FINAL
SILVER DYKE ADIT AQUAFIX TREATMENT PILOT TEST
TECHNICAL MEMORANDUM

CARPENTER-SNOW CREEK MINING DISTRICT NATIONAL PRIORITIES LIST SITE
SUPPLEMENTAL STUDIES FOR THE REMEDIAL INVESTIGATION
CASCADE COUNTY, MONTANA

November 2017

Prepared for:

Montana Department of Environmental Quality
Remediation Division
P.O. Box 200901
Helena, Montana 59620

and

U.S. Environmental Protection Agency – Region 8
10 West 15th Street
Helena, Montana 59626

Prepared By:

Tetra Tech, Inc. (EMI Unit)
825 West Custer Avenue
Helena, Montana 59602
(406) 442-5588

CONTENTS

Appendices

CONTENTS (Cont.)

Figures

Tables

ACRONYMS AND ABBREVIATIONS

AMSL	Above mean sea level
CFR	Code of Federal Regulations
CSCMD	Carpenter-Snow Creek Mining District
°C	Degrees Centigrade
DEQ	Montana Department of Environmental Quality
DO	Dissolved oxygen
EPA	U.S. Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FS	Feasibility Study
gpm	Gallons per minute
µg/L	Micrograms per liter
mg/L	Milligrams per liter
µS/cm	MicroSiemens per centimeter
MIW	Mine-influenced water
mV	Millivolts
NTU	Nephelometric turbidity units
NPL	National Priorities List
ORP	Oxidation-reduction potential
OU	Operable Unit
PVC	Polyvinyl chloride
SAP	Sampling and Analysis Plan
SC	Specific conductivity
SOP	Standard operating procedure
SRB	Sulfate Reducing Bioreactor
TCLP	Toxicity characteristic leaching procedure
TDS	Total dissolved solids
Tetra Tech	Tetra Tech, Inc. (EMI Unit)
TSS	Total suspended solids
USFS	U.S. Forest Service

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ), in cooperation with the U.S. Environmental Protection Agency (EPA) and the U.S. Forest Service (USFS), tasked Tetra Tech, Inc. (EMI Unit) (Tetra Tech) to perform pilot scale treatability testing using an Aquafix® system on mine-influenced water (MIW) from the Silver Dyke mine adit at the Carpenter-Snow Creek Mining District (CSCMD) National Priorities List (NPL) Site (Figure 1). The pilot test was completed under Contract Number 414038, Task Order 30. Results of the pilot study treatability test will be used to evaluate passive treatment alternatives for the Operable Unit (OU3) Feasibility Study (FS).

The CSCMD Site is located in Cascade County starting approximately 4 miles northeast of Neihart, Montana, trending southwest through town and ending just southwest of Neihart. Mine tailings, waste rock, and MIW are present throughout the CSCMD Site. Previous investigations showed that MIW discharging from many adits at the CSCMD Site contains elevated concentrations of heavy metals and arsenic that may pose a risk to human and ecological receptors. Silver Dyke mine MIW was targeted because it is the major contributor of dissolved and total metals to Carpenter Creek in Operable Unit 3 (OU3).

In 2012, EPA and DEQ expressed interest in determining if passive treatment technologies could be a component of future response actions to address Silver Dyke MIW. In 2013, Tetra Tech conducted bench-scale treatability testing of Silver Dyke mine adit discharge water to evaluate potential MIW treatment alternatives as specified in the 2013 Sampling and Analysis Plan (SAP) Addendum 02 for the CSCMD Site (Tetra Tech 2013a). Through screening of available technologies and bench-scale treatability testing, Tetra Tech identified two technologies to field-test: a sulfate reducing bioreactor (SRB) and Aquafix, a water-powered quicklime application system. Tetra Tech conducted a pilot-scale treatability study using these two technologies, and prepared a technical memorandum summarizing findings (Tetra Tech 2014a). The test of the SRB was unsuccessful due to clogging of the water lines. Operation and maintenance of the Aquafix system was straightforward. MIW flow that powered the water wheel was adjusted by use of a valve until attainment of the desired pH (quicklime feed rate). The adjustment was relatively simple during steady flow conditions, but could become difficult during rapidly changing flow rates. After determination of an appropriate quicklime feed rate (1 ton per 3 weeks), the system was self-sufficient when the hopper contained quicklime. Toxicity characteristic leaching procedure (TCLP) analytical results from the sample of precipitate collected from the sediment basin did not contain metals at concentration greater than toxicity characteristic regulatory levels (Code of Federal Regulations [CFR] § 261.24). The sediment will not require disposal as hazardous waste.

The Aquafix system uses natural water gradients to power a quick lime dispensing system. The quicklime raises the pH of the water, causing precipitation of many metals. The treated water is routed to a retention pond where the metal precipitates settle out. The purpose of the treatability test was to:

- Determine amounts of metals that will precipitate when pH is between 9 and 12.

- Identify operational conditions that can affect performance.
- Determine logistical requirements for operating an Aquafix system.

The remainder of this technical memorandum includes:

- Site history of the Silver Dyke mine
- Methods applied to implement the Aquafix treatability study
- Sampling methods
- Pilot scale testing results
- Conclusions.

2.0 SILVER DYKE MINE SITE HISTORY

During its operation, the Silver Dyke mine was the largest producer of ore in the Neihart mining district, with silver production second only to Silver Bow County (Schafer 1935). The ore body consisted of "a partially altered quartz porphyry and gneiss breccia surrounded by granite gneiss on one side and unaltered porphyry on the other." The ore body configuration was elliptical, with maximum length of 600 feet and width of 400 feet; mining depth was approximately 150 feet.

Beginning in 1921, 1 million tons of ore was blocked out and a 500-ton flotation mill was constructed. In 1926, the capacity of the mill was increased to 950 tons. The Silver Dyke operated until 1929, when the blocked-out ore was depleted and no new deposits could be found. Water now flows continuously from an adit at an elevation of 6,830 feet above mean sea level (AMSL) on the southwest side of the Silver Dyke mine. This adit drainage is the primary source of water in Sih-mem Creek, a tributary to Carpenter Creek. Since 2012, Tetra Tech has monitored flow from a 6-inch polyvinyl chloride (PVC) pipe that drains the collapsed adit. Average flows from the adit in 2012, 2013, and 2014 were 41, 43, and 25 gallons per minute (gpm), respectively (Tetra Tech 2013b, 2014b, 2015a). Metals concentrations in the MIW are the highest detected at the CSCMD Site.

3.0 AQUAFIX IMPLEMENTATION

The Aquafix system was reinstalled in September 2015.

3.1 EQUIPMENT SETUP

The installation included:

- Constructing a base for the Aquafix machine and placing the unit onto the constructed pad
- Installing a protective shed with a sliding door over the Aquafix unit
- Installing insulated, 2-inch-diameter, PVC pipe from the 6-inch-diameter adit discharge to the Aquafix unit
- Installing a fabric building to protect the quicklime
- Loading of 22 tons of ¼ inch minus quicklime into the fabric building
- Expanding the lined retention pond
- Routing the MIW into the retention pond.

During the reinstallation of the Aquafix system, the joint between the liner sections was found to leak. The joint was sealed with bentonite, and the retention pond was filled.

3.2 OPERATION

The hopper of the Aquafix unit was filled with 0.25-inch minus quicklime in September 2015; however, fine-grained quicklime particles caused the quicklime to bridge. Multiple attempts to eliminate the bridging proved unsuccessful. Operation of the Aquafix unit was suspended for the season.

In September 2016, 12 1-ton supersacks of quicklime in 0.25-inch to 0.625 inch size fraction were procured. Table 3-1 lists details of operation of the Aquafix unit restarted on October 25, 2016. During the first week of operation, field parameters were monitored, samples were collected and the hopper was kept full. The primary variable during operation of the Aquafix unit was water flow rate, which in turn controlled the dispensation of lime. The flow rate was adjusted by use of a valve on the input pipe. Backed up water was discharged through an overflow pipe to the historical drainage channel. Water in the historical channel was routed into the retention pond for treatment. The valve was open 11 turns at the start, but monitoring suggested need for lower flow rates to prevent quicklime over-dosing. Over the course of the first week the valve was tightened until it was open one turn. During the 2016 treatability test water flow rate decreased slowly from October to March. Valve settings ranged from one and a quarter turns open from early November 2016 to one turn open until March 16, 2017. By March 16, flow rate had dropped such that water no longer discharged from the overflow pipe, and the valve setting no longer affected rate of dispensation of lime.

On November 4, the final portion of the first supersack of quicklime was added to the hopper. The amount of fine-grained quicklime increased towards the bottom of the supersack. The fine-grained material caused the quicklime to bridge in the Aquafix hopper. From November 7 through December 22, periodic bridging of quicklime occurred. The quicklime in the hopper was stirred, quicklime was removed, and not until all quicklime had been removed and sieved to greater than 0.25 inch did bridging cease. From December 22 through February 27, quicklime cycled through the Aquafix system at a rate that emptied or mostly emptied the hopper before the next weekly refilling date. After February 27, decrease in water flow rate resulted in a one-third to one-half full hopper. On March 21, the Aquafix unit was inspected for the last time. The hopper was approximately three-quarters full, and adjusting the water intake valve did not affect water wheel rotations per minute (rpm).

At the initiation of Aquafix system operation, performance was evaluated by measuring field parameters, the water intake valve setting, and consumption of quicklime. In mid-January it became apparent that water wheel rpm was also an important parameter. By the end of February the water supply valve setting became less important as water flow rate decreased. The rate at which the Aquafix system dispensed quicklime could be evaluated only through measurement of water wheel rpm. Over the operational period of October 25, 2016, to March 21, 2017, the Aquafix unit dispensed approximately 7.5 tons of lime.

The quicklime was purchased from Graymont and produced at Graymont's plant in Tacoma, Washington. The quicklime contained a significant portion of fines in the bottom portion of the

supersack which caused bridging. It is unclear whether the fines were generated during the production process or from abrasion during shipping. Differences in grain sizes among different supersacks also were noticeable.

3.3 SHUTDOWN

At the end of operations the remaining quicklime was allowed to pass through the system. Currently, the Aquafix unit, piping, and protective shed all remain in place. The fabric building has been damaged by weather but the remains are still in place. The metal framing is intact, and a new fabric cover could be installed. Approximately 4.5 tons of quick lime remain.

4.0 SAMPLING METHODS

Pilot-scale treatability testing proceeded at the Silver Dyke adit in accordance with the 2015 SAP Addendum 1 (Tetra Tech 2015b). All surface water samples were collected in accordance with Tetra Tech standard operating procedure (SOP) 009-4 of the 2015 SAP. Surface water samples were shipped to the EPA Environmental Services Assistance Team (ESAT) laboratory to be analyzed for dissolved metals. Surface water samples were collected for dissolved metals analysis, by use of a pump or syringe that pushed water through a 0.45-micron barrel water filter into a sample jar. At sample locations SDAQ1 and SDAQ2 samples were also collected for total metals, anions, total dissolved solids (TDS) and total suspended solids (TSS) analyses. Samples collected at locations SDAQ1 to SDAQ8 were analyzed for dissolved metals.

Sampling points were (Figure 1):

- SDAQ1 – Characteristics of water from the adit prior to lime addition (baseline)
- SDAQ2 – Water characteristics post-lime treatment and retention
- SDAQ3 – Water characteristics at a mid-point along Sih-mem Creek
- SDAQ4 – Water characteristics in Sih-mem Creek prior to confluence with Carpenter Creek
- SDAQ5 – Water characteristics in Carpenter Creek after confluence with Sih-mem Creek
- SDAQ6 - Water characteristics and dilution in Carpenter Creek after confluence with Snow Creek
- SDAQ7 – Water characteristics in Carpenter Creek prior to confluence with Belt Creek
- SDAQ8 – Water characteristics in Belt Creek after confluence with Carpenter Creek.

Sample collection occurred biweekly from October 27 through November 17, weekly until January 5, and biweekly until March 21. Presence of ice and snow and extreme cold prevented some sample collection. Table 4-1 lists samples collected and reasons why samples were not collected.

5.0 AQUAFIX PERFORMANCE

Performance of the Aquafix unit was assessed though measurement of field parameters and collection of water samples for metals analysis at the following eight locations:

- SDAQ1 – Silver Dyke mine adit
- SDAQ2 – Outflow of the sedimentation pond

- SDAQ3 – Sih-mem Creek where the creek crosses the Sih-mem Creek road
- SDAQ4– Sih-mem Creek before confluence Carpenter Creek (immediately upstream of the culvert under the Carpenter Creek road)
- SDAQ5 – Carpenter Creek downstream of confluence with Sih-mem Creek
- SDAQ6 – Carpenter Creek downstream of confluence with Snow Creek
- SDAQ7 – Carpenter Creek upstream of confluence with Belt Creek
- SDAQ8 – Belt Creek downstream of confluence with Carpenter Creek.

Samples were collected before operation (pre-operation) and at regular intervals during operation. Events during which measured pH at the outfall of the retention pond exceeded 9 were classified as operation and events during which pH was less than 9 were classified as non- or interrupted operation. Exceptions were as follows: metals concentrations were elevated but pH was high (10.75) on November 23 and metals concentrations were lower but pH was low (5.04) on January 16. Whether the Aquafix treatment system was operating was therefore based on metals concentrations. Classification of each sampling event was as follows:

- Pre-Operation: October 19, October 25
- Normal Operation: October 26, October 27, October 28, November 2, November 4, November 10 (bridging), November 17, December 22 (bridging), January 16 (hopper empty), January 19, January 25, January 31, February 27, March 4, March 9, and March 16.
- Interrupted-operation: October 31 (hopper empty), November 7 (bridging), November 14 (bridging), November 23 (bridging), December 1 (bridging), and December 7 (bridging), December 29 (hopper empty), January 5 (hopper empty), January 11 (hopper empty), February 14 (hopper empty), February 21 (hopper empty), and March 21 (low water flow).

The following sections present field parameter data and metal concentrations and discuss removal efficiency.

5.1 FIELD PARAMETERS

Field parameters included pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), specific conductivity (SC), temperature, and turbidity. Table 5-1 lists field parameter data and Appendix A contains graphs of field parameter data.

At location SDAQ1 – Silver Dyke adit, field parameters remained relatively stable over time. The pH ranged from 3.27 to 3.98, with one outlier of 5.03. ORP ranged from 218 to 347 millivolts (mV) with one outlier of 117 mV. DO ranged from 2.5 to 5.0 milligrams per liter (mg/L) except for the 18 days between December 29 and January 16 when it ranged from 0.57 to 0.93 mg/L. SC ranged from 2,017 to 3,283 microSiemens per centimeter (µS/cm) with one outlier of 4,147 µS/cm. Temperature ranged from 8.31 to 8.69 degrees Centigrade (°C) except for the 15 days between December 7 and 22 when it ranged from 5.95 to 6.7 °C. Sub-zero (° Fahrenheit) atmospheric temperatures occurred in mid-December 2016. Turbidity ranged from 22 to 49 nephelometric turbidity units (NTU) except for the 11 days between January 5 and January 16 where it ranged from 4.3 NTU to 8.3 NTU. The probe was inoperable from January 31 through March 4.

At location SDAQ2 – outflow of sedimentation pond, pH varied based on operational status during each sampling event. During pre-operation, pH values were 3.61 and 3.87. During interrupted operation, pH ranged from 4.11 to 10.75 with an average of 6.89. During interrupted operation, one pH value exceeded 4, three exceeded 5, two exceeded 6, three exceeded 7, and three exceeded 8. During normal operation, pH ranged from 5.04 to 12.04, with an average of 10.33. All but four pH measurements exceeded 10. The range of pH values suggests presence of residual reactive lime in the drainage channel or pond, episodic bridging of lime in the hopper, mixing within the settling pond, or limited time since the hopper became empty. During pre-operation, ORP values were 278 and 408 mV. During interrupted operation, ORP ranged from 57 to 264 mV with an average of 184 mV while during operation, ORP ranged from -7.3 to 180 mV with an average of 95 mV. ORP dropped as pH increased. During pre-operation, DO values were 6.25 and 6.52 mg/L. During interrupted operation, DO ranged from 0.9 to 9.4 mg/L with an average of 5.6 mg/L while during operation, DO ranged from 1.1 to 8.2 mg/L with an average of 5.7 mg/L. During pre-operation, SC values were 2,626 and 2,781 µS/cm. During interrupted operation, SC ranged from 1,350 to 3,881 µS/cm with an average of 2,830 µS/cm while during operation, SC ranged from 2,389 to 3,795 µS/cm with an average of 2,782 µS/cm. During pre-operation, temperature values were 5.58 and 6.46 °C. During interrupted operation, temperature ranged from 1.5 to 8.53 °C with an average of 4.89 °C while during operation, temperature ranged from 0.06 to 8.94 °C with an average of 4.80 °C. Variations in DO, SC, and temperature appear to have been independent of the operational status of the Aquafix unit. During pre-operation, turbidity values were 3.3 and 10.2 NTU. During interrupted operation, turbidity ranged from 1.3 to 431 NTU with an average of 96.1 NTU while during operation, turbidity ranged from 9.7 to 649 NTU with an average of 228 NTU. Turbidity appeared to increase when the Aquafix unit was operational.

At location SDAQ3 – Sih-mem Creek where it crosses the Sih-mem Creek road, pH during pre-operation was 4.91. During interrupted operation, pH ranged from 5.22 to 9.27 with an average of 6.90 over nine sampling events. During three sampling events pH exceeded 7. During normal operation, pH ranged from 5.03 to 9.73 with an average of 7.59 over 13 sampling events. During five sampling events pH was less than 7 and four where it exceeded 9. During pre-operation, the ORP was 248 mV. During interrupted operation, ORP ranged from 148 to 237 mV with an average of 205 mV while during operation, ORP ranged from 129 to 207 mV with an average of 172 mV. ORP dropped as pH increased. During pre-operation, the DO was 7.33 mg/L. During interrupted operation, DO ranged from 5.35 to 11.19 mg/L with an average of 8.46 mg/L while during operation, DO ranged from 1.59 to 17.15 mg/L with an average of 8.76 mg/L. During pre-operation, the SC was 1,214 µS/cm. During interrupted operation, SC ranged from 785 to 2,003 µS/cm with an average of 1,574 µS/cm while during operation, SC ranged from 37 to 2,102 µS/cm with an average of 1,572 µS/cm. During pre-operation, the temperature was 3.92 °C. During interrupted operation, temperature ranged from 0.32 to 5.34 °C with an average of 2.37 °C while during operation, temperature ranged from -2.53 to 7.97 °C with an average of 2.29 °C. Variation in DO, SC, and temperature appear to be independent of the operational status of the Aquafix unit. During pre-operation, the turbidity was 1.8 NTU. During interrupted operation, turbidity ranged from 9.3 to 85.6 NTU with an average of 40 NTU while during operation, turbidity ranged from 20.1 to 245 NTU with an average of 87.3 NTU. Turbidity appeared to increase when the Aquafix unit was operational.

At location SDAQ4 – Sih-mem Creek where it crosses Carpenter Creek road, pH during pre-operation was 5.04. During interrupted operation, pH ranged from 5.17 to 8.84 with an average of 6.49 over nine sampling events. During two sampling events pH exceeded 7. The pH during normal operation, ranged from 5.43 to 9.32 with an average of 7.48 over 12 sampling events. During five sampling events pH was less than 7 and during one pH exceeded 9. During pre-operation, the ORP was 247 mV. During interrupted operation, ORP ranged from 167 to 324 mV with an average of 232 mV while during operation, ORP ranged from 144 to 234 mV with an average of 190 mV. ORP dropped as pH increased though less than at upstream locations. During pre-operation, the DO was 7.48 mg/L. During interrupted operation, DO ranged from 3.1 to 11.71 mg/L with an average of 8.26 mg/L while during operation, DO ranged from 5.76 to 29.53 mg/L with an average of 10.15 mg/L. During pre-operation, the SC was 400 µS/cm. During interrupted operation, SC ranged from 49 to 1,500 µS/cm with an average of 1,106 µS/cm while during operation, SC ranged from 160 to 1,472 µS/cm with an average of 1,113 µS/cm. During pre-operation, the temperature was 4.06 °C. During interrupted operation, temperature ranged from -0.02 to 6.08 °C with an average of 2.64 °C while during operation, temperature ranged from -2.53 to 8.31 °C with an average of 2.78 °C. Variations in DO, SC, and temperature appear to have been independent of the operational status of the Aquafix unit. During pre-operation, the turbidity was 0.1 NTU. During interrupted operation, turbidity ranged from 12.3 to 248 NTU with an average of 57.2 NTU while during operation, turbidity ranged from 15.7 to 213 NTU with an average of 73.7 NTU. Turbidity rises slightly when the Aquafix unit was operational.

At location SDAQ5 – Carpenter Creek downstream of the confluence with Sih-mem Creek, pH during pre-operation was 5.61. During interrupted operation, pH ranged from 5.38 to 8.89 with an average of 6.72 over nine sampling events. During three sampling events pH exceeded 7. The pH varied during normal operation, from 5.45 to 9.47 with an average of 7.75 over 12 sampling events. During four sampling events pH was less than 7, and during two sampling events pH exceeded 9. During pre-operation, the ORP was 230 mV. During interrupted operation, ORP ranged from 157 to 354 mV with an average of 223 mV while during operation, ORP ranged from 158 to 260 mV with an average of 193 mV. ORP dropped as pH increased though less than at upstream locations. During pre-operation, the DO was 7.37 mg/L. During interrupted operation, DO ranged from 3.28 to 9.9 mg/L with an average of 7.86 mg/L while during operation, DO ranged from 7.08 to 25.1 mg/L with an average of 10.2 mg/L. During pre-operation, the SC was 400 µS/cm. During interrupted operation, SC ranged from 24 to 333 µS/cm with an average of 166 µS/cm while during operation, SC ranged from 44 to 628 µS/cm with an average of 190 µS/cm. During pre-operation, the temperature was 4.06 °C. During interrupted operation, temperature ranged from -0.02 to 4.12 °C with an average of 1.65 °C while during operation, temperature ranged from -2.52 to 6.38 °C with an average of 1.81 °C. During pre-operation, the turbidity was 0.1 NTU. During interrupted operation, turbidity ranged from 3.7 to 40.3 NTU with an average of 11.7 NTU while during operation, turbidity ranged from 0 to 10.5 NTU with an average of 5.5 NTU. Variations in DO, SC, temperature, and turbidity appear to have been independent of the operational status of the Aquafix unit.

At location SDAQ6 – Carpenter Creek downstream of the confluence with Snow Creek, pH during pre-operation was 5.58. During interrupted operation, pH ranged from 6.02 to 7.96 with an average of 7.0

over 10 sampling events. During four sampling events pH exceeded 7. During normal operation, pH ranged from 5.62 to 8.69 with an average of 7.56 over 11 sampling events. During four sampling events pH was less than 7 and none where pH exceeded 9. During pre-operation, the ORP was 238 mV. During interrupted operation, ORP ranged from 150 to 310 mV with an average of 215 mV while during operation, ORP ranged from 158 to 261 mV with an average of 200 mV. During pre-operation, the DO was 7.65 mg/L. During interrupted operation, DO ranged from 3.66 to 19.4 mg/L with an average of 9.28 mg/L while during operation, DO ranged from 4.06 to 22.85 mg/L with an average of 9.63 mg/L. During pre-operation, the SC was 154 µS/cm. During interrupted operation, SC ranged from 95 to 242 µS/cm with an average of 174 µS/cm while during operation, SC ranged from 138 to 227 µS/cm with an average of 177 µS/cm. During pre-operation, the temperature was 4.18 °C. During interrupted operation, temperature ranged from -0.01 to 5.18 °C with an average of 1.88 °C while during operation, temperature ranged from -2.32 to 8.1 °C with an average of 2.08 °C. During pre-operation, the turbidity was 0.2 NTU. During interrupted operation, turbidity ranged from 8.2 to 13.8 NTU with an average of 11 NTU while during operation, turbidity ranged from 0.5 to 15.9 NTU with an average of 7.5 NTU. Variation, in field parameters appears to have been independent of the operational status of the Aquafix unit.

At location SDAQ7 – Carpenter Creek upstream of the confluence with Belt Creek, pH during pre-operation was 6.11. During interrupted operation, pH ranged from 6.04 to 8.41 with an average of 7.24 over nine sampling events. During six sampling events pH exceeded 7. During normal operation, pH ranged from 5.62 to 8.64 with an average of 7.7 over 10 sampling events. During two sampling events pH was less than 7 and none where it exceeded 9. During pre-operation, the ORP was 228 mV. During interrupted operation, ORP ranged from 100 to 270 mV with an average of 205 mV while during operation, ORP ranged from 169 to 267 mV with an average of 204 mV. During pre-operation, the DO was 7.97 mg/L. During interrupted operation, DO ranged from 6.15 to 16.01 mg/L with an average of 9.98 mg/L while during operation, DO ranged from 4.24 to 11.31 mg/L with an average of 8.89 mg/L. During pre-operation, the SC was 152 µS/cm. During interrupted operation, SC ranged from 130 to 235 µS/cm with an average of 177 µS/cm while during operation, SC ranged from 138 to 220 µS/cm with an average of 174 µS/cm. During pre-operation, the temperature was 3.92 °C. During interrupted operation, temperature ranged from 0.0 to 4.87 °C with an average of 1.63 °C while during operation, temperature ranged from 0.04 to 7.54 °C with an average of 2.36 °C. During pre-operation, the turbidity was 0.1 NTU. During interrupted operation, turbidity ranged from 3.5 to 18.8 NTU with an average of 9.6 NTU while during operation, turbidity ranged from 1.1 to 13.7 NTU with an average of 7.7 NTU. Variations in field parameters appear to have been independent of the operational status of the Aquafix unit.

At location SDAQ8 – Belt Creek downstream of the confluence with Carpenter Creek, pH during pre-operation was 6.16. During interrupted operation, pH ranged from 6.19 to 7.92 with an average of 7.0 over six sampling events. During two sampling events pH exceeded 7. During normal operation, pH ranged from 7.64 to 8.57 with an average of 8.09 over six sampling events. There were no sampling events where pH was less than 7 or exceeded 9. During pre-operation, the ORP was 222 mV. During interrupted operation, ORP ranged from 150 to 270 mV with an average of 194 mV while during

operation, ORP ranged from 170 to 209 mV with an average of 184 mV. During pre-operation, the DO was 7.76 mg/L. During interrupted operation, DO ranged from 7.7 to 10.2 mg/L with an average of 9.12 mg/L while during operation, DO ranged from 7.52 to 9.95 mg/L with an average of 8.88 mg/L. During pre-operation, the SC was 147 µS/cm. During interrupted operation, SC ranged from 134 to 769 µS/cm with an average of 251 µS/cm while during operation, SC ranged from 106 to 154 µS/cm with an average of 136 µS/cm. During pre-operation, the temperature was 4.07 °C. During interrupted operation, temperature ranged from 0.16 to 4.93 °C with an average of 3.03 °C while during operation, temperature ranged from 0.88 to 7.13 °C with an average of 3.70 °C. During pre-operation, the turbidity was 0.0 NTU. During interrupted operation, turbidity ranged from 4.8 to 13.2 NTU with an average of 7.7 NTU while during operation, turbidity ranged from 2.5 to 9.5 NTU with an average of 7.6 NTU. Variations in field parameters appear to have been independent of the operational status of the Aquafix unit.

5.2 METALS CONCENTRATIONS

Fourteen metals were detected at a majority of sampling locations. Of these, calcium, magnesium, potassium, silica, and sodium are not of concern. The remaining metals include aluminum, cadmium, cobalt, copper, iron, lead, manganese, nickel, and zinc. Arsenic and selenium were detected episodically at SDAQ1 at concentrations below the detection limit but greater than the quantitation limit. They were only detected sporadically at downstream locations and are not included in the evaluation. Dissolved metals concentrations are listed in Table 5-2 and the total metals concentrations, anion data, TDS, and TSS are listed in Table 5-3. Table 5-4 presents a summary of the metals concentrations. Appendix D contains plots of metals concentrations by date and by location.

At the Silver Dyke adit (SDAQ1) 21 samples were collected for analysis of dissolved metals, 21 and a duplicate for analysis of total metals, 19 for analysis of TDS and TSS, and 21 for analysis of anions. Dissolved metals concentrations of the adit discharge (SDAQ1 and CCSD-AD) from October 13, 2016 to March 21, 2017 were:

- Aluminum – Minimum was 1,270 micrograms per liter (µg/L), maximum was 2,960 µg/L, and the mean was 2,213 µg/L.
- Cadmium – Minimum was 661 µg/L, maximum was 886 µg/L, and the mean was 785 µg/L.
- Cobalt – Minimum was 243 µg/L, maximum was 338 µg/L, and the mean was 295 µg/L.
- Copper – Minimum was 5,820 µg/L, maximum was 14,900 µg/L, and the mean was 10,494 µg/L.
- Iron – Minimum was 26,400 µg/L, maximum was 36,500 µg/L, and the mean was 32,152 µg/L.
- Lead – Minimum was 765 µg/L, maximum was 950 µg/L, and the mean was 849 µg/L.
- Manganese – Minimum was 127,000 µg/L, maximum was 159,000 µg/L, and the mean was 140,905 µg/L.
- Nickel – Minimum was 262 µg/L, maximum was 374 µg/L, and the mean was 323 µg/L.
- Zinc – Minimum was 128,000 µg/L, maximum was 175,000 µg/L, and the mean was 145,476 µg/L.

Dissolved metals concentrations at the remaining locations on Sih-mem Creek varied according to whether the Aquafix treatment unit was operational. At the outflow of the retention pond (SDAQ2), 21

samples (1 during pre-operation, 10 during interrupted operation, and 10 during operation) were collected and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 2,200 µg/L. During interrupted operation, minimum was 146 µg/L, maximum was 2,060 µg/L, and the mean was 696 µg/L. During operation, minimum was 21 µg/L, maximum was 662 µg/L, and the mean was 202 µg/L.
- Cadmium – During pre-operation the concentration was 677µg/L. During interrupted operation, minimum was 92 µg/L, maximum was 935 µg/L, and the mean was 536 µg/L. During operation, minimum was non-detect at 2 µg/L, maximum was 112 µg/L, and the mean was 35 µg/L.
- Cobalt – During pre-operation the concentration was 253 µg/L. During interrupted operation, minimum was 21 µg/L, maximum was 341 µg/L, and the mean was 194 µg/L. During operation, minimum was 1.4 µg/L, maximum was 36 µg/L, and the mean was 10 µg/L.
- Copper – During pre-operation the concentration was 8,880 µg/L. During interrupted operation, minimum was 20 µg/L, maximum was 10,000 µg/L, and the mean was 3,263 µg/L. During operation, minimum was 12 µg/L, maximum was 1,810 µg/L, and the mean was 297 µg/L.
- Iron – During pre-operation the concentration was 21,100 µg/L. During interrupted operation, minimum was non-detect at 1,250 µg/L, maximum was 30,100 µg/L, and the mean was 10,306 µg/L. During operation, minimum was 204 µg/L, maximum was 4,390 µg/L, and the mean was 1,629 µg/L.
- Lead – During pre-operation the concentration was 858 µg/L. During interrupted operation, minimum was 0.5 µg/L, maximum was 804 µg/L, and the mean was 158 µg/L. During operation, minimum was 1.1 µg/L, maximum was 48 µg/L, and the mean was 15 µg/L.
- Manganese – During pre-operation the concentration was 124,000 µg/L. During interrupted operation, minimum was 31,000 µg/L, maximum was 166,000 µg/L, and the mean was 109,090 µg/L. During operation, minimum was 58 µg/L, maximum was 50,700 µg/L, and the mean was 8,446 µg/L.
- Nickel – During pre-operation the concentration was 280 µg/L. During interrupted operation, minimum was non-detect at 5 µg/L, maximum was 371 µg/L, and the mean was 220 µg/L. During operation, minimum was non-detect at 5 µg/L and the only detected concentration of 26 µg/L was the maximum.
- Zinc – During pre-operation the concentration was 118,000 µg/L. During interrupted operation, minimum was 7,450 µg/L, maximum was 166,000 µg/L, and the mean was 92,705 µg/L. During operation, minimum was 356 µg/L, maximum was 25,800 µg/L, and the mean was 4,942 µg/L.

At the intersection of Sih-mem Creek with the Sih-mem Creek road (SDAQ3) 20 samples (one during pre-operation, eight during interrupted operation, and 11 during operation) were collected and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 1,100 µg/L. During interrupted operation, minimum was non-detect at 250 µg/L, maximum was 1,900 µg/L, and the mean was 830 µg/L. During operation, minimum was 66 µg/L, maximum was 405 µg/L, and the mean was 187 µg/L.
- Cadmium – During pre-operation the concentration was 261 µg/L. During interrupted operation, minimum was 99 µg/L, maximum was 457 µg/L, and the mean was 318 µg/L. During operation, minimum was 15 µg/L, maximum was 359 µg/L, and the mean was 92 µg/L.

- Cobalt – During pre-operation the concentration was 85.3 µg/L. During interrupted operation, minimum was 27 µg/L, maximum was 164 µg/L, and the mean was 111 µg/L. During operation, minimum was 0.652 µg/L, maximum was 124 µg/L, and the mean was 26 µg/L.
- Copper – During pre-operation the concentration was 3,480 µg/L. During interrupted operation, minimum was 680 µg/L, maximum was 6,020 µg/L, and the mean was 3,373 µg/L. During operation, minimum was 12 µg/L, maximum was 2,100 µg/L, and the mean was 446 µg/L.
- Iron – During pre-operation the concentration was 2,240 µg/L. During interrupted operation, minimum was 1,770 µg/L, maximum was 13,500 µg/L, and the mean was 5,105 µg/L. During operation, minimum was 166 µg/L, maximum was 5,990 µg/L, and the mean was 1,723 µg/L.
- Lead – During pre-operation the concentration was 405 µg/L. During interrupted operation, minimum was 34 µg/L, maximum was 626 µg/L, and the mean was 275 µg/L. During operation, minimum was 1.9 µg/L, maximum was 137 µg/L, and the mean was 41 µg/L.
- Manganese – During pre-operation the concentration was 41,800 µg/L. During interrupted operation, minimum was 20,700 µg/L, maximum was 90,000 µg/L, and the mean was 60,538 µg/L. During operation, minimum was 2,170 µg/L, maximum was 70,000 µg/L, and the mean was 21,776 µg/L.
- Nickel – During pre-operation the concentration was 102 µg/L. During interrupted operation, minimum was 34 µg/L, maximum was 194 µg/L, and the mean was 130 µg/L. During operation, minimum was non-detect at 5 µg/L, maximum was 139 µg/L, and the mean was 32 µg/L.
- Zinc – During pre-operation the concentration was 45,800 µg/L. During interrupted operation, minimum was 15,400 µg/L, maximum was 100,000 µg/L, and the mean was 62,425 µg/L. During operation, minimum was 220 µg/L, maximum was 63,300 µg/L, and the mean was 11,827 µg/L.

Metals concentrations at SDAQ3 generally exceeded those detected at SDAQ2. Increases in concentrations may be due to further oxidation of iron producing acidity that dissolves stream sediment or entrained particulate. At the intersection of Sih-mem Creek with the Carpenter Creek road (SDAQ4) 18 samples (one and a duplicate during pre-operation, eight during interrupted operation, and nine during operation) were collected and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the mean concentration was 1,436 µg/L. During interrupted operation, minimum was non-detect at 112 µg/L, maximum was 1,070 µg/L, and the mean was 452 µg/L. During operation, minimum was 51 µg/L, maximum was 480 µg/L, and the mean was 201 µg/L.
- Cadmium – During pre-operation the mean concentration was 174 µg/L. During interrupted operation, minimum was 63 µg/L, maximum was 275 µg/L, and the mean was 199 µg/L. During operation, minimum was 36 µg/L, maximum was 223 µg/L, and the mean was 125 µg/L.
- Cobalt – During pre-operation the mean concentration was 24 µg/L. During interrupted operation, minimum was 17 µg/L, maximum was 73 µg/L, and the mean was 54 µg/L. During operation, minimum was 7.7 µg/L, maximum was 44 µg/L, and the mean was 23 µg/L.
- Copper – During pre-operation the mean concentration was 2,240 µg/L. During interrupted operation, minimum was 299 µg/L, maximum was 3,280 µg/L, and the mean was 1,949 µg/L. During operation, minimum was 25 µg/L, maximum was 1,250 µg/L, and the mean was 379 µg/L.
- Iron – During pre-operation the detected concentration was 740 µg/L. During interrupted operation, minimum was 424 µg/L, maximum was 3,750 µg/L, and the mean was 2,011 µg/L. During operation, minimum was 102 µg/L, maximum was 1,950 µg/L, and the mean was 750 µg/L.

- Lead – During pre-operation the mean concentration was 136 µg/L. During interrupted operation, minimum was 25 µg/L, maximum was 237 µg/L, and the mean was 118 µg/L. During operation, minimum was 1.9 µg/L, maximum was 75 µg/L, and the mean was 28 µg/L.
- Manganese – During pre-operation the mean concentration was 22,150 µg/L. During interrupted operation, minimum was 12,500 µg/L, maximum was 47,600 µg/L, and the mean was 34,688 µg/L. During operation, minimum was 13,000 µg/L, maximum was 30,600 µg/L, and the mean was 20,656 µg/L.
- Nickel – During pre-operation the mean concentration was 70 µg/L. During interrupted operation, minimum was 26 µg/L, maximum was 193 µg/L, and the mean was 94 µg/L. During operation, minimum was non-detect at 3.7 µg/L, maximum was 63 µg/L, and the mean was 35 µg/L.
- Zinc – During pre-operation the mean concentration was 446 µg/L. During interrupted operation, minimum was 8,390 µg/L, maximum was 59,700 µg/L, and the mean was 39,249 µg/L. During operation, minimum was 816 µg/L, maximum was 27,200 µg/L, and the mean was 15,968 µg/L.

Below SDAQ4 Sih-mem Creek joins larger Carpenter Creek significantly diluting the adit discharge. Below the confluence of Sih-mem Creek with the Carpenter Creek (SDAQ5, SDAQ6, and SDAQ7), metals concentrations differed little between when the Aquafix system was operating and when it was not operating. At SDAQ5 17 samples (one during pre-operation, eight during interrupted operation, and eight during operation) were collected and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 107 µg/L. During interrupted operation, minimum was 25 µg/L, maximum was 204 µg/L, and the mean was 61 µg/L. During operation, minimum was 26 µg/L, maximum was 256 µg/L, and the mean was 91 µg/L.
- Cadmium – During pre-operation the concentration was 50.5 µg/L. During interrupted operation, minimum was 1.9 µg/L, maximum was 38 µg/L, and the mean was 15 µg/L. During operation, minimum was 3 µg/L, maximum was 77 µg/L, and the mean was 39 µg/L.
- Cobalt – During pre-operation the concentration was 0.482 µg/L. During interrupted operation, minimum was non-detect at 0.2 µg/L, maximum was 1.69 µg/L, and the mean was 0.60 µg/L. During operation, minimum was non-detect at 0.2 µg/L, maximum was 0.97 µg/L, and the mean was 0.58 µg/L.
- Copper – During pre-operation the concentration was 536 µg/L. During interrupted operation, minimum was 20 µg/L, maximum was 429 µg/L, and the mean was 162 µg/L. During operation, minimum was 12 µg/L, maximum was 1,080 µg/L, and the mean was 471 µg/L.
- Iron – All concentrations were non-detect at 250 µg/L.
- Lead – During pre-operation the concentration was 11.1 µg/L. During interrupted operation, minimum was 1.8 µg/L, maximum was 9.4 µg/L, and the mean was 4.7 µg/L. During operation, minimum was 0.3 µg/L, maximum was 52 µg/L, and the mean was 17 µg/L.
- Manganese – During pre-operation the concentration was 4,700 µg/L. During interrupted operation, minimum was 104 µg/L, maximum was 3,540 µg/L, and the mean was 1,412 µg/L. During operation, minimum was 228 µg/L, maximum was 6,360 µg/L, and the mean was 3,458 µg/L.
- Nickel – During pre-operation the concentration was 21.2 µg/L. During interrupted operation, minimum was 0.5 µg/L, maximum was 17 µg/L, and the mean was 6.7 µg/L. During operation, minimum was 1.2 µg/L, maximum was 34 µg/L, and the mean was 17 µg/L.

- Zinc – During pre-operation the concentration was 10,700 µg/L. During interrupted operation, minimum was 378 µg/L, maximum was 9,460 µg/L, and the mean was 3,486 µg/L. During operation, minimum was 561 µg/L, maximum was 17,200 µg/L, and the mean was 8,345 µg/L.

At SDAQ6, on Carpenter Creek below the confluence with Snow Creek, 19 samples (one during pre-operation, nine during interrupted operation, and nine during operation) were collected, and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 47 µg/L. During interrupted operation, minimum was 24 µg/L, maximum was 68 µg/L, and the mean was 39 µg/L. During operation, minimum was 21 µg/L, maximum was non-detect at 50 µg/L, and the mean was 29 µg/L.
- Cadmium – During pre-operation the concentration was 6.08 µg/L. During interrupted operation, minimum was 5.34 µg/L, maximum was 9.43 µg/L, and the mean was 6.76 µg/L. During operation, minimum was 5.04 µg/L, maximum was 9.1 µg/L, and the mean was 7.25 µg/L.
- Cobalt – During pre-operation the concentration was 0.108 µg/L. During interrupted operation, minimum was 0.22 µg/L, maximum was 1.24 µg/L, and the mean was 0.45 µg/L. During operation, minimum was 0.13 µg/L, maximum was 1.29 µg/L, and the mean was 0.59 µg/L.
- Copper – During pre-operation the concentration was 41.8 µg/L. During interrupted operation, minimum was 14 µg/L, maximum was 79 µg/L, and the mean was 34 µg/L. During operation, minimum was 8.1 µg/L, maximum was 48 µg/L, and the mean was 26 µg/L.
- Iron – All concentrations were non-detect at 250 µg/L.
- Lead – During pre-operation the concentration was 2.04 µg/L. During interrupted operation, minimum was 0.40 µg/L, maximum was 10.1 µg/L, and the mean was 2.16 µg/L. During operation, minimum was non-detect at 0.2 µg/L, maximum was 2.25 µg/L, and the mean was 1.42 µg/L.
- Manganese – During pre-operation the concentration was 328 µg/L. During interrupted operation, minimum was 295 µg/L, maximum was 761 µg/L, and the mean was 460 µg/L. During operation, minimum was 307 µg/L, maximum was 734 µg/L, and the mean was 503 µg/L.
- Nickel – During pre-operation the concentration was 2.55 µg/L. During interrupted operation, minimum was 2.6 µg/L, maximum was 4.52 µg/L, and the mean was 3.55 µg/L. During operation, minimum was 3.19 µg/L, maximum was 4.91 µg/L, and the mean was 4.01 µg/L.
- Zinc – During pre-operation the concentration was 1,200 µg/L. During interrupted operation, minimum was 1,070 µg/L, maximum was 2,170 µg/L, and the mean was 1,426 µg/L. During operation, minimum was 909 µg/L, maximum was 1,960 µg/L, and the mean was 1,478 µg/L.

At SDAQ7, on Carpenter Creek above the confluence with Belt Creek, 16 samples (one during pre-operation, eight during interrupted operation, and seven during operation) were collected, and the dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 27 µg/L. During interrupted operation, minimum was 21 µg/L, maximum was 47 µg/L, and the mean was 31 µg/L. During operation, minimum was 22 µg/L, maximum was non-detect at 50 µg/L, and the mean was 26 µg/L.
- Cadmium – During pre-operation the concentration was 4.61 µg/L. During interrupted operation, minimum was 2.94 µg/L, maximum was 7.4 µg/L, and the mean was 4.96 µg/L. During operation, minimum was 4.09 µg/L, maximum was 6.32 µg/L, and the mean was 5.26 µg/L.

- Cobalt – During pre-operation the concentration was 0.1 µg/L. During interrupted operation, minimum was 0.14 µg/L, maximum was 0.82 µg/L, and the mean was 0.28 µg/L. During operation, minimum was 0.11 µg/L, maximum was 0.63 µg/L, and the mean was 0.32 µg/L.
- Copper – During pre-operation the concentration was 26.5 µg/L. During interrupted operation, minimum was 17 µg/L, maximum was 27 µg/L, and the mean was 21 µg/L. During operation, minimum was 7.3 µg/L, maximum was 22 µg/L, and the mean was 16 µg/L.
- Iron – All concentrations were non-detect at 250 µg/L.
- Lead – During pre-operation the concentration was 0.953 µg/L. During interrupted operation, minimum was 0.46 µg/L, maximum was 2.93 µg/L, and the mean was 1.37 µg/L. During operation, minimum was 0.42 µg/L, maximum was 0.93 µg/L, and the mean was 0.77 µg/L.
- Manganese – During pre-operation the concentration was 184 µg/L. During interrupted operation, minimum was 175 µg/L, maximum was 523 µg/L, and the mean was 265 µg/L. During operation, minimum was 165 µg/L, maximum was 371 µg/L, and the mean was 281 µg/L.
- Nickel – During pre-operation the concentration was 3.11 µg/L. During interrupted operation, minimum was 2.37 µg/L, maximum was 3.76 µg/L, and the mean was 3.23 µg/L. During operation, minimum was 3.27 µg/L, maximum was 4.87 µg/L, and the mean was 3.9 µg/L.
- Zinc – During pre-operation the concentration was 1,060 µg/L. During interrupted operation, minimum was 708 µg/L, maximum was 1,740 µg/L, and the mean was 1,180 µg/L. During operation, minimum was 922 µg/L, maximum was 1,450 µg/L, and the mean was 1,210 µg/L.

At SDAQ8, on Belt Creek below the confluence with Carpenter Creek, additional dilution from Belt Creek obscured any impact of the Aquafix system. Twelve samples (one during pre-operation, six during interrupted operation, and five during operation) were collected, and dissolved metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was non-detect at 50 µg/L. Six of the results were non-detect at 50 µg/L. Remaining concentrations ranged from 21 to 57 µg/L.
- Cadmium – During pre-operation the concentration was 2.64 µg/L. During interrupted operation, minimum was 0.81 µg/L, maximum was 4.62 µg/L, and the mean was 2.44 µg/L. During operation, minimum was 1.42 µg/L, maximum was 3.65 µg/L, and the mean was 2.74 µg/L.
- Cobalt – During pre-operation the concentration was non-detect at 0.2 µg/L. Four of the results were non-detect at 0.2 µg/L. The remaining concentrations ranged from 0.11 to 0.27µg/L.
- Copper – During pre-operation the concentration was 15.5 µg/L. During interrupted operation, minimum was 3.27 µg/L, maximum was 27.5 µg/L, and the mean was 12.8 µg/L. During operation, minimum was 6.04 µg/L, maximum was 17 µg/L, and the mean was 12.4 µg/L.
- Iron – All concentrations were non-detect at 250 µg/L.
- Lead – During pre-operation the concentration was 0.486 µg/L. During interrupted operation, minimum was 0.183 µg/L, maximum was 1.86 µg/L, and the mean was 0.828 µg/L. During operation, minimum was 0.231 µg/L, maximum was 0.862 µg/L, and the mean was 0.571 µg/L.
- Manganese – During pre-operation the concentration was 113 µg/L. During interrupted operation, minimum was 39 µg/L, maximum was 258 µg/L, and the mean was 143 µg/L. During operation, minimum was 87 µg/L, maximum was 194 µg/L, and the mean was 142 µg/L.
- Nickel – During pre-operation the concentration was 2.09 µg/L. During interrupted operation, minimum was non-detect at 1 µg/L, maximum was 3.86 µg/L, and the mean was 2.19 µg/L. During operation, minimum was 0.71 µg/L, maximum was 5.02 µg/L, and the mean was 2.77 µg/L.

- Zinc – During pre-operation the concentration was 648 µg/L. During interrupted operation, minimum was 240 µg/L, maximum was 1,070 µg/L, and the mean was 576 µg/L. During operation, minimum was 359 µg/L, maximum was 891 µg/L, and the mean was 655 µg/L.

Samples for total metals analysis were collected at the Silver Dyke mine adit (SDAQ1) and at the outfall of the sedimentation basin (SDAQ2). Total metals concentrations of the adit discharge (SDAQ1 and CCSD-AD) from October 13, 2016 to March 21, 2017, were as follows:

- Aluminum – Minimum was 1,270 µg/L, maximum was 2,780 µg/L, and the mean was 2,138 µg/L.
- Cadmium – Minimum was 661 µg/L, maximum was 879 µg/L, and the mean was 788 µg/L.
- Cobalt – Minimum was 243 µg/L, maximum was 335 µg/L, and the mean was 297 µg/L.
- Copper – Minimum was 5,820 µg/L, maximum was 15,000 µg/L, and the mean was 10,368 µg/L.
- Iron – Minimum was 30,800 µg/L, maximum was 55,600 µg/L, and the mean was 38,955 µg/L.
- Lead – Minimum was 806 µg/L, maximum was 977 µg/L, and the mean was 908 µg/L.
- Manganese – Minimum was 127,000 µg/L, maximum was 162,000 µg/L, and the mean was 143,227 µg/L.
- Nickel – Minimum was 262 µg/L, maximum was 371 µg/L, and the mean was 327 µg/L.
- Zinc – Minimum was 132,000 µg/L, maximum was 178,000 µg/L, and the mean was 149,545 µg/L.

At the outflow of the retention pond (SDAQ2) 21 samples (one during pre-operation, 10 during interrupted operation, and 10 during operation) were collected, and total metals concentrations were as follows:

- Aluminum – During pre-operation the concentration was 2,340 µg/L. During interrupted operation, minimum was 639 µg/L, maximum was 5,770 µg/L, and the mean was 2,365 µg/L. During operation, minimum was 92 µg/L, maximum was 3,920 µg/L, and the mean was 1,999 µg/L.
- Cadmium – During pre-operation the concentration was 681 µg/L. During interrupted operation, minimum was 284 µg/L, maximum was 1,240 µg/L, and the mean was 740 µg/L. During operation, minimum was non-detect at 4.6 µg/L, maximum was 856 µg/L, and the mean was 552 µg/L.
- Cobalt – During pre-operation the concentration was 250 µg/L. During interrupted operation, minimum was 103 µg/L, maximum was 460 µg/L, and the mean was 276 µg/L. During operation, minimum was 2.7 µg/L, maximum was 322 µg/L, and the mean was 206 µg/L.
- Copper – During pre-operation the concentration was 8,850 µg/L. During interrupted operation, minimum was 2,490 µg/L, maximum was 17,100 µg/L, and the mean was 8,961 µg/L. During operation, minimum was 55 µg/L, maximum was 12,800 µg/L, and the mean was 6,823 µg/L.
- Iron – During pre-operation the concentration was 26,300 µg/L. During interrupted operation, minimum was 13,000 µg/L, maximum was 103,000 µg/L, and the mean was 39,380 µg/L. During operation, minimum was 125 µg/L, maximum was 38,200 µg/L, and the mean was 26,954 µg/L.
- Lead – During pre-operation the concentration was 904 µg/L. During interrupted operation, minimum was 62 µg/L, maximum was 2,110 µg/L, and the mean was 771 µg/L. During operation, minimum was 12 µg/L, maximum was 1,460 µg/L, and the mean was 386 µg/L.
- Manganese – During pre-operation the concentration was 132,000 µg/L. During interrupted operation, minimum was 64,900 µg/L, maximum was 196,000 µg/L, and the mean was 129,760

µg/L. During operation, minimum was 1,290 µg/L, maximum was 122,000 µg/L, and the mean was 83,951 µg/L.
- Nickel – During pre-operation the concentration was 276 µg/L. During interrupted operation, minimum was 87 µg/L, maximum was 510 µg/L, and the mean was 298 µg/L. During operation, minimum was non-detect at 5 µg/L, maximum was 344 µg/L, and the mean was 266 µg/L.
- Zinc – During pre-operation the concentration was 134,000 µg/L. During interrupted operation, minimum was 46,600 µg/L, maximum was 220,000 µg/L, and the mean was 137,650 µg/L. During operation, minimum was 1,240 µg/L, maximum was 153,000 µg/L, and the mean was 102,624 µg/L.

Total metals concentration at SDAQ2 were much greater than dissolved metals concentrations, suggesting that particulate was leaving the retention pond.

At the adit discharge (SDAQ1), TDS concentrations were as follows: minimum of 2,790 mg/L, maximum of 3,140 mg/L, and average of 3,050 mg/L. At the sedimentation pond discharge (SDAQ2), TDS concentrations during interrupted operation were: minimum of 2,240 mg/L, maximum of 3,130 mg/L, and average of 2,880 mg/L. During Aquafix operation, concentrations were: minimum of 1,430 mg/L, maximum of 3,150 mg/L, and average of 2,700 mg/L.

At the adit discharge (SDAQ1), TSS concentrations were as follows: minimum of 16 mg/L, maximum of 73 mg/L, and average of 36 mg/L. At the sedimentation pond discharge (SDAQ2), TSS concentrations during interrupted operation were: minimum of 10 mg/L, maximum of 984 mg/L, and average of 308 mg/L. During Aquafix operation, concentrations were: minimum of 18 mg/L, maximum of 1,520 mg/L, and average of 669 mg/L.

TDS concentrations suggest that calcium was replacing other metals in solution after Aquafix treatment, while TSS concentrations suggest that significant amounts of fine-grained precipitate were forming.

5.3 REMOVAL EFFICENCY

Removal percentages were calculated by use of dissolved concentrations at the adit discharge (SDAQ1) and the dissolved metals concentrations at discharge from the retention pond (SDAQ2) during time periods when the Aquafix unit was operational. Removal efficiency was not calculated at downstream locations due to the complicating factors of dilution and sediment dissolution. Table 5-5 contains the calculated removal percentages. Minimum, maximum, and mean removal percentages were as follows:

- Aluminum – Minimum was 73.9 percent, maximum was 99.2 percent, and the mean was 89.1 percent.
- Cadmium – Minimum was 87.4 percent, maximum was 99.8 percent, and the mean was 96.1 percent.
- Cobalt – Minimum was 89.3 percent, maximum was 99.5 percent, and the mean was 96.8 percent.
- Copper – Minimum was 87.1 percent, maximum was 99.9 percent, and the mean was 97.2 percent.
- Iron – Minimum was 86.5 percent, maximum was 99.3 percent, and the mean was 95.5 percent.

- Lead – Minimum was 94.6 percent, maximum was 99.9 percent, and the mean was 98.3 percent.
- Nickel – Minimum was 93.0 percent, maximum was 98.4 percent, and the mean was 97.3 percent.
- Zinc – Minimum was 83.5 percent, maximum was 99.8 percent, and the mean was 96.7 percent.

6.0 SUMMARY AND CONCLUSIONS

The pilot test revealed that operation of the Aquafix system will require once or twice weekly visits. The size of lime particles significantly affected system performance. Even lime graded to exceed 0.25 inch contained enough fine-grained material, near the bottom of each super sack, to induce bridging. Other lime suppliers may be able to provide material without fine-grained particles.

The hopper frequently did not have sufficient volume to hold enough lime to treat water for an entire week. Depending on water flow rate, the hopper may require refilling more than once every 7 days or a larger hopper could be installed.

The TSS data suggest that a larger retention pond or several retention ponds in series are required to settle precipitate generated by the Aquafix treatment. The current retention pond had a capacity of approximately 2,000 cubic yards. By the end of operation in March, 2017 the pond was between half and two thirds full of precipitate of indeterminate density. No sample was collected from the sludge for TCLP analysis since the pond was partially frozen and approach to unfrozen locations was difficult. Accurate determination of the amount of sludge cannot be made until the sludge is removed from the settling pond and dried.

When the Aquafix system was operating properly the pH exceeded 10 and removal percentages for metals of concern generally exceeded 90 percent.

7.0 REFERENCES

Code of Federal Regulations. § 261.24. Toxicity Characteristic, Table 1. – Maximum Concentration of Contaminants for the Toxicity Characteristic.

Schafer, P.A. 1935. Geology and Ore Deposits of the Neihart Mining District, Cascade County, Montana. Bureau of Mines and Geology Memoir No. 13. Montana School of Mines, Butte.

Tetra Tech. 2013a. Sampling and Analysis Plan, Carpenter-Snow Creek Mining District NPL Site. Supplemental Studies for the Feasibility Investigation. April.

Tetra Tech. 2013b. Silver Dyke Adit and Broadwater Adit Water Balance Technical Memorandum, Carpenter-Snow Creek Mining District NPL Site. Supplemental Studies for the Remedial Investigation. March.

Tetra Tech. 2014a. Mine Adit Discharge Bench Scale Testing Technical Memorandum. Carpenter-Snow Creek Mining District NPL Site. March.

Tetra Tech. 2014b. Adit Discharge Monitoring Technical Memorandum. Carpenter-Snow Creek Mining District NPL Site. February.

Tetra Tech. 2015a. Adit Discharge Monitoring Technical Memorandum. Carpenter-Snow Creek Mining District NPL Site. May.

Tetra Tech. 2015b. Sampling and Analysis Plan, Carpenter-Snow Creek Mining District Superfund Site, Supplemental Data Collection for Feasibility Study. Prepared for Montana Department of Environmental Quality Remediation Division. October.

FIGURES

LEGEND

- STREAM
- MINE
- MONITORING WELL LOCATION
- DISSOLVED METALS SAMPLING POINT
- TOTAL AND DISSOLVED METALS SAMPLING POINT

N

0 1,000 2,000 Feet

CARPENTER-SNOW CREEK MINING DISTRICT
NATIONAL PRIORITIES LIST SITE

FIGURE 1
SILVER DYKE AQUAFIX
PILOT STUDY AREA AND
CONCEPTUAL DESIGN

TETRA TECH

GIS MAP BY DOUG HEROLD TTEMI-HELENA - Figure_1_Silver_Dyke_Aquafix_100215.mxd

TABLES

TABLE 3-1
AQUAFIX FIELD ACTIVITIES

Date	Gallons of Lime	Valve Setting	Water Wheel RPM	Notes
19-Oct				Pre-operation sampling
25-Oct	0	11	NM	Parameters measured prior to startup, hopper filled with lime to bottom of support brace.
26-Oct	NM	5	NM	Quick check, everything working.
27-Oct	NM	2	NM	Filled hopper to crossbar. 1st supersack is 1/4 empty.
28-Oct	NM	2	NM	Filled hopper to crossbar. 1st supersack is a little less than 1/2 empty.
31-Oct	NM	1	NM	Filled hopper to crossbar. 1st supersack is 1/4 remains, hopper empty.
2-Nov	30	1	NM	Filled hopper to crossbar.
4-Nov	52	1.25	NM	Finished 1st supersack, started on second, hopper filled to very top.
7-Nov	16	1.5	NM	Apparent bridging in hopper after 16 gallons was dispensed (about 3 days worth), hopper completely filled.
10-Nov	40	1.25	NM	Hopper completely filled and lime was packed in.
14-Nov	8	1.5	NM	Apparent bridging in hopper after 8 gallons was dispensed (about 1.5 days worth), hopper completely filled.
17-Nov	15	1.25	NM	Low amount of lime dispensed (about 3 days worth), filled hopper to below bar.
23-Nov	30	1.25	NM	Hopper 1/4 full upon arrival. Filled hopper to below bar.
1-Dec	-10	1.25	NM	Lime had bridged, appeared to have used <5 gallons of lime, 10 gallons lime removed - now 3" below crossbar.
7-Dec	10	1.25	NM	Lime has bridged, added 10 gallons of lime, stirred hopper.
22-Dec	12	1.25	NM	Lime had bridged, removed all lime from hopper, added 3, 5-gallon buckets of lime, recalibrated flow meter.
29-Dec	32	1.25	NM	Hopper empty, lime feeding through system, filled to cross bar.
5-Jan	36	1.25	NM	Hopper empty, filled to cross bar.
11-Jan	32	1.25	NM	Hopper empty, seived lime to 1/2 inch, filled to cross bar.
16-Jan	37	1.25	NM	Hopper empty, seived lime to 1/4 inch, filled to top.
19-Jan	36	1.25	20.5	Hopper had some lime, seived lime to 1/4 inch, filled to top.
25-Jan	44	1.25	20.7	1 gallon of lime left in hopper, seived to 1/4 inch, filled to top.
31-Jan	50	1.25	19.5	Hopper empty, hopper filled to top.
14-Feb	50	1.06	18.3	Hopper empty, filled to top, 5 unopened sacks of lime remain, as well as 1 sack about 1/3 full.
21-Feb	50	1	17	Hopper empty, lime size is approx 1/2 size of lime from previous sack, filled to top.
27-Feb	30	1	15.8	Hopper was approximately 1/3 full, filled to top.
4-Mar	35	1	16.3	Roughly half of hopper volume remained, filled to top. Started new super sack, 4.8 remaining after loading.
9-Mar	30	1	12.7	Hopper was approximately 1/3 full, filled to top.
16-Mar	40	1	15	Lime remained, filled to top, 4.5 super sacks remaining. Lime shed is starting to fall apart, zippers broken.
21-Mar	0	Open	9.1	Hopper was approximatly 3/4 full, no lime added. Adjusting valve did not appear to affect rpm. Valve left completely open.

