2022 WATER RESOURCES MONITORING REPORT

EAST HELENA FACILITY

FINAL

Prepared for:

Montana Environmental Trust Group, LLC
Trustee of the Montana Environmental Custodial Trust
P.O. Box 1230
East Helena, MT 59635

Prepared by:

Hydrometrics, Inc.
3020 Bozeman Avenue
Helena, MT 59601

December 2023

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF EXHIBITS

LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	Above Mean Sea Level
bgs	Below Ground Surface
CAMU	Corrective Action Management Unit
CAMP	Corrective Action Monitoring Plan
CAPMP	Corrective Action Performance Monitoring Plan
cfs	Cubic Feet Per Second
CM	Corrective Measure
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	Constituents of Concern
COEH	City of East Helena
Custodial Trust	Montana Environmental Custodial Trust
DI	Deionized
DMP	Data Management Plan
DO	Dissolved Oxygen
EI	Environmental Indicator
ET	Evapotranspiration
EVCGWA	East Valley Controlled Groundwater Area
GMP	Groundwater Monitoring Plan
HHS	Human Health Standard
IC	Institutional Controls
IM	Interim Corrective Measures
MCL	Maximum Contaminant Level
METG	Montana Environmental Trust Group
mg/L	milligrams/liter
MT	Metric Tons
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
SAI	Source Area Investigations
SC	Specific Conductance
SPHC	South Plant Hydraulic Control
SWL	Static Water Level
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UFS	Unfumed Slag
USEPA	United States Environmental Protection Agency
USL	Upper Simultaneous Limits
WRM	Water Resources Monitoring

EXECUTIVE SUMMARY

Hydrometrics, Inc. conducted groundwater and surface water monitoring for the Former East Helena Smelter Project in 2022. The East Helena Smelter produced lead bullion from a variety of concentrates and other feed stock from 1888 until 2001 when the smelter was permanently shut down. Smelting activities have resulted in water quality impacts to local groundwater with the primary constituents of concern (COCs) arsenic and selenium. The 2022 performance monitoring program was a continuation of annual monitoring programs designed to document the effectiveness of remedial measures completed to date, with a focus on groundwater contaminant concentration trends and status (expanding, contracting, stable) of the groundwater arsenic and selenium plumes.

The overall objective of the 2022 performance monitoring program was to continue assessment of groundwater quality status and trends within and downgradient of the former smelter, and to evaluate the effectiveness of remedial measures at reducing concentrations and migration of groundwater contaminants. As outlined in the 2022 Corrective Action Performance Monitoring Plan (CAPMP), the 2022 performance monitoring program included semiannual streamflow and water quality sampling at 11 sites on or tributary to Prickly Pear Creek, seasonal groundwater level monitoring at 183 monitoring wells, semiannual or annual groundwater quality sampling at 83 monitoring wells, and semiannual water quality monitoring at 20 residential/public water supply wells. All water quality samples were analyzed for an extended suite of parameters including general chemistry constituents and trace metals, including the primary COCs arsenic and selenium. All 2022 data was reviewed and validated for data quality, and entered into the East Helena Project electronic database.

Residential and water supply well monitoring in 2022 showed no drinking water standard exceedances for selenium at any of the sampled wells, and arsenic drinking water standard exceedances at four wells. Concentrations of arsenic in the four wells exhibiting arsenic exceedances were similar to previously observed values, and these wells are located south (upgradient) of the former smelter, or to the west in an area of known naturally occurring groundwater arsenic.

Prickly Pear Creek flows were near their long-term average in 2022 due to a return to near normal annual precipitation in 2022 after several years of drought conditions. Groundwater elevations on the former smelter remained low and have declined by up to 10 feet or more in response to remedial measures and the long-term drought conditions. The water level declines on the former plant site have resulted in approximately 50 to 70% reductions in saturated thickness in the former Acid Plant, West Selenium, and North Plant Arsenic source areas and corresponding reductions in groundwater contaminant flux migrating from the source areas. In general, groundwater contaminant concentrations have continued to decline in response to corrective measures with 2022 arsenic concentrations in the Acid Plant, North Plant Arsenic, and Slag Pile source areas and selenium concentrations in the West Selenium and Slag Pile source areas at or near the minimum values observed to date. Downgradient (north) of the former smelter, arsenic and selenium concentrations were generally stable or continued decreasing in 2022 in response to the corrective remedial

measures. Arsenic concentrations at some wells along the west margin of the downgradient arsenic plume have recently increased and remained elevated in 2022 above historic values due to a westward shift in the plume caused by elimination of a large irrigation ditch to the west, and associated loss of groundwater recharge in this area. The leading edge of the selenium plume to the north, as defined by the approximate location of the 0.050 mg/L human health standard (HHS) groundwater isocontour, has retracted approximately 2,000 feet over the last six years.

Plume geometry and stability metrics, including average plume concentrations, plume areas and plume centroid locations show the downgradient arsenic plume to be largely stable and the selenium plume to be receding. Compared with 2010 conditions, the downgradient arsenic plume has decreased in size by about 10% and in average concentration by about 15%. Compared with 2016 conditions, when adequate selenium data is available, the downgradient selenium plume has decreased in size and average concentration by 60% and 41%, respectively. Plume metrics on the former smelter site show that the plumes continue to decrease in size and concentration in the groundwater contaminant source areas, with the average arsenic and selenium concentrations both decreasing by approximately 50% over the last decade.

Groundwater monitoring in the Corrective Action Management Unit (CAMU) landfill area monitoring wells showed consistent groundwater quality in 2022 compared to previous years. Most CAMU area wells continue to show stable concentrations of arsenic (0.007 to 0.017 mg/L) consistent with naturally occurring background arsenic concentrations in this area. Monitoring well MW-6, which has shown elevated arsenic concentrations in the past, increased from 0.058 mg/L in 2021 to 0.078 mg/L in 2022, well within the range of prior arsenic concentrations. Selenium concentrations at all CAMU area wells have consistently been less than the 0.05 mg/L drinking water standard. All other trace metals were near or less than analytical detection limits in all 2022 CAMU well samples, including parameters that have been documented at elevated concentrations in plant site soils and/or groundwater such as antimony (<0.003 mg/L), cadmium (<0.001 mg/L), zinc (<0.01 mg/L), and thallium (<0.001 mg/L), although manganese remained elevated at well MW-6 (2.68 mg/L).

While not considered primary COCs, zinc and cadmium are currently present at elevated concentrations in some site monitoring wells, although concentrations generally remain much lower than those observed when the smelter was operating. The ongoing localized occurrence of elevated zinc and cadmium concentrations may be due to fluctuating groundwater levels caused by annual variations in precipitation patterns, and/or associated changes in groundwater pH or redox conditions. Currently, drinking water standards are exceeded at two wells for zinc and four wells for cadmium on the plant site. Despite the elevated zinc and cadmium groundwater concentrations in certain areas of the former smelter, no off-site migration at concentrations above the groundwater HHS of 2.0 mg/L is currently indicated for zinc. Offsite exceedances for cadmium (HHS of 0.005 mg/L) are limited to one well north of the plant site (EH-100 at 0.008 mg/L). No residential well concentrations currently exceed the cadmium or zinc drinking water standards. Future groundwater monitoring will continue to include collection and evaluation of zinc and cadmium data, to assess any changes in concentration distributions and trends.

In addition to the routine CAPMP monitoring, increased groundwater sampling was conducted in 2022 at select monitoring wells in the slag pile area to assess potential impacts to groundwater quality from excavation, processing, and offsite transport of unfumed slag (UFS). The 2022 UFS project monitoring program included monthly sampling at seven primary wells for a full suite of common constituents and trace metals. Similar to the 2021 program monitoring results, the 2022 UFS monitoring results identified no adverse impacts to site groundwaters from the slag excavation and removal activities.

Finally, the 2022 CAPMP groundwater monitoring program included a comparison of sample analytical results collected using conventional (3 volume) well purging techniques and low flow/low volume purging techniques. Use of low flow/low volume sampling procedures has the potential to significantly reduce long-term monitoring costs by reducing equipment and labor costs, and reducing the volume of purge water requiring storage and ultimate offsite disposal. A total of 12 wells were sampled by both conventional and low flow procedures with the vast majority of analytes in the 12 sample pairs showing good comparability. As a result, adoption of the low flow/low volume sampling procedures may be implemented in future annual CAPMP monitoring programs.

2022 WATER RESOURCES MONITORING REPORT

EAST HELENA FACILITY

FINAL

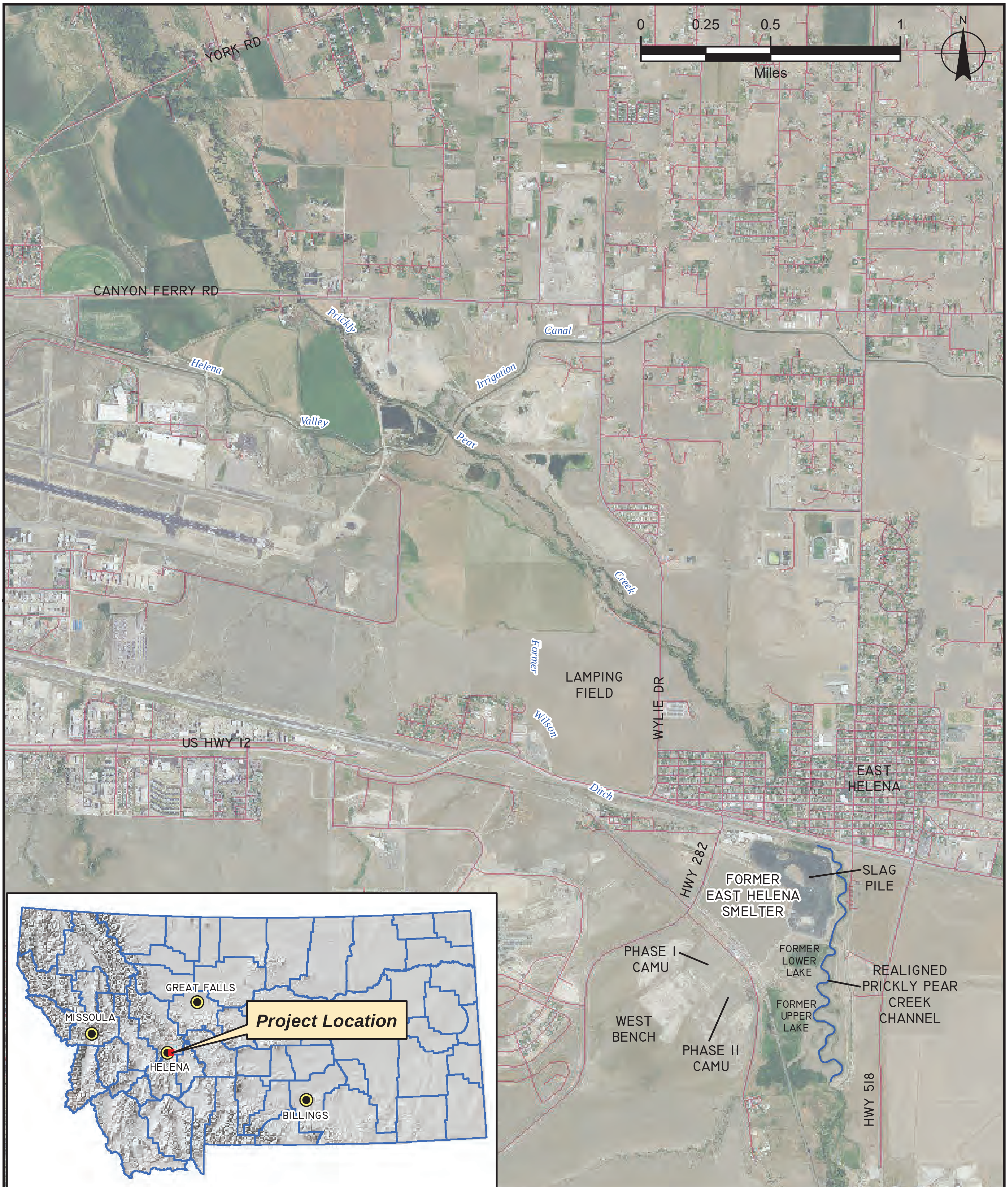
1.0 INTRODUCTION

This report presents a summary of water resources monitoring (WRM) activities conducted in 2022 for the former East Helena Smelter remediation project. For purposes of this WRM report, the project area includes the former East Helena smelter site or Facility[1], and the surrounding area encompassing two groundwater plumes and the project groundwater monitoring network. The WRM program has been implemented by the Montana Environmental Trust Group (METG), Trustee of the Montana Environmental Custodial Trust (the Custodial Trust). The 2022 performance monitoring activities are part of the Corrective Measures Implementation (CMI) program implemented by the Custodial Trust to identify and address groundwater contamination originating from the Facility, under the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. This report summarizes the WRM activities and associated data collected in 2022 as outlined in the 2022 Corrective Action Performance Monitoring Plan (CAPMP) (Hydrometrics, 2022a). In addition, the WRM report summarizes groundwater data collected to date under a separate monitoring program initiated in 2021 and continued through 2022, as outlined in the Unfumed Slag Processing and Removal Groundwater Monitoring Plan (Hydrometrics, 2021a). Information provided in this report will support the planning and implementation of future long-term WRM activities, along with ongoing remedial measure evaluations and other CMI-related activities.

1.1 PROJECT BACKGROUND

The former East Helena Smelter was a custom lead smelter located in Lewis and Clark County, Montana (Figure 1-1). The former smelter began operations in 1888 and produced lead bullion from smelting of a variety of foreign and domestic concentrates, ores, fluxes, and other non-ferrous metal bearing materials. In addition to lead bullion, the Facility produced copper by-products and food-grade sulfuric acid. The Facility ceased operation in April 2001.

[1] The former smelter site or Facility refers to the approximately 142 acres previously occupied by the East Helena Lead Smelter.



Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 2/24/2023 8:55:27 AM	2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**PROJECT LOCATION AND FEATURES**	**FIGURE** **1-1**

Path: G:\PROJECT\10022\2022 WRM\Fig1-1_Location_and_Features.mxd

The Facility covers approximately 142 acres located primarily on the Prickly Pear Creek alluvial plain. The Facility is bounded to the east and northeast by Prickly Pear Creek; to the west and southwest by uplands or foothills comprised of Tertiary-age sediments; and to the north by U.S. Highway 12 and the American Chemet plant (a manufacturer of copper- and zinc-based chemicals). The City of East Helena (COEH) business district and residential areas are located immediately north of Highway 12 (Figure 1-1). Prior to 2014, the Facility was bordered to the south by Upper Lake, a large manmade lake/marsh complex. Upper Lake has been eliminated and the Prickly Pear Creek channel and floodplain lowered to reduce groundwater levels and groundwater interaction with contaminated soils (Section 1.2). The site background and history of the former smelter is described further in numerous reports including Hydrometrics (1999, 2010, 2017), GSI (2014), and CH2M (2018).

Soils and non-native fill material (i.e., slag, ore, concentrates, demolition debris) located on the Facility contain elevated concentrations of a number of contaminants, primarily arsenic, selenium, and certain trace metals. Contaminants within site soils and fill are the result of more than a century of ore handling and processing, storage and disposal of smelting wastes and byproducts, and periodic releases of plant process water. The contaminated soil/fill represents the primary historic source of contaminant loading to groundwater. Loading of contaminants to groundwater has resulted in the generation and migration of groundwater plumes (arsenic and selenium) from the Facility to the north and northwest. The Custodial Trust implemented a number of interim corrective measures (IMs) concurrent with the corrective measures study (CMS), including the South Plant Hydraulic Control project, contaminant source removal, and plant site capping (CH2M, 2018; METG, 2020). The IMs were adopted as the final corrective measures (CMs) for the East Helena Facility with EPA's issuance of the Statement of Basis (USEPA, 2020). The primary purpose of the CMs completed to date by the Custodial Trust is to reduce contaminant mass loading to groundwater and downgradient migration of contaminants from the Facility in order to protect public health and the environment.

1.2 CORRECTIVE MEASURES IMPLEMENTATION

The Custodial Trust has completed the CMS for the East Helena Facility, under oversight of the United States Environmental Protection Agency (USEPA), pursuant to the First Modification to the 1998 RCRA Consent Decree (U.S. District Court, 2012), and involved the completion of several site investigations designed to delineate groundwater contaminant source areas and aid in selection of groundwater corrective measures. The Custodial Trust has implemented several CMs to address ongoing groundwater contaminant loading. The three CMs completed to date include:

1. South Plant Hydraulic Control (SPHC): SPHC is a multicomponent remedial action intended to lower groundwater levels and groundwater flux across the Facility. Since the primary source of contaminant loading to groundwater is groundwater flow through contaminated Facility soils and associated contaminant leaching, lowering the water table has reduced the volume of contaminated soil in contact with groundwater, and thus the mass of contaminants available for leaching. Components of SPHC include: 1) dewatering of former Upper Lake immediately south of the Facility, previously a major source of recharge to the Facility

groundwater system; 2) removal of the Smelter Dam from Prickly Pear Creek thereby lowering the creek stage by up to 15 feet and reducing leakage from the creek to the shallow groundwater system; and 3) reconstructing Prickly Pear Creek upstream of and adjacent to the Facility to further reduce the creek stage and leakage to groundwater.

2. Evapotranspiration (ET) Cover: The ET Cover included placement of an engineered soil cover over approximately 57 acres of the western portion of the Facility where smelting operations and associated activities occurred (the Former plant site). The ET Cover is designed to store precipitation infiltration in the engineered soil cap for subsequent evapotranspiration during the growing season. The purpose of the ET Cover is to minimize deep percolation of incident precipitation and snowmelt water through contaminated vadose zone soils and associated leaching of contaminants to groundwater.
3. Contaminant Source Removal: Source removal actions were performed on the Facility to remove areas of localized, higher contaminant concentration soils from below the groundwater table. Source removal actions were completed in the southern portion of the Facility (South Plant Area), including the former Tito Park and Upper Ore Storage areas, and in the Former Acid Plant Area. The excavated soils were placed beneath the ET Cover and the excavations backfilled with clean soil.

In addition to these CMs, a number of institutional controls (ICs) have been implemented by the Custodial Trust and other entities to further mitigate potential exposures to contaminated soil and groundwater. These ICs include a well abandonment program to encourage abandonment of private wells located in areas potentially impacted by the groundwater contaminant plumes; deeded land-use restrictions on Trust-owned property; administration of the East Valley Controlled Groundwater Area (EVCGWA) to control and restrict groundwater appropriations within and adjacent to the groundwater contaminant plumes; a prohibition on new well installation within the COEH boundaries; and implementation of the COEH Lead Education and Abatement Program Soil Ordinance to regulate earthwork in areas of potential soil contamination.

Additional information on the completed CMs and the ICs is available in the CMS Report (CH2M, 2018; METG, 2020). Evaluation of the CMs effectiveness in terms of the groundwater system response is a primary focus of the East Helena Project monitoring program, as outlined in the 2022 CAPMP.

1.3 CORRECTIVE ACTION PERFORMANCE MONITORING PROGRAM

Groundwater and surface water monitoring activities performed in 2022 were conducted in accordance with the 2022 CAPMP (Hydrometrics, 2022a) and the CMI Work Plan (Hydrometrics, 2021b). As described in the CAPMP, the overall objective of the 2022 performance monitoring program was to continue assessment of groundwater quality status and trends within and downgradient of the former smelter, and to evaluate the effectiveness of the CMs and other remedial measures at reducing concentrations and migration of groundwater contaminants. Similar to the

2017 – 2021 post-CM monitoring activities, the 2022 program focused on performance monitoring applicable to the CMI phase of a RCRA Corrective Action remediation project including the following objectives:

1. Assessment of sitewide groundwater level trends and groundwater flow directions;
2. Assessment of groundwater quality trends for the COCs arsenic and selenium as well as other key constituents (cadmium, zinc , chloride, and sulfate) at specific wells located in both Facility source areas and downgradient areas;
3. Assessment of arsenic and selenium plume geometry and stability;
4. Evaluation of residential/public water supply well water quality in the area of former smelter site impacts;
5. Evaluation of surface water flow and quality trends, from upstream of the Facility through the Prickly Pear Creek realignment area, and downstream to Canyon Ferry Road; and
6. Continued evaluation of groundwater chemistry in CAMU area wells.

Assessment of groundwater level trends, groundwater quality trends, and arsenic and selenium plume geometry and stability (objectives (1), (2), and (3) above) are addressed through a remedy performance monitoring data evaluation program, as outlined in the 2022 CAPMP (Hydrometrics, 2022a). This data evaluation program forms the basis of the discussion of 2022 monitoring results in Section 3.3 of this WRM report.

Although not a remedy-related monitoring program objective, groundwater comparison sampling to evaluate a low-flow/low-volume well purging method as a replacement for the standard three to five well volume purge method was conducted at selected wells in 2022, in anticipation of a potential transition of the East Helena Facility groundwater monitoring methodology to a low-flow/low-volume method on a permanent basis. The 2022 purge method comparison sampling was outlined in the 2022 CAPMP, and the results of the sampling are discussed in Section 3.3.7 of this WRM report.

1.4 UNFUMED SLAG PROJECT GROUNDWATER MONITORING PROGRAM

Additional groundwater monitoring activities in 2022 were conducted in accordance with the Unfumed Slag Processing and Removal Groundwater Monitoring Plan (GMP) (Hydrometrics, 2021a). The unfumed slag (UFS) at the Facility contains economically recoverable amounts of zinc and other non-ferrous metals. Approximately 2 million metric tons (MT) of UFS is planned for removal from the Facility via rail for offsite processing, at an approximate average rate of 33,330 MT per month over a period of five years. Due to the nature of the UFS Project (excavation, crushing, and transport of slag), some short-term impacts to groundwater may occur during operations due to the potential for enhanced contaminant leaching, although the project has been designed to minimize any such impacts. In addition, non-UFS Project-related short- and long-term variability in groundwater quality in the vicinity of the slag pile also occurs, due primarily to seasonal precipitation and infiltration patterns and to the ongoing effects of the CMs.

The primary objective of the UFS GMP is to provide for collection of groundwater data and establish data evaluation procedures to identify any UFS Project-related impacts to groundwater quality with the potential to cause unacceptable water quality impacts. The UFS monitoring program (Hydrometrics, 2021a) was initiated in 2021 and continued throughout 2022, to assess potential groundwater quality impacts associated with the processing and removal of UFS from the Facility.

This document presents a summary of the 2022 CAPMP groundwater and surface water monitoring activities and resulting data, along with the 2022 UFS groundwater monitoring activities and data. The scope of monitoring activities is presented in Section 2 and monitoring results are discussed in Section 3.

2.0 MONITORING SCOPE

The 2022 CAPMP monitoring program included semiannual monitoring at an extensive network of groundwater and surface water locations spanning the project area. The sampling protocol is detailed in the 2022 CAPMP (Hydrometrics, 2022a), and followed established standard operating procedures included in the Project Quality Assurance Project Plan (QAPP; Hydrometrics, 2015a) and the Project Data Management Plan (DMP; Hydrometrics, 2011). The scope of the 2022 monitoring is described below.

2.1 SURFACE WATER MONITORING

The 2022 surface water monitoring program delineated in the CAPMP included semiannual surface water elevation or stage measurements, streamflow measurements and water quality sampling in June and October. The semiannual monitoring schedule included eleven monitoring sites (Table 2-1, Figure 2-1), with eight sites located on Prickly Pear Creek and three sites (Trib-1, Trib-1B, and Trib-1D) located on a spring-fed tributary drainage flowing from the southwest through the former Upper and Lower Lake areas on the south end of the Facility to Prickly Pear Creek (Figure 2-1). Surface water elevations were measured in June and October using a survey grade GPS, with the exception of Trib-1B, which was dry during the October monitoring event. Elevation surveys were conducted concurrently with site-wide groundwater static water level (SWL) measurements to allow comparison of groundwater and surface water elevation data. Besides informing the estimation of groundwater flow directions and gradients, the resulting data was used to assess potential gaining and losing reaches of Prickly Pear Creek. Streamflow and water quality monitoring was conducted at nine of the eleven surface water sites during high flow (June) and eight sites during low flow (October); site Trib-1B was dry in October (Table 2-1).

Site Trib-1 was not included in the 2022 CAPMP, but was added as a supplemental semiannual monitoring site on the tributary drainage. Tributary sites have shown highly variable flows and water quality results during past monitoring, particularly during the spring season. Elevated metals concentrations throughout the tributary drainage have been documented through past sampling, resulting in removal of approximately 350 cubic yards of metals-impacted soils by METG in the vicinity of Trib-1B in November 2018. Tributary drainage sampling was conducted in 2022 to further evaluate ongoing water quality trends in response to the 2018 soil removal.

All surface water samples were analyzed for the parameters shown in Table 2-2, including field analysis of pH, specific conductance (SC), dissolved oxygen (DO) and water temperature, and laboratory analysis of common constituents and total recoverable metals by Energy Laboratories in Helena, Montana. All of the 2022 surface water stage, flow, and water quality results have been entered into the project database and validated for data quality and usability per the project QAPP (Hydrometrics, 2015a). The 2022 validated database is included in Appendix A. Surface water monitoring results for 2022 are discussed in Section 3.1.

Table 2-1. 2022 Surface Water Monitoring Locations and Schedule
2022 Water Resources Monitoring Report - East Helena Facility

Site ID	Northing	Easting	Description	June/October Water Elevation	June/October Flow and Water Quality
Semiannual Sampling Sites					
PPC-3A	856283.87	1361694.37	Prickly Pear Creek upstream of former smelter site	X	X
PPC-4A	858437.51	1361223.39	Prickly Pear Creek realigned channel upstream of former smelter dam, in former Upper Lake area	X	X
PPC-5A	859568.08	1361450.05	Prickly Pear Creek realigned channel downstream of former smelter dam; near historic site PPC-5	X	X
PPC-7	861473.74	1360743.50	Prickly Pear Creek channel upstream of Highway 12 bridge; between slag pile and Highway 12	X	X
PPC-8	863372.55	1360137.99	Prickly Pear Creek at West Gail Street in East Helena	X	
PPC-36A	864556.11	1358753.31	Prickly Pear Creek approximately 3,500 feet downstream of former smelter site	X	X
PPC-9A	865555.92	1357841.22	Prickly Pear Creek approximately 5,250 feet downstream of former smelter site	X	
SG-16	872677.17	1350559.96	Prickly Pear Creek downstream of Canyon Ferry Road bridge	X	X
Trib-1*	857989.72	1360189.58	Tributary drainage at railroad bridge crossing, upstream of site Trib-1B and 2018 soil removal area	X	X
Trib-1B	858476.27	1360181.89	Tributary drainage south of Facility, upstream of site Trib-1D and downstream of 2018 soil removal area	X	X**
Trib-1D	859392.30	1361402.33	Tributary drainage immediately upstream of Prickly Pear Creek confluence	X	X

Locations shown on Figure 2-1.

Sites listed in upstream to downstream order.

*Supplemental monitoring location (not included in 2022 CAPMP)

**Site dry during October 2022 monitoring event.

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 3/2/2023 12:02:23 PM	2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2022 SURFACE WATER MONITORING LOCATIONS	FIGURE 2-1

Path: G:\PROJECT\10022\2022 WRM\Fig2-1_SW_Locations.mxd

Table 2-2. 2022 Surface Water Sample Analytical Parameter List
2022 Water Resources Monitoring Report - East Helena Facility

Parameter	Analytical Method [1]	Project Required Detection Limit (mg/L)
Physical Parameters		
pH	150.2/SM 4500H-B	0.1 s.u.
Specific Conductance	120.1/SM 2510B	1 µmhos/cm
TDS	SM 2540C	10
TSS	SM 2540D	10
Common Ions		
Alkalinity	SM 2320B	1
Bicarbonate	SM 2320B	1
Sulfate	300.0	1
Chloride	300.0/SM 4500CL-B	1
Calcium	215.1/200.7	5
Magnesium	242.1/200.7	5
Sodium	273.1/200.7	5
Potassium	258.1/200.7	5
Trace Constituents (Total Recoverable)		
Antimony (Sb)	200.7/200.8	0.0005
Arsenic (As)	200.8/SM 3114B	0.001
Cadmium (Cd)	200.7/200.8	0.00003
Copper (Cu)	200.7/200.8	0.002
Iron (Fe)	200.7/200.8	0.02
Lead (Pb)	200.7/200.8	0.0003
Manganese (Mn)	200.7/200.8	0.01
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.000005
Selenium (Se)	200.7/200.8/SM 3114B	0.001
Thallium (Tl)	200.7/200.8	0.0002
Zinc (Zn)	200.7/200.8	0.008
Field Parameters		
Stream Flow	HF-SOP-37/-44/-46	NA
Water Temperature	HF-SOP-20	0.1 °C
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L
pH	HF-SOP-20	0.01 s.u.
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm

Notes:

(1) Analytical methods are from the most recent edition of*Standard Methods for the Examination of Water and Wastewater* (SM); *Methods for the Determination of Metals in Environmental Samples,* Supplement I, EPA/600/R-94/111 (May 1994); or *Methods for the Determination of Inorganic Substances in Environmental Samples*, EPA/600/R-93/100 (August 1993).

2.2 2022 GROUNDWATER MONITORING

The 2022 groundwater monitoring program included groundwater level and water quality monitoring at an extensive network of monitoring wells and residential/public water supply wells. The current monitoring well network includes 185 wells with well coverage extending from south (upgradient) of the Facility northward approximately four miles, to about 1600 feet north of Canyon Ferry Road. Monitoring well depths range from less than 10 feet for some wells located near Prickly Pear Creek, to 247 feet (EH-145D) north of Canyon Ferry Road. The groundwater monitoring network is shown on Exhibit 1 and summarized in Table 2-3.

2.2.1 Groundwater Level Monitoring

Groundwater level monitoring has been a key component of the monitoring program throughout the implementation of CMs due to its relevance to groundwater remediation objectives. As described in Section 1, the objective of the SPHC CM is to lower groundwater levels on the Facility thereby reducing groundwater interaction with, and contaminant leaching from, plant site fill/soils. The groundwater level data also provides information on changing hydraulic gradients and groundwater (and contaminant) flow directions, and provides for development of project-area groundwater potentiometric maps.

Groundwater levels measurement events included 183 of the 185 total wells in June and September (two wells, Amchem4 and the Dartman well, have no access for measurement). All water levels were measured manually with electronic meters with depths to water from the top of the well casing recorded to the nearest 0.01 foot. The depth to water measurements were converted to elevations (relative to mean sea level) using surveyed casing elevations for each well. The water level monitoring events were all completed in a single day to provide a snapshot of seasonal groundwater elevation conditions, and were coordinated with the surface water elevation surveys (Section 2.1) to provide more comprehensive water level datasets for the project area. The 2022 water level monitoring schedule is included in Table 2-3 with results presented in Section 3.3.

