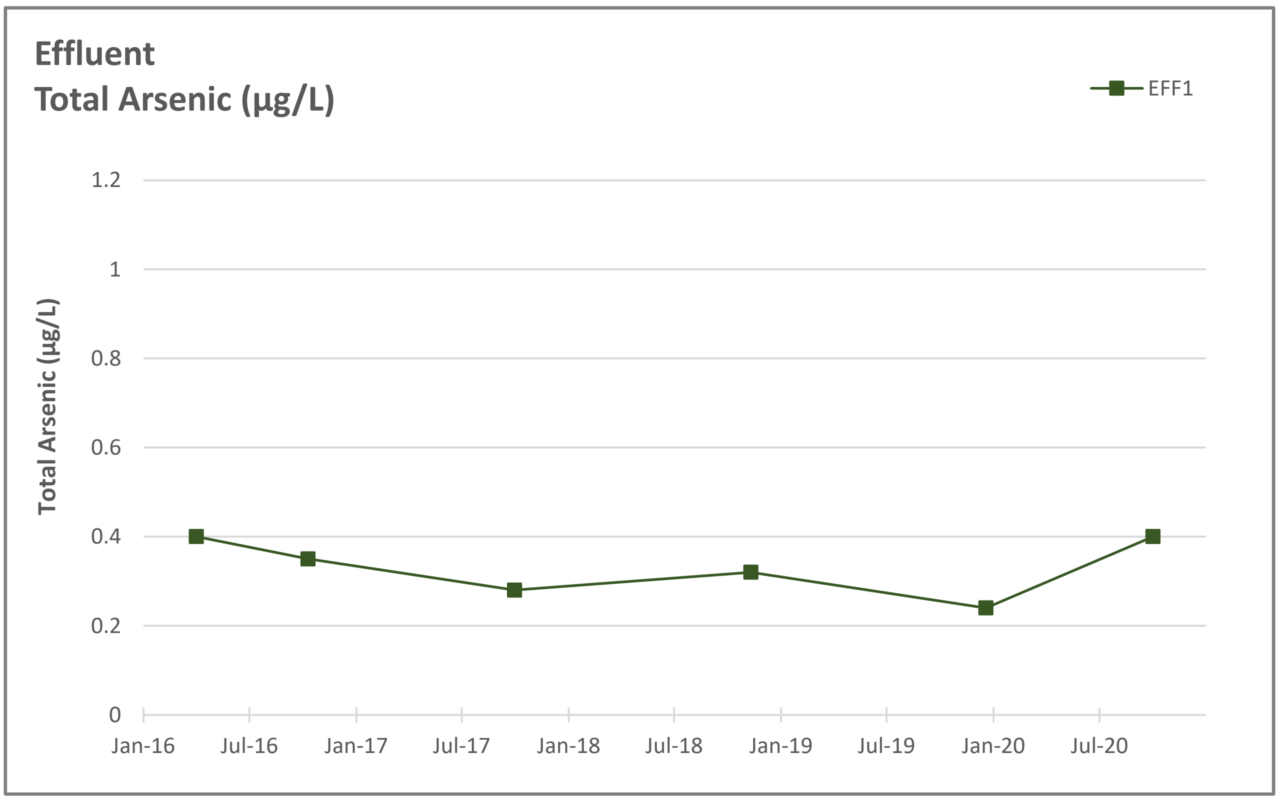


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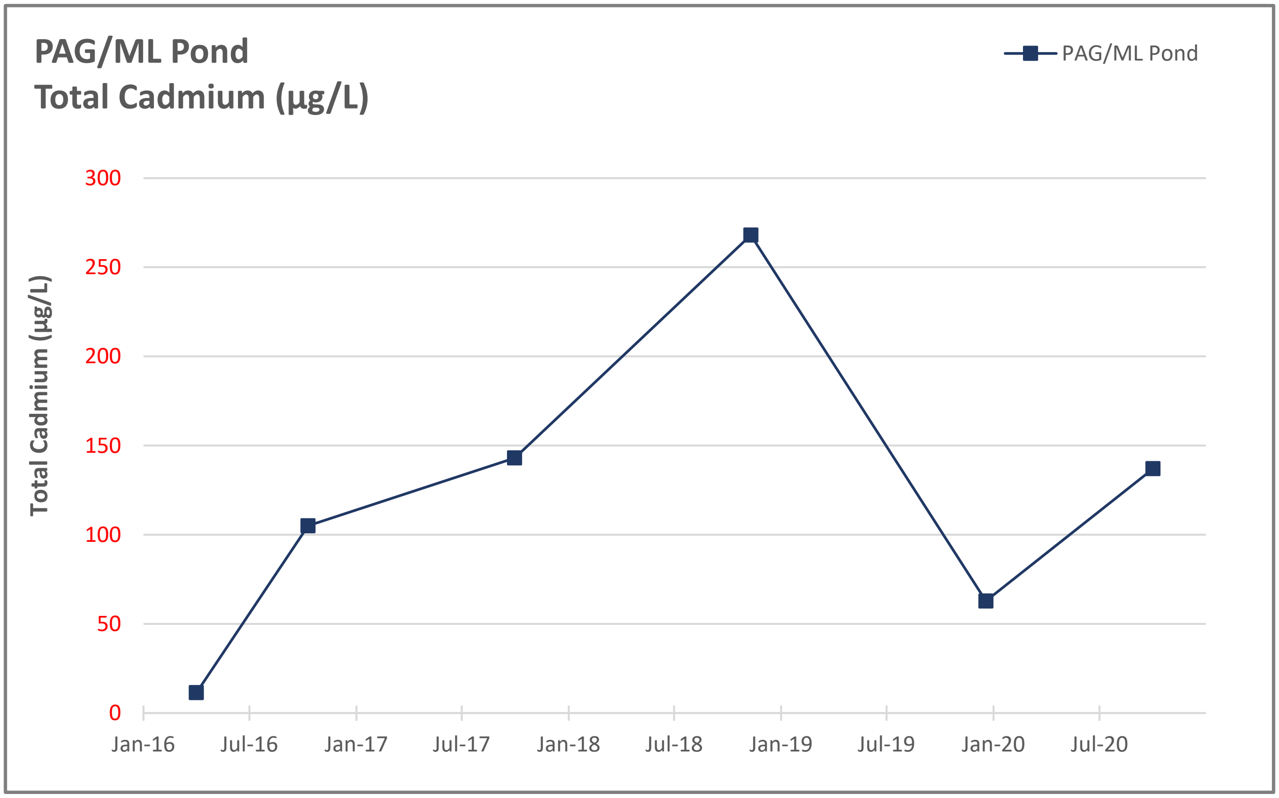
Figure 6-11
Time Series Graphs: Total Aresnic
PAG Pond and Effluent



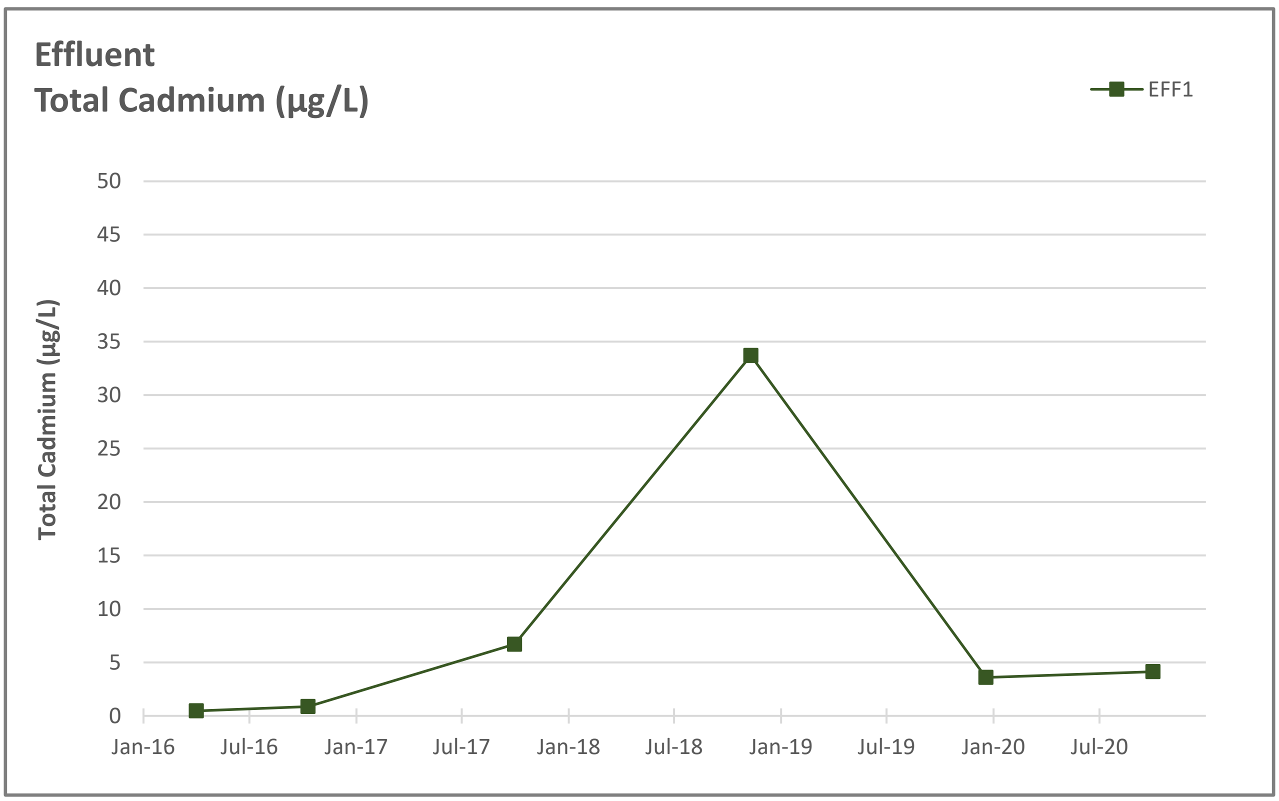


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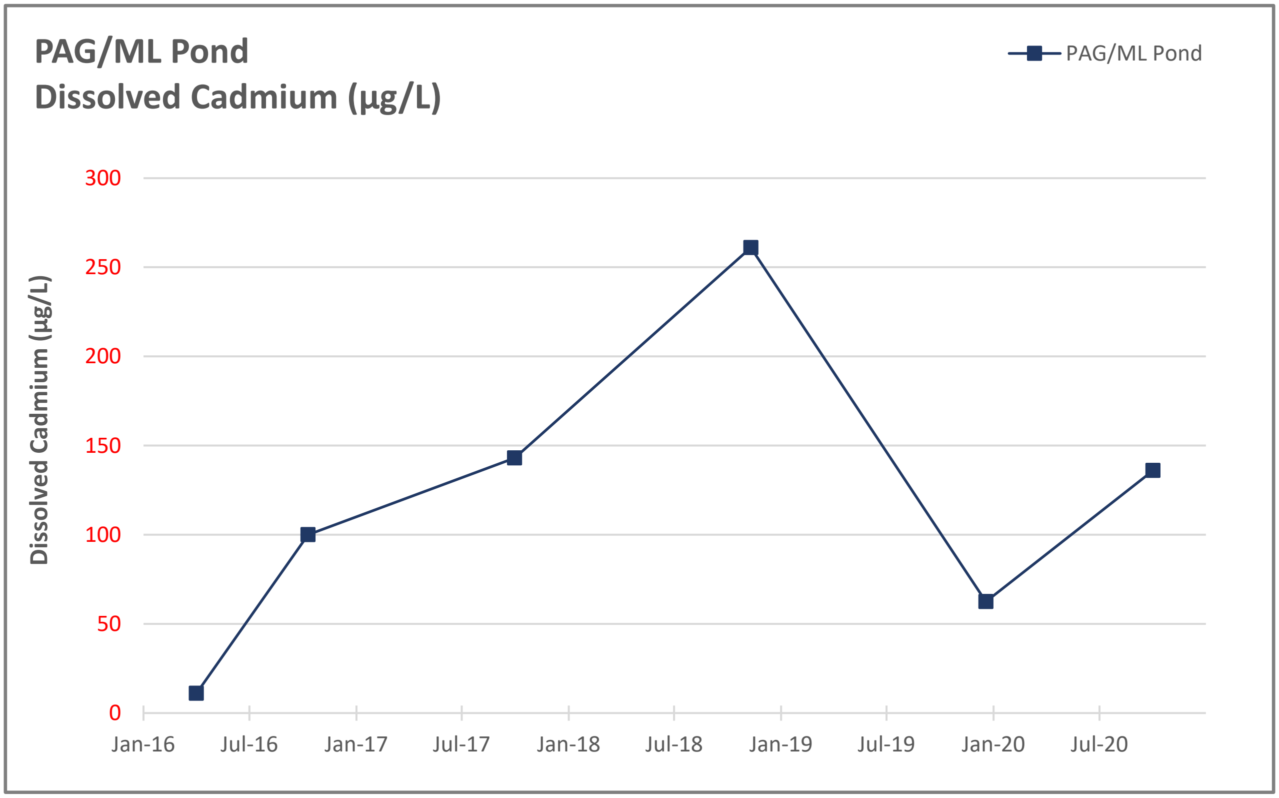
Figure 6-12
Time Series Graphs: Total Cadmium
PAG Pond and Effluent