Notes: NM = Not measured

TABLE 4-1
LOCATIONS SAMPLED

Date	Samples Collected	Stations Not Sampled
19-Oct	SDAQ1 to SDAQ8	None
27-Oct	SDAQ1 to SDAQ8	None
28-Oct	SDAQ1 to SDAQ8	None
31-Oct	SDAQ1 to SDAQ8	None
2-Nov	SDAQ1 to SDAQ8	None
4-Nov	SDAQ1 to SDAQ8	None
7-Nov	SDAQ1 to SDAQ8	None
10-Nov	SDAQ1 to SDAQ8	None
14-Nov	SDAQ1 to SDAQ8	None
17-Nov	SDAQ1 to SDAQ8	None
23-Nov	SDAQ1 to SDAQ8	None
1-Dec	SDAQ1 to SDAQ8	None
7-Dec	SDAQ1 to SDAQ7	SDAQ8, ice - unsafe access
14-Dec	None	SDAQ1 to SDAQ8, temperature -21° - hazardously cold
22-Dec	SDAQ1 to SDAQ6	SDAQ7 and SDAQ8, ice - unsafe access
29-Dec	SDAQ1, SDAQ2, and SDAQ6	SDAQ3, SDAQ4 iced over SDAQ5, SDAQ7, and SDAQ8, ice - unsafe access
5-Jan	SDAQ1 and SDAQ2	SDAQ3 to SDAQ7, iced over SDAQ8, ice - unsafe access
16-Jan	SDAQ1 to SDAQ3	SDAQ4 to SDAQ7, iced over SDAQ8, ice - unsafe access
31-Jan	SDAQ1 to SDAQ6	SDAQ7, iced over SDAQ8, ice - unsafe access
27-Feb	SDAQ1 to SDAQ7	SDAQ8, ice - unsafe access
9-Mar	SDAQ1 to SDAQ7	SDAQ8, ice - unsafe access
21-Mar	SDAQ1 to SDAQ8	None

Notes: Field parameters were measured on 10/25, 1/11, 1/19, 1/25, 2/14

TABLE 5-1
FIELD PARAMETERS

Sample Name	Date	Status	pH	ORP (mV)	DO (mg/L)	SC (µS/cm)	Temp (°C)	Tubidity (NTU)
SDAQ1-SW-L-001	10/19/2016	Adit	3.87	269	3.18	2,504	8.62	48.8
SDAQ1-SW-L-002	10/27/2016	Adit	3.62	295	2.86	2,771	8.67	36.5
SDAQ1-SW-L-003	10/28/2016	Adit	3.63	325	2.70	2,704	8.65	30.6
SDAQ1-SW-L-004	10/31/2016	Adit	3.60	309	2.50	2,749	8.65	29.3
SDAQ1-SW-L-005	11/2/2016	Adit	3.27	321	2.78	2,287	8.62	37.8
SDAQ1-SW-L-006	11/4/2016	Adit	3.67	347	2.84	2,736	8.67	38.1
SDAQ1-SW-L-007	11/7/2016	Adit	3.89	305	2.73	2,789	8.68	30.6
SDAQ1-SW-L-008	11/10/2016	Adit	3.66	315	2.70	2,816	8.67	32.4
SDAQ1-SW-L-009	11/14/2016	Adit	3.82	296	2.69	2,886	8.69	NA
SDAQ1	11/17/2016	Adit	3.71	302	2.60	2,827	8.67	26.2
SDAQ1-SW-L-010	11/23/2016	Adit	3.70	269	2.64	2,793	8.64	26.5
SDAQ1-SW-L-011	12/1/2016	Adit	3.84	281	2.63	2,017	8.64	24.5
SDAQ1-SW-L-012	12/7/2016	Adit	5.03	238	3.21	2,853	6.70	27.5
SDAQ1	12/21/2016	Adit	3.92	264	5.04	2,896	5.95	NA
SDAQ1-SW-L-013	12/22/2016	Adit	3.85	244	3.97	2,906	5.95	NA
SDAQ1-SW-L-014	12/29/2016	Adit	3.69	294	0.66	2,695	8.59	22.2
SDAQ1-SW-L-015	1/5/2017	Adit	3.83	287	0.68	3,283	8.59	7.1
SDAQ1	1/11/2017	Adit	3.76	117	0.93	4,147	NA	8.3
SDAQ1-SW-L-016	1/16/2017	Adit	3.29	227	0.57	2,801	8.58	4.3
SDAQ1-SW-L-017	1/31/2017	Adit	3.48	221	3.85	2,828	8.53	NA
SDAQ1-SW-L-018	2/14/2017	Adit	3.65	307	4.78	2,772	8.50	NA
SDAQ1	2/21/2017	Adit	3.71	311	3.53	3,104	8.50	NA
SDAQ1-SW-L-019	2/27/2017	Adit	3.75	218	3.63	2,983	8.49	NA
SDAQ1	3/4/2017	Adit	3.73	262	3.51	2,932	8.48	NA
SDAQ1-SW-L-020	3/9/2017	Adit	3.44	250	3.58	2,809	8.47	39.3
SDAQ1	3/16/2017	Adit	3.48	238	3.63	2,883	8.36	33.2
SDAQ1-SW-L-021	3/21/2017	Adit	3.98	229	3.61	2,736	8.31	24.6
	Pretreatment	Minimum	3.27	117	0.57	2,017	5.95	4.3
		Maximum	5.03	347	5.04	4,147	8.69	48.8
		Mean	3.74	272	2.89	2,834	8.30	27.8
SDAQ2-SW-L-001	10/19/2016	Pre-operation	3.87	278	6.25	2,626	5.58	10.2
SDAQ2	10/25/2016	Pre-operation	3.61	408	6.52	2,781	6.46	3.3
SDAQ2	10/26/2016	Operation	11.66	20	3.47	2,785	7.69	29.4
SDAQ2-SW-L-002	10/27/2016	Operation	12.04	-7	5.12	3,795	8.94	14.1
SDAQ2-SW-L-003	10/28/2016	Operation	11.54	32	5.71	3,032	7.14	9.7
SDAQ2-SW-L-005	11/2/2016	Operation	9.09	125	4.95	2,437	3.18	400
SDAQ2-SW-L-006	11/4/2016	Operation	9.60	122	6.67	2,787	8.02	166
SDAQ2-SW-L-008	11/10/2016	Operation	11.88	-2	5.60	2,951	5.71	649
SDAQ2	11/17/2016	Operation	10.60	30	2.47	2,422	5.26	393
SDAQ2-SW-L-013	12/22/2016	Operation	10.10	109	1.77	2,774	0.06	NA
SDAQ2-SW-L-016	1/16/2017	Operation	5.04	172	1.05	2,674	0.75	174
SDAQ2	1/19/2017	Operation	10.57	49	7.86	2,814	4.92	262
SDAQ2	1/25/2017	Operation	11.07	139	8.11	2,559	3.63	NA
SDAQ2-SW-L-017	1/31/2017	Operation	10.92	180	8.16	2,728	3.71	NA
SDAQ2-SW-L-019	2/27/2017	Operation	10.61	170	7.50	2,389	3.02	NA
SDAQ2	3/4/2017	Operation	10.06	123	6.88	2,878	4.28	NA

TABLE 5-1
FIELD PARAMETERS

Sample Name	Date	Status	pH	ORP (mV)	DO (mg/L)	SC (µS/cm)	Temp (°C)	Tubidity (NTU)
SDAQ2-SW-L-20	3/9/2017	Operation	10.54	110	7.83	2,817	5.15	250
SDAQ2	3/16/2017	Operation	9.90	154	7.94	2,674	5.36	165
SDAQ2-SW-L-004	10/31/2016	Interupted	6.22	190	6.09	2,807	5.05	39.6
SDAQ2-SW-L-007	11/7/2016	Interupted	7.24	175	4.40	2,817	4.62	NA
SDAQ2-SW-L-009	11/14/2016	Interupted	5.42	231	7.62	2,935	6.20	43.2
SDAQ2-SW-L-010	11/23/2016	Interupted	10.75	57	7.60	2,995	4.73	194
SDAQ2-SW-L-011	12/1/2016	Interupted	4.11	264	7.65	1,350	4.06	27.0
SDAQ2-SW-L-012	12/7/2016	Interupted	6.43	189	4.69	2,907	1.50	12.4
SDAQ2-SW-L-014	12/29/2016	Interupted	5.28	234	2.95	2,716	2.95	431
SDAQ2-SW-L-015	1/5/2017	Interupted	8.02	189	0.92	3,881	7.01	32.0
SDAQ2	1/11/2017	Interupted	5.62	188	1.72	3,308	NA	1.3
SDAQ2-SW-L-018	2/14/2017	Interupted	7.44	194	9.43	2,907	3.96	NA
SDAQ2	2/21/2017	Interupted	8.94	103	6.95	2,977	5.13	NA
SDAQ2-SW-L	3/21/2017	Interupted	7.15	199	7.42	2,359	8.53	84.1
	Pre-operation	Mean	3.74	343	6.39	2,704	6.02	6.8
	Operation	Minimum	5.04	-7.3	1.05	2,389	0.06	9.7
		Maximum	12.04	180	8.16	3,795	8.94	649
		Mean	10.33	95	5.69	2,782	4.80	228
	Interupted	Minimum	4.11	57	0.92	1,350	1.50	1.3
		Maximum	10.75	264	9.43	3,881	8.53	431
		Mean	6.89	184	5.62	2,830	4.89	96.1
SDAQ3-SW-L-001	10/19/2016	Pre-operation	4.91	248	7.33	1,214	3.92	1.8
SDAQ3-SW-L-002	10/27/2016	Operation	9.40	137	6.85	1,430	7.97	46.1
SDAQ3-SW-L-003	10/28/2016	Operation	9.41	149	7.06	1,427	5.97	20.1
SDAQ3-SW-L-005	11/2/2016	Operation	8.31	192	8.44	1,260	2.12	74.2
SDAQ3-SW-L-006	11/4/2016	Operation	7.60	206	8.01	1,651	5.27	86.0
SDAQ3-SW-L-008	11/10/2016	Operation	9.38	129	8.28	1,792	6.20	162
SDAQ3	11/17/2016	Operation	8.05	158	9.01	1,634	0.65	64.6
SDAQ3-SW-L-013	12/22/2016	Operation	6.00	190	17.15	37	-2.53	NA
SDAQ3-SW-L-016	1/16/2017	Operation	5.03	207	1.59	1,965	0.70	34.8
SDAQ3-SW-L-017	1/31/2017	Operation	6.36	145	9.07	2,102	0.54	NA
SDAQ3-SW-L-019	2/27/2017	Operation	8.01	154	8.98	1,924	0.06	NA
SDAQ3	3/4/2017	Operation	6.10	188	9.09	1,918	0.59	NA
SDAQ3-SW-L-20	3/9/2017	Operation	9.73	180	10.03	1,973	0.80	245
SDAQ3	3/16/2017	Operation	5.35	196	10.31	1,327	1.43	52.6
SDAQ3-SW-L-004	10/31/2016	Interupted	6.00	217	7.03	1,346	4.43	23.4
SDAQ3-SW-L-007	11/7/2016	Interupted	6.88	209	8.14	1,537	5.18	36.9
SDAQ3-SW-L-009	11/14/2016	Interupted	5.22	237	8.49	1,673	5.34	72.4
SDAQ3-SW-L-010	11/23/2016	Interupted	9.27	148	9.17	1,805	0.58	85.6
SDAQ3-SW-L-011	12/1/2016	Interupted	6.14	236	8.47	1,387	0.72	9.3
SDAQ3-SW-L-012	12/7/2016	Interupted	6.57	195	5.35	1,752	0.32	9.4
SDAQ3-SW-L-018	2/14/2017	Interupted	7.63	225	11.19	2,003	0.68	NA
SDAQ3	2/21/2017	Interupted	8.96	196	8.54	1,875	0.90	NA
SDAQ3-SW-L-021	3/21/2017	Interupted	5.41	182	9.77	785	3.17	42.7
	Operation	Minimum	5.03	129	1.59	37	-2.53	20.1
		Maximum	9.73	207	17.15	2,102	7.97	245

TABLE 5-1
FIELD PARAMETERS

Sample Name	Date	Status	pH	ORP (mV)	DO (mg/L)	SC (µS/cm)	Temp (°C)	Tubidity (NTU)
		Mean	7.59	172	8.76	1,572	2.29	87.3
	Interupted	Minimum	5.22	148	5.35	785	0.32	9.3
		Maximum	9.27	237	11.19	2,003	5.34	85.6
		Mean	6.90	205	8.46	1,574	2.37	40.0
SDAQ4-SW-L-001	10/19/2016	Pre-operation	5.04	247	7.48	400	4.06	0.1
SDAQ4-SW-L-002	10/27/2016	Operation	8.70	174	6.76	1,208	8.31	15.7
SDAQ4-SW-L-003	10/28/2016	Operation	8.81	178	7.19	1,216	6.07	16.0
SDAQ4-SW-L-005	11/2/2016	Operation	8.08	205	8.44	1,080	2.66	47.3
SDAQ4-SW-L-006	11/4/2016	Operation	7.27	219	7.74	1,269	6.63	57.7
SDAQ4-SW-L-008	11/10/2016	Operation	9.32	150	8.54	1,367	6.30	88.2
SDAQ4	11/17/2016	Operation	7.75	167	9.62	1,350	0.85	129
SDAQ4-SW-L-013	12/22/2016	Operation	6.23	209	29.53	160	-2.53	NA
SDAQ4-SW-L-017	1/31/2017	Operation	6.98	144	5.76	239	0.75	NA
SDAQ4-SW-L-019	2/27/2017	Operation	7.91	186	9.26	1,472	0.41	NA
SDAQ4	3/4/2017	Operation	6.40	195	9.00	1,445	1.01	NA
SDAQ4-SW-L-20	3/9/2017	Operation	6.87	234	9.90	1,471	0.35	213
SDAQ4	3/16/2017	Operation	5.43	215	10.04	1,077	2.57	23.0
SDAQ4-SW-L-004	10/31/2016	Interupted	6.01	217	7.13	1,169	4.73	13.9
SDAQ4-SW-L-007	11/7/2016	Interupted	6.56	210	7.94	1,243	6.08	12.3
SDAQ4-SW-L-009	11/14/2016	Interupted	5.17	237	8.30	1,373	5.97	16.7
SDAQ4-SW-L-010	11/23/2016	Interupted	8.84	167	9.12	1,456	1.40	17.4
SDAQ4-SW-L-011	12/1/2016	Interupted	6.82	237	8.48	996	0.80	76.3
SDAQ4-SW-L-012	12/7/2016	Interupted	7.07	191	3.11	49	-0.02	248
SDAQ4-SW-L-018	2/14/2017	Interupted	6.44	324	11.71	1,500	0.05	NA
SDAQ4	2/21/2017	Interupted	6.01	312	8.68	1,441	1.36	NA
SDAQ4-SW-L-21	3/21/2017	Interupted	5.52	193	9.89	731	3.41	15.9
	Operation	Minimum	5.43	144	5.76	160	-2.53	15.7
		Maximum	9.32	234	29.53	1,472	8.31	213
		Mean	7.48	190	10.15	1,113	2.78	73.7
	Interupted	Minimum	5.17	167	3.11	49	-0.02	12.3
		Maximum	8.84	324	11.71	1,500	6.08	248
		Mean	6.49	232	8.26	1,106	2.64	57.2
SDAQ5-SW-L-001	10/19/2016	Pre-operation	5.61	230	7.37	400	4.06	0.1
SDAQ5-SW-L-002	10/27/2016	Operation	8.85	163	7.22	230	6.38	9.7
SDAQ5-SW-L-003	10/28/2016	Operation	8.56	185	7.35	198	5.28	10.5
SDAQ5-SW-L-005	11/2/2016	Operation	8.04	205	8.56	191	2.25	5.2
SDAQ5-SW-L-006	11/4/2016	Operation	7.55	207	8.92	116	2.40	2.0
SDAQ5-SW-L-008	11/10/2016	Operation	9.09	161	9.31	99	3.09	7.4
SDAQ5	11/17/2016	Operation	7.65	260	9.59	102	0.86	7.4
SDAQ5-SW-L-013	12/22/2016	Operation	6.58	193	25.10	44	-2.52	NA
SDAQ5-SW-L-017	1/31/2017	Operation	6.91	158	7.08	628	0.75	NA
SDAQ5-SW-L-019	2/27/2017	Operation	8.10	186	9.23	168	0.24	NA
SDAQ5	3/4/2017	Operation	6.70	186	9.27	152	0.93	NA
SDAQ5-SW-L-020	3/9/2017	Operation	9.47	198	10.51	123	0.39	0.0
SDAQ5	3/16/2017	Operation	5.45	209	10.28	223	1.71	2.1
SDAQ5-SW-L-004	10/31/2016	Interupted	6.40	206	7.03	250	4.12	11.0

TABLE 5-1
FIELD PARAMETERS

Sample Name	Date	Status	pH	ORP (mV)	DO (mg/L)	SC (µS/cm)	Temp (°C)	Tubidity (NTU)
SDAQ5-SW-L-007	11/7/2016	Interupted	6.89	189	9.04	100	2.91	3.9
SDAQ5-SW-L-009	11/14/2016	Interupted	5.38	233	8.86	133	4.09	7.3
SDAQ5-SW-L-010	11/23/2016	Interupted	8.89	157	8.78	242	0.73	7.3
SDAQ5-SW-L-011	12/1/2016	Interupted	7.18	188	9.07	176	0.03	8.2
SDAQ5-SW-L-012	12/7/2016	Interupted	7.34	192	3.28	24	-0.02	40.3
SDAQ5-SW-L-018	2/14/2017	Interupted	6.30	354	5.58	90	0.06	NA
SDAQ5	2/21/2017	Interupted	6.34	298	9.24	145	0.91	NA
SDAQ5-SW-L-21	3/21/2017	Interupted	5.77	187	9.90	333	2.05	3.7
	Operation	Minimum	5.45	158	7.08	44	-2.52	0.0
		Maximum	9.47	260	25.10	628	6.38	10.5
		Mean	7.75	193	10.20	190	1.81	5.5
	Interupted	Minimum	5.38	157	3.28	24	-0.02	3.7
		Maximum	8.89	354	9.90	333	4.12	40.3
		Mean	6.72	223	7.86	166	1.65	11.7
SDAQ6-SW-L-001	10/19/2016	Pre-operation	5.58	238	7.65	154	4.18	0.2
SDAQ6-SW-L-002	10/27/2016	Operation	8.69	177	7.10	151	8.10	15.9
SDAQ6-SW-L-003	10/28/2016	Operation	8.55	182	7.47	153	5.82	9.1
SDAQ6-SW-L-005	11/2/2016	Operation	8.06	200	8.98	138	1.70	6.2
SDAQ6-SW-L-006	11/4/2016	Operation	7.75	197	8.98	157	2.49	4.2
SDAQ6-SW-L-008	11/10/2016	Operation	8.64	178	8.82	167	5.24	9.2
SDAQ6	11/17/2016	Operation	7.77	158	9.94	168	0.51	7.4
SDAQ6-SW-L-013	12/22/2016	Operation	6.93	195	22.85	139	-2.32	NA
SDAQ6-SW-L-017	1/31/2017	Operation	6.70	176	9.88	227	0.00	NA
SDAQ6-SW-L-19	2/27/2017	Operation	7.82	210	4.06	200	0.03	NA
SDAQ6	3/4/2017	Operation	7.52	261	10.15	224	0.19	NA
SDAQ6-SW-L-020	3/9/2017	Operation	6.63	256	7.15	205	0.13	0.5
SDAQ6	3/16/2017	Operation	5.62	215	10.22	198	3.09	7.1
SDAQ6-SW-L-004	10/31/2016	Interupted	6.47	207	7.50	162	4.70	10.8
SDAQ6-SW-L-007	11/7/2016	Interupted	6.81	199	8.64	154	4.75	13.8
SDAQ6-SW-L-009	11/14/2016	Interupted	6.02	257	8.90	158	5.18	9.0
SDAQ6-SW-L-010	11/23/2016	Interupted	7.09	162	9.30	164	0.02	12.0
SDAQ6-SW-L-011	12/1/2016	Interupted	6.90	207	9.14	127	0.03	8.2
SDAQ6-SW-L-012	12/7/2016	Interupted	7.68	168	4.66	95	-0.01	12.4
SDAQ6-SW-L-014	12/29/2016	Interupted	7.96	150	3.66	238	0.18	NA
SDAQ6-SW-L-018	2/14/2017	Interupted	6.63	310	11.97	233	0.03	NA
SDAQ6	2/21/2017	Interupted	6.65	296	9.58	242	0.88	NA
SDAQ6-SW-L-021	3/21/2017	Interupted	7.74	191	19.40	171	3.01	NA
	Operation	Minimum	5.62	158	4.06	138	-2.32	0.5
		Maximum	8.69	261	22.85	227	8.10	15.9
		Mean	7.56	200	9.63	177	2.08	7.5
	Interupted	Minimum	6.02	150	3.66	95	-0.01	8.2
		Maximum	7.96	310	19.40	242	5.18	13.8
		Mean	7.00	215	9.28	174	1.88	11.0
SDAQ7-SW-L-001	10/19/2016	Pre-operation	6.11	228	7.97	152	3.92	0.1
SDAQ7-SW-L-002	10/27/2016	Operation	8.64	182	7.26	157	7.54	13.7
SDAQ7-SW-L-003	10/28/2016	Operation	8.50	188	7.47	157	6.35	9.2

TABLE 5-1
FIELD PARAMETERS

Sample Name	Date	Status	pH	ORP (mV)	DO (mg/L)	SC (µS/cm)	Temp (°C)	Tubidity (NTU)
SDAQ7-SW-L-005	11/2/2016	Operation	7.76	220	9.17	138	2.07	6.7
SDAQ7-SW-L-006	11/4/2016	Operation	7.97	174	9.55	160	1.61	4.1
SDAQ7-SW-L-008	11/10/2016	Operation	8.61	179	9.60	169	3.43	8.7
SDAQ7	11/17/2016	Operation	7.60	169	10.27	167	0.61	7.4
SDAQ7-SW-L-019	2/27/2017	Operation	7.77	208	9.70	220	0.04	NA
SDAQ7	3/4/2017	Operation	8.07	237	10.32	217	0.27	NA
SDAQ7-SW-L-020	3/9/2017	Operation	6.44	267	4.24	170	0.15	1.1
SDAQ7	3/16/2017	Operation	5.62	217	11.31	184	1.57	11.0
SDAQ7-SW-L-004	10/31/2016	Interupted	6.43	212	7.67	161	4.87	18.8
SDAQ7-SW-L-007	11/7/2016	Interupted	6.89	202	9.39	157	2.73	3.5
SDAQ7-SW-L-009	11/14/2016	Interupted	6.04	270	8.90	166	4.56	7.0
SDAQ7-SW-L-010	11/23/2016	Interupted	7.64	148	9.84	173	0.36	8.0
SDAQ7-SW-L-011	12/1/2016	Interupted	7.46	173	9.47	130	0.03	6.1
SDAQ7-SW-L-012	12/7/2016	Interupted	8.41	100	6.15	183	0.00	14.0
SDAQ7-SW-L-018	2/14/2017	Interupted	7.44	269	12.63	224	0.03	NA
SDAQ7	2/21/2017	Interupted	7.80	247	9.73	235	0.81	NA
SDAQ7-SW-L-021	3/21/2017	Interupted	7.05	226	16.01	161	1.24	NA
	Operation	Minimum	5.62	169	4.24	138	0.04	1.1
		Maximum	8.64	267	11.31	220	7.54	13.7
		Mean	7.70	204	8.89	174	2.36	7.7
	Interupted	Minimum	6.04	100	6.15	130	0.00	3.5
		Maximum	8.41	270	16.01	235	4.87	18.8
		Mean	7.24	205	9.98	177	1.63	9.6
SDAQ8-SW-L-001	10/19/2016	Pre-operation	6.16	222	7.76	147	4.07	0.0
SDAQ8-SW-L-002	10/27/2016	Operation	8.57	180	7.84	143	7.13	9.3
SDAQ8-SW-L-003	10/28/2016	Operation	8.38	190	7.52	143	6.21	9.2
SDAQ8-SW-L-005	11/2/2016	Operation	7.82	209	8.98	130	2.28	7.7
SDAQ8-SW-L-006	11/4/2016	Operation	7.65	176	9.50	141	2.42	2.5
SDAQ8-SW-L-008	11/10/2016	Operation	8.50	181	9.49	154	3.26	9.5
SDAQ8	11/17/2016	Operation	7.64	170	9.95	106	0.88	7.6
SDAQ8-SW-L-004	10/31/2016	Interupted	6.52	207	7.70	134	4.93	13.2
SDAQ8-SW-L-007	11/7/2016	Interupted	6.95	196	9.21	144	2.96	4.8
SDAQ8-SW-L-009	11/14/2016	Interupted	6.19	270	8.94	152	4.80	7.3
SDAQ8-SW-L-010	11/23/2016	Interupted	7.53	150	9.72	162	0.85	7.7
SDAQ8-SW-L-011	12/1/2016	Interupted	7.92	156	10.20	145	0.16	5.4
SDAQ8-SW-L-21	3/21/2017	Interupted	6.88	185	8.93	769	4.48	NA
	Operation	Minimum	7.64	170	7.52	106	0.88	2.5
		Maximum	8.57	209	9.95	154	7.13	9.5
		Mean	8.09	184	8.88	136	3.70	7.6
	Interupted	Minimum	6.19	150	7.70	134	0.16	4.8
		Maximum	7.92	270	10.20	769	4.93	13.2
		Mean	7.00	194	9.12	251	3.03	7.7

Notes: NA = Not analyzed
Mean = Arithmetic mean

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	Adit	2,250	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-002	10/27/2016	Adit	2,650	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-003	10/28/2016	Adit	2,660	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-004	10/31/2016	Adit	2,540	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-005	11/2/2016	Adit	2,810	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-006	11/4/2016	Adit	2,960	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-007	11/7/2016	Adit	2,560	<5 U	4.18 J	<50 U	<25 U
SDAQ1-SW-L-008	11/10/2016	Adit	2,540	<5 U	3.07 J	<50 U	<25 U
SDAQ1-SW-L-009	11/14/2016	Adit	2,550	<5 U	2.88 J	<50 U	<25 U
SDAQ1-SW-L-010	11/23/2016	Adit	2,470	<25 U	<50 U	<250 U	<25 U
SDAQ1-SW-L-011	12/1/2016	Adit	2,280	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-012	12/7/2016	Adit	2,130	<10 U	<20 U	<100 U	<50 U
SDAQ1-SW-L-013	12/22/2016	Adit	2,050	<5 U	2.79 J	<50 U	<25 U
SDAQ1-SW-L-014	12/29/2016	Adit	1,890	<5 U	3.05 J	<50 U	<25 U
SDAQ1-SW-L-015	1/5/2017	Adit	1,770	<5 U	3.08 J	<50 U	<25 U
SDAQ1-SW-L-016	1/16/2017	Adit	1,610	<5 U	3.52 J	<50 U	<25 U
SDAQ1-SW-L-017	1/31/2017	Adit	1,560	<5 U	2.82 J	<50 U	<25 U
SDAQ1-SW-L-018	2/14/2017	Adit	NA	<5 U	<10 U	<50 U	<25 U
CCSD-AD-L-099	2/27/2017	Adit	NA	<5 U	<10 U	<50 U	<25 U
SDAQ1-SW-L-020	3/9/2017	Adit	1,500	<5 U	4.28 J	<50 U	<25 U
CCSD-AD-L-100	3/21/2017	Adit	1,270	<10 U	<20 U	<100 U	<50 U
	Pretreatment	Minimum	1,270	NC	2.79	NC	NC
		Maximum	2,960	NC	<50	NC	NC
		Mean	2,213	NC	3.30	NC	NC
SDAQ2-SW-L-001	10/19/2016	Pre-operation	2,200	<10 U	<20 U	<100 U	<50 U
SDAQ2-SW-L-002	10/27/2016	Operation	<500 U	<10 U	<20 U	<100 U	<50 U
SDAQ2-SW-L-003	10/28/2016	Operation	21 J	<10 U	<20 U	<100 U	<5 U
SDAQ2-SW-L-005	11/2/2016	Operation	75	<10 U	<20 U	<100 U	<5 U
SDAQ2-SW-L-006	11/4/2016	Operation	62	<10 U	<20 U	<100 U	<5 U
SDAQ2-SW-L-008	11/10/2016	Operation	662	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-013	12/22/2016	Operation	240 J	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-016	1/16/2017	Operation	146 J	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-017	1/31/2017	Operation	149 J	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-019	2/27/2017	Operation	NA	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-020	3/9/2017	Operation	265	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-004	10/31/2016	Interupted	856	<10 U	<20 U	<100 U	<50 U

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-007	11/7/2016	Interupted	207 J	<10 U	<20 U	<100 U	<50 U
SDAQ2-SW-L-009	11/14/2016	Interupted	231 J	<5 U	2.71 J	<50 U	<25 U
SDAQ2-SW-L-010	11/23/2016	Interupted	1,210	<25 U	<50 U	<250 U	<25 U
SDAQ2-SW-L-011	12/1/2016	Interupted	2,060	<10 U	<20 U	<100 U	<50 U
SDAQ2-SW-L-012	12/7/2016	Interupted	235 J	<10 U	<20 U	<100 U	<50 U
SDAQ2-SW-L-014	12/29/2016	Interupted	146 J	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-015	1/5/2017	Interupted	228 J	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-018	2/14/2017	Interupted	NA	<5 U	<10 U	<50 U	<25 U
SDAQ2-SW-L-021	3/21/2017	Interupted	1,090	<10 U	<20 U	<100 U	<50 U
	Operation	Minimum	21	NC	NC	NC	NC
		Maximum	662	NC	NC	NC	NC
		Mean	202	NC	NC	NC	NC
	Interupted	Minimum	146	NC	NC	NC	NC
		Maximum	2,060	NC	NC	NC	NC
		Mean	696	NC	NC	NC	NC
SDAQ3-SW-L-001	10/19/2016	Pre-operation	1,100	<1 U	1.04 J	16.3	<5 U
SDAQ3-SW-L-002	10/27/2016	Operation	110	<10 U	<20 U	<100 U	<5 U
SDAQ3-SW-L-003	10/28/2016	Operation	405	<10 U	<20 U	<100 U	<5 U
SDAQ3-SW-L-005	11/2/2016	Operation	66	<5 U	<10 U	<50 U	<5 U
SDAQ3-SW-L-005	11/2/2016	Operation	71	<1 U	<2 U	15	<5 U
SDAQ3-SW-L-006	11/4/2016	Operation	275	<10 U	<20 U	<100 U	<5 U
SDAQ3-SW-L-008	11/10/2016	Operation	268	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-013	12/22/2016	Operation	107 J	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-016	1/16/2017	Operation	318	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-017	1/31/2017	Operation	103 J	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-019	2/27/2017	Operation	148 J	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-020	3/9/2017	Operation	<250 U	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-004	10/31/2016	Interupted	351	<5 U	<10 U	<50 U	<5 U
SDAQ3-SW-L-007	11/7/2016	Interupted	<250 U	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-009	11/14/2016	Interupted	274	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-010	11/23/2016	Interupted	1,900	<25 U	<50 U	<250 U	<25 U
SDAQ3-SW-L-011	12/1/2016	Interupted	1,580	<10 U	<20 U	<100 U	<50 U
SDAQ3-SW-L-012	12/7/2016	Interupted	953	<10 U	<20 U	<100 U	<50 U
SDAQ3-SW-L-018	2/14/2017	Interupted	350	<5 U	<10 U	<50 U	<25 U
SDAQ3-SW-L-021	3/21/2017	Interupted	402 J	<10 U	<20 U	<100 U	<50 U
	Operation	Minimum	66	NC	NC	NC	NC

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
		Maximum	405	NC	NC	NC	NC
		Mean	187	NC	NC	NC	NC
	Interupted	Minimum	<250	NC	NC	NC	NC
		Maximum	1,900	NC	NC	NC	NC
		Mean	830	NC	NC	NC	NC
SDAQ4-SW-L-001	10/19/2016	Pre-operation	901	<1 U	0.719 J	14.1	<5 U
SDAQ4B-SW-L-001	10/19/2016	Pre-operation	1,970	<1 U	0.568 J	13.6	<5 U
SDAQ4-SW-L-002	10/27/2016	Operation	303	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-003	10/28/2016	Operation	77	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-005	11/2/2016	Operation	364	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-006	11/4/2016	Operation	480	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-008	11/10/2016	Operation	<250 U	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-013	12/22/2016	Operation	69	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-017	1/31/2017	Operation	193 J	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-019	2/27/2017	Operation	51	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-020	3/9/2017	Operation	74	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-004	10/31/2016	Interupted	112	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-007	11/7/2016	Interupted	180 J	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-009	11/14/2016	Interupted	330	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-010	11/23/2016	Interupted	1,070	<25 U	<50 U	<250 U	<5 U
SDAQ4-SW-L-011	12/1/2016	Interupted	515	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-012	12/7/2016	Interupted	929	<5 U	<10 U	<50 U	<25 U
SDAQ4-SW-L-018	2/14/2017	Interupted	190	<5 U	<10 U	<50 U	<5 U
SDAQ4-SW-L-021	3/21/2017	Interupted	292	<5 U	<10 U	<50 U	<25 U
	Pre-operation	Mean	1,436	NC	0.64	13.9	NC
	Operation	Minimum	51	NC	NC	NC	NC
		Maximum	480	NC	NC	NC	NC
		Mean	201	NC	NC	NC	NC
	Interupted	Minimum	112	NC	NC	NC	NC
		Maximum	1,070	NC	NC	NC	NC
		Mean	452	NC	NC	NC	NC
SDAQ5-SW-L-001	10/19/2016	Pre-operation	107	<1 U	<2 U	14.6	<5 U
SDAQ5-SW-L-002	10/27/2016	Operation	256	<1 U	<2 U	15.1	<5 U
SDAQ5-SW-L-003	10/28/2016	Operation	82	<1 U	<2 U	15.2	<5 U
SDAQ5-SW-L-006	11/4/2016	Operation	<50 U	<1 U	<2 U	14.4	<5 U
SDAQ5-SW-L-008	11/10/2016	Operation	26 J	<1 U	<2 U	16.7	<5 U

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ5-SW-L-013	12/22/2016	Operation	29 J	<1 U	<2 U	15.2	<5 U
SDAQ5-SW-L-017	1/31/2017	Operation	90	<1 U	<2 U	14.4	<5 U
SDAQ5-SW-L-019	2/27/2017	Operation	119	<1 U	0.508 J	14.5	<5 U
SDAQ5-SW-L-020	3/9/2017	Operation	35 J	<1 U	<2 U	16.8	<5 U
SDAQ5-SW-L-004	10/31/2016	Interupted	75	<1 U	<2 U	14.8	<5 U
SDAQ5-SW-L-007	11/7/2016	Interupted	25 J	<1 U	<2 U	16.1	<5 U
SDAQ5-SW-L-009	11/14/2016	Interupted	32 J	<1 U	<2 U	16.4	<5 U
SDAQ5-SW-L-010	11/23/2016	Interupted	204	<1 U	<2 U	15.2	<5 U
SDAQ5-SW-L-011	12/1/2016	Interupted	26 J	<1 U	<2 U	15.1	<5 U
SDAQ5-SW-L-012	12/7/2016	Interupted	36 J	<1 U	<2 U	14.9	<5 U
SDAQ5-SW-L-018	2/14/2017	Interupted	<50 U	<1 U	<2 U	17.8	<5 U
SDAQ5-SW-L-021	3/21/2017	Interupted	28 J	<1 U	<2 U	15.4	<5 U
	Operation	Minimum	26	NC	NC	14	NC
		Maximum	256	NC	NC	17	NC
		Mean	91	NC	NC	15	NC
	Interupted	Minimum	25	NC	NC	15	NC
		Maximum	204	NC	NC	18	NC
		Mean	61	NC	NC	16	NC
SDAQ6-SW-L-001	10/19/2016	Pre-operation	47 J	<1 U	<2 U	20.6	<5 U
SDAQ6-SW-L-002	10/27/2016	Operation	41 J	<1 U	<2 U	20.8	<5 U
SDAQ6-SW-L-003	10/28/2016	Operation	35 J	<1 U	<2 U	21.9	<5 U
SDAQ6-SW-L-006	11/4/2016	Operation	21 J	<1 U	<2 U	18.5	<5 U
SDAQ6-SW-L-005	11/2/2016	Operation	33 J	<1 U	<2 U	21.1	<5 U
SDAQ6-SW-L-008	11/10/2016	Operation	<50 U	<1 U	<2 U	22.1	<5 U
SDAQ6-SW-L-013	12/22/2016	Operation	22 J	<1 U	<2 U	22.8	<5 U
SDAQ6-SW-L-017	1/31/2017	Operation	<50 U	<1 U	<2 U	23.3	<5 U
SDAQ6-SW-L-019	2/27/2017	Operation	<50 U	<1 U	<2 U	24.9	<5 U
SDAQ6-SW-L-020	3/9/2017	Operation	21 J	<1 U	<2 U	23.9	<5 U
SDAQ6-SW-L-004	10/31/2016	Interupted	57	<1 U	<2 U	20.3	<5 U
SDAQ6-SW-L-007	11/7/2016	Interupted	31 J	<1 U	<2 U	22.2	<5 U
SDAQ6-SW-L-009	11/14/2016	Interupted	28 J	<1 U	<2 U	21.1	<5 U
SDAQ6-SW-L-010	11/23/2016	Interupted	68	<1 U	<2 U	21.5	<5 U
SDAQ6-SW-L-011	12/1/2016	Interupted	27 J	<1 U	<2 U	22	<5 U
SDAQ6-SW-L-012	12/7/2016	Interupted	24 J	<1 U	<2 U	22.2	<5 U
SDAQ6-SW-L-014	12/29/2016	Interupted	<50 U	<1 U	<2 U	22.3	<5 U
SDAQ6-SW-L-018	2/14/2017	Interupted	<50 U	<1 U	<2 U	25.7	<5 U

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ6-SW-L-021	3/21/2017	Interupted	<50 U	<1 U	<2 U	20	<5 U
	Operation	Minimum	21	NC	NC	18.5	NC
		Maximum	<50	NC	NC	24.9	NC
		Mean	29	NC	NC	22.1	NC
	Interupted	Minimum	24	NC	NC	20.0	NC
		Maximum	68	NC	NC	25.7	NC
		Mean	39	NC	NC	21.9	NC
SDAQ7-SW-L-001	10/19/2016	Pre-operation	27 J	<1 U	<2 U	20.3	<5 U
SDAQ7-SW-L-002	10/27/2016	Operation	30 J	<1 U	<2 U	21.1	<5 U
SDAQ7-SW-L-003	10/28/2016	Operation	22 J	<1 U	<2 U	22.4	<5 U
SDAQ7-SW-L-005	11/2/2016	Operation	25 J	<1 U	<2 U	20.9	<5 U
SDAQ7-SW-L-006	11/4/2016	Operation	<50 U	<1 U	<2 U	20.2	<5 U
SDAQ7-SW-L-008	11/10/2016	Operation	<50 U	<1 U	<2 U	28.2	<5 U
SDAQ7-SW-L-019	2/27/2017	Operation	<50 U	<1 U	<2 U	26.9	<5 U
SDAQ7-SW-L-020	3/9/2017	Operation	<50 U	<1 U	<2 U	27.6	<5 U
SDAQ7-SW-L-004	10/31/2016	Interupted	38 J	<1 U	<2 U	47.2	<5 U
SDAQ7-SW-L-007	11/7/2016	Interupted	23 J	<1 U	<2 U	21.7	<5 U
SDAQ7-SW-L-009	11/14/2016	Interupted	25 J	<1 U	<2 U	23	<5 U
SDAQ7-SW-L-010	11/23/2016	Interupted	39 J	<1 U	<2 U	22.6	<5 U
SDAQ7-SW-L-011	12/1/2016	Interupted	28 J	<1 U	<2 U	25.4	<5 U
SDAQ7-SW-L-012	12/7/2016	Interupted	21 J	<1 U	<2 U	22.8	<5 U
SDAQ7-SW-L-018	2/14/2017	Interupted	24 J	<1 U	<2 U	27.8	<5 U
SDAQ7-SW-L-021	3/21/2017	Interupted	47 J	<1 U	<2 U	20.6	<5 U
	Operation	Minimum	22	NC	NC	20	NC
		Maximum	<50	NC	NC	28	NC
		Mean	26	NC	NC	24	NC
	Interupted	Minimum	21	NC	NC	21	NC
		Maximum	47	NC	NC	47	NC
		Mean	31	NC	NC	26	NC
SDAQ8-SW-L-001	10/19/2016	Pre-operation	<50 U	<1 U	<2 U	52.8	<5 U
SDAQ8-SW-L-002	10/27/2016	Operation	21 J	<1 U	<2 U	46.4	<5 U
SDAQ8-SW-L-003	10/28/2016	Operation	<50 U	<1 U	<2 U	47.5	<5 U
SDAQ8-SW-L-005	11/2/2016	Operation	27 J	<1 U	<2 U	42.9	<5 U
SDAQ8-SW-L-006	11/4/2016	Operation	<50 U	<1 U	<2 U	77.8	<5 U
SDAQ8-SW-L-008	11/10/2016	Operation	<50 U	<1 U	<2 U	67	<5 U
SDAQ8-SW-L-004	10/31/2016	Interupted	36 J	<1 U	<2 U	20.8	<5 U

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium	Beryllium
	Method		201	200.8	200.8	200.8	200.7
	Unit		ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ8-SW-L-007	11/7/2016	Interupted	<50 U	<1 U	<2 U	73.4	<5 U
SDAQ8-SW-L-009	11/14/2016	Interupted	<50 U	<1 U	<2 U	56.7	<5 U
SDAQ8-SW-L-010	11/23/2016	Interupted	36 J	<1 U	<2 U	60.1	<5 U
SDAQ8-SW-L-011	12/1/2016	Interupted	<50 U	<1 U	0.601 J	93.9	<5 U
SDAQ8-SW-L-021	3/21/2017	Interupted	57	<1 U	0.557 J	67.9	<5 U
	Operation	Minimum	21	NC	NC	43	NC
		Maximum	<50	NC	NC	78	NC
		Mean	24	NC	NC	56	NC
	Interupted	Minimum	36	NC	NC	21	NC
		Maximum	57	NC	NC	94	NC
		Mean	43	NC	NC	62	NC

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
	Method	200.8	201	200.8	200.8	200.8	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	737	279,000	<20 U	274	10,800	28,600	798
SDAQ1-SW-L-002	10/27/2016	812	290,000	<20 U	298	14,300	27,000	810
SDAQ1-SW-L-003	10/28/2016	782	290,000	<20 U	296	13,700	27,300	799
SDAQ1-SW-L-004	10/31/2016	796	285,000	<20 U	295	13,900	26,400	809
SDAQ1-SW-L-005	11/2/2016	836	287,000	<20 U	307	14,800	26,600	868
SDAQ1-SW-L-006	11/4/2016	832	317,000	<20 U	308	14,300	29,500	871
SDAQ1-SW-L-007	11/7/2016	874	324,000	<10 U	329	14,200	29,900	862
SDAQ1-SW-L-008	11/10/2016	886	327,000	<10 U	338	14,000	32,600	889
SDAQ1-SW-L-009	11/14/2016	872	326,000	<10 U	330	14,900	32,000	950
SDAQ1-SW-L-010	11/23/2016	741	330,000	<50 U	291	10,800	33,400	844
SDAQ1-SW-L-011	12/1/2016	833	344,000	<20 U	313	11,000	36,500	899
SDAQ1-SW-L-012	12/7/2016	805	340,000	<20 U	303	10,100	35,300	880
SDAQ1-SW-L-013	12/22/2016	771	317,000	6.83 J	294	8,850	35,100	891
SDAQ1-SW-L-014	12/29/2016	771	312,000	5.21 J	288	8,370	34,400	889
SDAQ1-SW-L-015	1/5/2017	762	321,000	5.49 J	291	7,820	34,100	872
SDAQ1-SW-L-016	1/16/2017	763	325,000	7.57 J	287	7,150	35,700	808
SDAQ1-SW-L-017	1/31/2017	754	321,000	<10 U	278	6,850	35,000	838
SDAQ1-SW-L-018	2/14/2017	730	340,000	<10 U	274	6,470	36,500	809
CCSD-AD-L-099	2/27/2017	723	347,000	<10 U	268	5,940	32,300	765
SDAQ1-SW-L-020	3/9/2017	746	329,000	9.46 J	282	6,310	36,200	878
CCSD-AD-L-100	3/21/2017	661	309,000	<20 U	243	5,820	30,800	806
	Pretreatment	661	279,000	NC	243	5,820	26,400	765
		886	347,000	NC	338	14,900	36,500	950
		785	317,143	NC	295	10,494	32,152	849
SDAQ2-SW-L-001	10/19/2016	677	281,000	<20 U	253	8,880	21,100	858
SDAQ2-SW-L-002	10/27/2016	<2 U	792,000	<20 U	1.39 J	11.9	<2,500 U	14
SDAQ2-SW-L-003	10/28/2016	2.69	981,000	<20 U	2.15	29.6	218 J	6.11
SDAQ2-SW-L-005	11/2/2016	13.1	825,000	<20 U	4.43	80.7	484	4.49
SDAQ2-SW-L-006	11/4/2016	5.44	748,000	<20 U	1.6 J	23.8	204 J	1.13 J
SDAQ2-SW-L-008	11/10/2016	112	979,000	<10 U	36.2	1,810	4,390	47.8
SDAQ2-SW-L-013	12/22/2016	29.2	681,000	<10 U	10.9	330	1,440	20.3
SDAQ2-SW-L-016	1/16/2017	81.6	556,000	<10 U	13.1	93.1	<1,250 U	11.8
SDAQ2-SW-L-017	1/31/2017	5.98	679,000	<10 U	3.14	54.6	<1,250 U	5.41
SDAQ2-SW-L-019	2/27/2017	6.34	753,000	<10 U	3.4	60.6	<1,250 U	5.73
SDAQ2-SW-L-020	3/9/2017	55.6	605,000	<10 U	20.1	473	3,040	33.7
SDAQ2-SW-L-004	10/31/2016	735	318,000	<20 U	275	9,260	16,200	271

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium		Cobalt	Copper	Iron		Lead	
	Method	200.8	201	200.8		200.8	200.8	200.7		200.8	
	Unit	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L		ug/L	
SDAQ2-SW-L-007	11/7/2016	935	342,000	<20	U	341	1,200	1,560	J	32.3	
SDAQ2-SW-L-009	11/14/2016	836	388,000	<10	U	313	1,960	2,940		51.6	
SDAQ2-SW-L-010	11/23/2016	286	654,000	<50	U	92.4	4,200	11,300		83.4	
SDAQ2-SW-L-011	12/1/2016	800	336,000	<20	U	298	10,000	30,100		804	
SDAQ2-SW-L-012	12/7/2016	701	416,000	<20	U	269	1,230	5,650		13.9	
SDAQ2-SW-L-014	12/29/2016	241	530,000	<10	U	85.2	20.2	<1,250	U	0.52	J
SDAQ2-SW-L-015	1/5/2017	333	425,000	<10	U	108	432	2,070		49.5	
SDAQ2-SW-L-018	2/14/2017	91.6	544,000	<10	U	21.2	300	3,730		47.1	
SDAQ2-SW-L-021	3/21/2017	397	431,000	<20	U	140	4,030	19,200		229	
	Operation	<2	556,000	NC		1.4	12	204		1.1	
		112	981,000	NC		36	1,810	4,390		48	
		35	759,900	NC		10	297	1,629		15	
	Interupted	92	318,000	NC		21	20	<1,250		0.5	
		935	654,000	NC		341	10,000	30,100		804	
		536	438,400	NC		194	3,263	10,306		158	
SDAQ3-SW-L-001	10/19/2016	261	117,000	<2	U	85.3	3,480	2,240		405	
SDAQ3-SW-L-002	10/27/2016	71.4	295,000	<20	U	17.3	131	<250	U	25	
SDAQ3-SW-L-003	10/28/2016	71.6	290,000	<20	U	20.9	651	383		134	
SDAQ3-SW-L-005	11/2/2016	73.8	266,000	<10	U	16	71.7	166	J	6.29	
SDAQ3-SW-L-005	11/2/2016	21	24,100	<2	U	0.652	168	<250	U	3.78	
SDAQ3-SW-L-006	11/4/2016	108	313,000	<20	U	27.2	800	1,540		52	
SDAQ3-SW-L-008	11/10/2016	42.2	413,000	<10	U	13.5	617	1,280		39.1	
SDAQ3-SW-L-013	12/22/2016	199	293,000	<10	U	46.5	84.2	<1,250	U	10.1	
SDAQ3-SW-L-016	1/16/2017	359	253,000	<10	U	124	2,100	5,990		137	
SDAQ3-SW-L-017	1/31/2017	37	377,000	<10	U	7.56	118	<1,250	U	15.5	
SDAQ3-SW-L-019	2/27/2017	16.9	375,000	<10	U	5.84	154	979	J	23.2	
SDAQ3-SW-L-020	3/9/2017	15.4	375,000	<10	U	2.99	12.3	<1,250	U	1.86	
SDAQ3-SW-L-004	10/31/2016	248	160,000	<10	U	86.2	2,030	2,060		103	
SDAQ3-SW-L-007	11/7/2016	347	194,000	<10	U	126	1,700	1,770		34.1	
SDAQ3-SW-L-009	11/14/2016	378	201,000	<10	U	135	4,380	6,570		209	
SDAQ3-SW-L-010	11/23/2016	409	256,000	<50	U	144	6,010	13,500		426	
SDAQ3-SW-L-011	12/1/2016	457	224,000	<20	U	164	6,020	5,460		626	
SDAQ3-SW-L-012	12/7/2016	425	206,000	<20	U	151	5,410	6,550		574	
SDAQ3-SW-L-018	2/14/2017	178	331,000	<10	U	58.9	680	2,980		107	
SDAQ3-SW-L-021	3/21/2017	99.2	132,000	<20	U	26.6	755	1,950	J	123	
	Operation	15	24,100	NC		0.7	12	166		1.9	

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
	Method	200.8	201	200.8	200.8	200.8	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
		359	413,000	NC	124	2,100	5,990	137
		92	297,645	NC	26	446	1,723	41
	Interupted	99	132,000	NC	27	680	1,770	34
		457	331,000	NC	164	6,020	13,500	626
		318	213,000	NC	111	3,373	5,105	275
SDAQ4-SW-L-001	10/19/2016	184	117,000	<2 U	46.3	2,410	740	218
SDAQ4B-SW-L-001	10/19/2016	163	109,000	<2 U	1.38	2,070	<250 U	53
SDAQ4-SW-L-002	10/27/2016	106	213,000	<10 U	16.8	530	168 J	59
SDAQ4-SW-L-003	10/28/2016	96.3	216,000	<10 U	15.3	265	<250 U	10.2
SDAQ4-SW-L-005	11/2/2016	164	204,000	<10 U	31	850	1,270	56.9
SDAQ4-SW-L-006	11/4/2016	178	206,000	<10 U	38.6	1,250	1,950	75.4
SDAQ4-SW-L-008	11/10/2016	81	255,000	<10 U	14.7	25.9	<1,250 U	1.91
SDAQ4-SW-L-013	12/22/2016	223	207,000	<10 U	43.9	56.6	<250 U	4.62
SDAQ4-SW-L-017	1/31/2017	119	241,000	<10 U	22.5	335	773 J	32.7
SDAQ4-SW-L-019	2/27/2017	36.4	241,000	<10 U	7.66	24.6	102 J	2.97
SDAQ4-SW-L-020	3/9/2017	124	226,000	<10 U	19.9	75.7	239 J	9.78
SDAQ4-SW-L-004	10/31/2016	172	145,000	<10 U	46.9	1,220	424	24.9
SDAQ4-SW-L-007	11/7/2016	227	165,000	<10 U	64.9	2,240	1,650	76.8
SDAQ4-SW-L-009	11/14/2016	251	173,000	<10 U	69.9	2,830	3,000	152
SDAQ4-SW-L-010	11/23/2016	242	180,000	<50 U	69.2	2,230	3,750	201
SDAQ4-SW-L-011	12/1/2016	262.0	165,000	<10 U	68.60	3,070	1290	158.0
SDAQ4-SW-L-012	12/7/2016	275	171,000	<10 U	73.3	3,280	2,300	237
SDAQ4-SW-L-018	2/14/2017	114	250,000	<10 U	22	299	994	31.8
SDAQ4-SW-L-021	3/21/2017	62.6	94,700	<10 U	16.9	426	2,680	61.1
	Pre-operation	174	113,000	NC	24	2,240	NC	136
	Operation	36.4	204,000	NC	7.7	25	102	1.9
		223	255,000	NC	44	1,250	1,950	75
		125	223,222	NC	23	379	750	28
	Interupted	63	94,700	NC	17	299	424	25
		275	250,000	NC	73	3,280	3,750	237
		201	167,963	NC	54	1,949	2,011	118
SDAQ5-SW-L-001	10/19/2016	50.5	40,300	<2 U	0.482	536	<250 U	11.1
SDAQ5-SW-L-002	10/27/2016	46.8	37,600	<2 U	0.493	528	<250 U	13.6
SDAQ5-SW-L-003	10/28/2016	48.1	41,000	<2 U	0.652	496	<250 U	10.6
SDAQ5-SW-L-006	11/4/2016	7.92	14,000	<2 U	0.969	11.9	<250 U	0.301
SDAQ5-SW-L-008	11/10/2016	2.95	10,300	<2 U	<0.2 U	32.7	<250 U	1.9

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
	Method	200.8	201	200.8	200.8	200.8	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ5-SW-L-013	12/22/2016	41.2	37,700	1.35 J	0.412	479	<250 U	11.6
SDAQ5-SW-L-017	1/31/2017	66.5	58,300	1.08 J	0.624	887	<250 U	35.3
SDAQ5-SW-L-019	2/27/2017	77.2	75,900	<2 U	0.694	1,080	<250 U	51.6
SDAQ5-SW-L-020	3/9/2017	24.4	30,300	1.92 J	0.245	252	<250 U	9.59
SDAQ5-SW-L-004	10/31/2016	20.2	21,900	<2 U	0.254	189	<250 U	4.21
SDAQ5-SW-L-007	11/7/2016	2.87	10,100	<2 U	<0.2 U	31.9	<250 U	1.76
SDAQ5-SW-L-009	11/14/2016	9.24	14,300	<2 U	1.69	75.1	<250 U	3.43
SDAQ5-SW-L-010	11/23/2016	20.2	22,200	<2 U	0.233	245	<250 U	8.97
SDAQ5-SW-L-011	12/1/2016	3.68	12,700	<2 U	<0.2 U	36.7	<250 U	2.07
SDAQ5-SW-L-012	12/7/2016	38.4	38,500	<2 U	0.37	429	<250 U	9.36
SDAQ5-SW-L-018	2/14/2017	1.87	11,500	1.53 J	<0.2 U	19.8	<250 U	1.94
SDAQ5-SW-L-021	3/21/2017	26.2	36,000	<2 U	0.428	269	<250 U	5.99
	Operation	3.0	10,300	NC	<0.2	12	NC	0.3
		77	75,900	NC	0.97	1,080	NC	52
		39	38,138	NC	0.58	471	NC	17
	Interupted	1.9	10,100	NC	<0.2	20	NC	1.8
		38	38,500	NC	1.69	429	NC	9.4
		15	20,900	NC	0.60	162	NC	4.7
SDAQ6-SW-L-001	10/19/2016	6.08	16,900	<2 U	0.108 J	41.8	<250 U	2.04
SDAQ6-SW-L-002	10/27/2016	5.04	17,700	<2 U	0.127 J	33.9	<250 U	1.8
SDAQ6-SW-L-003	10/28/2016	7.12	17,300	<2 U	0.138 J	47.5	<250 U	2.25
SDAQ6-SW-L-006	11/4/2016	5.56	16,800	<2 U	0.291	20.6	<250 U	0.953
SDAQ6-SW-L-005	11/2/2016	7.54	17,600	<2 U	0.253	40.3	<250 U	1.64
SDAQ6-SW-L-008	11/10/2016	8.04	17,400	<2 U	0.869	12.7	<250 U	0.49
SDAQ6-SW-L-013	12/22/2016	6.33	19,400	1.27 J	0.224	32.7	<250 U	0.977
SDAQ6-SW-L-017	1/31/2017	9.1	22,000	1.58 J	1.29	15.1	<250 U	1.08
SDAQ6-SW-L-019	2/27/2017	8.14	24,200	<2 U	1.03	8.14	<250 U	<0.2 U
SDAQ6-SW-L-020	3/9/2017	8.36	23,800	1.9 J	1.11	22	<250 U	2.14
SDAQ6-SW-L-004	10/31/2016	6.49	18,500	<2 U	0.262	41.7	<250 U	2.88
SDAQ6-SW-L-007	11/7/2016	6.52	16,600	<2 U	0.454	30.9	<250 U	1.04
SDAQ6-SW-L-009	11/14/2016	5.55	16,800	<2 U	0.42	30.5	<250 U	1.25
SDAQ6-SW-L-010	11/23/2016	7.14	18,100	<2 U	0.604	78.6	<250 U	10.1
SDAQ6-SW-L-011	12/1/2016	6.72	19,900	<2 U	0.232	28.8	<250 U	1.24
SDAQ6-SW-L-012	12/7/2016	6.85	20,100	<2 U	0.256	35.4	<250 U	1.01
SDAQ6-SW-L-014	12/29/2016	6.79	19,600	1.39 J	0.376	25.4	<250 U	0.569
SDAQ6-SW-L-018	2/14/2017	9.43	24,900	<2 U	1.24	14	<250 U	0.943

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
	Method	200.8	201	200.8	200.8	200.8	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ6-SW-L-021	3/21/2017	5.34	18,700	<2 U	0.217	17.9	<250 U	0.398
	Operation	5.04	16,800	NC	0.13	8.1	NC	<0.2
		9.10	24,200	NC	1.29	48	NC	2.25
		7.25	19,578	NC	0.59	26	NC	1.42
	Interupted	5.34	16,600	NC	0.22	14	NC	0.40
		9.43	24,900	NC	1.24	79	NC	10.10
		6.76	19,244	NC	0.45	34	NC	2.16
SDAQ7-SW-L-001	10/19/2016	4.61	16,300	<2 U	0.10 J	26.5	<250 U	0.953
SDAQ7-SW-L-002	10/27/2016	4.09	16,900	<2 U	0.113 J	22.2	<250 U	0.921
SDAQ7-SW-L-003	10/28/2016	4.69	17,100	<2 U	0.117 J	22.4	<250 U	0.866
SDAQ7-SW-L-005	11/2/2016	4.99	17,500	<2 U	0.159 J	22.4	<250 U	0.931
SDAQ7-SW-L-006	11/4/2016	5.21	17,400	<2 U	0.224	17.6	<250 U	0.644
SDAQ7-SW-L-008	11/10/2016	5.39	17,700	<2 U	0.45	10.8	<250 U	0.416
SDAQ7-SW-L-019	2/27/2017	6.1	23,500	1.01 J	0.522	7.32	<250 U	<0.2 U
SDAQ7-SW-L-020	3/9/2017	6.32	23,800	2.5	0.632	12.6	<250 U	0.82
SDAQ7-SW-L-004	10/31/2016	2.94	17,200	<2 U	0.15 J	17.2	<250 U	0.997
SDAQ7-SW-L-007	11/7/2016	4.85	17,100	<2 U	0.284	20.2	<250 U	0.664
SDAQ7-SW-L-009	11/14/2016	4.8	17,300	<2 U	0.308	20.6	<250 U	1.24
SDAQ7-SW-L-010	11/23/2016	5.03	18,200	<2 U	0.241	27.4	<250 U	2.93
SDAQ7-SW-L-011	12/1/2016	5.12	20,300	<2 U	0.143 J	19.5	<250 U	1.23
SDAQ7-SW-L-012	12/7/2016	5.28	19,400	<2 U	0.163 J	20	<250 U	0.461
SDAQ7-SW-L-018	2/14/2017	7.4	23,800	<2 U	0.823	26.3	<250 U	2.84
SDAQ7-SW-L-021	3/21/2017	4.28	17,700	1.58 J	0.153 J	16.6	<250 U	0.586
	Operation	4.09	16,900	NC	0.11	7.3	NC	0.42
		6.32	23,800	NC	0.63	22	NC	0.93
		5.26	19,129	NC	0.32	16	NC	0.77
	Interupted	2.94	17,100	NC	0.14	17	NC	0.46
		7.40	23,800	NC	0.82	27	NC	2.93
		4.96	18,875	NC	0.28	21	NC	1.37
SDAQ8-SW-L-001	10/19/2016	2.64	16,200	<2 U	<0.2 U	15.5	<250 U	0.486
SDAQ8-SW-L-002	10/27/2016	2.75	16,900	<2 U	0.107 J	16.1	<250 U	0.862
SDAQ8-SW-L-003	10/28/2016	3.12	16,900	<2 U	<0.2 U	15.7	<250 U	0.666
SDAQ8-SW-L-005	11/2/2016	3.65	17,400	<2 U	0.127 J	17.0	<250 U	0.712
SDAQ8-SW-L-006	11/4/2016	1.42	17,200	1.19 J	<0.2 U	6.04	<250 U	0.231
SDAQ8-SW-L-008	11/10/2016	2.76	17,100	<2 U	0.268	7.35	<250 U	0.386
SDAQ8-SW-L-004	10/31/2016	4.62	17,600	<2 U	0.189 J	27.5	<250 U	1.86