2.2.2 Groundwater Quality Monitoring

The 2022 CAPMP groundwater monitoring program included planned groundwater quality sampling at 29 monitoring wells in June and 83 wells in October. The groundwater sampling schedule is summarized in Table 2-3 with well locations shown on Exhibit 1. A number of wells scheduled for sampling in spring and/or fall 2022 could not be sampled due to dry conditions or insufficient water for sampling, including six wells (DH-17, DH-56, DH-58, DH-66, DH-77, and DH-79) in spring 2022, and nine wells (DH-17, DH-42, DH-56, DH-58, DH-66, DH-77, DH-79, EH-57A, and EH-60) in fall 2022 (Table 2-3). In addition, residential and public water supply well sampling was conducted in June and October to monitor the quality of local drinking water sources at 20 residential/public water supply wells (Table 2-4, Exhibit 1). The residential/public water supply well sampling program includes measurement of water levels (where well access permits) and collection of groundwater samples for

Table 2-3. 2022 CAPMP Monitoring Well Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[(3)]	MP Elevation	Water Levels	Water Quality Monitoring	
				June / October	June	October
2843 Canyon Ferry	145-165	Valley Fill	NA	X	X	X
2853 Canyon Ferry	132-152	Valley Fill	NA	X	X	X
Amchem4	100-160	Deeper System	NA			X
ASIW-1	53-73	Upper Aquifer	3915.99	X		
ASIW-2	10-95	Upper Aquifer	3909.13	X		
Dartman	84.00	Upper Aquifer	3863.03		X	X
DH-1	40-50	Tertiary	3910.89	X		
DH-2	55.5-65.5	Upper Aquifer	3936.91	X		
DH-3	44-54	Tertiary	3947.48	X		
DH-4	17-23	Upper Aquifer	3917.26	X		
DH-5	9-17	Upper Aquifer	3921.18	X		
DH-6	15-25	Upper Aquifer	3889.85	X		X
DH-7	18.5-28.5	Upper Aquifer	3898.66	X		
DH-8	39-49	Upper Aquifer	3923.38	X		X
DH-9	6.5-11.5	Upper Aquifer	3918.08	X		
DH-10A	5-10	Upper Aquifer	3886.97	X		
DH-13	35-45	Upper Aquifer	3923.91	X		
DH-14	34-46	Upper Aquifer	3916.06	X		
DH-15	41.5-50	Upper Aquifer	3889.82	X		X
DH-17	31-41	Upper Aquifer	3917.56	X	Dry	Dry
DH-18	55.5-63.5	Deeper System	3924.93	X		
DH-20	21-31	Upper Aquifer	3927.09	X		
DH-22	24-34	Upper Aquifer	3948.63	X		
DH-23	10-20	Upper Aquifer	3931.82	X		
DH-27	19-29	Upper Aquifer	3946.21	X		
DH-30	12-22	Upper Aquifer	3943.24	X		
DH-36	21-31	Upper Aquifer	3920.66	X		
DH-42	24-34	Upper Aquifer	3942.63	X		Dry
DH-47	5-15	Upper Aquifer	3926.82	X		
DH-48	24-34	Upper Aquifer	3905.96	X		
DH-52	7-17	Upper Aquifer	3889.18	X		X
DH-53	7-17	Upper Aquifer	3892.87	X		
DH-54	17-27	Upper Aquifer	3890.27	X		
DH-55	83-93	Upper Aquifer	3972.76	X		X
DH-56	70-85	Upper Aquifer	3958.17	X	Dry	Dry
DH-57	23-28	Upper Aquifer	3929.53	X		
DH-58	9-24	Upper Aquifer	3919.33	X	Dry	Dry
DH-59	10-25	Upper Aquifer	3937.44	X		
DH-5A	8-18	Upper Aquifer	3921.92	X		
DH-61	20-30	Upper Aquifer	3926.84	X		
DH-62	65-75	Deeper System	3926.95	X		
DH-63	24-39	Upper Aquifer	3905.37	X		

Table 2-3. 2022 CAPMP Monitoring Well Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit(3)	MP Elevation	Water Levels	Water Quality Monitoring	
				June / October	June	October
DH-65	60-70	Upper Aquifer	3945.85	X		
DH-66	38-48	Upper Aquifer	3919.28	X	Dry	Dry
DH-67	36-46	Upper Aquifer	3899.77	X		X
DH-68	40-50	Upper Aquifer	3943.28	X		
DH-69	30-40	Upper Aquifer	3934.49	X		X
DH-70	24-30	Upper Aquifer	3933.91	X		
DH-71	25-34	Upper Aquifer	3944.88	X		
DH-72	40-50	Deeper System	3939.67	X		
DH-73	38-48	Upper Aquifer	3918.08	X		
DH-74	118-128	Upper Aquifer	4006.44	X		
DH-75	136-146	Upper Aquifer	4006.54	X		
DH-76	104-124	Upper Aquifer	3994.28	X		
DH-77	38-48	Upper Aquifer	3932.20	X	Dry	Dry
DH-78	35-45	Upper Aquifer	3921.12	X		
DH-79	32-42	Upper Aquifer	3928.80	X	Dry	Dry
DH-80(2)	20-30	Upper Aquifer	3942.36	X	X	X
DH-82	39-49	Upper Aquifer	3908.18	X		
DH-83	49.5-54.5	Upper Aquifer	3922.14	X		
East-PZ-1	14-34	Valley Fill	3911.93	X		
East-PZ-2	29	Valley Fill	3924.58	X		
East-PZ-4	28.00	Valley Fill	3935.66	X		
East-PZ-6	19-26	Tertiary	3943.83	X		
East-PZ-7	28-33	Tertiary	3928.83	X		
EH-50	25-45	Upper Aquifer	3889.39	X		X
EH-51	10-30	Upper Aquifer	3880.09	X		X
EH-52(2)	5-13	Upper Aquifer	3880.50	X		X
EH-53	25-35	Upper Aquifer	3872.82	X		X
EH-54	8-18	Upper Aquifer	3869.66	X		X
EH-57	25-35	Upper Aquifer	3885.05	X		
EH-57A	35-45	Upper Aquifer	3885.45	X		Dry
EH-58	21-31	Upper Aquifer	3888.15	X		X
EH-59	8-18	Upper Aquifer	3876.57	X		X
EH-60	22-28	Upper Aquifer	3888.46	X		Dry
EH-61	36-45	Upper Aquifer	3889.77	X		X
EH-62	25-45	Upper Aquifer	3875.07	X		X
EH-63	20-35	Upper Aquifer	3878.32	X		X
EH-64	20-35	Upper Aquifer	3882.67	X		
EH-65(2)	20-35	Upper Aquifer	3879.96	X		X
EH-66	28.5-38.5	Upper Aquifer	3869.48	X		X
EH-67	27-37	Upper Aquifer	3869.46	X		
EH-68	15-25	Upper Aquifer	3867.60	X	X	X
EH-69	26-36	Upper Aquifer	3869.10	X	X	X

Table 2-3. 2022 CAPMP Monitoring Well Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[3]	MP Elevation	Water Levels	Water Quality Monitoring	
				June / October	June	October
EH-70	40-50	Upper Aquifer	3863.48	X		X
EH-100[2]	52-60	Upper Aquifer	3889.83	X		X
EH-101	34-45	Upper Aquifer	3879.95	X		X
EH-102	25-35	Upper Aquifer	3880.45	X		X
EH-103	59.5-74.5	Upper Aquifer	3890.54	X		X
EH-104[2]	38-48	Upper Aquifer	3887.83	X		X
EH-106	31-46	Upper Aquifer	3882.07	X		X
EH-107	68-78	Upper Aquifer	3880.15	X		X
EH-109	50-65	Upper Aquifer	3885.67	X		
EH-110	40-55	Upper Aquifer	3884.05	X		X
EH-111	39-49	Upper Aquifer	3876.50	X		X
EH-112	31-41	Upper Aquifer	3875.78	X		
EH-113	34-44	Upper Aquifer	3871.34	X		
EH-114[1]	42-52	Upper Aquifer	3878.07	X	X	X
EH-115[2]	39-49	Upper Aquifer	3883.29	X	X	X
EH-116	38-48	Upper Aquifer	3874.52	X		
EH-117[2]	33-43	Upper Aquifer	3871.33	X		X
EH-118	40-50	Upper Aquifer	3879.95	X		X
EH-119	58-68	Upper Aquifer	3873.75	X		X
EH-120	55-65	Upper Aquifer	3865.78	X	X	X
EH-121	59-69	Upper Aquifer	3869.49	X		X
EH-122	60-65	Upper Aquifer	3868.08	X		
EH-123	50-60	Upper Aquifer	3885.71	X	X	X
EH-124	64-74	Upper Aquifer	3874.46	X		X
EH-125	59-69	Upper Aquifer	3863.22	X		X
EH-126[2]	63-73	Upper Aquifer	3870.00	X		X
EH-127	63-73	Upper Aquifer	3860.75	X		
EH-128	34-44	Upper Aquifer	3892.17	X		
EH-129	80-90	Upper Aquifer	3870.21	X	X	X
EH-130	68-78	Upper Aquifer	3858.55	X	X	X
EH-131	74-84	Valley Fill	3834.44	X		
EH-132	70-80	Upper Aquifer	3893.90	X		X
EH-133	85-95	Upper Aquifer	3884.36	X		
EH-134	54-64	Upper Aquifer	3870.21	X	X	X
EH-135	55-65	Upper Aquifer	3852.25	X		X
EH-136	64-74	Valley Fill	3838.59	X		
EH-137	75-85	Valley Fill	3839.66	X		
EH-138	55-85	Valley Fill	3839.70	X	X	X
EH-139	47-57	Valley Fill	3839.78	X	Dry	X
EH-140	56-86	Valley Fill	3812.08	X		
EH-141[1]	60-90	Valley Fill	3813.32	X	X	X
EH-142	80-120	Valley Fill	3804.68	X		

Table 2-3. 2022 CAPMP Monitoring Well Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[3]	MP Elevation	Water Levels	Water Quality Monitoring	
				June / October	June	October
EH-143	100-125	Valley Fill	3803.37	X	X	X
EH-144D	143.5-168.5	Valley Fill	3778.86	X		
EH-144M	118-128	Valley Fill	3778.95	X		
EH-144S	83-103	Valley Fill	3778.70	X		
EH-145D	211-241	Valley Fill	3789.60	X		
EH-145S	167-187	Valley Fill	3790.09	X		
EH-200	38-48	Tertiary	3953.33	X		
EH-201	99-119	Tertiary	3973.48	X		
EH-202	70-90	Tertiary	3930.56	X		
EH-203	125-145	Tertiary	4003.92	X		
EH-204	55-65	Tertiary	3925.69	X	X	X
EH-205	24-34	Upper Aquifer	3900.66	X		
EH-206	33-53	Upper Aquifer	3898.10	X		X
EH-208	60-85	Valley Fill	3910.58	X		
EH-209	96-116	Valley Fill	3898.34	X		
EH-210[2]	50-60	Deeper System	3901.19	X	X	X
EH-211	40-50	Valley Fill	3905.75	X		
EH-212	57-72	Valley Fill	3905.90	X		
EHMW-3	80-130	NA	3825.45	X		
EHTW-3	NA	NA	3827.66	X		
IW-01	NA	Upper Aquifer	3888.28	X		
IW-02	NA	Upper Aquifer	3871.08	X		
MW-1	58-68	Tertiary	3953.05	X		X
MW-2	56.0-66.0	Tertiary	3945.97	X		X
MW-3	38.5-48.0	Tertiary	3940.95	X		X
MW-4	54-64	Tertiary	3947.06	X		X
MW-5	55-65	Tertiary	3956.18	X		X
MW-6	30-40	Tertiary/Qal	3938.14	X		X
MW-7	44-57	Qal	3963.67	X		X
MW-8	44.5-64.5	Tertiary	3958.65	X		X
MW-9	50-70	Valley Fill	3959.01	X		X
MW-10	42-62	Valley Fill	3946.28	X		X
MW-11	49.6-69.6	Tertiary	3973.33	X		X
PBTW-1	29-46	Upper Aquifer	3914.59	X		
PBTW-2[1]	30-54	Upper Aquifer	3906.73	X	X	X
PLANT ROAD TEST WELL	217-346	Upper Aquifer	3838.72	X		
PPCRPZ-02	<10	Upper Aquifer	3919.76	X		
PRB-1	35-50	Upper Aquifer	3918.37	X		
PRB-2	37-52	Upper Aquifer	3905.34	X	X	X
PRB-3	36-51	Upper Aquifer	3919.19	X		
PZ-36A	<10	Upper Aquifer	3858.96	X		
PZ-36B	<10	Upper Aquifer	3858.75	X		

Table 2-3. 2022 CAPMP Monitoring Well Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit(3)	MP Elevation	Water Levels	Water Quality Monitoring	
				June / October	June	October
PZ-36C	20-25	Upper Aquifer	3859.60	X		
PZ-9A	<10	Upper Aquifer	3850.70	X		
PZ-9B	<10	Upper Aquifer	3849.43	X		
SC-1	75-85	Upper Aquifer	3890.42	X		
SDMW-1	25.6-45.6	Upper Aquifer	3925.11	X	X	X
SDMW-2	22.5-42.5	Upper Aquifer	3928.09	X		
SDMW-3	19-39	Upper Aquifer	3935.14	X		
SDMW-4	19-39	Upper Aquifer	3936.10	X		
SDMW-5	29-49	Upper Aquifer	3929.86	X	X	X
SP-3	17-27	Upper Aquifer	3905.91	X		
SP-4	20-30	Upper Aquifer	3908.16	X		
SP-5	17-27	Upper Aquifer	3903.52	X		
TW-1	25-40	Upper Aquifer	3930.10	X		
TW-2	NA	NA	3931.44	X		
ULM-PZ-1	<10	Upper Aquifer	3924.40	X		
ULTP-1	<10	Upper Aquifer	3919.63	X		
ULTP-2	<10	Upper Aquifer	3921.23	X		
			Total # Wells Per Event	**183**	**29**	**83**

All monitoring locations shown on Exhibit 1.

(1) Well sampled in June 2022 using both low-flow/low-volume and standard purge methods for comparison per 2022 CAPMP.

(2) Well sampled in October 2022 using both low-flow/low-volume and standard purge methods for comparison per 2022 CAPMP.

(3) Unit refers to hydrostratigraphic unit. Upper Aquifer and Deeper System refer to units on plant site and downgradient through Lamping Field. Other wells identified by geologic unit.

NA - Not Available

bgs - below ground surface

Table 2-4. 2022 Residential/Public Water Supply Well Sampling Sites and Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Map Key (see Exhibit 1)	Northing	Easting	Water Quality Monitoring	
			June	October
R1	863425.39	1359501.01	X	X
R2	863266.68	1359337.84	X	X
R3	863296.03	1360955.74	X	X
R4	863053.71	1361184.11	X	X
R5	864206.53	1358674.56	X	X
R6	866156.57	1356934.48	X	X
R7	872346.42	1354330.00	X	X
R8	872391.53	1354773.24	X	X
R9	872086.41	1355030.70	X	X
R10	863376.30	1361815.27	X	X
R11	863255.39	1358240.44	X	X
R12	861502.42	1362101.41	X	X
R13	855347.37	1359909.48	X	X
R14	863233.58	1359840.14	X	X
R15	861784.41	1356574.41	X	X
R16	861925.29	1356400.09	X	X
R17	861781.59	1356290.54	X	X
R18	872558.37	1356681.06	X	X
R19	871444.75	1356882.84	X	X
R20	868437.60	1356673.10	X	X

Well locations shown on Exhibit 1.

water quality analyses, with the water quality data provided to the well owners. The COEH public water supply wells (numbers R18, R19, and R20, Table 2-4 and Exhibit 1) are included in each semiannual sampling event.

2.2.3 Well Purge Method Comparison Sampling

Well purge comparison sampling at selected monitoring wells was conducted in 2022 to assess the comparability of groundwater quality data collected by the low-flow/low-volume and standard purge methods. Three monitoring wells were selected for 2022 purge comparison sampling in spring 2022, and nine wells were selected for comparison sampling in fall 2022 (Table 2-3), covering a range of groundwater arsenic and selenium concentrations, as well as a range of standard purge volumes. One of the primary concerns when transitioning from standard purge to low-flow purge groundwater sampling methods is ensuring that the different purge rates and volumes yield representative groundwater samples, and thus that the data obtained using the two different methods is comparable. Previous comparison sampling conducted during 2016 East Helena project sampling activities demonstrated that low-flow and standard purge methods using a submersible pump (Grundfos) at different flow rates generated comparable water quality data for most wells and constituents tested. The 2022 purge comparison sampling compared a low-flow/low-volume purging and sampling method using a Waterra inertial pump with the standard purge submersible pump method. The representativeness and comparability of the inertial pump and submersible pump methods was recently verified in wells currently monitored under the ongoing unfumed slag (UFS) processing and removal project (Hydrometrics, 2021a). The low-flow method provides the following advantages compared with the standard purge method:

1. Reduction of well purge water volumes and the amount of containerized purge water requiring storage and disposal by as much as 90%;
2. Use of all dedicated equipment at each well, eliminating the need for pump decontamination, generation of additional water requiring disposal, and the potential for cross-contamination between monitoring locations; and
3. Streamlining the purging and sampling procedure, which reduces the time required for sample collection and associated expenses.

On-site handling and storage of sampling-derived water as well as shipping and off-site disposal of water results in added project costs. Adopting a low-flow sampling methodology in lieu of the standard purge method would greatly reduce the volume of sampling-derived water requiring disposal and associated costs. In addition, the low-flow sampling method is a streamlined approach to sample collection requiring less time and equipment than the standard three- to five-volume purge method. As a result, labor and equipment costs for low-flow sampling are generally less than the standard purge method.

Groundwater quality samples collected as part of the 2022 CAPMP were analyzed for the parameters shown in Table 2-5, including field analysis of pH, SC, DO, turbidity, oxidation/reduction potential, and water temperature, and laboratory analysis of common constituents and trace metals (dissolved at monitoring wells and total and dissolved at residential/water supply wells) by Energy Laboratories in Helena, Montana. All groundwater data collected under the 2022 CAMP has been entered into the project database and validated for data quality and usability. The validated database is included in Appendix A. Groundwater monitoring results for residential wells are presented in Section 3.2 and monitoring well results, including purge method comparison sample results, are presented in Section 3.3.

2.2.4 Unfumed Slag Processing and Removal Groundwater Monitoring

The UFS GMP (Hydrometrics, 2021a) outlines a scope, schedule, and strategy for collection and evaluation of groundwater quality data to assess potential changes in groundwater quality resulting from UFS processing / removal activities.

In accordance with the UFS GMP (Hydrometrics, 2021a), the 2022 UFS project groundwater monitoring network consisted of the wells listed in Table 2-6 and shown on Figure 2-2. A pre-UFS project monitoring event (prior to the commencement of slag crushing[2]) was conducted in July 2021. Biweekly monitoring of indicator and sentinel wells was conducted in October, November, and December 2021. The UFS project groundwater monitoring frequency was decreased to monthly beginning in January 2022 due to a lack of detected groundwater impacts from the slag processing, and remained on a monthly schedule throughout 2022. As noted in Table 2-6, wells DH-56 and EH-60 have been dry since the UFS monitoring program was initiated. Well EH-61 was added to the program as a sentinel well replacement for adjacent well EH-60. In accordance with the UFS GMP, Tier 2 monitoring well EH-58 was added to the monitoring program beginning in February 2022 and well EH-110 was added in April 2022, based on water quality results at upgradient sentinel wells DH-53 and EH-61.

Groundwater quality samples collected as part of the UFS project were analyzed for the parameters shown in Table 2-7, including field analysis of pH, SC, DO, and water temperature, and laboratory analysis of two primary COCs for slag leaching (dissolved arsenic and selenium), and potential slag pile impact indicator parameters (potassium, magnesium, sulfate, and chloride) by Energy Laboratories in Helena, Montana. All groundwater data collected under the UFS GMP has been entered into the project database and validated for data quality and usability. The validated database is included in Appendix A. Additional details regarding the UFS project groundwater monitoring program are in the UFS GMP (Hydrometrics, 2021a). UFS project groundwater monitoring results are discussed in Section 3.3.6.

[2] The initial phase of slag crushing extended from 9/21/21 to 3/3/22. Crushing will resume as needed to maintain adequate stockpiles.

Table 2-5. 2022 Groundwater Sample Analytical Parameter List
2022 Water Resources Monitoring Report - East Helena Facility

Parameter	Analytical Method(1)	Project Required Detection Limit (mg/L)	Montana Groundwater Human Health Standards (mg/L)(2)
Physical Parameters			
pH	150.2/SM 4500H-B	0.1 s.u.	NA
Specific Conductance	120.1/SM 2510B	1 µmhos/cm	NA
TDS	SM 2540C	10	NA
TSS	SM 2540D	10	NA
Common Ions			
Alkalinity	SM 2320B	1	NA
Bicarbonate	SM 2320B	1	NA
Sulfate	300.0	1	NA
Chloride	300.0/SM 4500CL-B	1	NA
Bromide	300.0	0.05	NA
Calcium	215.1/200.7	1	NA
Magnesium	242.1/200.7	1	NA
Sodium	273.1/200.7	1	NA
Potassium	258.1/200.7	1	NA
Trace Constituents (Total and/or Dissolved) (3)(4)			
Antimony (Sb)	200.7/200.8	0.003	0.006
Arsenic (As)	200.8/SM 3114B	0.002	0.01
Cadmium (Cd)	200.7/200.8	0.001	0.005
Copper (Cu)	200.7/200.8	0.001	1.3
Iron (Fe)	200.7/200.8	0.02	NA
Lead (Pb)	200.7/200.8	0.005	0.015
Manganese (Mn)	200.7/200.8	0.01	NA
Mercury (Hg)	245.2/245.1/200.8/SM 3112B	0.001	0.002
Selenium (Se)	200.7/200.8/SM 3114B	0.001	0.05
Thallium (Tl)	200.7/200.8	0.001	0.002
Zinc (Zn)	200.7/200.8	0.01	2
Field Parameters (5)			
Static Water Level	HF-SOP-10	0.01 ft	NA
Water Temperature	HF-SOP-20	0.1 °C	NA
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L	NA
pH	HF-SOP-20	0.01 pH standard unit	NA
Turbidity		0.1 NTU	NA
ORP/Eh	HF-SOP-23	1 mV	NA
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm	NA

Notes:

(1) Analytical methods are from the most recent edition of Standard Methods for the Examination of Water and Wastewater (SM); Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA/600/R-94/111 (May 1994); or Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100 (August 1993).

(2) Standards from Montana Circular DEQ-7 (June 2019 Version). NA = not applicable (no human health standard).

(3) Residential/water supply well samples analyzed for total and dissolved trace constituents; monitoring well samples analyzed for dissolved metals only.

(4) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

(5) Field parameters measured in a flow-through cell in accordance with project SOPs.

Table 2-6. UFS Project Groundwater Sampling Schedule

2022 Water Resources Monitoring Report - East Helena Facility

Well ID	Screen Interval bgs	Unit	Measuring Point Elevation (ft AMSL)	Well Type
DH-55	83-93	Upper Aquifer	3972.76	Indicator
DH-56(1)	70-85	Upper Aquifer	3958.17	Indicator
DH-6	15-25	Upper Aquifer	3889.85	Sentinel
DH-15	41.5-50	Upper Aquifer	3889.82	Sentinel
DH-52	7-17	Upper Aquifer	3889.18	Sentinel
DH-53	7-17	Upper Aquifer	3892.87	Sentinel
EH-58(2)	9-24	Upper Aquifer	3888.15	Tier 2
EH-60(1)	22-28	Upper Aquifer	3888.46	Sentinel
EH-61(3)	20-30	Upper Aquifer	3889.77	Sentinel
EH-103	59.5-74.5	Upper Aquifer	3890.54	Sentinel
EH-110(2)	40-55	Upper Aquifer	3890.54	Tier 2

NOTES:

Well locations shown on Figure 2-2.

A pre-UFS project groundwater monitoring event was conducted in July 2021.

After slag crushing was initiated, biweekly sampling was conducted in October, November, and December 2021.

In accordance with the UFS GMP, sampling frequency transitioned to monthly from January 2022 to present.

(1) Wells DH-56 and EH-60 have been dry since the UFS groundwater monitoring program was initiated.

(2) Tier 2 well EH-58 was added to the monitoring program in February, March, and April 2022 based on trends observed at upgradient sentinel well DH-53.

Tier 2 well EH-110 was added to the monitoring program in April 2022 based on trends observed at upgradient sentinel well EH-61.

(3) Well EH-61 was added to the monitoring program as a replacement for adjacent well EH-60.

bgs-Below Ground Surface

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 3/7/2023 10:45:36 AM	2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	UFS PROJECT GROUNDWATER MONITORING LOCATIONS	FIGURE 2-2

Path: G:\PROJECT\10022\2022 WRM\Fig2-2_SlagWells.mxd

Table 2-7. UFS Project Groundwater Sample Analytical Parameter List
2022 Water Resources Monitoring Report - East Helena Facility

Parameter	Analytical Method (1)	Project Required Detection Limit (mg/L)	Montana Groundwater Human Health Standards (mg/L)(2)
Common Ions			
Sulfate	300.0	1	NA
Chloride	300.0/SM 4500CL-B	1	NA
Magnesium	242.1/200.7	1	NA
Potassium	258.1/200.7	1	NA
Trace Constituents (Total and/or Dissolved) (3)(4)			
Arsenic (As)	200.8/SM 3114B	0.002	0.010
Selenium (Se)	200.7/200.8/SM 3114B	0.001	0.050
Field Parameters (5)			
Static Water Level	HF-SOP-10	0.01 ft	NA
Water Temperature	HF-SOP-20	0.1 °C	NA
Dissolved Oxygen (DO)	HF-SOP-22	0.01 mg/L	NA
pH	HF-SOP-20	0.01 pH standard unit	NA
Specific Conductance (SC)	HF-SOP-79	1 µmhos/cm	NA

Notes:

(1) Analytical methods are from the most recent edition of *Standard Methods for the Examination of Water and Wastewater* (SM); *Methods for the Determination of Metals in Environmental Samples,* Supplement I, EPA/600/R-94/111 (May 1994); or *Methods for the Determination of Inorganic Substances in Environmental Samples* , EPA/600/R-93/100 (August 1993).

(2) Standards from Montana Circular DEQ-7 (June 2019 Version). NA = not applicable (no human health standard).

(3) If sampled, residential/public water supply well samples will be analyzed for both total and dissolved trace constituents; monitoring well samples will be analyzed for dissolved metals only.

(4) Samples to be analyzed for dissolved constituents will be field-filtered through a 0.45 µm filter.

(5) Field parameters measured in a flow cell in accordance with project SOPs.

2.3 CAPMP DATA MANAGEMENT AND QUALITY CONTROL

Procedures for CAPMP data review, validation, and reporting are presented and discussed in the East Helena QAPP (Hydrometrics, 2015a), the DMP (Hydrometrics, 2011), the 2022 CAPMP (Hydrometrics, 2022a), and the UFS GMP (Hydrometrics, 2021a). Included in these documents are control limits and criteria for specific types of field and laboratory quality control (QC) samples, data validation and verification methods, potential corrective actions if criteria are not met, and database management procedures. Field QC samples collected for the groundwater monitoring program included deionized (DI) water blanks, equipment rinsate blanks (to verify the effectiveness of equipment decontamination procedures), and field duplicate samples, all collected at a frequency of 5% (1 per 20 field samples) for both monitoring wells and residential wells. Field QC samples for surface water included DI blanks and field duplicate samples, both collected at a frequency of 5% (1 per 20 samples).

The DMP includes checklists for review of both field and laboratory documentation (prior to formal validation of laboratory data), and post-validation review and approval of the East Helena database (Hydrometrics, 2011). All data collected under the 2022 WRM program has been reviewed and validated in accordance with these procedures and entered into the East Helena Project water quality database. The 2022 data validation and verification process resulted in qualification of a small percentage of the total data points collected as estimated due to minor QC sample exceedances (e.g., field duplicate control limit exceedances). For the spring 2022 data set, 97.4% of the surface water results and 100% of the monitoring well and residential/public water supply well results were accepted without any qualifiers applied; for the fall 2022 data set, 99.7% of the surface water results, and 100% of the monitoring well and residential/public water supply well results were accepted without any qualifiers applied. All WRM data collected during 2022 was designated as usable for CAPMP objective purposes following validation.

3.0 2022 WATER RESOURCES MONITORING RESULTS

3.1 SURFACE WATER MONITORING RESULTS

The 2022 surface water monitoring program included measurement of surface water elevations, streamflow rates, and surface water quality sampling (Section 2.1). The surface water elevation data was used in conjunction with concurrent groundwater elevation data to develop groundwater potentiometric maps and evaluate groundwater flow directions and groundwater/surface water interactions. The streamflow and surface water quality data were used to delineate gaining and losing segments of Prickly Pear Creek, and document current water quality conditions in the project area.

The total precipitation measured in 2022 at the Helena Regional Airport station (11.50 inches) represented a 34% increase from the 2021 total of 8.61 inches. The 2022 precipitation total returned to near the long-term average of 11.31 inches after several relatively dry years in 2020 (9.87 inches) and 2021 (8.61 inches)[3]. Snowpack in 2022, however, (measured as snow-water equivalents at a SNOTEL station in Tizer Basin, near the headwaters of Prickly Pear Creek) was low throughout most of early 2022, remaining at near minimum period of record values from November 2021 through March 2022. Some additional snowfall and lack of snowmelt in April 2022 shifted the snow-water equivalent toward the period of record median through early May[4]. Annual variability in precipitation and associated Prickly Pear Creek streamflow directly impacts plant site and downgradient groundwater conditions.

3.1.1 Surface Water Elevation and Flow

Streamflow and elevation measurements were recorded in June and October 2022. Streamflow and stream stage data are in Table 3-1 with site locations shown on Figure 2-1. Prickly Pear Creek flows measured in 2022 (Table 3-1) were higher than those measured in 2021. Measured flows for June 2022 were 95 to 143 cubic feet per second (cfs), compared with a June 2021 range of 33 to 73 cfs. Similarly, October 2022 flows (19 to 26 cfs) were higher than September 2021 flows (4 to 16 cfs). Besides climatic affects discussed above, the timing of sampling events can affect measured streamflows and therefore water quality data. For example, 2021 fall flow measurements were recorded in September, while irrigation water was being diverted from the creek, while the 2022 fall event in October likely occurred after irrigation diversions were terminated for the season.

[3] https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt4055
[4] https://www.nrcs.usda.gov/Internet/WCIS/AWS_PLOTS/siteCharts/POR/WTEQ/MT/Tizer%20Basin.html

TABLE 3-1. 2022 PRICKLY PEAR CREEK STREAMFLOW AND STAGE MEASUREMENTS

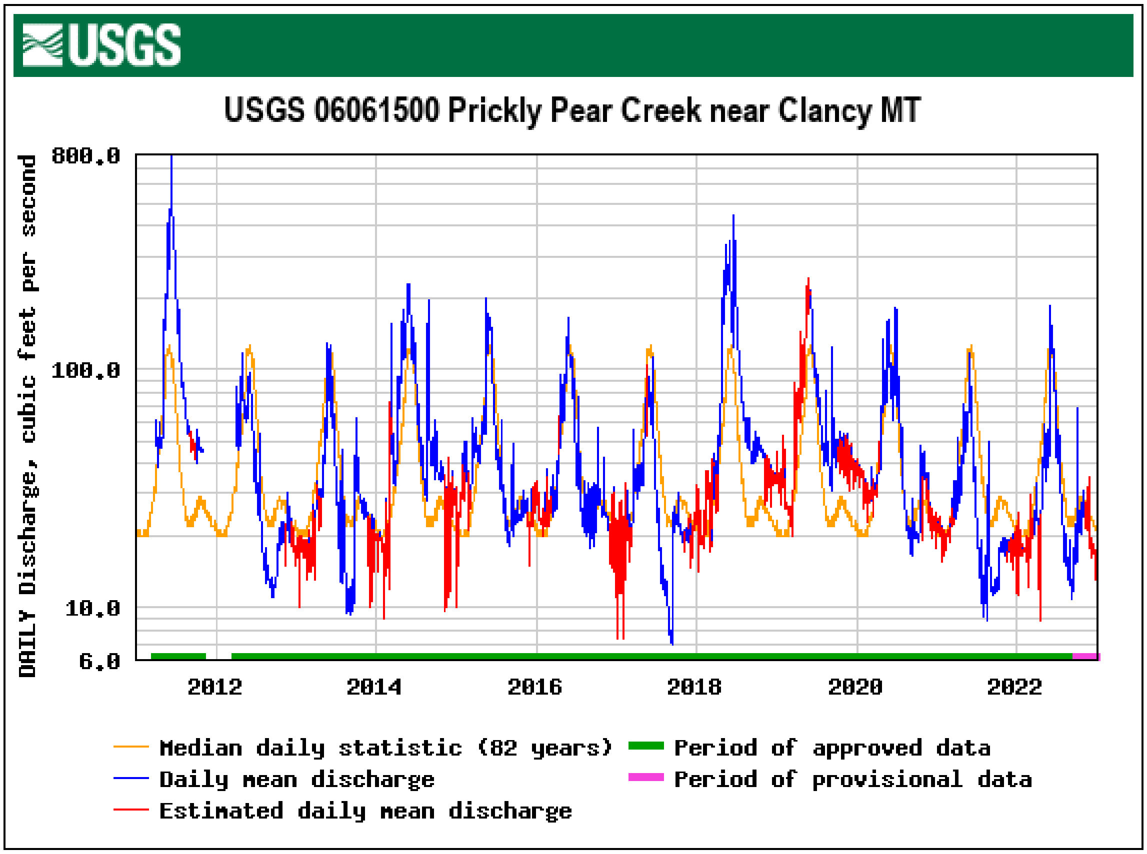
Monitoring Site	Location	Stream Stage – ft AMSL		Stream Flow – cfs	
		6/6/2022	10/13/2022	6/14/2022	10/13/2022
PPC-3A	PPC Upstream of Facility	3928.23	3927.05	136.3	25.4
PPC-4A	PPC Adjacent to Facility	3911.07	3910.02	142.3	25.6
Trib-1	Tributary drainage at railroad crossing	3919.18	3917.83	0.10	0.009
Trib-1B	Tributary drainage south of Facility	3914.69	Dry	0.004 E	Dry
Trib-1D	Tributary site at PPC Confluence	3905.34	3905.20	0.040	0.012
PPC-5A	PPC Adjacent to Facility	3903.58	3902.26	142.8	24.9
PPC-7	PPC Downstream Facility Boundary	3883.21	3881.74	138.4	25.8
PPC-8	PPC at West Gail St in East Helena	3868.86	3867.81	NM	NM
PPC-36A	PPC 0.7 mi downstream of Facility	3855.92	3854.68	105.1	24.5
PPC-9A	PPC 1.0 mi downstream of Facility	3846.10	3845.40	NM	NM
SG-16	PPC 2.9 mi downstream of Facility	3767.37	3765.90	94.9	18.9

PPC – Prickly Pear Creek
AMSL – Above Mean Sea Level
Sites listed in upstream to downstream order; locations shown on Figure 2-1
NM – not measured per 2022 CAPMP
E – flow estimated

Figure 3-1 shows daily average streamflow data for 2011 through 2022 from a USGS gaging station on Prickly Pear Creek approximately five miles upstream of the Facility. As shown on the hydrograph, 2022 Prickly Pear Creek flows at the gaging station tracked the long-term median closely, with 2022 values only slightly below long-term median flows during the ascending and descending portions of the hydrograph (Figure 3-1).