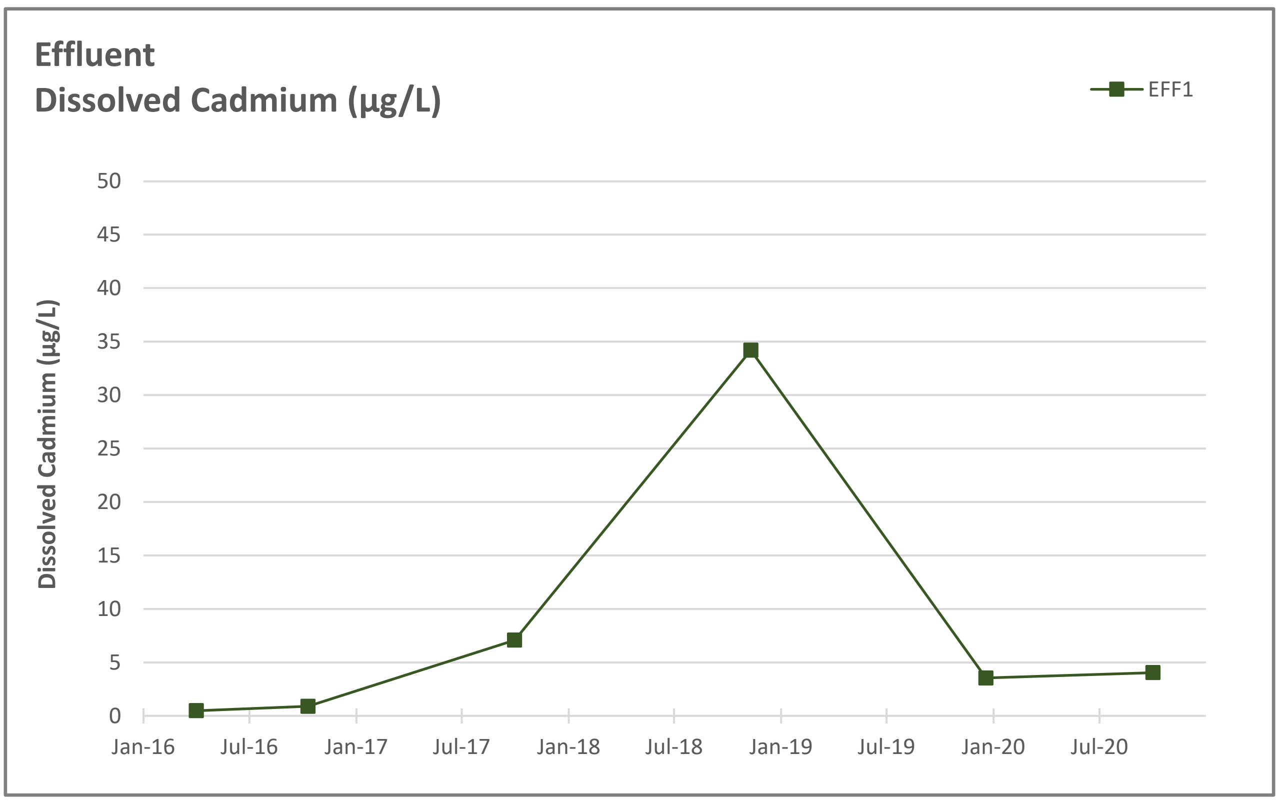


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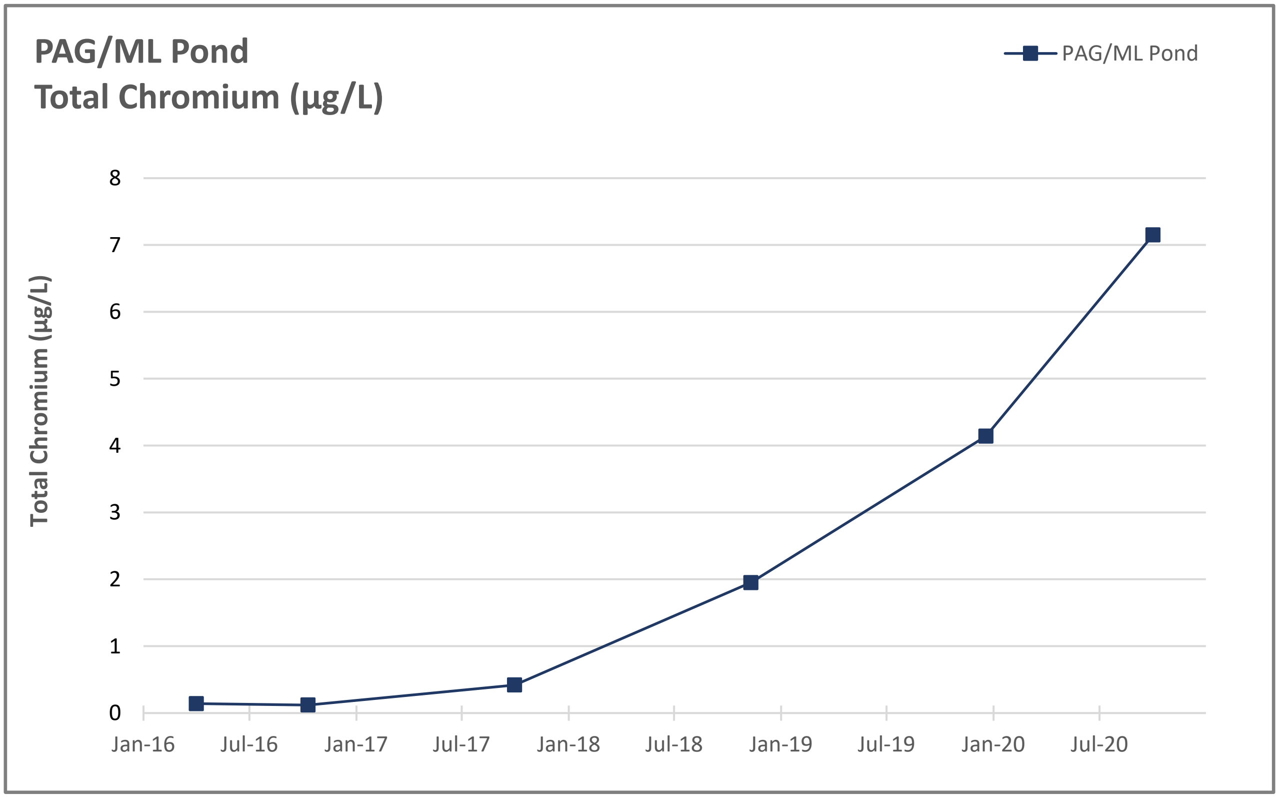
Figure 6-13
Time Series Graphs: Dissolved Cadmium
PAG Pond and Effluent



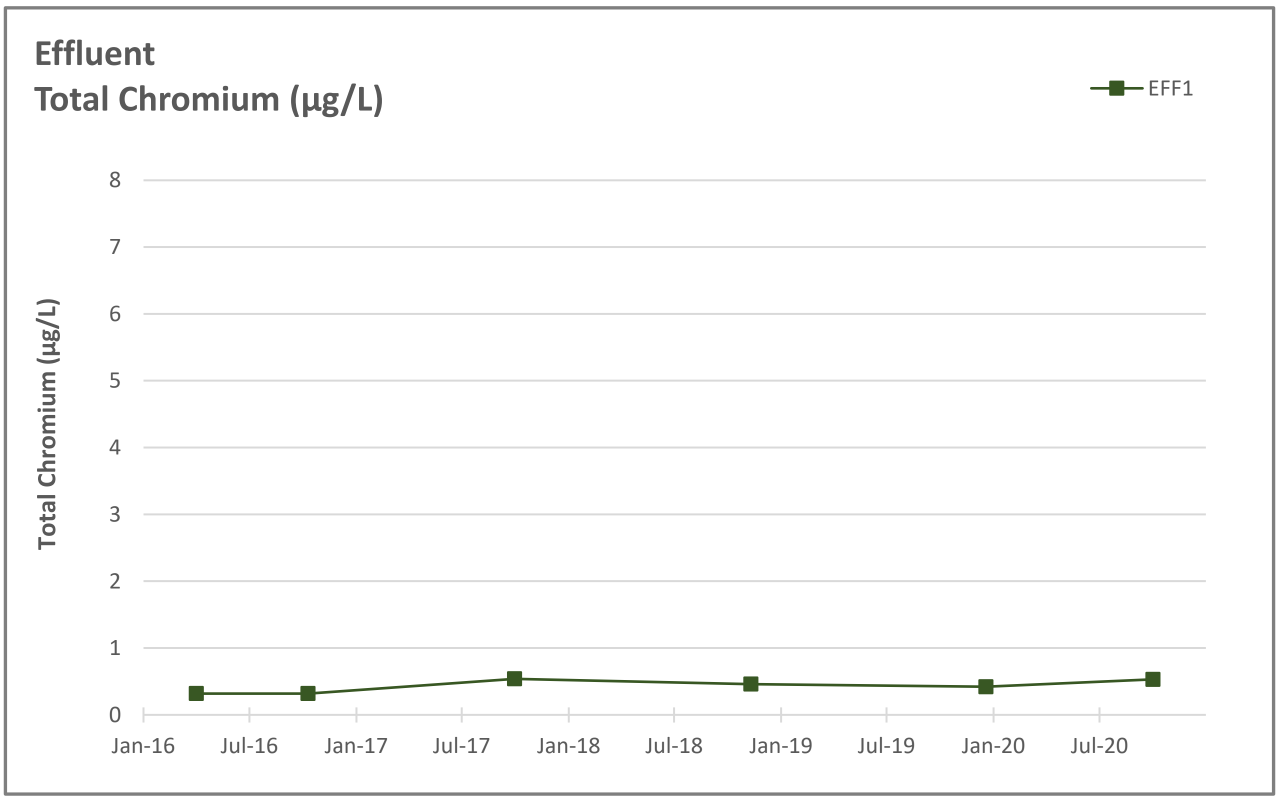


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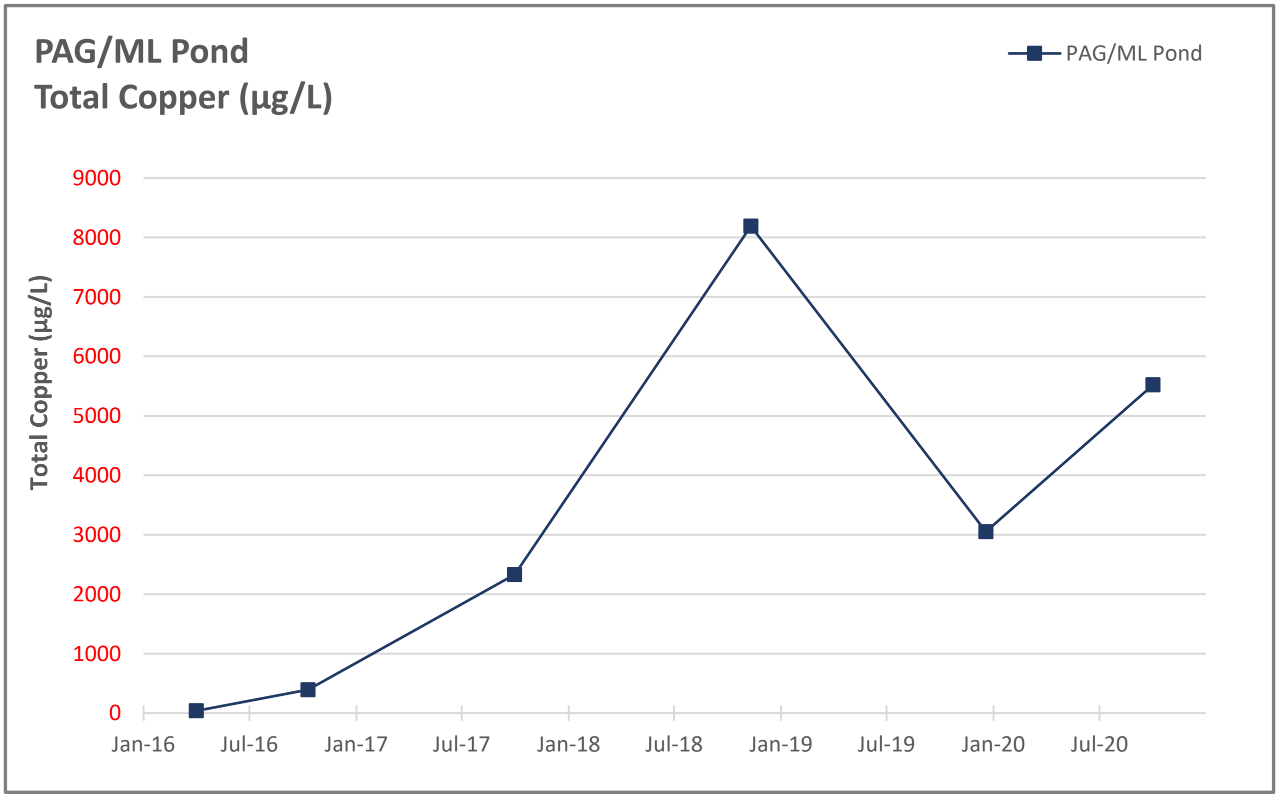
Figure 6-14
Time Series Graphs: Total Chromium
PAG Pond and Effluent