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
	Method	200.8	201	200.8	200.8	200.8	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ8-SW-L-007	11/7/2016	2.11	16,800	<2 U	0.129 J	8.41	<250 U	0.242
SDAQ8-SW-L-009	11/14/2016	3.07	17,100	<2 U	0.204	13	<250 U	0.573
SDAQ8-SW-L-010	11/23/2016	2.82	18,200	<2 U	0.239	18.6	<250 U	1.85
SDAQ8-SW-L-011	12/1/2016	0.812	19,000	1.22 J	<0.2 U	3.27	<250 U	0.183 J
SDAQ8-SW-L-021	3/21/2017	1.22	16,200	3.51	<0.2 U	5.80	<250 U	0.261
	Operation	1.42	16,900	NC	0.11	6.04	NC	0.231
		3.65	17,400	NC	0.27	17.0	NC	0.862
		2.74	17,100	NC	0.17	12.4	NC	0.571
	Interupted	0.81	16,200	NC	0.13	3.27	NC	0.183
		4.62	19,000	NC	0.24	27.5	NC	1.860
		2.44	17,483	NC	0.19	12.8	NC	0.828

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	125,000	134,000	303	5,000 J	<20 U	18,800
SDAQ1-SW-L-002	10/27/2016	134,000	143,000	335	5,090 J	<20 U	18,600
SDAQ1-SW-L-003	10/28/2016	134,000	144,000	328	5,110 J	<20 U	19,000
SDAQ1-SW-L-004	10/31/2016	131,000	144,000	326	4,820 J	<20 U	18,600
SDAQ1-SW-L-005	11/2/2016	135,000	148,000	344	4,960 J	<20 U	19,300
SDAQ1-SW-L-006	11/4/2016	148,000	159,000	344	5,940 J	<20 U	19,900
SDAQ1-SW-L-007	11/7/2016	140,000	146,000	365	4,540 J	11.3	20,600
SDAQ1-SW-L-008	11/10/2016	140,000	146,000	374	4,610 J	8.83 J	20,400
SDAQ1-SW-L-009	11/14/2016	138,000	146,000	372	4,540 J	8.89 J	20,800
SDAQ1-SW-L-010	11/23/2016	142,000	141,000	319	4,680 J	<50 U	20,300
SDAQ1-SW-L-011	12/1/2016	140,000	159,000	343	4,940 J	<20 U	20,600
SDAQ1-SW-L-012	12/7/2016	133,000	154,000	335	4,920 J	<20 U	19,800
SDAQ1-SW-L-013	12/22/2016	136,000	136,000	316	4,810 J	7.7 J	20,500
SDAQ1-SW-L-014	12/29/2016	131,000	135,000	310	4,670 J	8.22 J	19,900
SDAQ1-SW-L-015	1/5/2017	136,000	135,000	313	4,770 J	9.32 J	20,100
SDAQ1-SW-L-016	1/16/2017	136,000	135,000	309	4,810 J	8.91 J	20,100
SDAQ1-SW-L-017	1/31/2017	131,000	132,000	297	4,550 J	8.37 J	20,000
SDAQ1-SW-L-018	2/14/2017	131,000	134,000	293	4,770 J	8.31 J	20,100
CCSD-AD-L-099	2/27/2017	135,000	133,000 J	286	4,980 J	8.37 J	20,000
SDAQ1-SW-L-020	3/9/2017	132,000	128,000	304	4,830 J	9.32 J	19,600
CCSD-AD-L-100	3/21/2017	121,000	127,000	262	4,580 J	<20 U	19,800
	Pretreatment	121,000	127,000	262	4,540	7.70	18,600
		148,000	159,000	374	5,940	<50	20,800
		134,714	140,905	323	4,853	8.87	19,848
SDAQ2-SW-L-001	10/19/2016	117,000	124,000	280	4,750 J	<20 U	19,200
SDAQ2-SW-L-002	10/27/2016	<2,500 U	58	<10 U	4,880 J	<20 U	<10,000 U
SDAQ2-SW-L-003	10/28/2016	3,250	1,100	<10 U	4,290	<20 U	2,220
SDAQ2-SW-L-005	11/2/2016	59,200	3,910	<10 U	4,680	<20 U	1,250
SDAQ2-SW-L-006	11/4/2016	91,200	3,350	<10 U	4,630	<20 U	929 J
SDAQ2-SW-L-008	11/10/2016	18,800	12,800	26	4,260 J	<10 U	4,100 J
SDAQ2-SW-L-013	12/22/2016	38,800	3,820	<5 U	4,860 J	<10 U	1,660 J
SDAQ2-SW-L-016	1/16/2017	88,900	50,700	<5 U	4,720 J	<10 U	1,700 J
SDAQ2-SW-L-017	1/31/2017	20,500	870	<5 U	4,610 J	<10 U	<5,000 U
SDAQ2-SW-L-019	2/27/2017	22,400	851	<5 U	5,470	<10 U	<5,000 U
SDAQ2-SW-L-020	3/9/2017	61,100	7,000	<5 U	4,730 J	<10 U	2,160 J
SDAQ2-SW-L-004	10/31/2016	125,000	134,000	304	4,810 J	<20 U	17,000

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-007	11/7/2016	144,000	166,000	371	4,410 J	<20 U	16,400
SDAQ2-SW-L-009	11/14/2016	136,000	152,000	337	4,380 J	8.23 J	15,900
SDAQ2-SW-L-010	11/23/2016	96,800	31,000	87.8	4,570 J	<50 U	8,530
SDAQ2-SW-L-011	12/1/2016	130,000	151,000	328	4,490 J	<20 U	19,600
SDAQ2-SW-L-012	12/7/2016	130,000	149,000	280	5,040 J	<20 U	12,700
SDAQ2-SW-L-014	12/29/2016	92,000	59,600	64.8	4,640 J	<10 U	4,840 J
SDAQ2-SW-L-015	1/5/2017	140,000	115,000	59.9	4,710 J	<10 U	4,050 J
SDAQ2-SW-L-018	2/14/2017	105,000	61,700	<5 U	4,600 J	<10 U	2,050 J
SDAQ2-SW-L-021	3/21/2017	98,100	71,600	149	4,140 J	<20 U	14,500
	Operation	<2,500	58	<5	4,260	NC	929
		91,200	50,700	26	5,470	NC	<10,000
		44,906	8,446	NC	4,713	NC	2,003
	Interupted	92,000	31,000	<5	4,140	NC	2,050
		144,000	166,000	371	5,040	NC	19,600
		119,690	109,090	220	4,579	NC	11,557
SDAQ3-SW-L-001	10/19/2016	47,900	41,800	102	2,460	3.31	19,800
SDAQ3-SW-L-002	10/27/2016	14,200	11,500	15.7	2,650	<20 U	12,100
SDAQ3-SW-L-003	10/28/2016	16,500	14,000	24.4	2,700	<20 U	13,700
SDAQ3-SW-L-005	11/2/2016	39,200	23,300	9.08	2,370	<10 U	8,660
SDAQ3-SW-L-005	11/2/2016	8,110	2,170	9.67	930 J	<2 U	11,000
SDAQ3-SW-L-006	11/4/2016	54,700	34,500	21	2,660	<20 U	8,630
SDAQ3-SW-L-008	11/10/2016	33,500	7,460	10.1	2,760 J	<10 U	3,840 J
SDAQ3-SW-L-013	12/22/2016	58,300	42,000	27.8	2,950 J	<10 U	8,200
SDAQ3-SW-L-016	1/16/2017	77,700	70,000	139	3,170 J	<10 U	14,800
SDAQ3-SW-L-017	1/31/2017	53,500	19,900	<5 U	3,100 J	<10 U	3,240 J
SDAQ3-SW-L-019	2/27/2017	42,400	3,710	<5 U	3,310 J	<10 U	2,520 J
SDAQ3-SW-L-020	3/9/2017	47,000	11,000	<5 U	3,160 J	<10 U	2,890 J
SDAQ3-SW-L-004	10/31/2016	45,900	43,000 J	106	2,380	<10 U	17,400
SDAQ3-SW-L-007	11/7/2016	60,100	67,000	146	2,340 J	<10 U	17,100
SDAQ3-SW-L-009	11/14/2016	64,500	72,000	162	2,440 J	5.08 J	19,300
SDAQ3-SW-L-010	11/23/2016	70,800	64,300	165	2,680 J	<50 U	19,100
SDAQ3-SW-L-011	12/1/2016	78,500	90,000	194	3,030 J	<20 U	20,300
SDAQ3-SW-L-012	12/7/2016	72,900	82,800	178	2,840 J	<20 U	19,800
SDAQ3-SW-L-018	2/14/2017	63,800	44,500	53.7	3,340 J	<10 U	10,000
SDAQ3-SW-L-021	3/21/2017	29,900	20,700	34.2	<10,000 U	<20 U	13,000
	Operation	8,110	2,170	<5	930	NC	2,520

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
		77,700	70,000	139	3,310	NC	14,800
		40,465	21,776	32	2,705	NC	8,144
	Interupted	29,900	20,700	34	2,340	NC	10,000
		78,500	90,000	194	<10,000	NC	20,300
		60,800	60,538	130	2,721	NC	17,000
SDAQ4-SW-L-001	10/19/2016	41,700	30,400	73.8	2,270	2.28	22,000
SDAQ4B-SW-L-001	10/19/2016	37,900	13,900	66	2,300	1.79 J	25,200
SDAQ4-SW-L-002	10/27/2016	27,600	16,900	40.3	2,410	<10 U	18,200
SDAQ4-SW-L-003	10/28/2016	27,000	14,900	37.2	2,480	<10 U	17,700
SDAQ4-SW-L-005	11/2/2016	42,400	24,800	46.6	2,400	<10 U	16,600
SDAQ4-SW-L-006	11/4/2016	45,400	27,800	52.7	2,360	<10 U	16,000
SDAQ4-SW-L-008	11/10/2016	36,400	17,900	20	2,260 J	<10 U	10,200
SDAQ4-SW-L-013	12/22/2016	52,600	30,600 J	62.5	2,580	<10 U	15,500
SDAQ4-SW-L-017	1/31/2017	46,600	22,900	27.4	2,410 J	<10 U	10,000
SDAQ4-SW-L-019	2/27/2017	44,000	13,000	3.72 J	2,640	<10 U	7,280
SDAQ4-SW-L-020	3/9/2017	44,300	17,100	24.5	2,480	<10 U	11,100
SDAQ4-SW-L-004	10/31/2016	40,200	29,800	76.9	2,390	<10 U	19,700
SDAQ4-SW-L-007	11/7/2016	46,800	40,700	96.7	2,220 J	<10 U	18,400
SDAQ4-SW-L-009	11/14/2016	50,100	44,400	193	2,210 J	<10 U	19,700
SDAQ4-SW-L-010	11/23/2016	55,100	37,800	98.1	2,610	<50 U	19,300
SDAQ4-SW-L-011	12/1/2016	53,000	44,500	110.0	2,500 J	<10 U	20,700
SDAQ4-SW-L-012	12/7/2016	55,600	47,600	117	2,450 J	<10 U	20,800
SDAQ4-SW-L-018	2/14/2017	47,500	20,200	26.4	2,600	<10 U	10,600
SDAQ4-SW-L-021	3/21/2017	23,300	12,500	30.5	1,840 J	<10 U	14,100
	Pre-operation	39,800	22,150	70	2,285	2.04	23,600
	Operation	27,000	13,000	3.7	2,260	NC	7,280
		52,600	30,600	63	2,640	NC	18,200
		40,700	20,656	35	2,447	NC	13,620
	Interupted	23,300	12,500	26	1,840	NC	10,600
		55,600	47,600	193	2,610	NC	20,800
		46,450	34,688	94	2,353	NC	17,913
SDAQ5-SW-L-001	10/19/2016	14,100	4,700	21.2	1,250	<2 U	14,400
SDAQ5-SW-L-002	10/27/2016	13,400	4,500	21	1,160	<2 U	14,300
SDAQ5-SW-L-003	10/28/2016	13,900	4,820	21.3	1,240	<2 U	14,300
SDAQ5-SW-L-006	11/4/2016	4,970	808	2.44	774 J	<2 U	9,770
SDAQ5-SW-L-008	11/10/2016	3,910	228	1.24	758 J	<2 U	9,290

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ5-SW-L-013	12/22/2016	12,900	3,640	17.9	1,100	<2 U	13,100
SDAQ5-SW-L-017	1/31/2017	19,100	5,450	28.7	1,390	1.05 J	15,500
SDAQ5-SW-L-019	2/27/2017	24,000	6,360	34.1	1,720	1.66 J	17,200
SDAQ5-SW-L-020	3/9/2017	9,700	1,860	11.4	1,030	<2 U	11,800
SDAQ5-SW-L-004	10/31/2016	7,790	1,950	9.83	959 J	<2 U	11,500
SDAQ5-SW-L-007	11/7/2016	3,870	228	1.25	733 J	<2 U	9,370
SDAQ5-SW-L-009	11/14/2016	5,180	1,310	3.66	792 J	<2 U	9,780
SDAQ5-SW-L-010	11/23/2016	7,930	1,790	8.27	863 J	<2 U	10,800
SDAQ5-SW-L-011	12/1/2016	4,160	303	1.39	722 J	<2 U	9,990
SDAQ5-SW-L-012	12/7/2016	11,600	3,540	16.5	1,030	<2 U	13,200
SDAQ5-SW-L-018	2/14/2017	4,000	104	0.513 J	807 J	<2 U	10,100
SDAQ5-SW-L-021	3/21/2017	11,200	2,070	11.9	1,260	<2 U	12,500
	Operation	3,910	228	1.2	758	1.05	9,290
		24,000	6,360	34	1,720	1.66	17,200
		12,735	3,458	17	1,147	1.36	13,158
	Interupted	3,870	104	0.5	722	NC	9,370
		11,600	3,540	17	1,260	NC	13,200
		6,966	1,412	6.7	896	NC	10,905
SDAQ6-SW-L-001	10/19/2016	5,270	328	2.55	992 J	<2 U	12,700
SDAQ6-SW-L-002	10/27/2016	5,450	317	3.62	1,060	<2 U	12,500
SDAQ6-SW-L-003	10/28/2016	5,340	402	4.11	999 J	<2 U	12,500
SDAQ6-SW-L-006	11/4/2016	5,440	374	3.55	880 J	<2 U	11,400
SDAQ6-SW-L-005	11/2/2016	5,360	494	4.91	953 J	<2 U	12,000
SDAQ6-SW-L-008	11/10/2016	5,540	675	3.19	927 J	<2 U	11,600
SDAQ6-SW-L-013	12/22/2016	6,110	307	3.43	999 J	<2 U	12,600
SDAQ6-SW-L-017	1/31/2017	6,700	734	4.7	1,010	<2 U	12,600
SDAQ6-SW-L-019	2/27/2017	6,770	624	4.15	1,120	<2 U	13,700
SDAQ6-SW-L-020	3/9/2017	6,720	599	4.41	1,060	<2 U	13,100
SDAQ6-SW-L-004	10/31/2016	5,640	514	4.01	1,080	<2 U	13,000
SDAQ6-SW-L-007	11/7/2016	5,100	541	2.83	905 J	<2 U	11,700
SDAQ6-SW-L-009	11/14/2016	5,350	437	3.31	893 J	<2 U	11,500
SDAQ6-SW-L-010	11/23/2016	5,820	528	3.26	883 J	<2 U	11,600
SDAQ6-SW-L-011	12/1/2016	6,040	322	3.68	969 J	<2 U	12,400
SDAQ6-SW-L-012	12/7/2016	6,020	338	4.08	990 J	<2 U	12,400
SDAQ6-SW-L-014	12/29/2016	6,190	402	3.62	992 J	<2 U	12,600
SDAQ6-SW-L-018	2/14/2017	7,440	761	4.52	1,140	<2 U	13,600

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ6-SW-L-021	3/21/2017	5,040	295	2.60	1,040	<2 U	13,900
	Operation	5,340	307	3.19	880	NC	11,400
		6,770	734	4.91	1,120	NC	13,700
		5,937	503	4.01	1,001	NC	12,444
	Interupted	5,040	295	2.60	883	NC	11,500
		7,440	761	4.52	1,140	NC	13,900
		5,849	460	3.55	988	NC	12,522
SDAQ7-SW-L-001	10/19/2016	5,160	184	3.11	936 J	<2 U	11,700
SDAQ7-SW-L-002	10/27/2016	5,420	165	4.34	950 J	<2 U	11,800
SDAQ7-SW-L-003	10/28/2016	5,410	181	4.54	974 J	<2 U	11,700
SDAQ7-SW-L-005	11/2/2016	5,530	256	4.87	930 J	<2 U	11,900
SDAQ7-SW-L-006	11/4/2016	5,490	289	3.42	902 J	<2 U	11,500
SDAQ7-SW-L-008	11/10/2016	5,560	360	3.39	859 J	<2 U	11,100
SDAQ7-SW-L-019	2/27/2017	6,680	342	3.27	1,030	<2 U	12,900
SDAQ7-SW-L-020	3/9/2017	6,740	371	3.44	1,050	<2 U	12,600
SDAQ7-SW-L-004	10/31/2016	5,370	175	3.24	894 J	<2 U	10,100
SDAQ7-SW-L-007	11/7/2016	5,470	299	3.53	885 J	<2 U	11,300
SDAQ7-SW-L-009	11/14/2016	5,520	299	3.51	905 J	<2 U	11,200
SDAQ7-SW-L-010	11/23/2016	6,000	266	3.01	924 J	<2 U	11,400
SDAQ7-SW-L-011	12/1/2016	6,060	180	3.04	969 J	<2 U	12,300
SDAQ7-SW-L-012	12/7/2016	6,100	201	3.39	980 J	<2 U	12,100
SDAQ7-SW-L-018	2/14/2017	7,070	523	3.76	1,090	<2 U	13,200
SDAQ7-SW-L-021	3/21/2017	5,030	178	2.37	982 J	<2 U	12,800
	Operation	5,410	165	3.27	859	NC	11,100
		6,740	371	4.87	1,050	NC	12,900
		5,833	281	3.90	956	NC	11,929
	Interupted	5,030	175	2.37	885	NC	10,100
		7,070	523	3.76	1,090	NC	13,200
		5,828	265	3.23	954	NC	11,800
SDAQ8-SW-L-001	10/19/2016	5,200	113	2.09	854 J	<2 U	9,780
SDAQ8-SW-L-002	10/27/2016	5,380	120	3.05	873 J	<2 U	10,100
SDAQ8-SW-L-003	10/28/2016	5,370	128	5.02	893 J	<2 U	10,200
SDAQ8-SW-L-005	11/2/2016	5,520	182	3.18	871 J	<2 U	10,500
SDAQ8-SW-L-006	11/4/2016	5,470	87	0.708 J	769 J	<2 U	8,260
SDAQ8-SW-L-008	11/10/2016	5,530	194	1.87	805 J	<2 U	9,190
SDAQ8-SW-L-004	10/31/2016	5,470	258	3.86	984 J	<2 U	11,600

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Magnesium	Manganese	Nickel	Potassium	Selenium	Silica (SiO2)
	Method	201	201	200.8	201	200.8	201
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ8-SW-L-007	11/7/2016	5,360	130	1.46	771 J	<2 U	8,800
SDAQ8-SW-L-009	11/14/2016	5,520	184	2.13	875 J	<2 U	9,720
SDAQ8-SW-L-010	11/23/2016	6,030	185	1.32	828 J	<2 U	9,470
SDAQ8-SW-L-011	12/1/2016	6,270	39	<1 U	831 J	<2 U	8,110
SDAQ8-SW-L-021	3/21/2017	5,400	62	<1 U	824 J	<2 U	8,600
	Operation	5,370	87	0.71	769	NC	8,260
		5,530	194	5.02	893	NC	10,500
		5,454	142	2.77	842	NC	9,650
	Interupted	5,360	39	<1	771	NC	8,110
		6,270	258	3.86	984	NC	11,600
		5,675	143	2.19	852	NC	9,383

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver	Sodium	Thallium	Vanadium	Zinc	Hardness
	Method	200.8	201	200.8	200.8	201	2340B
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
SDAQ1-SW-L-001	10/19/2016	<10 U	6,100 J	<20 U	<30 U	128,000	1,210
SDAQ1-SW-L-002	10/27/2016	<10 U	6,210 J	<20 U	<30 U	133,000	1,270
SDAQ1-SW-L-003	10/28/2016	<10 U	6,240 J	<20 U	<30 U	135,000	1,280
SDAQ1-SW-L-004	10/31/2016	<10 U	6,060 J	<20 U	<30 U	135,000	1,250
SDAQ1-SW-L-005	11/2/2016	<10 U	6,220 J	<20 U	<30 U	140,000	1,270
SDAQ1-SW-L-006	11/4/2016	<10 U	6,700 J	<20 U	<30 U	145,000	1,400
SDAQ1-SW-L-007	11/7/2016	<5 U	6,200	<10 U	<15 U	154,000	1,380
SDAQ1-SW-L-008	11/10/2016	<5 U	6,220	<10 U	<15 U	156,000	1,400
SDAQ1-SW-L-009	11/14/2016	<5 U	6,170	<10 U	<15 U	159,000	1,380
SDAQ1-SW-L-010	11/23/2016	<25 U	6,590	<50 U	<75 U	148,000	1,410
SDAQ1-SW-L-011	12/1/2016	<10 U	6,760 J	<20 U	<30 U	175,000	1,440
SDAQ1-SW-L-012	12/7/2016	<10 U	6,410 J	<20 U	<30 U	171,000	1,400
SDAQ1-SW-L-013	12/22/2016	<5 U	6,960	NA	<15 U	145,000	1,350
SDAQ1-SW-L-014	12/29/2016	<5 U	6,820	NA	<15 U	142,000	1,320
SDAQ1-SW-L-015	1/5/2017	<5 U	7,040	NA	<15 U	144,000	1,360
SDAQ1-SW-L-016	1/16/2017	<5 U	7,130	NA	<15 U	144,000	1,370
SDAQ1-SW-L-017	1/31/2017	<5 U	6,810	NA	<15 U	140,000	1,340
SDAQ1-SW-L-018	2/14/2017	<5 U	6,540	NA	<15 U	146,000	1,390
CCSD-AD-L-099	2/27/2017	<5 U	6,890	NA	<15 U	143,000	1,420
SDAQ1-SW-L-020	3/9/2017	<5 U	6,780	NA	<15 U	139,000	1,370
CCSD-AD-L-100	3/21/2017	<10 U	6,340 J	NA	<30 U	133,000	1,270
	Pretreatment	NC	6,060	NC	NC	128,000	1,210
		NC	7,130	NC	NC	175,000	1,440
		NC	6,533	NC	NC	145,476	1,347
SDAQ2-SW-L-001	10/19/2016	<10 U	5,970 J	<20 U	<30 U	118,000	1,180
SDAQ2-SW-L-002	10/27/2016	<10 U	5,990 J	<20 U	<30 U	377	1,980
SDAQ2-SW-L-003	10/28/2016	<10 U	4,980	<20 U	<30 U	819	2,460
SDAQ2-SW-L-005	11/2/2016	<10 U	5,390	<20 U	<30 U	1,520	2,300
SDAQ2-SW-L-006	11/4/2016	<10 U	5,470	<20 U	<30 U	356	2,240
SDAQ2-SW-L-008	11/10/2016	<5 U	5,530	<10 U	<15 U	25,800	2,520
SDAQ2-SW-L-013	12/22/2016	<5 U	6,860	NA	<15 U	5,660	1,860
SDAQ2-SW-L-016	1/16/2017	<5 U	7,020	NA	<15 U	2,180	1,760
SDAQ2-SW-L-017	1/31/2017	<5 U	6,700	NA	<15 U	1,040	1,780
SDAQ2-SW-L-019	2/27/2017	<5 U	7,410	NA	<15 U	1,270	1,970
SDAQ2-SW-L-020	3/9/2017	<5 U	6,460	NA	<15 U	10,400	1,760
SDAQ2-SW-L-004	10/31/2016	<10 U	6,180 J	<20 U	<30 U	122,000	1,310

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver		Sodium		Thallium		Vanadium		Zinc	Hardness
	Method	200.8		201		200.8		200.8		201	2340B
	Unit	ug/L		ug/L		ug/L		ug/L		ug/L	mg/L
SDAQ2-SW-L-007	11/7/2016	<10	U	6,040	J	<20	U	<30	U	154,000	1,450
SDAQ2-SW-L-009	11/14/2016	<5	U	5,720		<10	U	<15	U	165,000	1,530
SDAQ2-SW-L-010	11/23/2016	<25	U	6,460		<50	U	<75	U	53,500	2,030
SDAQ2-SW-L-011	12/1/2016	<10	U	6,330	J	<20	U	<30	U	166,000	1,370
SDAQ2-SW-L-012	12/7/2016	<10	U	6,720	J	<20	U	<30	U	131,000	1,580
SDAQ2-SW-L-014	12/29/2016	<5	U	6,830		NA		<15	U	32,700	1,700
SDAQ2-SW-L-015	1/5/2017	<5	U	7,090		NA		<15	U	14,500	1,640
SDAQ2-SW-L-018	2/14/2017	<5	U	6,390		NA		<15	U	7,450	1,790
SDAQ2-SW-L-021	3/21/2017	<10	U	5,630	J	NA		<30	U	80,900	1,480
	Operation	NC		4,980		NC		NC		356	1,760
		NC		7,410		NC		NC		25,800	2,520
		NC		6,181		NC		NC		4,942	2,063
	Interupted	NC		5,630		NC		NC		7,450	1,310
		NC		7,090		NC		NC		166,000	2,030
		NC		6,339		NC		NC		92,705	1,588
SDAQ3-SW-L-001	10/19/2016	0.516	J	4,860		<2	U	<3	U	45,800	490
SDAQ3-SW-L-002	10/27/2016	<10	U	4,860		<20	U	<30	U	8,930	796
SDAQ3-SW-L-003	10/28/2016	<10	U	4,900		<20	U	<30	U	15,300	792
SDAQ3-SW-L-005	11/2/2016	<5	U	4,700		<10	U	<15	U	2,110	826
SDAQ3-SW-L-005	11/2/2016	<1	U	2,000		<2	U	<3	U	4,130	94
SDAQ3-SW-L-006	11/4/2016	<10	U	4,860		<20	U	<30	U	14,600	1,010
SDAQ3-SW-L-008	11/10/2016	<5	U	4,790	J	<10	U	<15	U	8,510	1,170
SDAQ3-SW-L-013	12/22/2016	<5	U	5,890		NA		<15	U	7,700	970
SDAQ3-SW-L-016	1/16/2017	<5	U	6,200		NA		<15	U	63,300	952
SDAQ3-SW-L-017	1/31/2017	<5	U	6,070		NA		<15	U	2,270	1,160
SDAQ3-SW-L-019	2/27/2017	<5	U	6,200		NA		<15	U	3,030	1,110
SDAQ3-SW-L-020	3/9/2017	<5	U	5,870		NA		<15	U	220	1,130
SDAQ3-SW-L-004	10/31/2016	<5	U	4,700		<10	U	<15	U	44,100	589
SDAQ3-SW-L-007	11/7/2016	<5	U	4,630	J	<10	U	<15	U	69,200	732
SDAQ3-SW-L-009	11/14/2016	<5	U	4,810	J	<10	U	<15	U	79,800	768
SDAQ3-SW-L-010	11/23/2016	<25	U	5,510		<50	U	<75	U	75,400	930
SDAQ3-SW-L-011	12/1/2016	<10	U	5,580	J	<20	U	<30	U	100,000	883
SDAQ3-SW-L-012	12/7/2016	<10	U	5,600	J	<20	U	<30	U	92,400	815
SDAQ3-SW-L-018	2/14/2017	<5	U	6,110		NA		<15	U	23,100	1,090
SDAQ3-SW-L-021	3/21/2017	<10	U	4,120	J	NA		<30	U	15,400	452
	Operation	NC		2,000		NC		NC		220	94

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver	Sodium	Thallium	Vanadium	Zinc	Hardness
	Method	200.8	201	200.8	200.8	201	2340B
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
		NC	6,200	NC	NC	63,300	1,170
		NC	5,122	NC	NC	11,827	910
	Interupted	NC	4,120	NC	NC	15,400	452
		NC	6,110	NC	NC	100,000	1,090
		NC	5,133	NC	NC	62,425	782
SDAQ4-SW-L-001	10/19/2016	<1 U	5,180	<2 U	<3 U	38,000	464
SDAQ4B-SW-L-001	10/19/2016	<1 U	5,080	<2 U	<3 U	33,600	428
SDAQ4-SW-L-002	10/27/2016	<5 U	5,350	<10 U	<15 U	25,700	647
SDAQ4-SW-L-003	10/28/2016	<5 U	5,520	<10 U	<15 U	20,900	650
SDAQ4-SW-L-005	11/2/2016	<5 U	5,570	<10 U	<15 U	23,900	683
SDAQ4-SW-L-006	11/4/2016	<5 U	5,550	<10 U	<15 U	26,400	702
SDAQ4-SW-L-008	11/10/2016	<5 U	5,140	<10 U	<15 U	2,370	786
SDAQ4-SW-L-013	12/22/2016	<5 U	6,320	NA	<15 U	27,200	735
SDAQ4-SW-L-017	1/31/2017	<5 U	6,300	NA	<15 U	8,260	795
SDAQ4-SW-L-019	2/27/2017	<5 U	6,260	NA	<15 U	816	782
SDAQ4-SW-L-020	3/9/2017	<5 U	5,950	NA	<15 U	8,170	746
SDAQ4-SW-L-004	10/31/2016	<5 U	5,380	<10 U	<15 U	34,000	527
SDAQ4-SW-L-007	11/7/2016	<5 U	5,010	<10 U	<15 U	45,300	604
SDAQ4-SW-L-009	11/14/2016	<5 U	5,110	<10 U	<15 U	53,900	639
SDAQ4-SW-L-010	11/23/2016	<25 U	6,130	<50 U	<75 U	44,100	677
SDAQ4-SW-L-011	12/1/2016	<5 U	6,000	<10 U	<15 U	56,500	630
SDAQ4-SW-L-012	12/7/2016	<5 U	6,020	<10 U	<15 U	59,700	657
SDAQ4-SW-L-018	2/14/2017	<5 U	6,330	NA	<15 U	8,390	820
SDAQ4-SW-L-021	3/21/2017	<5 U	3,980 J	NA	<15 U	12,100	332
	Pre-operation	NC	5,130	NC	NC	35,800	446
	Operation	NC	5,140	NC	NC	816	647
		NC	6,320	NC	NC	27,200	795
		NC	5,773	NC	NC	15,968	725
	Interupted	NC	3,980	NC	NC	8,390	332
		NC	6,330	NC	NC	59,700	820
		NC	5,495	NC	NC	39,249	611
SDAQ5-SW-L-001	10/19/2016	<1 U	2,630	<2 U	<3 U	10,700	159
SDAQ5-SW-L-002	10/27/2016	<1 U	2,560	<2 U	<3 U	9,910	149
SDAQ5-SW-L-003	10/28/2016	<1 U	2,650	<2 U	<3 U	10,300	160
SDAQ5-SW-L-006	11/4/2016	<1 U	1,590	<2 U	<3 U	1,300	55
SDAQ5-SW-L-008	11/10/2016	<1 U	1,450	<2 U	<3 U	561	42

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver	Sodium	Thallium	Vanadium	Zinc	Hardness
	Method	200.8	201	200.8	200.8	201	2340B
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
SDAQ5-SW-L-013	12/22/2016	<1 U	2,680	NA	<3 U	8,610	147
SDAQ5-SW-L-017	1/31/2017	<1 U	3,440	NA	<3 U	13,700	224
SDAQ5-SW-L-019	2/27/2017	<1 U	4,180	NA	<3 U	17,200	288
SDAQ5-SW-L-020	3/9/2017	<1 U	2,390	NA	<3 U	5,180	116
SDAQ5-SW-L-004	10/31/2016	<1 U	1,970	<2 U	<3 U	4,340	87
SDAQ5-SW-L-007	11/7/2016	<1 U	1,440	<2 U	<3 U	560	41
SDAQ5-SW-L-009	11/14/2016	<1 U	1,580	<2 U	<3 U	1,740	57
SDAQ5-SW-L-010	11/23/2016	<1 U	2,000	<2 U	<3 U	3,980	88
SDAQ5-SW-L-011	12/1/2016	<1 U	1,520	<2 U	<3 U	863	49
SDAQ5-SW-L-012	12/7/2016	<1 U	2,360	<2 U	<3 U	9,460	144
SDAQ5-SW-L-018	2/14/2017	<1 U	1,750	NA	<3 U	378	45
SDAQ5-SW-L-021	3/21/2017	<1 U	2,500	NA	<3 U	6,570	136
	Operation	NC	1,450	NC	NC	561	42
		NC	4,180	NC	NC	17,200	288
		NC	2,618	NC	NC	8,345	148
	Interupted	NC	1,440	NC	NC	378	41
		NC	2,500	NC	NC	9,460	144
		NC	1,890	NC	NC	3,486	81
SDAQ6-SW-L-001	10/19/2016	<1 U	2,280	<2 U	<3 U	1,200	64
SDAQ6-SW-L-002	10/27/2016	<1 U	2,420	<2 U	<3 U	909	67
SDAQ6-SW-L-003	10/28/2016	<1 U	2,340	<2 U	<3 U	1,440	65
SDAQ6-SW-L-006	11/4/2016	<1 U	1,980	<2 U	<3 U	1,200	64
SDAQ6-SW-L-005	11/2/2016	<1 U	2,230	<2 U	<3 U	1,450	66
SDAQ6-SW-L-008	11/10/2016	<1 U	2,110	<2 U	<3 U	1,270	66
SDAQ6-SW-L-013	12/22/2016	<1 U	2,540	NA	<3 U	1,400	74
SDAQ6-SW-L-017	1/31/2017	<1 U	2,590	NA	<3 U	1,960	82
SDAQ6-SW-L-019	2/27/2017	<1 U	2,960	NA	<3 U	1,850	88
SDAQ6-SW-L-020	3/9/2017	<1 U	2,730	NA	<3 U	1,820	87
SDAQ6-SW-L-004	10/31/2016	<1 U	2,400	<2 U	<3 U	1,260	69
SDAQ6-SW-L-007	11/7/2016	<1 U	2,110	<2 U	<3 U	1,140	62
SDAQ6-SW-L-009	11/14/2016	<1 U	2,020	<2 U	<3 U	1,070	64
SDAQ6-SW-L-010	11/23/2016	<1 U	2,230	<2 U	<3 U	1,460	69
SDAQ6-SW-L-011	12/1/2016	<1 U	2,340	<2 U	<3 U	1,550	75
SDAQ6-SW-L-012	12/7/2016	<1 U	2,370	<2 U	<3 U	1,600	75
SDAQ6-SW-L-014	12/29/2016	<1 U	2,570	NA	<3 U	1,450	74
SDAQ6-SW-L-018	2/14/2017	<1 U	2,930	NA	<3 U	2,170	93

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver	Sodium	Thallium	Vanadium	Zinc	Hardness
	Method	200.8	201	200.8	200.8	201	2340B
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
SDAQ6-SW-L-021	3/21/2017	<1 U	2,590	NA	<3 U	1,130	67
	Operation	NC	1,980	NC	NC	909	64
		NC	2,960	NC	NC	1,960	88
		NC	2,433	NC	NC	1,478	73
	Interupted	NC	2,020	NC	NC	1,070	62
		NC	2,930	NC	NC	2,170	93
		NC	2,396	NC	NC	1,426	72
SDAQ7-SW-L-001	10/19/2016	<1 U	2,040	<2 U	<3 U	1,060	62
SDAQ7-SW-L-002	10/27/2016	<1 U	2,100	<2 U	<3 U	922	65
SDAQ7-SW-L-003	10/28/2016	<1 U	2,100	<2 U	<3 U	1,110	65
SDAQ7-SW-L-005	11/2/2016	<1 U	2,060	<2 U	<3 U	1,230	66
SDAQ7-SW-L-006	11/4/2016	<1 U	2,030	<2 U	<3 U	1,210	66
SDAQ7-SW-L-008	11/10/2016	<1 U	1,900	<2 U	<3 U	1,130	67
SDAQ7-SW-L-019	2/27/2017	<1 U	2,760	NA	<3 U	1,420	86
SDAQ7-SW-L-020	3/9/2017	<1 U	2,710	NA	<3 U	1,450	87
SDAQ7-SW-L-004	10/31/2016	<1 U	1,920	<2 U	<3 U	708	65
SDAQ7-SW-L-007	11/7/2016	<1 U	1,980	<2 U	<3 U	1,140	65
SDAQ7-SW-L-009	11/14/2016	<1 U	1,990	<2 U	<3 U	1,080	66
SDAQ7-SW-L-010	11/23/2016	<1 U	2,220	<2 U	<3 U	1,190	70
SDAQ7-SW-L-011	12/1/2016	<1 U	2,300	<2 U	<3 U	1,330	76
SDAQ7-SW-L-012	12/7/2016	<1 U	2,330	<2 U	<3 U	1,270	74
SDAQ7-SW-L-018	2/14/2017	<1 U	2,840	NA	<3 U	1,740	89
SDAQ7-SW-L-021	3/21/2017	<1 U	2,470	NA	<3 U	980	65
	Operation	NC	1,900	NC	NC	922	65
		NC	2,760	NC	NC	1,450	87
		NC	2,237	NC	NC	1,210	72
	Interupted	NC	1,920	NC	NC	708	65
		NC	2,840	NC	NC	1,740	89
		NC	2,256	NC	NC	1,180	71
SDAQ8-SW-L-001	10/19/2016	<1 U	1,850	<2 U	<3 U	648	62
SDAQ8-SW-L-002	10/27/2016	<1 U	1,910	<2 U	<3 U	639	64
SDAQ8-SW-L-003	10/28/2016	<1 U	1,930	<2 U	<3 U	778	64
SDAQ8-SW-L-005	11/2/2016	<1 U	1,960	<2 U	<3 U	891	66
SDAQ8-SW-L-006	11/4/2016	<1 U	1,700	<2 U	<3 U	359	65
SDAQ8-SW-L-008	11/10/2016	<1 U	1,750	<2 U	<3 U	607	66
SDAQ8-SW-L-004	10/31/2016	<1 U	2,100	<2 U	<3 U	1,070	66

TABLE 5-2
AQUAFIX FILTERED METAL CONCENTRATIONS

Sample	Date	Silver	Sodium	Thallium	Vanadium	Zinc	Hardness
	Method	200.8	201	200.8	200.8	201	2340B
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
SDAQ8-SW-L-007	11/7/2016	<1 U	1,670	<2 U	<3 U	485	64
SDAQ8-SW-L-009	11/14/2016	<1 U	1,810	<2 U	<3 U	673	65
SDAQ8-SW-L-010	11/23/2016	<1 U	1,900	<2 U	<3 U	673	70
SDAQ8-SW-L-011	12/1/2016	<1 U	1,850	<2 U	<3 U	240	73
SDAQ8-SW-L-021	3/21/2017	<1 U	2,180	NA	<3 U	315	63
	Operation	NC	1,700	NC	NC	359	64
		NC	1,960	NC	NC	891	66
		NC	1,850	NC	NC	655	65
	Interupted	NC	1,670	NC	NC	240	63
		NC	2,180	NC	NC	1,070	73
		NC	1,918	NC	NC	576	67

Notes:
U = Nondetect at reported concentration
J = Estimated concentration
D = Sample diluted prior to analysis
µg/L = Micrograms per liter
mg/L = Milligrams per liter
NA = Not analyzed
NC = Not calculated
Mean = arithmetic mean of detected concentrations

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium
	Method		200.7	200.8	200.8	200.8
	Unit		ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	Adit	2,300	<10 U	<20 U	<100 U
SDAQ1-SW-L-002	10/27/2016	Adit	2,670	<10 U	<20 U	<100 U
SDAQ1-SW-L-003	10/28/2016	Adit	2,600	<10 U	5.18 J	<100 U
SDAQ1-SW-L-004	10/31/2016	Adit	2,680	<10 U	<20 U	<100 U
SDAQ1-SW-L-005	11/2/2016	Adit	2,780	<10 U	<20 U	<100 U
SDAQ1-SW-L-006	11/4/2016	Adit	2,770	<10 U	<20 U	<100 U
SDAQ1-SW-L-007	11/7/2016	Adit	2,610	<5 U	4.09 J	<50 U
SDAQ1-SW-L-008	11/10/2016	Adit	2,590	<5 U	2.80 J	<50 U
SDAQ1-SW-L-009	11/14/2016	Adit	2,510	<5 U	4.01 J	<50 U
SDAQ1-SW-L-010	11/23/2016	Adit	2,400	<25 U	<50 U	<250 U
SDAQ1-SW-L-011	12/1/2016	Adit	2,400	<10 U	<20 U	<100 U
SDAQ1-SW-L-012	12/7/2016	Adit	2,170	<10 U	<20 U	<100 U
SDAQ1-SW-L-013	12/22/2016	Adit	2,120	<5 U	3.22 J	<50 U
SDAQ1-SW-L-014	12/29/2016	Adit	2,000	<5 U	3.39 J	<50 U
SDAQ1-SW-L-015	1/5/2017	Adit	1,740	<5 U	2.64 J	<50 U
SDAQ1-SW-L-016	1/16/2017	Adit	1,770	<5 U	2.67 J	<50 U
SDAQ1-SW-L-017	1/31/2017	Adit	1,640	<5 U	<10 U	<50 U
SDAQ1-SW-L-018	2/14/2017	Adit	1,600	<5 U	4.27 J	<50 U
CCSD-AD-L-099	2/27/2017	Adit	1,520	<5 U	3.95 J	<50 U
SDAQ1-SW-L-020	3/9/2017	Adit	1,510	<5 U	3.71 J	<50 U
CCSD-AD-L-100	3/21/2017	Adit	1,390	<10 U	<20 U	<100 U
CCSD-AD-L-100	3/21/2017	Adit	1,270 D	<10 U	<20 U	<100 U
	Pretreatment	Minimum	1,270	NC	2.64	NC
		Maximum	2,780	NC	<20	NC
		Mean	2,138	NC	3.63	NC
SDAQ2-SW-L-001	10/19/2016	Pre-operation	2,340	<10 U	<20 U	<100 U
SDAQ2-SW-L-002	10/27/2016	Operation	437 J	<10 U	<20 U	<100 U
SDAQ2-SW-L-003	10/28/2016	Operation	92	<5 U	<10 U	<50 U
SDAQ2-SW-L-005	11/2/2016	Operation	3,060	<10 U	<20 U	<100 U
SDAQ2-SW-L-006	11/4/2016	Operation	2,660	<10 U	<20 U	<100 U
SDAQ2-SW-L-008	11/10/2016	Operation	3,920	<5 U	3.1 J	<50 U
SDAQ2-SW-L-013	12/22/2016	Operation	2,410	<5 U	<10 U	<50 U
SDAQ2-SW-L-016	1/16/2017	Operation	1,640	<5 U	5.3 J	<50 U
SDAQ2-SW-L-017	1/31/2017	Operation	2,070	<5 U	<10 U	<50 U
SDAQ2-SW-L-019	2/27/2017	Operation	1,840	<5 U	<10 U	<50 U
SDAQ2-SW-L-020	3/9/2017	Operation	1,860	<5 U	<10 U	<50 U
SDAQ2-SW-L-004	10/31/2016	Interupted	2,000	<10 U	<20 U	<100 U
SDAQ2-SW-L-007	11/7/2016	Interupted	2,450	<5 U	3.6 J	<50 U
SDAQ2-SW-L-009	11/14/2016	Interupted	2,330	<5 U	5.5 J	<50 U
SDAQ2-SW-L-010	11/23/2016	Interupted	3,300	<25 U	<50 U	<250 U
SDAQ2-SW-L-011	12/1/2016	Interupted	2,170	<10 U	<20 U	<100 U
SDAQ2-SW-L-012	12/7/2016	Interupted	639	<10 U	<20 U	<100 U

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Status	Aluminum	Antimony	Arsenic	Barium
	Method		200.7	200.8	200.8	200.8
	Unit		ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-014	12/29/2016	Interupted	833	<5 U	<10 U	<50 U
SDAQ2-SW-L-015	1/5/2017	Interupted	5,770	<5 U	4.6 J	<50 U
SDAQ2-SW-L-018	2/14/2017	Interupted	2,880	<5 U	5.2 J	<50 U
SDAQ2-SW-L-021	3/21/2017	Interupted	1,280	<10 U	<20 U	<100 U
	Operation	Minimum	92	NC	3	NC
		Maximum	3,920	NC	<20	NC
		Mean	1,999	NC	4	NC
	Interupted	Minimum	639	NC	4	NC
		Maximum	5,770	NC	<50	NC
		Mean	2,365	NC	5	NC

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper
	Method	200.7	200.8	200.7	200.8	200.8	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	<50 U	699	311,000	<20 U	271	10,900
SDAQ1-SW-L-002	10/27/2016	<50 U	755	318,000	<20 U	297	14,400
SDAQ1-SW-L-003	10/28/2016	<50 U	809	309,000	<20 U	298	13,800
SDAQ1-SW-L-004	10/31/2016	<50 U	829	311,000	<20 U	307	14,700
SDAQ1-SW-L-005	11/2/2016	<50 U	879	313,000	<20 U	313	15,000
SDAQ1-SW-L-006	11/4/2016	<50 U	837	316,000	<20 U	311	14,500
SDAQ1-SW-L-007	11/7/2016	<25 U	837	322,000	<10 U	324	13,600
SDAQ1-SW-L-008	11/10/2016	<25 U	861	325,000	<10 U	335	13,700
SDAQ1-SW-L-009	11/14/2016	<25 U	832	326,000	<10 U	326	12,700
SDAQ1-SW-L-010	11/23/2016	<25 U	799	348,000	<50 U	307	11,400
SDAQ1-SW-L-011	12/1/2016	<50 U	867	356,000	<20 U	324	11,300
SDAQ1-SW-L-012	12/7/2016	<50 U	835	342,000	<20 U	298	10,100
SDAQ1-SW-L-013	12/22/2016	<25 U	788	323,000	<10 U	299	9,070
SDAQ1-SW-L-014	12/29/2016	<25 U	802	326,000	<10 U	299	8,730
SDAQ1-SW-L-015	1/5/2017	<25 U	750	317,000	<10 U	288	7,720
SDAQ1-SW-L-016	1/16/2017	<25 U	759	328,000	<10 U	289	7,540
SDAQ1-SW-L-017	1/31/2017	<25 U	765	338,000	<10 U	294	7,200
SDAQ1-SW-L-018	2/14/2017	<25 U	756	336,000	<10 U	291	6,730
CCSD-AD-L-099	2/27/2017	<25 U	736	336,000	<10 U	275	6,160
SDAQ1-SW-L-020	3/9/2017	<25 U	782	331,000	<10 U	297	6,760
CCSD-AD-L-100	3/21/2017	<50 U	696	313,000	<20 U	256	6,270
CCSD-AD-L-100	3/21/2017	<50 U	661 D	309,000 D	<20 U	243 D	5,820 D
	Pretreatment	NC	661	309,000	NC	243	5,820
		NC	879	356,000	NC	335	15,000
		NC	788	325,182	NC	297	10,368
SDAQ2-SW-L-001	10/19/2016	<50 U	681	300,000	<20 U	250	8,850
SDAQ2-SW-L-002	10/27/2016	<50 U	13	877,000	<20 U	6.1	168
SDAQ2-SW-L-003	10/28/2016	<5 U	4.6	843,000	<10 U	2.7	55
SDAQ2-SW-L-005	11/2/2016	<50 U	728	677,000	<20 U	260	12,700
SDAQ2-SW-L-006	11/4/2016	<50 U	667	620,000	<20 U	244	11,500
SDAQ2-SW-L-008	11/10/2016	<25 U	856	1,020,000	<10 U	322	12,800
SDAQ2-SW-L-013	12/22/2016	<25 U	672	691,000	<10 U	249	7,740
SDAQ2-SW-L-016	1/16/2017	<25 U	582	555,000	<10 U	224	5,390
SDAQ2-SW-L-017	1/31/2017	<25 U	720	737,000	<10 U	276	6,690
SDAQ2-SW-L-019	2/27/2017	<25 U	612	730,000	<10 U	228	5,230
SDAQ2-SW-L-020	3/9/2017	<25 U	661	639,000	<10 U	251	5,960
SDAQ2-SW-L-004	10/31/2016	<50 U	744	347,000	<20 U	271	10,400
SDAQ2-SW-L-007	11/7/2016	<25 U	825	326,000	<10 U	314	12,700
SDAQ2-SW-L-009	11/14/2016	<25 U	860	341,000	<10 U	324	11,300
SDAQ2-SW-L-010	11/23/2016	<25 U	759	741,000	<50 U	289	11,300
SDAQ2-SW-L-011	12/1/2016	<50 U	858	356,000	<20 U	304	10,500
SDAQ2-SW-L-012	12/7/2016	<50 U	699	416,000	<20 U	270	2,490

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper
	Method	200.7	200.8	200.7	200.8	200.8	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-014	12/29/2016	<25 U	284	529,000	<10 U	103	2,790
SDAQ2-SW-L-015	1/5/2017	<25 U	1,240	434,000	<10 U	460	17,100
SDAQ2-SW-L-018	2/14/2017	<25 U	655	547,000	<10 U	251	6,430
SDAQ2-SW-L-021	3/21/2017	<50 U	477	438,000	<20 U	173	4,600
	Operation	NC	4.6	555,000	NC	2.7	55
		NC	856	1,020,000	NC	322	12,800
		NC	552	738,900	NC	206	6,823
	Interupted	NC	284	326,000	NC	103	2,490
		NC	1,240	741,000	NC	460	17,100
		NC	740	447,500	NC	276	8,961

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Iron	Lead	Magnesium	Manganese	Nickel
	Method	200.7	200.8	200.7	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ1-SW-L-001	10/19/2016	44,600	846	129,000	142,000	306
SDAQ1-SW-L-002	10/27/2016	55,600	879	138,000	152,000	336
SDAQ1-SW-L-003	10/28/2016	36,200	855	135,000	151,000	332
SDAQ1-SW-L-004	10/31/2016	35,400	893	136,000	154,000	346
SDAQ1-SW-L-005	11/2/2016	33,300	899	139,000	158,000	347
SDAQ1-SW-L-006	11/4/2016	38,700	899	139,000	156,000	349
SDAQ1-SW-L-007	11/7/2016	35,500	875	139,000	145,000	360
SDAQ1-SW-L-008	11/10/2016	35,100	916	141,000	146,000	371
SDAQ1-SW-L-009	11/14/2016	36,200	913	140,000	144,000	365
SDAQ1-SW-L-010	11/23/2016	39,500	924	145,000	145,000 J	340
SDAQ1-SW-L-011	12/1/2016	40,600	944	144,000	162,000	359
SDAQ1-SW-L-012	12/7/2016	39,000	901	137,000	154,000	332
SDAQ1-SW-L-013	12/22/2016	40,700	943	138,000	138,000	324
SDAQ1-SW-L-014	12/29/2016	38,800	967	138,000	139,000	322
SDAQ1-SW-L-015	1/5/2017	37,800	897	132,000	133,000	309
SDAQ1-SW-L-016	1/16/2017	39,500	929	138,000	136,000	311
SDAQ1-SW-L-017	1/31/2017	41,200	903	135,000	136,000	320
SDAQ1-SW-L-018	2/14/2017	39,600	975	135,000	137,000	312
CCSD-AD-L-099	2/27/2017	43,000	915	131,000	136,000 J	295
SDAQ1-SW-L-020	3/9/2017	38,500	977	135,000	132,000 J	319
CCSD-AD-L-100	3/21/2017	37,400	914	123,000	128,000	278
CCSD-AD-L-100	3/21/2017	30,800 D	806 D	121,000 D	127,000 D	262 D
	Pretreatment	30,800	806	121,000	127,000	262
		55,600	977	145,000	162,000	371
		38,955	908	135,818	143,227	327
SDAQ2-SW-L-001	10/19/2016	26,300	904	119,000	132,000	276
SDAQ2-SW-L-002	10/27/2016	4,510	83	2,240 J	2,620	<10 U
SDAQ2-SW-L-003	10/28/2016	125 J	12	2,410	1,290	<5 U
SDAQ2-SW-L-005	11/2/2016	27,800	285	125,000	115,000	282
SDAQ2-SW-L-006	11/4/2016	26,600	245	130,000	106,000	265
SDAQ2-SW-L-008	11/10/2016	35,900	95	150,000	113,000	344
SDAQ2-SW-L-013	12/22/2016	32,800	283	123,000	95,300	252
SDAQ2-SW-L-016	1/16/2017	31,900	1,460	119,000	102,000	223
SDAQ2-SW-L-017	1/31/2017	38,200	653	127,000	122,000	275
SDAQ2-SW-L-019	2/27/2017	36,900	315	121,000	88,000	235
SDAQ2-SW-L-020	3/9/2017	34,800	434	128,000	94,300	255
SDAQ2-SW-L-004	10/31/2016	30,700	609	126,000	140,000	299
SDAQ2-SW-L-007	11/7/2016	29,300	778	136,000	139,000	356
SDAQ2-SW-L-009	11/14/2016	34,500	868	139,000	146,000	360
SDAQ2-SW-L-010	11/23/2016	38,100	62	140,000	95,700	303
SDAQ2-SW-L-011	12/1/2016	34,800	881	138,000	157,000	338
SDAQ2-SW-L-012	12/7/2016	14,300	233	130,000	147,000	281

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Iron	Lead	Magnesium	Manganese	Nickel
	Method	200.7	200.8	200.7	200.7	200.8
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-014	12/29/2016	13,000	355	97,200	64,900	87
SDAQ2-SW-L-015	1/5/2017	103,000	2,110	165,000	196,000	510
SDAQ2-SW-L-018	2/14/2017	72,900	1,260	127,000	118,000	263
SDAQ2-SW-L-021	3/21/2017	23,200	558	99,400	92,000	182
	Operation	125	12	2,240	1,290	<5
		38,200	1,460	150,000	122,000	344
		26,954	386	102,765	83,951	266
	Interupted	13,000	62	97,200	64,900	87
		103,000	2,110	165,000	196,000	510
		39,380	771	129,760	129,560	298

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Potassium		Selenium		Silica (SiO2)		Silver		Sodium	
	Method	200.7		200.8		200.7		200.8		200.7	
	Unit	ug/L		ug/L		ug/L		ug/L		ug/L	
SDAQ1-SW-L-001	10/19/2016	4,650	J	11	J	20,400		<10	U	6,350	J
SDAQ1-SW-L-002	10/27/2016	4,650	J	<20	U	20,700		<10	U	6,450	J
SDAQ1-SW-L-003	10/28/2016	4,540	J	<20	U	20,500		<10	U	6,230	J
SDAQ1-SW-L-004	10/31/2016	4,470	J	11	J	20,600		<10	U	6,220	J
SDAQ1-SW-L-005	11/2/2016	4,470	J	12	J	20,900		<10	U	6,310	J
SDAQ1-SW-L-006	11/4/2016	4,640	J	11	J	20,600		<10	U	6,300	J
SDAQ1-SW-L-007	11/7/2016	4,820	J	9.2	J	20,500		<5	U	6,260	
SDAQ1-SW-L-008	11/10/2016	4,840	J	8.0	J	20,800		<5	U	6,450	
SDAQ1-SW-L-009	11/14/2016	4,650	J	9.5	J	20,700		<5	U	6,520	
SDAQ1-SW-L-010	11/23/2016	4,830	J	<50	U	20,700		<25	U	6,710	
SDAQ1-SW-L-011	12/1/2016	5,120	J	<20	U	21,000		<10	U	7,020	J
SDAQ1-SW-L-012	12/7/2016	4,670	J	<20	U	19,900		<10	U	6,590	J
SDAQ1-SW-L-013	12/22/2016	4,940	J	9.4	J	20,600		<5	U	7,210	
SDAQ1-SW-L-014	12/29/2016	4,830	J	8.2	J	20,700		<5	U	7,120	
SDAQ1-SW-L-015	1/5/2017	4,680	J	8.5	J	19,900		<5	U	6,960	
SDAQ1-SW-L-016	1/16/2017	4,880	J	10	J	20,300		<5	U	7,320	
SDAQ1-SW-L-017	1/31/2017	4,850	J	7.2	J	20,700		<5	U	7,130	
SDAQ1-SW-L-018	2/14/2017	5,070		11		20,800		<5	U	7,370	
CCSD-AD-L-099	2/27/2017	5,160		11		20,900		<5	U	7,050	
SDAQ1-SW-L-020	3/9/2017	4,930	J	11		20,500		<5	U	7,040	
CCSD-AD-L-100	3/21/2017	4,740	J	<20	U	20,300		<10	U	6,640	J
CCSD-AD-L-100	3/21/2017	4,580	JD	<20	U	19,800	D	<10	U	6,340	JD
	Pretreatment	4,470		7		19,800		NC		6,220	
		5,160		<50		21,000		NC		7,370	
		4,773		10		20,536		NC		6,709	
SDAQ2-SW-L-001	10/19/2016	4,460	J	<20	U	21,200		<10	U	6,050	J
SDAQ2-SW-L-002	10/27/2016	4,740	J	<20	U	<10000	U	<10	U	6,050	J
SDAQ2-SW-L-003	10/28/2016	4,540		<10	U	2,420		<5	U	5,970	
SDAQ2-SW-L-005	11/2/2016	4,190	J	10	J	21,000		<10	U	6,280	J
SDAQ2-SW-L-006	11/4/2016	4,150	J	<20	U	18,900		<10	U	6,270	J
SDAQ2-SW-L-008	11/10/2016	3,940	J	9.4	J	26,000		<5	U	6,350	
SDAQ2-SW-L-013	12/22/2016	4,270	J	7.5	J	20,300		<5	U	7,060	
SDAQ2-SW-L-016	1/16/2017	5,080		7.3	J	16,900		13		7,280	
SDAQ2-SW-L-017	1/31/2017	4,450	J	7.2	J	22,200		<5	U	7,140	
SDAQ2-SW-L-019	2/27/2017	4,630	J	9.5	J	19,900		<5	U	7,500	
SDAQ2-SW-L-020	3/9/2017	4,730	J	7.6	J	20,100		<5	U	6,990	
SDAQ2-SW-L-004	10/31/2016	4,460	J	<20	U	18,900		<10	U	6,220	J
SDAQ2-SW-L-007	11/7/2016	4,630	J	9.2	J	19,900		<5	U	6,250	
SDAQ2-SW-L-009	11/14/2016	4,820	J	10	J	21,800		<5	U	6,490	
SDAQ2-SW-L-010	11/23/2016	3,850	J	<50	U	23,600		<25	U	6,670	
SDAQ2-SW-L-011	12/1/2016	4,890	J	<20	U	20,500		<10	U	6,690	J
SDAQ2-SW-L-012	12/7/2016	4,560	J	<20	U	13,700		<10	U	6,570	J