The 2022 data indicates that Prickly Pear Creek flow adjacent to the Facility at sites PPC-3A, -4A, -5A, and -7 (Figure 2-1) showed no significant changes from upstream to downstream during either seasonal monitoring event (Table 3-1). Overall, upstream to downstream flow measurements along this reach differed by less than 5% for both the June and October monitoring events. The 2022 results are consistent with previous flow data, suggesting there is limited net interaction between Prickly Pear Creek and the local groundwater system adjacent to the Facility. Flow rates and trends at sites PPC-4A and PPC-5A, located on the realigned segment of the creek, are similar to those measured in previous years indicating that the realignment project, completed as part of the SPHC CM, has maintained the historic condition of no significant net flow gains or losses adjacent to the Facility. Downstream of the Facility, the 2022 flow data shows streamflow decreases in a downstream direction, indicating leakage from the creek to groundwater and irrigation diversions from the creek; this result is also consistent with historic observations. Although irrigation diversion flows were not measured in 2022, previous comprehensive synoptic flow data accounting for irrigation diversions has shown net leakage losses on the order of 10 to 20 cfs between Highway 12 and Canyon Ferry Road (sites PPC-7 and SG-16, Figure 2-1; Hydrometrics, 2018).

FIGURE 3-1. 2011 THROUGH 2022 PRICKLY PEAR CREEK FLOW HYDROGRAPH UPSTREAM OF FORMER SMELTER



3.1.2 Semiannual Surface Water Quality Results

The 2022 semiannual surface water quality data is summarized in Table 3-2 with the complete 2022 dataset in Appendix A. The data shows Prickly Pear Creek water to be a calcium-bicarbonate type water with alkaline pH and total dissolved solids (TDS) concentrations ranging from 97 to 212 milligrams per liter (mg/L) seasonally. As observed during past monitoring, seasonal concentrations of major ions (calcium, magnesium, sodium, potassium, sulfate) in 2022 were very consistent from upstream of the smelter site (site PPC-3A) to downstream site SG-16 near Canyon Ferry Road, with October low flow concentrations about 2 to 3 times higher than the June high flow concentrations. The tributary sites show higher TDS (282 to 531 mg/L) and major ion concentrations than Prickly Pear Creek, with Trib-1 and Trib-1B showing a calcium-bicarbonate signature and Trib-1D showing a calcium-bicarbonate-sulfate signature.

Table 3-2. 2022 Surface Water Quality Monitoring Results

2022 Water Resources Monitoring Report - East Helena Facility

Monitoring Site	Prickly Pear Creek						Tributary Drainage		
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	TRIB-1	TRIB-1B	TRIB-1D
Sample Date	6/6/22						6/6/22		
Field Parameters									
pH (s.u.)	7.77	7.87	7.85	7.77	7.66	7.77	7.56	6.88	7.73
SC (µmhos/cm)	133	132	134	132	132	132	425	479	494
Flow (cfs)	136.3	142.3	142.8	138.4	105.1	94.9	0.10	0.004 E	0.04
Laboratory Analyses									
Total Dissolved Solids	140	100	103	101	97	104	282	326	339
Calcium	15	16	16	16	16	15	53	60	56
Magnesium	3	3	3	3	3	3	13	14	16
Sodium	6	6	7	6	6	6	22	23	23
Potassium	1	1	2	2	2	2	4	4	3
Chloride	2	2	2	2	2	2	6	6	5
Sulfate	20	19	19	19	19	19	50	56	92
Trace Metals (Total Recoverable)									
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0011	0.0006
Arsenic	0.004	0.004	0.004	0.004	0.004	0.004	0.006	0.011	0.009
Cadmium	0.00020	0.00021	0.00018	0.00020	0.00021	0.00023	0.00008	0.02040	0.00008
Copper	0.004	0.004	0.004	0.005	0.005	0.005	<0.002	0.025	0.004
Iron	0.54	0.54	0.50	0.53	0.53	0.57	0.26	0.14	0.51
Lead	0.0058	0.0061	0.0058	0.0063	0.0064	0.0066	0.0053	0.0104	0.0025
Manganese	0.05	0.05	0.05	0.05	0.06	0.05	0.03	1.02	0.24
Mercury	0.000013	0.000012	0.000014	0.000013	0.000012	0.000014	0.000011	0.000178	0.000008
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.051	0.053	0.050	0.052	0.053	0.053	<0.008	0.850	0.008

Monitoring Site	Prickly Pear Creek						Tributary Drainage		
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	SG-16	TRIB-1	TRIB-1B	TRIB-1D
Sample Date	10/13/22						10/13/22		
Field Parameters									
pH (s.u.)	8.13	8.25	8.25	8.22	8.17	7.92	7.56		7.62
SC (µmhos/cm)	285	285	288	286	287	287	439		684
Flow (cfs)	25.4	25.6	24.9	25.8	24.5	18.9	0.009 E		0.012
Laboratory Analyses									
Total Dissolved Solids	198	207	204	196	199	212	302		531
Calcium	35	35	36	36	35	35	60	*Site*	101
Magnesium	8	8	8	9	9	8	15	*Dry*	22
Sodium	17	17	17	17	17	17	25	*No*	31
Potassium	3	3	3	3	3	3	4	*Sample*	8
Chloride	8	8	8	8	8	8	9		15
Sulfate	64	64	64	64	64	65	72		241
Trace Metals (Total Recoverable)									
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.0005
Arsenic	0.004	0.005	0.005	0.005	0.005	0.005	0.005		0.005
Cadmium	0.00008	0.00008	0.00008	0.00009	0.00008	0.00010	0.00039		0.00007
Copper	<0.002	<0.002	<0.002	0.002	0.002	0.002	<0.002		0.003
Iron	0.14	0.15	0.16	0.16	0.15	0.18	0.24		0.17
Lead	0.0010	0.0011	0.0011	0.0011	0.0011	0.0017	0.0067		0.0010
Manganese	0.04	0.04	0.04	0.04	0.03	0.03	0.02		0.02
Mercury	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	0.000021		0.000005
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Zinc	0.040	0.038	0.037	0.037	0.039	0.039	<0.008		<0.008

All concentrations in mg/L unless otherwise noted.

Concentration exceeds applicable surface water quality standard (MDEQ, 2019). (shaded cells)

Prickly Pear Creek sites listed in upstream to downstream order.

E-Estimated

Complete 2022 database in Appendix A.

Total recoverable trace metal concentrations are also relatively low and consistent throughout the sampled reach of Prickly Pear Creek (Table 3-2, Appendix A), with antimony and selenium below the laboratory reporting limits in all 2022 creek samples. Mercury concentrations were also below laboratory reporting limits in all fall 2022 samples. Water quality criterion exceedances (DEQ-7 surface water standards; MDEQ, 2019) in 2022 Prickly Pear Creek samples were limited to total recoverable lead, which exceeded the hardness-dependent chronic aquatic life criteria in all six June samples but none of the October samples (Table 3-2). As observed during previous monitoring, the lead surface water quality exceedances occurred both upstream and downstream of the Facility, indicating that upstream contaminant sources are producing these exceedances. The occurrence of elevated metals concentrations well upstream of the Facility has been noted in numerous studies, including the watershed total maximum daily load (TMDL) document (USEPA, 2004b). Overall, the 2022 Prickly Pear Creek water quality monitoring results are consistent with past sampling results dating back more than 20 years.

Sampling results from tributary drainage site Trib-1B in June 2022 showed water quality standard exceedances for cadmium, copper, lead, and zinc (aquatic criteria), along with HHS exceedances for arsenic and mercury. Trib-1B was dry in October 2022, and no sample was collected. No exceedances of water quality standards were observed at sites Trib-1 or Trib-1D (at the confluence with Prickly Pear Creek) during either of the 2022 seasonal monitoring events (Table 3-2). Elevated metals concentrations in the tributary drainage have been documented through past sampling (see below), resulting in removal of approximately 350 cubic yards of metals-impacted soils in the vicinity of Trib-1B in November 2018 (see Figure 2-1).

Table 3-3 includes a comparison of the post-soil removal (2019-2022) concentrations at tributary drainage sites Trib-1B and Trib-1D (downstream of the soil removal area) compared to pre-soil removal 2017-2018 concentrations. As shown in Table 3-3, average concentrations of numerous constituents have shown considerable decreases from 2017-2018 pre-soil removal averages compared to 2022 concentrations, with overall decreases at Trib-1B of 57% for sulfate and 71% for iron and zinc. At Trib-1D, where the tributary drainage flows into Prickly Pear Creek, decreases in annual average concentrations have been observed for sulfate and for all metals listed in Table 3-3, with decreases of more than 90% for both cadmium and zinc. Conversely, average manganese concentrations have increased at site Trib-1B over the comparison period, from 0.33 mg/L in 2017-2018 to 1.02 mg/L in 2022. The tributary drainage consists of a wetland area with both surface and subsurface flow in various reaches, and variability in metals concentrations over time at tributary sites likely reflects fluctuations in redox conditions, with higher concentrations generally present under more reducing conditions, possibly attributable to decreased precipitation and generally lower post-2017/2018 flows. When redox conditions are reducing, iron and manganese in soils tends to solubilize, which can also release other metals (e.g., arsenic, copper, lead) that may be adsorbed to the iron and manganese. The tributary sites will be included in the 2023 monitoring program to continue assessment of post-soil removal surface water concentrations.

TABLE 3-3. TRIBUTARY DRAINAGE CONCENTRATION COMPARISON 2017 - 2022

2022 Water Resources Monitoring Report - East Helena Facility

	Flow	Sulfate	Arsenic	pH	Cadmium	Copper	Iron	Lead	Manganese	Zinc
	(cfs)	mg/L	mg/L	S.U.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Trib-1B										
2017/18 Average	*0.07*	*129*	*0.011*	*7.07*	*0.038*	*0.022*	*0.48*	*0.0259*	*0.33*	*2.91*
2019 Average	*0.028*	*84*	*0.007*	*7.38*	*0.022*	*0.021*	*0.40*	*0.0179*	*0.71*	*1.08*
2020 Average	*0.021*	*68*	*0.016*	*6.77*	*0.018*	*0.025*	*0.71*	*0.0153*	*1.14*	*0.82*
2021 Average	*0.002*	*70*	*0.022*	*7.10*	*0.038*	*0.050*	*1.01*	*0.0590*	*0.73*	*1.21*
2022 Average	*0.004*	*56*	*0.011*	*6.88*	*0.0204*	*0.025*	*0.14*	*0.0104*	*1.02*	*0.85*
% Reduction		**57%**	**0%**	**3%**	**46%**	**-12%**	**71%**	**60%**	**-207%**	**71%**
Trib-1D										
2017/18 Average	*0.11*	*223*	*0.015*	*8.63*	*0.00211*	*0.0072*	*1.13*	*0.0081*	*0.40*	*0.202*
2019 Average	*0.056*	*176*	*0.008*	*8.99*	*0.00020*	*0.0025*	*0.72*	*0.0020*	*1.02*	*0.021*
2020 Average	*0.057*	*145*	*0.00867*	*7.59*	*0.00025*	*0.0023*	*0.74*	*0.0016*	*0.85*	*0.018*
2021 Average	*0.042*	*120*	*0.012*	*7.85*	*0.00013*	*0.002*	*0.81*	*0.0058*	*0.55*	*0.009*
2022 Average	*0.026*	*167*	*0.007*	*7.68*	*0.00008*	*0.0035*	*0.34*	*0.0018*	*0.13*	*0.008*
% Reduction		**25%**	**52%**	**11%**	**96%**	**51%**	**70%**	**78%**	**68%**	**96%**

Metals analyses are total recoverable fraction.
% Reduction shown as percent change from 2017/18 average to 2022 average.
2022 average for Trib-1B represents one sample (site was dry in fall 2022).

3.2 RESIDENTIAL / PUBLIC WATER SUPPLY SAMPLING RESULTS

Table 3-4 includes a statistical summary of the 2022 residential/public water supply well arsenic and selenium concentrations along with an exceedance summary of State of Montana human health standards (HHSs) for groundwater (MDEQ, 2019). Complete 2022 analytical results, including both total and dissolved metals concentrations, are included in Appendix A with residential well locations shown on Exhibit 1. With the exception of copper and iron at a few residential wells, the total and dissolved metals concentrations are virtually identical. Detectable total iron concentrations ranged from 0.03 to 0.92 mg/L in 2022, and detectable total copper concentrations ranged from 0.001 to 0.051 mg/L (Appendix A). Variable copper and iron concentrations at residential wells are occasionally observed due to the presence of copper and iron in domestic water system plumbing, piping, and well construction materials. Other metals concentrations in residential and public water supply wells were largely near or below reporting limits, with all 2022 results for cadmium, lead, mercury, and thallium below detection.

None of the sampled water supply wells exhibited HHS exceedances for selenium in 2022, while four of the twenty wells sampled showed HHS exceedances for arsenic, consistent with previous results (Table 3-4). Selenium concentrations at well R11 have increased over the last ten years but have remained below the 0.050 mg/L HHS; dissolved selenium concentrations at this well in 2022 ranged from 0.043 to 0.044 mg/L. The four wells in Table 3-4 exhibiting arsenic exceedances in 2022 (R13, R15, R16, and R17) showed concentrations comparable with historic results, and are located either south (upgradient) of the Facility or to the west in an area of known naturally occurring groundwater arsenic (see Section 3.3). There were no exceedances recorded in 2022 or in previous years at the three COEH municipal water supply wells located north of the Facility (Well IDs R18, R19, and R20 in Table 3-4).

3.3 GROUNDWATER MONITORING RESULTS AND DATA ANALYSIS

This section presents a summary of current groundwater quality conditions and trends, and the status of the groundwater arsenic and selenium plumes. With completion of the scheduled CMs in 2016, the monitoring program transitioned from a contaminant source area characterization and plume delineation program to a remedy performance monitoring program appropriate to the remediation and CMI phase of a RCRA Corrective Action remediation project. In their *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (USEPA, 2004a), USEPA defines performance monitoring as “the periodic measurement of physical and/or chemical parameters to evaluate whether a remedy is performing as expected.” More recently published USEPA guidance on groundwater remediation completion strategies (USEPA, 2013, 2014a, 2014b) includes discussions of recommended remedy evaluation strategies. Based on these guidance documents, and goals

Table 3-4. Summary of 2022 Residential/Public Water Supply Well Arsenic and Selenium Data

2022 Water Resources Monitoring Report - East Helena Facility

Map Key (see Exhibit 1)	Well Use	# of Samples in 2022	Dissolved Arsenic (mg/L)			Dissolved Selenium (mg/L)		
			Concentration		HHS Exceedances	Concentration		HHS Exceedances
			Jun-22	Oct-22		Jun-22	Oct-22	
R1	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R2	Irrigation	1	<0.002	NS	0	<0.001	NS	0
R3*	Drinking	3	<0.002/<0.002	<0.002	0	0.003/0.003	0.003	0
R4	Irrigation	2	<0.002	<0.002	0	0.001	0.001	0
R5	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R6	Drinking/Irrigation	2	<0.002	<0.002	0	0.002	0.002	0
R7	Drinking/Irrigation	2	<0.002	<0.002	0	0.001	<0.001	0
R8	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R9	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R10	Irrigation	1	<0.002	NS	0	0.002	NS	0
R11	Drinking/Irrigation	2	<0.002	<0.002	0	0.043	0.044	0
R12	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R13	Drinking/Irrigation	2	0.016	0.015	2	0.001	<0.001	0
R14	Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R15*	Drinking/Irrigation	3	0.016	0.016/0.017	3	0.002	0.002/0.002	0
R16	Drinking/Irrigation	2	0.017	0.016	2	0.002	0.002	0
R17	Drinking/Irrigation	2	0.018	0.017	2	0.002	0.002	0
R18	Public Water Supply	2	<0.002	<0.002	0	<0.001	<0.001	0
R19	Public Water Supply	2	<0.002	<0.002	0	<0.001	<0.001	0
R20	Public Water Supply	2	<0.002	<0.002	0	<0.001	<0.001	0

All concentrations are dissolved fraction; total metals concentrations included in Appendix A.

*Locations with two results shown for June 2022 (well R3) and October 2022 (well R15) represent sample/field duplicate results

HHS - Human Health Standard from MDEQ, 2019: arsenic = 0.010 mg/L, selenium = 0.050 mg/L

NS - not sampled (irrigation well shut down for season) and objectives specific to the East Helena Project (Section 1), the 2022 performance monitoring program included two components:

1. Groundwater level and contaminant concentration trend analyses at selected wells in Facility contaminant source areas, and near the leading edges of the arsenic and selenium plumes; and
2. Contaminant plume stability analyses (i.e., are the plumes expanding, contracting or stable).

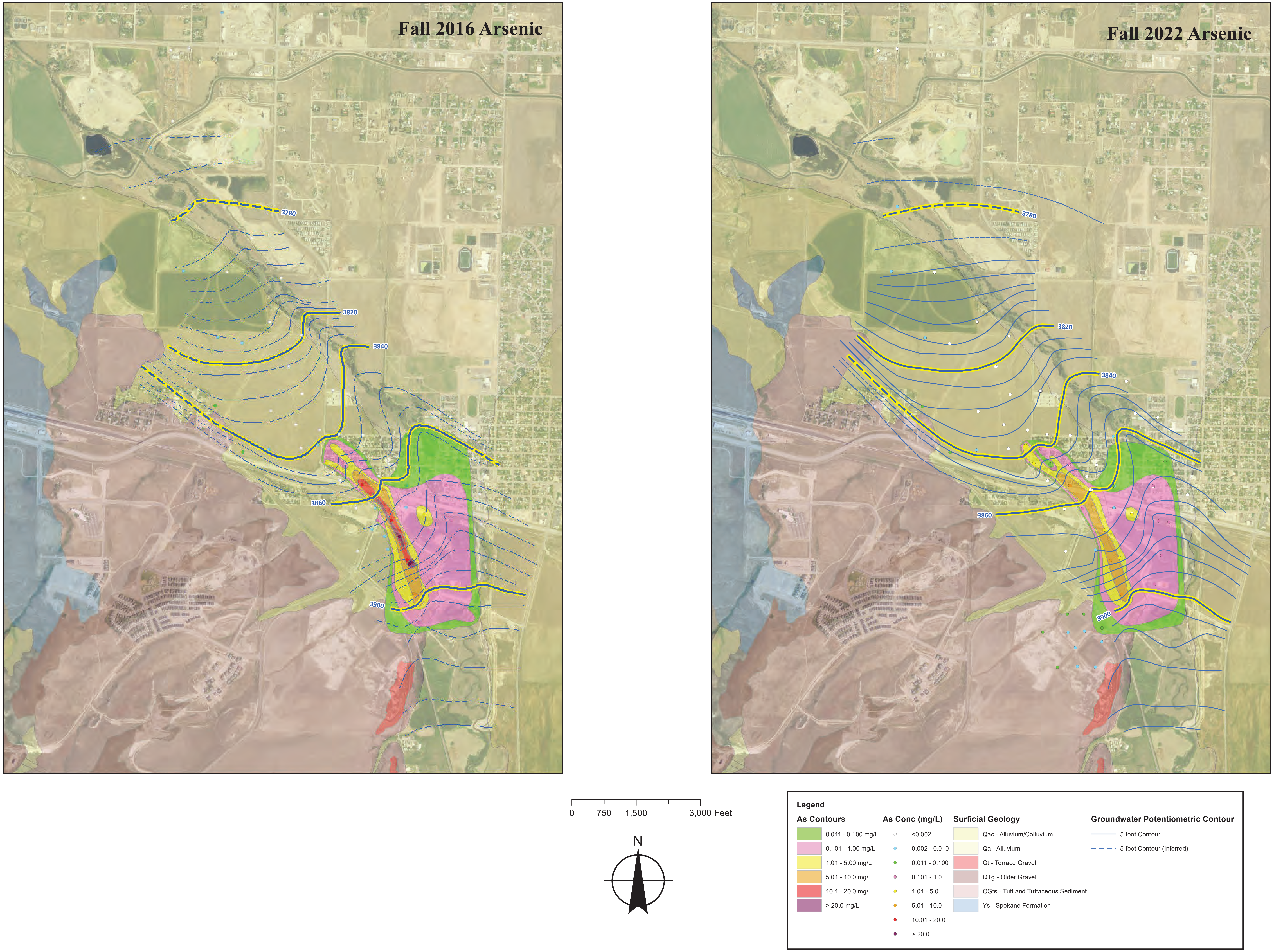
Following is a summary of 2022 groundwater conditions in the Project area, followed by discussions of the two performance monitoring components.

3.3.1 General Groundwater Conditions

The hydrogeology and geochemistry of the East Helena Facility and Project Area has been described in several documents including Hydrometrics, 2010, 2015b, and 2016; GSI, 2014; and CH2M, 2018. The alluvial aquifer on the Facility extends from the top of the saturated zone or water table, downward to a low permeability tertiary ash/clay basal layer. On the Facility, the depth to groundwater varies from less than 10 feet below ground surface (bgs) in the south and near Prickly Pear Creek, to about 50 feet bgs in the northwest portion of the Facility. The base of the aquifer (the ash/clay layer) varies in depth from about 20 feet bgs in the southwest portion of the Facility, to more than 70 feet in the northeast portion. As a result, the saturated thickness of the alluvial aquifer currently ranges from about 2 to 4 feet in the south, to about 6 to 8 feet in the north of the Facility (5 to 10 feet less than pre-SPHC conditions). A deeper groundwater system also occurs beneath the Facility with the deeper system comprised of isolated to poorly interconnected sandy lenses or zones within the Tertiary sediment unit. The contaminated soils/fill and groundwater plumes are largely restricted to the upper alluvial aquifer.

As previously noted, the primary groundwater constituents of concern (COCs) are arsenic and selenium, both of which exceed applicable HHSs in groundwater beneath and downgradient of the Facility. Secondary COCs exceeding HHSs in localized portions of the Facility, and rarely if ever in downgradient groundwater, include antimony, cadmium, and zinc. The 2022 arsenic and selenium groundwater plumes, as well as the 2016 through 2021 plumes for comparison, are shown on Figures 3-2 and 3-3, respectively.

Groundwater contaminant source areas have been delineated through multiple studies dating back more than two decades, with the two most recent investigations presented in Hydrometrics, 2015b and 2016. Based on results of prior investigations, confirmed or suspected historic (i.e., during smelter operations) groundwater contaminant sources include the South Plant Area (Tito Park, former Acid Plant Sediment Drying area, and Upper Ore Storage Area), former Lower Lake, the former Acid Plant settling pond area, former Speiss/Dross Area, and the former Lower Ore Storage Area (Figure 3-4). Based on the 2014 and 2015 Source Area Investigations (SAIs) and other data evaluations

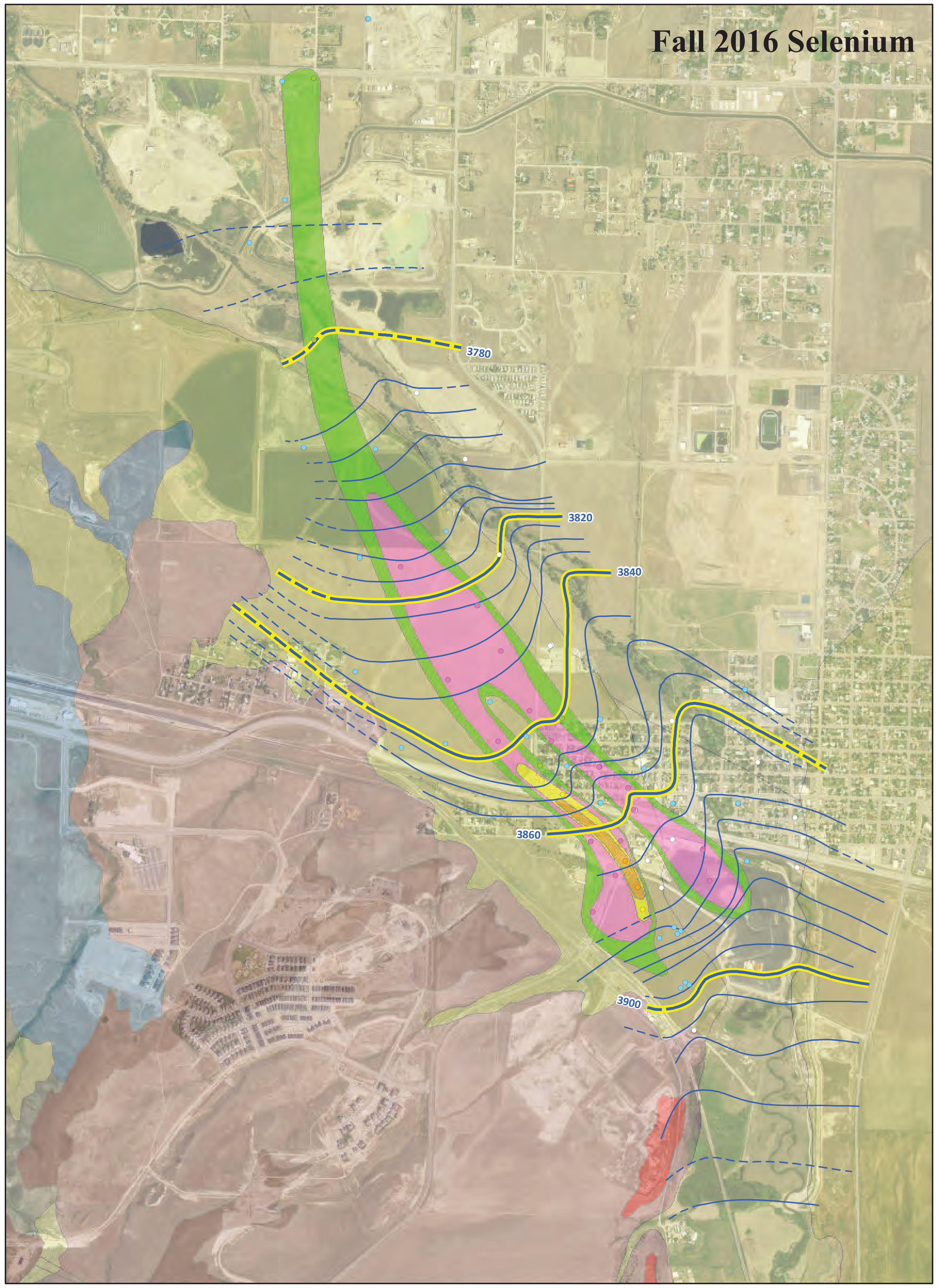


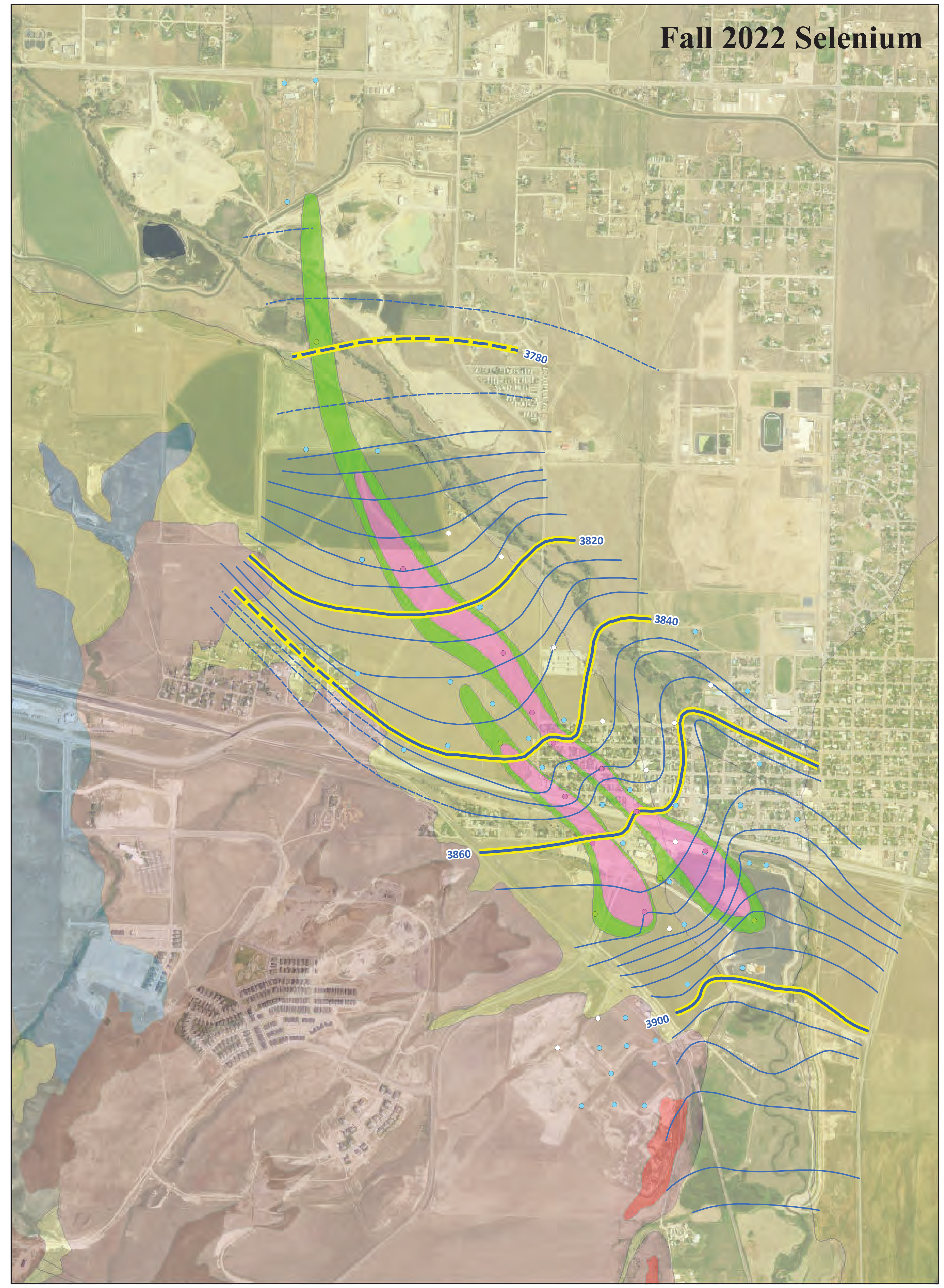
Hydrometrics, Inc.
Consulting Scientists and Engineers