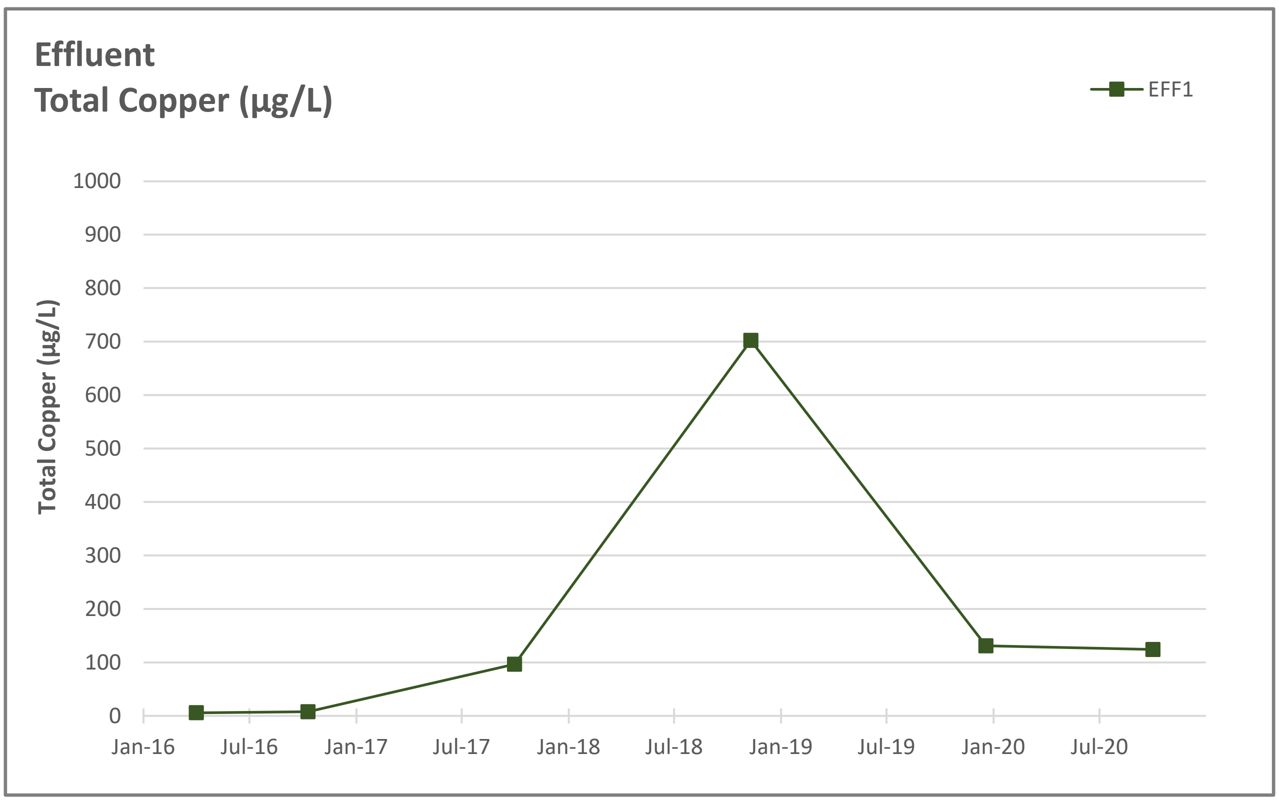


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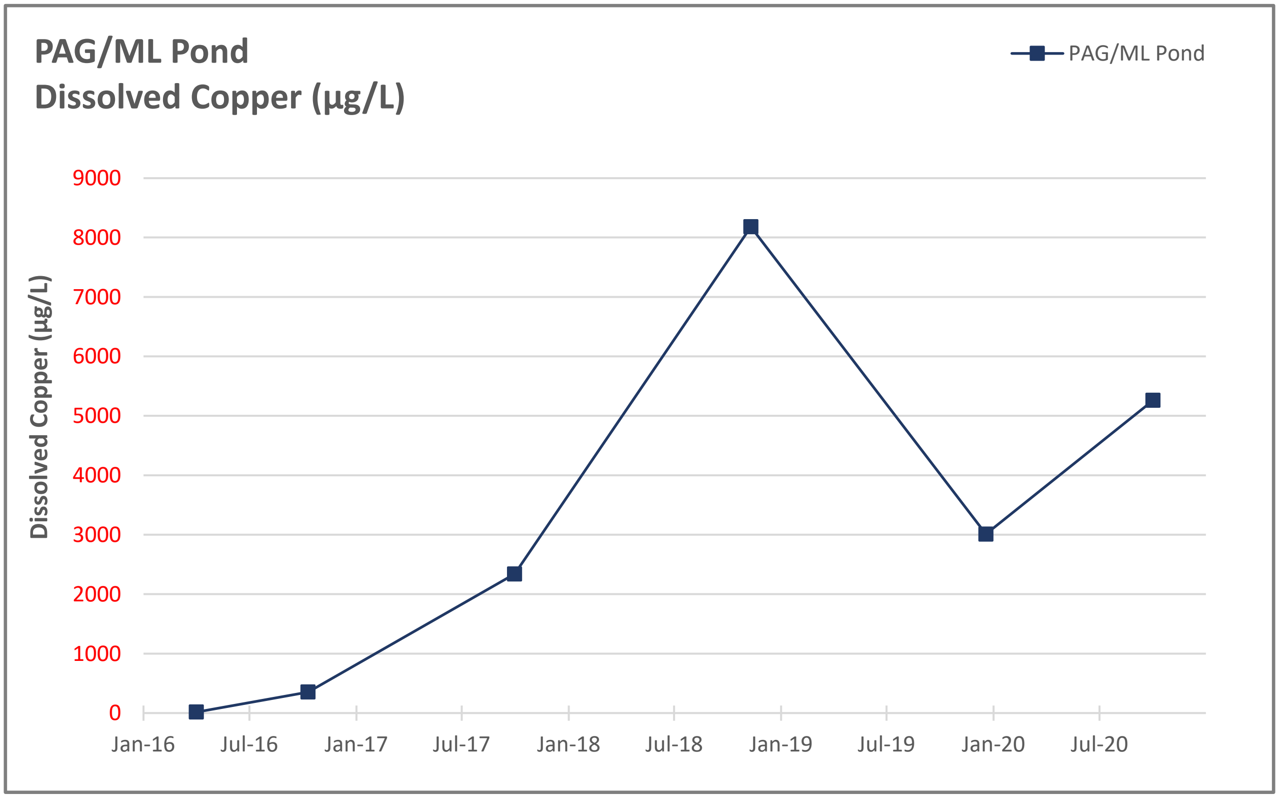
Figure 6-15
Time Series Graphs: Total Copper
PAG Pond and Effluent



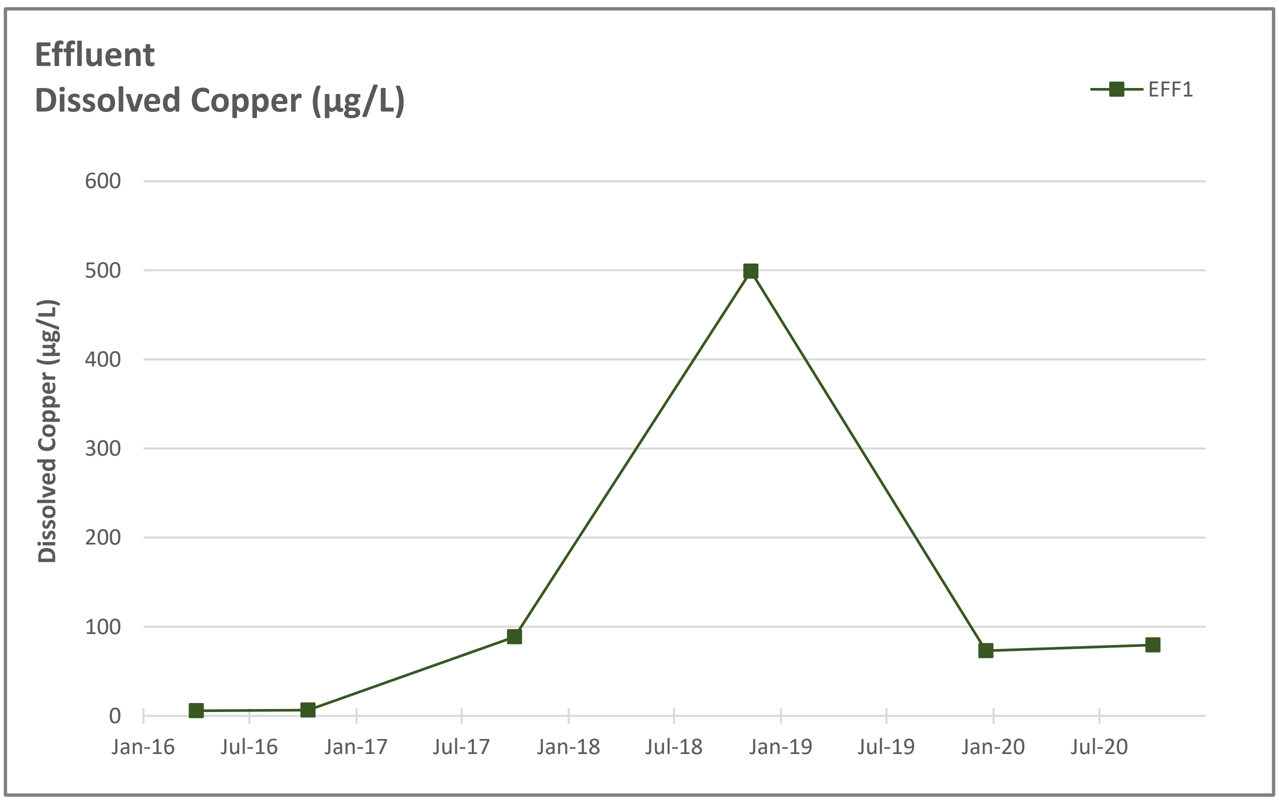


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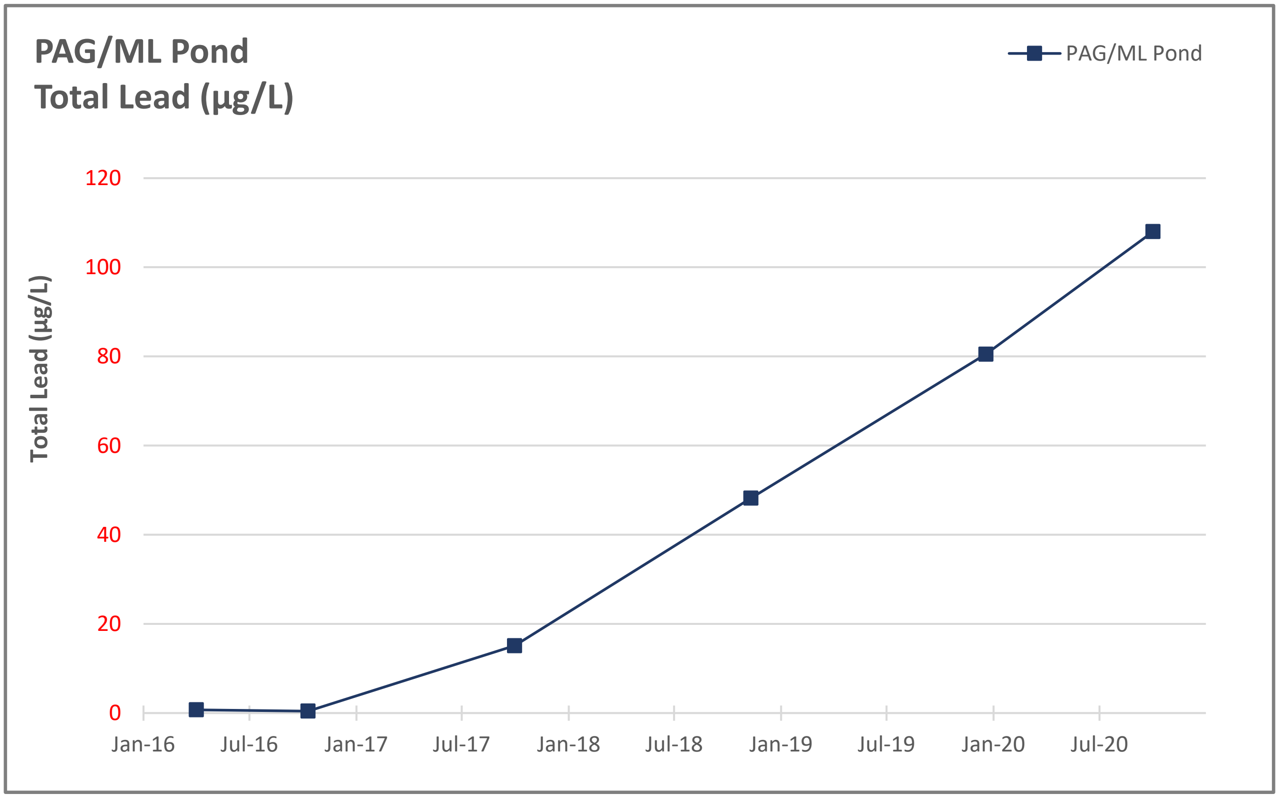
Figure 6-16
Time Series Graphs: Dissolved Copper
PAG Pond and Effluent