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Potassium	Selenium	Silica (SiO2)	Silver	Sodium
	Method	200.7	200.8	200.7	200.8	200.7
	Unit	ug/L	ug/L	ug/L	ug/L	ug/L
SDAQ2-SW-L-014	12/29/2016	4,930 J	<10 U	7,730	<5 U	7,220
SDAQ2-SW-L-015	1/5/2017	5,010	14	41,000	4.3 J	7,350
SDAQ2-SW-L-018	2/14/2017	5,160	8.2 J	23,900	3.3 J	7,230
SDAQ2-SW-L-021	3/21/2017	4,090 J	<20 U	16,300	<10 U	5,910 J
	Operation	3,940	7.2	2,420	<5	5,970
		5,080	<20	26,000	13	7,500
		4,472	8.4	18,636	13	6,689
	Interupted	3,850	8.2	7,730	3.3	5,910
		5,160	<50	41,000	<25	7,350
		4,640	10	20,733	3.8	6,660

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Thallium	Vanadium	Zinc	Total Dissolved Solids	Total Suspended Solids
	Method	200.8	200.8	200.7	EPA 160.1	EPA 160.2
	Unit	ug/L	ug/L	ug/L	mg/L	mg/L
SDAQ1-SW-L-001	10/19/2016	<20 U	<30 U	144,000	2,820	42
SDAQ1-SW-L-002	10/27/2016	<20 U	<30 U	152,000	2,980	36
SDAQ1-SW-L-003	10/28/2016	26	<30 U	152,000	3,040	42
SDAQ1-SW-L-004	10/31/2016	18 J	<30 U	155,000	3,080	42
SDAQ1-SW-L-005	11/2/2016	<20 U	<30 U	159,000	3,000	24
SDAQ1-SW-L-006	11/4/2016	<20 U	<30 U	157,000	3,120	18
SDAQ1-SW-L-007	11/7/2016	<10 U	<15 U	152,000	3,110 J	34 J
SDAQ1-SW-L-008	11/10/2016	13	<15 U	152,000	3,120 J	30 J
SDAQ1-SW-L-009	11/14/2016	<10 U	<15 U	152,000	3,110	34
SDAQ1-SW-L-010	11/23/2016	<50 U	<75 U	153,000	3,140	38
SDAQ1-SW-L-011	12/1/2016	24	<30 U	178,000	3,130	36
SDAQ1-SW-L-012	12/7/2016	12 J	<30 U	168,000	3,120	16
SDAQ1-SW-L-013	12/22/2016	--	<15 U	144,000	3,070	39
SDAQ1-SW-L-014	12/29/2016	--	<15 U	146,000	3,090	38
SDAQ1-SW-L-015	1/5/2017	--	<15 U	140,000	3,070	39
SDAQ1-SW-L-016	1/16/2017	--	<15 U	143,000	3,050	28
SDAQ1-SW-L-017	1/31/2017	--	<15 U	148,000	3,080	32
SDAQ1-SW-L-018	2/14/2017	--	<15 U	146,000	3,090	43
CCSD-AD-L-099	2/27/2017	--	<15 U	146,000	--	--
SDAQ1-SW-L-020	3/9/2017	--	<15 U	138,000	3,040	34
CCSD-AD-L-100	3/21/2017	--	<30 U	132,000	--	--
CCSD-AD-L-100	3/21/2017	--	<30 U	133,000 D	--	--
	Pretreatment	12	NC	132,000	2,820	16
		<50	NC	178,000	3,140	43
		19	NC	149,545	3,066	34
SDAQ2-SW-L-001	10/19/2016	<20 U	<30 U	134,000	2,750	<10 U
SDAQ2-SW-L-002	10/27/2016	<20 U	<30 U	3,000	3,050	62
SDAQ2-SW-L-003	10/28/2016	<10 U	<15 U	1,240	2,800	18
SDAQ2-SW-L-005	11/2/2016	<20 U	<30 U	137,000	2,840	662
SDAQ2-SW-L-006	11/4/2016	<20 U	<30 U	127,000	2,890	606
SDAQ2-SW-L-008	11/10/2016	<10 U	<15 U	153,000	3,150 J	1,520 J
SDAQ2-SW-L-013	12/22/2016	--	<15 U	122,000	2,750	844
SDAQ2-SW-L-016	1/16/2017	--	<15 U	107,000	2,850	407
SDAQ2-SW-L-017	1/31/2017	--	<15 U	137,000	1,430	952
SDAQ2-SW-L-019	2/27/2017	--	<15 U	120,000	2,640	768
SDAQ2-SW-L-020	3/9/2017	--	<15 U	119,000	2,640	850
SDAQ2-SW-L-004	10/31/2016	<20 U	<30 U	138,000	2,990	<10 U
SDAQ2-SW-L-007	11/7/2016	<10 U	<15 U	143,000	2,980 J	50 J
SDAQ2-SW-L-009	11/14/2016	<10 U	<15 U	153,000	3,050	46
SDAQ2-SW-L-010	11/23/2016	<50 U	<75 U	153,000	2,930	822
SDAQ2-SW-L-011	12/1/2016	<20 U	<30 U	175,000	3,130	10
SDAQ2-SW-L-012	12/7/2016	<20 U	<30 U	132,000	3,000	10

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Thallium	Vanadium	Zinc	Total Dissolved Solids	Total Suspended Solids
	Method	200.8	200.8	200.7	EPA 160.1	EPA 160.2
	Unit	ug/L	ug/L	ug/L	mg/L	mg/L
SDAQ2-SW-L-014	12/29/2016	--	<15 U	46,600	2,890	47
SDAQ2-SW-L-015	1/5/2017	--	<15 U	220,000	2,880	984
SDAQ2-SW-L-018	2/14/2017	--	<15 U	128,000	2,780	568
SDAQ2-SW-L-021	3/21/2017	--	<30 U	87,900	2,240 B	234
	Operation	NC	NC	1,240	1,430	18
		NC	NC	153,000	3,150	1,520
		NC	NC	102,624	2,704	669
	Interupted	NC	NC	46,600	2,240	<10
		NC	NC	220,000	3,130	984
		NC	NC	137,650	2,887	308

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Chloride		Sulfate as SO4	Hardness	
	Method	EPA 300.0		EPA 300.0	2340B	
	Unit	mg/L		mg/L	mg/L	
SDAQ1-SW-L-001	10/19/2016	<16	U	1,810	--	
SDAQ1-SW-L-002	10/27/2016	<16	U	1,930	--	
SDAQ1-SW-L-003	10/28/2016	<16	U	1,960	--	
SDAQ1-SW-L-004	10/31/2016	<16	U	1,940	--	
SDAQ1-SW-L-005	11/2/2016	<16	U	2,030	--	
SDAQ1-SW-L-006	11/4/2016	<16	U	2,010	--	
SDAQ1-SW-L-007	11/7/2016	<8	U	2,040	--	
SDAQ1-SW-L-008	11/10/2016	<8	U	2,050	--	
SDAQ1-SW-L-009	11/14/2016	<8	U	2,080	--	
SDAQ1-SW-L-010	11/23/2016	<8	U	2,000	--	
SDAQ1-SW-L-011	12/1/2016	<8	U	2,100	--	
SDAQ1-SW-L-012	12/7/2016	<8	U	2,020	--	
SDAQ1-SW-L-013	12/22/2016	<8	U	1,980	--	
SDAQ1-SW-L-014	12/29/2016	<8	U	2,060	--	
SDAQ1-SW-L-015	1/5/2017	<8	U	2,050	--	
SDAQ1-SW-L-016	1/16/2017	<8	U	2,050	--	
SDAQ1-SW-L-017	1/31/2017	<20	U	2,040	--	
SDAQ1-SW-L-018	2/14/2017	<20	U	2,110	--	
CCSD-AD-L-099	2/27/2017	<20	U	2,040	--	
SDAQ1-SW-L-020	3/9/2017	<20	U	2,110	--	
CCSD-AD-L-100	3/21/2017	<20	U	1,810	--	
CCSD-AD-L-100	3/21/2017	--		--	1,270	D
	Pretreatment	NC		1,810	--	
		NC		2,110	--	
		NC		2,010	--	
SDAQ2-SW-L-001	10/19/2016	<8	U	1,820	--	
SDAQ2-SW-L-002	10/27/2016	<16	U	1,800	--	
SDAQ2-SW-L-003	10/28/2016	<16	U	1,760	--	
SDAQ2-SW-L-005	11/2/2016	<16	U	1,890	--	
SDAQ2-SW-L-006	11/4/2016	<16	U	1,910	--	
SDAQ2-SW-L-008	11/10/2016	<8	U	1,830	--	
SDAQ2-SW-L-013	12/22/2016	<8	U	1,890	--	
SDAQ2-SW-L-016	1/16/2017	<8	U	1,980	--	
SDAQ2-SW-L-017	1/31/2017	<20	U	1,880	--	
SDAQ2-SW-L-019	2/27/2017	<20	U	1,820	--	
SDAQ2-SW-L-020	3/9/2017	<20	U	1,790	--	
SDAQ2-SW-L-004	10/31/2016	<16	U	1,900	--	
SDAQ2-SW-L-007	11/7/2016	<8	U	2,010	--	
SDAQ2-SW-L-009	11/14/2016	<8	U	1,990	--	
SDAQ2-SW-L-010	11/23/2016	<8	U	1,930	--	
SDAQ2-SW-L-011	12/1/2016	<8	U	2,010	--	
SDAQ2-SW-L-012	12/7/2016	<8	U	2,010	--	

TABLE 5-3
AQUAFIX UNFILTERED METALS

Sample	Date	Chloride		Sulfate as SO4	Hardness
	Method	EPA 300.0		EPA 300.0	2340B
	Unit	mg/L		mg/L	mg/L
SDAQ2-SW-L-014	12/29/2016	<8	U	1,980	--
SDAQ2-SW-L-015	1/5/2017	<8	U	2,050	--
SDAQ2-SW-L-018	2/14/2017	<20	U	2,050	--
SDAQ2-SW-L-021	3/21/2017	<20	U	1,550	--
	Operation	NC		1,760	--
		NC		1,980	--
		NC		1,855	--
	Interupted	NC		1,550	--
		NC		2,050	--
		NC		1,948	--

Notes:

U = Nondetect at reported concentration

J = Estimated concentration

D = Sample diluted prior to analysis

µg/L = Micrograms per liter

mg/L = Milligrams per liter

Mean = Arithetic mean of detected concentrations

TABLE 5-4
METAL CONCENTRATIONS SUMMARY

Analyte	Location	Status	Dissolved Metals			Total Metals		
			Minimum ug/L	Maximum ug/L	Mean ug/L	Minimum ug/L	Maximum ug/L	Mean ug/L
Aluminum	SDAQ1	Pretreatment	1,270	2,960	2,213	1,270	2,780	2,138
	SDAQ2	Operational	21	662	202	92	3,920	1,999
	SDAQ2	Interrupted	146	2,060	696	639	5,770	2,365
Cadmium	SDAQ1	Pretreatment	661	886	785	661	879	788
	SDAQ2	Operational	<2	112	35	5	856	552
	SDAQ2	Interrupted	92	935	536	284	1,240	740
Cobalt	SDAQ1	Pretreatment	243	338	295	243	335	297
	SDAQ2	Operational	1.39	36	10	2.68	322	206
	SDAQ2	Interrupted	21	341	194	103	460	276
Copper	SDAQ1	Pretreatment	5,820	14,900	10,494	5,820	15,000	10,368
	SDAQ2	Operational	12	1,810	297	55	12,800	6,823
	SDAQ2	Interrupted	20	10,000	3,263	2,490	17,100	8,961
Iron	SDAQ1	Pretreatment	26,400	36,500	32,152	30,800	55,600	38,955
	SDAQ2	Operational	204	4,390	1,629	125	38,200	26,954
	SDAQ2	Interrupted	<1,250	30,100	10,306	13,000	103,000	39,380
Lead	SDAQ1	Pretreatment	765	950	849	806	977	908
	SDAQ2	Operational	1.13	48	15	12	1,460	386
	SDAQ2	Interrupted	0.52	804	158	62	2,110	771
Manganese	SDAQ1	Pretreatment	127,000	159,000	140,905	127,000	162,000	143,227
	SDAQ2	Operational	58	50,700	8,446	1,290	122,000	83,951
	SDAQ2	Interrupted	31,000	166,000	109,090	64,900	196,000	129,560
Nickel	SDAQ1	Pretreatment	262	374	323	262	371	327
	SDAQ2	Operational	<5	26	NC	<5	344	266
	SDAQ2	Interrupted	<5	371	220	87	510	298
Zinc	SDAQ1	Pretreatment	128,000	175,000	145,476	132,000	178,000	149,545
	SDAQ2	Operational	356	25,800	4,942	1,240	153,000	102,624
	SDAQ2	Interrupted	7,450	166,000	92,705	46,600	220,000	137,650
TDS	SDAQ1	Pretreatment	NA	NA	NA	2,820	3,140	3,066
	SDAQ2	Operational	NA	NA	NA	1,430	3,150	2,704
	SDAQ2	Interrupted	NA	NA	NA	2,240	3,130	2,887
TSS	SDAQ1	Pretreatment	NA	NA	NA	16	43	34
	SDAQ2	Operational	NA	NA	NA	18	1,520	669
	SDAQ2	Interrupted	NA	NA	NA	<10	984	308

Notes:
NA = Not Applicable
NC = Not calculated
TDS = Total Dissolved Solids
TSS = Total Suspended Solids
ug/L = Micrograms per liter

TABLE 5-5
REMOVAL PERCENTAGES

Date	Aluminum	Cadmium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Zinc
10/27/2016	81.1%	99.8%	99.5%	99.9%	95.4%	98.3%	100.0%	97.0%	99.7%
10/28/2016	99.2%	99.7%	99.3%	99.8%	99.2%	99.2%	99.2%	97.0%	99.4%
11/2/2016	97.3%	98.4%	98.6%	99.5%	98.2%	99.5%	97.4%	97.1%	98.9%
11/4/2016	97.9%	99.3%	99.5%	99.8%	99.3%	99.9%	97.9%	97.1%	99.8%
11/10/2016[a]	73.9%	87.4%	89.3%	87.1%	86.5%	94.6%	91.2%	93.0%	83.5%
12/22/2016[a]	88.3%	96.2%	96.3%	96.3%	95.9%	97.7%	97.2%	98.4%	96.1%
1/16/2017[b]	90.9%	89.3%	95.4%	98.7%	96.5%	98.5%	62.4%	98.4%	98.5%
1/31/2017	90.4%	99.2%	98.9%	99.2%	96.4%	99.4%	99.3%	98.3%	99.3%
2/27/2017	NA	99.1%	98.7%	99.0%	96.1%	99.3%	99.4%	98.3%	99.1%
3/9/2017	82.3%	92.5%	92.9%	92.5%	91.6%	96.2%	94.5%	98.4%	92.5%
Minimum	73.9%	87.4%	89.3%	87.1%	86.5%	94.6%	62.4%	93.0%	83.5%
Maximum	99.2%	99.8%	99.5%	99.9%	99.3%	99.9%	100.0%	98.4%	99.8%
Mean	89.1%	96.1%	96.8%	97.2%	95.5%	98.3%	93.9%	97.3%	96.7%

Note: NA = Data not available

[a] = The lime had bridged in the hopper.

[b] = The hopper was empty

APPENDIX A

FIELD NOTES

10/14/15 Aquafix Construction 35° Clear

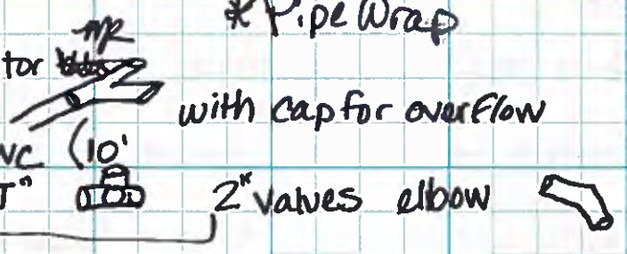
MR.SS with Keith Large (DEQ), Weave Consulting

0730- met to discuss days plans at Inconvenience Store.
0745- Mobilized equipment to head up Carpenter Creek

0820- Arrived at Silver Dyke with Eric from Weave Consulting
He started working on the Aquafix shed posts.

0830
0840- Will arrived onsite with telehandler.
Teiser brought up the excavator from below.
0840- Excavation of soil pile near where shed will be constructed began, making a soil (compacted) foundation.

Parts to purchase:



0855- Excavator started to clear channel for run-off above adit drainage.

0910- Teiser excavated run off drainage to road bed.
Will used telehandler to smooth and compact foundation area for lime shed.

0915- Excavated dam (adit collection pond from Proteus Pilot) and took out poly liner.

0930- Continued drainage basin excavation for hillside run off. Eric continued shed construction

0945- Moved Aquafix unit out of the back of the truck with excavator.

0950- Excavator making place for shed and beams for Aquafix placement.

1005- Redirected channel to the left of usual drainage to set and build aquafix shed.

1010- Created drainage basin.

1015- Lined channel with rocks, Set Foundation. Decided to move
-1045 foundation to allow more room for personnel inside the shed to dump in lime.

1115- Set Aquafix Unit.

1120- Started to demobilize equipment and supplies to head back down to Belt Creek for afternoon

1145- Departed Silver Dyke Adit.

1245- M. Roby left to get supplies in Great Falls

1630- M. Roby met S. Savage, Roger (EPA), Keith (DEQ), Will & Teiser from Wave
Eric was back at Silver Dyke Adit building Aquafix Shed.

1650- S. Savage. held safety debrief.

1735- M. Roby arrived onsite to see Aquafix shed nearly completed.

1750- Teiser used excavator to fill in area around the shed.
Eric and Will worked on installing the shed roof trusses.

1800- Teiser moved down to dewater the sedimentation pond, to let it dry out before constructing the pond tomorrow.

1820- Started cleaning up for the day.

1840- Loaded Bobcat to take on trailer back to Townsend to fix tire.

1900 - Departed Silver Dyke Adit. Dark.

10/15/15 Aquafix Construction 35F/50°F Clear (15)
M. Roby

-730- Waited for Shipment of Lime.
0850 Will 406-698-6315 422-9185
0730- Will took truck with broken bobcat back to Helena.
0730- Eric headed up to Silver Dyke to continue shed construction.
0850- M. Roby drove to meet Teiser at turnoff to Carpenter Creek Road.
0915- Shipment Arrived at Carpenter Creek Road junction pullout.
1010- Finished unloading trailer. Driver left.
1015- Cored off pullout to make it easier to load. Teiser headed up to Silver Dyke Adit
M. Roby went to Royal's store to call Will to have him pick up a load of lime on his way up to Silver Dyke. when he gets back from Helena.
1100- M. Roby arrived at Silver Dyke Adit. Roger (EPA), Keith (DEQ) had recently arrived.
Eric had installed roof and was ~~waiting for~~ starting to lay roof sheeting.
1115- Teiser worked on some more of the sedimentation pond
We moved material
1145- Teiser brought up excavator to level out shed area and entrance road, and packed
1200- Colin and Chris arrived.
Chris wanted the shed to be smaller.

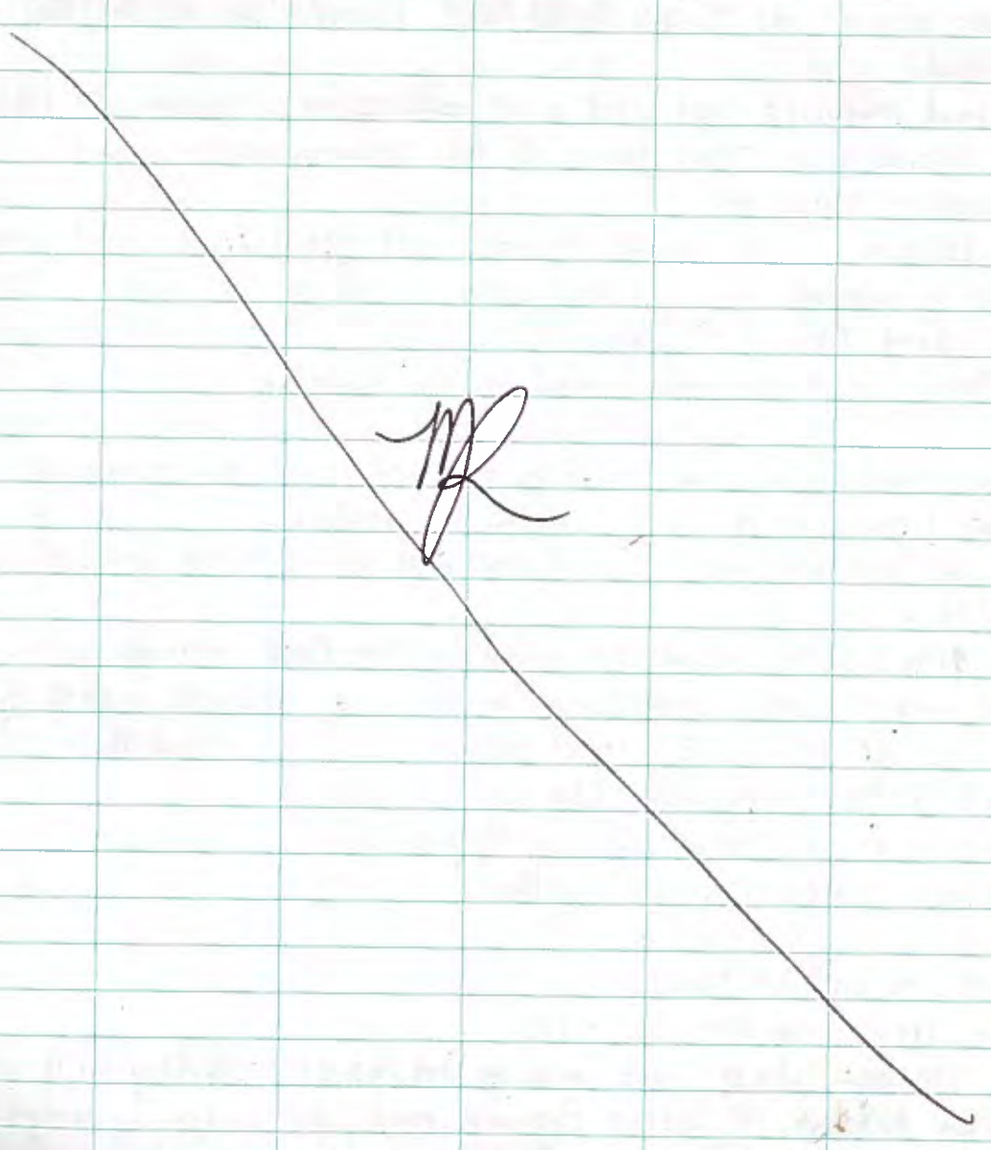
1215- Teiser used excavator to dig out more of the channel.
1230- Colin brought up 2 culverts to install.
1300- Culvert placed under road area, pipes will be installed through the culvert.
Will started to layout the shed for the lime storage.
1305- Measured pond dimensions to ensure volume would be sufficient.
Shelter for lime layed out.
1330- Started to figure out piping set-up.
Shed roof structure put together
1345- Started putting piping together.

1415- Supports up on shed.
1500- Chris and Colin left the site.
1500- Lime storage shed continues to be constructed by Will thru. Keith helped M. Roby figure out pipe wrapping and glued joints.
1700 Teiser brought up loads of lime (4 tons per trailer), which took about an hour and a half a load.
Eric finished the Aquafix shed.

1150 - Eric finished packing up and left to head down with Teiser.
1815 - Teiser picked up another load, and unloaded up at the Adit. He will pick up some 4 more bags and haul up tonight.
1830 - Keith, Will, and M. Roby cleaned up the site, after Will finished the lime storage assembly.

1845 - Keith left site
1845 - Will continued some excavation work around the sheds, and made a path down to the Aquafix unit. Continued until Teiser returned with the last load of lime for the night. 4 bags remain at the road to be brought up in the morning.
-1920

1930 - Departed Silver Dyke.



10/16/15 — Aquafix Construction — 40° Windy — M. Roby — (1.7)

0745 - Met with Keith (DEQ) and Will (Weave) to discuss morning plans. Will will go with Keith to look at the Lower Rebellion and discuss the potential to install the concrete cloth around the adit opening where the hill is eroding.
Teiser will load the remaining 4 bags on the trailer to take to the Silver Dyke then return for the straw bales and other misc. supplies to be hauled on the trailer and taken to Silver Dyke.

0820 - Collected Samples for the usual sampling rotation (Big Sevenly Turbidity Monitoring
to 0940 sites

0940 - Continued cutting pipe for piping network. Teiser, Will, and Keith were not at Silver Dyke adit, but Teiser had brought up the last Lime.
1000 - Kathie and Colin arrived. We planned the sedimentation pond.
1015 - Teiser arrived with a trailer of more supplies.
1045 - M. Roby departed site.

After discussion, the crew finished putting all of the lime in the lime shelter before departing the site around noon. The new liner was still back ordered and after trying to pick it up this afternoon, they will have to try again on Monday. The crew reset the culvert too.
-Added 5:30pm

Aquafix Installation

55°, Cloudy
M. Roby

10/19/15 Starting Mileage: 10,720

5:30am - Departed Helena.
7:45am - Arrived in Neihart to wait for Ray Besel's crew to move the dirt from Dixon's property.
8:30am - Adam and Brett from Besel Construction arrived with a load of gravel for Dixon's garage, and a backhoe to move the dirt back and rocks to the side.
to 10:45am - watched and told crew to move rocks for rip-rap to the left in a clearing to be used later.

11:00am - Arrived at Silver Dyke Adit with Teiser. Will brought up the trailer with the new rubber liner.
- Unloaded new supplies

12:00pm - Situated liner to be unloaded, cut and overlapped with original liner.

12:10pm - While Will and Teiser started to lay out the liner and excavate the remainder of the sedimentation pond, I had to return to the Besel Construction crew to check the progress of the Dixon pile.
12:30pm - Arrived at Dixon property. Crew was just finishing the ~~removal~~ re-placement of the dirt.

13:00pm - Besel Construction de-mobilized equipment, and left.
13:15pm - Went to Tony's (Bob's Bar) to call and talk to Colin & Spencer.

13:45pm - Arrived back at Silver Dyke Adit to find:
- remainder of sedimentation pond dug out
- new liner installed, overlapped on PVC liner with "Locktite" premium adhesive (Will said that the manufacturer of the new liner recommended a calking / adhesive seal)
- They had to cut the new liner to fit in the area.

14:00pm - Went down to look at ~~adhesive~~ area where adhesive was applied with Will.
- Walked perimeter of pond with Will (he described their process).
- Sedimentation pond not exact shape because ground is too soft to move excavator around.

14:15pm - Continued work on PVC pipe wrapping (with insulation) while Will and
- 15:45pm Teiser packed up equipment to demobilize. Teiser departed.

Note: The crew didn't want to remove the old liner because they would have Ⓐ to drain the pond, Ⓑ Re-build the wall on the backside after dewatering in a muddy area where the excavator would potentially sink. There was no feasible way, therefore, to re-design the outlet without demolishing the already existing wall on the downhill side. A berm was left btwn. old & new sed. pond to prevent water from leaking.

16:00 - Will moved down to lower road to excavate the sludge de-watering/drying area. The location was further away then we had hoped, but there was no feasible area to put it anywhere else, where the excavator wouldn't sink. The target dimensions were 25' x 25' in area.

M. Roby continued work on piping insulation/wrapping.

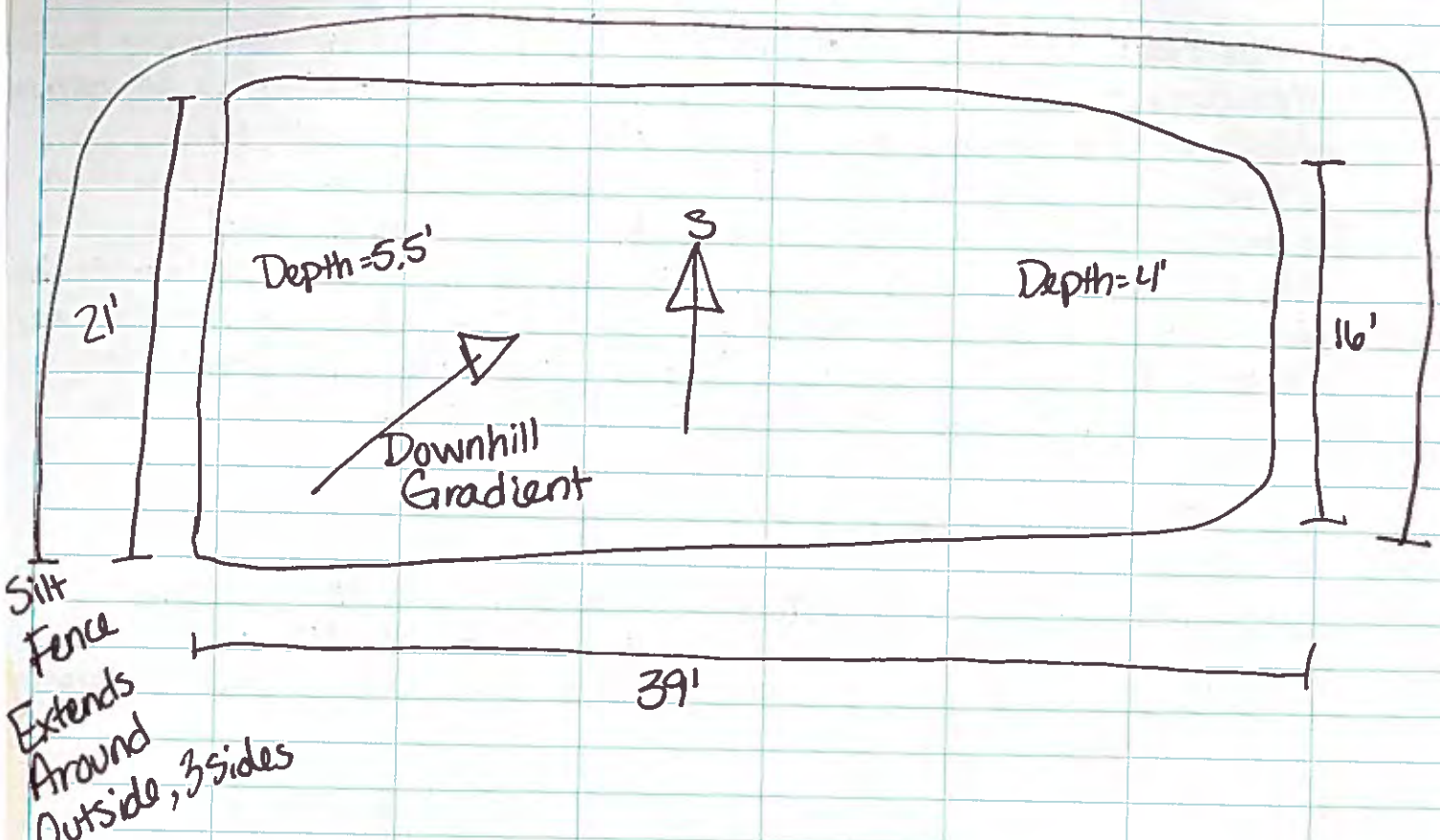
16:40 - Dimensions of sludge drying area ~~beloww~~ on following page.

16:45 - Will started installation of silt fence. M. Roby helped.

18:00 - Departed Site. M. Roby unlocked/locked gates. Will walked excavator down.

MR

Sludge Drying Area:



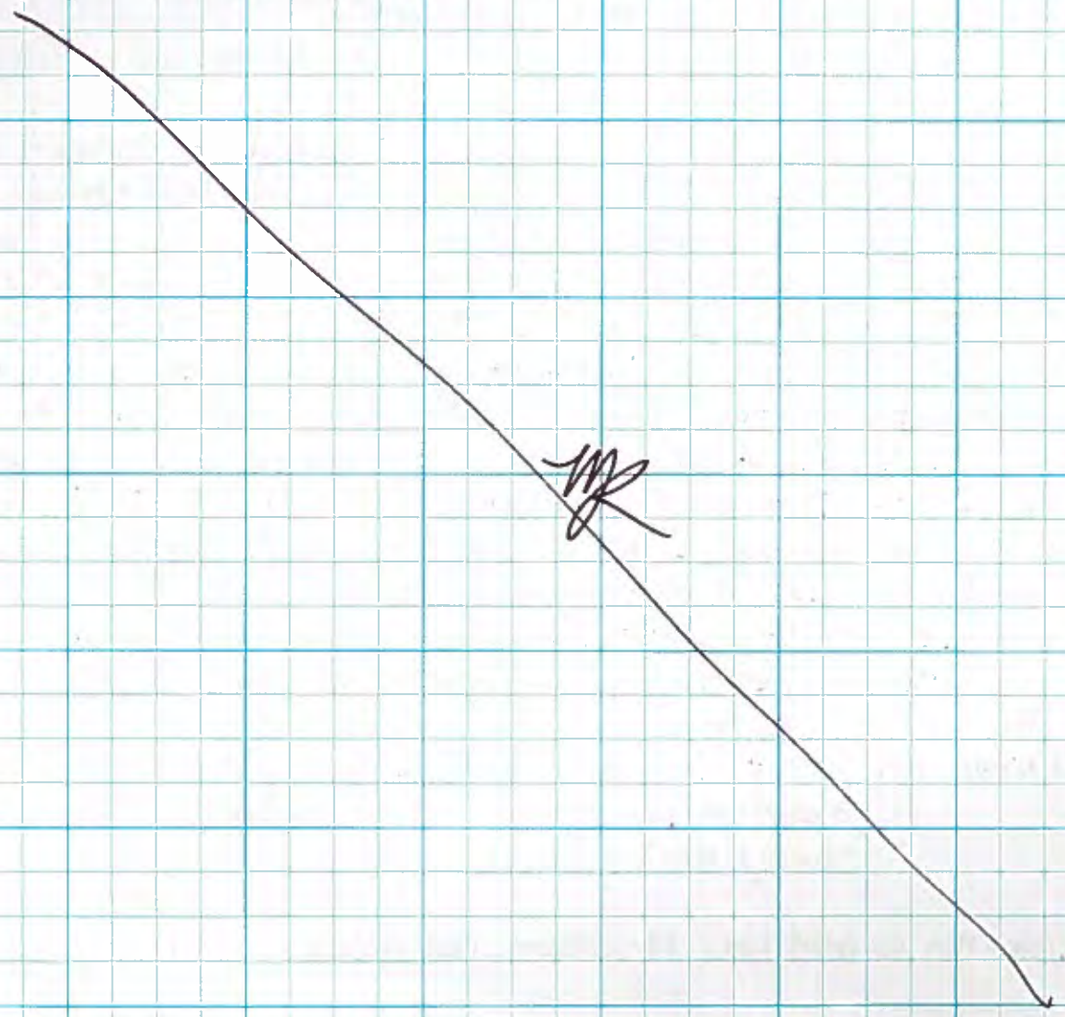
Silt Fence Extends Around Outside, 3 sides

10/20/15 Aquafix Installation 45°, Fog (21)
M. Roby

14:15pm- M. Roby Arrived at Silver Dyke Adit. Sedimentation pond SLOWLY Filling

Activities: - Installation of piping system/network at Aquafix
- Piping Sections put together
- Pipe Wrap/Insulation of piping sections.
- Attempt to install sections, no luck.
- Measurement and pipe layout.

18:35pm- Departure from SD Adit



10/21/15 Aquafix Installation 50°F, Clear
M. Roby
S. Savage

10:00am - Wrapping of final sections of piping, at Bob's Bar waiting on Spencer to arrive (we will drive up in pickup together).

11:45am - Spencer arrived, loaded up truck with supplies and headed up the hill. Keith arrived at Bob's Bar with DEQ accountant Russ. They will check out Snow Creek in addition to the Silver Dyke work.

12:05pm - Spencer and I started installing the piping (again. I had failed at this yesterday) through the installed culvert.

—14:00pm
- Installed braces at critical joints where pipe would not be able to lay in channel.
- Worked from bottom (Aquafix side) to up-side of culvert before installing 6" to 4" reducer and 4" assembled section.
- Fit pieces in between.

14:00pm - 14:30pm Checked joints, Wrapped insulation around joints, Cleaned up supplies. Checked Aquafix. It is rotating! Had to adjust gear operating auger and add water to dissolve lime.

14:30pm - Walked down channel from Aquafix shed to Sed. Pond ≈ 130ft.
- Sed. pond water elevation had not changed since yesterday. Checked seal of liners (adhesive), to find that the "locktite" hadn't adhered to the rubber liner, only the PVC (original liner). Therefore we have a leak!.
- However - Seaps below sed. pond seem to be unchanged from seaps present prior to new sed pond excavation.
- Measured Sed. Pond.

MF 1500pm - Checked on sludge drying area, took measurements
1515pm - Approximately 195ft from bottom of outflow liner to sludge drying basin.

1545pm - Decided not to add lime to system, not going to operate

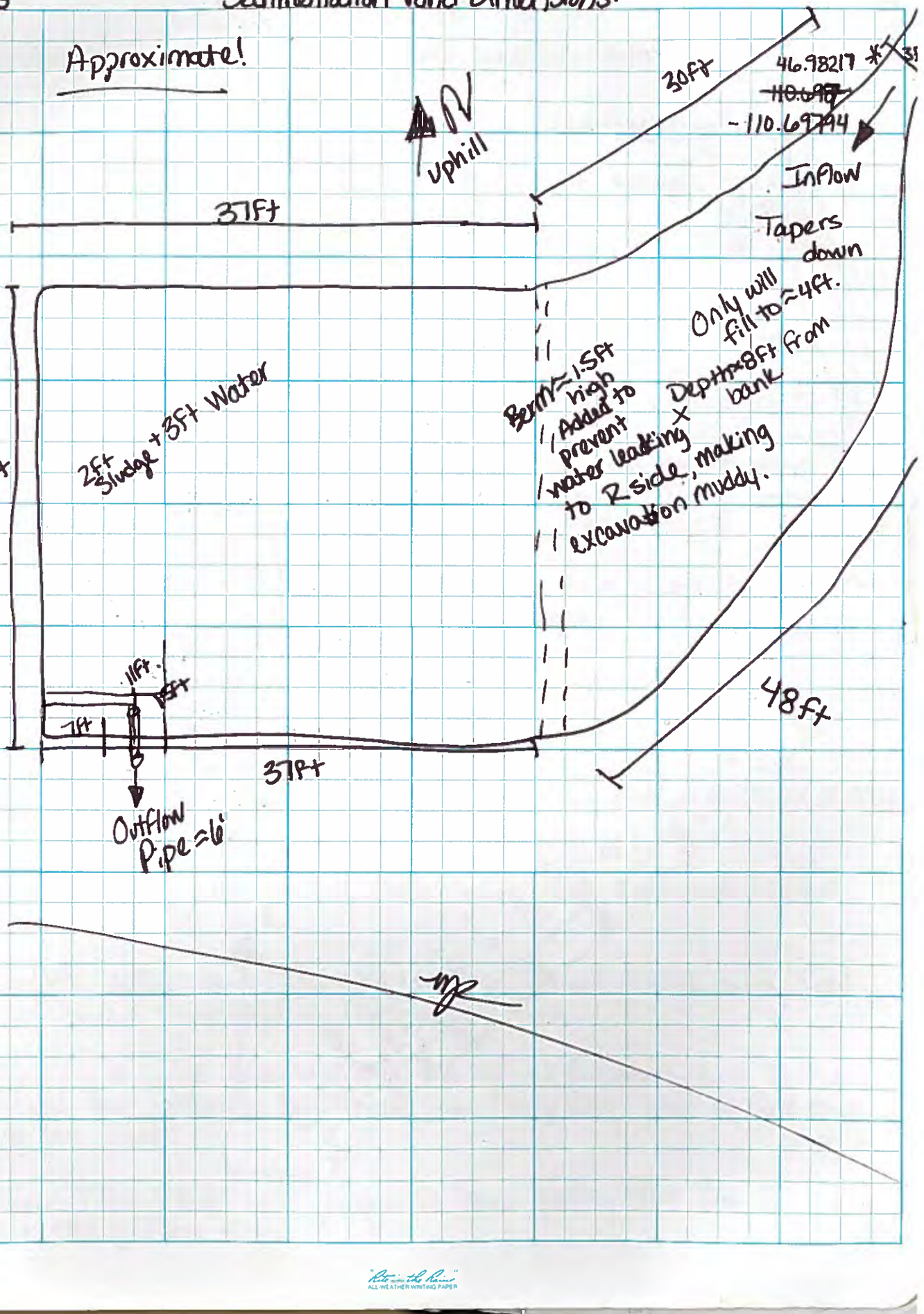
1625pm - Arrived At Big Seven Mill. Departed Site after.

MF

10/21/15

Sedimentation Pond Dimensions:

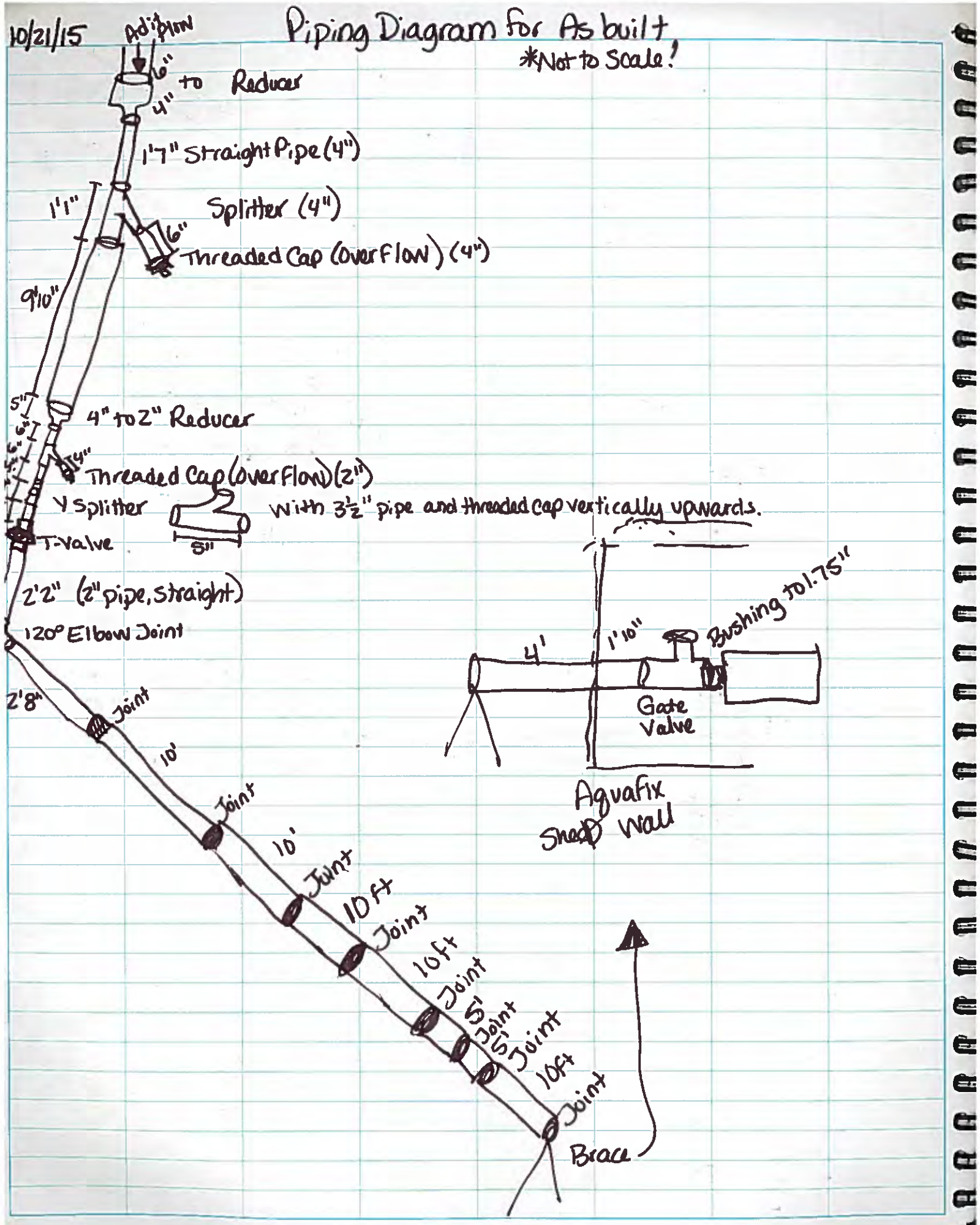
Approximate!



10/21/15

Piping Diagram for As built

*Not to Scale!



45° Overcast

0530 - Loaded up Equipment For weekly samplingr and Sedimentation pond Repair.

0600 - Left Helena For Neihart via White Sulphur Springs.

0750 - Arrived in Neihart. Waited For will For 15 min., then headed to SD Adit to see if he was there.

0830 - Arrived @ SD Adit. Will is not here. First Gate lock was Latched, Not locked. Headed Back to Neihart to wait.

0850 - Will arrived + Met @ Royals store. Was late Because he was waiting For trailer tire to get repaired.

0900 - Left For SD Adit to Fix Sed. pond liner.

0915 - Arrived @ SD Adit. Will put waders on and we walked to the sed. pond. Discovered Large Air pockets under liner which Might have caused seal to Break. Will Stepped around to push air out + placed Rocks along seam. Talked about potential repair options:

1.) Drain + Reseal w/more adhesive.
2.) Drain, Reseal, and place sand Bags along liner Seam.
3.) Wait For HDPE Liner and Hot weld to Existing/old liner.
4.) Leave Rocks w/o resealing.

0955 - Pond is Filling after placing Rocks along seam. Left pond to Finish door on Aquatix shed.

1030 - Called Colin and discussed options. He said Ideas sound Good But to put Responsibility / Decision on them.

1045 - Talked to will about options & Colin's thoughts. Said he thinks sand Bag option is Best. Helped him hang door and walked Back to Sed. pond.

1130 - Pond has Filled with water in Main portion But Some air Bubbles are seeping From seam.

1215 - Continued to help will hang Sliding door on AquaFix sled. Discussed in detail plan using sandbags.

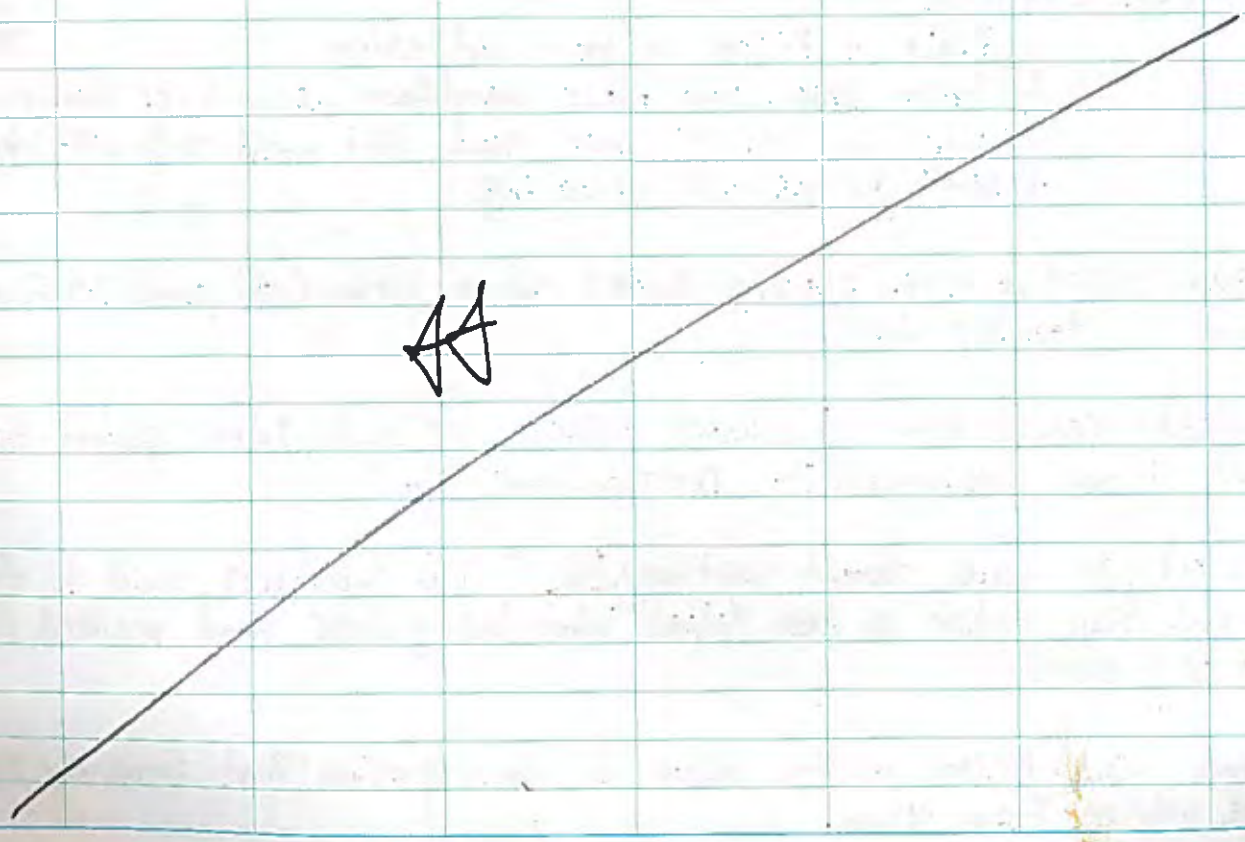
1245 - Talked to Colin and Told him detailed plan From will. He approved as long as adhesive was used.

1300 - Helped will Finish Door. Paint was applied. Decided to Lead to sed. pond and reroute Channel so liner could dry out over night.

1340 - Channel is rerouted and Liner Seam is out of H_2O For drying. Final plan For Fixing liner is:

1.) Dry Edges as Best as possible.
2.) Get adhesive, Sandbags + Bentonite.
3.) Scrub Edges of liner For optimal surface adhesion.
4.) Apply adhesive, work air pockets out, and Lay sand Bags on top of Adhesive seam.

1400 - Left SD Adit For the day and Began weekly Sampling.



10/28/15 SS 20°F Clear, SNOW

0600- Loaded Equipment For Aquafix Sampling.

0620- Left Helena For Neihart via White Sulphur Springs.

0810- Arrived in Neihart & met Will @ Royals store. Got Coffee & headed to SD Adit.

0830- Arrived @ SD Adit. Walked down to sed. pond and inspected repairs. Sand Bags placed appropriately and adhesive was used. Bentonite was also placed along edge for double protection.

0850- Rerouted channel Back to sed. pond and Began filling.

0920- Seam appears to Be holding and no Air pockets are visible. Pond is filling.

0930- Will Left SD adit and said to Contact him if anything else needs to Be done.

0945- Fill 3-5gal Buckets of lime and staged For Loading into Aquafix unit. Read through SAP to confirm Sampling procedures.

1030- Finished Reading SAP, Decided to Take Background Samples. Outlet of sed. pond sample will Be Collected at inlet due to time delay of pond Filling.

1045- Started Calibrating Sonde. Calibrated to within acceptable limits:

1145- Collected Background Sample From Adit: SDAQI-SW-L-001
Took field parameters: pH: 5.32 Temp: 8.31°C
ORP: 41.0 mV Turbidity: 18.7 FNU
DO: 0.55 ppm
SC: 3093 µS/cm
Sampled For Total & Dissolved Metals (HNO_3), Anions, TDS, and TSS.

10/28/15

1215 - Collected Background sample @ pond Inlet: SDAQ2-SW-L-001
Sampled For total + Dissolved Metals (HNO_3), Anions, TDS, and TSS.
Took field parameters:
pH: 5.51 SC: 3101 uS/cm
ORP: 59.0mV Temp: 6.51°C
DO: 2.17ppm Turb: 40.9 FNU

1230 - Added 3-5gal Buckets of Lime to Aquafix unit w/valve completely open. Left SD Adit to take remainder of Background Samples. Will check on Lime after.

1235 - Collected Background sample @ Sih'mem Creek on Sih'mem Creek Rd.
SDAQ3-SW-L-001
Sampled For Dissolved Metals (HNO_3).
Took field parameters:
pH: 5.79 SC: 1091 uS/cm
ORP: 99.5mV Temp: 4.12°C
DO: 2.57ppm Turb: 19.2 FNU

1250 - Collected Background sample @ Sih'mem Creek Before CC Confluence.
SDAQ4-SW-L-001
Sampled for Dissolved metals (HNO_3).
Took field parameters:
pH: 4.97 SC: 1375 uS/cm
ORP: 135.9mV Temp: 5.15°C
DO: 2.38ppm Turb: 1.0 FNU

1305 - Collected Background sample @ Confluence of Sih'mem Creek + CC
SDAQ5-SW-L-001
Sampled For dissolved Metals (HNO_3)
Took field parameters:
pH: 5.96 SC: 205
ORP: 112.9mV Temp: 1.67°C
DO: 2.62ppm Turb: 0.0
Sih'mem Creek Flow did not reach CC confluence. Flow stopped Just Below Log Cabin (Green Roof). Sample was taken @ Confluence Location though.

1320 - Someone in Red Ford Pickup is Burning Slash pile Near Grey House (Green Roof).

1325- Collected sample (Background) @ Confluence of Snow Creek & CC
SDAQ6-SW-L-001
Sampled For dissolved metals (HNO_3)
Took field parameters:
pH: 6.44 SC: 300 µS/cm
ORP: 110.4mV Temp: 2.93°C
DO: 2.73ppm Turb: 0.4 FNU

1340- Collected Background sample @ Mouth of CC
SDAQ7-SW-001
Sampled For dissolved Metals (HNO_3)
Took field parameters:
pH: 6.77 SC: 361 µS/cm
ORP: 107.6mV Temp: 1.87°C
DO: 2.87ppm Turb: 0.0 FNU

1350- Collected Background sample @ After CC confluence w/ Belt Creek
SDAQ8-SW-001
Sampled For dissdved Metals (HNO_3)
Took field parameters:
pH: 7.09 SC: 240 µS/cm
ORP: 97.1mV Temp: 3.74°C
DO: 2.65ppm Turb: 0.1 FNU

1410- Arrived Back @ SD Adit to Check on Aquafix. Lime had discharged From Hopper But Missed Main channel Flow. Shifted unit so Lime deposited directly into water. Adjusted Flow rate By closing valve. Lime did not discharge. Closed valve completely to Build Head pressure in pipe. Opened valve Entirely to "kick start" Lime. This worked well. However, Significant amount of orange/Red water Flowed Through unit. This is most likely due to High velocity through pipe that is "clearing out" metal deposits in pipe. Lime Began discharging @ visually anticipated rate. Water color cleared up. Sedimentation pond is slowly Filling up and seam appears to be holding.

1425- Took First pH measurement From Aquafix outlet. pH = 6.45. Sample size approximately 2.0 gal.

1515 - Lime was not depositing. Reduced Flow, checked side gate For plugged "screw driver" that drives lime. Looked Fine. Opened valve again For Full Flow. Lime began discharging. waited 20 min For Lime to Continuously Flow. Took 2nd pH reading.
pH = 6.20
Sample size ≈ 2.0 gal
Closed valve Slighty to reduce Flow. Lime deposit appears to be at good rate.

1540 - Lime is depositing nicely @ reduced Flow rate. took 3.0 gal sample and measured pH.
pH: 6.53
Will keep Flow @ this rate and Make Slight adjustments.

1545 - Checked overflow valve and there was a tremendous amount of pressure in pipes. If reducing Flow rate, Need to open valve and check pressure + water level in pipe. Pressure was so Bad that overflow Cap Blew out of Hand as I was Loosening it.

1630 - Left top overflow cap off and Reduced Flow @ Aquafix unit. kept reducing Flow until Flow out of Aquafix was Equalized and no overflow was coming From Top Cap.

1645 - Left top overflow cap Loose and kept Flow @ Aquafix the same. Left SD Adit For the day.

AJ

11/2/15 SS 41° overcast

0800- Met Molly @ office and coordinated where we would Meet surveyor. Talked to chris about Aquafix and he said Lime was Not discharging. Asked if I should even sample and he said NO.

0900- Picked up Rental car and Left For Neihart via Great Falls.

1115- Met Mark + Kyle @ BC Tailing To survey Slope stabilization area. Discussed if Data should Be UTM or State plane cordinates. I would prefer State plane. They said this could Be done/Figured out once Back in the office.

1215- Mark + Kyle Finished Surveying BC Tailings. Broke down Equipment and drove to Slope Stabilization Pilot study area @ Big Seven.

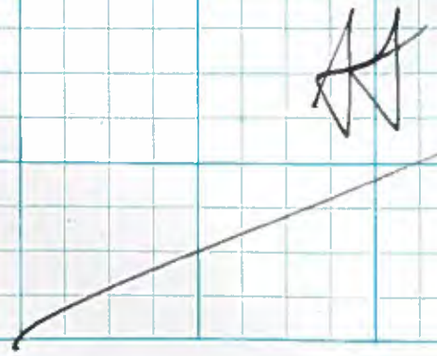
1235- Arrived @ Mackay Gulch Repository. Mark + Kyle setup Survey Base here.

1305 - Arrived @ Slope Stabilization Area @ Big Seven. Mark + Kyle Set Up Equipment For Survey.

1420 - Finished Surveying Area @ Big Seven.

1440 - Arrived @ SD adit to check Aquafix. Lime was not discharging very well. Removed 1.5 Buckets of lime From Hopper and lime discharged steadily @ a significant amount For 1 hr.

1540 - Left SD Adit.



2016 Aquafix MR. TD 10/18/16

windy/cloudy, 35°F

0800 - Arrived at office to load up equipment.
MR had to do some office work so were delayed.
0930 - Loaded equipment at storage unit.
1100 - Arrived at Belt Ranger Station. Left message for Bob Gleicho.
1215 - Uninstalled CCTMP3 Sonde. Downloaded data.
1230 - Uninstalled CCTMP 1 Sonde. Downloaded data.
1245 - Arrived at Silver Dyke. Showed TD around.
1305 - Started work on Aquafix Unit
Reinforced pipe fittings
Installed new ball valves and y-bends 2"
Insulated and repaired pipe wrap
Inspected and lubricated the aquafix
1830 - Departed site for the day

TD

2016 Aquafix MR, TD 10/19/16

0700 - Picked up supplies in Neihart cloudy, snow, 37°F
0740 - Arrived at Silver Dyke
Finished install of two remaining ball valves and insulated rest of the pipe
Reassembled piping and allowed flow through
Adjusted flow to the Aquafix by opening the closed 4" y-bend port and 2" T-bend port.
The 4" y-bend port was closed to increase flow to the aquafix. The 2" overflow remains open.
Installed two 10"x10" vents in the shed
Set combination for shed lock. 4687

1055 - Calibrated office sonde. Quick Cal Solution After Calibration:
pH: 6.83 SC: 5440 µS/cm
ORP: 166.7mV Turb: 2.5 FNU
DO: 7.23 ppm Temp: 4.81°C

Note: When 4" port was opened, the auger was rotating to slow.

1105 - Collected sample for Total Metals, Dissolved metals, Anions, TDS, and TSS from Aquafix Sample Station #1 at the adit drainage.
pH: 3.87 SC: 2504 µS/cm
ORP: 268.7 mV Turb: 48.8 ~~NTU~~ FNU
DO: 3.18 ppm Temp: 8.62°C

1110 - Collected sample for total metals, dissolved metals, anions, TDS & TSS at Aquifix Sample Station #2 at the outlet of the sedimentation pond.
pH: 3.87 SC: 2626 µS/cm
ORP: 277.5mV Turb: 10.2 FNU
DO: 6.25 ppm Temp: 5.58°C
Departed Silver Dyke Adit.

1150 - Collected dissolved metal sample from Aquafix Sample Station #3: Sihmem Creek (collected just below culvert passing under 3D Road).
pH: 4.91 SC: 1214 µS/cm
ORP: 248.3mV Turb: 1.8 FNU
DO: 7.33 ppm Temp: 3.92°C

Continued. 10/19/16

1200- Collected sample for dissolved metals just above Carpenter Creek Road from Sih-mem Creek. (Aquafix Sample Station #4).
pH: 5.04 SC: 400 µS/cm
ORP: 246.9 mV Temp: 4.06 °C
DO: 7.48 ppm Turb: 0.1 FNU

1205- Collected sample for dissolved metals from Sih-mem Creek (where marsh drains into Carpenter Creek) above Carpenter Creek confluence (Station #4B, to be confirmed) and below confluence from Carpenter Creek (Station #5)

4B (Above CC, Sih-mem Creek):
pH: 5.01
ORP: 266.6 mV
DO: 6.33 ppm
SC: 992 µS/cm
Turb: 0.1 FNU
Temp: 6.06 °C

5 (CC below confluence)
pH: 5.61
ORP: 230.0 mV
DO: 7.37 ppm
SC: 400 µS/cm
Turb: 0.1 FNU
Temp: 4.06 °C

1220 - Collected sample for dissolved metals from Carpenter Creek after the confluence with Snow Creek (Aquafix Sample Station #6)
pH: 5.58 SC: 154 µS/cm
ORP: 238.4 mV Temp: 4.18 °C
DO: 7.65 ppm Turb: 0.2 FNU

1235- Collected sample for ~~Do~~ dissolved metals from Carpenter Creek just above confluence with Belt Creek (Station #7).
pH: 6.11 SC: 152 µS/cm
ORP: 227.7 mV Temp: 3.92 °C
DO: 7.97 ppm Turb: 0.09 FNU

1240- Collected sample for dissolved metals from Belt Creek just below confluence w/ CC. (Station #8)
pH: 6.16 SC: 147 µS/cm
ORP: 222.2 mV Temp: 4.07 °C
DO: 7.74 ppm Turb: 0.02 FNU

1300- Departed Bob's for Helena. Spoke with Ken, he will allow us to store hay bales at his place.