Date Saved: 3/17/2023 3:04:05 PM

G:\PROJECT\10022\2022 WRM\Fig3-2_2016-22_As_Plume_Pot.mxd

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2016 AND 2022 GROUNDWATER ARSENIC PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY	FIGURE 3-2





0 750 1,500 3,000 Feet

N

Legend

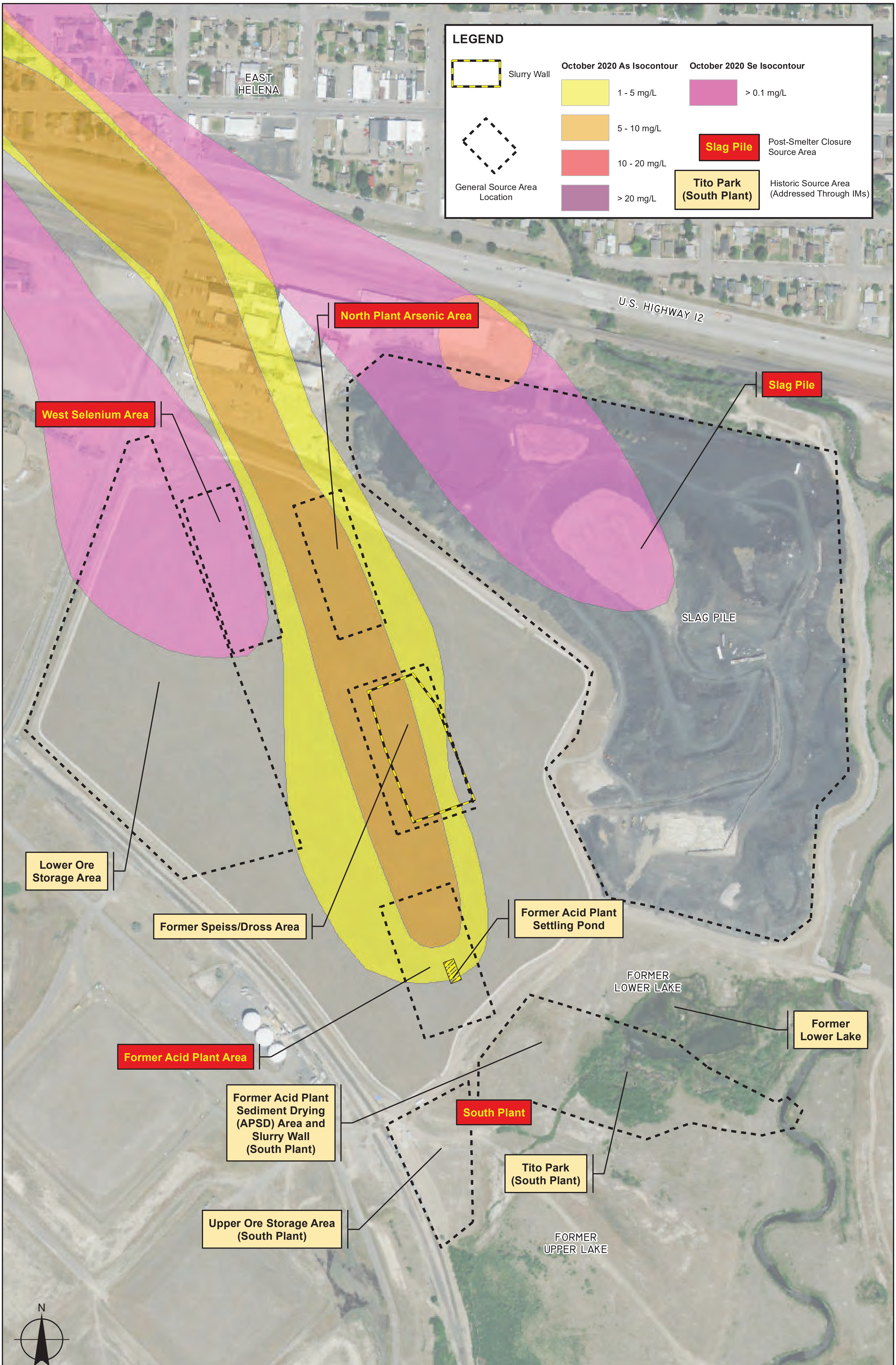
Se Contours	Se Conc (mg/L)	Surficial Geology	Groundwater Potentiometric Contours
0.051 - 0.100 mg/L	<0.001	Qac - Alluvium/Colluvium	5-foot Contour
0.101 - 0.500 mg/L	0.001-0.050	Qa - Alluvium	5-foot Contour (Inferred)
0.501 - 1.0 mg/L	0.051-0.100	Qt - Terrace Gravel	
1.01 - 3.0 mg/L	0.101-0.500	QTg - Older Gravel	
> 3.0 mg/L	0.501-1.0	OGts - Tuff and Tuffaceous Sediment	
	1.01-3.0	Ys - Spokane Formation	
	>3.0		

Hydrometrics, Inc.
Consulting Scientists and Engineers

Date Saved: 3/17/2023 2:40:01 PM

G:\PROJECT\10022\2022 WRM\Fig3-3_2016-22_Se_Plume_Pot.mxd

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2016 AND 2022 GROUNDWATER SELENIUM PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY	FIGURE 3-3



0 150 300 600
Scale in Feet

Hydrometrics, Inc.
Consulting Scientists and Engineers

Date Saved: 3/7/2023 2:53:48 PM

2022 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

HISTORIC AND POST-SMELTER CLOSURE GROUNDWATER CONTAMINANT SOURCE AREAS

FIGURE
3-4

conducted as part of the CMS, the primary post-smelter closure contaminant source areas included portions of the South Plant Area, the former Acid Plant settling pond area (both areas where source removal CMs were subsequently implemented), the West Selenium Source Area, the North Plant Arsenic Source Area, and the slag pile. The SPHC, source removals, and ET Cover CMs have been completed at all source areas, with the exception of the slag pile. The planned slag pile remedial action (regrading and capping), to be completed after the UFS removal and reprocessing project, is intended to address this source area.

The configuration and geometry of the current arsenic plume (Figure 3-2) shows the primary plant site plume extending approximately 0.5 miles northwest of the Facility into the COEH, with a more diffuse (lower concentration) plume extending north of the slag pile. Maximum concentrations near 10 mg/L arsenic occur in the central plant site near the Speiss/Dross slurry wall in the North Plant Arsenic Source Area (Figure 3-4). Note that many plant site wells were dry or had insufficient water for sampling in 2022, including a number of the higher arsenic concentration (DH-17 and DH-79) and selenium concentration (DH-66) wells identified during previous monitoring, attesting to the effectiveness of the SPHC CM. The downgradient boundary of the arsenic plume as defined by the 0.01 mg/L (HHS) concentration contour is located along the north and west edges of East Helena, and has remained relatively stable since at least 2001 when the Facility was shutdown. An area of groundwater south and west of the former smelter with arsenic concentrations in the 0.005 to 0.025 mg/L range (Figure 3-2) is believed to be derived primarily from groundwater interactions with naturally-occurring arsenic-bearing Tertiary-age volcanoclastic sediments.

The selenium plume (Figure 3-3) extends offsite significantly further than the arsenic plume, due to a lower rate of geochemical attenuation (adsorption or coprecipitation) and the associated relatively conservative transport behavior of selenium, with the 0.05 mg/L (HHS) selenium plume extending approximately two miles northwest of the Facility. The primary current groundwater selenium sources are the West Selenium Source Area (west lobe) and the slag pile (east lobe) (Figure 3-4).

3.3.2 Groundwater Level and Concentration Trends

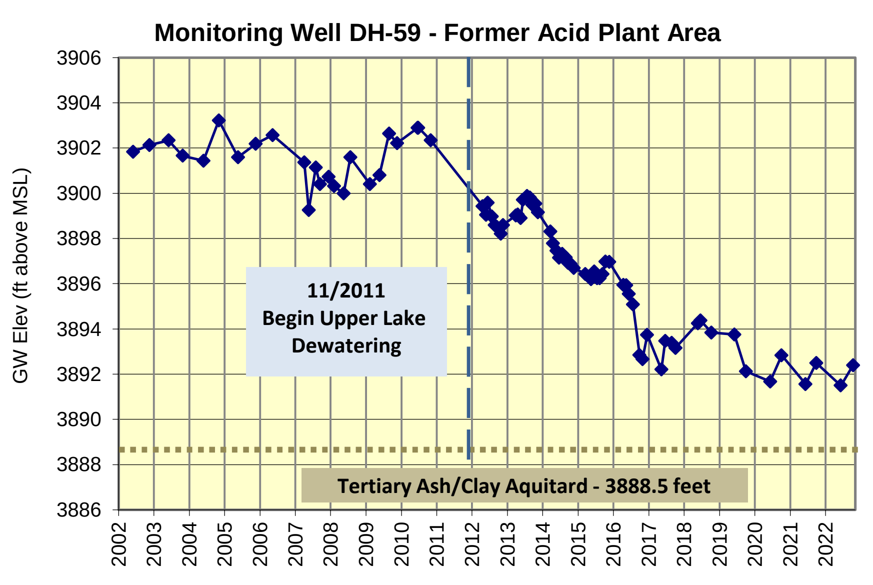
Precipitation totals in 2022 returned to near long-term averages after the exceptionally dry conditions experienced in 2020 and 2021, as discussed above in Section 3.1 and in the 2021 WRM Report (Hydrometrics, 2022b). However, generally lower groundwater levels persisted throughout the project area in 2022, and a number of wells scheduled for sampling in spring and/or fall 2022 could not be sampled due to dry conditions or insufficient water for sampling (Table 2-3), including DH-17, DH-56, DH-58, DH-66, DH-77, DH-79, and EH-139 in spring 2022, and DH-17, DH-42, DH-56, DH-58, DH-66, DH-77, DH-79, EH-57A, and EH-60 in fall 2022.

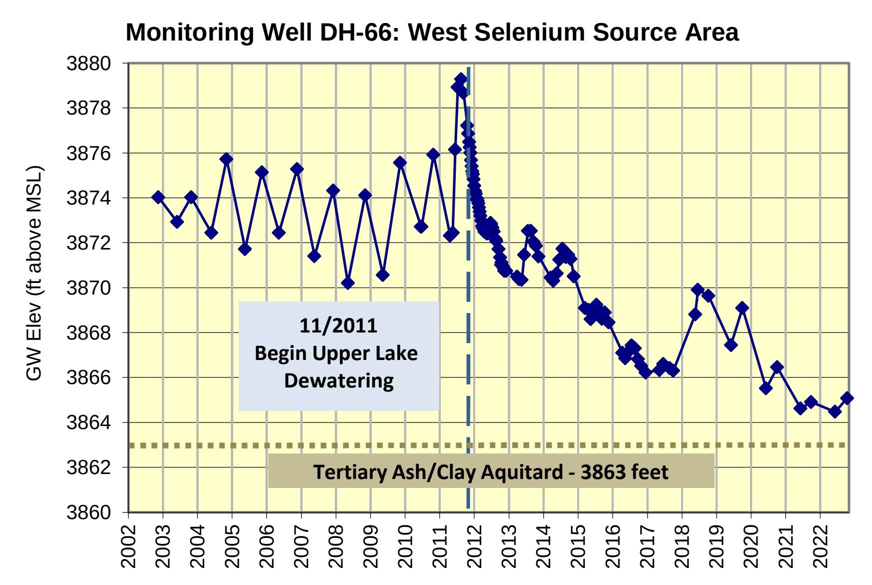
3.3.2.1 Groundwater Level Trends

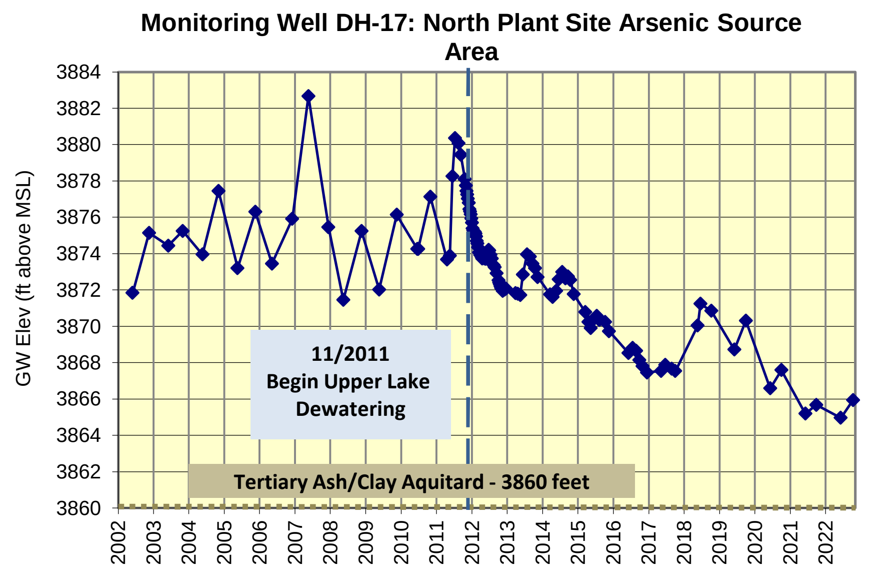
Groundwater level trends on the Facility are of particular interest since reducing groundwater levels is a critical component of the corrective measures program. As previously noted, the main objective of the SPHC CM is to reduce groundwater levels on the Facility, thereby reducing groundwater interaction with contaminated soils and associated contaminant leaching to groundwater.

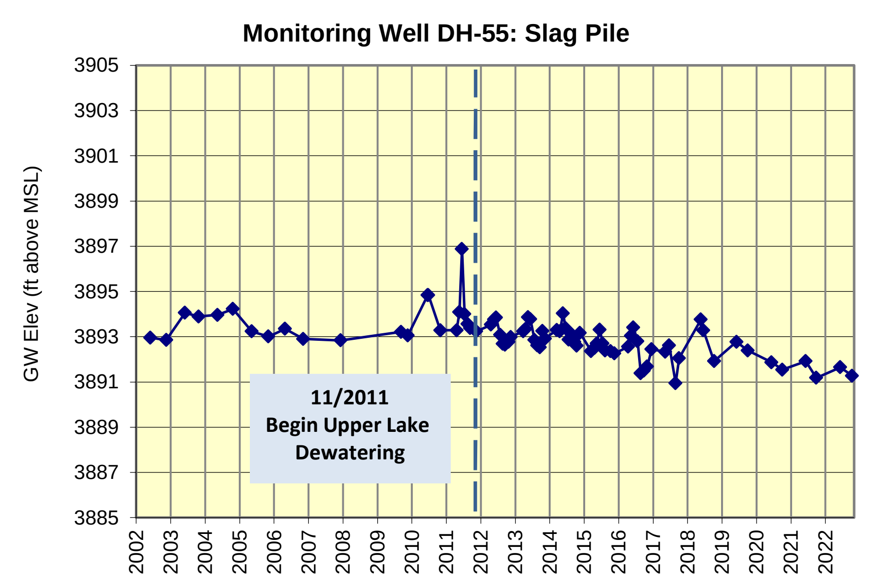
Appendix B includes the 2022 manual groundwater level measurements from the project area (in addition to the manual measurements, approximately 25 of the project area monitoring wells are instrumented for continuous water level recording). In 2022, manual water level measurements or dry conditions were recorded at 183 monitoring wells; seventeen wells were dry during both the June and October monitoring events including: DH-9, DH-22, DH-23, DH-36, DH-56, DH-57, DH-58, DH-61, EH-57, EH-57A, EH-60, EH-128, PZ-9A, PZ-36B, PZ-36C, SP-3, and SP-4; three wells (DH-54, EH-53, and EH-139) were dry during the June monitoring event, and eight wells (DH-42, DH-47, DH-48, DH-63, DH-71, DH-78, EH-205, and SP-5) were dry during the October monitoring event. Figure 3-5 includes groundwater hydrographs illustrating groundwater level trends for various portions of the Facility. Groundwater levels over most of the Facility have decreased since 2012 in response to the SPHC CM and other CM-related activities. Groundwater levels in the Acid Plant Area, illustrated by well DH-59, have declined by about 8 to 10 feet from typical pre-2012 levels, prior to SPHC CM initiation, through 2022. Similarly, the hydrograph for well DH-66 shows that water levels in the West Selenium Source Area have declined about 8 to 10 feet from 2012 through 2022, and in the North plant site Arsenic Source Area (well DH-17), water levels declined about 9 feet through 2022 (Figure 3-5). All three of these locations (DH-59, DH-66, and DH-17) also show the transitory effects of elevated 2018 and 2019 precipitation and snowpack on groundwater levels, illustrated by the temporary increase in water levels observed in 2018 and 2019, followed by a decrease to near-minimum values in 2020 and 2021 (Figure 3-5). In contrast to the Acid Plant, West Selenium, and North Plant Arsenic source area water level declines, water levels beneath the slag pile (well DH-55), have shown only small decreases (about 1 to 2 feet) in response to the SPHC CM. Groundwater levels in the eastern portion of the Facility (i.e., beneath the slag pile), are largely controlled by the relatively constant Prickly Pear Creek stage while water levels at the other locations were historically heavily influenced by the former Upper Lake, which was drained as part of the SPHC CM.

The CM-induced groundwater level declines between 2012 and 2022 have resulted in the desaturation of some of the most contaminated Facility soils, thereby reducing groundwater interactions with and potential contaminant leaching from these soils. The Figure 3-5 hydrographs include the elevation of the Tertiary ash/clay layer representing the base of the plume-bearing upper alluvial groundwater system at each location. In the former Acid Plant area, groundwater elevations have decreased from about 3901 feet AMSL to about 3892 feet in 2022 with the ash/clay layer at about 3889 feet. This represents a decrease in saturated thickness from 12 feet to 3 feet in this source area. The reduced saturated thickness, and relatively consistent hydraulic gradient over that time, represents an approximate 75% reduction in the groundwater flux through the former Acid Plant area







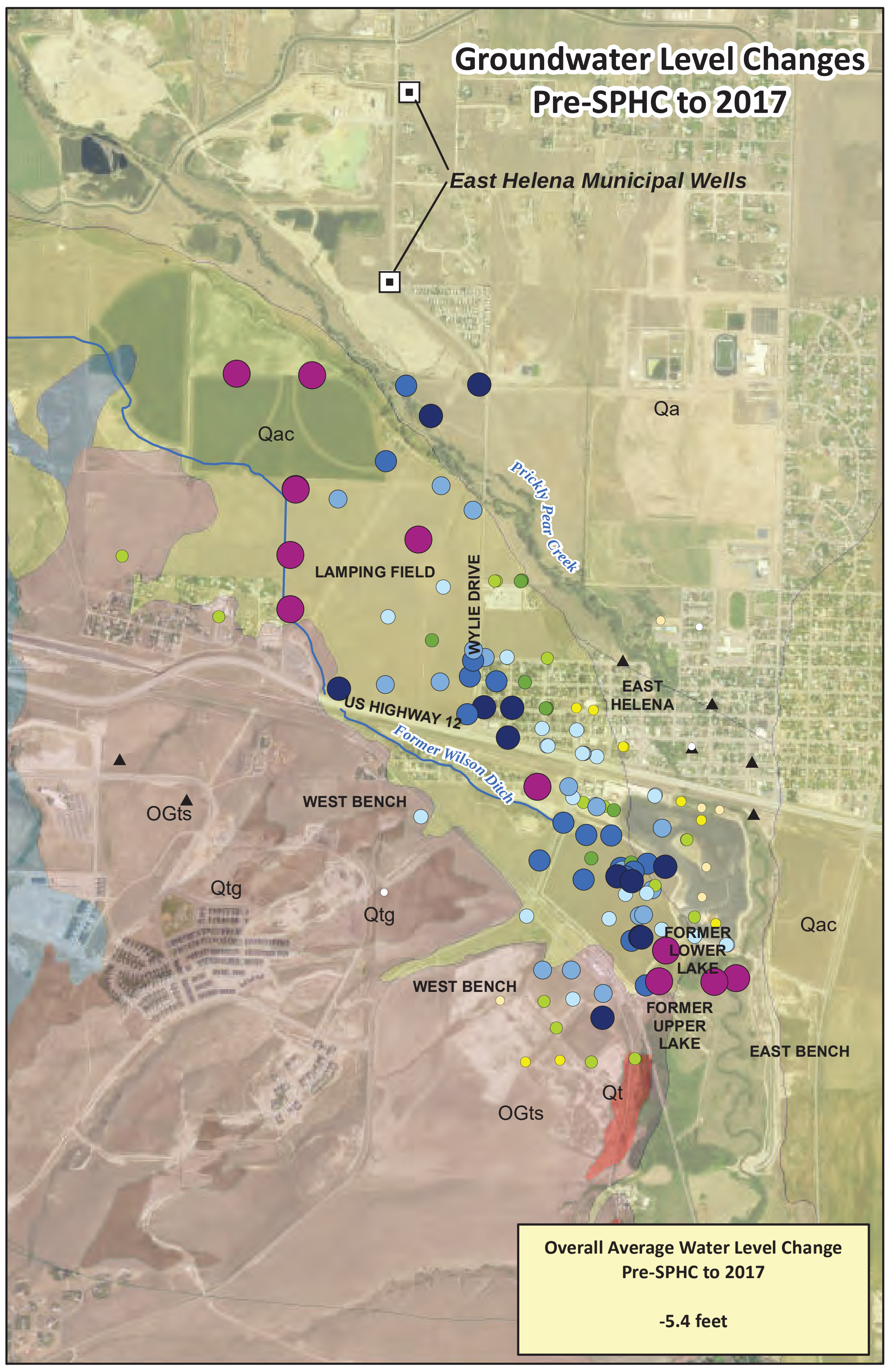


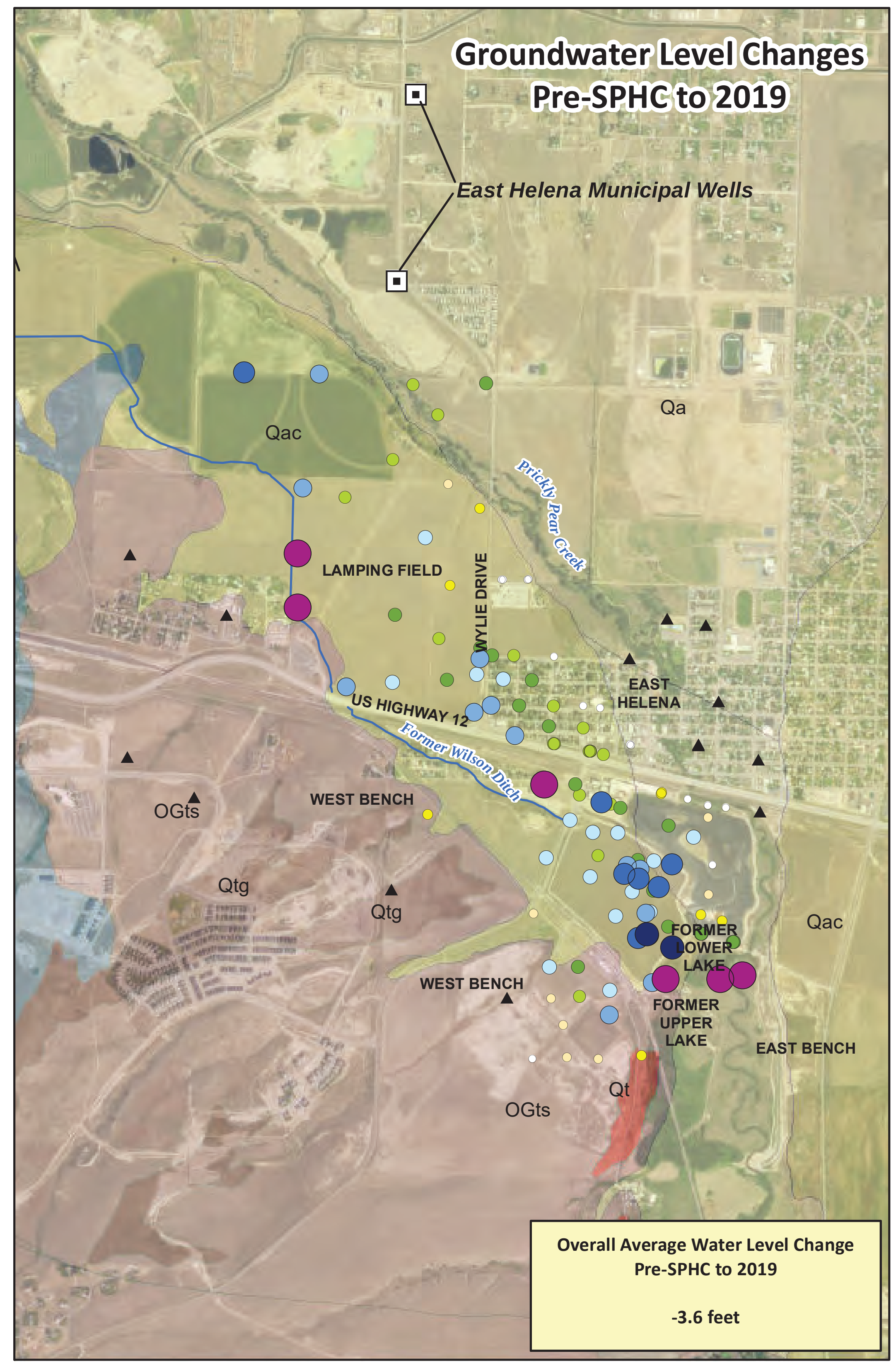
2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	GROUNDWATER LEVEL HYDROGRAPHS FROM FACILITY SOURCE AREA MONITORING WELLS	FIGURE 3-5

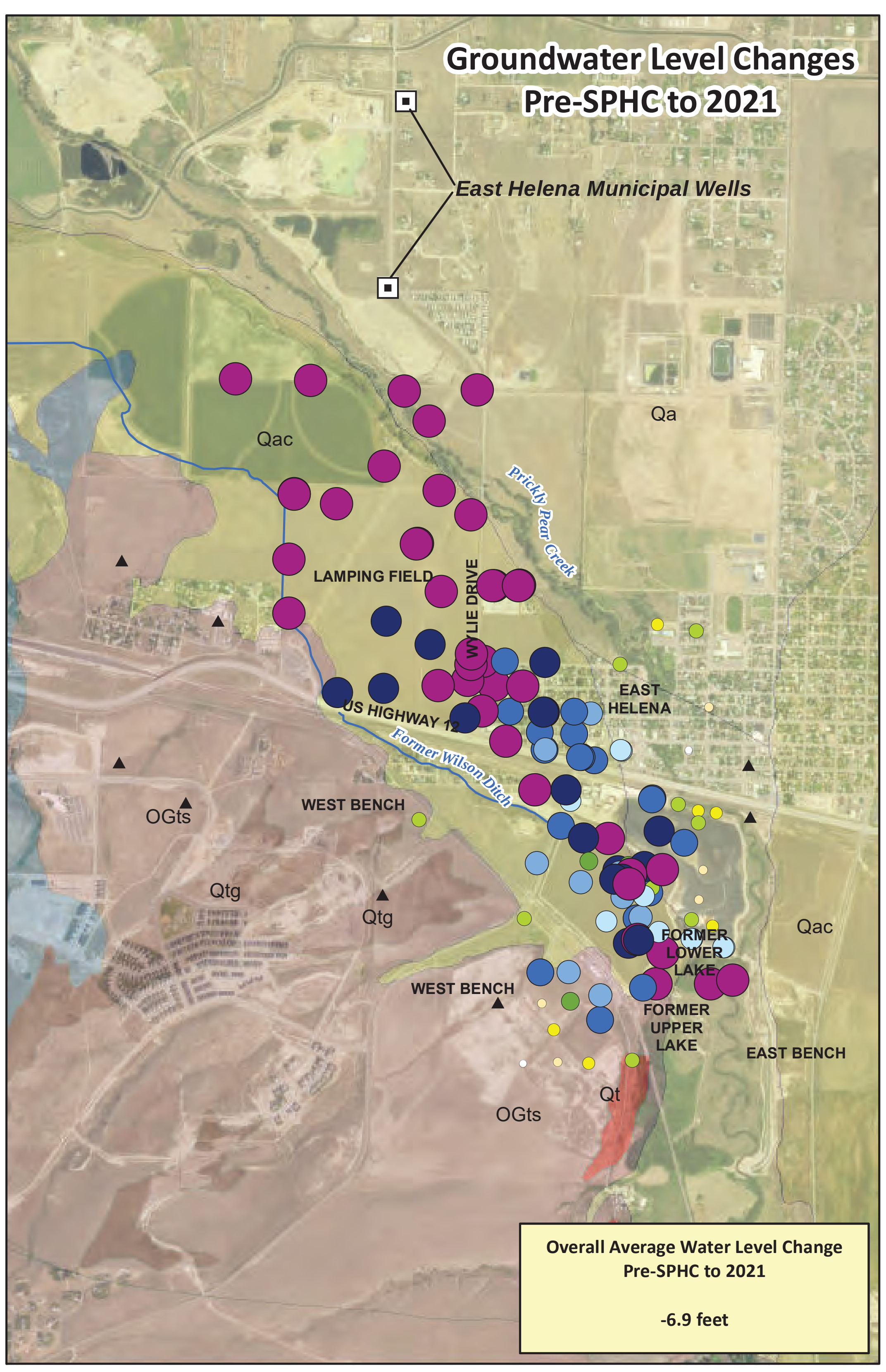
contaminated soils. Using similar comparisons for the West Selenium Source Area (well DH-66) and North Plant Arsenic Source Area (DH-17) yields reductions in the saturated thickness and groundwater flux of about 80% and 55%, respectively for these areas. The reduced groundwater flux through the contaminant source areas results in a corresponding reduction in the groundwater contaminant load leaving the Facility, thereby reducing downgradient groundwater loads and concentrations.