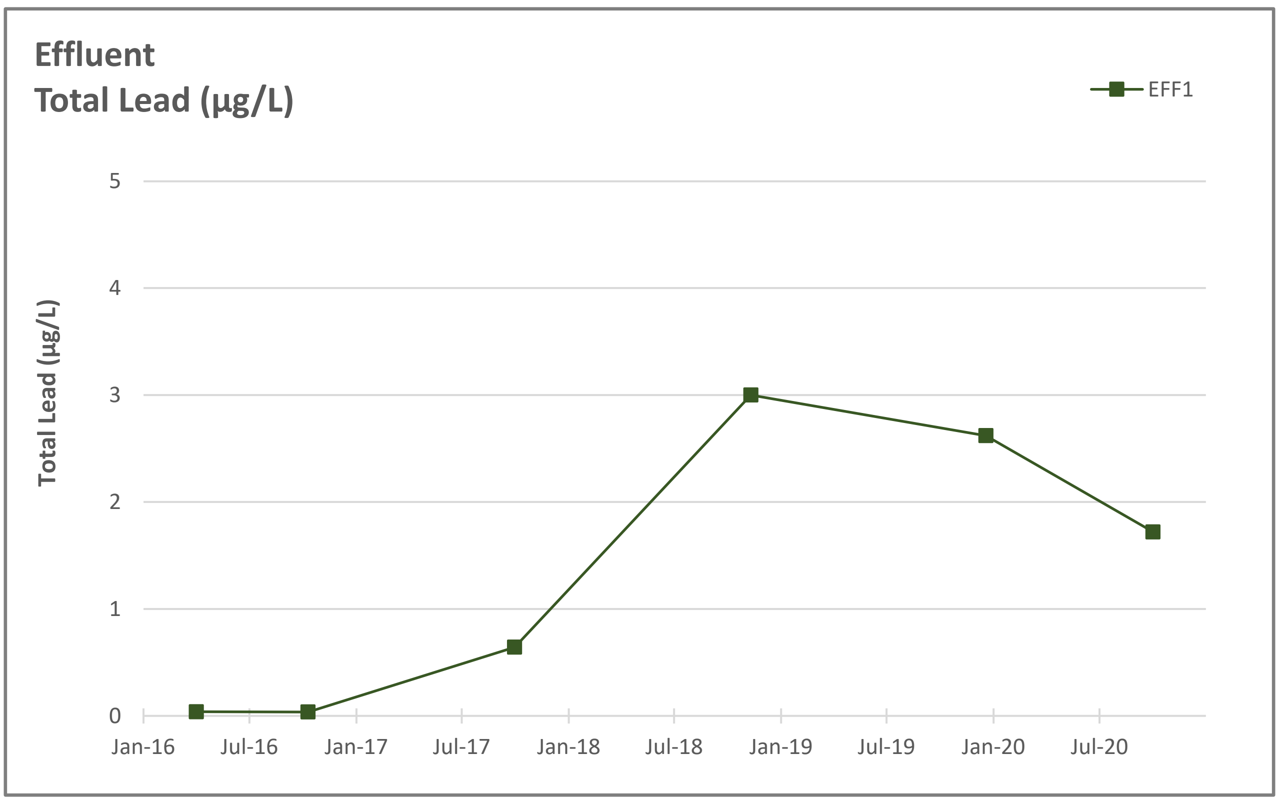


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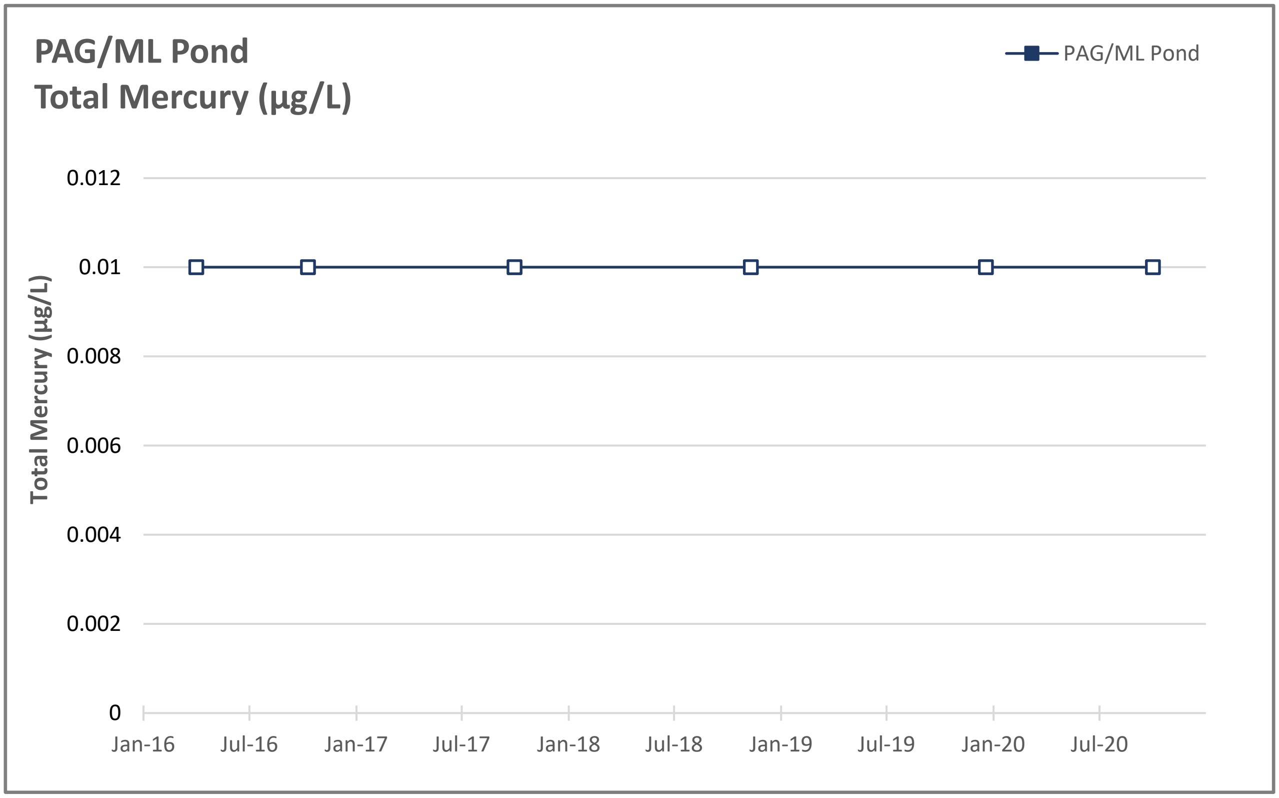
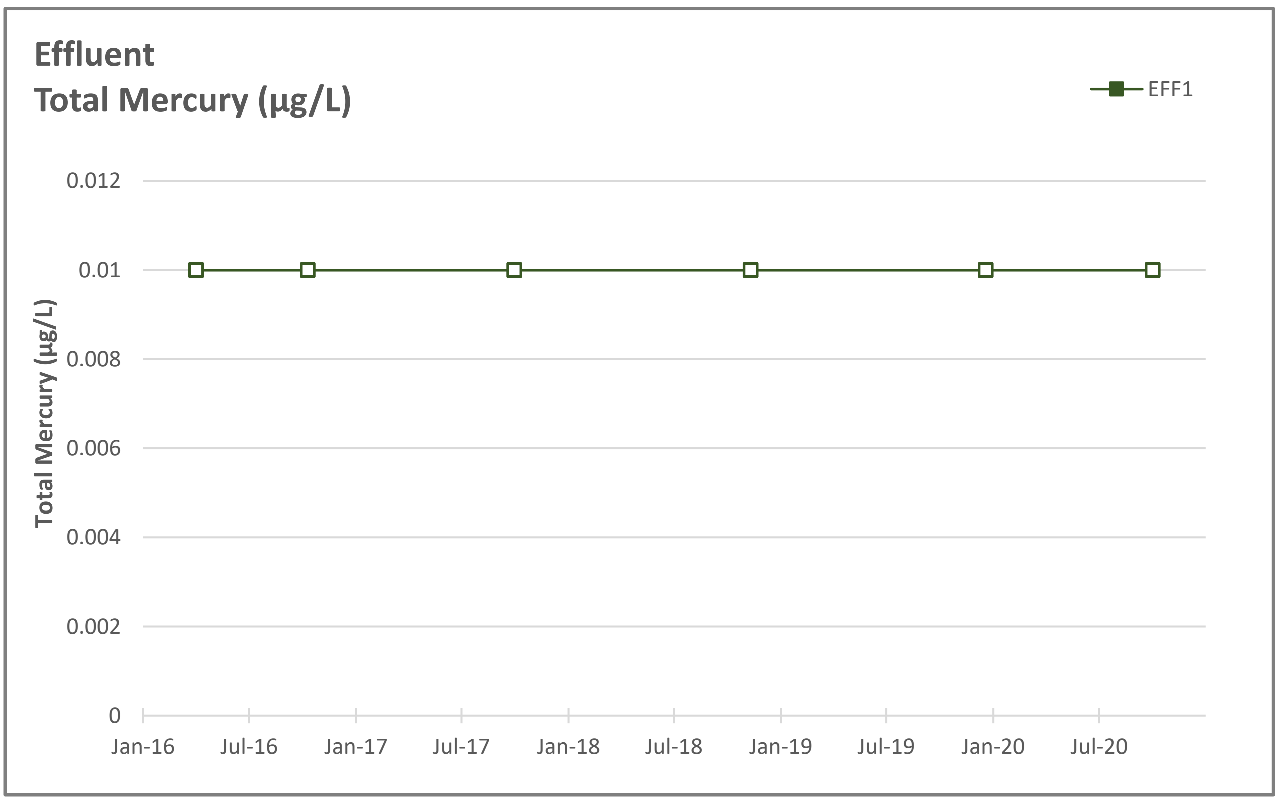
Figure 6-17
Time Series Graphs: Total Lead
PAG Pond and Effluent





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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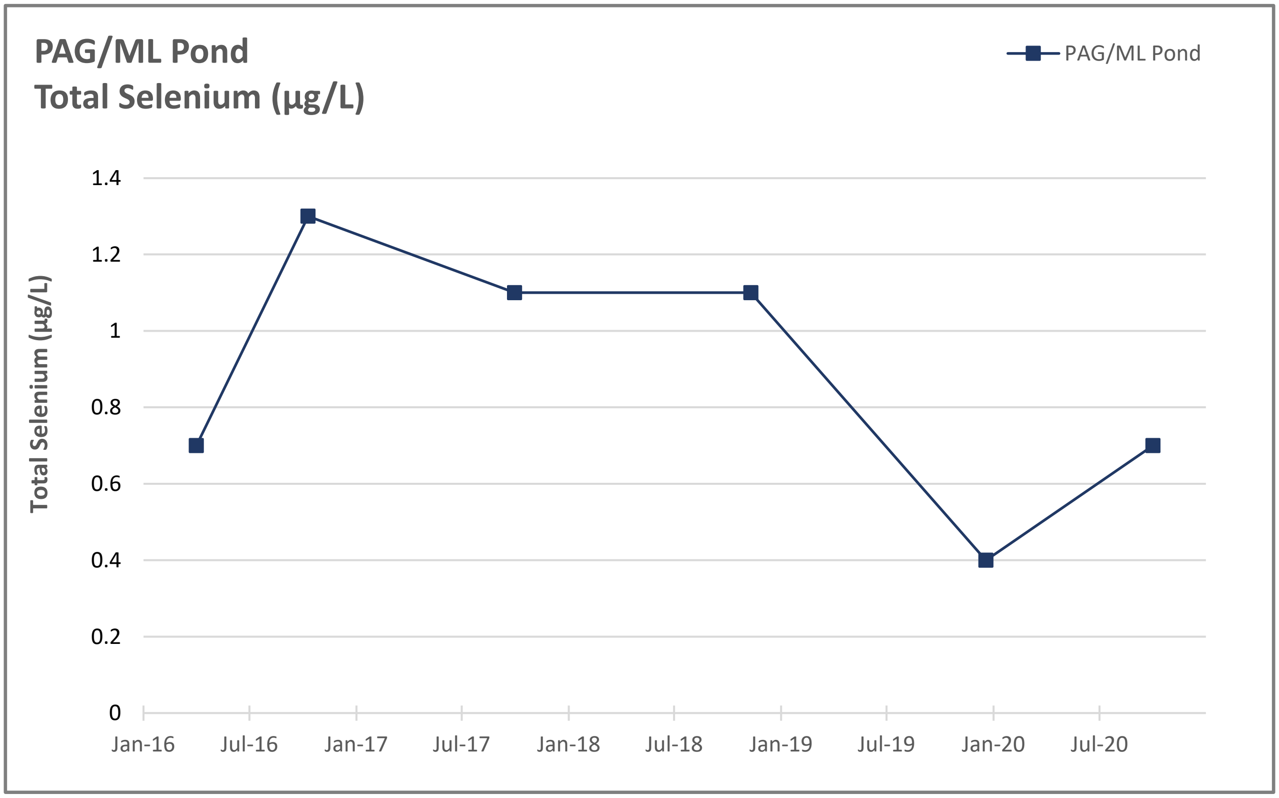
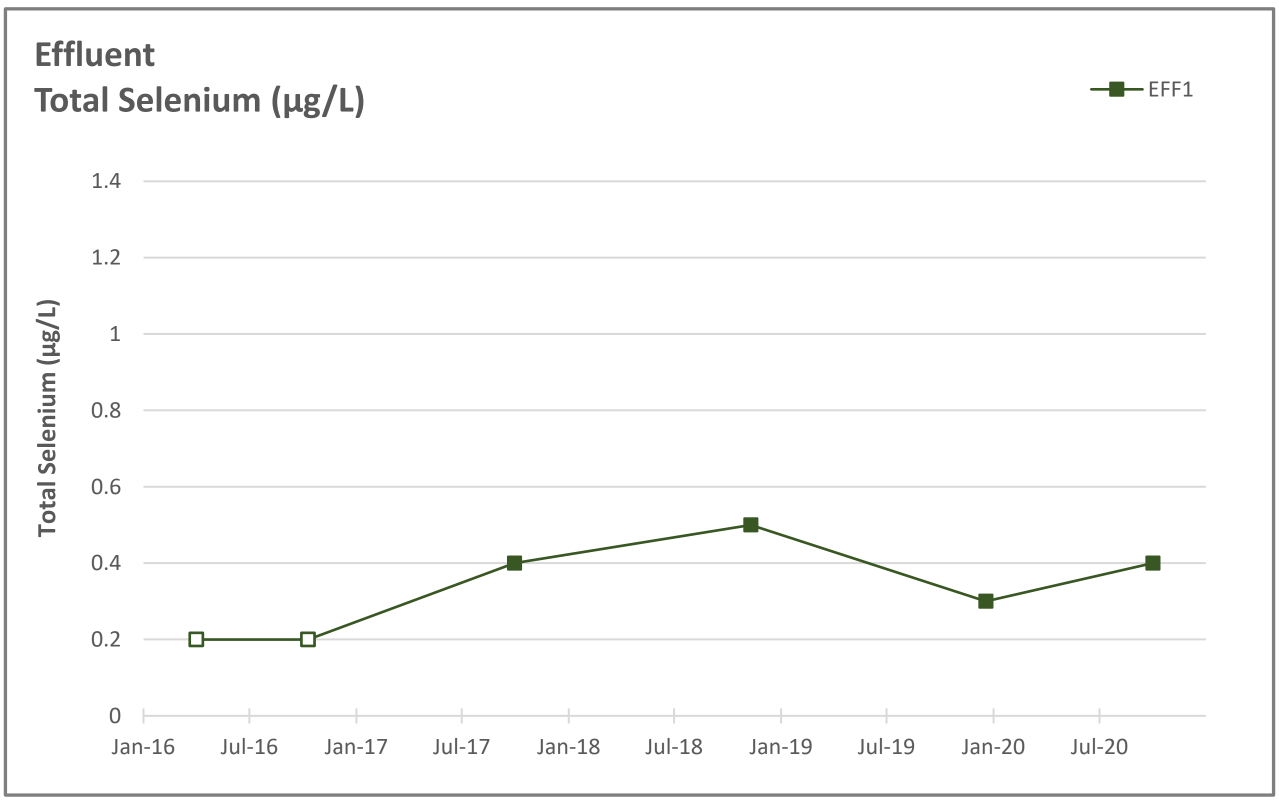
Figure 6-18
Time Series Graphs: Total Mercury
PAG Pond and Effluent





Note: Values qualified as nondetect, by the laboratory or during data validation, are plotted as hollow symbols at half the qualified value.