2016 Aquafix TD, CR 10/25/16

0600	Left Helena, MT	clear 37°F
0800	Meet Olympus technical service and Dunlap trucking in Neihart, MT	
	Loaded ten one ton bags of lime on to a haul trailer with	
0910	Arrived at staging area, Chris took Olympus to genie loader plan hauling of line to Silver Dyke	
0920	Calibrated office sonde. Quick cal solution after calibration	
	pH: 6.85 SC: 1125 uS/cm	
	ORP: 187.5 mV Turb: 1.5 FNU	
	DO: 4.16 ppm Temp: 14.76 °C	
0930	GPS waypoint 265	parameters from CC road
	pH: 5.26 SC: 1178 uS/cm	to settling pond on
	ORP: 283.8 mV Turb: 0.0 FNU	Sih-mem creek.
	DO: 7.16 ppm Temp: 4.92 °C	
0940	GPS waypoint 266	
	pH: 4.8 SC: 688 uS/cm	
	ORP: 297.7 mV Turb: 0.0 FNU	
	DO: 6.92 ppm Temp: 5.09 °C	
0950	GPS waypoint 267	
	pH: 4.81 pH SC: 1197 uS/cm	
	ORP: 297.4 mV Turb: 2.4 FNU	
	DO: 6.99 ppm Temp: 5.12 °C	
0955	GPS waypoint 268	
	pH: 4.8 SC: 1191 uS/cm	
	ORP: 295.7 mV Turb: 0.0 FNU	
	DO: 6.97 ppm Temp: 5.18 °C	
1000	GPS waypoint 269	
	pH: 4.85 SC: 1200 uS/cm	
	ORP: 293.4 mV Turb: 0.0 FNU	
	DO: 6.91 ppm Temp: 5.17 °C	
1005	GPS waypoint 270	
	pH: 4.89 SC: 1216	
	ORP: 290.8 mV Turb: 0.0 FNU	
	DO: 6.93 ppm Temp: 5.19 °C	
1010	GPS waypoint 271	
	pH: 4.94 SC: 1222 uS/cm	
	ORP: 288 mV Turb: 0.1 FNU	
	DO: 6.96 ppm Temp: 5.19 °C	

continued

1015	GPS waypoint 272		
	pH: 4.9	SC: 1209 uS/cm	
	ORP: 285.9 mV	Turb: 0.0 FNU	
	DO: 6.8 ppm	Temp: 5.21 °C	
1020	GPS waypoint 273		
	pH: 4.83	SC: 1272 uS/cm	
	ORP: 286.5 mV	Turb: 0.1 FNU	
	DO: 6.98 ppm	Temp: 5.06 °C	
1025	GPS waypoint 274		
	pH: 4.8	SC: 1301 uS/cm	
	ORP: 285.7 mV	Turb: 0.1 FNU	
	DO: 6.99 ppm	Temp: 5.08 °C	
1030	GPS waypoint 275		
	pH: 4.74	SC: 1367 uS/cm	
	ORP: 286.4 mV	Turb: 0.5 FNU	
	DO: 6.97 ppm	Temp: 5.06 °C	
1035	GPS waypoint 276		
	pH: 4.8	SC: 1366 uS/cm	
	ORP: 287.1 mV	Turb: 2.0 FNU	
	DO: 6.94 ppm	Temp: 4.97 °C	
1040	GPS waypoint 277		
	pH: 3.69	SC: 2041 uS/cm	
	ORP: 331.3 mV	Turb: 0.5 FNU	
	DO: 6.84 ppm	Temp: 4.99 °C	
1045	GPS waypoint 278		
	pH: 3.64	SC: 2123 uS/cm	
	ORP: 376.4 mV	Turb: 0.6 FNU	
	DO: 6.84 ppm	Temp: 5.03 °C	
1050	GPS waypoint 279		
	pH: 3.64	SC: 2151 uS/cm	
	ORP: 397.5 mV	Turb: 0.7 FNU	
	DO: 6.86 ppm	Temp: 5.06 °C	
1055	GPS waypoint 280		
	pH: 3.65	SC: 2167 uS/cm	
	ORP: 405.8 mV	Turb: 1.0 FNU	
	DO: 6.79 ppm	Temp: 5.14 °C	
1055	GPS waypoint 281		
	pH: 3.66	SC: 2174 uS/cm	
	ORP: 409.7 mV	Turb: 1.1 FNU	
	DO: 6.86 ppm	Temp: 5.23 °C	

continued

1100 GPS way point 282
pH: 3.67 SC: 2234 uS/cm
ORP: 410.4 mV Turb: 0.7 FNU
DO: 6.77 ppm Temp: 5.40°C

1105 GPS waypoint 283
pH: 3.61 SC: 2474 uS/cm
ORP: 411.9 mV Turb: 2.1 FNU
DO: 6.65 ppm Temp: 5.76°C

1110 GPS waypoint 284
pH: 3.57 SC: 2665 uS/cm
ORP: 412.4 mV Turb: 2.3 FNU
DO: 6.73 ppm Temp: 5.90°C

1115 GPS way point 285
pH: 3.59 SC: 2684 uS/cm
ORP: 408.5 mV Turb: 2.8 FNU
DO: 6.55 ppm Temp: 6.11°C

1120 GPS way point 286 settling pond outlet
pH: 3.61 SC: 2781 uS/cm
ORP: 407.6 mV Turb: 3.3 FNU
DO: 6.52 ppm Temp: 6.46°C

1130 Haul trailer with lime reached Silver Dyke at 1030. ~~Unloaded storage tent~~ TD Removed 23 one ton bags of unused lime and stored them south of the aquafix shed next to the road. Used Genie loader to move bags

1140 Backed haul trailer closer to the storage shed tent. Started unloading lime from haul trailer and placing bags in storage shed tent.

1210 Finished storing new lime in storage shed tent and started filling aquafix hopper via 5-gallon buckets.

1225 Finished loading aquafix hopper. Appears to be operating valve is fully open
Covered the 23 unused bags of lime with heavy duty tarps. 3 20'x16' 1 16'x12' weighted tarps with rocks and iron bar until rope can be brought up. small amount of overflow

1300 Checked site over before departing for Helena, MT

JD

2016 Aquafix TD, RF 10/26/16

1300	Arrived at Silver Pyke and checked lime hopper. It was near empty closed the inlet valve down by 6 turns. 11 turns is fully closed.	cloudy 49°F
1310	Calibrated office sonde. Quick cal solution after calibration pH: 6.91 SC: 8345 µS/cm ORP: 187.8 mV Turb: 0.0 FNU DO: 4.39 ppm Temp: 16.06 °C	
1320	Settling pond parameters pH: 11.66 SC: 2785 µS/cm ORP: 20.3 mV Turb: 29.4 FNU DO: 3.47 ppm Temp: 7.69 °C	
1325	Started filling lime hopper back to previous level	
1400	tied down 23 lime bags and tarps. departed Silver Dyke	

TD

2016 Aquafix 10/27/16

1305 - Arrived at Silver Dyke and checked lime hopper. It is nearly empty. Cloudy, 50°F

Calibrated office sonde. Quick cal solution after calibration
pH: 6.85 SC: 8246 uS/cm
ORP: 231.1 mV Turb: 12.0 FNU
DO: 5.16 ppm Temp: 13.6 °C

1315 - Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #1 at the adit drainage.
pH: 3.62 SC: 2771 uS/cm
ORP: 295.0 mV Turb: 36.5 FNU
DO: 2.86 ppm Temp: 8.67 °C

1340 - Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #2 at the outlet of the sedimentation pond
pH: 12.04 SC: 3795 uS/cm
ORP: -7.3 mV Turb: 14.1 FNU
DO: 5.12 ppm Temp: 8.94°C

Closed inlet valve to the waterwheel by an additional 3 turns for a total of 9.11 turns is fully closed.

Reloaded the lime hopper. First bag of lime is 1/4 empty now

1430 - Collected sample for dissolved metals from aquafix sample station #3: Sihnem Creek (collected just below culvert passing under SD road.)
pH: 9.4 SC: 1430 uS/cm
ORP: 137.2 ~~OR~~ TD mV Turb: 46.1 FNU
DO: 6.85 ppm Temp: 7.97°C

1435 Collected sample for dissolved metals from aquafix sample station #4: just above CC road from Sih-mem creek.
pH: 8.7 SC: 1208 uS/cm
ORP: 174.3 mV Turb: 15.7 FNU
DO: 6.76 ppm Temp: 8.31°C

1440 Collected sample for dissolved metals from aquafix sample station #5 from below confluence of Sih-men and Carpenter creek.
pH: 8.85 SC: 230 uS/cm
ORP: 162.5 mV Turb: 9.7 FNU
DO: 7.22 ppm Temp: 6.38°C

continued

1450 Collected sample for dissolved metals from aquafix sample station #6 from CC after confluence with Snow Creek
pH: 8.69 SC: 151 µS/cm
ORP: 177.1 mV Turb: 15.9 FNU
DO: 7.10 ppm Temp: 8.10°C

1500 Collected sample for dissolved metals from aquafix sample station #7 from just above confluence with belt creek.
pH: 8.64 SC: 157 µS/cm
ORP: 182.4 mV Turb: 13.7 FNU
DO: 7.26 ppm Temp: 7.54°C

1505 Collected sample for dissolved metals from aquafix sample station #8 from Belt creek just below confluence with CC.
pH: 8.57 SC: 143.40 S/cm
ORP: 179.7 mV Turb: 9.3 FNU
DO: 7.34 ppm Temp: 7.13°C

JD

2016 Aquafix 10/28/16

0900 - Arrived at Silver Dyke rain, cloudy 43°F
checked lime hopper. It was half empty. FD
~~collected sample~~
Calibrated office sonde. Quick cal solution after calibration
pH: 6.87 SC: 10.6 mS/cm
ORP: 230.8 mV Turb: 10.8 FNU
DO: 5.24 ppm Temp: 9.41°C
Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #1 at the adit drainage
pH: 3.63 SC: 2704 mS/cm
ORP: 325 mV Turb: 30.6 FNU
DO: 2.70 ppm Temp: 8.65°C

0820 Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #2 at the outlet of the sedimentation pond.
pH: 11.54 SC: 80.32 ms/cm
ORP: 31.6 mV Turb: 9.7 FNU
DO: 5.71 ppm Temp: 7.14°C

0840 Refilled lime hopper and left valve at 2 of 11 turns open. Will check pH again monday (10/31) and adjust as needed. A little over ½ of the first bag of lime remains. TD

0855 Collected sample for ~~total~~ dissolved metals from aquafix sample station #3: Sib-mem creek just below culvert passing under SD road.
pH: 9.41 SC: 1427 mS/cm
ORP: 148.8 mV Turb: 20.1 FNU
DO: 7.06 ppm Temp: 5.97°C

0925 collected sample for dissolved metals from aquafix samde station #4 just above CC road from Sib-mem creek.
pH: 8.81 SC: 1216 mS/cm
ORP: 177.6 mV Turb: 16 FNU
DO: 7.19 ppm Temp: 6.07 °C

0930 Collected sample for dissolved metals from aquafix sample station #5 from below confluence of Sib-mem and CC.
pH: 8.56 SC: 198 mS/cm
ORP: 185.3 mV Turb: 10.5 FNU
DO: 7.35 ppm Temp: 5.28 °C

Continued

0945 Collected sample for dissolved metals from aquafix sample station #6 from CC after confluence with Snowcreek
pH: 8.55 SC: 153 uS/cm
ORP: 182.3 mV Turb: 9.1 FNU
DO: 7.47 ppm Temp: 5.82 °C

0955 Collected sample for dissolved metals from aquafix sample station #7 from just above confluence of CC and Belt creek.
pH: 8.50 SC: 157 uS/cm
ORP: 187.5 mV Turb. 9.2 FNU
DO: 7.47 ppm Temp: 6.35 °C

1000 Collected sample for dissolved metals from aquafix sample station #8 from Belt creek just below confluence with CC.
pH: 8.38 SC: 143 us/cm
ORP: 190 mV Turb: 9.2 FNU
DO: 7.52 ppm Temp: 6.21 °C

1230 Departed for Helena after taking straw bales to the compromise shaft.

JD

2016 Aquafix TD 10/31/16

0930 - Departed Helena for Neihart overcast, snow 36°F

1230 - Arrived at silver Dyke
Checked lime hopper. It was empty
Calibrated office sonde. Quick cal solution after calibration
. pH: 6.81 SC: 17.47 mS/cm
ORP: 218.5 mV Turb: 15.1 FNU
DO: 4.46 ppm Temp: 17.29 °C

1250 Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #1 at the adit drainage
pH: 3.60 SC: 2749 uS/cm
ORP: 309 mV Turb: 29.3 FNU
DO: 2.5 ppm Temp: 8.65 °C
GPS point Aqua 1

1320 Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #2 at the outlet of the sedimentation pond.
pH: ~~8.67~~ 6.22 SC: 2807 uS/cm
ORP: ~~255.7~~ 190.4 mV Turb: 39.6 FNU
DO: 6.09 ppm Temp: 5.05 °C
GPS point Aqua 2
~~Collected sample~~ TD

1340 Refilled lime hopper and adjusted valve to 1 of 11 turns open since hopper was completely empty.
V4 of first bag of lime remains.

1415 Collected sample for dissolved metals from aquafix sample station #3 from Sih-mem creek just below culvert passing under SD road
pH: 6.00 SC: 1346 uS/cm
ORP: 216.7 mV Turb: 23.4 FNU
DO: 7.03 ppm Temp: 4.43 °C
GPS point Aqua 3

1430 Collected sample for dissolved metals from aquafix sample station #4 from Sih-mem creek just above CC road.
pH: 6.01 SC: 1169 uS/cm
ORP: 216.4 mV Turb: 13.9 FNU
DO: 7.13 ppm Temp: 4.23 °C
Gps point Aqua 4

continued

1435 Collected sample for dissolved metals from aquafix sample station #5 from below confluence of Silvermand CC
pH: 6.4 SC: 250 mS/cm
ORP: 206.4 mV Turb: 11 FNU
DO: 7.03 ppm Temp: 4.12 °C

~~TP 1445~~ GPS point Aqua 5

1445 Collected sample for dissolved metals from aquafix sample station #6 from CC after confluence with Snow creek.
pH: 6.47 SC: 162 mS/cm
ORP: 207.2 mV Turb: 10.8 FNU
DO: 7.5 ppm Temp: 4.7 °C

GPS point Aqua 6

1500 Collected sample for dissolved metals from aquafix sample station #7 from just above confluence of CC and Belt creek
pH: 6.43 SC: 161 mS/cm
ORP: 212.3 mV Turb: 18.8 FNU
DO: 7.67 ppm Temp: 4.87 °C

GPS point Aqua 7

1505 Collected sample for dissolved metals from aquafix sample station #8 from just below Belt creek and CC confluence.
pH: 6.52 SC: 134 mS/cm
ORP: 207.2 mV Turb: 13.2 FNU
DO: 7.7 ppm Temp: 4.93 °C

1510 Parameters of Belt creek above confluence with CC.
pH: 6.63 SC: 132 mS/cm
ORP: 200.2 mV Turb: 14.3 FNU
DO: 7.65 ppm Temp: 4.97 °C

1540 Departed Neihart for Helena.

12

2016 Aquafix 11/2/16

0830 - Arrived at Silver Dyke clear, wind, 36 °F
Checked lime hopper. It was half full.
Calibrated office sonde. Quickcal solution after calibration.
pH: 6.83 SC: 20.3 mS/cm
ORP: 192.9 mV Turb: 22.8 FNU
DO: 7.16 ppm Temp: 0.98 °C
The SC calibration is off and reading 4 times higher than the standard.

0845 Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #1 at the adit drainage.
pH: 3.27 SC: 2287 uS/cm
ORP: 321 mV Turb: 37.8 FNU
DO: 2.78 ppm Temp: 8.62 °C

0910 Collected sample for total metals, dissolved metals, anions, TDS, and TSS from aquafix sample station #2 at the outlet of the sedimentation pond.
pH: 9.09 SC: 2437 uS/cm
ORP: 125.1 mV Turb: 400 FNU
DO: 4.95 ppm Temp: 3.18 °C

0950 Collected sample for dissolved metals from aquafix sample station #3 from Sih-nem creek just below culvert passing under SP road.
pH: 8.31 SC: 1260 uS/cm
ORP: 192.4 mV Turb: 74.2 FNU
DO: 8.44 ppm Temp: 2.12 °C

1006 Collected sample for dissolved metals from aquafix sample station #4 from Sih-nem creek just above CC road.
pH: 8.08 SC: 1080 uS/cm
ORP: 205.1 mV Turb: 47.3 FNU
DO: 8.44 ppm Temp: 2.66 °C

1005 Collected sample for dissolved metals from aquafix sample station #5 from below confluence of Sih-nem and CC
pH: 8.04 SC: 191 uS/cm
ORP: 205.1 mV Turb: 5.2 FNU
DO: 8.56 ppm Temp: 2.25 °C

Continued

1015	Collected sample for dissolved metals from aquafix sample station #6 from CC after confluence with Snow creek. pH: 8.06 SC: 138 mS/cm ORP: 220.1 mV Turb: 6.2 FNU DO: 8.98 ppm Temp: 1.7 °C
1020	Collected sample for dissolved metals from aquafix sample station #7 from just above confluence of CC and Belt creek. pH: 7.76 SC: 138 mS/cm ORP: 219.5 mV Turb: 6.7 FNU DO: 9.17 ppm Temp: 2.07 °C
1025	Collected sample for dissolved metals from aquafix sample station #8 from just below Belt creek and CC confluence pH: 7.82 SC: 130 mS/cm ORP: 209.4 mV Turb: 7.7 FNU DO: 8.98 ppm Temp: 2.28 °C
1120	Returned to Silver Dyke and started to fill the hopper.
1145	Finished refilling hopper with 6 buckets of lime. Let the valve 1 of 11 turns open.
1155	Departed Silver Dyke.

JD

Need to Filter + Preserve

Sample Name	Location	Date	pH	ORP (µs/cm)	DO (mg/L)	SC (uS/cm)	Temp (°C)	Turbidity NTU	Samples to Collect					Notes
									Total Metals (8oz. HNO3)	Diss. Metals (8oz. HNO3)	Anions (16oz.)	TDS (1L)	TSS (1L)	
SDAQ1-SW-L-001	Adit	10/28	5.32	41.0	0.55	3093	8.31	18.7	X	X	X	X	X	BACKGROUND SAMPLE
SDAQ2-SW-L-001	Outflow of Sedimentation Pond		5.51	59.0	2.17	310	6.51	40.9	X	X	X	X	X	BACKGROUND SAMPLE
SDAQ3-SW-L-001	Sih'mem Creek on Sih'mem Creek Road		5.79	99.5	2.57	109	4.12	19.2		X				BACKGROUND SAMPLE
SDAQ4-SW-L-001	Sih'mem Creek before CC confluence		4.97	135.9	2.38	1375	5.15	1.0		X				BACKGROUND SAMPLE
SDAQ5-SW-L-001	Confluence of Sih'mem Creek and CC		5.96	113.9	2.62	205	1.67	0.0		X				BACKGROUND SAMPLE
SDAQ6-SW-L-001	Confluence of Snow Creek and CC		6.44	110.4	2.73	300	2.93	0.4		X				BACKGROUND SAMPLE
SDAQ7-SW-L-001	Mouth of Carpenter Creek		6.77	107.6	2.97	361	1.87	0.0		X				BACKGROUND SAMPLE
SDAQ8-SW-L-001	After CC confluence with Belt Creek		7.09	97.1	2.65	240	3.74	0.1		X				BACKGROUND SAMPLE
SDAQ1-SW-L-002	Adit								X	X	X	X	X	Day #1 Monitoring
SDAQ2-SW-L-002	Outflow of Sedimentation Pond								X	X	X	X	X	Day #1 Monitoring
SDAQ3-SW-L-002	Sih'mem Creek on Sih'mem Creek Road									X				Day #1 Monitoring
SDAQ4-SW-L-002	Sih'mem Creek before CC confluence									X				Day #1 Monitoring
SDAQ5-SW-L-002	Confluence of Sih'mem Creek and CC									X				Day #1 Monitoring
SDAQ6-SW-L-002	Confluence of Snow Creek and CC									X				Day #1 Monitoring
SDAQ7-SW-L-002	Mouth of Carpenter Creek									X				Day #1 Monitoring
SDAQ8-SW-L-002	After CC confluence with Belt Creek									X				Day #1 Monitoring
SDAQ1-SW-L-003	Adit								X	X	X	X	X	Day #2 Monitoring
SDAQ2-SW-L-003	Outflow of Sedimentation Pond								X	X	X	X	X	Day #2 Monitoring
SDAQ3-SW-L-003	Sih'mem Creek on Sih'mem Creek Road									X				Day #2 Monitoring
SDAQ4-SW-L-003	Sih'mem Creek before CC confluence									X				Day #2 Monitoring
SDAQ5-SW-L-003	Confluence of Sih'mem Creek and CC									X				Day #2 Monitoring
SDAQ6-SW-L-003	Confluence of Snow Creek and CC									X				Day #2 Monitoring
SDAQ7-SW-L-003	Mouth of Carpenter Creek									X				Day #2 Monitoring
SDAQ8-SW-L-003	After CC confluence with Belt Creek									X				Day #2 Monitoring
SDAQ1-SW-L-004	Adit								X	X	X	X	X	Day #3 Monitoring
SDAQ2-SW-L-004	Outflow of Sedimentation Pond								X	X	X	X	X	Day #3 Monitoring
SDAQ3-SW-L-004	Sih'mem Creek on Sih'mem Creek Road									X				Day #3 Monitoring
SDAQ4-SW-L-004	Sih'mem Creek before CC confluence									X				Day #3 Monitoring
SDAQ5-SW-L-004	Confluence of Sih'mem Creek and CC									X				Day #3 Monitoring
SDAQ6-SW-L-004	Confluence of Snow Creek and CC									X				Day #3 Monitoring
SDAQ7-SW-L-004	Mouth of Carpenter Creek									X				Day #3 Monitoring
SDAQ8-SW-L-004	After CC confluence with Belt Creek									X				Day #3 Monitoring
SDAQ1-SW-L-005	Adit								X	X	X	X	X	Day #4 Monitoring
SDAQ2-SW-L-005	Outflow of Sedimentation Pond								X	X	X	X	X	Day #4 Monitoring
SDAQ3-SW-L-005	Sih'mem Creek on Sih'mem Creek Road									X				Day #4 Monitoring
SDAQ4-SW-L-005	Sih'mem Creek before CC confluence									X				Day #4 Monitoring
SDAQ5-SW-L-005	Confluence of Sih'mem Creek and CC									X				Day #4 Monitoring
SDAQ6-SW-L-005	Confluence of Snow Creek and CC									X				Day #4 Monitoring
SDAQ7-SW-L-005	Mouth of Carpenter Creek									X				Day #4 Monitoring
SDAQ8-SW-L-005	After CC confluence with Belt Creek									X				Day #4 Monitoring
SDAQ1-SW-L-006	Adit								X	X	X	X	X	Day #5 Monitoring
[illegible]SW-L-006	Outflow of Sedimentation Pond								X	X	X	X	X	Day #5 Monitoring
[illegible]-006	Sih'mem Creek on Sih'mem Creek Road									X				Day #5 Monitoring
[illegible]	Sih'mem Creek before CC confluence									X				Day #5 Monitoring
[illegible]	Confluence of Sih'mem Creek and CC									X				Day #5 Monitoring
[illegible]	fluence of Snow Creek and CC									X				Day #5 Monitoring
[illegible]	f Carpenter Creek									X				Day #5 Monitoring
[illegible]	fluence with Belt Creek									X				Day #5 Monitoring

Sample Name	Location	Date	pH	ORP (µs/cm)	DO (mg/L)	SC (uS/cm)	Temp (°C)	Turbidity NTU	Samples to Collect: Total Metals (8oz. HNO3)	Diss. Metals (8oz. HNO3)	Anions (16oz.)	TDS (1L)	TSS (1L)	Notes
SDAQ1-SW-L-001	Adit	10/5	[illegible]	268.7	3.18	2504	8.162	48.8	X	X	X	X	X	BACKGROUND SAMPLE
SDAQ2-SW-L-001	Outflow of Sedimentation Pond	10/5	[illegible]	277.5	6.25	2626	5.58	10.2	X	X	X	X	X	BACKGROUND SAMPLE
SDAQ3-SW-L-001	Sih'mem Creek on Sih'mem Creek Road	10/5	4.91	249.3	7.33	1214	3.92	1.8		X				BACKGROUND SAMPLE
SDAQ4-SW-L-001	Sih'mem Creek before CC confluence	1200	5.04	246.9	7.48	1081	9.38	0.7		X				BACKGROUND SAMPLE
SDAQ5-SW-L-001	Confluence of Sih'mem Creek and CC	1205	5.61	236.0	7.37	400	4.06	0.1		X				BACKGROUND SAMPLE
SDAQ6-SW-L-001	Confluence of Snow Creek and CC	1220	5.58	238.4	7.65	154	4.18	.02		X				BACKGROUND SAMPLE
SDAQ7-SW-L-001	Mouth of Carpenter Creek	1235	6.11	227.7	7.92	152	3.92	.09		X				BACKGROUND SAMPLE
SDAQ8-SW-L-001	After CC confluence with Belt Creek	1240	6.16	222.2	7.76	147	4.07	.02		X				BACKGROUND SAMPLE
SDAQ1-SW-L-002	Adit	10/27 1315	7.62	295	2.96	2771	[illegible]	36.3	X	X	X	X	X	Day #1 Monitoring
SDAQ2-SW-L-002	Outflow of Sedimentation Pond	1340	12.04	-7.3	5.12	3795	[illegible]	14.1	X	X	X	X	X	Day #1 Monitoring
SDAQ3-SW-L-002	Sih'mem Creek on Sih'mem Creek Road	1430	9.4	137.2	6.85	1430	7.97	461		X				Day #1 Monitoring
SDAQ4-SW-L-002	Sih'mem Creek before CC confluence	1435	8.7	174.3	6.76	1208	8.31	[illegible]	15.7	X				Day #1 Monitoring
SDAQ5-SW-L-002	Confluence of Sih'mem Creek and CC	1440	8.85	162.5	7.22	230	6.38	9.7		X				Day #1 Monitoring
SDAQ6-SW-L-002	Confluence of Snow Creek and CC	1450	8.69	177.1	7.10	131	8.1	15.9		X				Day #1 Monitoring
SDAQ7-SW-L-002	Mouth of Carpenter Creek	1500	8.64	182.4	7.26	157	9.54	13.7		X				Day #1 Monitoring
SDAQ8-SW-L-002	After CC confluence with Belt Creek	1505	8.57	179.7	7.34	143	[illegible]	9.3		X				Day #1 Monitoring
SDAQ1-SW-L-003	Adit	10/29 800	3.63	325	2.7	2704	8.65	30.6	X	X	X	X	X	Day #2 Monitoring
SDAQ2-SW-L-003	Outflow of Sedimentation Pond	820	11.54	31.6	5.71	30.32	7.14	9.7	X	X	X	X	X	Day #2 Monitoring
SDAQ3-SW-L-003	Sih'mem Creek on Sih'mem Creek Road	855	9.41	148.8	7.06	1427	5.47	20.1		X				Day #2 Monitoring
SDAQ4-SW-L-003	Sih'mem Creek before CC confluence	925	9.91	117.6	7.19	1216	6.07	1.6		X				Day #2 Monitoring
SDAQ5-SW-L-003	Confluence of Sih'mem Creek and CC	930	9.56	185.3	7.35	198	5.28	10.5		X				Day #2 Monitoring
SDAQ6-SW-L-003	Confluence of Snow Creek and CC	945	8.55	182.3	7.47	153	5.82	8.1		X				Day #2 Monitoring
SDAQ7-SW-L-003	Mouth of Carpenter Creek	955	8.50	187.5	7.47	157	6.35	9.2		X				Day #2 Monitoring
SDAQ8-SW-L-003	After CC confluence with Belt Creek	1000	8.38	190	7.52	143	6.21	9.2		X				Day #2 Monitoring
SDAQ1-SW-L-004	Adit	10/31 1250	3.60	309	2.5	2749	8.65	29.3	X	X	X	X	X	Day #3 Monitoring
SDAQ2-SW-L-004	Outflow of Sedimentation Pond	1320	6.22	190.4	6.09	2807	5.05	39.6	X	X	X	X	X	Day #3 Monitoring
SDAQ3-SW-L-004	Sih'mem Creek on Sih'mem Creek Road	1415	6.00	216.7	7.03	1346	4.43	23.4		X				Day #3 Monitoring
SDAQ4-SW-L-004	Sih'mem Creek before CC confluence	1430	6.111	216.4	7.13	1169	4.73	13.9		X				Day #3 Monitoring
SDAQ5-SW-L-004	Confluence of Sih'mem Creek and CC	1435	6.4	206.4	7.03	[illegible]250	4.12	11		X				Day #3 Monitoring
SDAQ6-SW-L-004	Confluence of Snow Creek and CC	1445	6.47	207.2	7.5	162	4.7	16.8		X				Day #3 Monitoring
SDAQ7-SW-L-004	Mouth of Carpenter Creek	1500	6.43	212.3	7.67	161	4.87	18.8		X				Day #3 Monitoring
SDAQ8-SW-L-004	After CC confluence with Belt Creek	1510	6.63	200.2	7.65	172	4.93	14.3		X				Day #3 Monitoring
SDAQ1-SW-L-005	Adit	11/1 0945	3.27	321	2.78	2297	8.62	37.8	X	X	X	X	X	Day #4 Monitoring
SDAQ2-SW-L-005	Outflow of Sedimentation Pond	910	4.09	125.1	4.95	2437	3.18	480	X	X	X	X	X	Day #4 Monitoring
SDAQ3-SW-L-005	Sih'mem Creek on Sih'mem Creek Road	0950	8.71	192.4	9.44	1260	2.12	74.2		X				Day #4 Monitoring
SDAQ4-SW-L-005	Sih'mem Creek before CC confluence	1000	8.08	205.1	8.44	1080	2.66	47.3		X				Day #4 Monitoring
SDAQ5-SW-L-005	Confluence of Sih'mem Creek and CC	1005	8.04	205.1	8.56	141	2.25	6.2		X				Day #4 Monitoring
SDAQ6-SW-L-005	Confluence of Snow Creek and CC	1015	8.06	200.1	8.98	138	1.7	6.2		X				Day #4 Monitoring
SDAQ7-SW-L-005	Mouth of Carpenter Creek	1020	7.76	219.5	9.17	178	2.07	6.7		X				Day #4 Monitoring
SDAQ8-SW-L-005	After CC confluence with Belt Creek	1025	7.82	209.4	8.98	130	2.28	7.7		X				Day #4 Monitoring
SDAQ1-SW-L-006	Adit								X	X	X	X	X	Day #5 Monitoring
SDAQ2-SW-L-006	Outflow of Sedimentation Pond								X	X	X	X	X	Day #5 Monitoring
SDAQ3-SW-L-006	Sih'mem Creek on Sih'mem Creek Road									X				Day #5 Monitoring
SDAQ4-SW-L-006	Sih'mem Creek before CC confluence									X				Day #5 Monitoring
SDAQ5-SW-L-006	Confluence of Sih'mem Creek and CC									X				Day #5 Monitoring
SDAQ6-SW-L-006	Confluence of Snow Creek and CC									X				Day #5 Monitoring
SDAQ7-SW-L-006	Mouth of Carpenter Creek									X				Day #5 Monitoring
SDAQ8-SW-L-006	After CC confluence with Belt Creek									X				Day #5 Monitoring

CONTENTS

PAGE	REFERENCE	DATE

CSC Combos
SD#1 : 3287
SD#2 : 1901
Snow Creek : 7996
Aqua Fix : 4687
Storage Unit: 5588/7182
Cells
Colin : 465-3287
Chris: 439-1901
Roger: 422-9725
Keith: 841-5039

Bobs Bar: 236-5955

Hospital (Benefis - Great Falls)
One Hour From Site
406-455-5500

1101 26th St. S

HWY 89 N → (L) on 200 → (L) on 26th St. S.

Rite in the Rain
ALL-WEATHER WRITING PAPER

ALL-WEATHER
JOURNAL
FIELD BOOK

Name TetraTech Inc

Address 7 W. 6th Ave, Suite 612
Helena MT 59601

Phone 406-442-5588

Project Carpenter Snow Creek
Mining District
Field Log Book #3

Rite in the Rain — A patented, environmentally responsible, all-weather writing paper that sheds water and enables you to write anywhere, in any weather. Using a pencil or all-weather pen, *Rite in the Rain* ensures that your notes survive the rigors of the field, regardless of the conditions.

Specifications for this book:

Page Pattern		Cover Options	
Left Page	Right Page	Polydura Cover	Fabrikoid Cover
Lined	Lined	Item No. 390	Item No. 390F

RiteintheRain.com

11/4/16 SM 34°F Sunny Helena

0940 Leave Helena; DDO at pickup 17037

1140 Arrive Site. Sunny 48°F

Calibrate sonde w/ Quick Cal

pH 6.87 ORP 215.6mV

DO 5.85 ppm SpCond 5021 µS/cm

Turb 3.7 Temp 10.39°C

1150 Collect sample SDAQ8-SW-L-006

- Diss. Metals

Params:

pH 7.65 ORP 175.5mV

DO 9.50 ppm SpCond 141 µS/cm

Turb 2.5 FNU Temp 2.42°C

1200 Collect sample SDAQ7-SW-L-006

- Diss Metals

Params:

pH 7.97 ORP 174.1mV

DO 9.55 ppm SpCond 160 µS/cm

Turb 4.1 FNU Temp 1.61°C

1210 Collect sample SDAQ6-SW-L-006

- Diss. Metals

Params: pH: 7.75 ORP: 186.7mV

DO: 8.98 ppm SpCond 157 µS/cm

Turb 4.2 FNU Temp 2.49°C

11/4/16 cont.

1225 Collect sample SDAQ5-SW-L-006

- Diss. Metals

Params

pH 7.55 ORP 209.0mV

DO 8.92 ppm SpCond 116 µS/cm

Turb 2.0 FNU Temp 2.40°C

1240 Collect sample SDAQ4-SW-L006

- Diss Metals

Params:

pH 7.27 ORP 219.4 mV

DO 7.74 ppm SpCond 1269 µS/cm

Turb 57.7 Temp 6.63°C

1245 Collect sample SDAQ3-SW-L-006

- Diss. Metals

Params

pH 7.60 ORP 206.0mV

DO 8.01 ppm SpCond 165 µS/cm

Turb 86.0 FNU Temp 5.27°C

1300 Collect sample SDAQ1-SW-L-006

- Total Metals; Diss. Metals; Anions; TDS; TSS

Params pH 3.67 ORP 347.4 µS/cm

DO 2.84 ppm SpCond 2731 µS/cm

Turb 38.1 FNU Temp 8.67°C

11/4/16 Cont.

1315 Collect sample SDAQ2-SW-L-006
-Total Metals, Dissolved Metals, anions, TDS, TSS

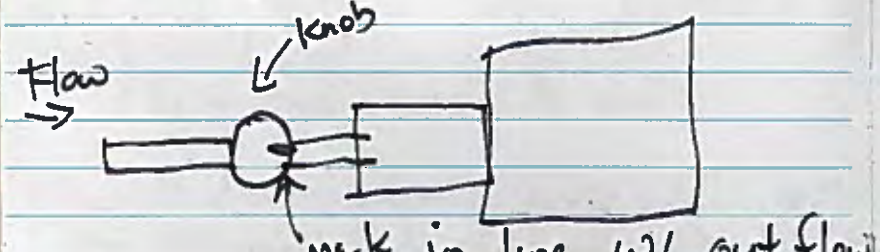
Params:

pH	9.60	ORP	121.5
DO	6.67 ppm	SpCond	2787 µS/cm
Turb	166 FNU	Temp	8.02°C

Took a long time for pH to stabilize - ~15 mins.

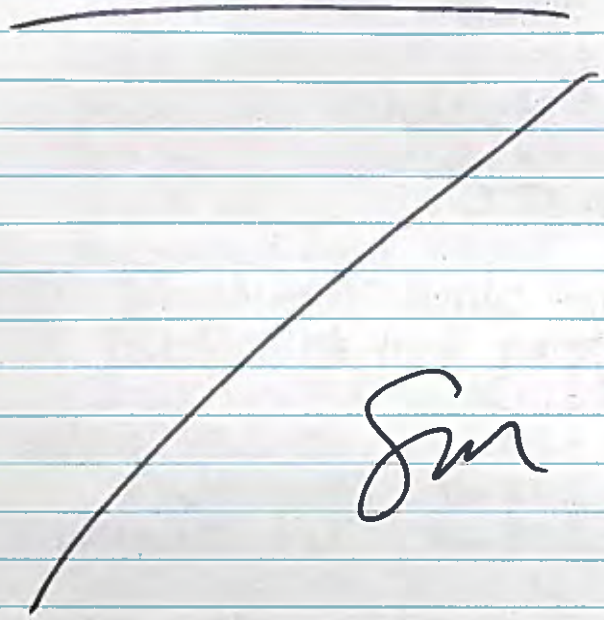
1345 Load Hopper w/ CaO
ADDED 11.5 5-gallon buckets
Finished supersack - Started another (2nd)

1415 Finished loading
Opened 1/4 turn - ADDED Sharpie Mark to Knob



11/4/16 Cont

1420 Filtered samples
1453 Leave Silver Dylee
1500 Leave site



11/7/16 MR windy, Clear

1100 - Arrived at Silver Dyke. Calibrated office sonde. Quick Cal Sols after calibration:
pH: 6.91
ORP: 214.1mV
DO: 5.05ppm
SC: 5,118 µS/cm
Turb: 4.6 FNU
Temp: 17°C

1120 - Collected sample from Aquafix Monitoring Point #1 (SD Adit):
SDAQ1 - SW-L-007
pH: 3.89 SC: 2,789 µS/cm
ORP: 304.7 mV Temp: 8.68°C
DO: 2.73 ppm Turb: 30.6 FNU

Collected total & dissolved metals, anions, TDS, and TSS.

1130 - Collected sample from outflow of sedimentation pond, Aquafix Monitoring Point #2 (total & dissolved metals, anions, TDS, TSS). SDAQ2-SW-L-007
pH: 7.24 SC: 2817 µS/cm Turb: 1000+ FNU
ORP: 174.6 mv Temp: 4.62°C DO: 9.40 ppm

11/7/16 Continued.

1150: Hopper was only depleted by about 1/5 Lime. Added 4 buckets to fill. pH 7.24 in pond, opened valve to total of + 1/5 = 1/2 1½ turns open.

Water seemed to have build-up sludge, but when disturbed (in Sed pond) looked like suspended material.
Re-covered lime stored

1250 - Departed SD Adit

1255 - Collected sample at Sihinem Creek and 2nd gate for dissolved metals only.
SDAQ3 - SW-L-007
pH: 6.88 SC: 1537 µS/cm
ORP: 208.5 mV Turb. 36.9 FNU
DO: 8.14 ppm Temp: 5.18 °C

1310 - Collected sample from Sihinem Creek before CC Road for dissolved metals: SDAQ4-SW-L-007
pH: 6.56 SC: 1243 µS/cm
ORP: 210.0 mV Turb. 12.3 FNU
DO: 7.99 ppm Temp: 6.08 °C

11/7/16 Continued.

1315 - Collected sample from Carpenter Creek after Sihimen Creek Confluence.
SDAQ5-SW-L-007

pH: 6.99 SC: 100 µS/cm
ORP: 189.0 mV Turb: 3.9 FNU
DO: 9.04 ppm Temp: 2.91 °C

1330 - Collected dissolved metal sample from Carpenter Creek at confluence with Snow Creek.
SDAQ6-SW-L-007

pH: 6.81 SC: 154 µS/cm
ORP: 199.0 mV Turb: 13.8 FNU
DO: 8.64 ppm Temp: 4.75 °C

1345 - Collected dissolved metals sample from Carpenter Creek, below HWY 87 crossing and above Belt Creek Confluence.
SDAQ7-SW-L-007

pH: 6.89 SC: 157 µS/cm
ORP: 202.0 mV Turb: 3.5 FNU
DO: 9.39 ppm Temp: 2.73 °C

11/7/16 MR Continued

1350 - Collected dissolved metal sample from Belt Creek below CC Confluence:
SDAQ8-SW-L-007

pH: 6.95 SC: 144 µS/cm
ORP: 196.0 mV Turb: 4.8 FNU
DO: 9.21 ppm Temp: 2.96 °C

1400 - Departed Site.

11/10/16 CM, SM, RF, MR, KB, WJ Clear 28° in Mi.land

0810 Arrive Site - Compromise.
Remove the Sm Bales from
Compromise pump down.

0910- Arrived (MR) at SD adit. Unloaded
bales. Team continued to begin
work along SD Road.

0940- Calibrated office sonde. At first
Conductivity would not calibrate w/
Quick Cal, nor 1413 µS/cm standard.
Replaced Quick Cal w/ new Soln.
Recalibrated. DO: 6.12 ppm
pH: 6.87 ORP: 232.7 mV SC: 5121 µS/cm Turb: 7.7 FNU

0955- Collected sample from aquafix
monitoring point #1: SD Adit.
SDAQ1-SW-L-008
pH: 3.66 SC: 2816 µS/cm
ORP: 315.1 mV Turbi: 32.4 FNU
DO: 2.70 ppm Temp: 8.67 °C

1010- Collected sample from aquafix monitoring
point #2: Sed pond outflow.
SDAQ2-SW-L-008

11/10/16 Continued.
pH: 11.88 SC: 2951 µS/cm
ORP: -2.2 mV Turbi: 649 FNU
DO: 5.60 ppm Temp. 5.71 °C

Note: SDAQ1 & SDAQ2 will be
analyzed for TDS, TSS, Anions,
Total & dissolved metals.
SDAQ3 - SDAQ8 will be analyzed
for only dissolved metals.

Floc and particulates have made the
Sed Pond very turbid and marble-
looking. Precipitate material is
dropping out.

1030- Aquafix unit was only about half
empty, turned valve down to 1 1/4
turns (open) so mark is in line with
outflow pipe.

1040- Added 10 buckets of lime to the
hopper. Scraped down sides of
culvert where lime had accumulated.
Buckets were 4 gallons full.

11/10/16 Continued.

1235 Collect Sample SDAQ3-SW-L-008 - Dissolved Metals

Params

pH	9.38	ORP	128.6 mV
DO	8.28 ppm	SpCond	1792 µS/cm
Turb	162 FNU	Temp	6.2°C

1500 Collected Sample SDAQ4-SW-L-008 for dissolved metals before Sitmem crosses CC Road.

pH: 9.32 SC: 1367 µS/cm
ORP: 149.9 mV Turb: 88.2 FNU
DO: 8.54 ppm Temp: 6.30° F

1510 - Collected sample SDAQ5-SW-L-008 for dissolved metals after Sitmem Creek confluence in CC.

pH: 9.09 SC: 99 µS/cm
ORP: 160.7 mV Turb: 7.4 FNU
DO: 9.31 ppm Temp: 3.09 °C

1520 - Collected sample SDAQ6-SW-L-008 for dissolved metals after CC and SC confluence.

11/10/16 Continued

pH: 8.64 SC: 167 µS/cm
ORP: 178.3 mV Turb: 9.2 FNU
DO: 8.82 ppm Temp: 5.24°C

1540 - Collected sample SDAQ7-SW-L-008 from mouth of CC after it crosses under the bridge.

pH: 8.61 SC: 169 µS/cm
ORP: 179.1 mV Turb: 8.7 FNU
DO: 9.60 ppm Temp: 3.43 °C

1545 - Collected sample SDAQ8-SW-L-008 from Belt Creek below CC confluence. MK

pH: 8.60 SC: 154 µS/cm
ORP: 181.8 mV Turb: 9.5 FNU
DO: 9.49 ppm Temp: 3.26 °C

11/14/16 KE 45°, Partly cloudy

0830 Depart Helena for Neihart
11:00 Arrive Neihart
1115 Calibrate sonde
Could not get conductivity to calibrate correctly. It reads ~2x what it should be,

pH	6.83	SC	9740
ORP	226.9	turb	7.7
DO	4.81	temp	20.9

The 2nd silver dyke lock will not open (combo 1901). Walk to silver Dyke from 2nd gate.

1150 Arrive Silver Dyke
Filled Hopper with 2 buckets of lime.

1210 Collect SDAQ1-SW-L-009 for total, dissolved, anions TDS, TSS

pH	3.82	SC	12886
ORP	~~29.4.9~~ 295.9	turb	1000
DO	2.69	temp	6.69

11/14/16 KE 45°, windy

1220 collect sample SDAQ2-SW-L-009 for total, dissolved, anions, TDS, TSS

pH	5.42	SC	2935
ORP	231.14	turb	43.2
DO	7.62	temp	6.20

12:30 Opened aquafix valve to a total of 1½ turns open.

13:00 Arrive SDAQ3 (Sih-me creek at 2nd gate). Collect sample SDAQ3-SW-L-009 for dissolved

pH	5.22	SC	1673
ORP	236.9	turb	72.4
DO	8.49	temp	5.34

1315 Arrive Sih-mem creek before it crosses carpenter creek road. Collect SDAQ4-SW-L-009 for dissolved

pH	5.17	SC	1373
ORP	236.4	turb	16.7
DO	8.30	temp	5.97

1325 Arrive Sih-mem creek and CC creek confluence. Collect SDAQ5-SW-L-009 for dissolved.

11/14/16 KE

1325 continued

pH 5.38	DO 8.85
ORP 232.8	turb 7.3
SC 133	temp 4.09

1345 Arrive confluence of Carpenter creek and snow creek. Collect SDAQ6-SW-L-009

pH 6.02	DO 8.90
ORP 257.2	turb 9.0
SC 158	temp 5.18

1355 Arrive Carpenter Creek confluence with Belt Creek. Collect SDAQ7-SW-L-009 from Carp Creek above Belt.

pH 6.04	DO 8.90
ORP 270.1	turb 7.0
SC 166	temp 4.56

1400 Collect SDAQ8-SW-L-009 for dissolved from Belt creek below Carpenter creek.

pH 6.19	DO 8.94
ORP 270.2	turb 8.3
SC 157	temp 4.48

11/14/16

1430 Finish filtering samples. Depart Neihart.

KE

11/17/16 KE 26°F, snow

0715 Depart Helena for Nahart

0940 Arrive Silver Dyke gate 2. Approx 2 inches of snow on road, light flurries. Calibrate sonde:

pH	6.82	SC	8751
ORP	226.6	turb	6.1
DO	5.71	temp	18.53

SC will not calibrate correctly in quickical soln after cleaning probe with Distilled water. The goals of today's trip is to refill hopper, dial valve back to 1.25 turns open and collect water quality parameters. No samples will be collected.

1020 Arrive Silver Dyke. parameters at SDAQ1:

PH	3.71	SC	2827
ORP	301.6	turb	26.2
DO	2.60	temp	8.67

parameters at SDAQ2 pond outlet

pH	10.60	SC	2.2.2
ORP	29.5	turb	393
DO	2.47	temp	5.26

11/17/16 KE 24°, Snow

Filled hopper to just below the bar to prevent bridging. Used approx 1 Sgal of lime. Adjusted the valve to 1.25 turns open.

1120 Arrive SDAQ3 Sih-mem Creek by 2nd gate. Snowing heavily.

pH	8.05	SC	1634
ORP	157.8	turb	64.6
DO	9.01	temp	0.65

1135 Arrive Sih-mem creek before it crosses Carpenter Creek road. Station SDAQ4

pH	7.75	SC	1350
ORP	167.1	turb	129
DO	9.62	temp	0.85°C

1145 Arrive Sih-mem creek and Carpenter Creek confluence SDAQ5 7.65 Parameters jumped around

pH	~~7.03~~ ace	SC	102
ORP	260.2	turb	7.4
DO	9.59	temp	0.86

11/17/16 KE 24°F, snow

11:30 Arrive confluence of Carpenter Creek and Swan Creek.

pH	7.77	Sc	168
ORP	157.6	turb	7.4
DO	9.94	temp	0.5

1205 Arrive Carpenter Creek just above Belt Creek SDAQ7

pH	7.60	Sc	167
ORP	168.7	turb	7.4
DO	10.27	temp	0.6

1210 Arrive Belt Creek below Carpenter Creek

pH	7.64	Sc	106
ORP	169.8	turb	7.6
DO	9.95	temp	0.88

12:30 Depart Neihart

ME

11/23/16 KE, RF 25F, cloudy

0730 Pick Ryan up in Great Falls

0915 Arrive Silver Dyke to collect monthly adit samples, reload hopper, and collect Aquafix samples. Calibrated office Sonde. Quick Cal Soln after Calibration

pH = 6.82	Sc = 6827
ORP = 203.4	Turb = 8.3
DO = 7.56	Temp = 3.58

Collected Sample from Aquafix monitoring point #1 (SD Adit). Collect samples for regular adit monitoring as well for total + dissolved metals + anions

- SDAQ1 - SW-L-010

pH = 3.70	SC = 2798
ORP = 268.9	Turb = 26.5
DO = 2.64	Temp = 8.64

- CCSD-AD-L-096

Added 6 5-gallon buckets of lime to the hopper. The hopper was about 1/4 full. Did not change the valve setting. Valve is 1.25 turns open.

11/23/16 KE, RF 25°, cloudy

10:00 Collect sample SDAQ2-SW-L-010 from the outlet of settling pond for total, dissolved, anions, TDS, TSS

Downloaded flow meter.
Flow= 31.67 gpm. Flow seems high.
parameters! (take in pond just before pipe)
pH 8.26 SC 2972
ORP 160.2 turb 653
DO 2.38 temp 3.95°C
Note: Sonde has been in the pond for over 20 minutes and the pH is still going up. Moved sonde to a pool 20 feet down the pipe.
pH 10.75 SC 2995
ORP 56.6 turb 194
DO 7.60 temp 4.73

tarps on supersacks had partially blown. Attempted to retape them.

11:00 Arrive Silverman Creek at 2nd gate. Collect SDAQ3-SW-L-010 for ~~to~~ NE dissolved

11:23/16 KE, RF 25°, cloudy

11:00 cont.
pH 9.27 SC 1805
ORP 147.6 turb 85.6
DO 9.17 temp 0.58°C

11:05 Arrive Silverman creek before it crosses Carpenter Creek road Collect sample SDAQ4-SW-L-06 for dissolved
parameters
pH 8.84 SC 1456
ORP 166.9 turb 17.4
DO 9.12 temp 1.4°

11:10 Arrive confluence of Silverman Creek and Carpenter Creek. Collect SDAQ5-SW-L-011 for dissolved
pH 8.89 SC 242
ORP 156.5 turb 7.3
DO 8.78 temp 0.73

11:50 Arrive Lorin for Collect SCLX-AD-L for anions total, dissolved
pH 8.72 DO 7.64 turb 9.1
ORP 156.5 SC 147 temp 2.14

11/23/16 KB, RF 25°, snow

11:50 Downloaded flow meter
4.25 gpm

12:00 Arrive Big Seven. Collect sample SCBS-AD-L-75 for total dissolved, anions parameters

pH	7.78	SC	2853
ORP	135.2	turb	25.5
DO	8.04	temp	2.94

Snowing heavily

1210 Arrive lower rebellion. collect sample SCLR-AD-L-079 for total, dissolved, anions

pH	7.17	SC	389
ORP	131.5	turb	14.4
DO	7.08	temp	3.04

Download flow meter 171.38 gpm

1300 Arrive at Snow creek confluence with Carpenter Creek. Collect sample SDAQ6-SW-L-010

pH	7.09	SC	164
ORP	161.9	turb	12.0
DO	9.30	temp	0.02°C

11/23/16 KB, RF 28°, cloudy

1310 Arrive confluence of Carpenter creek and Belt creek. Collect sample SDAQ7-SW-L-010

pH	7.64	SC	173
ORP	147.6	turb	8.0
DO	9.84	temp	0.36

1315 Collect SDAQ8-SW-L-010 from Belt creek below Carp. creek

pH	7.53	SC	162
ORP	150.0	turb	7.7
DO	9.72	temp	0.85

1320 Arrive Evening Star. NSES-AD-L-081 for total dissolved anions

pH	7.30	SC	793
ORP	160.5	turb	9.8
DO	5.6	temp	7.39

1335 Arrive Moulton Collect Sample NSMO-AD-L-066 for total, dissolved, anions

pH	7.35	SC	473
ORP	153.7	Turb	9.0
DO	6.14	temp	6.06

11/23/16 RF, KE 25°, sun

1400 Arrive Compromise, collect sample NSCO-AD-L-081 totals, dissolved, anions

pH	7.33	SC	643
ORP	160.5	turb	16.5
DO	5.40	temp	6.65

1415 Arrive Broadwater, Collect Sample
NSBW-AD-L-097
NSBW-AD-L-098 (Duplicate)

pH=	7.07	SC=	908
ORP=	164.1	turb=	6.5
DO:	7.85	temp=	6.06

1530 Depart Neihart

KE

12/1/2016 SM, CM 23°, Cloudy

0815 Pick up K. Large. Leave Helena.

1040 Calibrate Hanna w/ Quick Cal

pH: 6.80	ORP: 185.8 mV
DO: 4.80 ppm	SC: 5100 us/cm
TURB: 6.7 FNU	Temp: 19.77

SpCond did not calibrate under Quick Cal settings. Had to Calibrate manually

1050 Arrive Neihart. & Snowing between east side Big Belt Mtn + Showdown. Temp in Neihart 28°F Partly cloudy - not snowing

1055 Collect sample SDAQ@-NSN-2-11
Dissolved Metals

pH: 7.92	ORP: 156.4
DO: 10.2	SpCond: 145 us/cm
Turb: 5.4	Temp: 0.16

Ice on Belt Creek required sampling near bank.

12/1/16 Cont.

1100 Collect Sample SDAQ7-SW-L-011
Params: -2 L> Dissolved Metals
pH: 7.46 ORP: 173.0 mV
DO: 9.47 ppm SpCond: 130 µS/cm
Turb 6.1 FNU Temp 0.03°C

1115 Collect sample SDAQ6-SW-L-011
Dissolved metals
Params:
pH: 6.9 Temp: 0.03°C
ORP 207 mV
DO: 9.14 ppm
Cond: 127 µS/cm
Turb: 7.6 FNU
Had to break through ice to make sample point

1130 Collect sample SDAQ5-SW-L-011
Dissolved metals
Params:
pH 7.18 Cond: 176 µS/cm
ORP 188.1 Turb 8.2 FNU
DO 9.07 ppm Temp 0.05°C

12/1/16 Cont.

1140: Collect sample SDAQ4-SW-L-011
pH: 6.82 Turb 76.3 FNU
ORP: 236.7 T: 0.5°C
DO: 8.48
Cond: 996
Dissolved Metals

1150 Collect sample SDAQ3-SW-L-011
Dissolved metals

Params:
pH: 6.14 ORP: 236.1 mV
DO: 8.47 ppm SpCond: 1387 µS/cm
Turb: 9.3 FNU Temp: 0.72°C

1205 Arrive AquaFix. Aquafix was bridged. Appeared to Drop <5 gallons since Last Fill.
Collect sample: SDAQ1-SW-L-011
pH: 3.84 DO: 2.63
ORP: 281.3 Turb: 24.5
Cond: 2017 T: 8.64°C

12/1/16 Cont.

1220 Collect sample # ~~SDQ~~ SM: SDAQ2-SW-L-011
pH 4.11 Cond 1350
ORP: 264 Turb 27.6
DO 765 T 4.06°C

1230 Filtered Samples

1240 Removed 10 gallons of Lime From Hopper. Fixed Bridging. About 3" of Room below Cross Bar on Hopper. Took Picture.

1330 Leave SITE

SM

12/7/16 RF, MR Clear, -7°F

0800 - Departed Helena. 10,744 miles Brr.

1030 - Arrived at Belt Creek and Carpenter Creek Confluence. Put on winter gear and calibrated sonde.
Readings from Quick Cal Soln.
pH: 6.83 SC: 4805 µS/cm
ORP: 1580 mV Turb: 5.2 FNU
DO: 4.36 ppm Temp: 12.14 °C

1050 - Collected sample from Aquafix Station #8 (Belt Creek below CC confluence):
SDAQ8-SW-L-012
pH: SC: µS/cm
ORP: mV Turb: FNU
DO: ppm Temp: °C
- No sample collected. Ice on creek

1055 - Collected sample from Aquafix Station #7 (CC confluence w/ Belt, above Belt Confluence):
SDAQ7-SW-L-012
pH: 8.41 SC: 183 µS/cm
ORP: 100.0 mV Turb: 14.0 FNU
DO: 6.15 ppm Temp: 0.0 °C

12/7/16 Cont.

1115 - Collected sample from Aquafix Station #6 (SC confluence w/ CC)
SDAQ6-SW-L-012

pH=	7.68		SC = 95	µS/cm
ORP=	168.0	mV	Turb= 12.4	FNU
DO=	4.66	ppm	Temp= -0.01	°C

1125 - Collected sample from Aquafix Station #5.
SDAQ5-SW-L-012

pH=	7.34		SC= 24	µS/cm
ORP=	192.3	mV	Turb= 40.3	FNU
DO=	3.28	ppm	Temp= -0.02	°C

1135 - Collected sample from Aquafix Station #4
SDAQ4-SW-L-012

pH=	7.34		SC= 24	µS/cm
ORP=	192.3	mV	Turb= 40.3	FNU
DO=	3.28	ppm	Temp= -0.02	°C

NR

pH=	7.07		SC= 49	µS/cm
ORP=	191.3	mV	Turb= 24.8	FNU
DO=	3.11	ppm	Temp= -0.02	°C

12/7/16 Continued

1155 - Drove up SD Road to Repository Junction to turn around. Stopped and hiked in to SD Adit from there.

1230 - Arrived at SD Adit. Collected sample from Aquafix Station #1 (@SD Adit) for TDS, TSS, Anions, total & dissolved metals.
SDAQ1-SW-L-012

pH:	5.03		SC: 2853	µS/cm
ORP:	238.1	mV	Turb: 27.5	FNU
DO:	3.21	ppm	Temp: 6.70	°C

- Checked hopper, which was 2/3 full. Filled with 2 buckets. Filled sides of hopper, stirred hopper

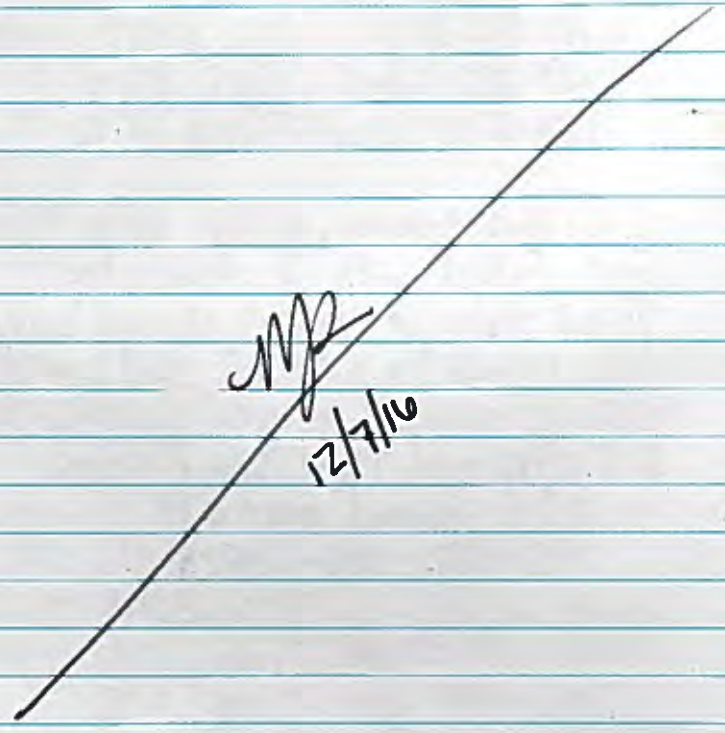
1245 - Hiked down to exit of Sed pond to collect sample from Aquafix Station #2. Collected TDS, TSS, Anions, total and dissolved metals sample.
SDAQ2-SW-L-012

pH:	6.43		SC: 2907	µS/cm
ORP:	188.5	mV	Turb: 12.4	FNU
DO:	4.69	ppm	Temp: 1.5	°C

12/7/16 Continued

1400 - Collected sample from Aquafix Station #3, below Silver Dyke Road for dissolved metals:
SDAQ3-SW-L-012
pH: 6.57 SC: 1,752 µs/cm
ORP: 194.5 mV Turb: 9.4 FNU
DO: 5.35 ppm Temp: 0.32°C

1445 - Departed Neihart for Helena.