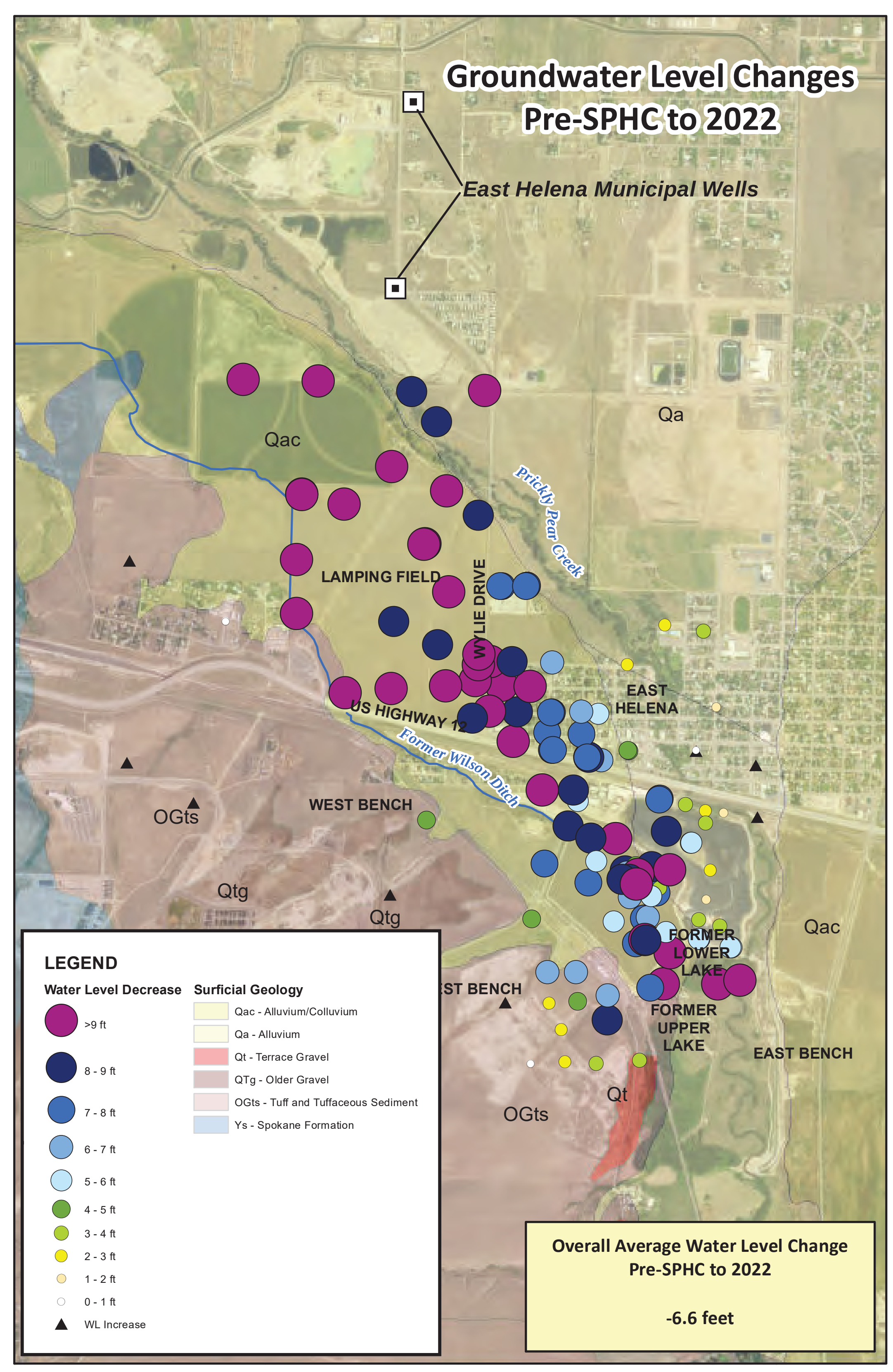
Figure 3-6 summarizes groundwater elevation changes throughout the project area since inception of the CMs in 2011. Water level changes since the inception of the CMs compared to the 2017, 2019, 2021, and 2022 data sets are shown on Figure 3-6, demonstrating not only the effects of the CMs, but also the short-term effects of high precipitation totals in 2018 and 2019 (two-year average of 14.7 inches), and the lower precipitation observed in 2020, 2021 and 2022 (three-year average of 10.0 inches). Groundwater levels throughout much of the study area have declined since 2011 with the largest declines (>9 feet) as of 2022 occurring in the south and central plant area, the western portion of East Helena, Lamping Field, and the area north of Lamping Field. As noted in previous WRM reports, groundwater level declines in the plant area are due mainly to elimination of former Upper and Lower Lake as part of the SPHC CM, and in the western portion of Lamping Field in response to decommissioning of Wilson Ditch, formerly a significant seasonal source of groundwater recharge (Figure 3-6). Water level fluctuations in the northernmost wells are a function of both precipitation/ recharge patterns and other non-project related land use practices such as groundwater pumping and irrigation practices (Hydrometrics, 2018). In addition to desaturating remaining contaminated soils, the large declines in the south plant area have also decreased the hydraulic gradient, and thus the groundwater flux and associated contaminant load leaving the plant site. Decreases along the west side of Lamping Field are responsible for the slight westward shift observed in the selenium plume since 2012.

Figure 3-6 also shows the relatively small water level declines (1 to 4 feet) observed in the eastern portion of the slag pile, and similar small declines or slight water level increases near Prickly Pear Creek north of the plant site in East Helena. This last observation exemplifies the influence of the creek on local groundwater flow and plume migration patterns with the most significant groundwater quality impacts from the former smelter primarily restricted to areas west of the creek. Modest decreases or water level increases over time have also been observed at most of the wells to the west of the former smelter, completed in Tertiary sediments.









NOTE: Groundwater level changes calculated as the difference between 2002 -2010 average elevations (pre-SPHC) and 2017, 2019, 2021, 2022 average elevations.

N

0 0.25 0.5 0.75
Scale In Miles

G:\PROJECT\10022\2022 WRM\Fig3-6_GWLevelChanges.mxd

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 3/8/2023 2:32:31 PM	2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	PROJECT AREA GROUNDWATER LEVEL CHANGES 2017, 2019, 2021, 2022	FIGURE 3-6

3.3.2.2 Groundwater Concentration Trends

Remediation phase performance trend evaluations currently focus on the primary COCs at the Facility (arsenic and selenium), as well as the indicator geochemical parameters sulfate and chloride, and groundwater levels. Monitoring wells included in the concentration trend analysis are located in three primary areas of interest: (1) the Facility source areas, including the Acid Plant area, slag pile area, West Selenium area, and North Plant Site Arsenic area; (2) wells defining the downgradient extent of the arsenic plume; and (3) wells defining the downgradient extent of the selenium plume. Wells selected for concentration trend analyses are listed in Table 3-5 and are shown on Figure 3-7. Trends have been segregated into the two periods prior to and following the initial implementation of CMs in late 2011 including:

1. RCRA Facility Investigation (RFI) period (2002-October 2011); and
2. RCRA Corrective Measure (CM) implementation period (November 2011-2022).

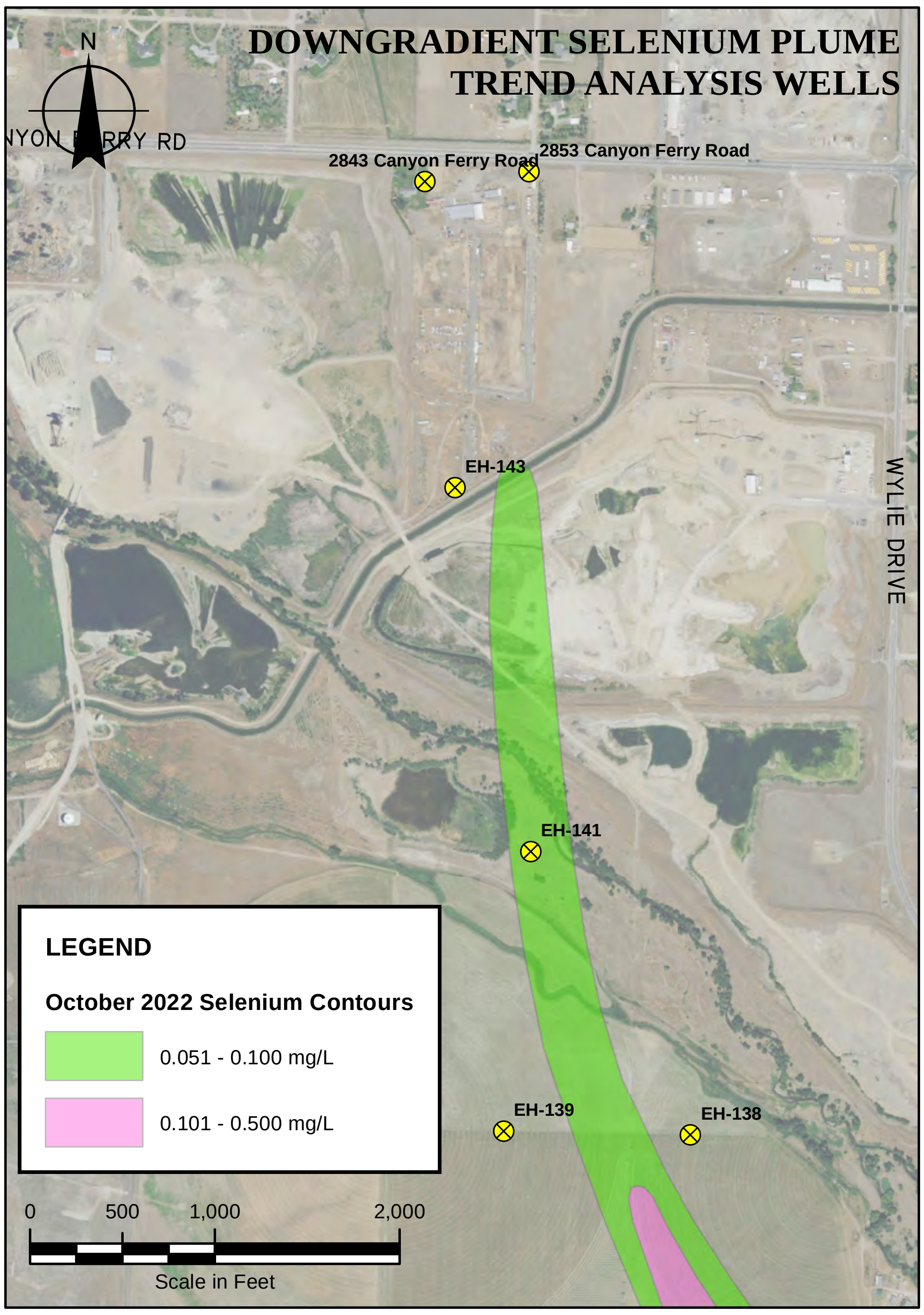
The complete set of arsenic and selenium trend plots for the trend analysis wells are shown on Figures 3-8 and 3-9 with additional constituent graphs (chloride and sulfate) included in Appendix C. Appendix D includes COC (arsenic and selenium) trend plots for a larger set of wells throughout the plant site and downgradient plume monitoring areas. Based on the trend plots shown on Figures 3-8 and 3-9 and presented in Appendices C and D, concentration trends through 2022 are summarized below.

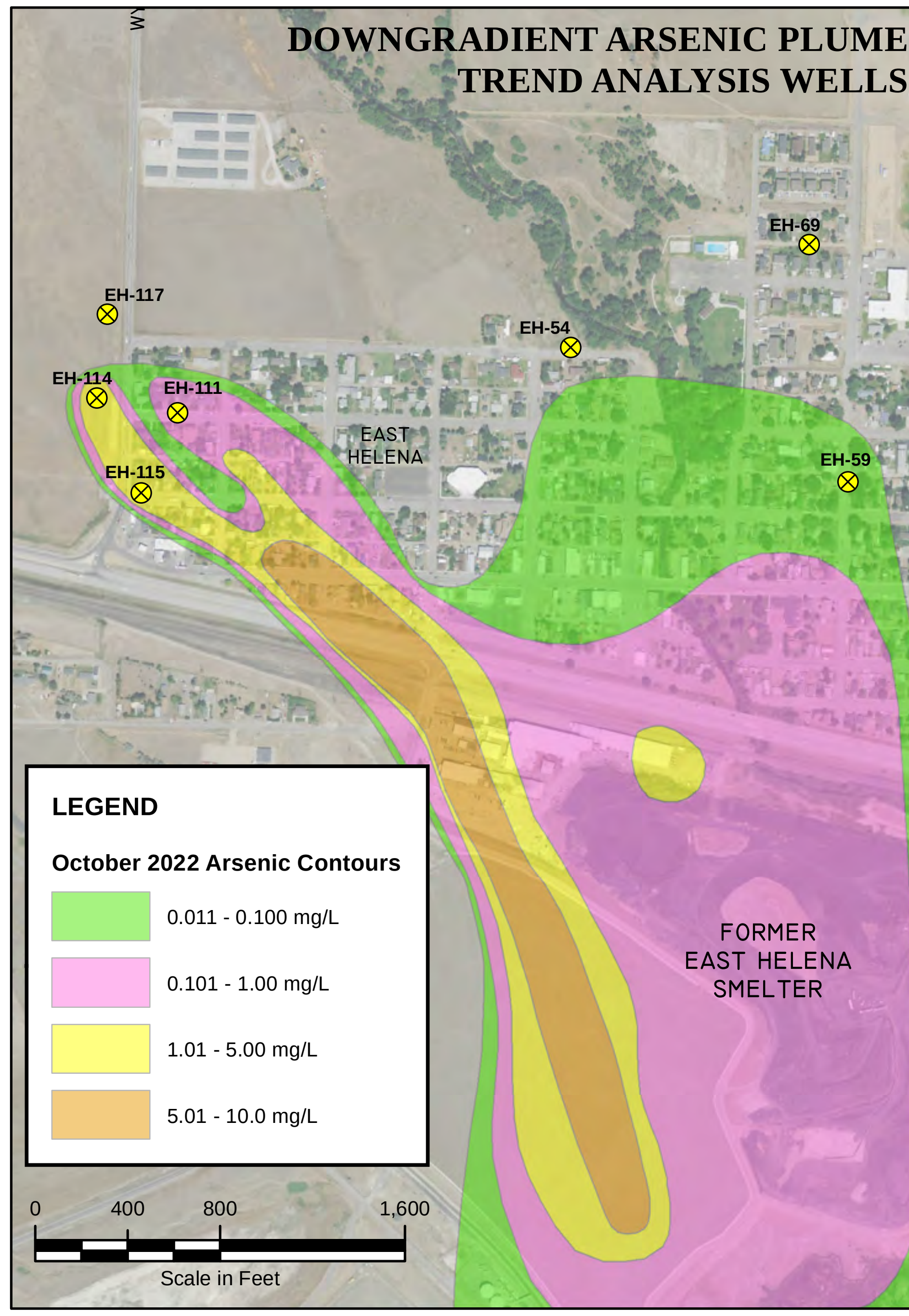
Acid Plant Area

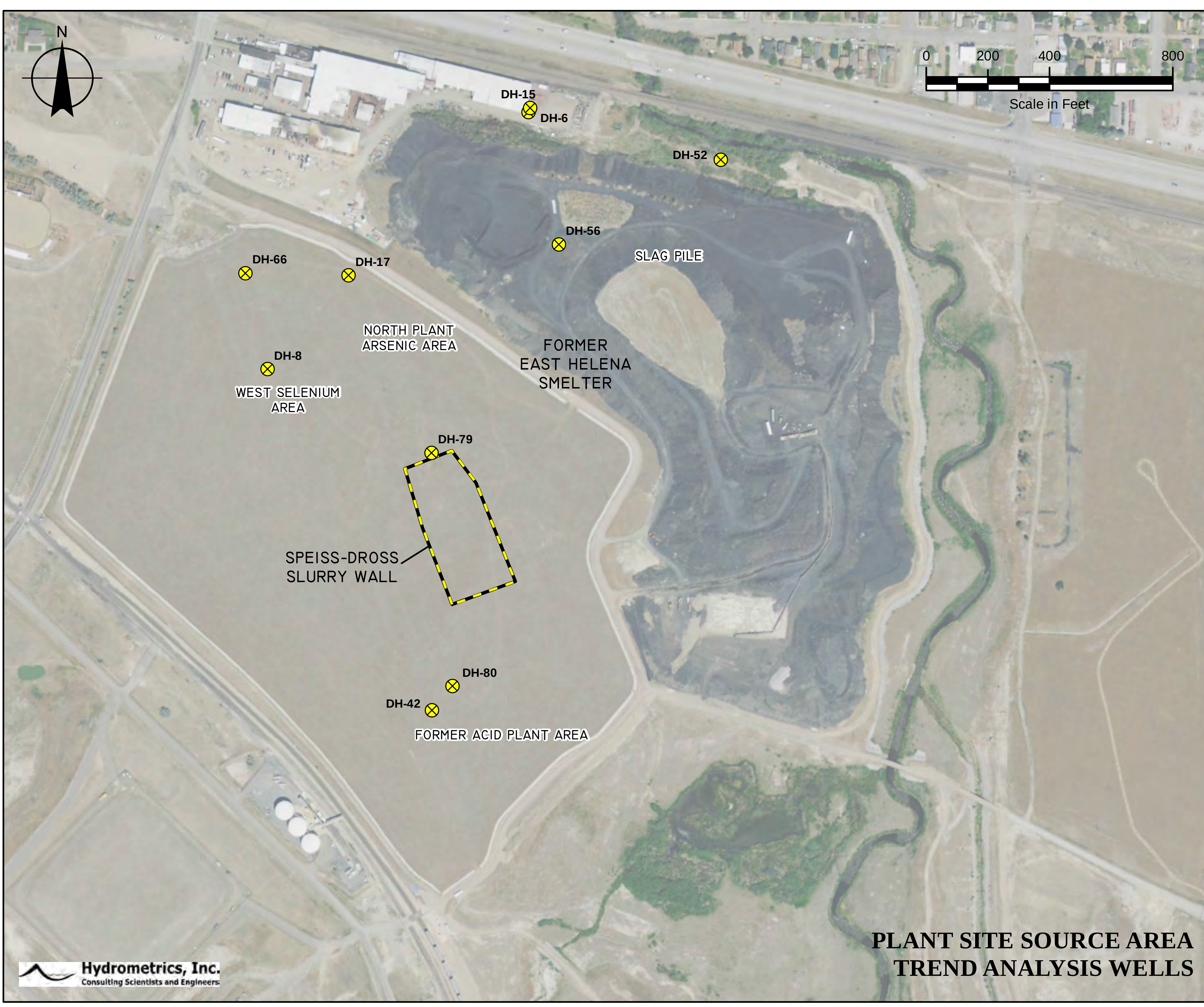
In the Acid Plant area, arsenic concentrations have decreased at well DH-42 during both the 2002 to 2011 RFI phase (after plant shutdown), and 2012 to 2022 CM phase (Figure 3-8). This well has had insufficient water for sampling since 2020, due to low water levels driven by lower than normal precipitation and the SPHC CM. Available data for DH-42 shows that arsenic decreased from 3.89 mg/L in June 2012 to 2.07 mg/L in October 2019. Selenium trends at DH-42 have been more variable (Figure 3-8), but overall concentrations have been lower during the CM period (0.016 to 0.094 mg/L) compared with the RFI period (0.067 to 0.221 mg/L). Monitoring well DH-80, completed in 2015 to document the water quality response to the acid plant area soil removal CM showed a significant decrease in arsenic concentrations following the 2016 removal action, from about 15 mg/L to 10 mg/L, and has subsequently decreased slowly to its lowest level on record in 2022 (7.0 to 7.09 mg/L) (Figure 3-8). The selenium concentration at DH-80 increased from 0.002 to 0.015 mg/L in 2018, presumably in response to short-term increase in groundwater levels and possible associated changes in geochemical conditions, before decreasing again to 0.002 to 0.004 mg/L in 2022. Sulfate concentrations at well DH-80 also reached the minimum values observed to date (242 to 243 mg/L) in 2022 (Appendix C).

Table 3-5. 2022 Concentration Trend Analysis Monitoring Wells
2022 Water Resources Monitoring Report - East Helena Facility

Well	Northing	Easting	Target Area
DH-42	859587.20	1359938.80	Acid Plant
DH-80	859665.45	1360005.89	Acid Plant
DH-17	860997.41	1359668.63	North Plant Arsenic
DH-79	860422.215	1359937.191	North Plant Arsenic
DH-6	861527.08	1360252.42	Slag Pile
DH-15	861541.06	1360257.00	Slag Pile
DH-52	861372.14	1360876.16	Slag Pile
DH-56	861098.43	1360350.74	Slag Pile
DH-66	861005.14	1359333.41	West Selenium
DH-8	860693.17	1359404.72	West Selenium
2843 Canyon Ferry Road	872346.42	1354330.00	Downgradient Selenium Plume
2853 Canyon Ferry Road	872391.53	1354773.24	Downgradient Selenium Plume
EH-138	867179.05	1355646.47	Downgradient Selenium Plume
EH-139	867197.45	1354635.30	Downgradient Selenium Plume
EH-141	868713.30	1354782.70	Downgradient Selenium Plume
EH-143	870683.75	1354372.76	Downgradient Selenium Plume
EH-54	863345.39	1359822.33	Downgradient Arsenic Plume
EH-59	862766.01	1361023.24	Downgradient Arsenic Plume
EH-69	863791.12	1360852.61	Downgradient Arsenic Plume
EH-111	863063.82	1358121.67	Downgradient Arsenic Plume
EH-114	863127.75	1357769.76	Downgradient Arsenic Plume
EH-115	862717.81	1357963.04	Downgradient Arsenic Plume
EH-117	863491.19	1357815.10	Downgradient Arsenic Plume

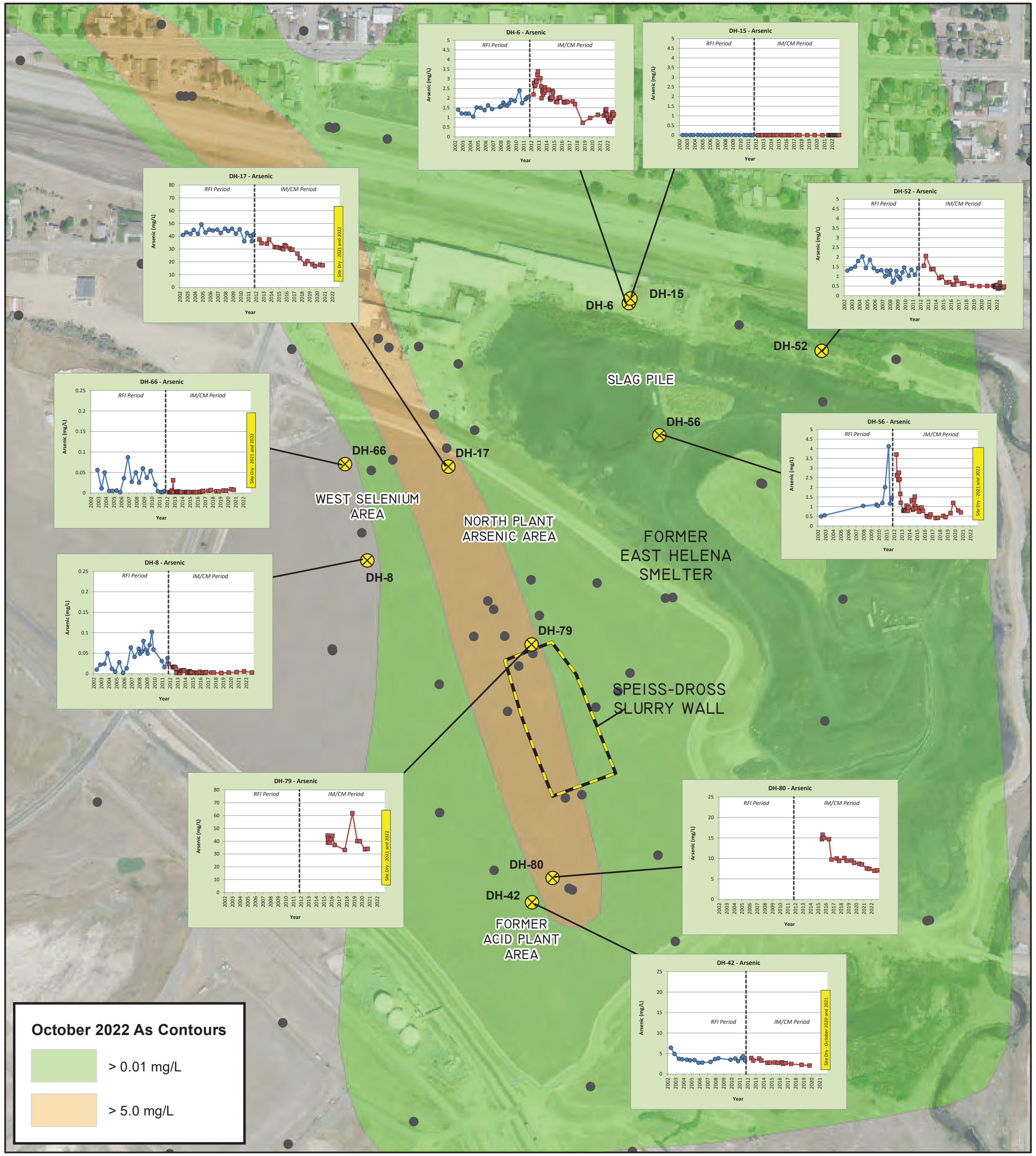




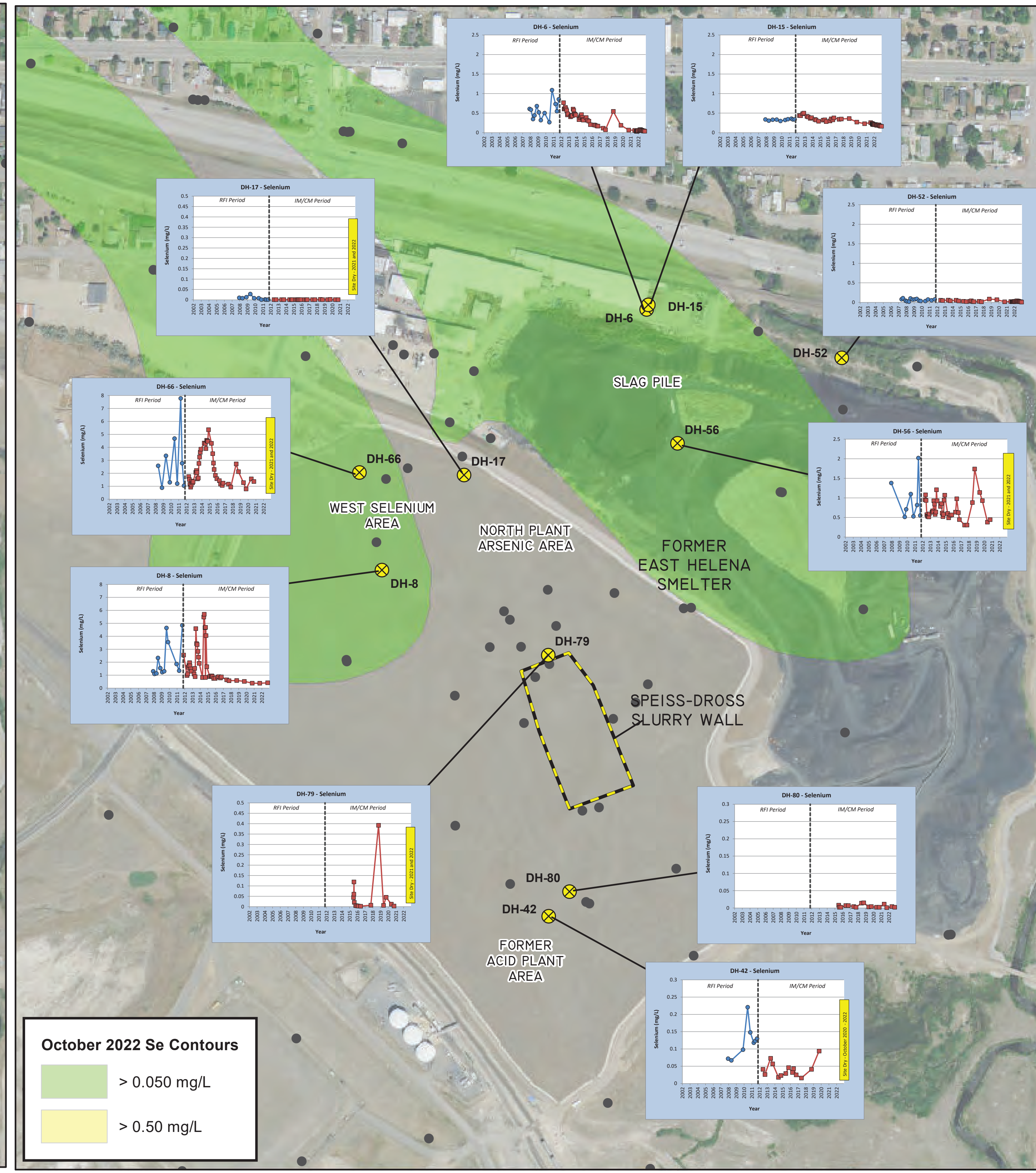


Path: G:\PROJECT\10022\2022 WRM\Fig3-7_Trend_Analysis_Wells.mxd   Date Saved: 11/8/2023 12:01:16 PM

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**2022 PERFORMANCE EVALUATION TREND ANALYSIS MONITORING WELLS**	**FIGURE** 3-7



PLANT SITE SOURCE AREA ARSENIC TRENDS



PLANT SITE SOURCE AREA SELENIUM TRENDS

N

0 200 400

Feet

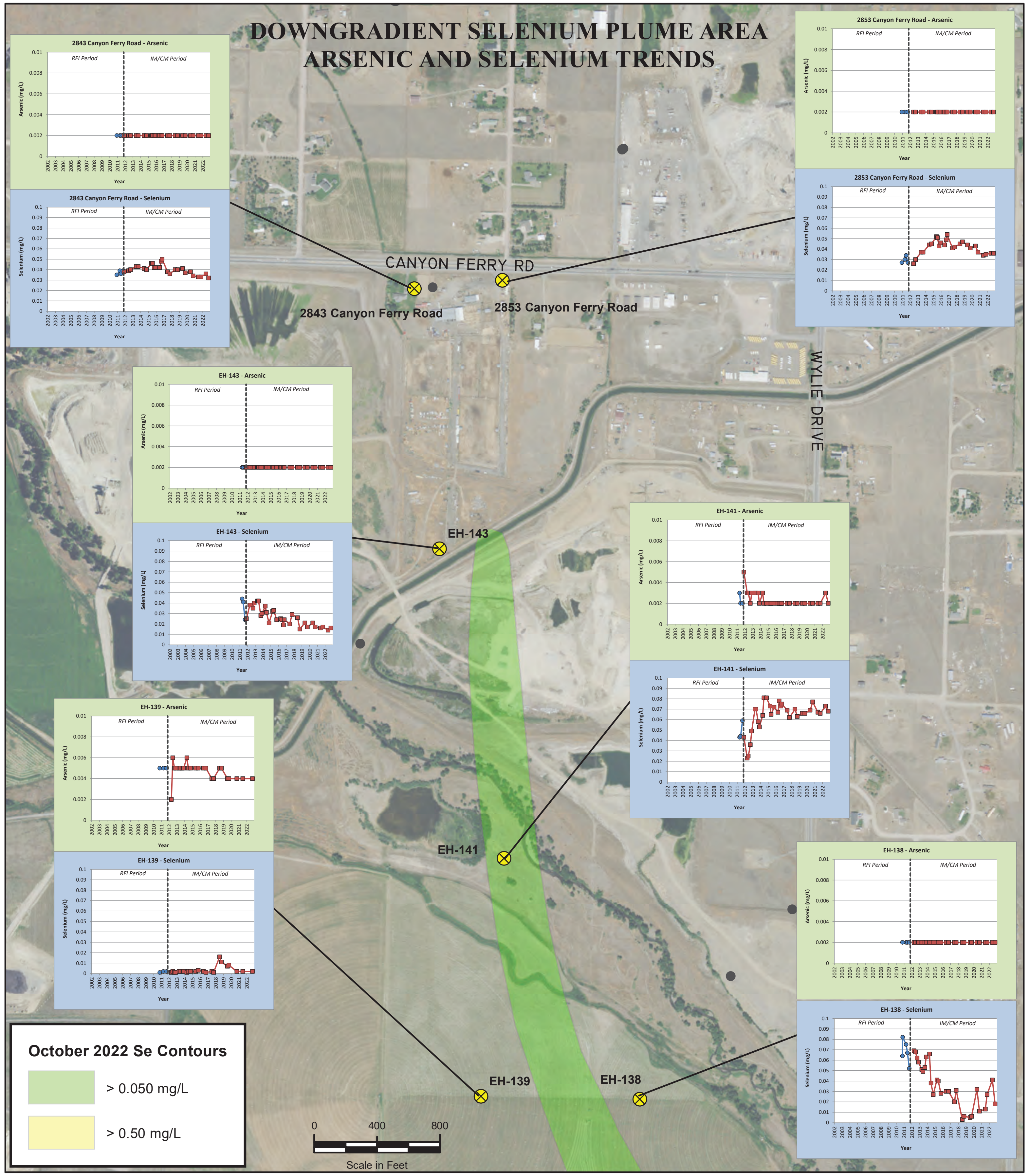
Hydrometrics, Inc.
Consulting Scientists and Engineers