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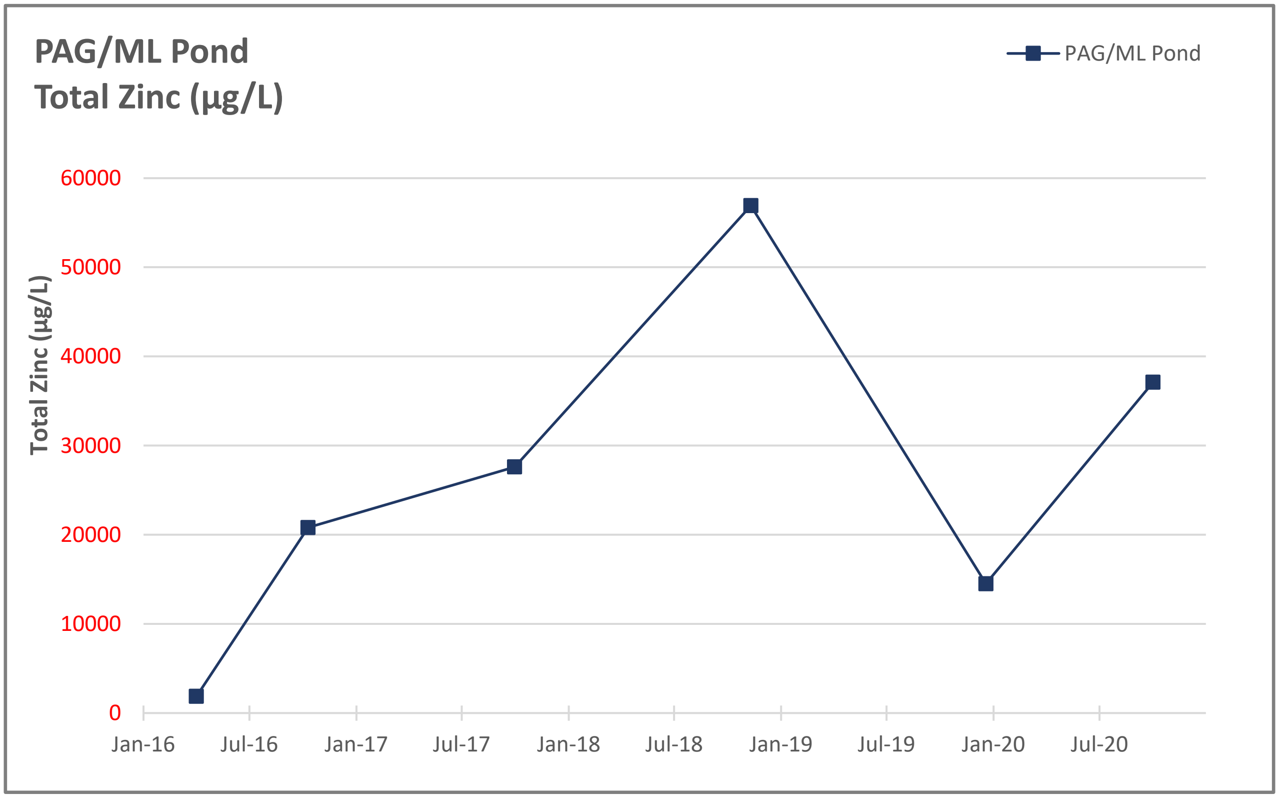
Figure 6-19

Time Series Graphs: Total Selenium
PAG Pond and Effluent



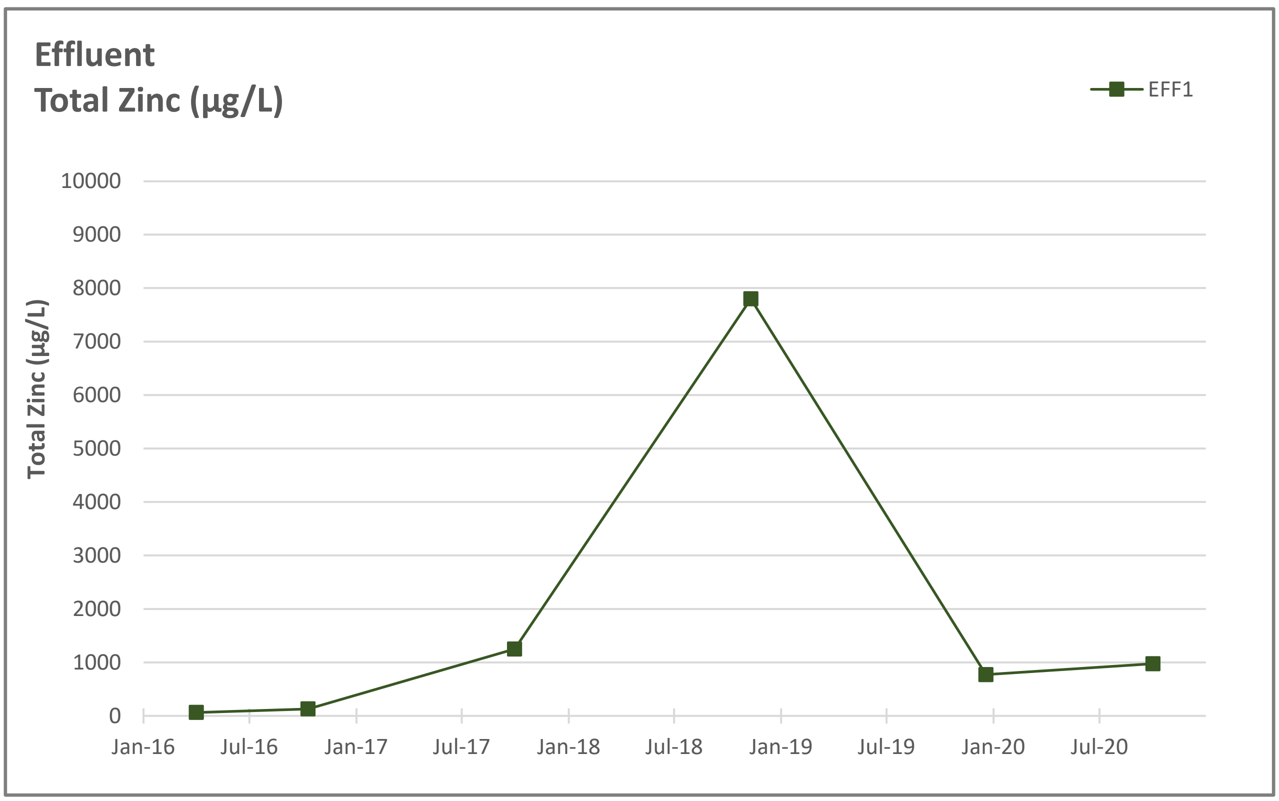


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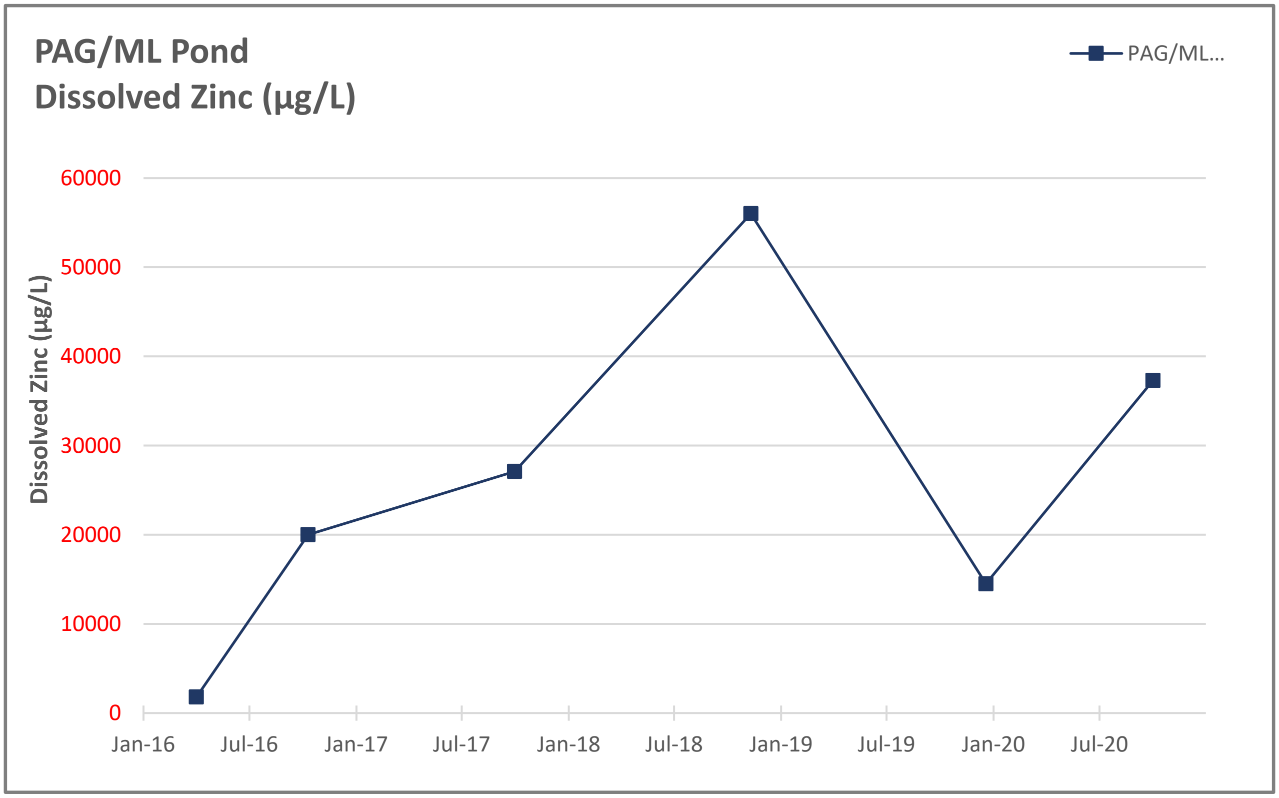
Figure 6-20
Time Series Graphs: Total Zinc
PAG Pond and Effluent



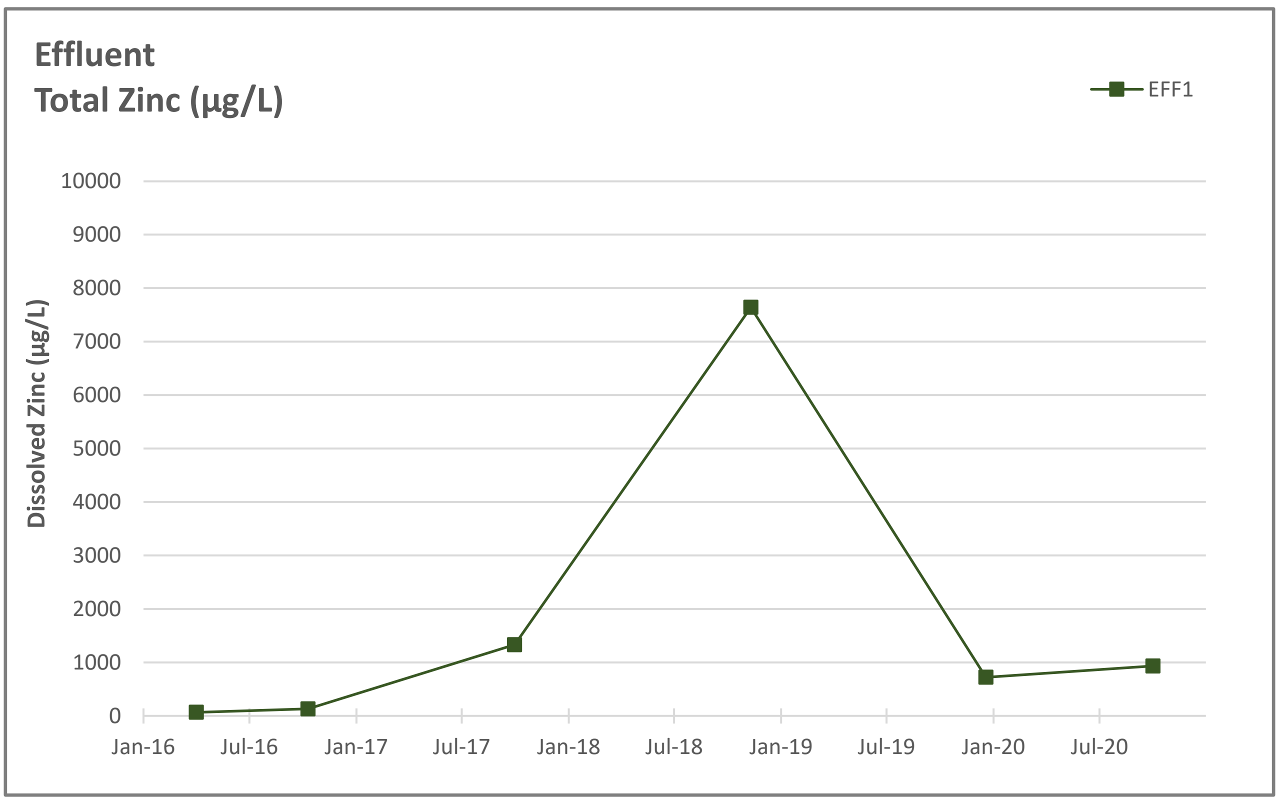


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Figure 6-21
Time Series Graphs: Dissolved Zinc
PAG Pond and Effluent