12/21/16 SM, CM, TD, RF 28° Cloudy

0900 Leave Helena. Poor road conditions west through Great Falls

1150 Arrive Neihart. 28°F. Clear ~ 8" of snow in town

1200 Safety meeting, discussed division of tasks
RF + TD1 -> Aqua Fix
SM, CM -> Neihart slope + compromise adit

1230 Quick calibration of office sonde
D.O. meter BAD - need replacement
tried new membrane + fluid.
D.O. values ~ 2 ppm low
Quick cal soln:
pH: 6.84 ORP: 193.0 mV
DO: 0.88 ppm SC: 4923 µS/cm
FNU: 8.8 Temp: 18.89°C

1250 Arrive Evening Stop
Parms:
pH 7.81 ORP 137.6 mV
DO 1.74 ppm* SC 855 µS/cm
Turb 12.4 Temp 7.14 °C
* BAD DO Value

12/21/16 Continued

Collect sample NSGS-AD-L-082
- total + dissolved metals + anions

Flow out of adit was at lowest baseD - typical low flow.
6-8 inches of snow at the mine.

1330 Arrive Moulton / Yellow Jacket
Collect sample NSMO-AD-L-067
- total, dissolved, anions

6" snow at adit. Flow ~ normal for winter

Params

pH	7.84	ORP	152.6 mV
DO	1.76 ppm*	SC	512 µS/cm
Turb	0.8 FNU	Temp	6.64°C

*DO value bad

1420 Arrive Broadwater
Collect sample NSBW-AD-L-099
- total, dissolved, anions

6-8" snow

12/21/16 Continued

Params:

pH	7.63	ORP	169.1 mV
DO	2.14 ppm	SC	996 µS/cm
Turb	0.70	Temp	5.35 °C

Met Gary (landowner near Decota) or hike up to broadwater

1510 Arrive Compromise
Collect Samples
NSCO-AD-L-082
NSCO-AD-L-083
Both are total, dissolved, anions

Params:

pH	7.60	ORP	170.3 mV
DO	1.70 ppm*	SC	714 µS/cm
Turb	1.9	Temp	4.38 °C

* Bad DO value

GM

12/22/2016 SM, CM, RF, TD SM 25° 10° clear

0750 Calibrate sonde w/ Quick cal

Params:

pH : 6.85 ORP : 218.7mV

DO : 1.41 ppm SC : 5256 µS/cm

Turb 96 Temp : 16.41°C

D.O. sensor BOD- A Did NOT calibrate values low by 3ppm

0820 Safety talk all hands

1115 Arrive Dry Seven

Collect sample

SCBS-AD-L-076

- total + dissolved Metals + anions

pH = 7.35

ORP = 57.6

DO = 1.67 ppm

SC = 2173 µs/cm

T = 3.42 °C

Turb 2.4 NTU

12/22/16 Cont.

1140 Arrive Lower Rebellion

Collect sample

SCLR-AD-L-080

- total, dissolved, anions

Params:

pH : 6.78 ORP : 76.6 mV

DO : 1.90 ppm SC : 467 µS/cm

Turb : 1.1 FNU Temp: 3.05

Downloaded Flow data

Level ~ 2.7 inches

Flow 80 gpm

1300 Pulled Blank

CSCB-AD-L-020

1500 Left Site

SM

12-29-16 SM, CM

0915 Leave Helena 60F

1050 Arrive Silver Dyke parking Area. 23° F.

1150 Arrive Silver Dyke.
Hopper Empty on Aquafix.
Auger Turning.

Added 8 x 5 gallon Buckets of Lime - 40 gals total.
Attempted to sieve out fines - need a more permanent solution for Next week

Aquafix Pipe from adit has a leak ~ 6 ft up from sled. Now iced over.

1230 Collect Sample SDAQ1-SW-L-14
total + dissolved metals, TSS, TDS, anions

params:
pH: 3.69 ORP 293.8mV
DO: 0.66* ppm SpCond: 2695 µS/cm
Turb: 22.2 FNU Temp: 8.59°C

12-29-16 cont.
* DO values Low - Bad sensor.
Have one on order.

1245 ~~SDAQ4~~ SM Arrive SDAQ2
Collect sample SDAQ2-SW-L-14
total + dissolved metals, anions, TSS + TDS

pH 5.28 ORP: 233.6 mV
DO 2.95* Spcond: 2716 µS/cm
Turb >1000 FNU Temp: 2.95°C

Pulses of turbid water from Breaking ice at sampling point
Turb values off chart.

Remeasured Turbidity @ 431 FNU

1315 Sampling pt SDAQ3 Iced over
Did NOT sample.

1330 Sampling Location SDAQ1 Iced over - Did not sample.

1335 Sampling Location SDAQ5 SM unsafe - did not sample

12-29-16 cont.

1350 Arrive SDAQ6. Sample: collect SDAQ6-sed-L-14 dissolved metals

pH: 7.96 ORP: 150.1 mV
DO: 3.66 ppm SpCond: 238 µS/cm
Turb: 0.0 FNU Temp: 0.18 °C

1400 SDAQ 7 + 8 unsafe to sample

1405 Leave site.

SM

1/4/17 KE

1400 Calibrate sonde in office in preparation for aquafix sampling tomorrow using pH 4 and 7 standards and 84 µS/cm conductivity standard to calibrate because we are out of quideal. More has been ordered.

pH 4 4.05
pH 7 6.97
Conduct. 252 µS/cm.

Note: the sonde read "wrong standard" when doing single point calibration. Ec readings may be high tomorrow.

KE

1/5/17 KE, RF 0°F, clear

8:00 Pick up rental truck
11:00 Arrive Neihart
12:00-12:50 Arrive Silver dyke after x-country skiing up. Blue bird day with no wind.

1300 Collect sample SDAQ15W-L-15 for TDS TSS Anions, total and dissolved metals.

pH	3.83	ORP	286.5
DO	0.68	SC	3283
turb	7.1 FNU	temp	8.59

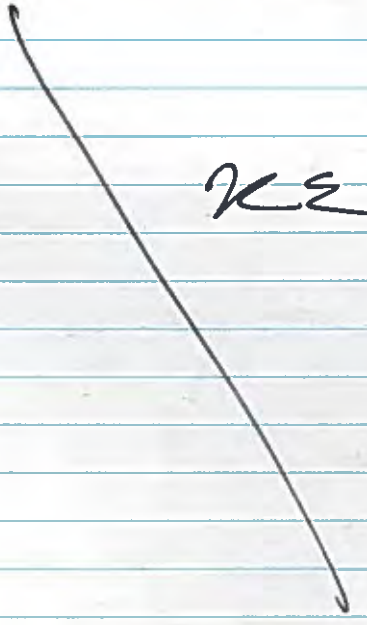
Hopper was empty. Drilled holes in a bucket to shake out the fine lime. Add 1/2 bucket of lime.

1330 Collect Sample SDAQ2-SW-L for TDS TSS Anions, metals -VB Pond was mostly frozen.

1/5/17 KE, RF 0°F, clear

pH	8.02	ORP	189
DO	0.92	SC	3881
turb	32	temp	7.01

17:30 return skis to basecamp and unload samples at office return truck to airport



1/10/17 KE

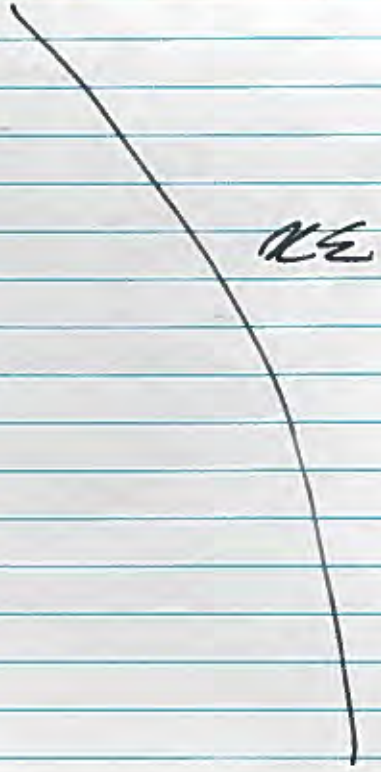
1600 Calibrating Sonde in preparation for aquafix field work tomorrow, Quadcal solution has been ordered but has not yet arrived

pH 4 buffer: 4.23

pH 7.01 buffer: ~~6.8~~ KE 7.02

84 mS/cm cond std: 281 mS/cm

Note: cond. readings could be high tomorrow due to incorrect calibration.



1/11/17 KE, RF 6°F, partly cloudy

0800 meet at Tetra Tech MM office to pick up truck. No rental company in Helena had an available 4WD vehicle.

11:00 Arrive Neihart. Stop by Bob's Bar to send a text to Colin & Scott that we were heading up to Silver Dyke.

13:10 Arrive Silver Dyke. Took up 1/2 inch mesh screen and 12 gallon rubbermaid tubs to screen out fine lime. Added 8 rubbermaid tubs that were 2/3 full to the hopper, so added approx 84 gal of lime. The hopper was mostly empty when we arrived with just a few piles of lime sticking to the sides.

The Sonde was frozen in storage soln so we collected water from SDAQ1 & SDAQ2 to measure parameters when it thaws.

1/11/17 KE, RF 6°F

14:45 Arrive bucke at truck.

17 40 Return truck to MM office

1800 unload sonde, sled at office.

Measure parameters for water collected at SDAQ1 & SDAQ2

SDAQ1

pH 3.76 SC 4147 ms/cm
ORP 117.1 mV turb 8.3 FNU
DO 0.93 ppm temp 15.73°C

SDAQ2 KE

pH ~~3.7~~ 5.62 SC 3308
ORP 187.7 turb 1.3
DO 1.72 temp 16.82

KE

1-16-2017 SM, RF 2°F, Clear @Helena

Sampling Event 17 for AquaFix

0845 Leave Helena

1100 Arrive Newhart - sent text

1107 Stop @ SDAQ8 - no sampling too dangerous.

1109 Stop @ SDAQ7 - Carpenter Creek covered in snow - not sampled.

1118 Arrive SDAQ6 - Carp. Creek frozen over - no where to sample.

1130 Arrive silver Dyke parking area Quick Calibrate Sonde

Params:

pH: 6.90 ORP: 195.3 mV
DO: 0.56* SC: ~~ORP~~ 4990 µS/cm
Turb: 0.0 FNU Temp: 13.57°C

D.O. Sensor BAD

1-16-2017 cont

1230 Arrive Silver Dyke
Hopper empty

Will fill to top today
- LAST Fill lasted 5 days
No Change to dosing
rate : 1.25 turns

SM
1240 Collect Sample ~~SDAQ17-SW-L~~
SDAQ1-SW-L-017 016 RE
total & dissolved Metals, anion,
TSS + TDS

Params:
pH : 3.29 ORP: 226.7mV
DO : 0.57 ppm* SpCond: 2801 uS/cm
Turb: 4.3 Temp 8.38 °C

Sieved Lime w/ 1/4 inch screen
8 LOADS of 9 gal
1 LOAD of 5 gal

77 gals total - filled to top.

1-16-17 cont.

1330 Arrive SDAQ2. Collect sample
SDAQ2-SW-L-017. 016 RE
Total & Dissolved metals, anions,
TDS + TSS

Params:
pH : 5.04 ORP : 171.9mV
DO : 1.05* SPCond : 2674 uS/cm
Turb : 174 FNU Temp : 0.75°C

1410 Arrive SDAQ3 - collect
Sample SDAQ3-SW-L-017 016 RE
Dissolved metals only

Params
pH : 5.03 ORP : 206.9mV
DO : 1.59* ppm SpCond : 1965 uS/cm
Turb: 34.8 FNU Temp : 0.70°C

DO Sensor BAD

1431 SDAQ4 covered in snow-
no sample

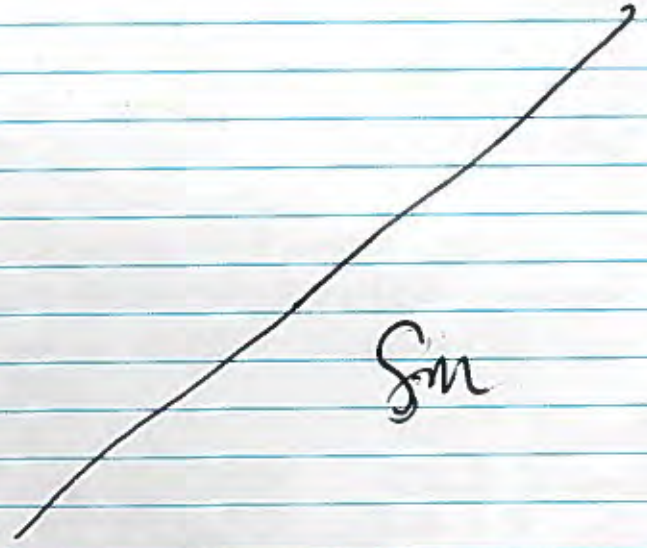
1434 SDAQ5 covered in snow -
no sample

1-16-17 Cont.

1440 Filter Sample

1455 Leave Corp. Creek

1715 Arrive Helena



1-19-16 SM, RF 26°F, Cloudy Helena

- Pickup vehicle - ODO 20753
Calibrated Logging Sonde in office prior to departure.

0845 - Leave Helena.

1120 - Arrive SD Parking Area

1230 - Arrive Aquafix.
Hopper down ~ 8 inches.
Still dropping lime.

1300 Added 45 tubbs - about 36 gallons. Estimated to be roughly half of capacity

Vortex wheel 180 RPMs
215 RPMs
220 RPMs

1320 Arrive treatment pond. Level on flow meter (measured): 0.5 inches.
Reset data logger from 0.2 → 0.5 inches. Cleaned sensor.
Downloaded Data

1-19-16 cont.

8.178 gpm at download.

Installed logging sonde at pond outflow.

Params at Start.

pH:	10.57	ORP:	488mV
DO:	7.86	SC:	2814 µS/cm
Turbs:	262	Temp:	4.92

1425 Return to vehicle and leave site.

Note: Sonde is attached to small lodgepole pine ~20 ft. downgradient of pond outflow.

1700 Return Vehicle. ODO 21001

END Day

SM

1-25-17 SM, WJ 15° overcast HLW

830 Pick up SUV from Avis
ODO: 291038

905 Pick up waste at 5 Aspen Grove

1100 Arrive Silver Dyke Parking Area.

1150 Arrive Silver Dyke AquaFix
~ 1 Gallon of lime left in hopper

Estimate/Count waterwheel RPMs
20.5 RPM
21.0 RPM
20.5 RPM

Reloaded Hopper.
~ 4 x 8 gals
~ 5 x 5 gals

Bins are starting to crack-
Bring replacement.

1245: Arrive Treatment Pond

1-25-17 cont.

Broke up ice at outflow of pond
Flow meter appears to have a hydraulic jump at front of sensor.
Tried to reposition pipe but it is froze in place.

Water level ~1 inch.

Adjusted level from 0.6 to 0.5 inches

Download flow data. ~11.4 gpm
Sonde cover was frozen on.
Could not recalibrate.

Params:

pH 11.07 ORP: 135.2
DO: 8.11 ppm SpCond: 255 µs/cm
Turb: 0.0 FNU (?) Temp: 3.63°C

Downloaded Sonde data

1345 Arrive Back at vehicle. Leave site.

1604 - Return HLN. ODO sn 29348.0

END DAY

SM

1/30/17 RF, WJ 30° Clear

1000 - Arrive at Snow Creek turn off to head up & sample at Lower Rebellion & Big 7
Calibrate office sonde.

pH = 6.85 ORP = 162
DO = 7.25 SC = 499.4 µs/cm
Turb = NA - no sensor Temp = 9.10°C

1130 - Arrive at Big 7, collect samples for total & dissolved metals & anions

pH = ~~3.67~~ RF 4.58 ORP = 226.1
DO = 6.48 SC = 227
Temp = 3.32

SCBS-AD-L-077

1155 - Arrive at Lower Rebellion
Collect samples for total & dissolved metals & anions.

pH = ~~3.72~~ RF 4.39 ORP = 226.4
DO = 6.76 SC = 507
Temp = 2.81

1/30/17 Cont
SCLR-AD-L-081

1400- Arrive at Brandwater Adit to collect sample for total & dissolved metals & anions

NSBW-AD-L-100

pH= 5.01 ORP= 116.6
DO= 7.98 SC= 1009 us/cm
Temp= 5.73°C

1540- Arrive at Moulton/Yellow Jacket adit to collect sample for total & dissolved metals & anions

NSMO-AD-L-068
NSMO-AD-L-067

pH= 5.58 ORP= 143.8
DO= 6.46 SC= 501
Temp= 6.01

1/31/17 RT, WJ 12° Snow

1030- Arrive at Silver Dyke to collect samples for regular adit sampling and Aquafix.

1040- Adit sample: CC5D-AD-L-095
total metals, dissolved metals & anions

Aquafix sample @ AQ1
1050- SDAQ1-SW-L-017
total & dissolved metals, anions, TSS & TDS

Params:
pH= 3.48 ORP= 220.8
DO= 3.85 SC= 2828 us/cm
Temp= 8.53°C

1100- Move to sediment pond & collect sample @ AQ2
SDAQ2-SW-L-017
total & dissolved metals, anions, TSS & TDS

Params:
pH= 10.92 ORP= 179.9
DO= 8.16 SC= 2728 us/cm
Turb= 0.0 Temp= 5.71°C

1/31/17 Cont
Cont.

Measure flow at sediment pond outlet. Level is 0.75".

Reading on flow meter:
Level = 0.823"
Flow = 21.576"
Change level to 0.75"

Download Flow data

Download Logging Sonde and then restart logging. 66 days battery life indicated

1130 - Finish loading Aquafix hopper.

Count RPM on Aquafix wheel
23, 18.5, 16.5, 18

Leave valve at same position.

Load 13 bins approximately 6 gallons each, 78 gallons total

1/31/17 Cont

1200 - Arrive at AQ3, sample for dissolved metals

pH: 6.36 ORP: 145.2
DO: 9.07 SC: 2102 ms/cm
Temp: 0.54°C

SDAQ3-SW-L-017
-wasted approximately 10 minutes for parameters to stabilize

1220 - Arrive at AQ4, sample for dissolved metals

SDAQ4-SW-L-017
pH: 6.98 ORP: 143.6
DO: 5.76 SC: 239 ms/cm
Temp: 0.03°C

1245 - Arrive at AQ5, sample for dissolved metals
SDAQ5-SW-L-017
pH: 6.91 ORP: 138.3
DO: 7.08 SC: 628 ms/cm
Temp: 0.76°C

1/31/17 Cont

1315- Arrive at AQ6, collect sample for dissolved metals

SDAQ6-SW-L-17

pH= 6.70 ORP= 176.3
DO= 9.88 SC= 237 µs/cm
Temp= 0.0°C

1320- AQ7 & AQ8 not able to be sampled due to snow & ice.

1335- Arrive at Evenings to Adit to collect sample for total & dissolved metals & anions

NSES-AD-L-083

pH= 6.60 ORP= 184.7
DO= 6.14 SC= 704 µs/cm
Temp= 6.77°C

1350- Arrive at Compromise shaft to collect sample for total & dissolved metals & anions.

1/31/17 Cont

NSCO-AD-L-084

~~pH= 6.60~~ ~~ORP= 184.7~~ ~~SC= 704 µs/cm~~ ~~DO= 6.14~~ ~~T= 6.77°C~~ BF

pH= 6.76 ORP= 174.2
DO= 7.29 SC= 684 µs/cm
T= 3.23°C

1430- Collect Field Blank

CSCB-AD-L-021
total & dissolved metals & anions

1500- Finish filtering samples & Leave site

2/7/17 RF, WJ 5°, clear

1100- Arrive at Pioneer Ln / Carpenter Creek Rd junction. Calibrate office sonde.

pH= 6.91 ORP= 299.1
DO= 5.57 SC= 9279 µS/cm
T= 14.76°C

DO would not calibrate correctly displaying "wrong standard"; Conductivity seems wrong.

1215- Arrive at Aquafix, line still in hopper, looks the same as it did last tuesday (2/31/17) count revolutions to see what feed rate is.

RPM= 16, 16.5, 15.75

1300- Complete filling Aquafix Hopper 11 tubs @ ~7 gals each & 1 @ 3 gals = 80 gals total.

2/7/17 Cont

1315- Download Flow meter
Flow = 12.471
Level = 0.736

Measured level was ~0.7" adjustment made to Flowlink

1320- Check Sonde @ AP2

pH= 10.55 SC= 2102
DO= 6.24 Turb= 0.0
ORP = 156.7 T= 4.48°C

Download log from 1/31/17 to 2/7/17.

Calibrate logging sonde, pH will not calibrate. Check pH with office sonde

pH= 9.98 SC= 5134 µS/cm
DO= 6.95 T= 4.07
ORP = 108.4

SC seems off but pH is correct

Pull logging sonde & bring back to

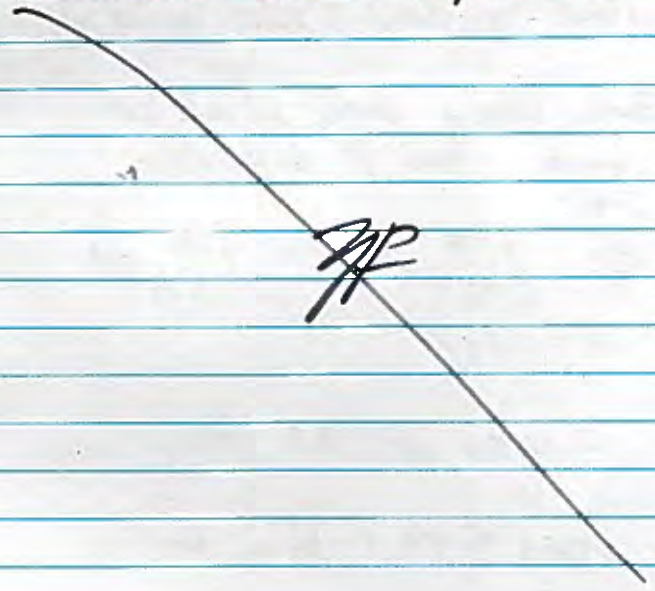
2/7/17
to office to fix & install new pH probe.

1400- Check Aquafix RPM again.

RPM = 20, 21, 19

Do not adjust valve because pH recorded with office sonde is measuring 10 s drop rate seems to be accurate.

1445- Get back to truck, leave site.



2-14-17 SM, WS 23°F, Clear
Arrive Neihart Night of 2-13

0720 Calibrate office SONDE in Quicksal
pH: 6.90 ORP: 302.9 mV
DO: 6.95 ppm SpCond: 5228 ms/cm
Temp: 21.06°C

0740 Leave Bobs
0744 Arrive SPAQ8- Belt Creek
Sampling location unsafe- not sampled
0750 Arrive SPAQ7, Collect sample
SPAQ7-SW-L-018 - Diss metals
pH: 7.44 ORP: 269 mV
DO: 12.63 ppm SpCond: 224 ms/cm
Temp: 0.03°C
0805 Arrive SPAQ6, collect sample
SPAQ6-SW-L-018 - diss. metals
pH: ~~6.66~~ SM 6.63 ORP: 343 mV
DO: 11.97 ppm SpCond: 235 ms/cm
Temp: 0.03
0820 Visited w/ Ken talked about loggers
0840 Arrive SPAQ4-SW-L-018 collect sample diss metals
pH: 6.44 ORP: 323.6
DO: 11.71 Sp cond: 1,500
Temp: 0.05

2-14-17 cont.

0850 Arrive SPAQ5 Collect sample

SPAQ 5 - SW-L 018 Diss metals

PH: 6.70 ORP: 354.5
DO: 5.58 uS/cm: 90
Temp 0.0C

0905 Calibrate logging sonde for deployment at SDAQ2
pH 6.97 ORP 315.6 mV
DO 11.08 ppm SPCond 4958 MS/cm
Turb 20.0 FNU Temp: 5.80°C

0955 Arrive AquaFix. Hopper empty
Measure RPMs on water wheel
23.5 RPMs/Minute - Before loading
24.0 RPMs/minute. - Before loading
21.0 RPMs/minute - after loading
17.0 RPMs/minute - after loading
20.5 RPMs/Minute.
Turned water input down to 1 full turn (from 1.25 turns)
15.0 RPMs/minute
17.0 RPMs/minute
18.0 RPMs/minute

2-14-17 cont.

Turned Knob to 1 + 1/8 turns
19.0 RPMs/Minute
21.0 RPMs/minute.

Turned Knob to 1 + 1/16 turns
18.5
16.5
18.0
20.0
} RPMs/Minute

RPMs Appear to be influenced by augee loading.

Knob Left at 1 and 1/16 turns - down from 1.25 turns.

Started New Super sack of Lime. 5 unopend Sacks Remain plus one about 3/4 full after loading.

1115 SPAQ1-SW-L-018 Collect Sq sample 4 PSS, TDS, total metals, dissolved metals and anions

2-14-17 Cont.

pH: 3.65 ORP: 307.1
DO: 4.78 µS/cm: 2772
Temp: 8.50

1130 Arrive SDAQ2. Collect sample SDAQ2-SW-L-018 for: TDS, TSS, Total Metals, dissolved metals and anions.

pH 7.44 ORP 193.6
DO 9.43ppm SpCond 2907
Turb NA Temp 3.56°C

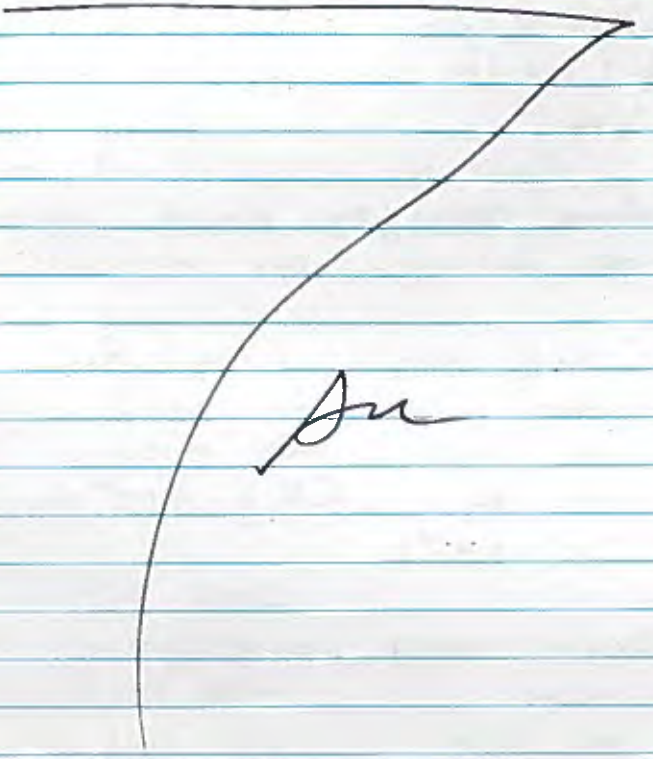
Installed Logging Sonde at SDAQ2. Cleaned flow sensor. Made slight adjustment to level 0.65 → 0.75 inches Flow was ~10gpm

1220 Arrive SDAQ3. Collect Sample SDAQ3-SW-L-018 for dissolved metals,

pH: 7.63 ORP: 225.4 mV
DO: 11.19 ppm Spcond: 2003 µS/cm
Temp: 0.68°C

2-14-17 Cont.

1235 Arrive at truck; filter samples.
1330 Leave Neihart



2-21-17 SM, WS 35°, snowing

1100 Arrive SITE. Snow + sleet between white sulphur + Neihart. Neihart had ~ 1/2 inch accumulation of slush.

1105 Arrive SDAQ8 (Belt Creek). Approach dangerous - parameters not collected.

1108 Calibrate sonde w/ Quick cal.
params:
pH: 6.86 ORP: 295.4
DO: 6.86 SpCond: ~~335~~ 5228 µS/cm
Temp: 10.45°C

1120 Arrive SDAQ7 - no sample
params:
pH 7.80 ORP 247.3 mV
DO 9.73 ppm SpCond 235 µS/cm
Temp 0.81

1130 Arrive SDAQ6 - Snow Creek - no sample
pH ~~6.75~~ 6.65 ORP: 295.8 mV
DO 9.58 ppm SpCond 242 µS/cm
Temp: 0.88

2-21-17

1156 Arrive SDAQ5 - no sample
pH 6.34 ORP 297.7 mV
DO: 9.24 ppm SpCond 145 µS/cm
Temp: 0.91 °C

1205 Arrive SDAQ4 - no sample
pH 6.01 ORP 311.6 mV
DO 8.68 ppm SpCond 1441 µS/cm
Temp ~~0~~ 1.36 °C

1254 Arrive Aquafix. - System empty.
Aquafix revolutions - empty

21.5 RPMs
21.0 RPMs
20.25 RPMs

Aquafix revolutions - full 14'/14 turns

19.0 RPM
19.0 RPM
19.5 RPM

2-21-17, cont.
Adjust to 1 turn.

18 RPMS
18 RPMS
16 RPMS
16 RPMS

Knob left at 1 turn. Hopper Full.

Rock size is smaller in this sack - about ½ the diameter of previous sack.

1400 Arrive SDAQ1 No sample

PH: 3.71 ORP: 311.1 mV 8.50°C
DO; 3.53 ppm Sp 3104 µS/cm
PRIME

1420 Arrive SDAQ2 - No sample.
Cleaned flow sensor - checked level 0.7 inches - Consistent w/ data logger. Downloaded data. 13 gpm.

2-21-17 cont,
Office Sonde parameters - allowed to equilibrate for 10 minutes. pH continues to increase.
pH: 8.94 ORP: 1026 mV
DO: 6.95 SpCond: 2977 µS/cm
Temp: 5.13°C

Calibrated Logging Sonde
Params in Quickeal
pH: 6.62 ORP: 355.6
DO: 6.73 ppm SpCond: 5732 µS/cm
Temp: 3.96°C.

1505 Arrive SDAQ3 - No sample
pH: 8.96 ORP: 195.4 mV
DO: 8.54 ppm SpCond: 1879 µS/cm
Temp: 0.90°C

NOTE: Parameters from SDAQ2+ SDAQ3 were after time was reloaded in system. ALL others were taken when the hopper was empty.

1530 Leave Site

SM

2/27/17 RF, WJ 20° clear, wind

1100- Arrive at Pioneer Ln & CC road junction. Get gear together to sample Aquafix and regular monthly addt sampling.

1130- Calibrate office sonde.
pH= 6.95 ORP= 211.9
DO= 6.24 SC= 5055 us/cm
Temp= 9.46°C

DO would not calibrate, "wrong standard" message.

1235- Arrive at Aquafix Shed. Lots of lime left in hopper. Appears to be approximately 1/3 full after 6 days

1245- Collect addt sample from Silver Dyke along with sample for AQ1 for TSS & TDS

2/27/17 Cont

CCSD-AD-L-099
total & dissolved metals & anions

SDAQ1-SW-L-019
TDS & TSS

pH= 3.75 ORP= 218.2
DO= 3.63 SC= 2983
Temp= 8.49°C

1310- Arrive at sed pond. Large amount of ice built up at flow meter impeding flow out of pond

Measured flow level= 0.65"

1320- Collect samples from AQ2 for total & dissolved metals, anions & TDS & TSS

SDAQ2-SW-L-019

Parameter from logging sonde

2/27/17 Cont

pH= 10.61 ORP= 170.1
DO= 7.50 Sc= 2389
Temp= 3.02°C

Calibrate logging sonde.

Download logging sonde. Save to Lot Plot015.

After calibration

pH= 7.09 ORP= 447.3
DO= 3.69 Sc= 4196
Temp= -0.13°C

1345-
Try to download flow meter but laptop will not turn on. Battery might be dead from cold

1355- Loaded 8.5 tubs into hopper
Full to top

RPM after loading= 17, 16.5, 15, 15, 16, 15.5, 15.5

2/27/17 Cont

1400- Leave aquafix site & head down to AQ3.

1425- Arrive at AQ3, collect sample for dissolved metals

SDAQ3-SW-L-019

pH= 8.01 ORP= 153.7
DO= 8.98 Sc= 1924
Temp= 0.06

1515- Meet MSU grad students at Bob's and head to Farmington Motel

1535- Collect adit sample for total & dissolved metals & anions.

NSES-AD-L-084 - 1535

NSES-AD-L-085 - 1540

pH= 7.79 ORP= 172.6
DO= 5.62 Sc= 766
Temp= 6.51°C

2/27/17 Cat

1615- Collect sample & parameters from AQ4

SDAQ4-SW-L-019

pH= 7.91 ORP= 186.4
DO= 9.26 SC= 1472
Temp= 0.41°C

1630- Collect sample & parameters from AQ5

SDAQ5-SW-L-019

pH= 8.10 ORP= 186.4
DO= 9.23 SC= 168
Temp= 0.24°C

1645- Collect sample & parameters from AQ6

SDAQ6-SW-L-019

pH= 7.82 ORP= 209.5
DO= 4.06 SC= 200
Temp= 0.07°C

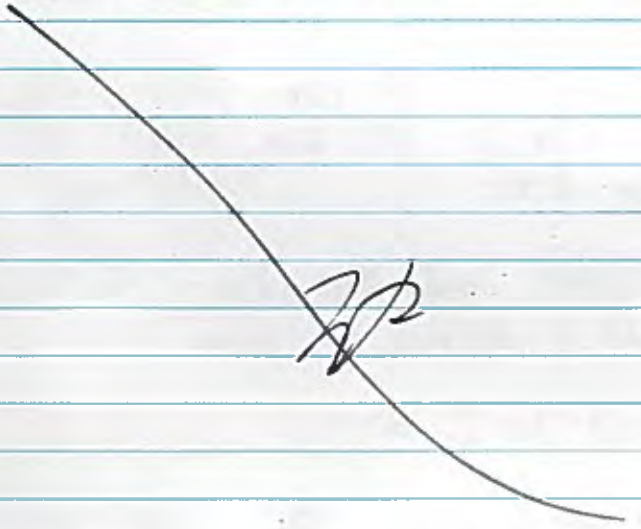
2/27/17 Cat

1700- Collect sample & parameters from AQ7

SDAQ7-SW-L-019

pH= 7.77 ORP= 205.7
DO= 9.7 SC= 220
Temp= 0.04°C

1710- Leave site, AQ8 is inaccessible for sampling and parameters.



2/28/17 RF, WJ 14° overcast windy

0800- Meet loggers at Bob's parking lot to follow them up Snow Creek to Sample from Big 7 a Lower Rebellion.

0825- Park below Big 7 and get gear ready to hike up to Big 7 to sample from adit.

Collect sample from Big 7 for total & dissolved metals & anions

0915- SCBS-AD-L-078

pH= 6.64 ORP= 46.1
DO= 5.54 SC= 2026
Temp= 2.72°C

1000- Collect sample from Lower Rebellion for total & dissolved and anions.

SCLR-AD-L-082

pH= 6.50 ORP= 103.5
DO= 5.88 SC= 519
Temp= 2.48°C

2/28/17 Cont

Download flow meter at Lower Rebellion
Level = 2.10"
Flow = 29 gpm

Measured level = 2.0", no adjustment made to flow meter level.

1145- Collect sample from Monitor / Yellow Jacket for total & dissolved metals and anions.

NSMO-AD-L-070

pH= 6.37 ORP= 159.8
DO= 5.92 SC= 474
Temp= 5.97°C

1215- Collect sample from Compromise for total & dissolved and anions.

NSCO-AD-L-085

pH= 6.57 ORP= 165.9
DO= 6.48 SC= 658
Temp= 4.53°C

2/28/17 Cont

1315- Collect sample from Broadwater for total & dissolved metals and anions

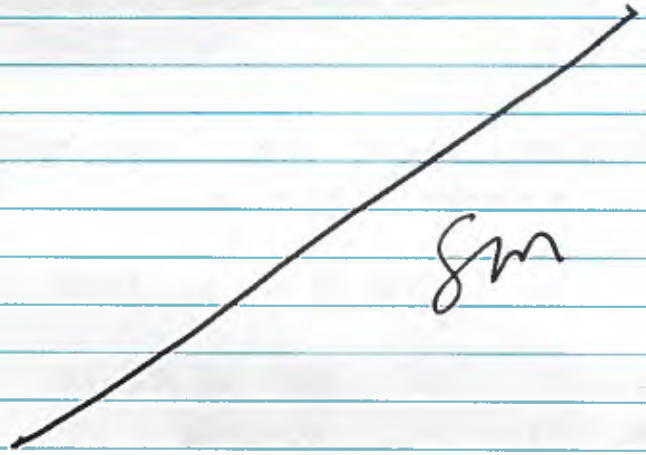
NSBW-AD-L-101

pH= 6.55 ORP= 168.7
DO= 6.82 SC= 970
Temp= 4.9°C

1400- Collect field blank

CSCB-AD-L-022

total & dissolved metals & anions



3-4-17 SM

~~4-3-17~~ SM, CWS 39° Partly Cloudy

1050 Arrive SITE. Checked Site SDAQ8 - not sampled due to hazardous access.

1052 Arrive SDAQ7. Calibrate office Sonde.

Quick Cal Params:
pH: 6.92 ORP: 286.1 mV
DO: 5.96 ppm SpCond: 4988 uS/cm
Temp: 13.89°C

1100 SDAQ7 no sample

pH: 8.07 ORP: 236.5 mV
DO: 10.32 ppm SC: 217 uS/cm
Temp: 0.27°C

1111 Arrive SDAQ6. No sample.
pH: 7.52 ORP: 261.3 mV
DO: 10.15 ppm SpCond: 224 uS/cm
Temp: 0.19°C

1122 Arrive Silver Dyke parking area

3-4-17 cont.

1200 Arrive SDAQ2. Download flow data.
- Removed ice from flow sensor + checked level (0.7").
Level on data logger OK.

Flow after clearing ice ~~8pm~~ WSS
13.5 gpm.

OFFICE SONDE @ SDAQ2
pH: ~~10.06~~ 10.08 ORP: 123.1 mV
DO: 6.88 ppm SpCond: 2878 µS/cm
Temp: 4.28 °C

Downloaded Logging sonde.
Recalibrated Logging sonde.
Redeployed Logging Sonde

1245 Arrive SDAQ1. No sample
Params:
pH: 3.73 ORP: ~~8pm~~ 362.0 mV
DO: 3.51 ppm SpCond: ~~277.9~~ 2932 µS/cm
Temp: 8.48°C

3-4-17 cont.

8pm
Water wheel Revolutions

17.0
17.5
16.0
15.5
15.5
} RPMs

Loaded 5.5 bins into hopper
Roughly half of hopper volume.

Started new super sack. After loading have 4.8 sacks.

1330 Arrive SDAQ3. No sample.
Params: 6.10 188.0 mV
pH: ~~5.48~~ ORP: ~~197.6~~ mV
DO: 9.09 ppm SpCond: 1918 µS/cm
Temp: 0.59°C

pH slowly increasing. waited 10 minutes for stabilization

1350 Arrive SDAQ4. No sample.
pH: 6.40 ORP: 194.6
DO 9.00 ppm SpCond ~~1445~~ 1445 µS/cm
Temp: 1.01°C

3-4-17 cont.

1400 Arrive SDAQ5. no sample

Params:

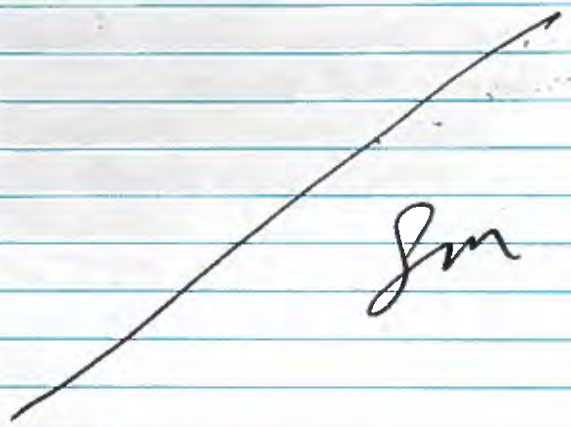
pH : 6.70 ORP : 185.6 mV

DO : 9.27 ppm Spcond : 152 µS/cm

Temp: 0.93°C

1430 Met w/ Resident to talk about groundwater quality

1500 Leave site



3-9-17 SMyW5 90, Snowing

1100 Arrive Site

1120 Arrive Silver Dyke parking area

Calibrate office Sonde (Quick Cal)

Params:

pH 6.95 ORP 253.0 mV

DO 6.38 ppm SpCond 5033 µS/cm

Temp 15.5°C Turb 5.9 FNU

1215 Arrive Silver Dyke. Aquafix Y3 Full - 8 loads to fill

1225 Collect Sample SDAQ1-SW-L-020 TOTAL + Dissolved Metals, anions TDS + TSS.

pH 3.44 ORP 250.0 mV

DO 3.58 ppm SpCond 2809 µS/cm

Temp 8.47°C Turb 32.3 FNU

RPMs: 12, 11.5, 10.75, 11.5, 13.75, 14, 14.25, 14

1240 Arrive SDAQ2

Download flow data. Clean Sensor Level ~ 0.7". OK - Flow: 17.3 gpm

Collect Sample SDAQ2-SW-L-020 total + dissolved metals, anions, TDS, TSS.

3-09-17 Cont.

Params:

pH	10.54	ORP	110.3
DO	7.83ppm	SpCond	2817 MS/cm
Turb	250 FNU	Temp:	5.15°C

Installed new pH sensor on SDAQ2 Logging Sonde & calibrated. Downloaded Logging Sonde Data.

1350 Arrive SDAQ3. Collect sample SDAQ3-SW-L-020. ~~Total~~ + dissolved Metals, ~~anions, TDS, TSS~~ SM

pH	9.73	ORP	179.5 mV
DO	10.03 ppm	SpCond	1993 MS/cm
Temp	0.80°C	Turb.	245 FNU

1415 Arrive SDAQ5. Collect Sample SDAQ5-SW-L-020. Collect dissolved Metals.

pH:	9.47 (?)	ORP:	198.3mV
DO:	10.51 ppm	SpCond:	123 MS/cm
Temp:	0.39°C	Turb:	0.0 FNU

pH reading likely too high.

3-09-17 Cont.

Checked pH w/ 4.01 Buffer. -7 4.15

pH readings at ~~SDAQ~~ SDAQ3 + SDAQ5 May be accurate

1435 Arrive SDAQ4. Collect Sample SDAQ4SW-L-020 Dissolved Metals.

PH:	6.87	ORP	234.1mV
DO:	9.90ppm	SpCond:	1471 MS/cm
Temp	0.55°C	Turb:	213 FNU.

1450 Arrive SDAQ6. Collect Sample SDAQ6-SW-L-020. Dissolved metals.

pH	6.63	ORP	256.5mV
DO	7.15ppm	SpCond	205 MS/cm
Turb	0.5FNU	Temp	0.13°C

1503 Arrive SDAQ7 Collect Sample SDAQ6-SW-L-020

pH	6.44	ORP	267 mV
DO	4.24ppm	SpCond	170 µS/cm
Turb	1.1 FNU	Temp	0.15°C

3-16-17 SM, WJ 44°F, Cloudy in Nelwt

0830 Leave HLN

Calibrate office sonde w/ Quickcal

pH	6.89	ORP	318.1 mV
DO	8.23 ppm	SpCond	5033 µS/cm
Turb	4.0 FNU	Temp	9.21°C

1140 Arrive SDAQ2 - no sample.
- Cleaned sensor. Level: 8"
Flow data logger not downloaded
Params

pH : 9.90		ORP : 153.9	
DO : 7.94		SpCond: 2674 µS/cm	
Turb: 165 FNU		Temp: 5.36°C	

Downloaded logging sonde data. Device failed on 3/07/17
- Recorded only 2 events.
Changed batteries, recalibrated and redeployed.

1230 Arrive SDAQ1 - no sample
Hopper 1/4 - 1/3 full - 8.5 bags to fill.

3-16-17 SM, WJ - Cont.
Params: SM

pH	~~3.57~~ 3.48	ORP	237.5 mV
DO	3.63 ppm	SpCond	2883 µS/cm
Turb	33.2 FNU	Temp	8.36°C

AquaFix ~~RPS~~ RPMs:
16, 16.5, 14.5, 14.0, 14.0

4.5 Super Sacks Remaining
Shed is starting to fall apart.
Zippers on both ends broken -
Wind is whipping through structure.
Rips are appearing in canvas

1300 Arrive SDAQ3 - no sample
Params

pH	5.35	ORP	196.3 mV
DO	10.31 ppm	SpCond	327 µS/cm
Turb	52.6 FNU	Temp	1.43°C

1330 Arrive SDAQ5 - no sample
Params:

pH	5.45	ORP	208.9 mV
DO	10.28	SpCond	223 µS/cm
Turb	2.1 FNU	Temp	1.71°C

3-16-17 Cont.

1340 Arrive SDAQ4 - no sample.
Params:

pH	5.43	ORP	215.3 mV
DO	10.04	SpCond	1077 µS/cm
Turb	23.0 FNU	Temp.	2.57°C

1345 Arrive SDAQ6 - no sample

Params

pH	5.62	ORP	215 mV
DO	10.22	SpCond	198 µS/cm
Turb	7.1	Temp	3.09

1355 Arrive SDAQ7 - no sample

params

pH	5.62	ORP	217.1 mV
DO	11.31 ppm	SpCond	184 µS/cm
Temp	1.57 °C	Turb	11.0 FNU

1400 Arrive SDAQ8 - no samp.
Approach unsafe no samples or params.

1410 Leave site

SM

3-21-17 SM, RG (WS), CM, PM 40°F Partly cloudy Neihart

1100 Arrive Neihart. Calibrate office sonde. Safety Talk.

OK Quick calibration: ~~B~~ for Params

pH:	6.86	ORP	299.5 mV
DO	5.48 ppm	SpCond	4821 µS/cm
Turb	8.4 FNU	Temp:	1.07°C

1227 Arrive Big Seven Collect Sample SCBS-AD-L-079
total + dissolved metals + anions

pH	5.94	ORP	
DO	7.31 ppm	SpCond	1885 µS/cm
Turb	3.3 FNU	Temp:	3.69°C

1305 Arrive Lexington
Collect SCLX-AD-L-026
Total metals, dissolved metals & anions.

pH	6.13	ORP	92.0 mV
DO	8.01 ppm	SpCond	191 µS/cm
Temp	2.21°C	Turb	0.3 FNU

3-21-17 cont.

1430 Arrive Lower Rebellion
Collect samples SCLR-AD-L-083 + SCLR-AD-L-084. Both samples are total + dissolved ~~cations~~ metals and anions.

Params:

pH	5.48	ORP	154.1 mV
DO	6.75 ppm	SpCond	454 µS/cm
Temp	3.21°C	Turb	6.6 FNU

Check level (~ 2.25 inches) - consistent w/ flow meter. Downloaded flow data : about 30 gpm.

Attempted to download rain gauge. Dead battery. Removed data logger and bring to office for download.

1615 Arrive SDAQ2. Download flow data, check level, replace batteries on 2150.
Collect Sample SDAQ2-SW-L-021.
- TOTAL + Dissolved metals, anions, TSS + TDS

3-21-17 cont.

pH	7.15	ORP	198.7
DO	7.42 ppm	SpCond	2359 µS/cm
Temp	8.53°C	Turb	84.1 FNU

Downloaded data from Logging sonde + recalibrated.

1625 - Collect Sample CCSD-AD-L-100
- Total + dissolved metals, anions
- Collect SDAQ1-SW-L-021
- TSS + TDS

pH =	3.98	ORP =	228.7
DO =	3.61 ppm	SpCond =	2736 µS/cm
Temp =	8.31°C	Turb =	24.6 FNU

Check Aquafix hopper, appears to be approximately 3/4 full
Measure RPM = 6.5, 8, 12
Based on pH reading below, adjust Valve on Aquafix to increase RPM. Valve did not accurately control rpt
New RPM reading = 10, 7.9, 11, 10
Open valve all the way to use line
No lime added to hopper.

3/21/17 Cont

Aquafix shutdown punchlist items.

- Grease gun
- Chain lube
- CLR cleaner & brush
- Blue spray paint
- Remove inflow piping & let adit flow freely
- Break levy forcing water into settling pond
- Empty remaining lime out of hopper
- Move flow meter back to SD adit

1745 Arrive SDAQ3
Collect sample SDAQ3-SW-G-021
Dissolved Metals.
Params:

pH	5.41	ORP	182.4mV
DO	9.77 ppm	SpCond	785 µS/cm
Temp	3.17°C	Turb	42.7 FNU.

3/21/17 cont.

1750 Arrive SDAQ4
Collect Sample SDAQ4-SW-G-021
Dissolved metals

pH	5.52	ORP	193.0mV
DO	9.89 ppm	SpCond	731 µS/cm
Temp	3.412	Turb	15.9 FNU

1800 Arrive SDAQ5
Collect Sample SDAQ5-SW-G-021
Dissolved Metals
params: ~~S~~ SW

pH	5.77	ORP	187.4
DO.	9.90 ppm	SpCond	333 µS/cm
Temp:	2.05°C	Turb:	~~3.04~~ 3.7 FNU

1830 END DAY

SM

41°F

3-22-17 SM, CM, PM, RF, WS Partly Cloudy

~~0830~~

0830 Calibrate ~~office~~ sonde - OK.

pH	6.87	ORP	196.4 mV
DO	5.90 ppm	SpCond	4975 µs/cm
Temp	17.73°C	Turb	4.8

1020 Arrive ~~Silver~~ ~~Bell~~ Fairplay

Params

pH	8.18	ORP	149.6 mV
DO	10.12 ppm	SpCond	140 mS/cm
Turb	0.0 FNU	Temp	0.84°C

Downloaded flow. Sensor on Flow meter was undercut. Flow data biased Low. Attempted to plug undercut

Changed level to 0.25" from 0.1", ~~sensor~~ SM. Flow reading less than 1 gpm, Change out batteries on flow meter.

Collect sample NSSB-AD-L-001 total + dissolved metals + anions.

3-22-17 cont.

1200 Poured field blank CSCB-AD-L-023 total + dissolved metals + anions

1300 FILTER Samples

1400 Leave Site.

SM

3/30/17 BF, TD, PM 40° overcast

1130- Arrive at Aquatix operation area. No lime present in the hopper. Prepare to remove soil & bale boom that is directing flow into settling pond.

1145- Download logging sonde below Aquatix settling pond.

pH= 5.49	ORP= 433.2
DO= 2.25	SC= 2322
Turb= NA	Temp= 6.85°

Remove logging sonde to bring back to office.

1200- Download flow meter at AQ2

Current readings= Flow= 6.90 GPM
Level= 0.754

Remove flow meter from outfall pipe in preparation for installation in the pipe from the Silver Pyke adit.

3/31/17 Cont

1210- Install hose near pond outflow to help drain pond & dry out sediment. Flow from hose directed into silt fence below pond outflow.

1215- Finish re-directing adit flow around settling pond and into original channel. Reinforce with hay bales & wood to help when flow picks up

1230- Removed 6" to 4" coupling from the adit. Seperated piping by sections and check the inside for precipitate. There was a large amount of build up. The 2" pipe was blocked in sections.

1300- Adit water was used to flush the 4" pipe and wire brushes were used to remove precipitate. The 2" sections were flushed. Two 2" sections were to long to be flushed or heavily clogged. The pipe sections were labeled 1 through 8 and stored in the lime shed. Sections 4 and 7 will need to be replaced and were placed outside the shed.

3-30-17

Section 4 was approximatly 19 ft.
Section 7 was approximatly 21 ft.

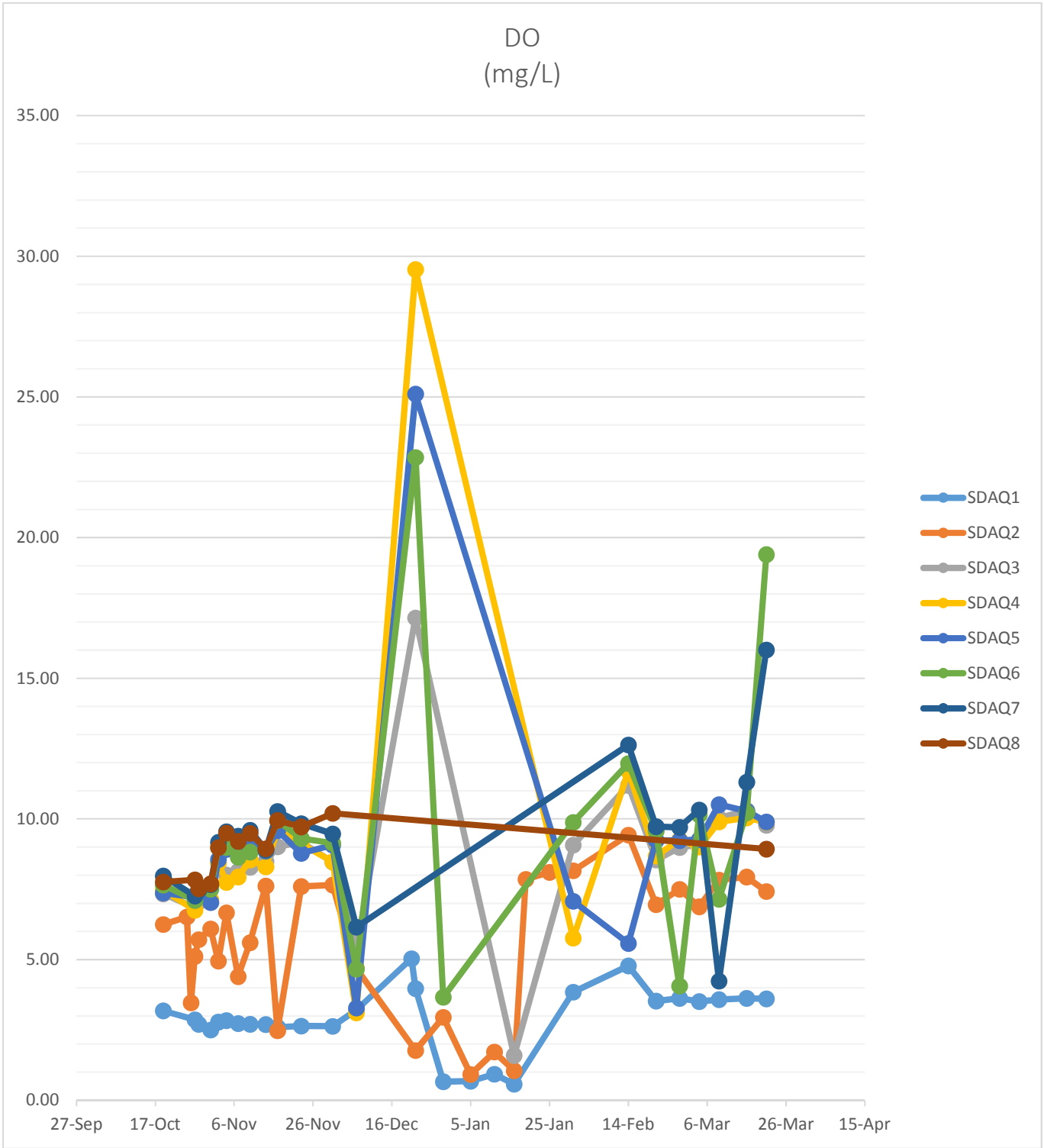
1345- Complete cleaning of Aquafix unit. Scrape excess iron oxide & lime from outside of unit. Fill bearings with grease & thoroughly lube chain. Chain is very loose & may need to be replaced or tightened before continuing operations.

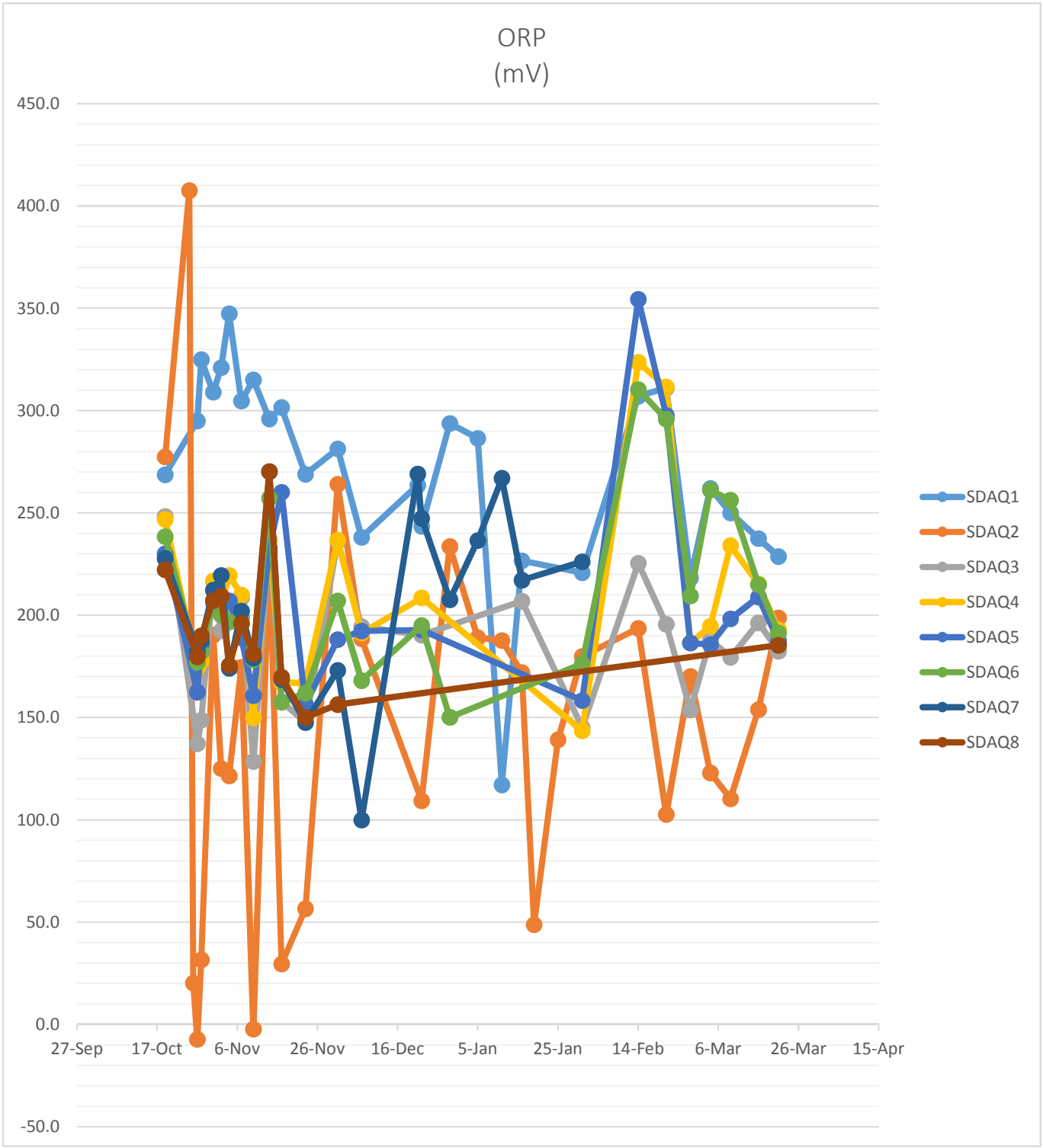
Piping running into water steel was very full of iron oxide and we attempted to clean piping with brushes & flush with water. Would be prudent to bring a compressor to blow out lines in Aquafix before starting it up again.