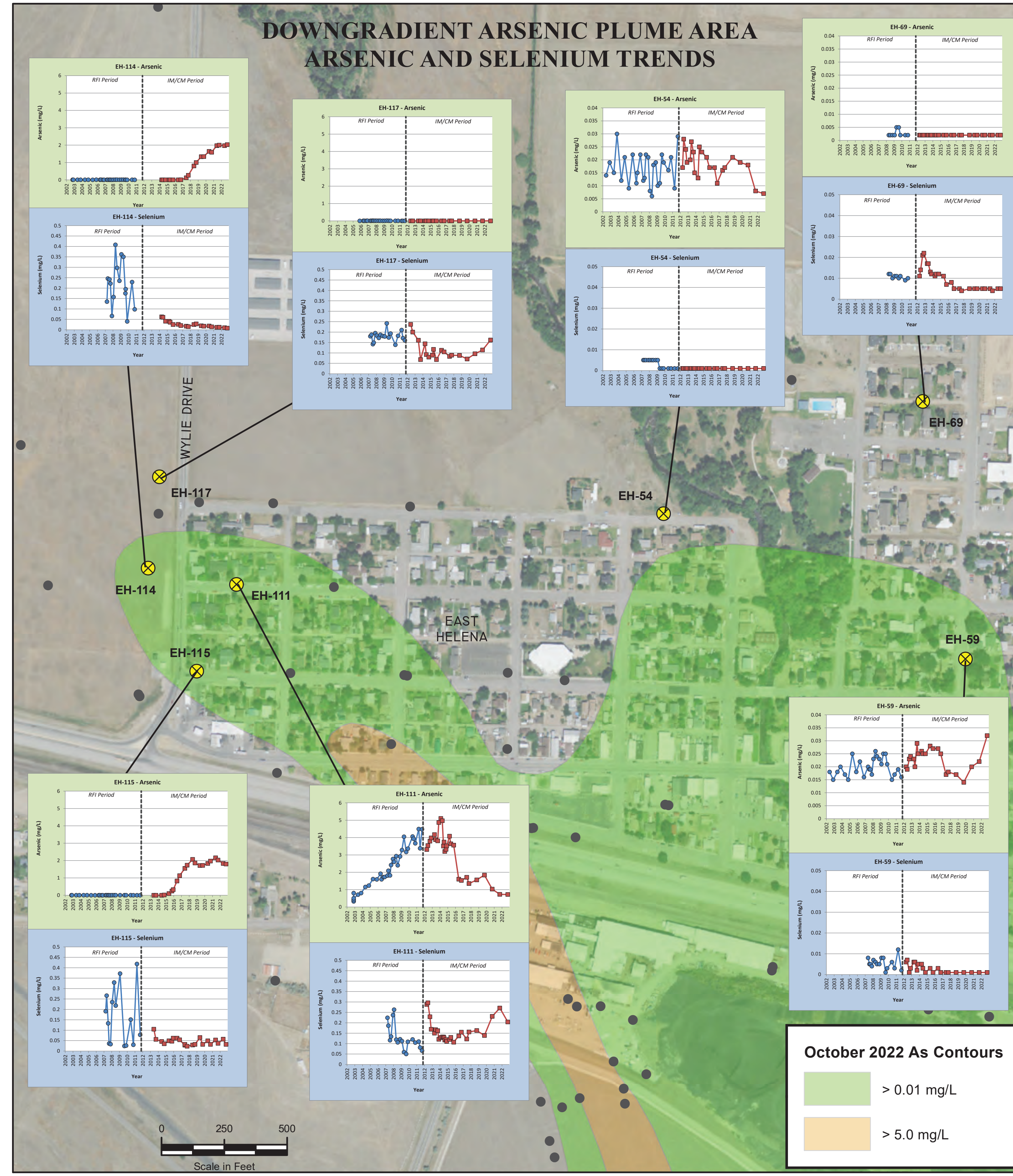
NOTE: Arsenic trend graphs have green background; selenium trend graphs have blue background

Path: G:\PROJECT\10022\2022 WRM\Fig3-8_AsSeTrend_Analysis_PlantSite.mxd

Date Saved: 3/7/2023 5:18:37 PM

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2022 PERFORMANCE EVALUATION TRENDS PLANT SITE AREA	FIGURE 3-8





NOTE: Arsenic trend graphs have green background;
selenium trend graphs have blue background

N

Hydrometrics, Inc.
Consulting Scientists and Engineers

Path: G:\PROJECT\10022\2022 WRM\Fig3-9_AsSeTrend_Analysis_DG.mxd   Date Saved: 11/8/2023 12:06:35 PM

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2022 PERFORMANCE EVALUATION TRENDS DOWNGRADIENT SELENIUM AND ARSENIC PLUME AREAS	FIGURE 3-9

Slag Pile Area

Concentration trend plots for slag pile area wells DH-6, DH-15, DH-52, and DH-56 are included in Figure 3-8 and Appendix C. Well DH-56 was dry during both the June and October 2022 monitoring events. Arsenic concentrations at the other three wells were either stable or increased during the RFI phase and have decreased overall during the CM phase. For example, the arsenic concentration at DH-6 decreased from a high of 3.38 mg/L in November 2012 to 1.08 mg/L in October 2022, a 68% reduction, although arsenic concentrations at this well have stabilized over the last three years (Figure 3-8). At well DH-52, arsenic has decreased from 2.06 mg/L in September 2012 to 0.406 in October 2022, an 80% reduction. DH-56 decreased from 3.7 to 0.698 mg/L arsenic from 2012 to 2020 (81% reduction) (Figure 3-8). The arsenic concentration at DH-56 showed a temporary increase from 2017 to 2019 (0.416 to 1.19 mg/L), followed by a subsequent decrease to 0.698 mg/L in 2020, most likely due to the above average precipitation recorded in 2018 and 2019. Arsenic concentrations at well DH-15 have been below detection throughout the RFI and CM periods (Figure 3-8).

Selenium concentrations at slag pile wells DH-6 and DH-15 have decreased during the CM period through 2022 apart from a notable increase in 2018 at DH-6 (Figure 3-8). The peak selenium concentration of 1.09 mg/L at DH-6 in October 2010 decreased to 0.046 mg/L in October 2022, a decrease of over 95%. At DH-15, the peak concentration of 0.50 mg/L (November 2012) has decreased to 0.172 mg/L as of October 2022, or about 65%. Well DH-52 selenium concentrations also decreased from 0.056 mg/L in 2012 to 0.019 mg/L in 2022. The 2022 selenium concentrations are near-minimum values for DH-6, DH-15, and DH-52. Additional discussion of slag pile area water quality related to the UFS project groundwater monitoring program is in Section 3.3.6.

An unusually elevated dissolved copper concentration of 1.44 mg/L was reported at well DH-6 during October 2022 (Appendix A), accompanied by a higher than usual chloride concentration of 32 mg/L. Copper has not historically been observed in plant-impacted groundwater at elevated concentrations except in low pH areas near the former Acid Plant, and previous concentrations at well DH-6 range from about 0.002 to 0.050 mg/L. During the October sampling, evidence was observed of surface runoff leaking into the flush mount well casing at DH-6 due to plowed snow and ice, suggesting potential sample contamination by runoff. A follow-up sample was collected for analysis of copper and chloride in November, yielding results of 0.070 mg/L copper and 16 mg/L chloride. These results indicate the elevated copper concentration was a temporary increase due to surface infiltration into the well. A temporary casing has been installed at well DH-6 to prevent surface infiltration, and permanent repairs will be conducted in 2023.

West Selenium Area

Concentration trend plots for West Selenium Area wells DH-66 and DH-8 are shown on Figure 3-8 and included in Appendix C. As with many wells on the former plant site, groundwater at DH-66 was not sampled during 2022 due to insufficient water. However, arsenic concentrations in wells DH-66 and DH-8 have historically been relatively low (0.1 mg/L or lower) and decreased to consistently below the 0.010 mg/L arsenic HHS after 2011. The arsenic concentration at DH-8 in October 2022 was 0.003 mg/L.

Selenium concentrations at wells DH-8 and DH-66 were highly variable historically, ranging from approximately 1 to nearly 8 mg/L. After CM implementation began in 2011, selenium concentrations increased consistently at DH-66 through 2014, possibly due to construction activities, reaching a post-RFI phase maximum concentration of 5.36 mg/L in November 2014 (Figure 3-8). Subsequently, selenium concentrations decreased to a minimum concentration of 0.786 mg/L in October 2019, increasing to 1.36 to 1.57 mg/L in 2020. The groundwater level in well DH-66 peaked at about 3870 feet in early July 2018, the highest level recorded since 2014, which may be related to the 2018 spike in selenium concentration shown on Figure 3-8. The October 2022 selenium concentration at source area well DH-8, 0.409 mg/L, is slightly above the 2021 minimum concentration recorded to date (0.372 mg/L), and more than 90% lower than the maximum concentration of 5.7 mg/L recorded in July 2014.

North Plant Source Area

Arsenic and selenium trend plots for North Plant Area wells DH-17 and DH-79 are shown on Figure 3-8. Both North Plant Source Area wells were dry during 2020 monitoring events. As noted in the 2021 WRM report (Hydrometrics, 2022b), arsenic concentrations at DH-17 decreased to near historic minimum concentrations (17.3 to 17.7 mg/L) in 2020, approximately one-third the RFI phase concentrations of 40 to 50 mg/L. Arsenic concentrations at well DH-79, located immediately north (downgradient) of the Speiss/Dross slurry wall, decreased to 33.7 to 34.1 mg/L in 2020 after spiking to 62 mg/L in 2018 and decreasing to about 40 mg/L in 2019. Selenium concentrations remained low at DH-17 in 2020 (<0.001 mg/L) while concentrations at DH-79 decreased to 0.003 to 0.012 mg/L after spiking to 0.39 mg/L in October 2018 (Figure 3-8). Similar to some other plant source area wells, the 2018 concentration spikes at well DH-79 may have been related to short-term water level increases at this well observed during 2018. Sulfate and chloride concentrations have been relatively stable at well DH-17 in the CM period, after decreasing throughout the RFI period (Appendix C).

Downgradient Concentration Trends

As part of performance monitoring, arsenic and selenium concentration trends have been evaluated for two groups of downgradient wells. The first group of wells is located along the downgradient end of the arsenic plume, including EH-111, EH-114, EH-115, and EH-117 in the higher concentration western portion of the plume, and EH-54, EH-59, and EH-69 in the lower concentration eastern portion of the plume. Arsenic and selenium plots for these wells are shown on Figure 3-9 (the Downgradient Arsenic Plume Area) with additional plots (chloride and sulfate) in Appendix C. Well EH-111, which has historically represented the furthest downgradient extent of arsenic concentrations greater than 1 mg/L (with maximum concentrations in the 5 mg/L range), has shown a significant decrease from 2015 through 2022. The October 2022 arsenic concentration at EH-111 (0.721 mg/L) is approximately 86% lower than the peak concentration of 5.1 mg/L in February 2014. Selenium concentration ranges at EH-111 in the RFI period (0.050 to 0.263 mg/L) are slightly lower than CM period concentrations (0.170 to 0.296 mg/L). An increasing selenium trend was observed at EH-111 from 2019 through 2021, but the October 2022 concentration of 0.204 mg/L selenium was lower than the October 2021 concentration of 0.271 mg/L (Figure 3-9). A recent selenium concentration increase is also apparent at well EH-117, downgradient of EH-111. Sulfate concentrations at EH-111 have increased during the CM period, while chloride stabilized near 40 mg/L (Appendix C). The overall water quality trends at EH-111 (and EH-117) suggest a potential increasing influence from the slag pile (a high sulfate source with ongoing selenium loading to groundwater) in the CM period, evidence of a westward plume shift in this area.

Water quality trends at wells EH-114 and EH-115 (south and west of EH-111; Figure 3-9) also show the impacts of the westward plume shift observed in the CM period. Prior to 2011, arsenic concentrations were below detect and selenium, sulfate, and chloride concentrations were highly variable as these wells received seasonal influxes of water from the West Selenium source area, with low arsenic concentrations and elevated selenium concentrations. Since 2016, arsenic concentrations have increased significantly at both wells and selenium concentrations have decreased to near or below the 0.05 mg/L maximum contaminant level (MCL) (Figure 3-9), while sulfate concentrations have increased (Appendix C). These trends are attributable to the lack of seasonal recharge and altered flow direction, and possibly altered geochemical conditions (lack of an influx of oxidizing recharge water), due to the decommissioning of Wilson Ditch in 2012. The arsenic concentrations at EH-114 and EH-115 currently appear stable at about 2.0 mg/L.

In the eastern, lower concentration portion of the arsenic plume, October 2022 arsenic concentrations were 0.007 and 0.032 mg/L at EH-54 and EH-59, respectively, and below reporting limits (<0.002 mg/L) at EH-69 (Figure 3-9). The concentration at EH-54 decreased to below the 0.01 mg/L human health standard in 2021 and 2022 for the first time since 2011, while arsenic has increased from 0.014 to 0.032 mg/L at EH-59 since 2019. Selenium and sulfate concentrations at EH-59 and EH-69 have both decreased during the CM period while groundwater quality at EH-54 has remained relatively consistent, with selenium concentrations at all three wells in the <0.001 to 0.005 mg/L range.

The second group of downgradient wells evaluated as part of performance monitoring trend evaluation is located near the downgradient end of the selenium plume, and includes former residential wells 2843 and 2853 Canyon Ferry Road, EH-138, EH-139, EH-141, and EH-143 (see Downgradient Selenium Plume Area on Figure 3-9). Available data for the period before 2011 is limited to three to four samples for this well set, precluding RFI phase trend analyses, with the available data indicating the following:

- Arsenic: concentrations in the downgradient area are consistently low, ranging from <0.002 to 0.006 mg/L, less than the 0.01 mg/L HHS, and showing no trends over time.
- Selenium:
  - At EH-139 on the west side of the downgradient plume, the selenium concentration increased from <0.001 to 0.003 mg/L pre-2018, to 0.011 to 0.016 mg/L in 2018, due to the slight westward plume shift. The concentration has since decreased to 0.002 mg/L as of October 2022. Well EH-139 was dry in both October 2021 and June 2022.
  - At well EH-138, located along the east side of the plume between the plume and East Helena municipal well #3, the selenium concentration has decreased from a range of

0.052 to 0.082 mg/L in 2010-2011 (immediately after well installation), to 0.018 mg/L in October 2022. Selenium concentrations decreased consistently at EH-138 from 2012 through 2018, but have since shown a slight increase with seasonally variable concentrations, including abrupt increases in June 2020 and June 2022 (Figure 3-9; Appendix C). The June 2020 and June 2022 increases are likely due to slight shifts in groundwater flow and plume migration directions in response to hydrologic conditions.

- At the other wells defining the downgradient selenium plume (2843 and 2853 Canyon Ferry Road wells, EH-141, EH-143), selenium concentrations have generally shown slight to moderate decreasing trends over the last 5 to 8 years (Figure 3-9), accompanied by similar trends in the indicator parameters chloride and sulfate (Appendix C). The October 2022 selenium concentration at 2843 Canyon Ferry Road (0.032 mg/L) was the lowest recorded to date at this well, and the October 2022 selenium concentration at 2853 Canyon Ferry Road of 0.036 mg/L represents a decrease of about 33% from the 2016 maximum of 0.054 mg/L. As of October 2022, the selenium concentration exceeded the 0.05 mg/L groundwater standard in only one downgradient trend analysis well, EH-141 at 0.068 mg/L.

Overall, arsenic and selenium concentrations show predominantly decreasing trends at most source area wells and a mixture of increasing, decreasing, and stable trends at downgradient (off-Site) wells during the post-2011 CM period. The slight to moderate decreasing selenium concentration trends exhibited at most downgradient wells, and the concurrent decreasing arsenic trend at EH-111 and increasing trends at EH-114 and EH-115 are due to a combination of (1) a slight westward shift in the contaminant plume geometry, along with (2) an overall decrease in groundwater contaminant loads migrating off the plant site, given the overall decreases in saturated thickness and plant site contaminant concentrations. Based on these trends, the downgradient extent of the selenium plume in 2022 has receded by approximately 2,000 feet compared with 2016 (see Figure 3-3).

3.3.3 Contaminant Plume Stability

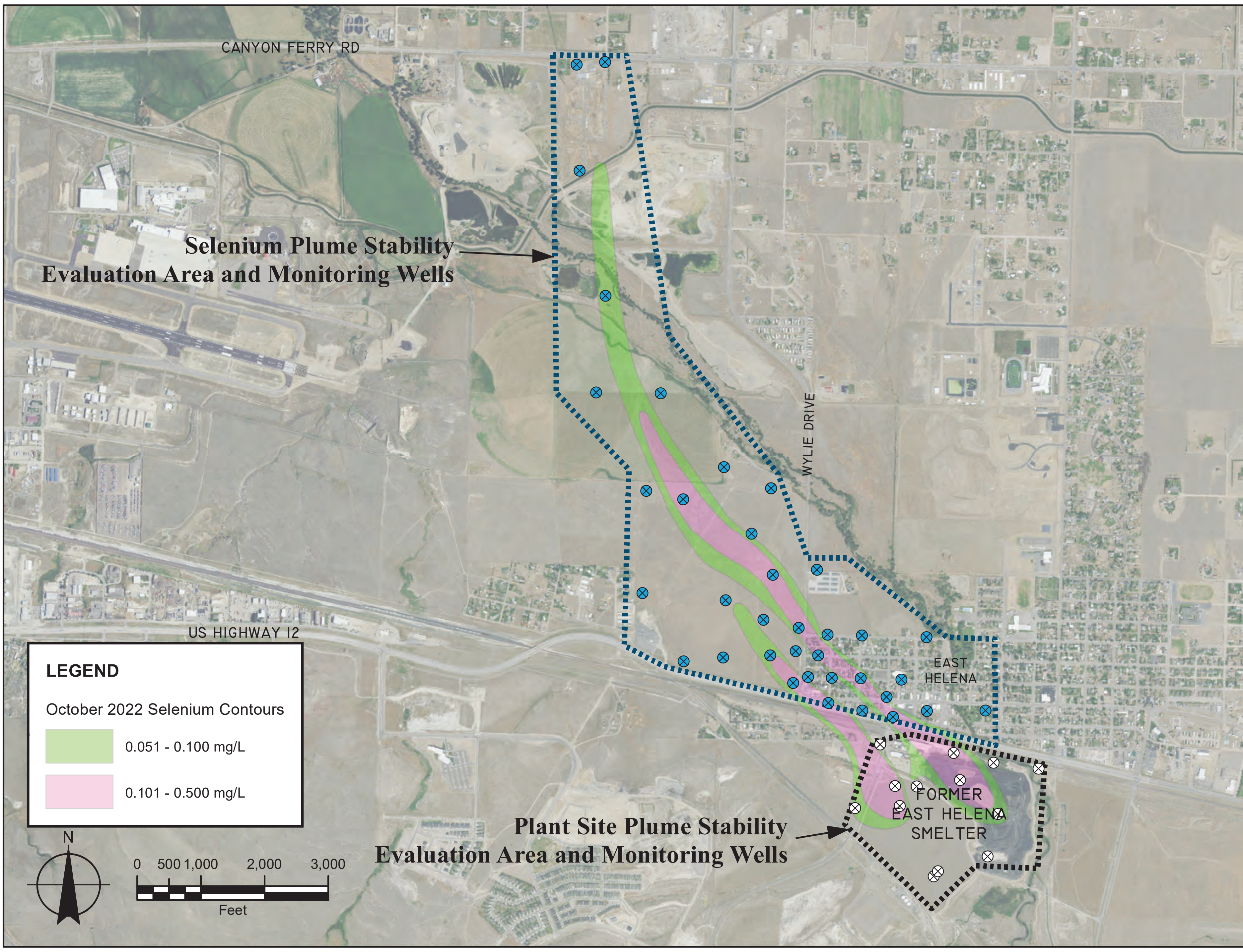
Another component of the East Helena groundwater remedy performance evaluation is plume stability analysis for the primary groundwater COCs arsenic and selenium. While contaminant concentration trends at individual wells within and downgradient of the primary source areas on the Facility may show varying trends (increasing, decreasing, or stable), particularly during the initial phase of remedy monitoring following completion of CMs, evaluation of plume stability allows an additional comprehensive assessment of plume characteristics, including any changes over time in metrics such as total plume area (as defined by the 0.01 mg/L boundary for arsenic and 0.05 mg/L boundary for selenium), average plume concentration, and plume concentration centroid location.

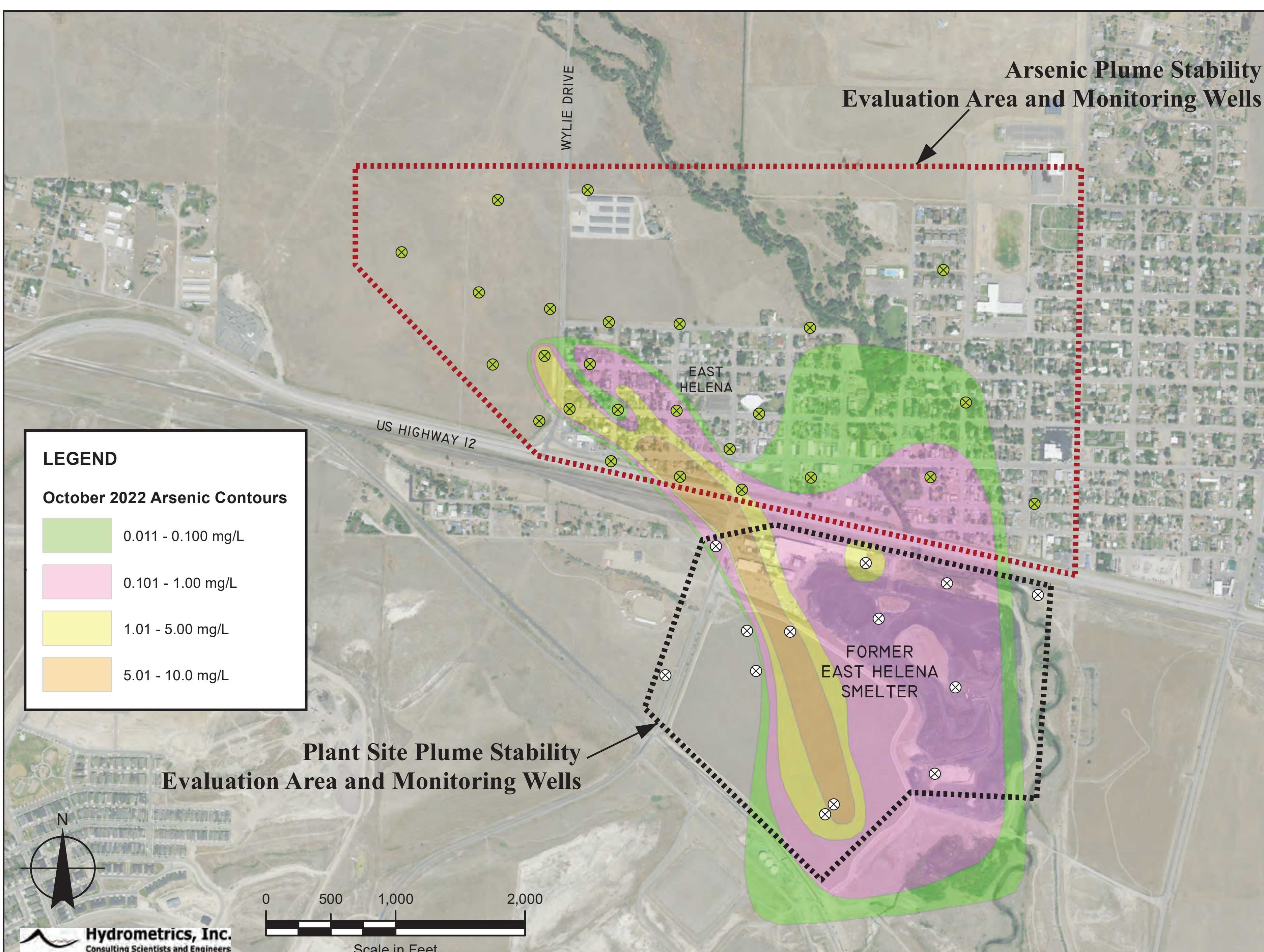
The calculation methods for arsenic and selenium plume stability are based on methods outlined in Ricker (2008). This method was originally developed as a tool to evaluate the stabilization of contaminated groundwater migration, in accordance with the requirements of Government

Performance and Results Act Environmental Indicator (EI) RCRIS Code CA 750 (Migration of Contaminated Groundwater Under Control). The evaluation procedure involves the following steps:

1. Define the areas for which plume characteristics will be calculated. As in previous years, for the purposes of performance evaluation monitoring described in the 2022 CAPMP, arsenic and selenium plume areas on the former smelter site ("plant site plume stability"), and in the near downgradient areas in the COEH and in Lamping Field were selected, to allow integration of results from multiple monitoring points into a single calculated measure of plume characteristics. The arsenic and selenium plume stability evaluation areas are shown on Figure 3-10.
2. Select a representative set of monitoring wells from the monitoring well network with sufficient spatial distribution to define the extent of the contaminant plume within the plume stability evaluation areas over multiple years. The selected well sets for the plume stability analyses are shown on Figure 3-10 and summarized in Table 3-6. The selected off-site well set for selenium covers a greater area than the off-site well set for arsenic, since the plume configurations are different.
3. For each well, calculate an annual average concentration of the COC. Below detect values were replaced with the detection limit for calculation of averages.
4. Generate a grid file of interpolated concentration values within the given plume stability area for an individual monitoring year and contaminant, using spatial analysis software such as Surfer® by Golden Software. As suggested in Ricker (2008), grid files were generated on log-transformed concentration data (for smoother interpolation), then transformed back to original concentration units prior to further calculations.
5. Use the grid file to calculate various average plume metrics for the monitoring year, including:
    a. Plume area;
    b. Average plume concentration; and
    c. Plume centroid of concentration.

Calculated values are then compared over time to determine any trends in total plume area or average plume concentration. In addition, Ricker (2008) notes that for shrinking plumes, the plume centroid of concentration (or mass) should recede toward the source over time; if the plume is transient (migrating away from the source) or expanding, the centroid of concentration will show migration downgradient away from the source. Therefore, by observing concentration centroids over time, plume stability (expanding, stable, shrinking, or transient) can be evaluated.





Path: G:\PROJECT\10022\2022 WRMR\Fig3-10_Plume_Stability_Areas.mxd Date Saved: 11/8/2023 12:39:30 PM

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	2022 PLUME STABILITY EVALUATION AREAS AND MONITORING WELLS	FIGURE 3-10

Table 3-6. 2022 Plume Stability Analysis Monitoring Wells

2022 Water Resources Monitoring Report - East Helena Facility

Arsenic Plume Stability Analysis Wells

Well/Well Set*	X	Y
EH-104	1358282.522	862312.6614
EH-106	1358337.119	862709.9336
EH-110	1359199.735	862408.9392
EH-111	1358121.671	863063.8249
EH-114	1357769.757	863127.7487
EH-115	1357963.035	862717.8146
EH-117	1357815.102	863491.194
EH-118	1357370.97	863059.9069
EH-119	1357263.087	863617.6238
EH-120	1357409.933	864330.2403
EH-124	1356666.492	863928.3931
EH-50/100	1358817.999	862195.6926
EH-51/101	1359828.415	862186.9796
EH-52/102	1360752.337	862191.6556
EH-53	1358268.831	863387.4722
EH-54	1359822.332	863345.3893
EH-57A	1357731.038	862625.8977
EH-58	1361553.2	861985.385
EH-59	1361023.244	862766.0055
EH-60/61/103	1359295.783	862093.3668
EH-62	1358812.977	863373.6172
EH-63	1359427.431	862682.4886
EH-65/107	1358789.927	862702.9806
EH-66/121	1358105.331	864406.8992
EH-69	1360852.608	863791.1154

Selenium Plume Stability Analysis Wells

Well/Well Set*	X	Y
EH-104	1358282.522	862312.6614
EH-106	1358337.119	862709.9336
EH-110	1359199.735	862408.9392
EH-111	1358121.671	863063.8249
EH-114	1357769.757	863127.7487
EH-115	1357963.035	862717.8146
EH-117	1357815.102	863491.194
EH-118	1357370.97	863059.9069
EH-119	1357263.087	863617.6238
EH-120	1357409.933	864330.2403
EH-123	1356631.306	863027.3459
EH-124	1356666.492	863928.3931
EH-126	1356002.798	865515.797
EH-129/134	1355425.088	865649.6907
EH-132	1355360.408	864040.3529
EH-135	1357384.976	865688.5946
EH-206	1356012.784	862969.4011
EH-50/100	1358817.999	862195.6926
EH-51/101	1359828.415	862186.9796
EH-52/102	1360752.337	862191.6556
EH-53	1358268.831	863387.4722
EH-54	1359822.332	863345.3893
EH-57A	1357731.038	862625.8977
EH-60/61/103	1359295.783	862093.3668
EH-62	1358812.977	863373.6172
EH-63	1359427.431	862682.4886
EH-65/107	1358789.927	862702.9806
EH-66/121	1358105.331	864406.8992
EH-70/125	1357077.783	864971.9141
EH-130	1356641.209	866018.012
EH-135	1357384.976	865688.5946
EH-138	1355646.472	867179.0458
EH-139	1354635.304	867197.4533
EH-141	1354782.704	868713.295
EH-143	1354372.763	870683.749
2843 Canyon Ferry	1354330.004	872346.417
2853 Canyon Ferry	1354773.236	872391.533

Plant Site Plume Stability Analysis Wells

Well/Well Set*	X	Y
DH-6/15	1360252.419	861527.0799
DH-7**	1361580.684	861281.5224
DH-8	1359404.724	860693.1656
DH-17	1359668.631	860997.414
DH-42	1359938.798	859587.2008
DH-52	1360876.159	861372.1393
DH-55	1360945.555	860568.8169
DH-56	1360350.744	861098.4318
DH-66	1359333.409	861005.14
DH-67	1359095.512	861657.6447
DH-69	1360783.894	859899.5982
EH-204	1358703.601	860660.9927

NOTES: *Data from well sets (paired wells) are combined to yield a single overall average concentration for a given monitoring year for plume stability calculations.