TABLES

Table 2-1. Water Balance Monthly Summary, 2019

	Flow from Portal [a]		Precipitation to Sediment Ponds [b]			Precipitation to PAG Site [b]			Flow to LAD Site [c]	
Month	**(gal)**	**(gal/min)**	**(inches)**	**(gal)**	**(gal/min)**	**(inches)**	**(gal)**	**(gal/min)**	**(gal)**	**(gal/min)**
Jan-19	*7,180,100*	*129*	14.1	*131,600*	*2.9*	14.1	*152,600*	*3.4*	7,464,300	135
Feb-19	*3,324,800*	*145*	1.4	*13,400*	*0.3*	1.4	*15,500*	*0.4*	3,353,700	146
Mar-19	*8,577,000*	*173*	4.0	*37,300*	*0.8*	4.0	*43,300*	*1.0*	8,657,600	174
Apr-19	*7,096,900*	*154*	9.6	*89,600*	*2.1*	9.6	*103,900*	*2.4*	7,290,400	159
May-19	*3,958,800*	*159*	1.4	*12,900*	*0.3*	1.4	*15,000*	*0.3*	3,986,700	159
Jun-19	*9,917,300*	*136*	9.6	*89,900*	*2.1*	9.6	*104,300*	*2.4*	10,111,500	141
Jul-19	*4,738,000*	*146*	3.9	*36,300*	*0.8*	3.9	*42,100*	*0.9*	4,816,400	148
Aug-19	*4,483,100*	*130*	9.0	*83,800*	*1.9*	9.0	*97,200*	*2.2*	4,664,100	135
Sep-19	*5,467,200*	*144*	7.5	*70,200*	*1.6*	7.5	*81,500*	*1.9*	5,618,900	148
Oct-19	*6,850,800*	*145*	13.3	*124,400*	*2.8*	13.3	*144,300*	*3.2*	7,119,500	151
Nov-19	*6,924,300*	*146*	16.0	*149,600*	*3.5*	16.0	*173,500*	*4.0*	7,247,400	153
Dec-19	*7,781,000*	*198*	18.3	*170,900*	*3.8*	18.3	*198,300*	*4.4*	8,150,200	207

Notes:

Italicized values indicate an estimated number.

LAD = land application/dispersion

PAG = potentially acid-generating

[a] Portal flow estimated based on LAD system flow meter measurements and estimates of precipitation to the sediment ponds and PAG facility according to the following equation: Portal Flow = LAD Flow – (Precipitation to Sediment Ponds + Precipitation to PAG Site).

[b] Precipitation data from NOAA Metlakatla station. Precipitation to settling ponds based on settling pond surface area of 15,000 ft^2; precipitation to PAG site based on PAG facility surface area of 17,400 ft^2.

[c] Flow to LAD site based on average daily flow rate for the month, as metered near the outlet of the sediment ponds.

Table 3-1 Water Quality Monitoring Stations

Monitoring Station	Location	Coordinates (NAD27, UTM Zone 8N)		Status	Purpose			
		Easting	Northing		Pre-project Reference Conditions	Compliance Location	Information Only	Post-closure Monitoring
Surface Waters								
WQ1	Offsite at Deer Pasture Creek – downstream	684358.0	6104664.0	Inactive			X	
WQ2	Offsite at Lookout Creek – downstream	683575.0	6105162.0	Inactive			X	
WQ3	Offsite at Myrtle Creek – downstream	683179.0	6105980.0	Inactive			X	
WQ-04	**Waterfall Creek – downstream**	**682283.3**	**6105575.9**	**Active**	**X**	**X**		**X**
WQ8	Waterfall Creek – upstream	682054.7	6105518.6	Discontinued [a]	X			
WQ5	Camp Creek – middle reach of creek	682054.7	6105518.6	Inactive	X			
WQ-06	**Camp Creek – downstream**	**682259.5**	**6105682.2**	**Active**	**X**	**X**		
WQ7	Camp Creek – upstream	681989.1	6105602.1	Discontinued [a]	X			
WQ-10	**Unnamed Creek 1 – downstream**	**682171.0**	**6105725.0**	**Active**	**X**	**X**		
WQ12	Unnamed Creek 1 – upstream	682019.5	6105713.6	Discontinued [a]	X			
Seep	Unnamed Creek 1 – upstream groundwater seep	682306.0	6105546.4	Inactive	X			
WQ-13	**Unnamed Creek 2 – downstream**	**682306.0**	**6105546.4**	**Active**	**X**	**X**		**X**
WQ14	Unnamed Creek on South side of Lookout Mountain	682955.0	6101933.0	Discontinued [b]			X	
Groundwater Wells								
MW-01	**Wetlands below NAG site**	**682335.3**	**6105502.0**	**Active**	**X**	**X** [c]		**X**
MW-02	**Wetlands below settling ponds and LAD area**	**682191.0**	**6105606.0**	**Active**	**X**	**X** [c]		**X**
MW-03	**Wetlands below PAG site and LAD area**	**682219.1**	**6105684.2**	**Active**	**X**	**X** [c]		**X**
MW-04	**Wetlands below and LAD area**	**682288.0**	**6105792.0**	**Active**	**X**	**X** [c]		**X**
MW7	Wetlands – offsite and to the east of the project	682607.0	6105469.0	Discontinued [a]	X			
MW8	Upgradient of LAD area and MW-03	682028.0	6105561.0	Discontinued [a]			X	
MW9	Upgradient of and LAD area and MW-04	682064.0	6105796.0	Discontinued [a]			X	
GW1	Pre-existing drill hole	682134.0	6105711.0	Inactive	X			
GW2	Upgradient of LAD area and MW6	682178.0	6105640.0	Inactive	X			

Table 3-1 Water Quality Monitoring Stations

Monitoring Station	Location	Coordinates (NAD27, UTM Zone 8N) Easting	Northing	Status	Purpose: Pre-project Reference Conditions	Compliance Location	Information Only	Post-closure Monitoring
Effluent, PAG Pond, and Barrels								
EFF1	**Settling ponds at point of discharge to LAD**	**682103.6**	**6105572.1**	**Active**			**X**	
PAG/ML Pond	**PAG leachate/runoff capture pond**	**682046.3**	**6105664.3**	**Active**		**X**		
PAG Underdrain	**PAG leak detection system**	**--**	**--**	**Active (no water) [d]**			**X [d]**	
LO1	Field kinetic test barrel	--	--	Discontinued [e]			X	
LO2	Field kinetic test barrel	--	--	Discontinued [e]			X	
HW1	Field kinetic test barrel	--	--	Discontinued [e]			X	
PORTAL/Drift	**Mine drift water at point of entry to main ponds**	**--**	**--**	**Active (intermittent)**			**X**	
Portal (mult.)	**Mine drift sampled within the drift or at the portal**	**--**	**--**	**Active (intermittent)**	**X [f]**		**X**	

Notes:

[a] Removed from the water quality monitoring network subsequent to Q3 2008, as per agreement with ADEC.

[b] Monitoring at station WQ14 was discontinued following collection of 20 baseline samples in the second quarter of 2012.

c MW-01, MW-02, MW-03, and MW-04 will be used to monitor changes to natural water quality in wetlands water when compared to historical values and remote wetland wells.

[d] A visual monitoring station was established below the PAG waste disposal area as part of a leak detection system. No water is anticipated to collect at this point unless there is a breach in the liner.

[e] LO1, LO2, and HW1 were maintained for informational purposes only and were closed in-place on July 20, 2015. This temporary closure of the barrels may be removed and sampling resumed at the discretion of Niblack Project LLC.

[f] As specified in Niblack Waste Management Permit 2013DB0001, samples were to be collected at seeps or drill holes near the portal entrance to determine natural groundwater quality to support post-closure monitoring of drainage water from the closed adit (if drainage occurs).

Table 3-2 Sampling Event Summary, 2020

Date	Stations Sampled	QA/QC Samples Collected	Parameters
2020-01-21	EFF1, PAG/ML pond	None	Field parameters
2020-02-11	EFF1, PAG/ML pond	None	Field parameters
2020-03-12	EFF1, PAG/ML pond	None	Field parameters
2020-04-26	EFF1, PAG/ML pond	None	Field parameters
2020-05-09	EFF1, PAG/ML pond	None	Field parameters
2020-06-23	EFF1, PAG/ML pond	None	Field parameters
2020-07-27	EFF1, PAG/ML pond	None	Field parameters
2020-08-03	EFF1, PAG/ML pond	None	Field parameters
2020-09-06	EFF1, PAG/ML pond	None	Field parameters
2020-10-01	MW-01, MW-02, MW-03, WQ-04, WQ-06 , WQ-13	Field duplicates of MW-01 and WQ-13; total and dissolved field blanks	Analytical chemistry; field parameters
2020-10-02	MW-04, WQ-10, EFF1, PAG/ML pond	None	Analytical chemistry; field parameters
2020-10-19	EFF1, PAG/ML pond	None	Field parameters
2020-11-19	EFF1, PAG/ML pond	None	Field parameters

Table 3-3 Summary of Water Quality Monitoring Conducted 2016-2020

Year	Quarter	Month	Surface Water (WQ-04, WQ-06, WQ-10, WQ-13)	Groundwater (MW-01, MW-02, MW-03, MW-04)	Settling Ponds (EFF1)	PAG/ML Pond (PAG)	PORTAL
2020	Q1	Jan					
		Feb					
		Mar					
	Q2	Apr					
		May					
		Jun					
	Q3	Jul					
		Aug					
		Sep					
	Q4	Oct	X	X	X	X	
		Nov					
		Dec					
2019	Q1	Jan					
		Feb					
		Mar					
	Q2	Apr					
		May					
		Jun					
	Q3	Jul					
		Aug					
		Sep					
	Q4	Oct					
		Nov					
		Dec	X	X	X	X	
2018	Q1	Jan					
		Feb					
		Mar		MW-01			
	Q2	Apr					
		May					
		Jun					
	Q3	Jul					
		Aug					
		Sep					
	Q4	Oct					
		Nov	X	X	X	X	X
		Dec					

Table 3-3 Summary of Water Quality Monitoring Conducted 2016-2020

Year	Quarter	Month	Surface Water (WQ-04, WQ-06, WQ-10, WQ-13)	Groundwater (MW-01, MW-02, MW-03, MW-04)	Settling Ponds (EFF1)	PAG/ML Pond (PAG)	PORTAL
2017	Q1	Jan					
		Feb					
		Mar					
	Q2	Apr				X	
		May					
		Jun					
	Q3	Jul					
		Aug					
		Sep	X	X	X	X	
	Q4	Oct					
		Nov					
		Dec					
2016	Q1	Jan	X	X	X	X	
		Feb					
		Mar					
	Q2	Apr	X	X	X	X	
		May					
		Jun					
	Q3	Jul					
		Aug					
		Sep					
	Q4	Oct	X	X	X	X	
		Nov					
		Dec					

Notes:
Monitoring for full analyte list (does not include field parameter-only monitoring events)

Table 3-4 Water Quality Parameters Monitored, 2020

Parameter	Sample Type
Monitoring Required in Permit 2013DB0001	
Field Parameters [a]	
Conductivity	Field test
Dissolved oxygen	Field test
pH	Field test
Temperature	Field test
Turbidity	Field test
General Chemistry	
Hardness (as $CaCO_3$)	Grab
Total dissolved solids (TDS)	Grab
Sulfate	Grab
Nitrogen (nitrate + nitrite)	Grab
Metals [b]	
Aluminum	Grab
Arsenic	Grab
Cadmium	Grab
Chromium	Grab
Cadmium [h]	Grab
Lead	Grab
Mercury	Grab
Selenium	Grab
Zinc	Grab

Notes:

[a] Permit 2013DB0001 requires field monitoring of pH, temperature, conductivity, dissolved oxygen and turbidity at PAG Pond station

[b] Permit 2013DB0001 requires collection of total (unfiltered) and dissolved (filtered) fractions for cadmium, copper, and zinc. Only the total fraction is required for aluminum, arsenic, chromium, lead, mercury, and selenium.

Table 3-5 Alaska Water Quality Standards Criteria, Analytical Methods, and Reporting Limits

Parameter	Units	Fraction	Project Applicability	Screening Criteria [a]	Criteria Source	Analytical Method	MRL [b]
Monitoring Required in Permit 2013DB0001							
Field Parameters							
Conductivity	mS/m	--	--	--	--	Field test	--
Dissolved oxygen	mg/L	--	--	--	--	Field test	--
pH	pH units	--	Surface Water	6.5 - 8.5 [c]	18 AAC 70	Field test	--
Temperature	°C	--	Surface Water	13 [d]	18 AAC 70	Field test	--
Turbidity	NTU	--	--	--	--	Field test	--
Physical Tests, Anions, and Nutrients							
Hardness (as $CaCO_3$)	mg/L	--	--	--	--	SM 2340C	2
Total Dissolved Solids	mg/L	--	Surface Water	1000 [e]	18 AAC 70	SM 2540C	5
Nitrogen (nitrate + nitrite)	mg/L	--	--	--	--	EPA 353.2	0.05
Sulfate	mg/L	--	--	--	--	EPA 300.0	0.2
Metals [f]							
Aluminum	µg/L	Total	Surface Water	Chronic: 87 - 750 [g] Acute: 750	18 AAC 70	EPA 6020A	4
Arsenic	µg/L	Dissolved	Surface Water	Chronic: 150 Acute: 340	18 AAC 70	EPA 6020A	0.5
Cadmium [h]	µg/L	Dissolved	Surface Water	Chronic: 0.01 - 0.14 Acute: 0.02 - 0.9	18 AAC 70	EPA 6020A	0.02
			Groundwater	0.044 - 0.07	Permit 2013DB0001		
Chromium (Cr VI) [j]	µg/L	Dissolved	Surface Water	Chronic: 11 Acute: 16	18 AAC 70	EPA 6020A	0.2
Chromium	µg/L	Total	Groundwater	6.31000	Permit 2013DB0001		
Copper [h]	µg/L	Dissolved	Surface Water	Chronic: 0.14 - 4.14 Acute: 0.14 - 6.15	18 AAC 70	EPA 6020A	0.1
			Groundwater	2.61000	Permit 2013DB0001		
Mercury	µg/L	Total	Surface Water	Chronic: 0.012 Acute: 2.4	18 AAC 70	EPA 7470A	0.2
Selenium	µg/L	Total	Surface Water	Chronic: 5 Acute: 20	18 AAC 70	EPA 6020A	1
Zinc [h]	µg/L	Dissolved	Surface Water	Chronic: 1.96 - 58.47 Acute: 1.96 - 58	18 AAC 70	EPA 6020A	2
			Groundwater	7.59 - 11.76	Permit 2013DB0001		

Table 3-5 Alaska Water Quality Standards Criteria, Analytical Methods, and Reporting Limits

Notes:

-- = Not applicable to the Niblack Project and/or not included in *Alaska Water Quality Manual for Toxic and Other Deleterious Organic and Inorganic Substances or 18 AAC 70 Water Quality Standards.*

[a] For Surface Water: Freshwater Aquatic Life Criteria from *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* , December 12, 2008 and from *18 AAC 70 Water Quality Standards* , March 5, 2020.