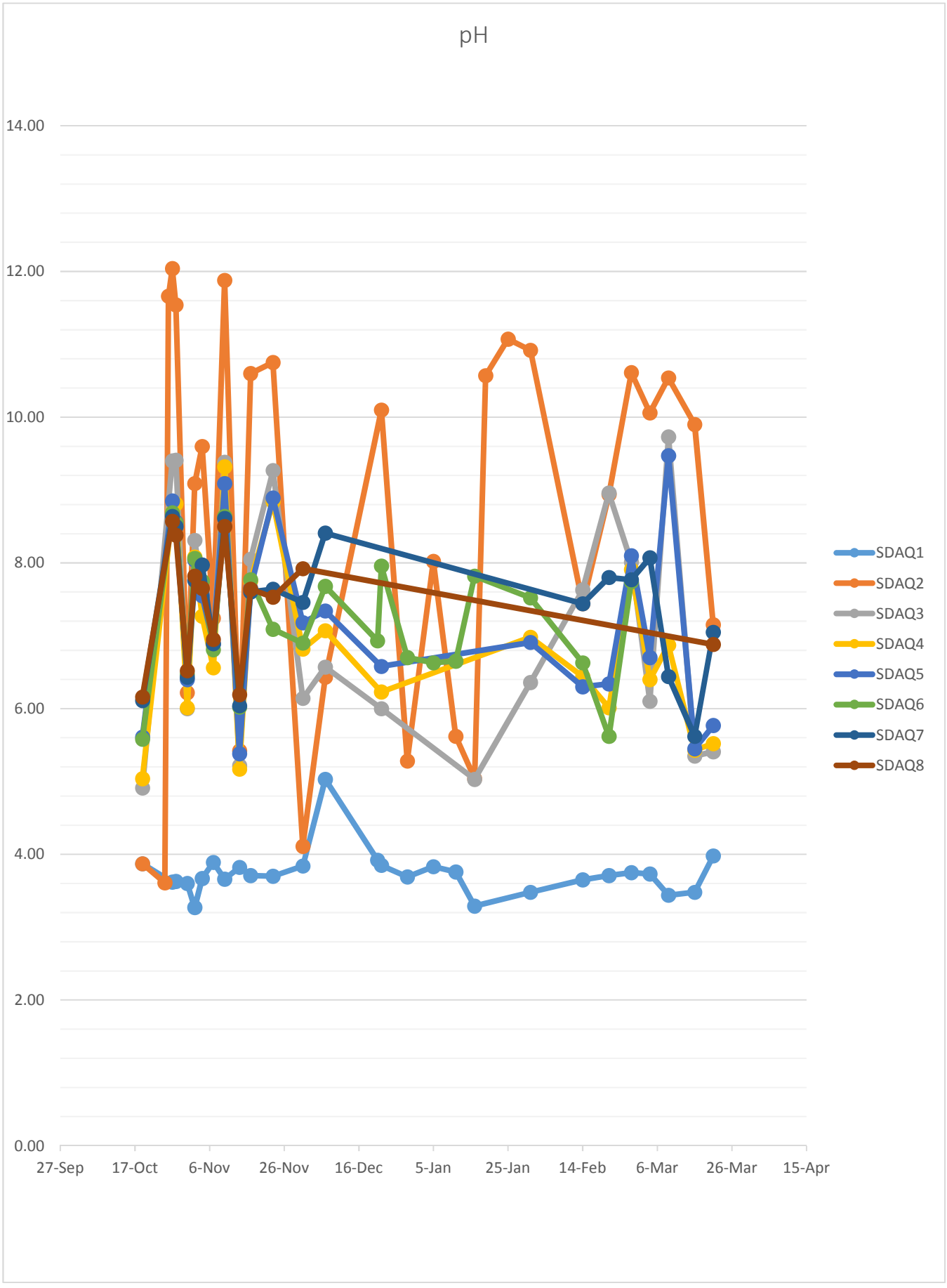
1430- Install flow monitor at SD Adit outlet & adjust level. Set level at 0.75". Flow reading at 7.8 GPM.

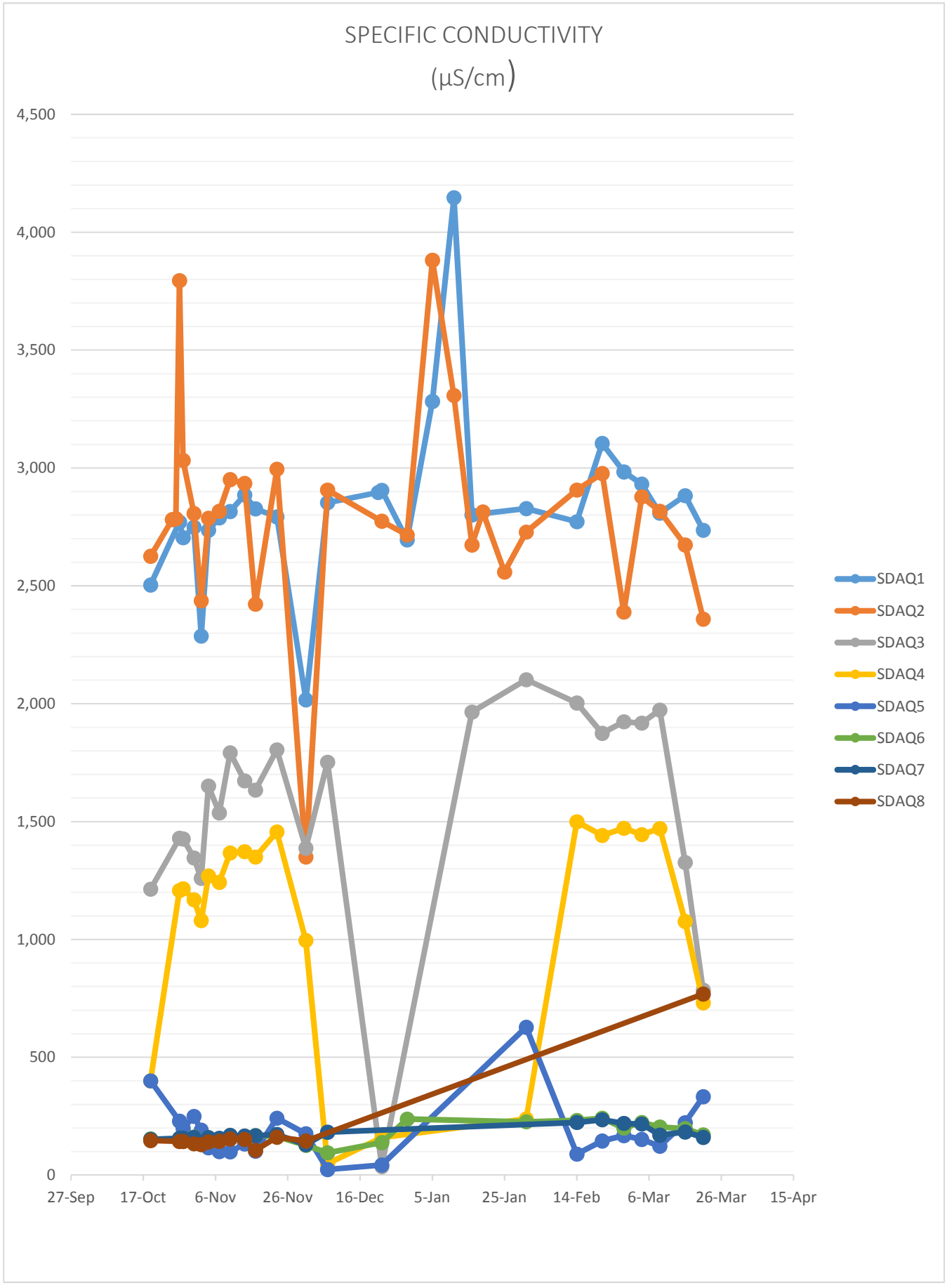
APPENDIX B

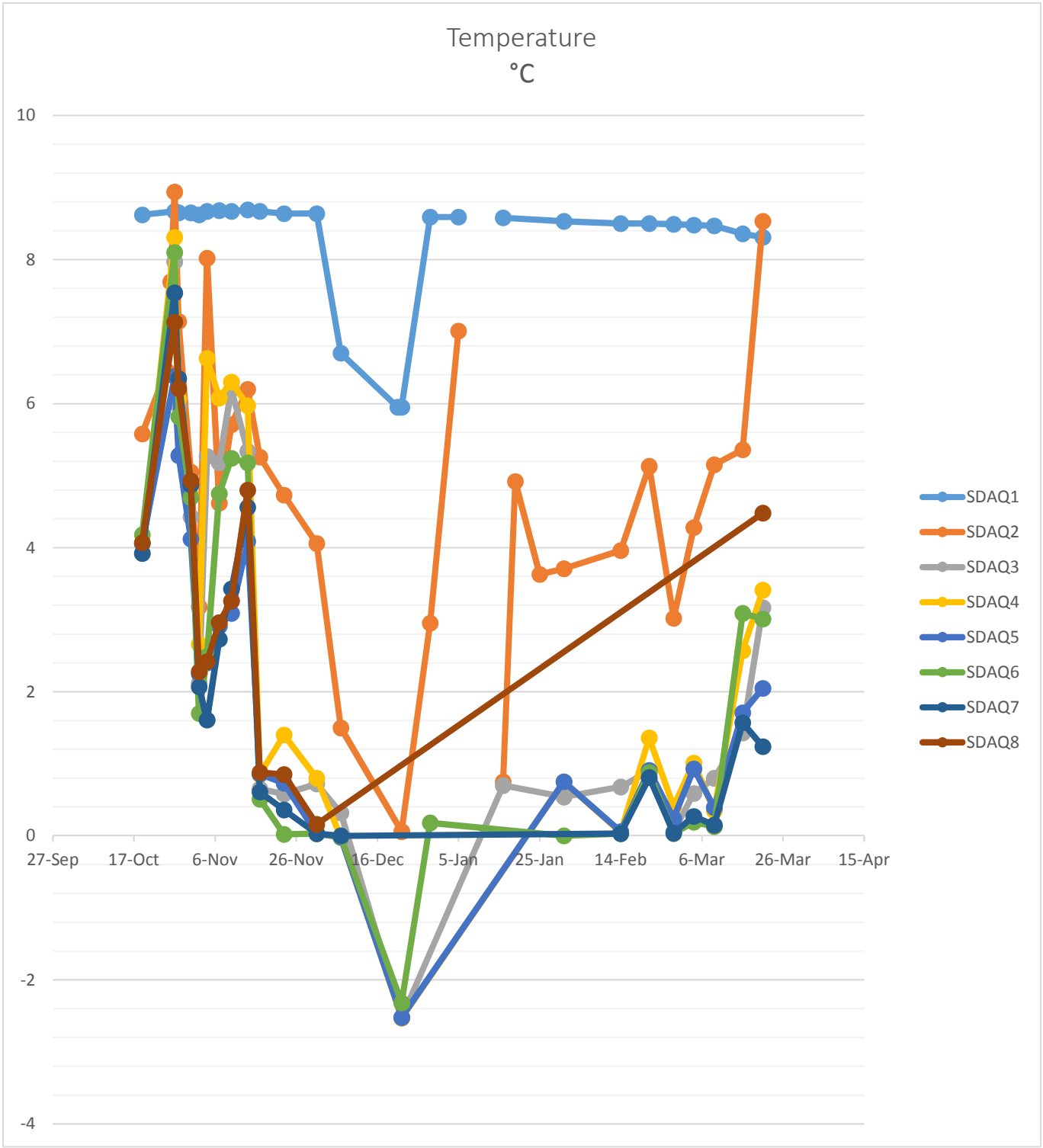
FIELD PARAMETER PLOTS

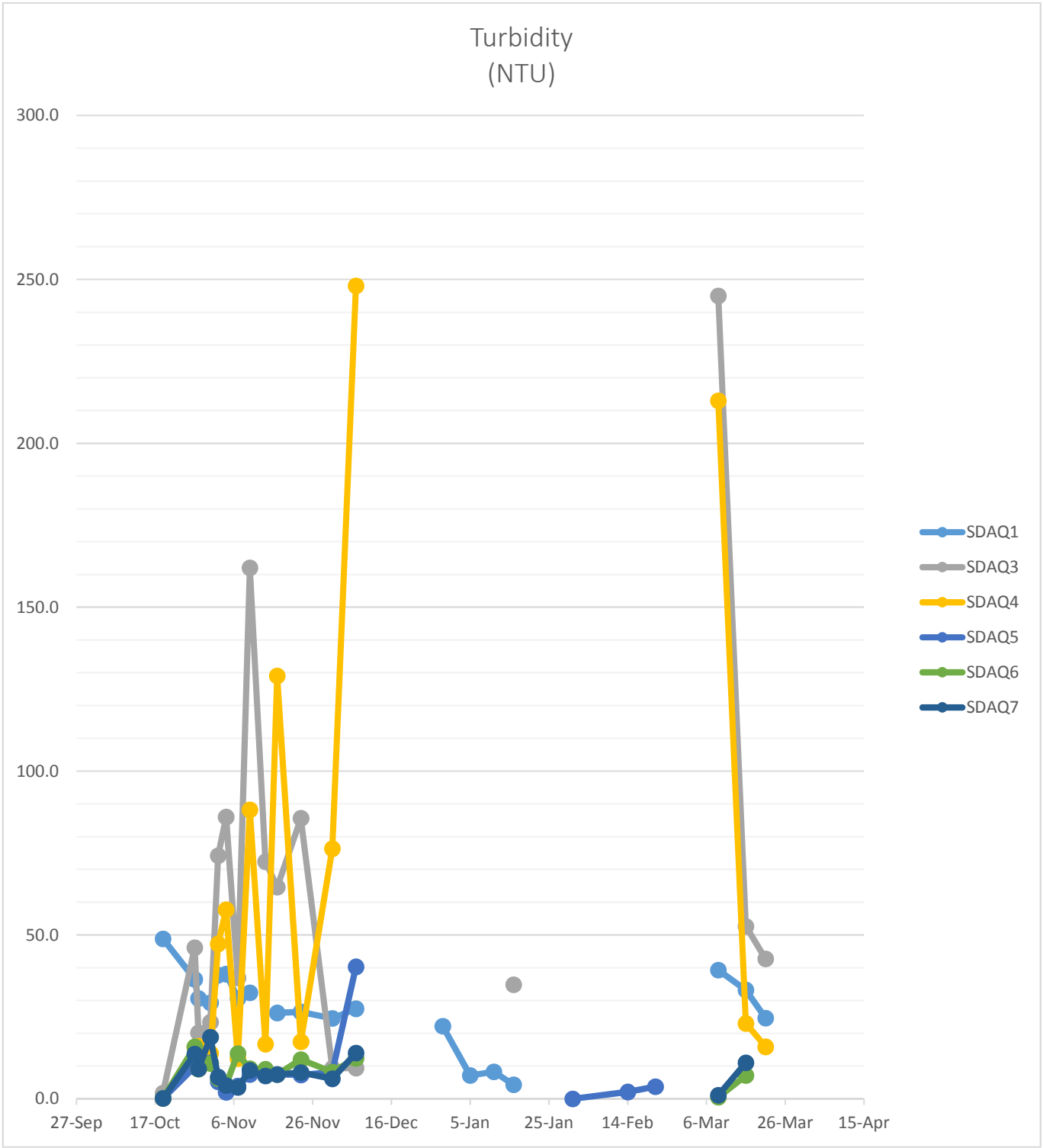

DO
(mg/L)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ2
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7
SDAQ8


ORP
(mV)
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ2
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7
SDAQ8


pH
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ2
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7
SDAQ8


SPECIFIC CONDUCTIVITY
(µS/cm)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ2
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7
SDAQ8


Temperature
°C
10
8
6
4
2
0
-2
-4
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ2
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7
SDAQ8

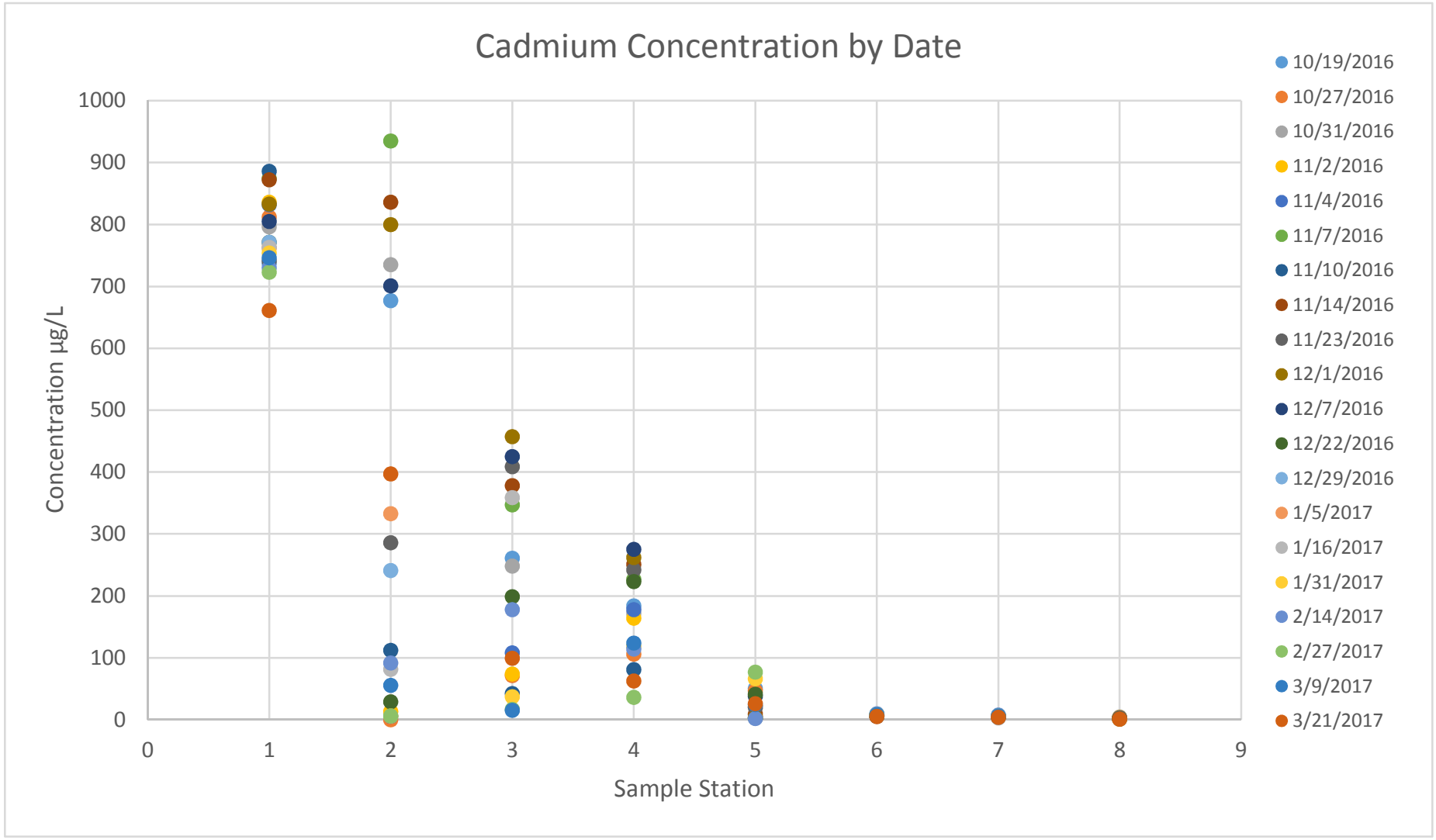

Turbidity
(NTU)
300.0
250.0
200.0
150.0
100.0
50.0
0.0
27-Sep
17-Oct
6-Nov
26-Nov
16-Dec
5-Jan
25-Jan
14-Feb
6-Mar
26-Mar
15-Apr
SDAQ1
SDAQ3
SDAQ4
SDAQ5
SDAQ6
SDAQ7

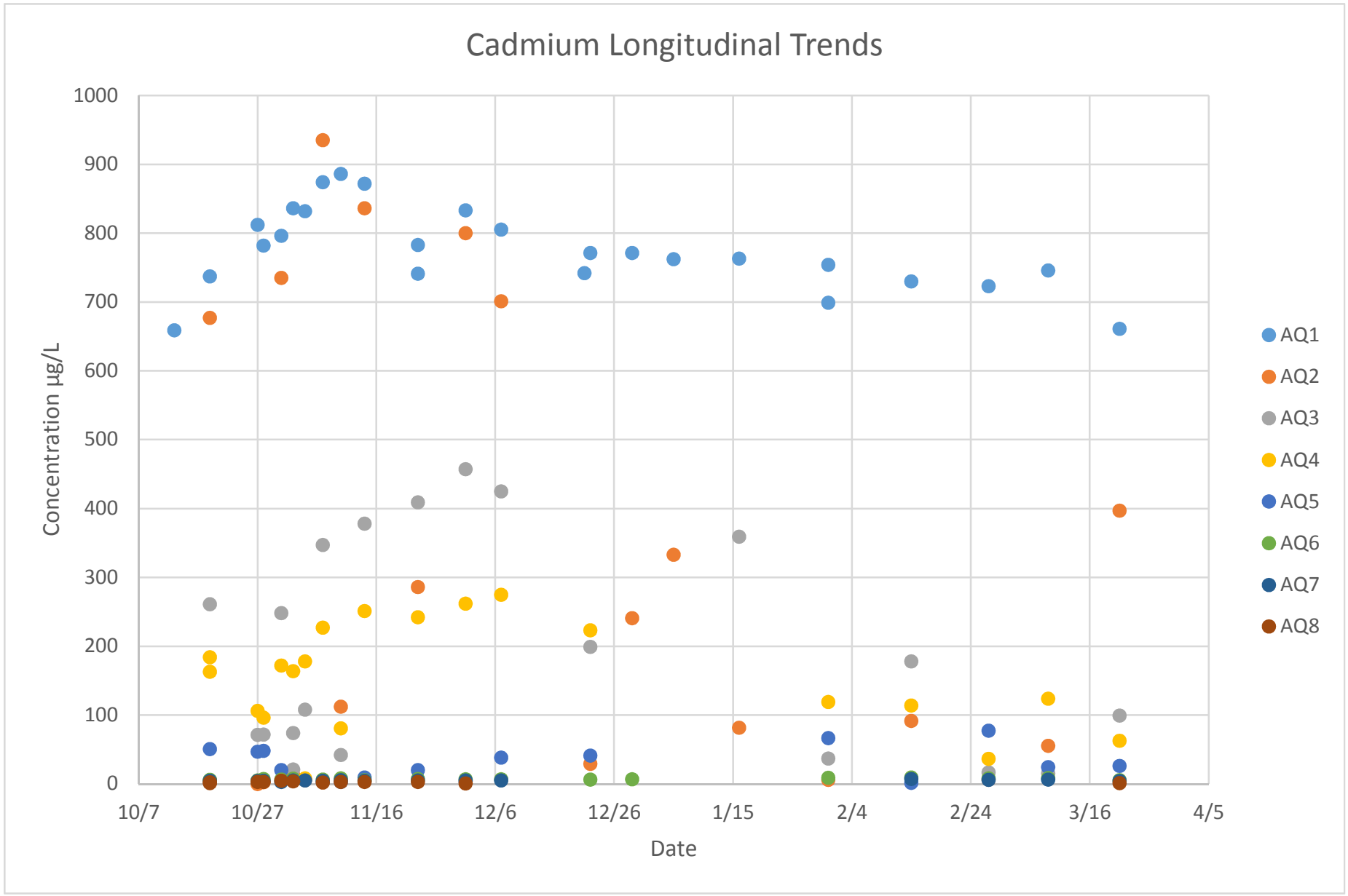
APPENDIX C

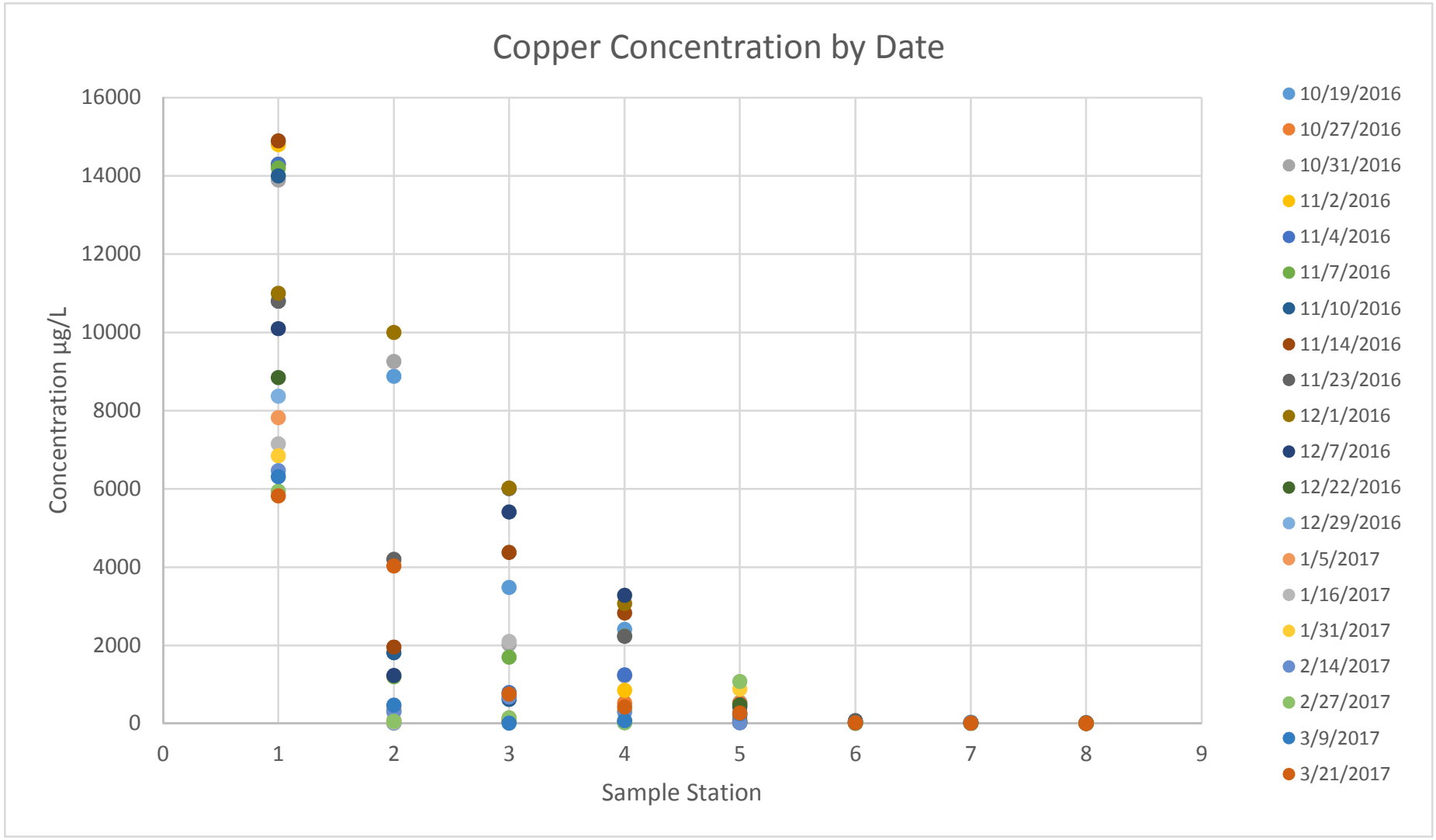
LABORATORY DATA
(on attached CD)

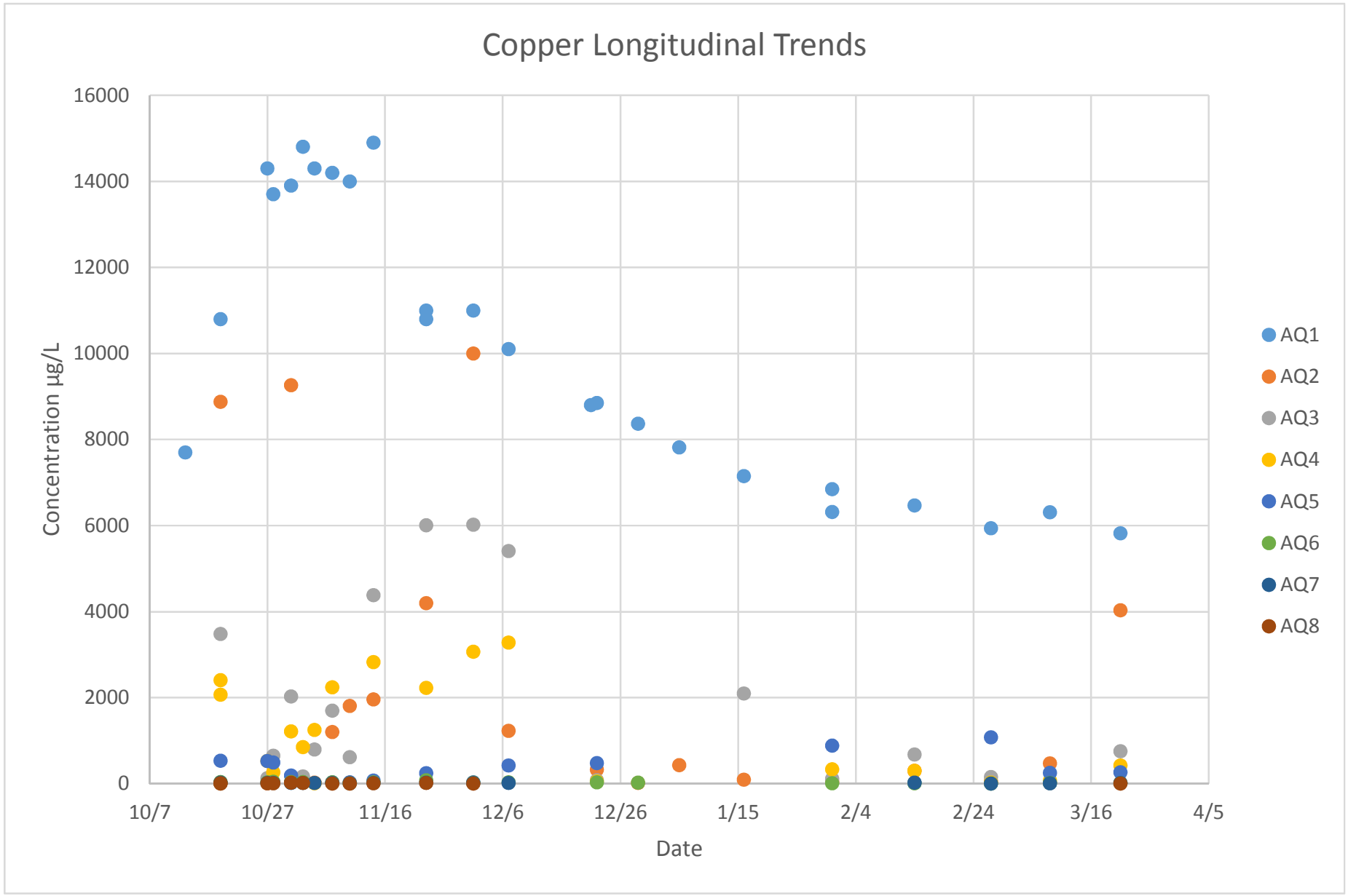
APPENDIX D

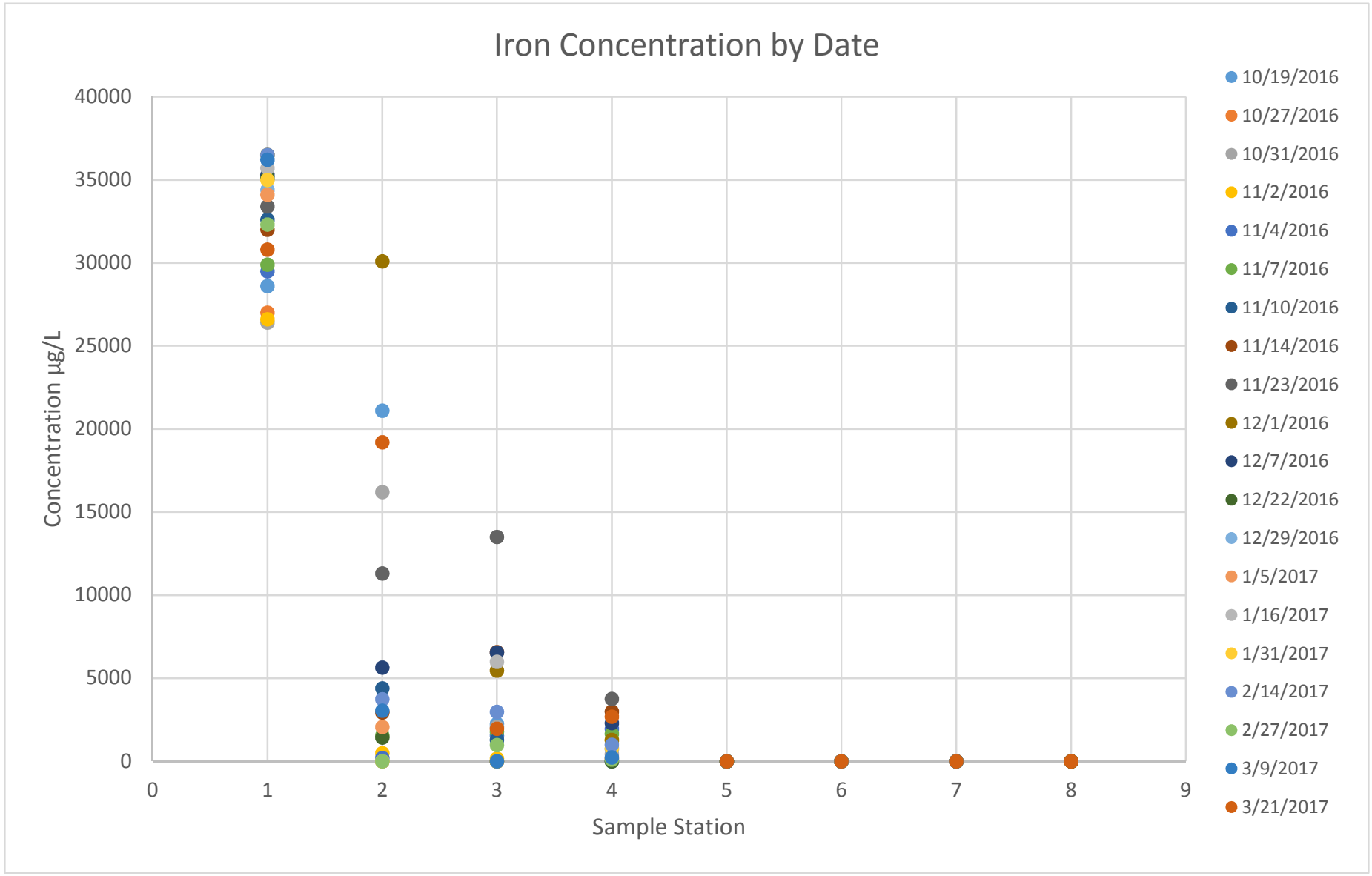
METALS DATA PLOTS

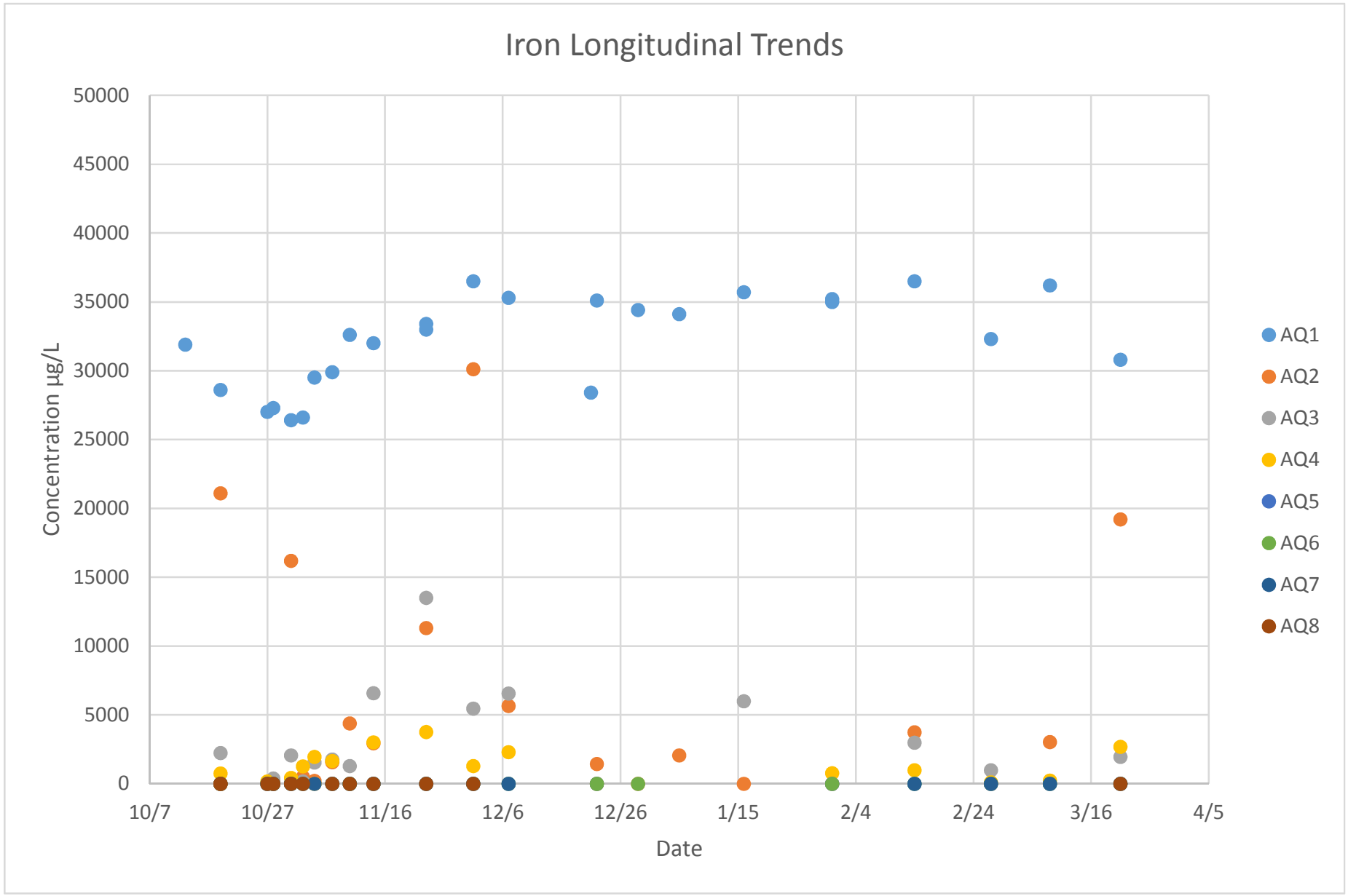

Cadmium Concentration by Date
Concentration µg/L
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017

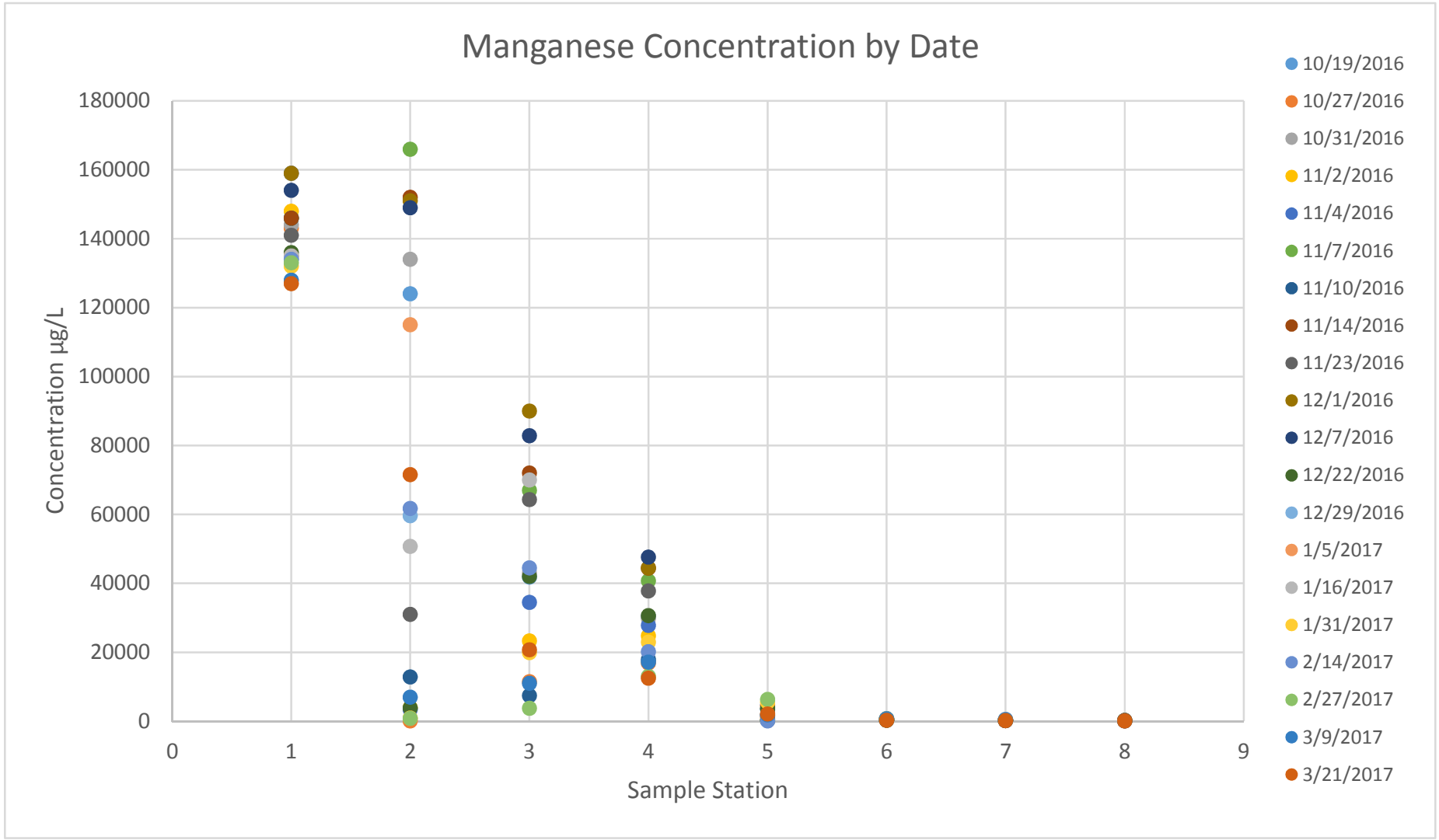

Cadmium Longitudinal Trends
Concentration µg/L
1000
900
800
700
600
500
400
300
200
100
0
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

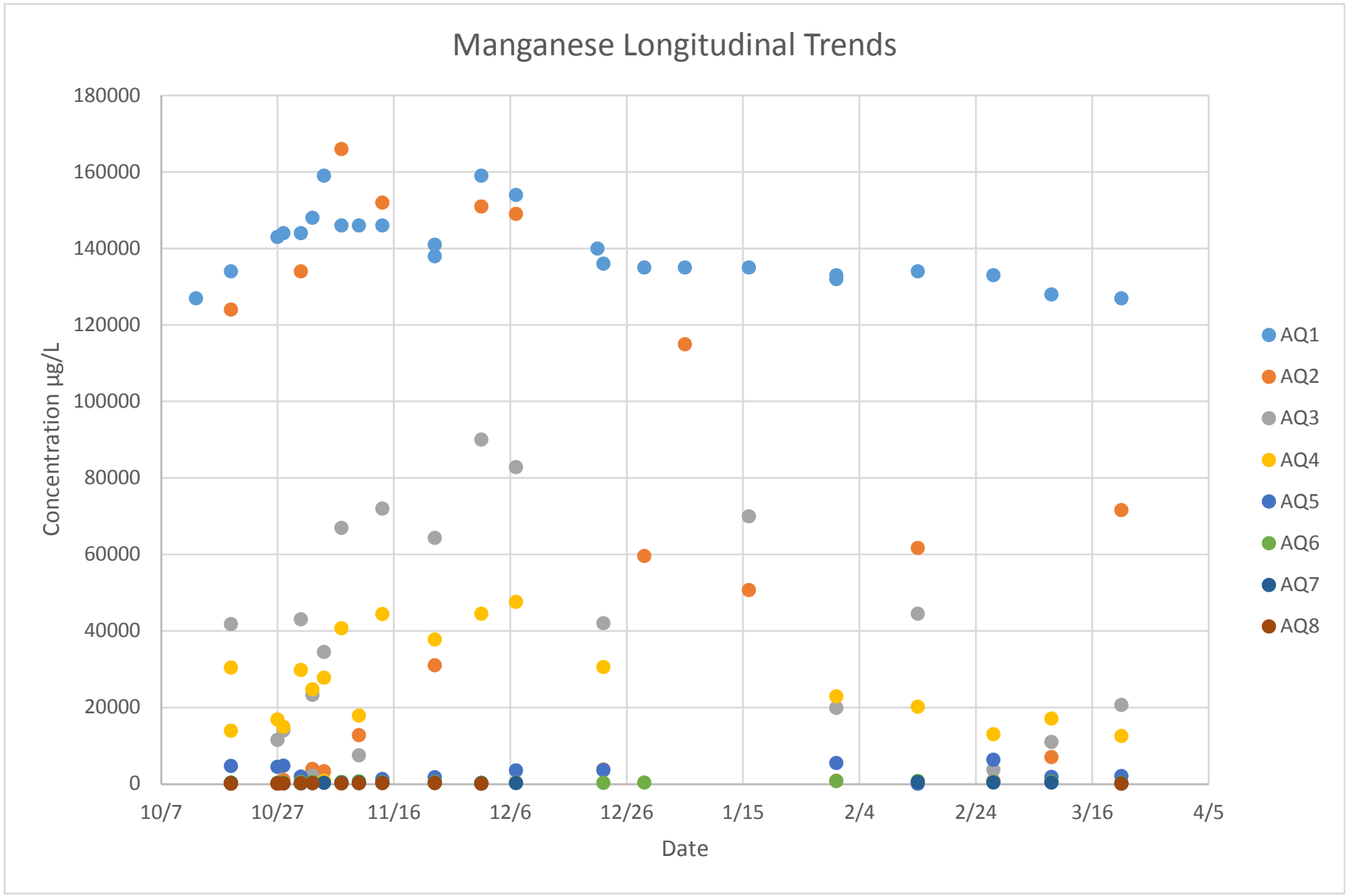

Copper Concentration by Date
Concentration µg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017

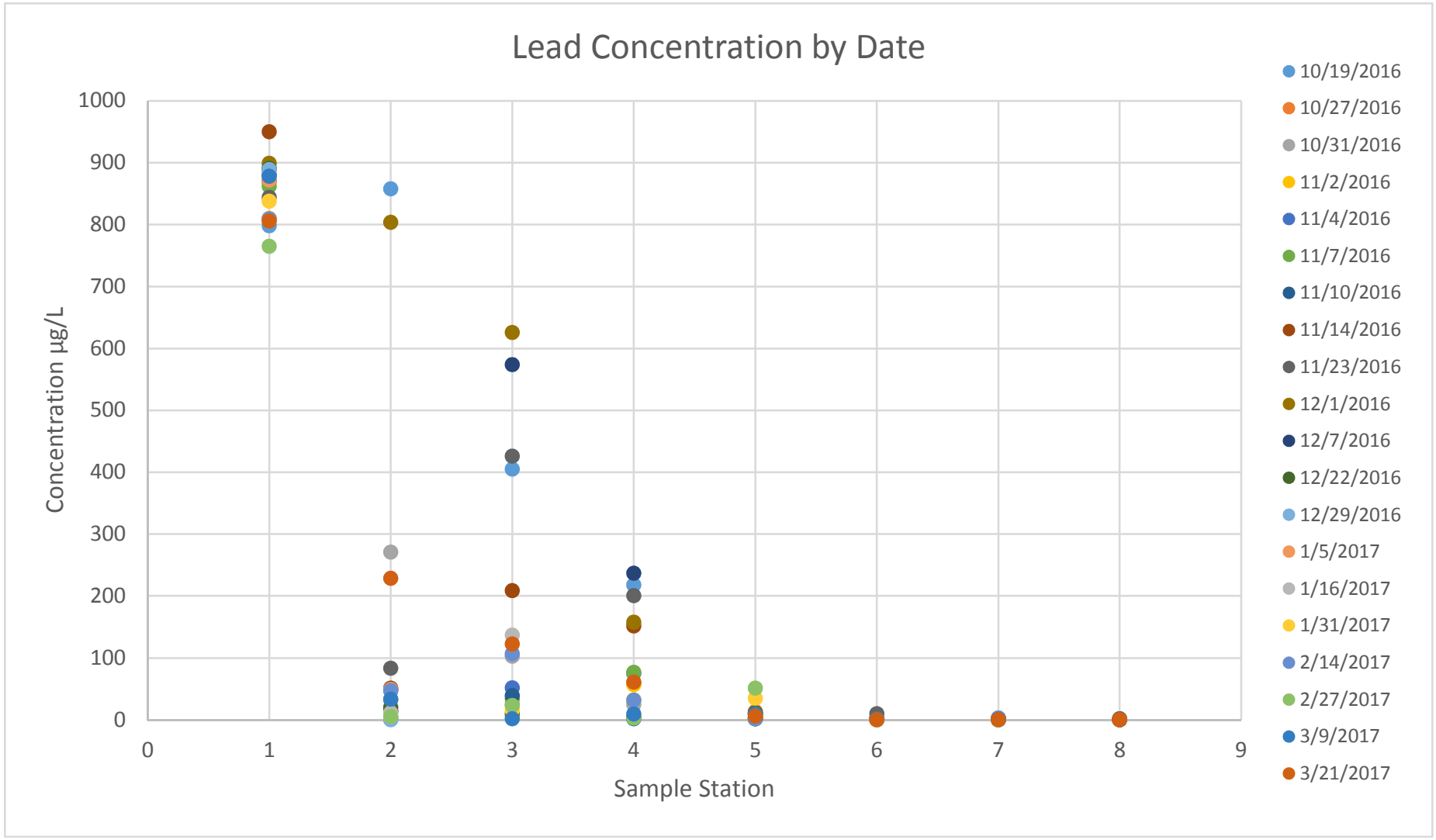

Copper Longitudinal Trends
Concentration µg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

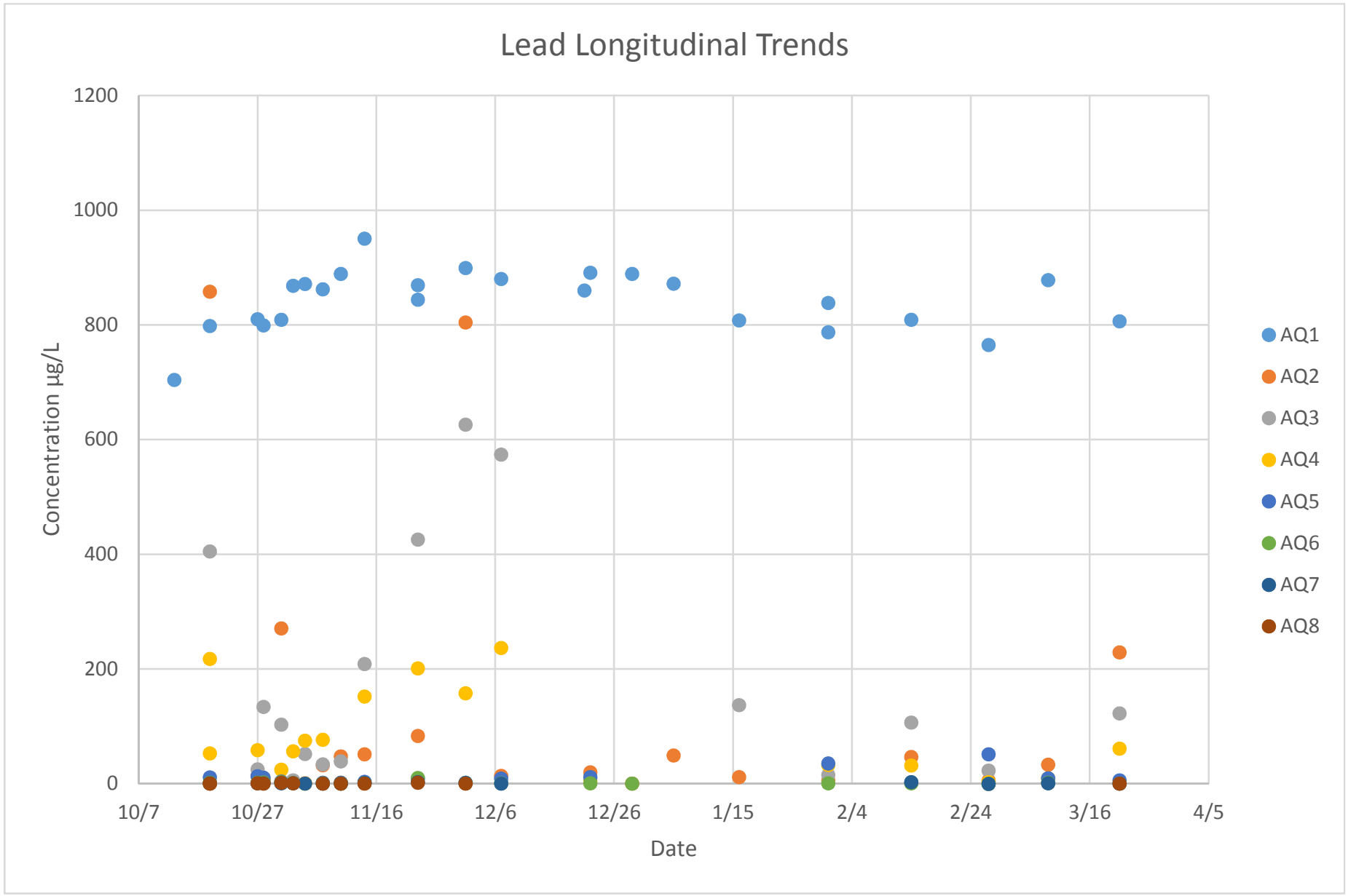

Iron Concentration by Date
Concentration µg/L
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017

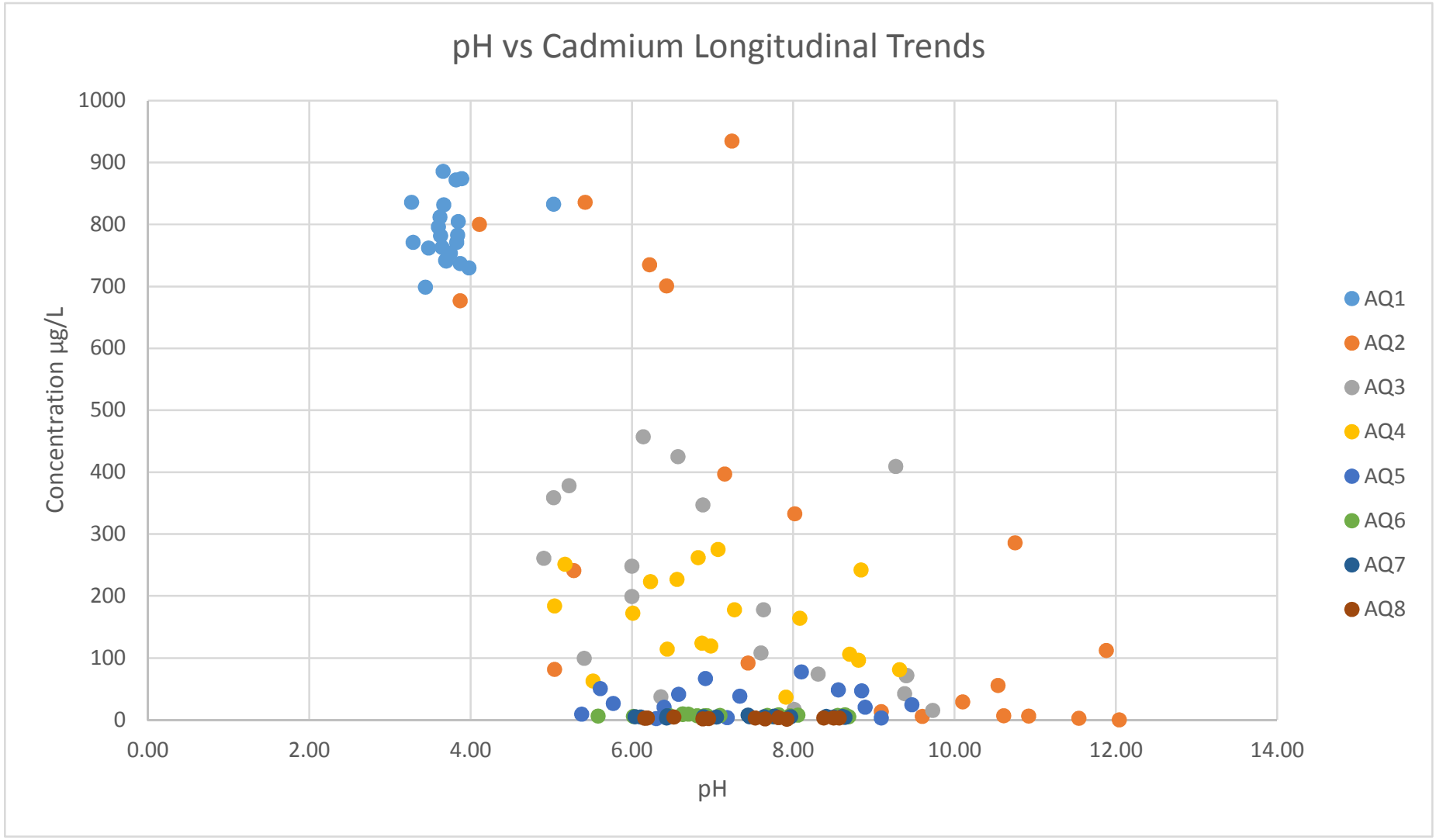

Iron Longitudinal Trends
Concentration µg/L
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

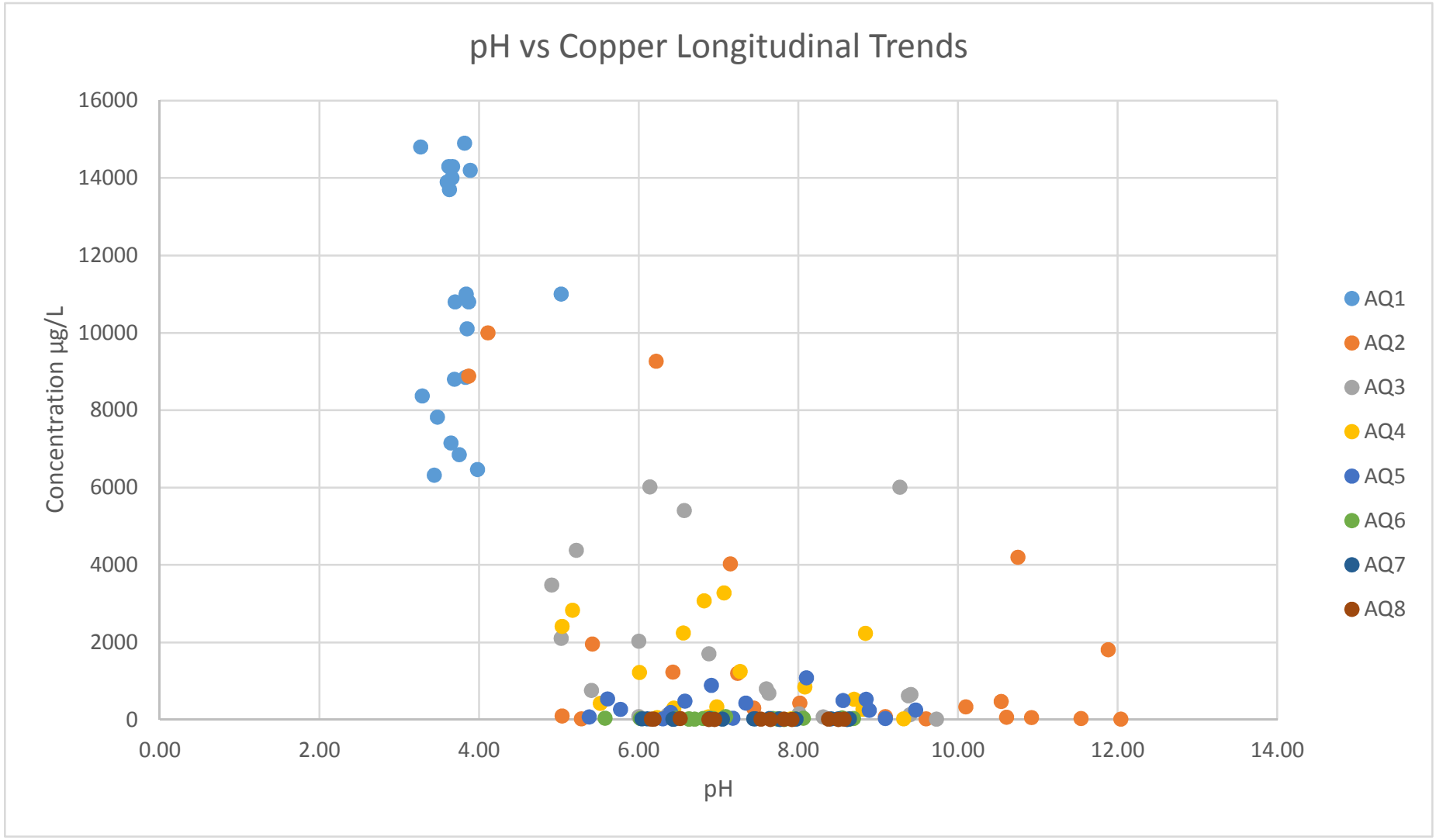

Manganese Concentration by Date
Concentration µg/L
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017