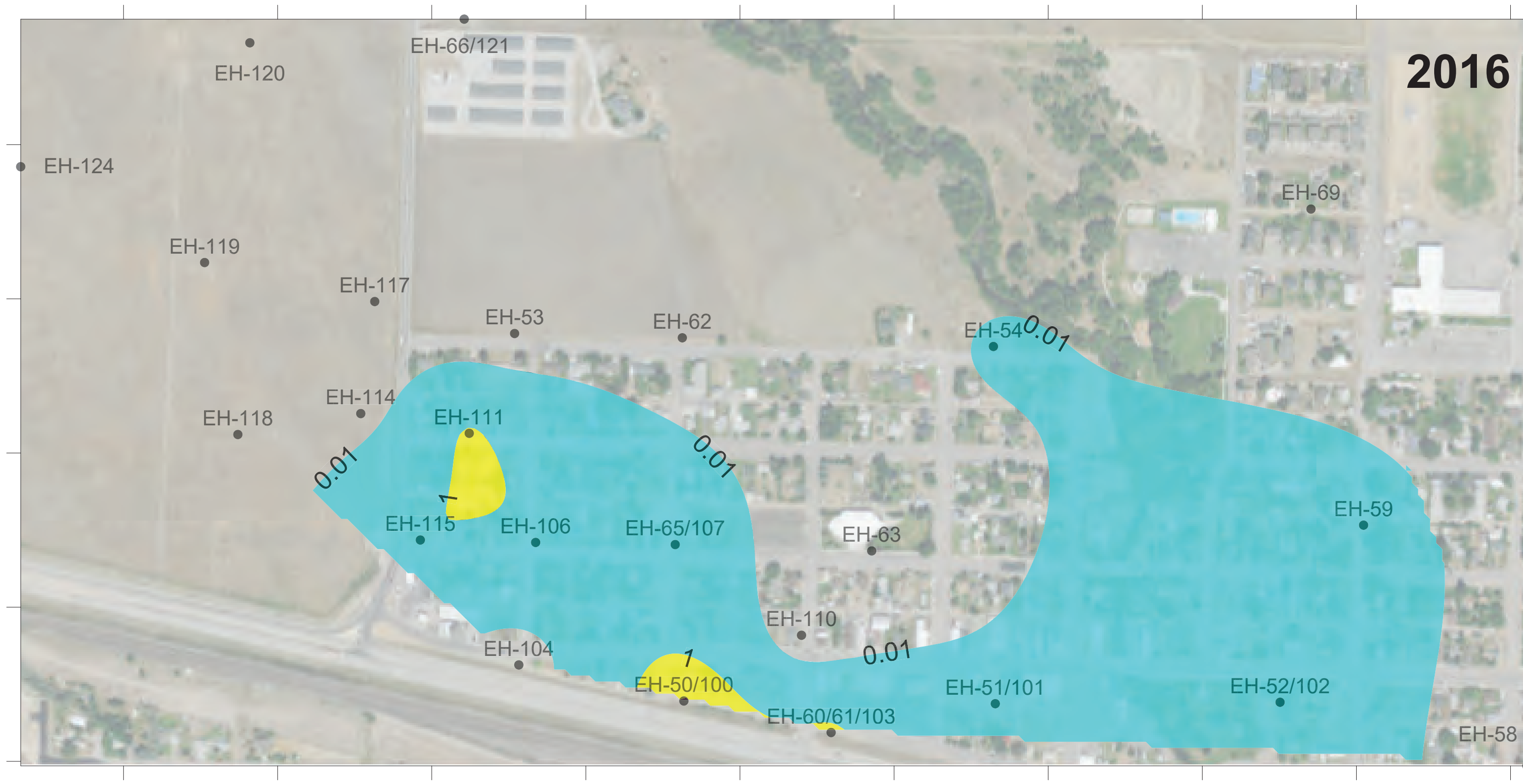
**Well DH-7 is not sampled; data from nearby well EH-58 (700' north) is used to approximate the concentration at DH-7 for plume stability calculations.

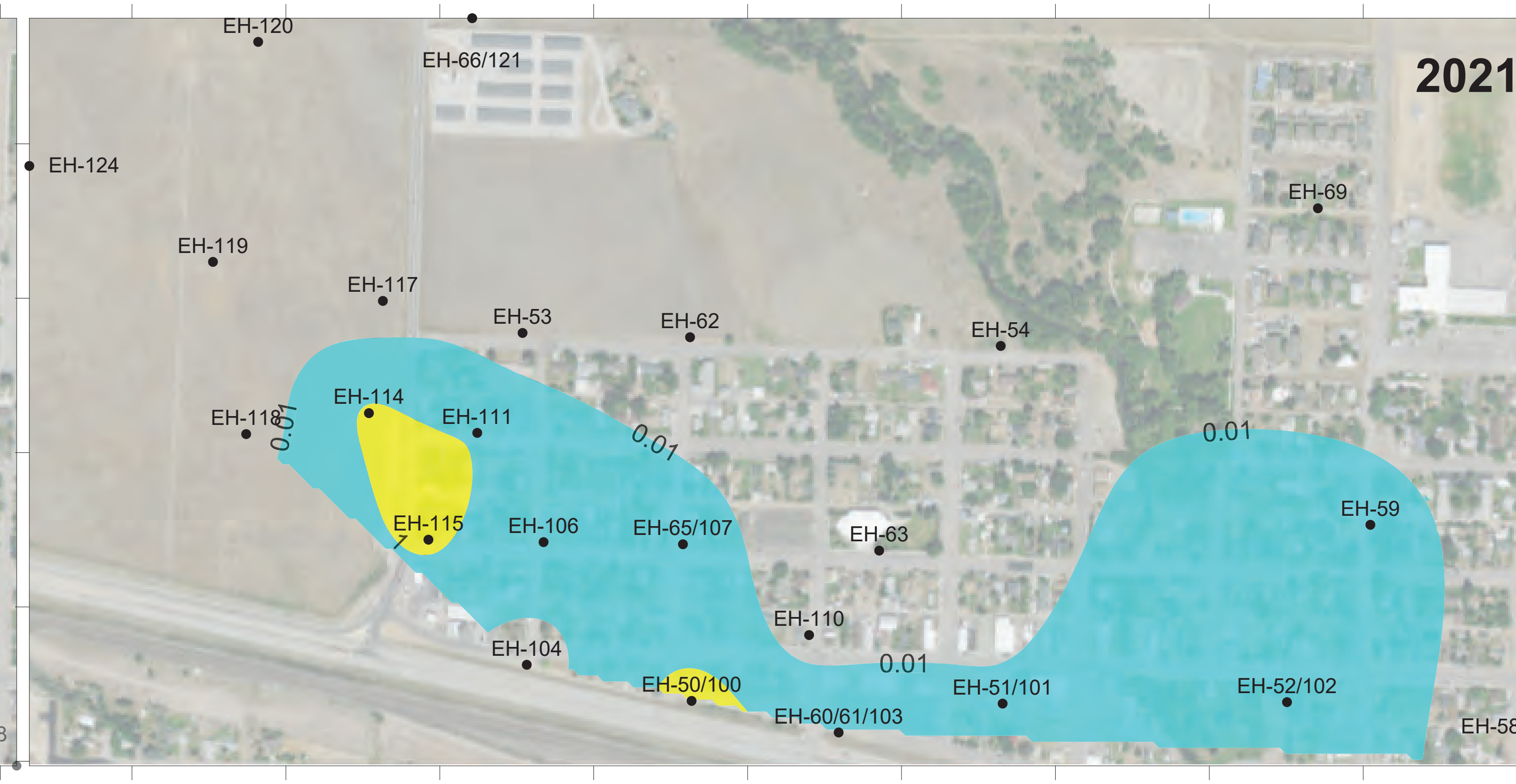
Off-site (downgradient) arsenic plume stability metrics are discussed in Section 3.3.3.1, and off-site selenium plume metrics are discussed in Section 3.3.3.2. As described in the 2021 WRM Report (Hydrometrics, 2022b), about 30% the wells used to derive the plant site plume stability metrics were dry in 2021 (including many in the highest concentration arsenic and selenium areas), precluding calculation of updated metrics for the plant site area in 2021. These low water level conditions persisted through 2022, with an equivalent number of dry wells; thus, plant site plume stability calculations were not conducted for 2022. The historically low water levels through much of the plant site due to the combination of the effects of the SPHC CM and the recent lower precipitation and recharge conditions suggest that routine annual calculation of plume stability metrics for the plant site may not be practical for future monitoring events. The results of the plant site plume stability calculations for monitoring events through 2020 are reiterated below in Section 3.3.3.3.

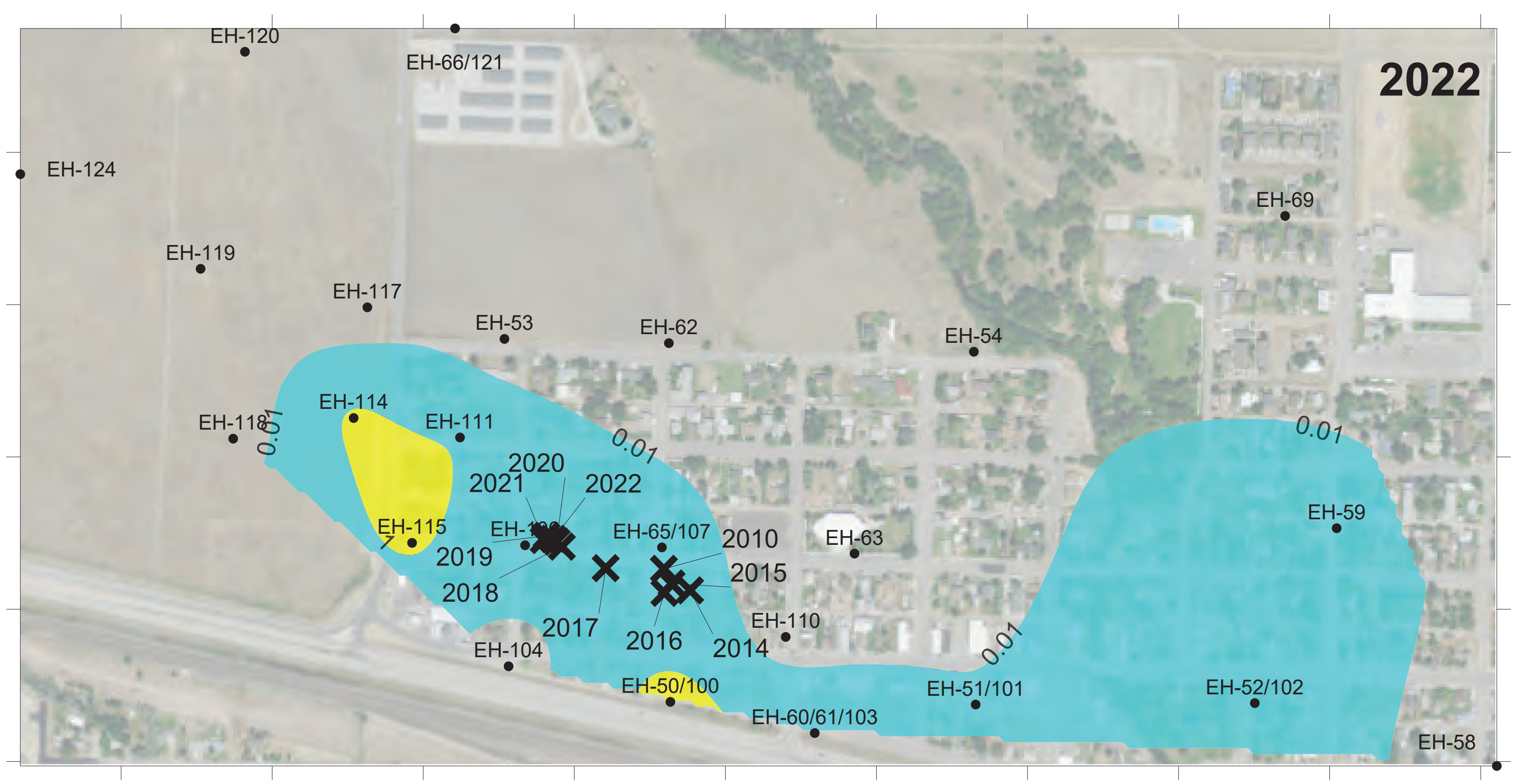
3.3.3.1 Downgradient Arsenic Plume Stability Results

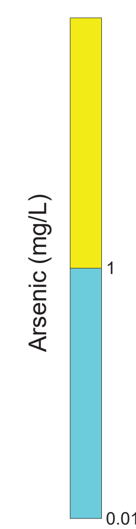
Arsenic plume stability analysis results for the area downgradient of the former smelter are summarized on Figure 3-11, including tabulated results for 2010 (representing conditions prior to implementation of CMs), 2016 (following completion of all CMs except for the slag pile cap), and 2021 and 2022. Software-generated arsenic contours are shown for 2016, 2021, and 2022. The overall plume area with arsenic concentrations above the 0.01 mg/L groundwater standard was virtually unchanged from 2010 to 2016 (66 and 64 acres, respectively); in 2021 and 2022, the calculated area decreased by about 10% to 57 and 59 acres, driven by a decrease in concentration at well EH-54 in the north-central part of the plume from above the 0.01 mg/L MCL to below the MCL (e.g., from 0.014 mg/L in 2016 to 0.007 mg/L in 2022). Average arsenic concentrations within the 0.01 mg/L contour have declined overall from 0.203 mg/L in 2010 to 0.172 mg/L in 2021, or about 15%. The locations of the calculated plume centroids show a distinctive westward shift from 2010 through 2022 (Figure 3-11). This shift is attributable to the increasing concentrations at wells EH-114 and EH-115 on the western margin of the plume discussed above, as well as decreases in concentration at historically elevated arsenic concentration wells such as EH-50 and EH-100.

The arsenic plume stability metrics suggest that the arsenic plume is relatively stable with a slight westward shift in the plume centroid over time attributable to the decommissioning of Wilson Ditch and associated loss of a recharge source west of the plumes (Section 3.3.2.1). The stability in downgradient plume area and concentrations is not unexpected. As noted in previous studies (Hydrometrics, 2016), although plant site arsenic concentrations have decreased significantly since inception of the CM program in 2010 (see Section 3.3.3.3), downgradient concentrations are not expected to decrease significantly in the near future due to the release of adsorbed arsenic from downgradient soils. By decreasing the plant site concentrations and arsenic loading to downgradient soils, however, the completed CMs are intended to prevent future significant advancement of the









Year	Arsenic Plume Area Exceeding 0.01 mg/L (acres)	Average Arsenic Concentration (mg/L)
2010	66	0.203
2016	64	0.167
2021	57	0.186
2022	**59**	**0.172**

NOTES:
X = calculated plume centroid for given year
Plume stability metrics calculated using method of Ricker (2008)
Concentration isocontours generated by Surfer Version 13

K:\PROJECT\10022\PLUME STABILITY\FIGURES\2022\Fig3-11_As_Plume_Stability_2022.srf

2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT ARSENIC PLUME STABILITY EVALUATION RESULTS

FIGURE

3-11

downgradient arsenic plume, to reduce concentrations within the 0.01 mg/L plume footprint, and to eventually diminish the downgradient plume extent. The arsenic plume stability results are generally consistent with observations based on preparation of hand-drawn arsenic isocontour maps. The arsenic contour maps shown for 2016 through 2022 on Figure 3-2, and the software-generated 0.01 mg/L arsenic contours shown on Figure 3-11 illustrate the stability in overall plume area, along with the recent shift to the west in the higher concentration western portion of the arsenic plume.

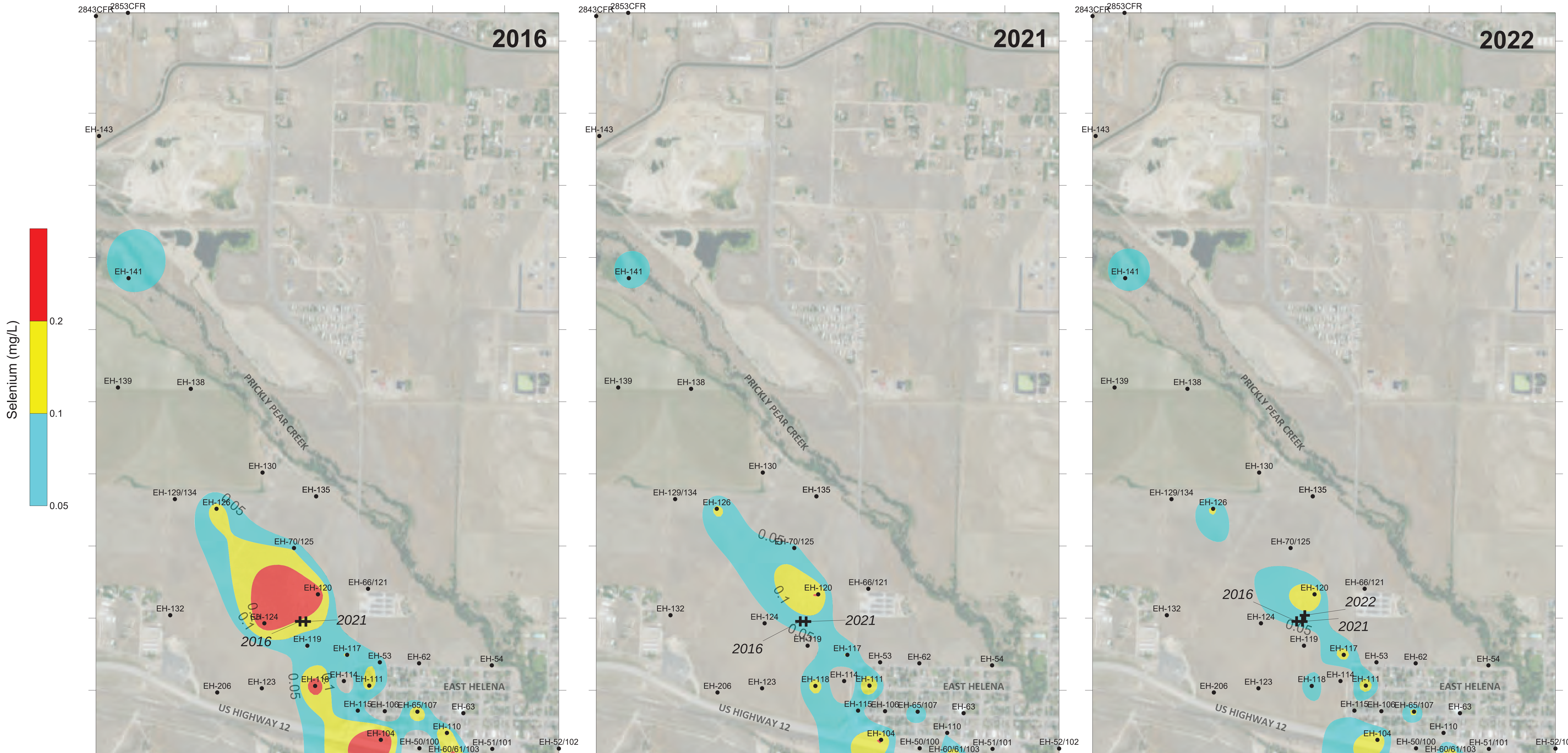
3.3.3.2 Downgradient Selenium Plume Stability Results

Off-site selenium plume metrics including the area from Highway 12 north to Canyon Ferry Road have been calculated for 2016, 2021, and 2022, based on data availability for wells within this area. The selenium plume stability analysis results are summarized on Figure 3-12. The overall Surfer-calculated plume area with selenium concentrations above the 0.05 mg/L groundwater standard decreased from 125 acres in 2016 to 76 acres in 2021, and decreased further to 50 acres in 2022, an overall decrease of about 60%. Average selenium concentrations showed a similar overall decrease from 2016 (0.126 mg/L) to 2021 (0.079 mg/L) and 2022 (0.074 mg/L). The plume centroid location for selenium has been relatively stable between 2016 and 2022. Also shown in Figure 3-12 is an apparent fragmentation of the plume between the Facility and Lamping Field. While the software-generated contours on Figure 3-12 may understate the overall true area of the plume (i.e., by not connecting the 0.05 mg/L exceedances at well EH-126 and well EH-141 further north), they do accurately reflect the decreasing selenium concentrations since 2016 in the southern portion of the plume stability area and the associated plume contraction. The observed trends are primarily attributable to the significant concentration decreases observed in the upgradient West Selenium source area since 2015 (Section 3.3.3.3).

Overall, the downgradient selenium plume metrics shown in Figure 3-12 suggest the plume is receding. The retraction of the downgradient plume extent by approximately 2,000 feet from 2016 to 2022 (Section 3.3.2.2) and the decrease in average plume selenium concentration over the same period indicate a receding plume. As noted in previous WRM reports, a pre-2016 increase in average plume selenium concentrations was consistent with temporary concentration increases noted at upgradient West Selenium Source well DH-66 (Section 3.3.2.2) through 2014, believed to be attributable to remediation construction activities in the area at that time.

3.3.3.3 Plant Site Arsenic and Selenium Plume Stability Results

As described previously, about 30% of the wells used to calculate plant site plume stability metrics were dry in both 2021 and 2022 due to water level decreases driven by the SPHC CM and local precipitation and recharge patterns, therefore, updated plume stability metrics have not been calculated. The following discussion reiterates the conclusions of the plant site plume stability evaluation through 2020, as summarized in Table 3-7 and presented in the 2020 WRM report (Hydrometrics, 2021c).



Year	Selenium Plume Area > 0.05 mg/L (acres)	Average Selenium Concentration (mg/L)
2016	125	0.126
2021	76	0.079
2022	**50**	**0.074**

NOTES:
✚ = calculated plume centroid for given year
Plume stability metrics calculated using method of Ricker (2008)
Concentration isocontours generated by Surfer Version 13

2022 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME STABILITY EVALUATION RESULTS

FIGURE
3-12

K:\PROJECT\10022\PLUME STABILITY\FIGURES\2022\Fig3-12_Se_Plume_Stability_2022.srf

Table 3-7. Plant Site Plume Stability Results (2010-2020)
2022 Water Resources Monitoring Report - East Helena Facility

Year	Selenium Plume Area Exceeding 0.05 mg/L (acres)	Selenium Average Concentration (mg/L)
2010	67	0.45
2016	48	0.27
2017	35	0.23
2018	52	0.34
2019	51	0.24
2020	33	0.22
Year	**Arsenic Plume Area Exceeding 0.01 mg/L (acres)**	**Arsenic Average Concentration (mg/L)**
2010	82	2.25
2016	77	1.29
2017	77	1.19
2018	69	0.94
2019	71	1.02
2020	72	1.04

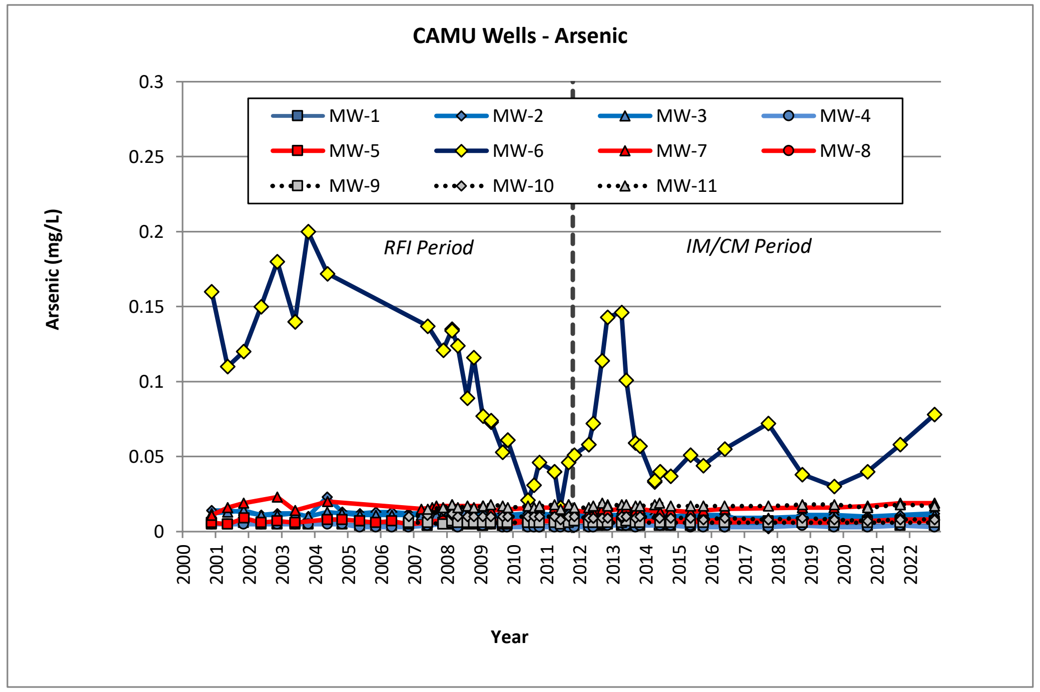
Plume stability results have shown a 2010 to 2020 reduction in overall selenium plume area from 67 to 33 acres, and a reduction in the arsenic plume area of 82 to 72 acres. Average concentrations have decreased by approximately 50%, from 0.45 to 0.22 mg/L for selenium, and 54%, from 2.25 to 1.04 mg/L for arsenic from 2010 to 2020. These trends reflect the generally decreasing concentration trends for arsenic and selenium observed in plant site source areas. The locations of the calculated arsenic plume centroids were virtually unchanged from 2010 to 2020, while the selenium plume centroid showed a notable eastward shift in 2018-2019, and a shift back to the west in 2020 (Hydrometrics, 2021c). The 2010 to 2019 eastward shift in the selenium plume centroid is due to a greater relative influence from the slag pile source area as the West Selenium source area concentrations continue to decrease, with the 2020 westward shift due to a significant decrease in selenium concentration at slag pile well DH-56 in 2020. The slag pile is scheduled to be regraded and partially capped to address this ongoing source.

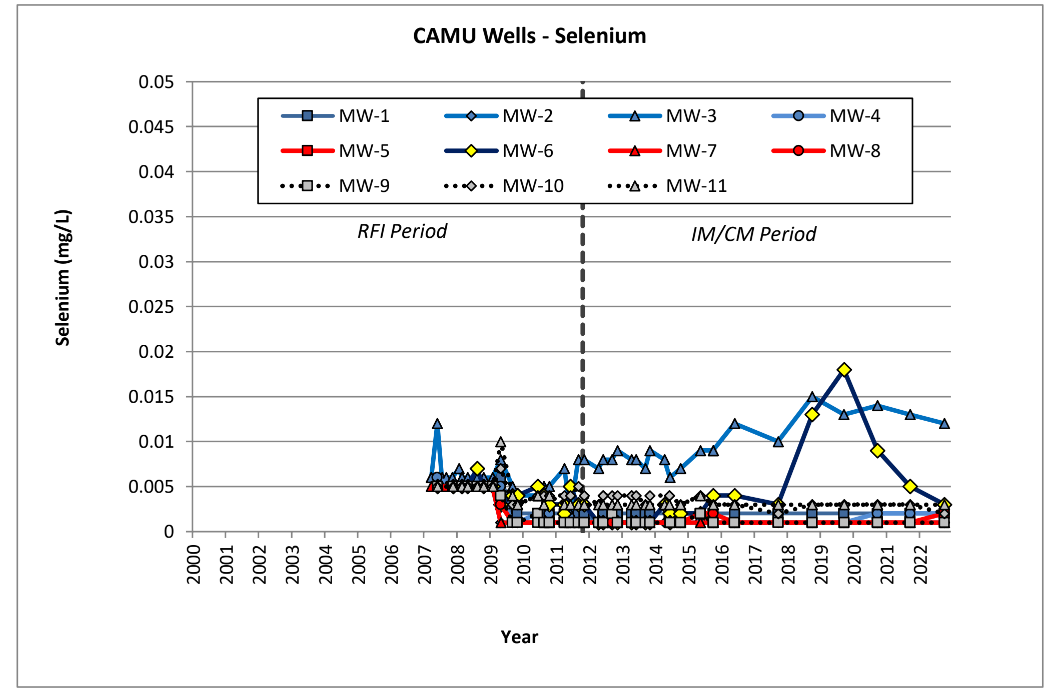
As evidenced by the high number of dry plant site monitoring wells in both 2021 and 2022 and discussed in Section 3.3.2.1, the saturated thickness of the contaminated shallow aquifer has also decreased by 50% or more on the plant site, resulting in decreased mass flux of arsenic and selenium migrating off-site. In time, the decreasing source area concentration trends and declining water levels should result in further decreases in the downgradient arsenic and selenium plume concentrations and extents, although that process is expected to take much longer for arsenic than for selenium due to the greater attenuation affinity and slower migration rate for arsenic.

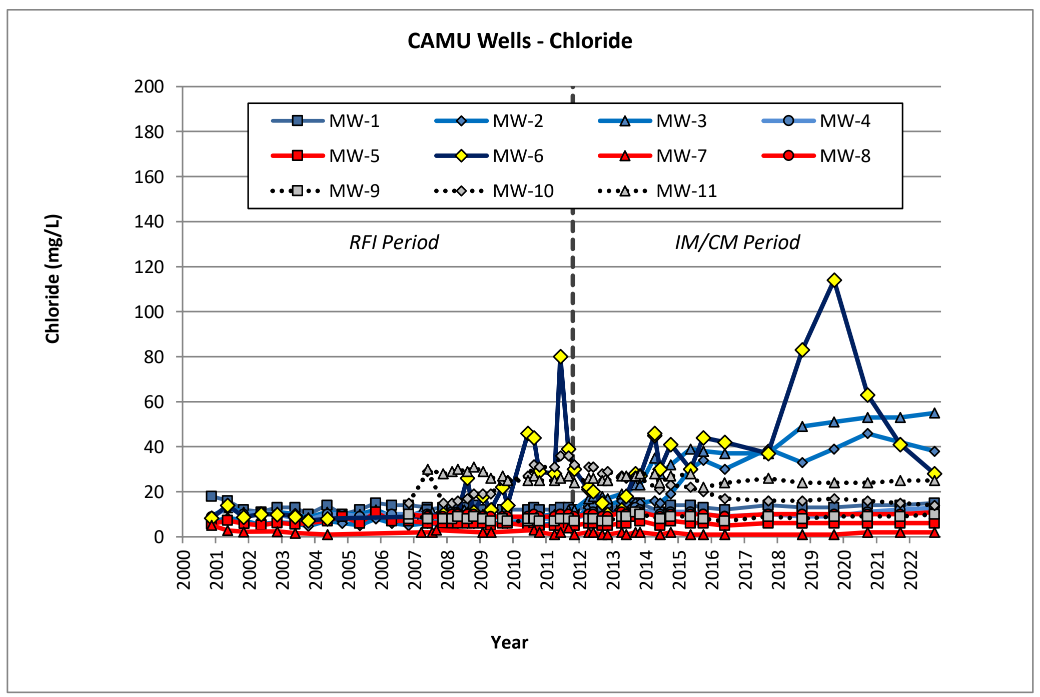
3.3.4 CAMU Area Monitoring Results

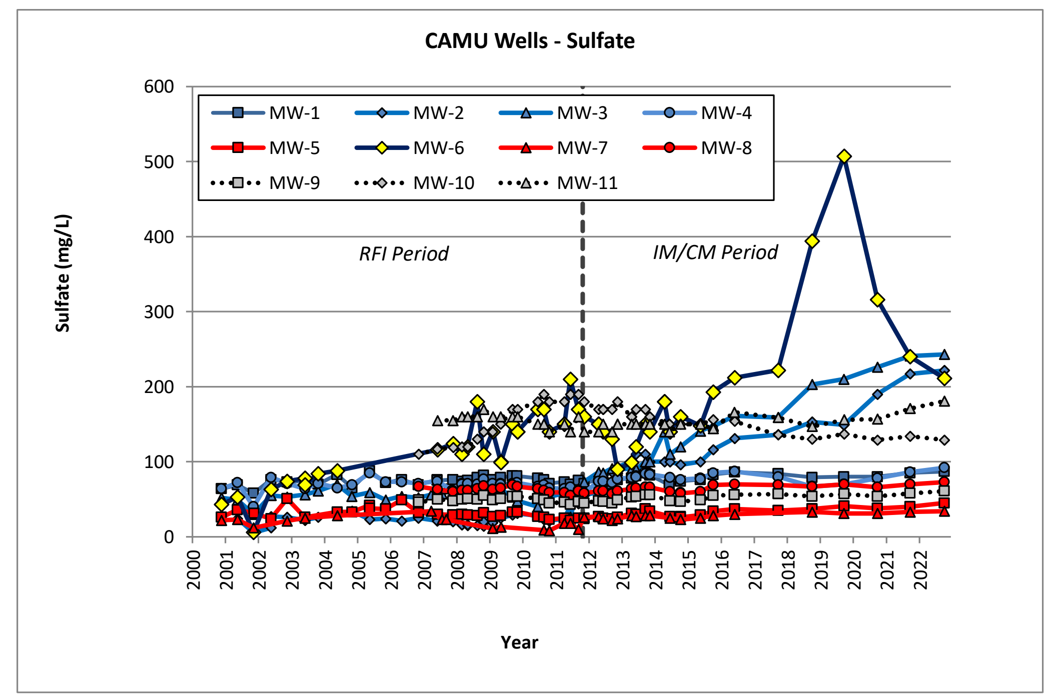
An additional objective of the 2022 performance monitoring program is to continue to evaluate groundwater quality in the vicinity of the two RCRA landfills, the CAMUs, located immediately southwest of the Facility (Figure 1-1). The CAMU groundwater monitoring network includes 11 monitoring wells ranging from 40 to 72 feet deep. All 11 wells were sampled in October 2022 to document current groundwater quality. Trend plots for arsenic, selenium, chloride, and sulfate at the CAMU wells through October 2022 are shown on Figure 3-13.