[b] ALS periodically updates Method Reporting Limites (MRL). MRLs are current as of Oct 5, 2020.

[c] pH, for freshwater uses (variation of pH for water naturally outside the specified range must be toward the range). May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.

[d] Temperature may not exceed 20°C at any time. The following maximum temperatures may not be exceeded, where applicable: migration routes, 15°C; spawning areas, 13°C; rearing areas, 15°C; and egg and fry incubation, 13°C. For all other waters, the weekly average temperature may not exceed site-specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms.

[e] TDS may not exceed 1,000 mg/L. A concentration of TDS may not be present in water if that concentration causes or reasonably could be expected to cause an adverse effect to aquatic life.

[f] Permit 2013DB0001 requires collection of total (unfiltered) and dissolved (filtered) fractions for cadmium, copper, and zinc. Only the total fraction is required for aluminum, arsenic, chromium, lead, mercury, and selenium.

[g] Aluminum chronic standards are pH and hardness dependent. Where the pH is greater than or equal to 7.0 and the hardness is greater than or equal to 50 ppm as $CaCO_3$, the chronic aluminum standard will then be equal to the acute aluminum standard, 750 μg/L as total recoverable aluminum.

[h] Surface water quality criterion is hardness dependent. A range of values based on hardness measured at surface water stations from 2016 to 2020 is presented.

[j] No aquatic life screening value is available for total recoverable chromium (III + VI). The chromium VI screening levels are presented here for comparison. As noted in Niblack Permit 2013DB0001, Table B, if the unfiltered total chromium value exceeds the chromium (VI) water quality standard of 50 μg/L, samples of dissolved chromium (VI) may be requested.

Table 3-6a QA/QC Replicate Results and Relative Percent Differences - General Chemistry, 2020

Station ID	Sample ID	ALS Kelso Lab SRN	Collection Contractor	Sample Event	Date	Time	TDS (mg/L)	Hardness as $CaCO_3$ (mg/L)	Sulfate (mg/L)	Nitrate+Nitrite as N (mg/L)
Permit Stations - Surface Water										
WQ-13	**WQ-13**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1740**	**35.5**	**12**	**0.04** *U*	**0.119** *J*
WQ-13	**WQ-20**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1740**	**35**	**14**	**3.51**	**0.119** *J*
						Sample Difference	*-0.5*	*2*	*NC*	*NC*
						RPD	*1%*	*-15%*	*NC*	*NC*
						abs (RPD)	*1%*	*15%*	*NC*	*NC*
Permit Stations - Groundwater										
MW-01	**MW-01**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1330**	**71**	**17.6**	**3.64**	**0.055**
MW-01	**MW-20**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1330**	**47.3**	**15.2**	**0.02** *U*	**0.057**
						Sample Difference	*-23.7*	*-2.4*	*NC*	*0.002*
						RPD	*40%*	*15%*	*NC*	*-4%*
						abs (RPD)	*40%*	*15%*	*NC*	*4%*

Notes:

Relative Percent Difference (RPD) calculated by:

RPD = [X1 - X2] / [Xavg x 100]

where:

X1 = concentration of normal sample

Cadmium [h]

Xavg = average concentration [(X1 + X2)/2]

abs(RPD) = absolute value of the RPD

SRN = Sample Reference No

NC = RPD not calculated in cases where one or more concentrations were below reporting limits or not available (i.e., U or J qualified data not included in

Sample Difference = (replicate sample - primary sample)

Replicate pairs are in bold.

Data Qualifiers:

J = The analyte was positively identified and the result is an estimated value.

U = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Table 3-6b QA/QC Replicate Results and Relative Percent Differences - Metals, 2020

Station ID	Sample ID	ALS Kelso Lab SRN	Collection Contractor	Sample Event	Date	Time	Aluminum (mg/L), Total	Arsenic (mg/L), Total	Cadmium (mg/L), Total	Cadmium (mg/L), Dissolved	Chromium (mg/L), Total	Copper (mg/L), Total	Copper (mg/L), Dissolved	Lead (mg/L), Total	Mercury (mg/L), Total	Selenium (mg/L), Total	Zinc (mg/L), Total	Zinc (mg/L), Dissolved
Permit Stations - Surface Water																		
WQ-13	**WQ-13**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1740**	**63.6**	**0.09 *U***	**0.008 *U***	**0.008 *U***	**0.31**	**1.51**	**1.39**	**0.008 *J***	**0.02 *U***	**0.2 *U***	**1.8 *J***	**1.4 *J***
WQ-13	**WQ-20**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1740**	**64.6**	**0.09 *U***	**0.008 *U***	**0.008 *U***	**0.26**	**1.48**	**1.41**	**0.008 *J***	**0.02 *J***	**0.2 *U***	**1.3 *J***	**1.3 *J***
						Sample Difference	1	NC	NC	NC	-0.05	-0.03	0.02	NC	NC	NC	NC	NC
						RPD	-2%	NC	NC	NC	18%	2%	-1%	NC	NC	NC	NC	NC
						abs (RPD)	2%	NC	NC	NC	18%	2%	1%	NC	NC	NC	NC	NC
Permit Stations - Groundwater																		
MW-01	**MW-01**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1330**	**109**	**0.11 *J***	**0.013 *J***	**0.009 *J***	**0.38**	**2.88**	**2.46**	**0.208**	**0.02 *U***	**0.2 *U***	**2.4**	**1.8 *J***
MW-01	**MW-20**	**K2008856**	**55 North**	**October 2020**	**2020-10-01**	**1330**	**110**	**0.12 *J***	**0.008 *J***	**0.01 *J***	**0.38**	**2.96**	**2.54**	**0.214**	**0.02 *U***	**0.2 *J***	**2.5**	**2.1**
						Sample Difference	1	NC	NC	NC	0	0.08	0.08	0.006	NC	NC	0.1	NC
						RPD	-1%	NC	NC	NC	0%	-3%	-3%	-3%	NC	NC	-4%	NC
						abs (RPD)	1%	NC	NC	NC	0%	3%	3%	3%	NC	NC	4%	NC

Notes:

Relative Percent Difference (RPD) calculated by:

RPD = [X1 - X2] / [Xavg x 100]

where:

X1 = concentration of normal sample

Cadmium h

Xavg = average concentration [(X1 + X2)/2]

abs(RPD) = absolute value of the RPD

SRN = Sample Reference No

NC = RPD not calculated in cases where one or more concentrations were below reporting limits or not available (i.e., U or J qualified data not

Sample Difference = (replicate sample - primary sample)

Replicate pairs are in bold.

Data Qualifiers:

J = The analyte was positively identified and the result is an estimated value.

U = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Table 3-7 Percent Completeness for Surface Water and Groundwater, 2020

Analysis	Total # of Data Points [a]	Number of Data Points Accepted	Number of Data Points Rejected	Completeness (%)
Permit Stations - Surface Water (WQ-04, WQ-06, WQ-10, WQ-13)				
Chemistry [b]	20	20	0	100
Metals [c]	45	45	0	100
Field [d]	25	25	0	100
Permit Stations - Groundwater (MW-01, MW-02, MW-03, MW-04)				
Chemistry [b]	20	20	0	100
Metals [c]	45	45	0	100
Field [d]	25	25	0	100
Effluent and PAG/ML Pond				
Chemistry [b]	8	8	0	100
Metals [c]	24	24	0	100
Field [e]	132	132	0	100

Notes:
[a] Totals include field duplicate samples and exclude field blanks.
[b] General chemistry include total dissolved solids, hardness, sulfate, and nitrate/nitrite as N.
[c] Metals include total Al, As, Cd, Cr, Cu, Pb, Hg, Se, Zn, and dissolved Cd, Cu, and Zn.
[d] Field parameters include pH, conductivity, turbidity, dissolved oxygen, and temperature;
[e] Field parameters include pH, conductivity, turbidity, dissolved oxygen, temperature, and sulfate.

Table 4-1a. Water Quality Monitoring Results - Field Parameters, 2020

					In situ (field measurements)					
Station ID	**Collection Contractor**	**Sample Event**	**Date**	**Time**	**pH (SU)**	**Cond. (50µS/cm)**	**Turbidity (NTU)**	**DO (mg/L)**	**Temp. (deg C)**	**Sulfate (mg/L)**
Permit Stations - Surface Water										
WQ-04	55 North	Annual	10-1-2020	1720	7.38	33.58	1.06	10.68	10.5	--
WQ-06	55 North	Annual	10-1-2020	1630	7.27	23.49	0.86	10.79	10.3	--
WQ-10	55 North	Annual	10-2-2020	1045	7.47	47.50	0.77	10.51	10.8	--
WQ-13	55 North	Annual	10-1-2020	1740	7.07	30.54	0.86	10.59	10.2	--
Permit Stations - Groundwater										
MW-01	55 North	Annual	10-1-2020	1330	6.87	35.46	3.70	7.64	11.3	--
MW-02	55 North	Annual	10-1-2020	1440	5.88	34.44	6.15	1.59	11.3	--
MW-03	55 North	Annual	10-1-2020	1540	5.58	25.88	1.87	3.10	11.1	--
MW-04	55 North	Annual	10-2-2020	0930	6.60	48.83	2.36	4.29	12.6	--
Permit Stations - Effluent and PAG Pond										
EFF1	NPLLC	Monthly	1-21-2020	1248	7.21	189	0	8.56	3.2	50 <
EFF1	NPLLC	Monthly	2-11-2020	955	7.27	202	1	8.41	5.6	100
EFF1	NPLLC	Monthly	3-12-2020	1134	7.14	234	2	10.37	4.7	75
EFF1	NPLLC	Monthly	4-26-2020	933	7.18	248	0	11.16	6.6	100
EFF1	NPLLC	Monthly	5-9-2020	1132	7.42	172	3	10.86	9.1	75
EFF1	NPLLC	Monthly	6-23-2020	846	6.57	211	0	9.66	9.4	125
EFF1	NPLLC	Monthly	7-27-2020	940	6.78	191	2	8.54	9.7	175
EFF1	NPLLC	Monthly	8-3-2020	1244	7.13	157	0	9.13	12.1	175
EFF1	NPLLC	Monthly	9-6-2020	1615	6.93	212	11	9.10	9.2	--
EFF1	55 North	Annual	10-2-2020	1345	7.70	179	1	11.05	10.5	60
EFF1	NPLLC	Monthly	10-19-2020	1736	6.96	182	10	9.52	6.7	--
EFF1	NPLLC	Monthly	11-19-2020	909	6.45	167	10	9.86	5.0	--
PAG/ML	NPLLC	Monthly	1-21-2020	1305	--	--	--	--	--	--
PAG/ML	NPLLC	Monthly	2-11-2020	1055	5.45	861	2	6.23	2.9	200
PAG/ML	NPLLC	Monthly	3-12-2020	1201	5.51	814	3	8.84	5.6	200
PAG/ML	NPLLC	Monthly	4-26-2020	955	4.14	1150	4	8.63	7.0	200
PAG/ML	NPLLC	Monthly	5-9-2020	1201	4.77	1110	2	8.03	19.5	200 >
PAG/ML	NPLLC	Monthly	6-23-2020	846	3.73	1170	2	6.83	14.2	200 >
PAG/ML	NPLLC	Monthly	7-27-2020	958	3.48	1330	8	6.54	15.4	200 >
PAG/ML	NPLLC	Monthly	8-1-2020	1244	3.50	1570	0	6.83	17.9	200 >
PAG/ML	NPLLC	Monthly	9-6-2020	1604	3.58	1600	0	6.34	16.6	--
PAG/ML	55 North	Annual	10-2-2020	1130	3.96	1446	4	7.10	14.2	200 >
PAG/ML	NPLLC	Monthly	10-19-2020	1749	4.19	1530	2	9.78	7.1	--
PAG/ML	NPLLC	Monthly	11-19-2020	1000	6.26	331	5	9.19	1.7	--

Notes:

-- = data not available

< or > = sulfate field tests can only measure 50-200mg/L; concentrations are greater (>) or lower (<) than given value

Table 4-1b. Water Quality Monitoring Results - General Chemistry, 2020

Station ID	ALS Kelso Lab SRN	Collection Contractor	Sample Event	Date	Time	TDS (mg/L)	Hardness as $CaCO_3$ (mg/L)	Sulfate (mg/L)	Nitrate+Nitrite as N (mg/L)
Permit Stations - Surface Water									
WQ-04	K2008856	55 North	October 2020	10-1-2020	1720	39.8	20.8	0.04 *U*	0.065
WQ-06	K2008856	55 North	October 2020	10-1-2020	1630	32.5	12.8	0.04 *U*	0.059
WQ-10	K2008856	55 North	October 2020	10-2-2020	1045	41.3	19.2	0.04 *U*	0.046 *J*
WQ-13	K2008856	55 North	October 2020	10-1-2020	1740	35.5	12.0	0.04 *U*	0.119
Permit Stations - Groundwater									
MW-01	K2008856	55 North	October 2020	10-1-2020	1330	71.0	17.6	3.64	0.055
MW-02	K2008856	55 North	October 2020	10-1-2020	1440	58.0	20.0	1.41	0.006 *U*
MW-03	K2008856	55 North	October 2020	10-1-2020	1540	75.8	20.0	0.20 *J*	0.006 *U*
MW-04	K2008856	55 North	October 2020	10-2-2020	0930	68.0	46.7	2.19	0.006 *U*
Effluent and PAG Pond									
EFF1	K2008856	55 North	October 2020	10-2-2020	1345	153.0	109.0	38.00	0.027 *J*
PAG/ML	K2008856	55 North	October 2020	10-2-2020	1130	1510.0	110.0	910.00	0.006 *U*

Notes:

Only Trace Elements currently required by the Permit and analyzed in 2020 are displayed

-- = data not available

SRN = Service Request No.