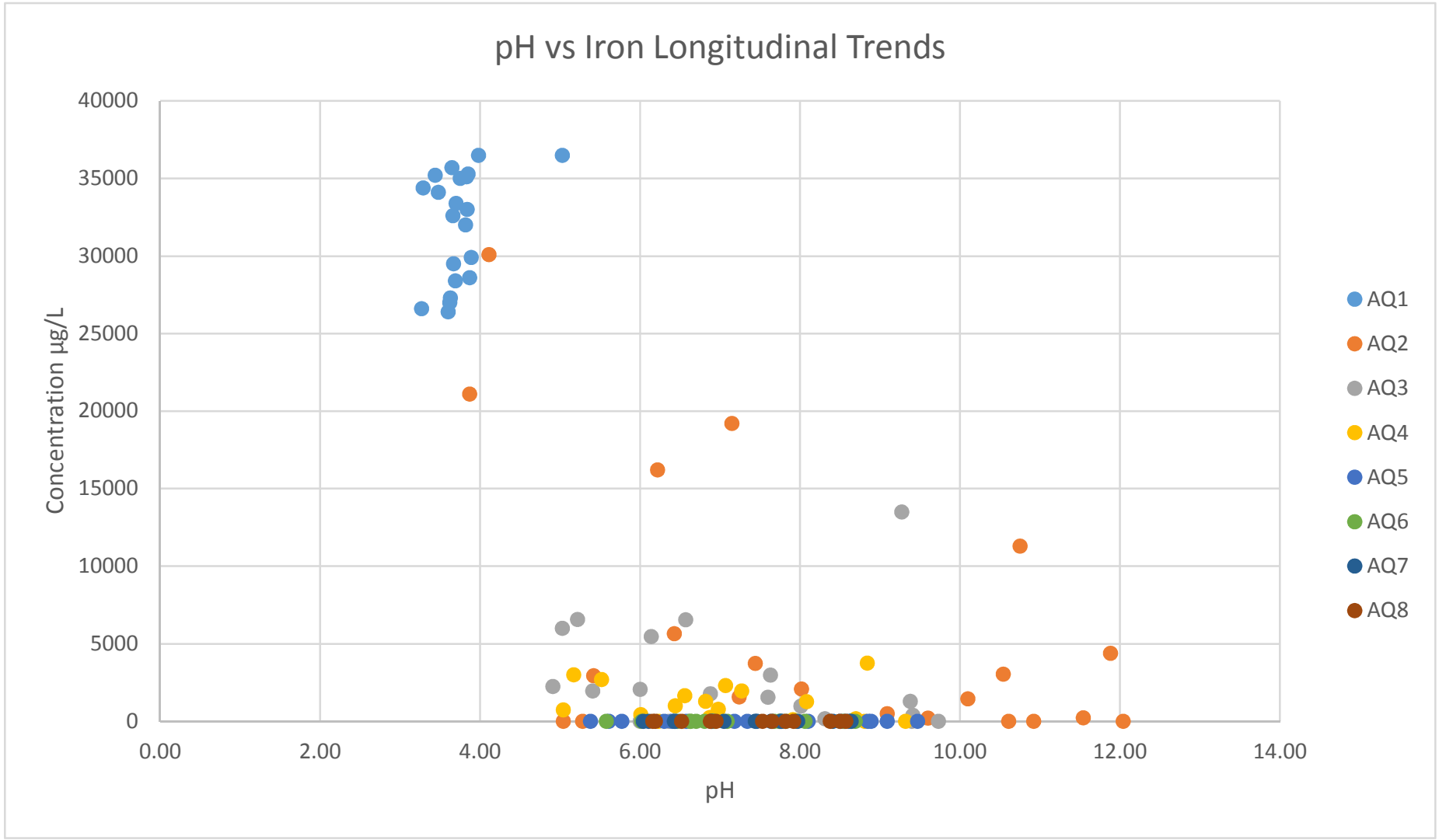

Manganese Longitudinal Trends
Concentration µg/L
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

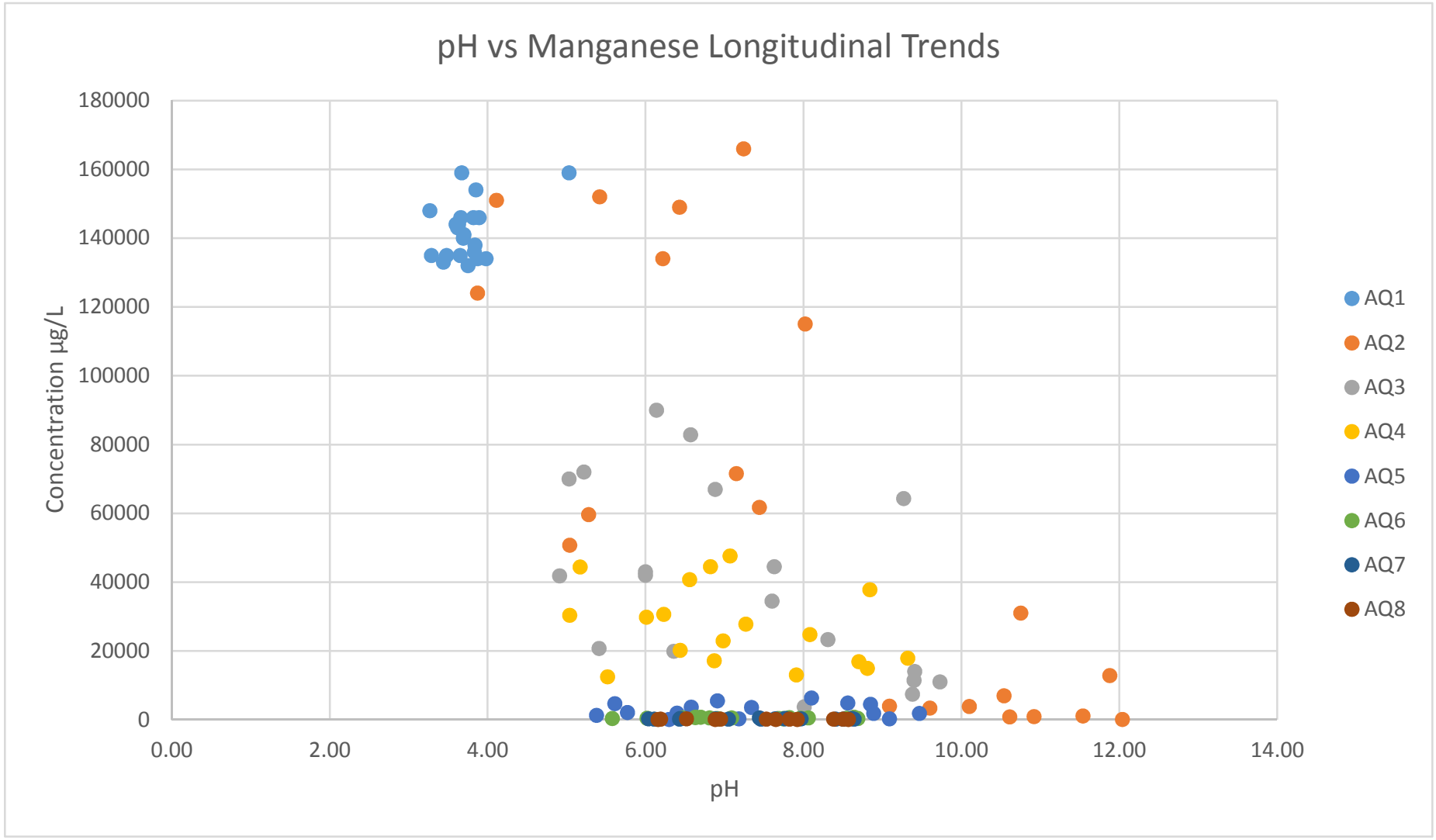

Lead Concentration by Date
Concentration µg/L
1000
900
800
700
600
500
400
300
200
100
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017

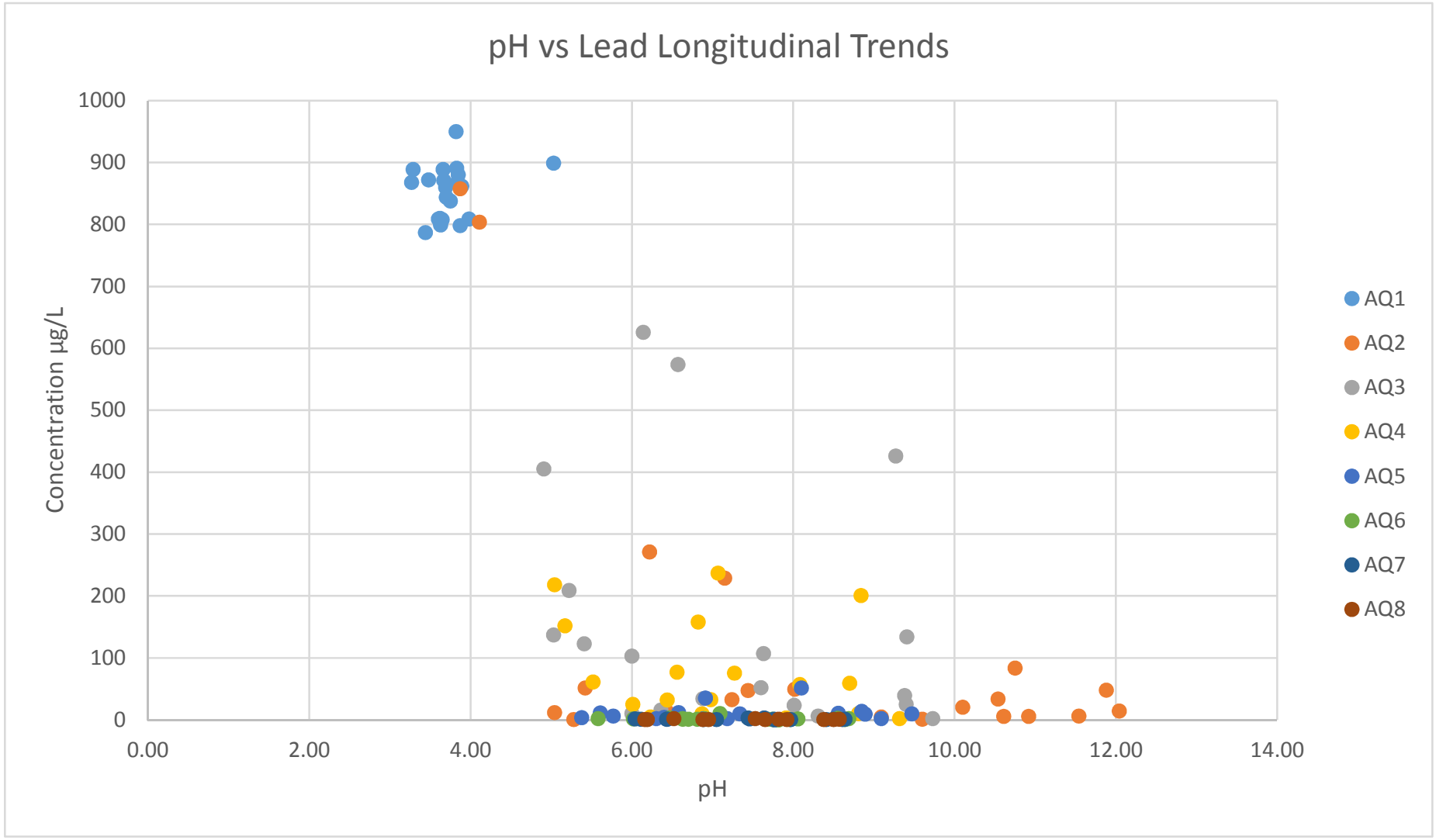

Lead Longitudinal Trends
1200
1000
800
600
400
200
0
Concentration µg/L
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

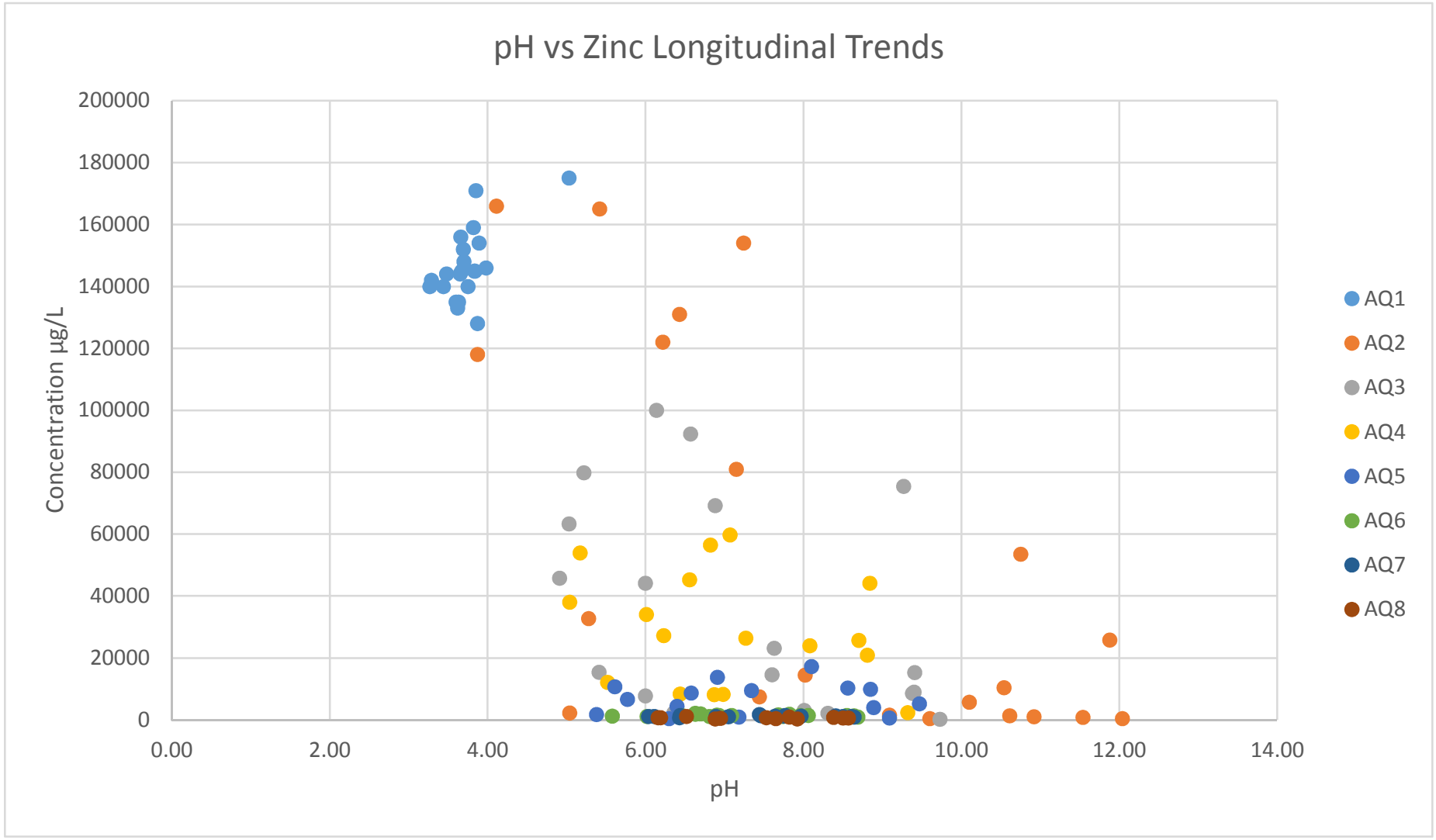

pH vs Cadmium Longitudinal Trends
Concentration µg/L
1000
900
800
700
600
500
400
300
200
100
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

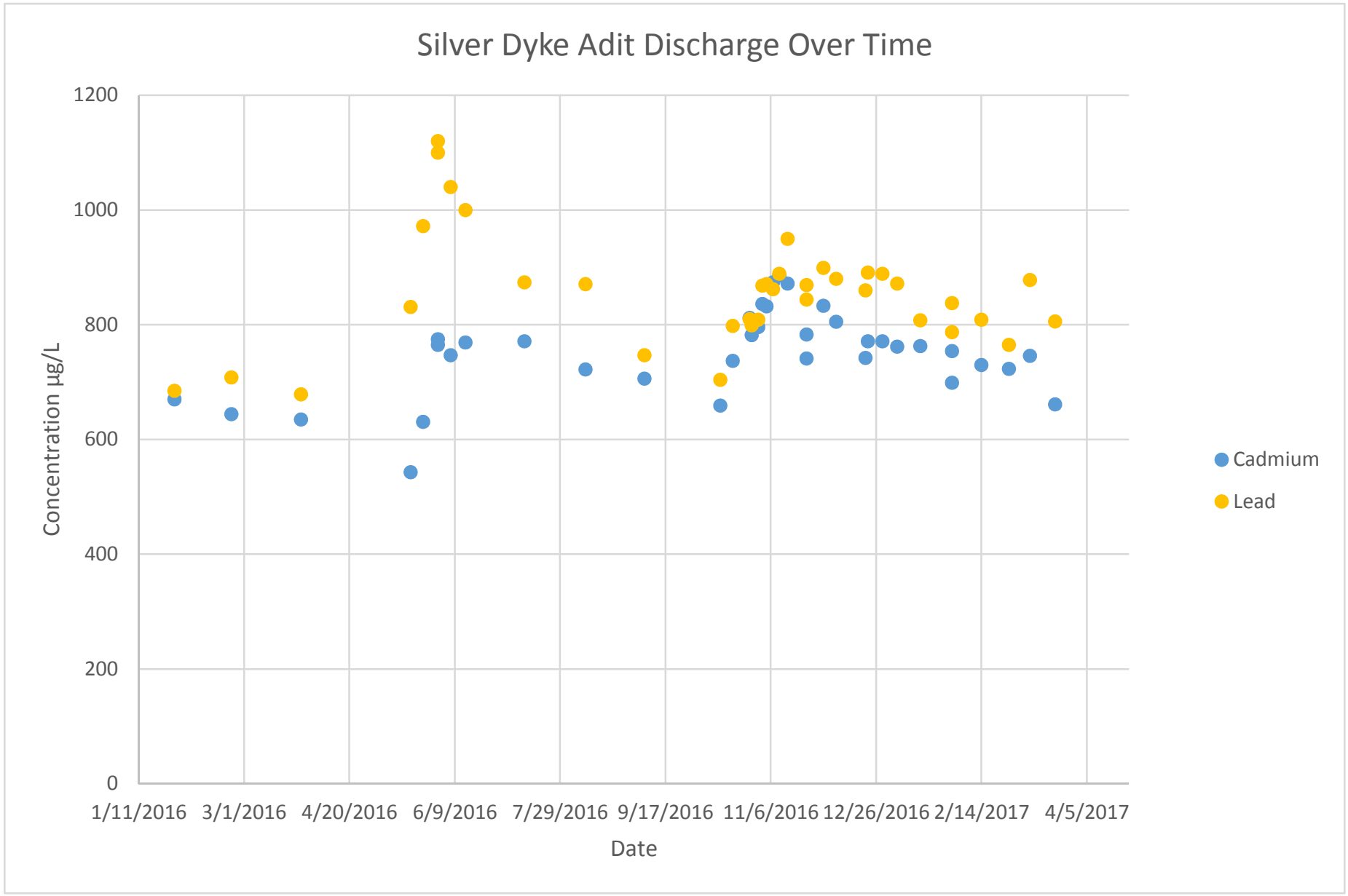

pH vs Copper Longitudinal Trends
Concentration µg/L
16000
14000
12000
10000
8000
6000
4000
2000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

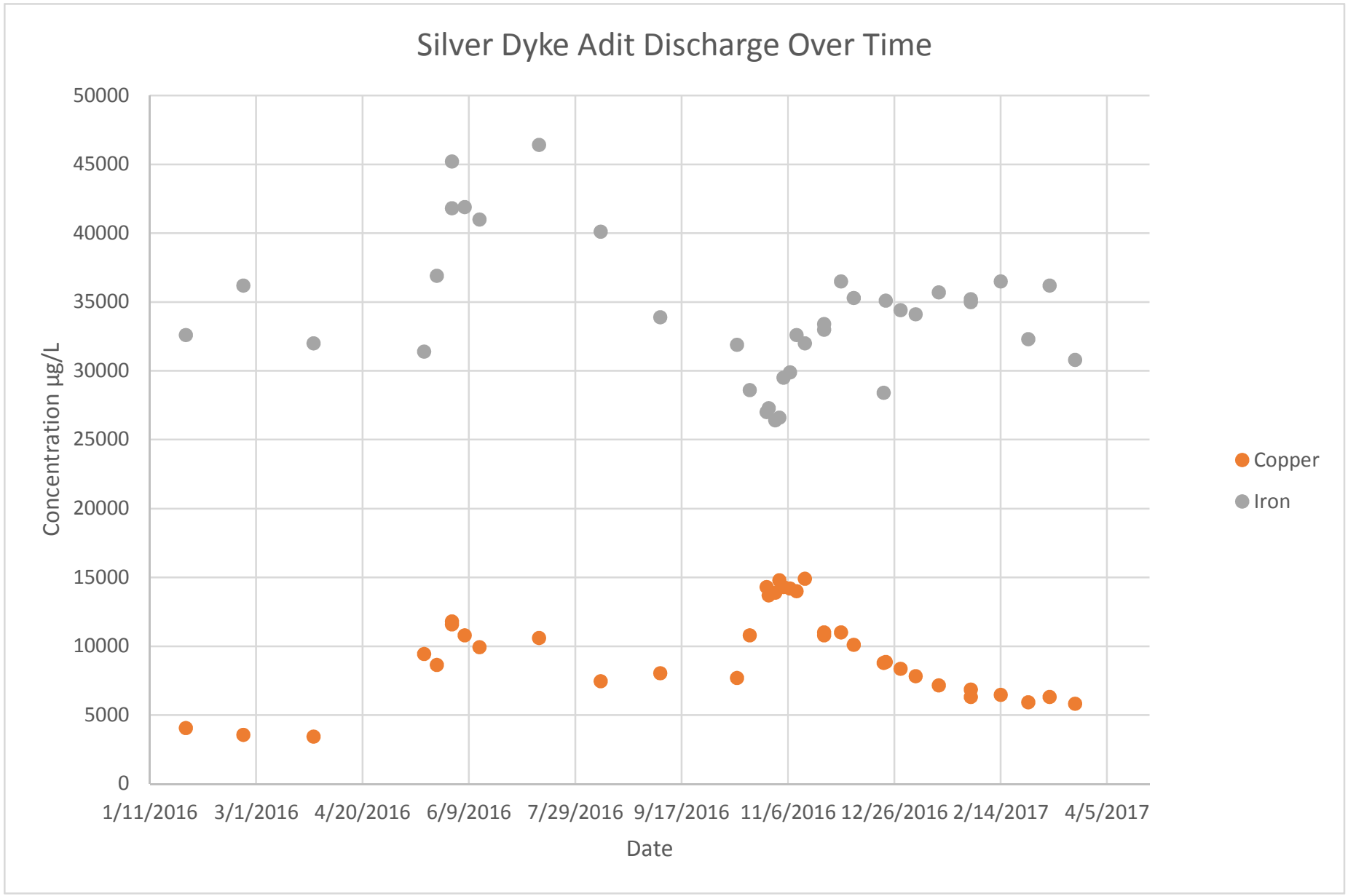

pH vs Iron Longitudinal Trends
Concentration µg/L
40000
35000
30000
25000
20000
15000
10000
5000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

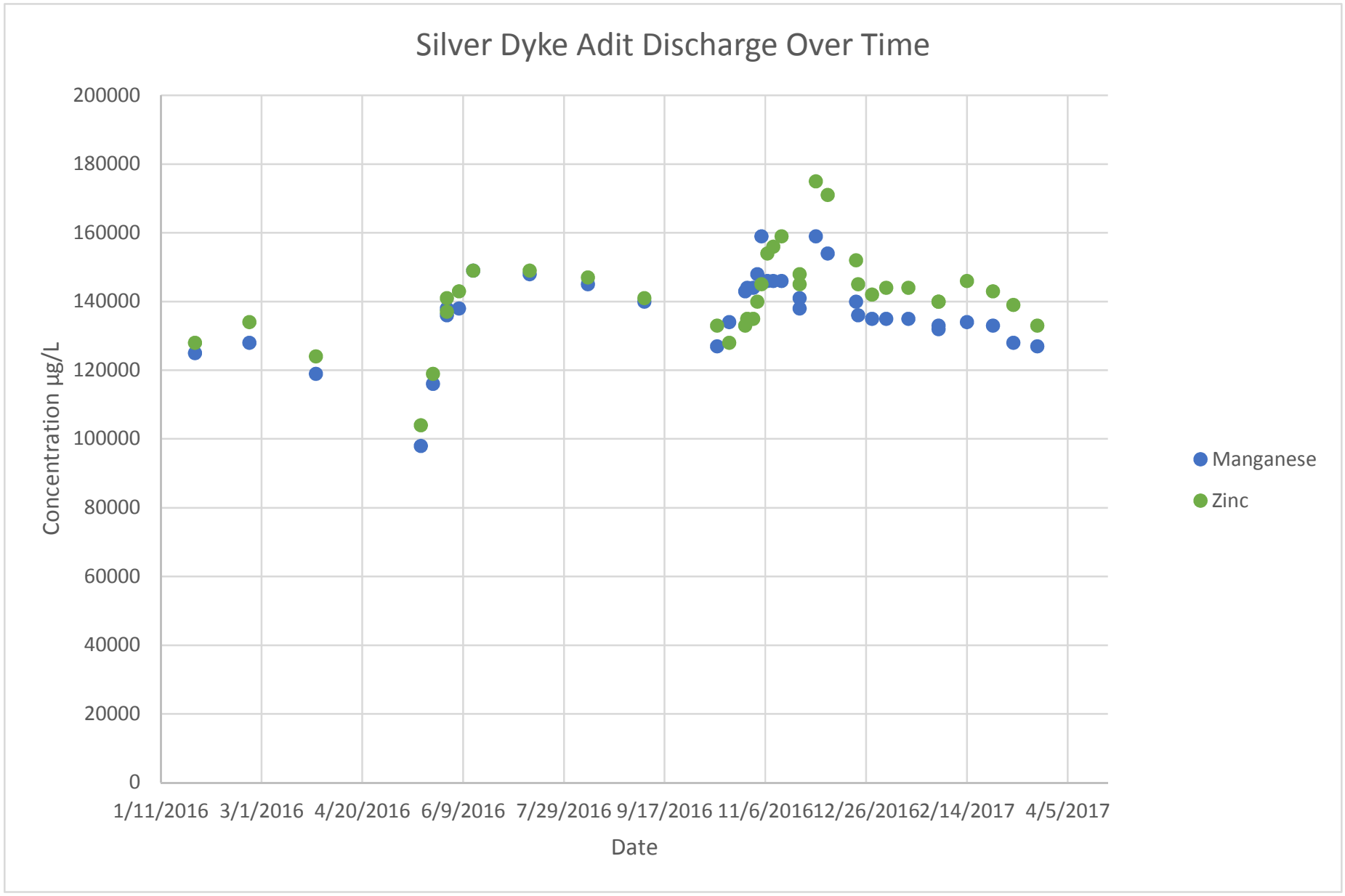

pH vs Manganese Longitudinal Trends
Concentration µg/L
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

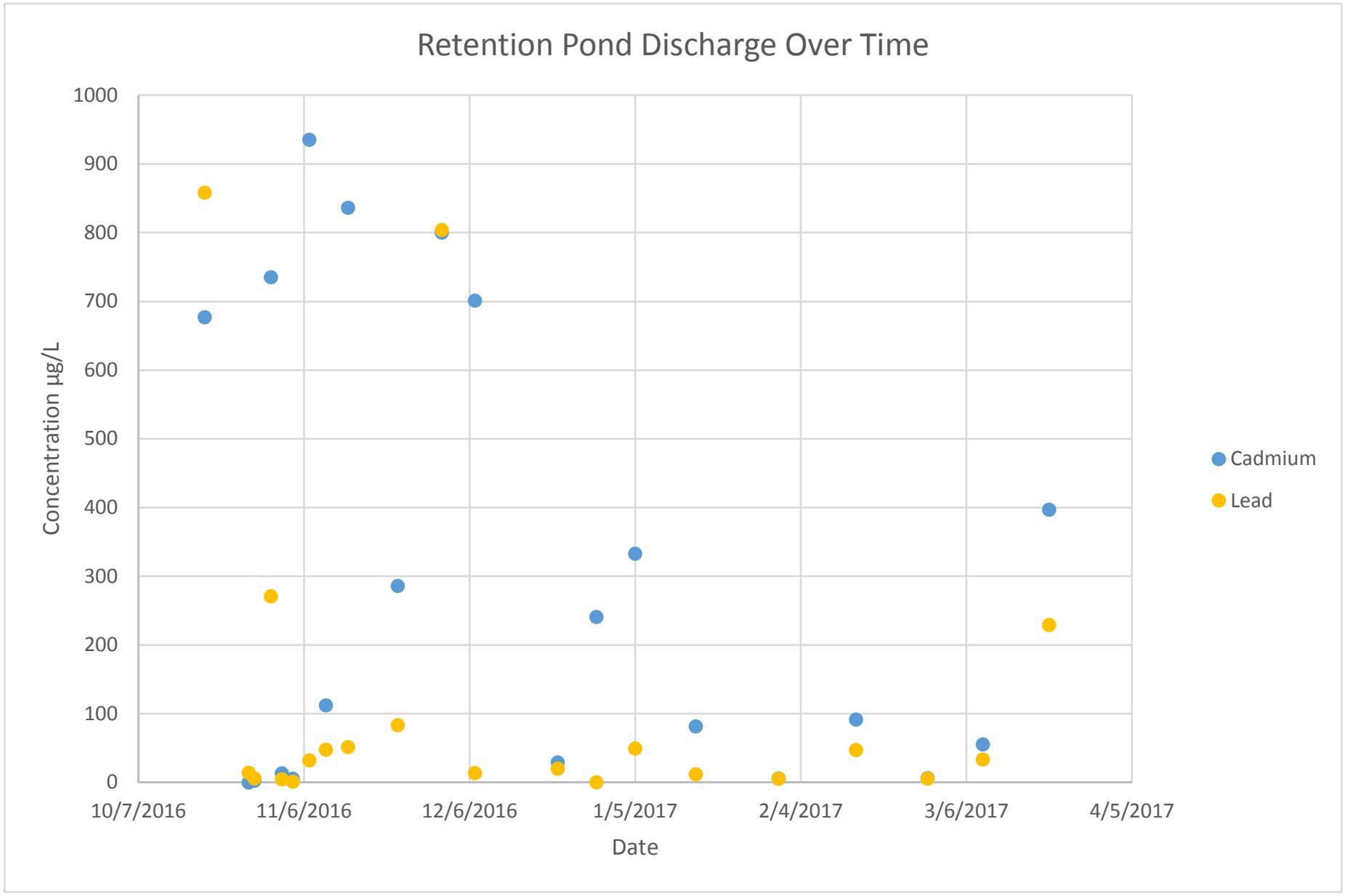

pH vs Lead Longitudinal Trends
Concentration µg/L
1000
900
800
700
600
500
400
300
200
100
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

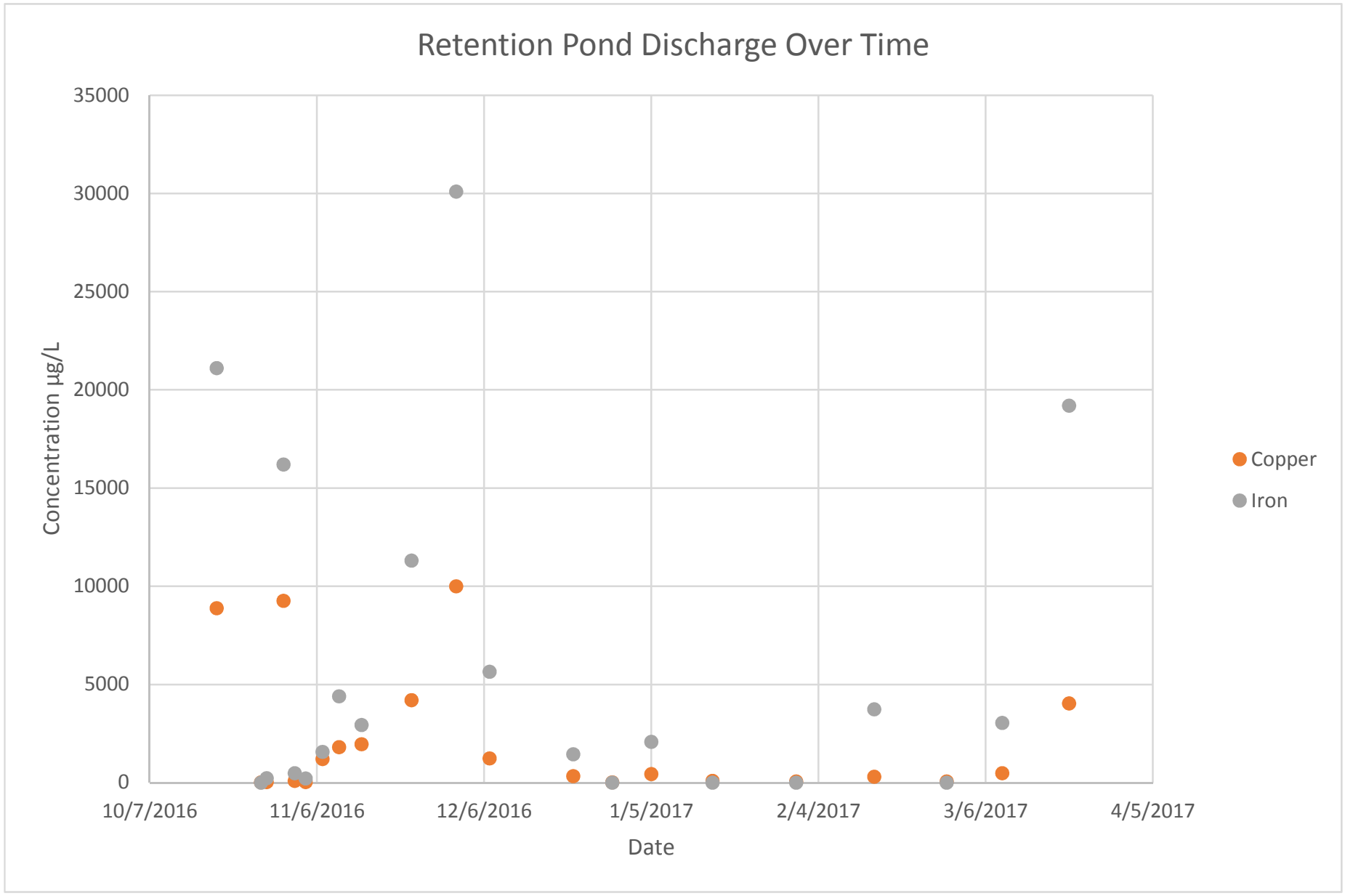

pH vs Zinc Longitudinal Trends
Concentration µg/L
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
pH
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8

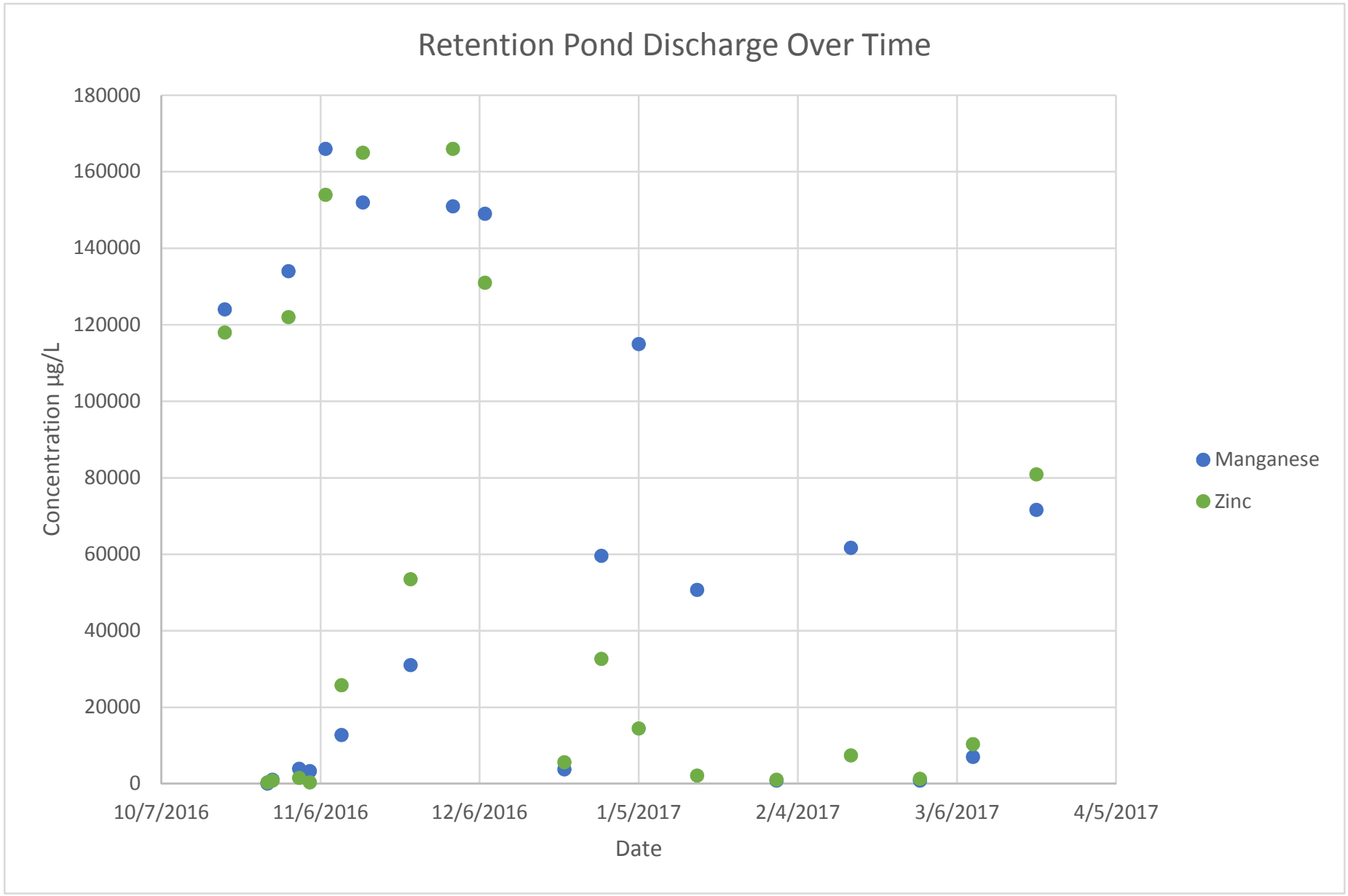

Silver Dyke Adit Discharge Over Time
1200
1000
800
600
400
200
0
Concentration µg/L
1/11/2016
3/1/2016
4/20/2016
6/9/2016
7/29/2016
9/17/2016
11/6/2016
12/26/2016
2/14/2017
4/5/2017
Date
Cadmium
Lead

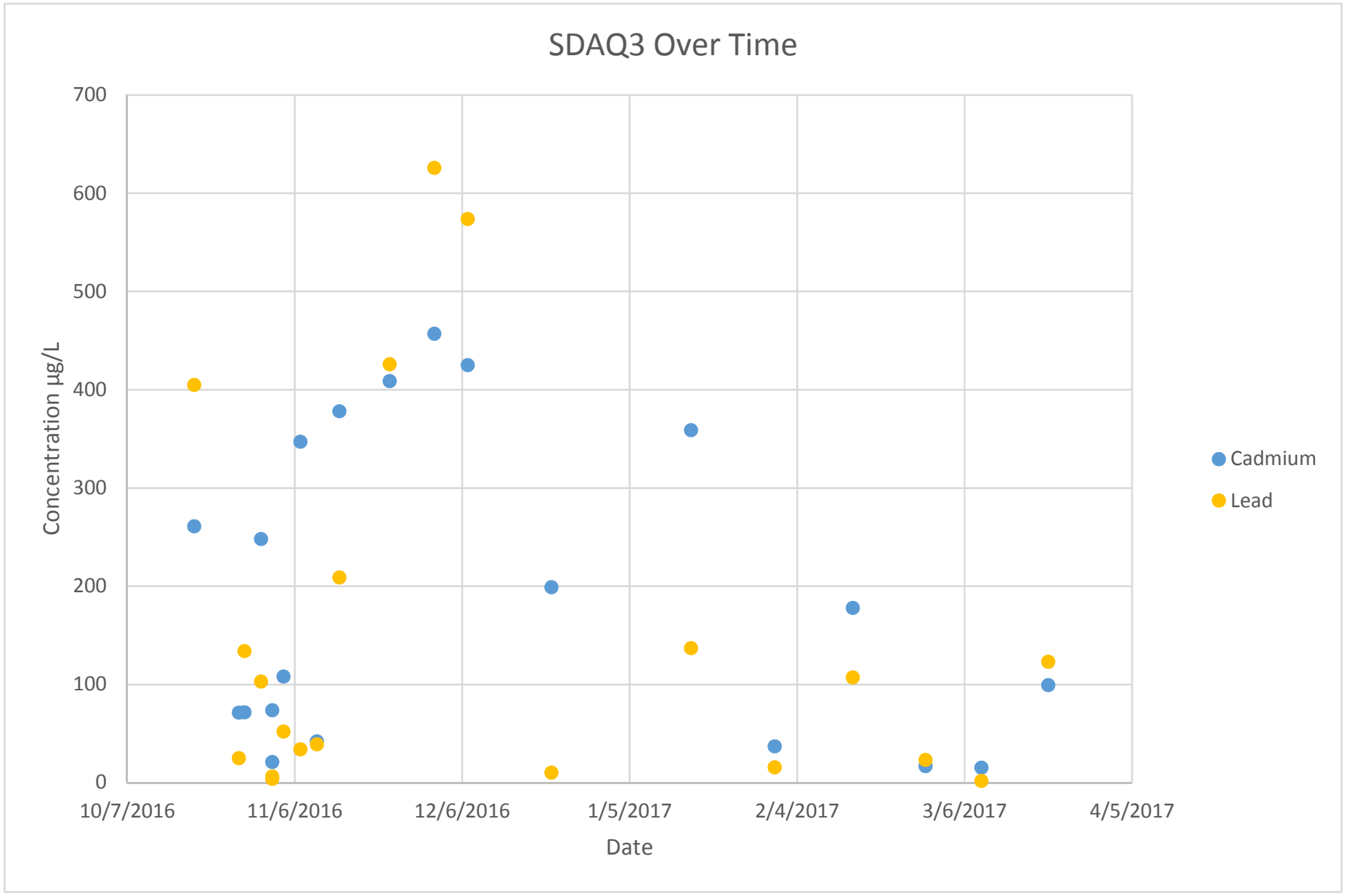

Silver Dyke Adit Discharge Over Time
Concentration µg/L
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1/11/2016
3/1/2016
4/20/2016
6/9/2016
7/29/2016
9/17/2016
11/6/2016
12/26/2016
2/14/2017
4/5/2017
Date
Copper
Iron

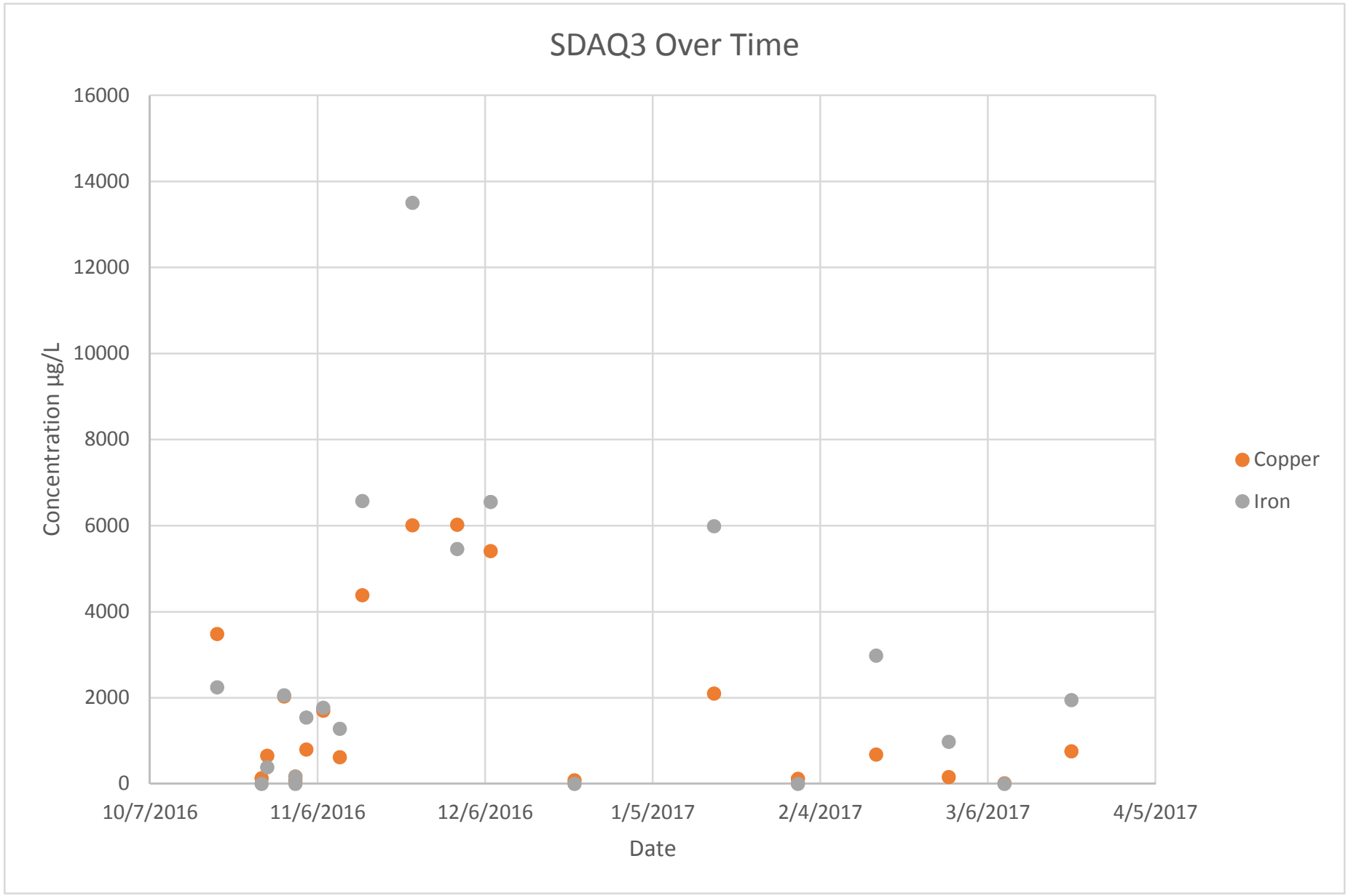

Silver Dyke Adit Discharge Over Time
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
Concentration µg/L
1/11/2016
3/1/2016
4/20/2016
6/9/2016
7/29/2016
9/17/2016
11/6/2016
12/26/2016
2/14/2017
4/5/2017
Date
Manganese
Zinc

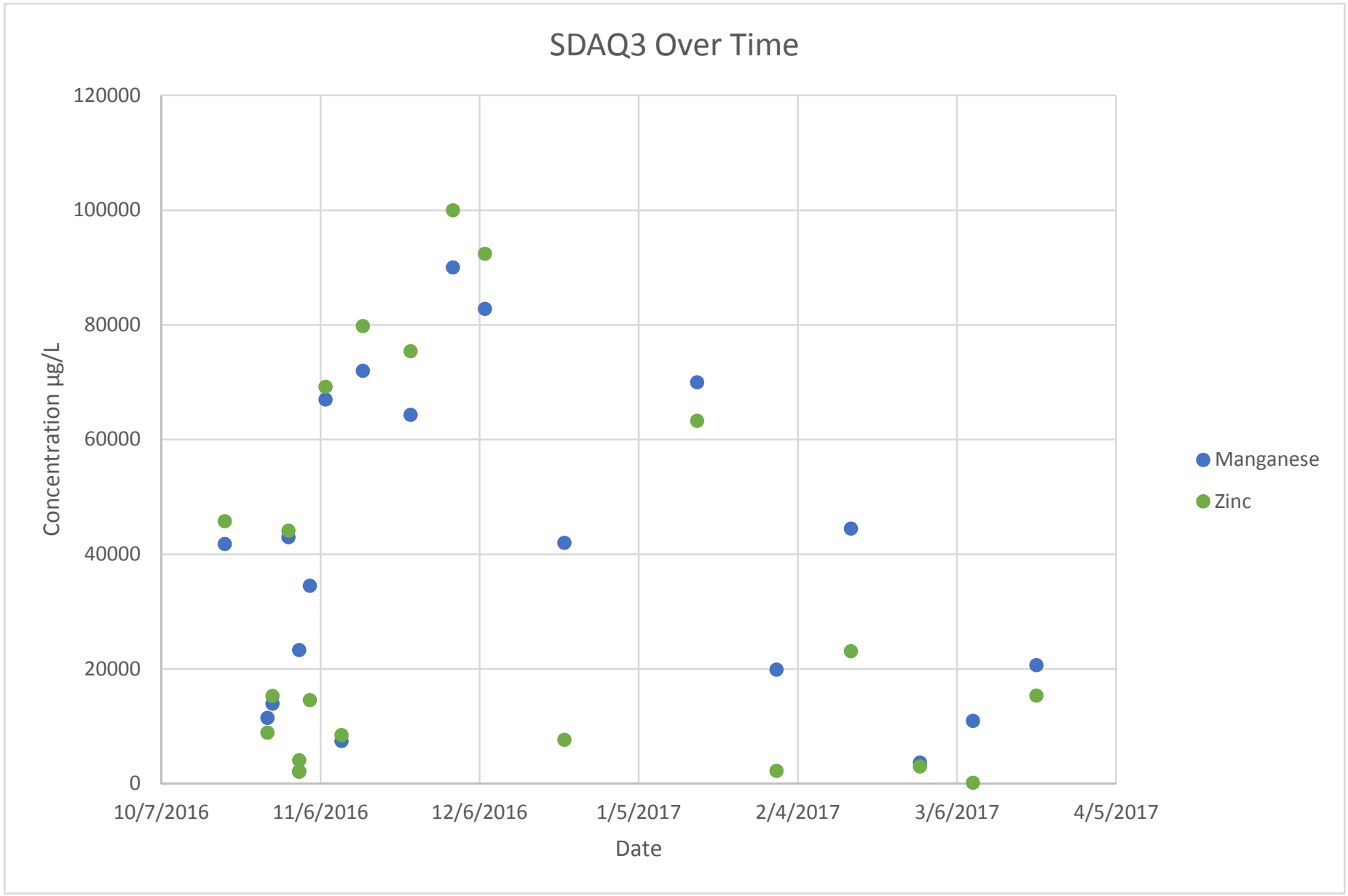

Retention Pond Discharge Over Time
1000
900
800
700
600
500
400
300
200
100
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Cadmium
Lead

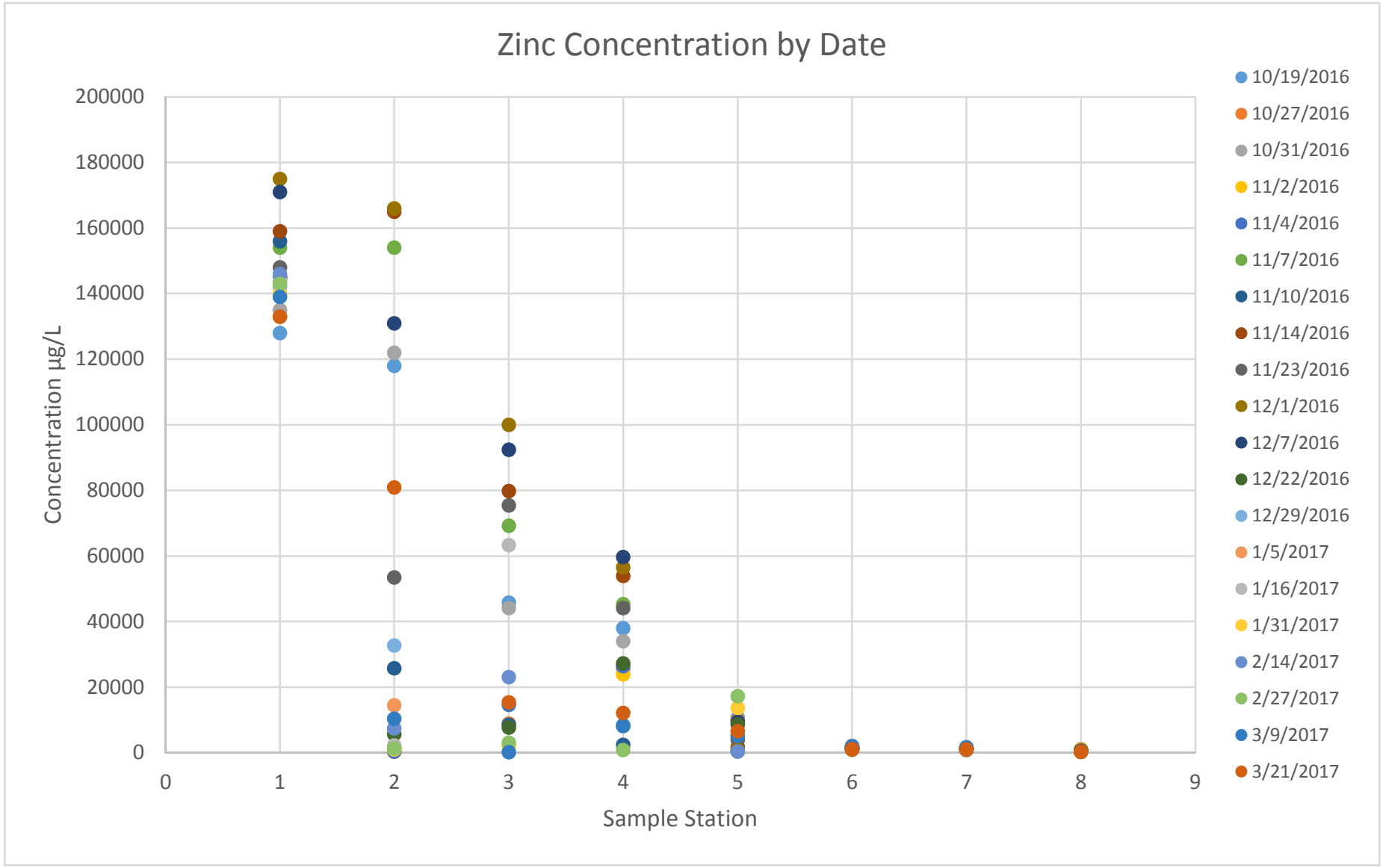

Retention Pond Discharge Over Time
35000
30000
25000
20000
15000
10000
5000
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Copper
Iron

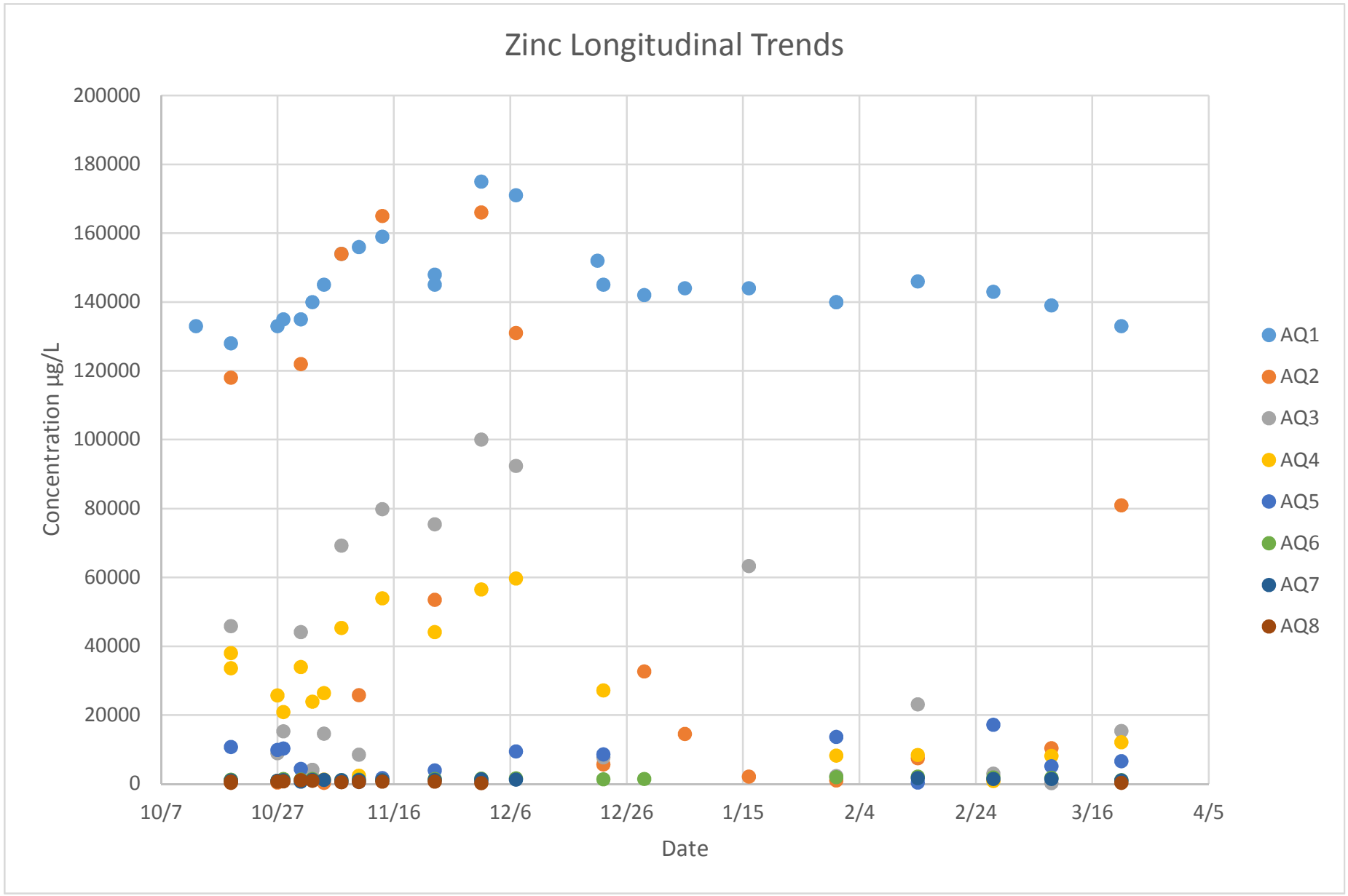

Retention Pond Discharge Over Time
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Manganese
Zinc


SDAQ3 Over Time
700
600
500
400
300
200
100
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Cadmium
Lead


SDAQ3 Over Time
16000
14000
12000
10000
8000
6000
4000
2000
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Copper
Iron


SDAQ3 Over Time
120000
100000
80000
60000
40000
20000
0
Concentration µg/L
10/7/2016
11/6/2016
12/6/2016
1/5/2017
2/4/2017
3/6/2017
4/5/2017
Date
Manganese
Zinc


Zinc Concentration by Date
Concentration µg/L
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0
1
2
3
4
5
6
7
8
9
Sample Station
10/19/2016
10/27/2016
10/31/2016
11/2/2016
11/4/2016
11/7/2016
11/10/2016
11/14/2016
11/23/2016
12/1/2016
12/7/2016
12/22/2016
12/29/2016
1/5/2017
1/16/2017
1/31/2017
2/14/2017
2/27/2017
3/9/2017
3/21/2017


Zinc Longitudinal Trends
Concentration µg/L
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
10/7
10/27
11/16
12/6
12/26
1/15
2/4
2/24
3/16
4/5
Date
AQ1
AQ2
AQ3
AQ4
AQ5
AQ6
AQ7
AQ8