Data Qualifiers:

J = The analyte was positively identified and the result is an estimated value.

U = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Table 4-1c. Water Quality Monitoring Results - Metals, 2020

Station ID	ALS Kelso Lab SRN	Collection Contractor	Sample Event	Date	Time	Total Aluminum (µg/L)	Total Arsenic (µg/L)	Total Cadmium (µg/L)	Dissolved Cadmium (µg/L)	Total Chromium (µg/L)	Total Copper (µg/L)	Dissolved Copper (µg/L)	Total Lead (µg/L)	Total Mercury (µg/L)	Total Selenium (µg/L)	Total Zinc (µg/L)	Dissolved Zinc (µg/L)
Permit Stations - Surface Water																	
WQ-04	K2008856	55 North	October 2020	10-1-2020	1720	52.4	0.09 *U*	0.012 *J*	0.011 *J*	0.26	1.15	1.16	0.006 *U*	0.02 *U*	0.2 *U*	2.8	2.5 *J*
WQ-06	K2008856	55 North	October 2020	10-1-2020	1630	55.3	0.09 *U*	0.046	0.043	0.24 *J*	1.72	1.51	0.011 *J*	0.02 *U*	0.2 *U*	12.5	12.4 *J*
WQ-10	K2008856	55 North	October 2020	10-2-2020	1045	57.1	0.09 *U*	0.214	0.210	0.31	4.39	3.70	0.037	0.02 *U*	0.2 *J*	62.1	59.9
WQ-13	K2008856	55 North	October 2020	10-1-2020	1740	63.6	0.09 *U*	0.008 *U*	0.008 *U*	0.31	1.51	1.39	0.008 *J*	0.02 *U*	0.2 *U*	1.8 *J*	1.4 *J*
Permit Stations - Groundwater																	
MW-01	K2008856	55 North	October 2020	10-1-2020	1330	109.0	0.11 *J*	0.013 *J*	0.009 *J*	0.38	2.88	2.46	0.208	0.02 *U*	0.2 *U*	2.4	1.8 *J*
MW-02	K2008856	55 North	October 2020	10-1-2020	1440	331	0.16 *J*	0.019 *J*	0.008 *U*	0.56	1.38	0.40	0.218	0.02 *J*	0.2 *U*	3.3	1.4 *J*
MW-03	K2008856	55 North	October 2020	10-1-2020	1540	613	0.23 *J*	0.008 *U*	0.008 *U*	0.95	0.73	0.68	0.064	0.02 *U*	0.2 *U*	2.7	3.0
MW-04	K2008856	55 North	October 2020	10-2-2020	0930	241	0.38 *J*	0.012 *J*	0.009 *J*	1.59	1.30	1.61	0.058	0.02 *U*	0.2 *U*	3.9	4.6
Effluent and PAG Pond																	
EFF1	K2008856	55 North	October 2020	10-2-2020	1345	228	0.40 *J*	4.13	4.040	0.53	124.00	79.60	1.72	0.02 *U*	0.4 *J*	974.0	933.0
PAG/ML	K2008856	55 North	October 2020	10-2-2020	1130	15700	1.05 *J*	137.00	136.00	7.15	5520.00	5260.0	108.00	0.02 *U*	0.7 *J*	37100.0	37300.0

Notes:

Only Trace Elements currently required by the Permit and analyzed in 2020 are displayed

-- = data not available

SRN = Service Request No.

Data Qualifiers:

J = The analyte was positively identified and the result is an estimated value.

U = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Table 4-2a. Method Detection Limits (MDL) - General Chemistry, 2020

ALS Kelso Lab Serial Request No	Collection Contractor	Sample Event	TDS (mg/L)	Hardness as $CaCO_3$ (mg/L)	Sulfate (mg/L)	Nitrate+Nitrite as N (mg/L)
Permit Stations - Surface Water						
K2008856	55 North	October 2020	--	0.8	0.04	0.006
Permit Stations - Groundwater						
K2008856	55 North	October 2020	--	0.8	0.04	0.01
PAG/ML Pond						
K2008856	55 North	October 2020	--	0.8	10.00	0.01
Effluent						
K2008856	55 North	October 2020	--	0.8	0.20	0.01

Notes:

Only parameters currently required by the Permit and analyzed in 2020 are displayed

-- = data not available

Table 4-2b. Method Detection Limits (MDL) - Metals, 2020

ALS Kelso Lab Serial Request No	Collection Contractor	Sample Event	Total Aluminum (µg/L)	Total Arsenic (µg/L)	Total Cadmium (µg/L)	Dissolved Cadmium (µg/L)	Total Chromium (µg/L)	Total Copper (µg/L)	Dissolved Copper (µg/L)	Total Lead (µg/L)	Total Mercury (µg/L)	Total Selenium (µg/L)	Total Zinc (µg/L)	Dissolved Zinc (µg/L)
Permit Stations - Surface Water														
K2008856	55 North	October 2020	0.5	0.09	0.008	0.008	0.03	0.05	0.05	0.006	0.02	0.2	0.5	0.5
Permit Stations - Groundwater														
K2008856	55 North	October 2020	0.5	0.09	0.008	0.008	0.03	0.05	0.05	0.006	0.02	0.2	0.5	0.5
PAG/ML Pond														
K2008856	55 North	October 2020	0.5	0.09	0.008	0.008	0.03	0.05	0.05	0.006	0.02	0.2	10.0	10.0
Effluent														
K2008856	55 North	October 2020	0.5	0.09	0.008	0.008	0.03	0.05	0.05	0.006	0.02	0.2	0.5	0.5

Notes:

Only parameters currently required by the Permit and analyzed in 2020 are displayed

Table 4-3a. Water Quality Criteria Screening Results - Surface Water Stations (2016-2020)

				Total Aluminum		Total Arsenic		Dissolved Cadmium		Dissolved Copper		Total Mercury		Total Selenium		Dissolved Zinc	
Station ID	**Sample Event**	**Date**	**Sample Purpose**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**	**Acute AKWQC**	**Chronic AKWQC**
WQ-04	April 2016	2016-04-01	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-04	October 2016	2016-10-10	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	ND	ND
WQ-04	September 2017	2017-09-30	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-04	November 2018	2018-11-10	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-04	December 2019	2019-12-18	Compliance	Pass	**Fail**	ND	ND	ND	ND	**Fail**	**Fail**	NA	NA	NA	NA	Pass	Pass
WQ-04	December 2019	2019-12-18	Field Replicate	Pass	**Fail**	ND	ND	ND	ND	**Fail**	**Fail**	NA	NA	NA	NA	Pass	Pass
WQ-04	October 2020	2020-10-01	Field Replicate	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	ND	ND	ND	ND	Pass	Pass
WQ-06	April 2016	2016-04-01	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-06	October 2016	2016-10-10	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-06	September 2017	2017-09-30	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-06	September 2017	2017-09-30	Field Replicate	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-06	November 2018	2018-11-10	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-06	December 2019	2019-12-18	Compliance	Pass	Pass	ND	ND	ND	ND	**Fail**	**Fail**	NA	NA	NA	NA	Pass	Pass
WQ-06	October 2020	2020-10-01	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	ND	ND	ND	ND	Pass	Pass
WQ-10	April 2016	2016-04-01	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-10	April 2016	2016-04-01	Field Replicate	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-10	October 2016	2016-10-10	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-10	September 2017	2017-09-30	Compliance	Pass	Pass	ND	ND	Pass	**Fail**	Pass	Pass	NA	NA	NA	NA	**Fail**	**Fail**
WQ-10	November 2018	2018-11-10	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-10	November 2018	2018-11-10	Field Replicate	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-10	December 2019	2019-12-18	Compliance	Pass	**Fail**	ND	ND	**Fail**	**Fail**	**Fail**	**Fail**	NA	NA	NA	NA	**Fail**	**Fail**
WQ-10	October 2020	2020-10-02	Compliance	Pass	Pass	ND	ND	Pass	**Fail**	**Fail**	**Fail**	ND	ND	ND	ND	**Fail**	**Fail**
WQ-13	April 2016	2016-04-01	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-13	October 2016	2016-10-10	Compliance	Pass	Pass	ND	ND	Pass	Pass	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-13	October 2016	2016-10-10	Field Replicate	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-13	September 2017	2017-09-30	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-13	November 2018	2018-11-10	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	NA	NA	NA	NA	Pass	Pass
WQ-13	December 2019	2019-12-18	Compliance	Pass	Pass	ND	ND	ND	ND	**Fail**	**Fail**	NA	NA	NA	NA	Pass	Pass
WQ-13	October 2020	2020-10-01	Compliance	Pass	Pass	ND	ND	ND	ND	Pass	Pass	ND	ND	ND	ND	Pass	Pass
WQ-13	October 2020	2020-10-01	Field Replicate	Pass	Pass	ND	ND	ND	ND	Pass	Pass	ND	ND	ND	ND	Pass	Pass
			Count of Exceedances - 2016-2020	**0**	**3**	**0**	**0**	**1**	**3**	**6**	**6**	**0**	**0**	**0**	**0**	**3**	**3**
			Count of Exceedances - Compliance Samples Only	**0**	**2**	**0**	**0**	**1**	**3**	**5**	**5**	**0**	**0**	**0**	**0**	**3**	**3**

Notes:

Shaded cells indicate samples collected during 2020.

Fail = Indicates that a detected sample concentration exceeds ADEC aquatic life criterion.

Pass = Indicates that a detected sample concentration is equal to or below ADEC aquatic life criterion.

ND = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.

Table 4-3b. Water Quality Criteria Screening Results - Groundwater Stations (2016-2020)

Station ID	Sample Event	Date	Sample Purpose	Dissolved Cadmium	Total Chromium		Dissolved Copper
				Permit	Permit	AWQC	Permit
MW-01	April 2016	2016-04-01	Compliance	--	--	Pass	Pass
MW-01	April 2016	2016-04-01	Field Replicate	--	--	Pass	Pass
MW-01	October 2016	2016-10-10	Compliance	--	--	Pass	Pass
MW-01	October 2016	2016-10-10	Field Replicate	--	--	Pass	Pass
MW-01	September 2017	2017-09-30	Compliance	--	--	Pass	**Fail**
MW-01	September 2017	2017-09-30	Field Replicate	--	--	Pass	**Fail**
MW-01	March 2018	2018-03-18	Compliance	--	--	--	Pass
MW-01	Novemer 2018	2018-11-10	Compliance	--	--	Pass	Pass
MW-01	Novemer 2018	2018-11-10	Field Replicate	--	--	Pass	Pass
MW-01	December 2019	2019-12-18	Compliance	--	--	Pass	Pass
MW-01	December 2019	2019-12-18	Field Replicate	--	--	Pass	Pass
MW-01	October 2020	2020-10-01	Compliance	--	--	Pass	Pass
MW-01	October 2020	2020-10-01	Field Replicate	--	--	Pass	Pass
MW-02	April 2016	2016-04-01	Compliance	ND	--	Pass	--
MW-02	October 2016	2016-10-10	Compliance	ND	--	Pass	--
MW-02	September 2017	2017-09-30	Compliance	ND	--	Pass	--
MW-02	November 2018	2018-11-10	Compliance	ND	--	Pass	--
MW-02	December 2019	2019-12-18	Compliance	ND	--	Pass	--
MW-02	October 2020	2020-10-01	Compliance	ND	--	Pass	--
MW-03	April 2016	2016-04-01	Compliance	ND	Pass	Pass	--
MW-03	October 2016	2016-10-10	Compliance	ND	Pass	Pass	--
MW-03	September 2017	2017-09-30	Compliance	Pass	Pass	Pass	--
MW-03	November 2018	2018-11-10	Compliance	ND	Pass	Pass	--
MW-03	December 2019	2019-12-18	Compliance	ND	Pass	Pass	--
MW-03	October 2020	2020-10-01	Compliance	ND	Pass	Pass	--
MW-04	April 2016	2016-04-01	Compliance	--	--	Pass	--
MW-04	October 2016	2016-10-10	Compliance	--	--	Pass	--
MW-04	September 2017	2017-09-30	Compliance	--	--	Pass	--
MW-04	November 2018	2018-11-10	Compliance	--	--	Pass	--
MW-04	December 2019	2019-12-18	Compliance	--	--	Pass	--
MW-04	October 2020	2020-10-01	Compliance	--	--	Pass	--
			Count of Exceedances - All Data	**0**	**0**	**0**	**2**
			Count of Exceedances - Compliance Samples Only	**0**	**0**	**0**	**1**

Notes:

Shaded cells indicate samples collected during 2020.

Fail = Indicates that a detected sample concentration exceeds ADEC aquatic life criterion.

Pass = Indicates that a detected sample concentration is equal to or below ADEC aquatic life criterion.

ND = The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.