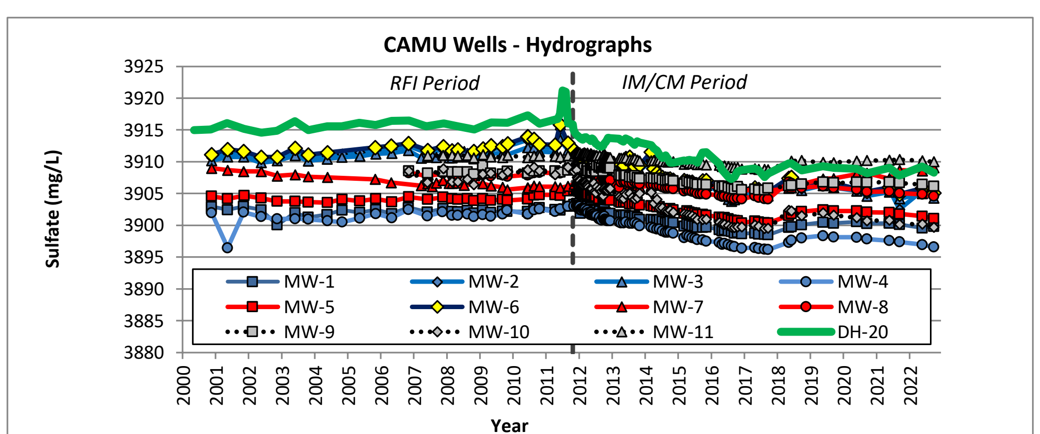
Overall, the 2022 CAMU monitoring results are consistent with previous monitoring results. For example, CAMU wells MW-2, MW-3, MW-7, MW-10, and MW-11 (Exhibit 1) yielded arsenic concentrations ranging from 0.008 to 0.019 mg/L (compared with the groundwater HHS of 0.01 mg/L). These results are consistent with previous observations and attributable to naturally occurring groundwater arsenic derived from the Tertiary volcanoclastic sediments in this area. Arsenic at well MW-6 (0.078 in October 2022) has been higher than other wells since the beginning of the monitoring record (Figure 3-13), suggesting some plant site influence. Selenium concentrations at all CAMU monitoring wells were well below the 0.05 mg/L HHS in October 2021, ranging from <0.001 to 0.012 mg/L. Selenium concentrations at wells MW-3 and MW-6 increased in 2015-2017, but have declined in the last several years. Selenium concentrations at MW-6 peaked at 0.018 mg/L in 2019 and have since decreased to 0.003 mg/L in 2022. At MW-3, selenium peaked in 2018 at 0.015 mg/L and was reported at 0.012 mg/L in October 2022.











*Well locations shown on Exhibit 1

Well DH-20 on hydrograph represents groundwater elevation in south plant area

Hydrometrics, Inc.

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**CAMU AREA GROUNDWATER QUALITY AND WATER LEVEL TRENDS**	FIGURE **3-13**

Manganese concentrations may indicate changes in oxidizing conditions in groundwater that are contributing to observed arsenic and selenium concentrations. Recent manganese concentrations have followed a similar trend to arsenic and an inverse trend to selenium. Manganese concentrations decreased slightly at well MW-6, from a range of 2.3 to 5.7 mg/L prior to 2018, to 0.7 mg/L in 2019. The lower manganese concentration at MW-6 could indicate more oxidizing groundwater conditions, which could also lead to the observed increase in selenium (more mobile under oxidizing conditions) and the decrease in arsenic (less mobile under oxidizing conditions) during the 2018-2020 period. Manganese has since increased to 1.11 (2020), 1.81 (2021) and 2.68 mg/L (2022), correlating with an increase in arsenic and decrease in selenium over the same period. All other metals were near or less than analytical detection limits in all 2022 CAMU well samples, including parameters that have been documented at elevated concentrations in plant site soils and/or groundwater. All 2022 CAMU well results were below detection limits for antimony, cadmium, copper, lead, mercury, thallium, and zinc (Appendix A). Overall, it appears that the observed localized arsenic and selenium concentration trends in certain CAMU wells may be redox driven, with changes in redox conditions attributable to variable influence from plant site groundwater and fluctuating annual precipitation and recharge conditions.

Sulfate and chloride concentrations at MW-2, MW-3, and MW-6 along the north and northeast sides of the CAMU adjacent to the plant site (see Exhibit 1) indicate an influence from plant site groundwater, with concentrations increasing significantly at all three wells beginning in about 2014 (Figure 3-13). The 2018-2019 increases in particular correspond with an increase in groundwater levels resulting from the above average precipitation experienced those years (as discussed in Section 3.3.2.1 and shown on the hydrographs in Figure 3-5 for plant site wells and Figure 3-13 for CAMU area wells), inducing westward migration of plant site groundwater. Concentrations of sulfate and chloride both decreased substantially from 2019 to 2022 at well MW-6, however, from 507 to 211 mg/L for sulfate and from 114 to 28 mg/L for chloride. Current (October 2022) concentrations at wells MW-2 and MW-3 are 214 to 243 mg/L sulfate and 38 to 55 mg/L chloride. The plant site influence on chloride and sulfate concentrations at these wells also corresponds with the relatively elevated (although overall decreasing) arsenic concentrations at well MW-6 and the slightly higher selenium concentration at MW-3.

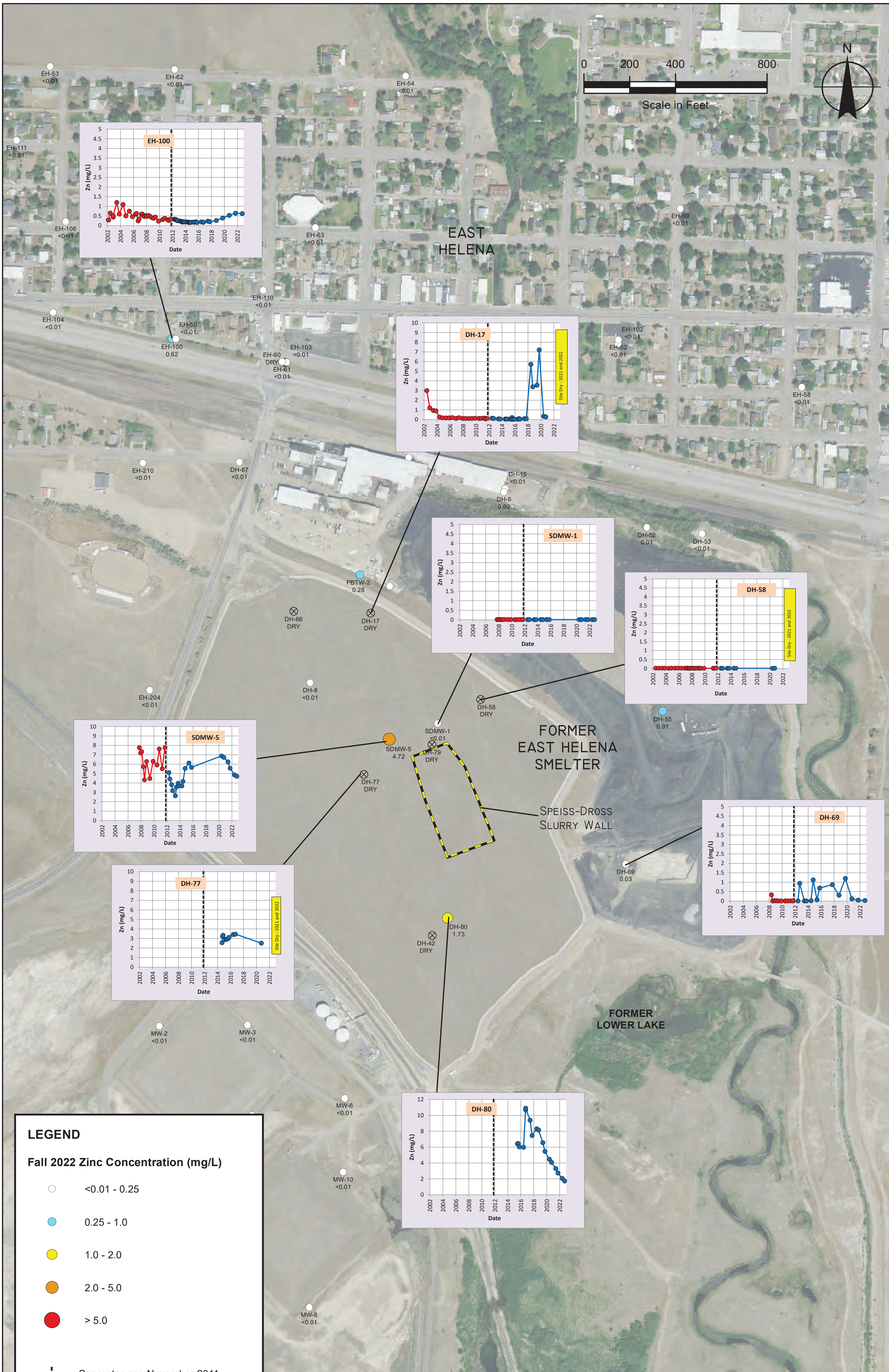
3.3.5 Zinc and Cadmium Concentrations and Trends

Although arsenic and selenium are the primary groundwater COCs for the former East Helena Smelter Site, the WRM program parameter suite includes other parameters that have been detected at elevated concentrations in Facility groundwater in the past, or that may be associated with metal smelting operations (Table 2-5). As discussed in previous site reports, both zinc and cadmium have persisted at elevated groundwater concentrations in certain areas of the former smelter, with concentrations of both constituents showing increasing trends in recent years at some wells. Variations in zinc and cadmium concentrations across the plant site are closely related to historic source areas and to local pH and redox conditions. The mobility of zinc and cadmium in groundwater is sensitive to even small changes in pH, with increased solubility and decreased adsorption occurring as pH decreases. While both zinc and cadmium exist in only one oxidation state under normal environmental conditions (Zn^{2+} and Cd^{2+}), changing redox conditions nevertheless impact their mobility through (1) affecting the formation and dissolution of iron and manganese oxides, which adsorb metals including zinc and cadmium, and (2) creating sulfate reducing conditions, which can lead to precipitation as stable zinc or cadmium sulfide. Semiannual sampling of four wells (DH-58, DH-77, SDMW-1, and SDMW-5) was included in the 2022 CAMP monitoring scope, to provide additional information on the current distribution of zinc and cadmium in site groundwater, as well as updated concentration trends for both zinc and cadmium.

As noted in the 2020 WRM Report (Hydrometrics, 2021c), groundwater zinc concentrations beneath process areas during the pre-2001 operational period of the smelter occasionally reached concentrations above 50 mg/L, with a few samples over 100 mg/L. These concentrations largely occurred in wells within and around the former Acid Plant, and were associated with releases from the process water circuit and contaminated Acid Plant sludges, and with low groundwater pH values (pH<5.0). Downgradient of the Acid Plant, groundwater showed maximum concentrations above 30 mg/L prior to the 2001 smelter shutdown. Following the smelter shutdown, however, zinc concentrations decreased, and although isolated areas of higher concentrations have remained, maximum observed concentrations are much lower than during the operational period. As in 2021, the 2022 data in Appendix A show elevated zinc concentrations above the 2.0 mg/L groundwater HHS at two monitoring wells (DH-80 and SDMW-5), and lower concentrations from 0.13 to 0.70 mg/L at three wells (EH-100, PBTW-1, and PRB-2); all of the remaining 2022 groundwater samples from both on and off-site monitoring wells and residential wells had zinc concentrations from <0.01 to 0.03 mg/L.

Figure 3-14 shows October 2022 zinc concentrations along with updated temporal trends from 2002 (post-plant shutdown) through 2022 for selected wells. As shown on Figure 3-14, zinc concentrations at monitoring well DH-17, located in the North Plant Arsenic Source Area, showed an abrupt increase from typical values of less than 0.1 mg/L to 5.72 mg/L in June 2018, and again in October 2019 to 7.21 mg/L. Zinc concentrations returned to much lower concentrations (0.28 to 0.34 mg/L) at DH-17 in 2020; well DH-17 was dry throughout 2021 and 2022. A recent slight increase in zinc concentration at downgradient well EH-100 from about 0.2 to 0.62 mg/L has occurred since 2018, likely influenced by the short-term increase at DH-17. At well DH-80 in the former Acid Plant area and downgradient of the 2016 soil removal CM, the October 2022 zinc concentration of 1.73 mg/L is the minimum recorded to date at this well, continuing a decreasing trend from the 2016 maximum of about 11 mg/L.

At slag pile well DH-69, zinc concentrations have been variable during the CM period, with occasional excursions above 1 mg/L and intermittently lower concentrations; zinc concentrations decreased from 1.2 to 0.03 mg/L from October 2019 to October 2022 at well DH-69 (Figure 3-14). Wells DH-77 (2.51 mg/L zinc in October 2020) and SDMW-5 (4.72 mg/L zinc in October 2022), downgradient of the former Acid Plant area and adjacent to the Speiss-Dross area, have consistently exhibited zinc concentrations above 2 mg/L and as high as nearly 8 mg/L (Figure 3-14). Well DH-77 was dry in October 2021 and 2022.



2022 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

ZINC CONCENTRATIONS AND TRENDS IN PLANT SITE GROUNDWATER

FIGURE
3-14

Path: G:\PROJECT\10022\2022 WRMFig3-14_ZnTrends.mxd Date Saved: 3/9/2023 10:15:22 AM

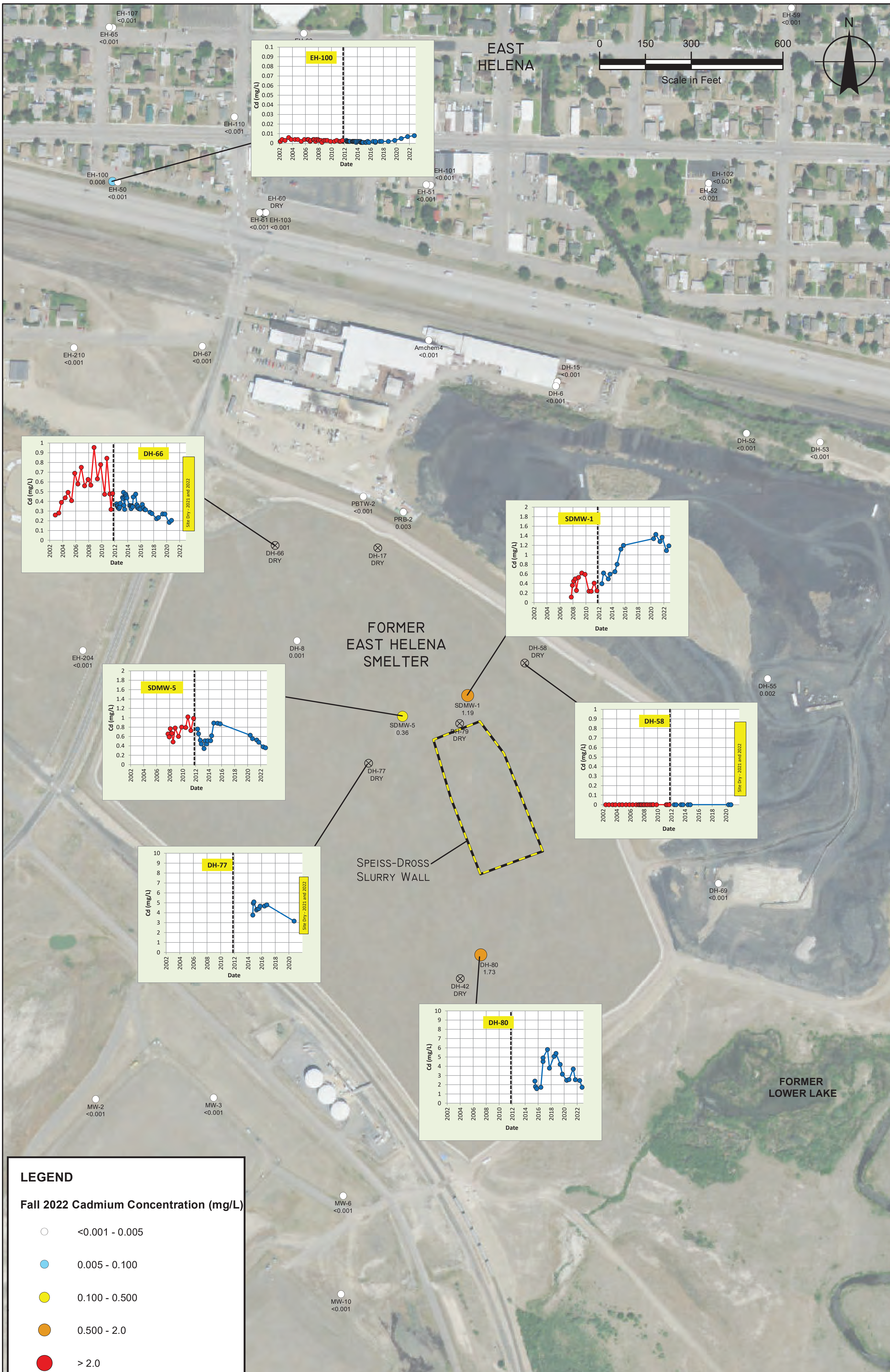
Hydrometrics, Inc.
Consulting Scientists and Engineers

Zinc concentrations above the HHS of 2.0 mg/L occurred frequently at well DH-17 prior to 2003, with concentrations as high as 8.2 mg/L in the late 1980s, but decreased significantly after the 2001 smelter shutdown. The higher zinc concentrations at DH-17 in 2018 and 2019 are likely attributable to the higher groundwater levels during those years, and/or varying geochemical conditions related to fluctuations in groundwater recharge.

The current elevated zinc concentrations observed in plant site wells are associated with lower pH conditions, including DH-80 (pH ~5.4 in 2022), SDMW-5 (pH ~5.8). At well DH-69, the decrease from 1.2 to 0.03 mg/L zinc from October 2019 to October 2022 was accompanied by a redox potential decrease of more than 100 mV and a decrease in sulfate concentration from 317 to 250 mg/L, which could indicate the onset of sulfate reducing conditions and the precipitation of zinc sulfide.

Similar to zinc, cadmium concentrations in Facility groundwater were historically elevated in the former Acid Plant area, due to process water releases, contaminated sediments, and low pH values, with concentrations often above 10 mg/L and periodically above 20 mg/L in area monitoring wells during smelter operations. Downgradient migration of cadmium, however, was more limited than that of zinc. For example, well EH-100 (maximum zinc concentration of 1.2 mg/L) has a maximum cadmium concentration of 0.008 mg/L. As with zinc, following the 2001 smelter shutdown cadmium concentrations decreased, with isolated areas of higher concentrations remaining at present (Figure 3-15). The 2022 groundwater monitoring data in Appendix A continue to show elevated cadmium concentrations above 1.0 mg/L at two wells (DH-80 and SDMW-1), concentrations above 0.1 mg/L at one additional well (SDMW-5), and concentrations from 0.001 to 0.008 mg/L at DH-8, DH-55, PRB-2, and EH-100. All the remaining 2022 groundwater samples from both on and off-site monitoring wells and residential wells had nondetect cadmium concentrations (<0.001 mg/L). The detectable cadmium concentrations all exceeded the 0.005 mg/L groundwater HHS, except at DH-8 (0.001 mg/L), DH-55 (0.002 mg/L) and PRB-2 (0.002 to 0.003 mg/L).

Figure 3-15 presents updated cadmium concentration trends through October 2022 for selected wells, and the most recent cadmium concentration observed at each well. The highest cadmium concentrations in Facility groundwater typically occur in and downgradient of the former Acid Plant area at wells DH-80 (1.73 to 2.46 mg/L in 2021) and DH-77 (dry in 2022; 3.16 mg/L in 2020), with slightly lower concentrations in the Speiss-Dross area at wells SDMW-1 and SDMW-5 (0.360 to 1.19 mg/L in 2022) (Figure 3-15). This area is generally coincident with the area of elevated zinc concentrations, although cadmium concentrations remained low at well DH-17 during the period of higher zinc concentrations in 2018 and 2019 (<0.001 to 0.002 mg/L), and at the south end of the slag pile (DH-69, all samples during the period of record less than or equal to 0.001 mg/L cadmium) where higher zinc concentrations have been observed (Figure 3-15). Cadmium concentration trends on the plant site indicate recent decreasing trends at wells DH-66, SDMW-5, and DH-80, and an overall increasing trend at well SDMW-1 (Figure 3-15).



2022 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

CADMIUM CONCENTRATIONS AND TRENDS IN PLANT SITE GROUNDWATER

FIGURE **3-15**

Hydrometrics, Inc.
Consulting Scientists and Engineers

Path: G:\PROJECT\10022\2022 WRM\Fig3-15_CdTrends.mxd

Date Saved: 3/17/2023 11:48:11 AM

Along with zinc (and other groundwater contaminants), cadmium concentrations and migration patterns in groundwater beneath the former plant site are a combined function of historic plant processes and source areas, changes in plant site water levels and flow patterns , and/or pH and redox conditions, as described previously. Elevated zinc and cadmium concentrations largely co-occur with elevated concentrations of the primary groundwater COCs arsenic and selenium. Despite the persistent elevated zinc and cadmium groundwater concentrations in certain areas of the former smelter, no off-site migration at concentrations above the groundwater HHS of 2.0 mg/L is currently indicated for zinc, and exceedances for cadmium (HHS of 0.005 mg/L) are limited to EH-100 north of the plant site (0.008 mg/L). Future groundwater monitoring will continue to include collection and evaluation of zinc and cadmium data, to assess any changes in concentration distributions and trends.

3.3.6 Unfumed Slag Groundwater Monitoring Results

The results of the UFS project groundwater monitoring conducted through 2022 are tabulated in Appendix E. Trend plots for the key COCs (arsenic and selenium) and potential slag leaching indicator parameters (sulfate, chloride, potassium, and magnesium) at UFS project monitoring wells from 2012-2022 are in Figures 3-16 through 3-21. As described in the UFS GMP (Hydrometrics, 2021a), statistical upper simultaneous limits (USLs) for each well and laboratory constituent were calculated using ProUCL software, based on pre-UFS project data from 2012 through 2020. The USLs are intended to provide a statistically-based upper limit on the expected range of values for each well, calculated from observations for the post-CM, pre-UFS project period. Sampling was initiated on July 29, 2021 with a pre-slag crushing monitoring event; the first post-crushing biweekly monitoring event was conducted on October 1, 2021. Sampling frequency for the project transitioned to monthly in 2022, based on the overall consistency of the biweekly sampling results and consistent with the USL GMP.

Adoption of a low-flow/low-volume sampling method for UFS project groundwater sampling was documented in a Sampling Methodology Addendum to the UFS GMP prepared in February 2022 (Hydrometrics, 2022c). The low-flow method reduces project costs by significantly reducing purge and decontamination water volumes requiring on-site storage and off-site disposal, and by streamlining the sampling procedure, reducing labor and equipment costs. Comparison samples for the UFS monitoring wells have shown good comparability between results obtained using the low-flow and the traditional purge (removing 3 to 5 well volumes) sampling methods, as documented in the Sampling Methodology Addendum.

The primary COCs arsenic and selenium and potential slag leaching/processing indicator parameters sulfate, chloride, potassium, and magnesium have shown slight variability in concentrations during the post-slag crushing monitoring period, but have largely remained within the range of pre-slag crushing concentrations and below calculated USLs (Figures 3-16 through 3-21; Appendix E). At well DH-53, however, selenium concentrations initially decreased from 0.034 mg/L in July 2021 (prior to crushing activities) to 0.004 mg/L in November 2021, before increasing to above the 0.028 mg/L USL in February and March 2022 (0.042 and 0.044 mg/L, respectively; below the 0.05 mg/L human health

Figure 3-16. Unfumed Slag Well Arsenic Trends
2022 Water Resources Monitoring Report

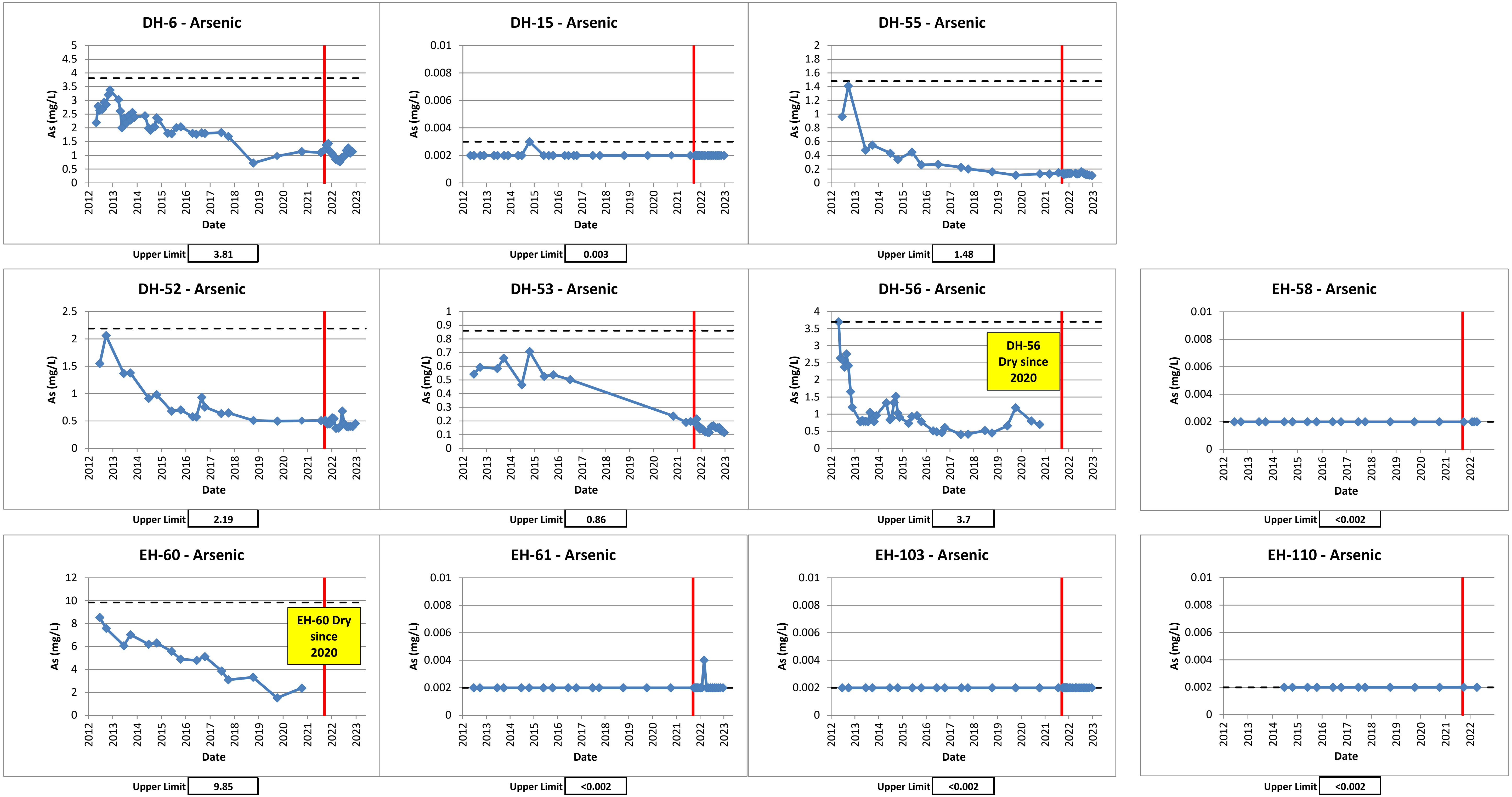


Figure 3-17. Unfumed Slag Well Selenium Trends
2022 Water Resources Monitoring Report

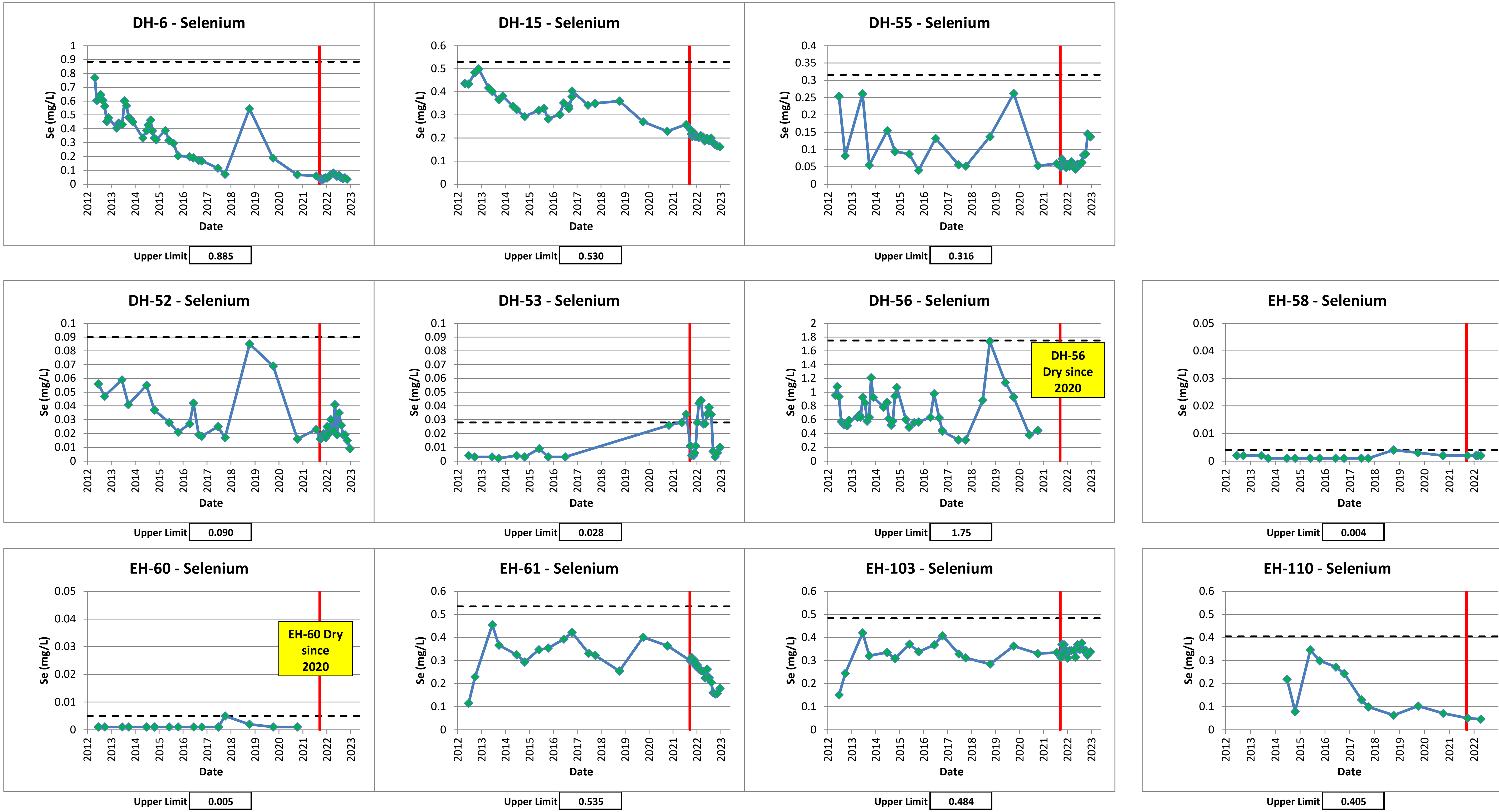


Figure 3-18. Unfumed Slag Well Sulfate Trends
2022 Water Resources Monitoring Report

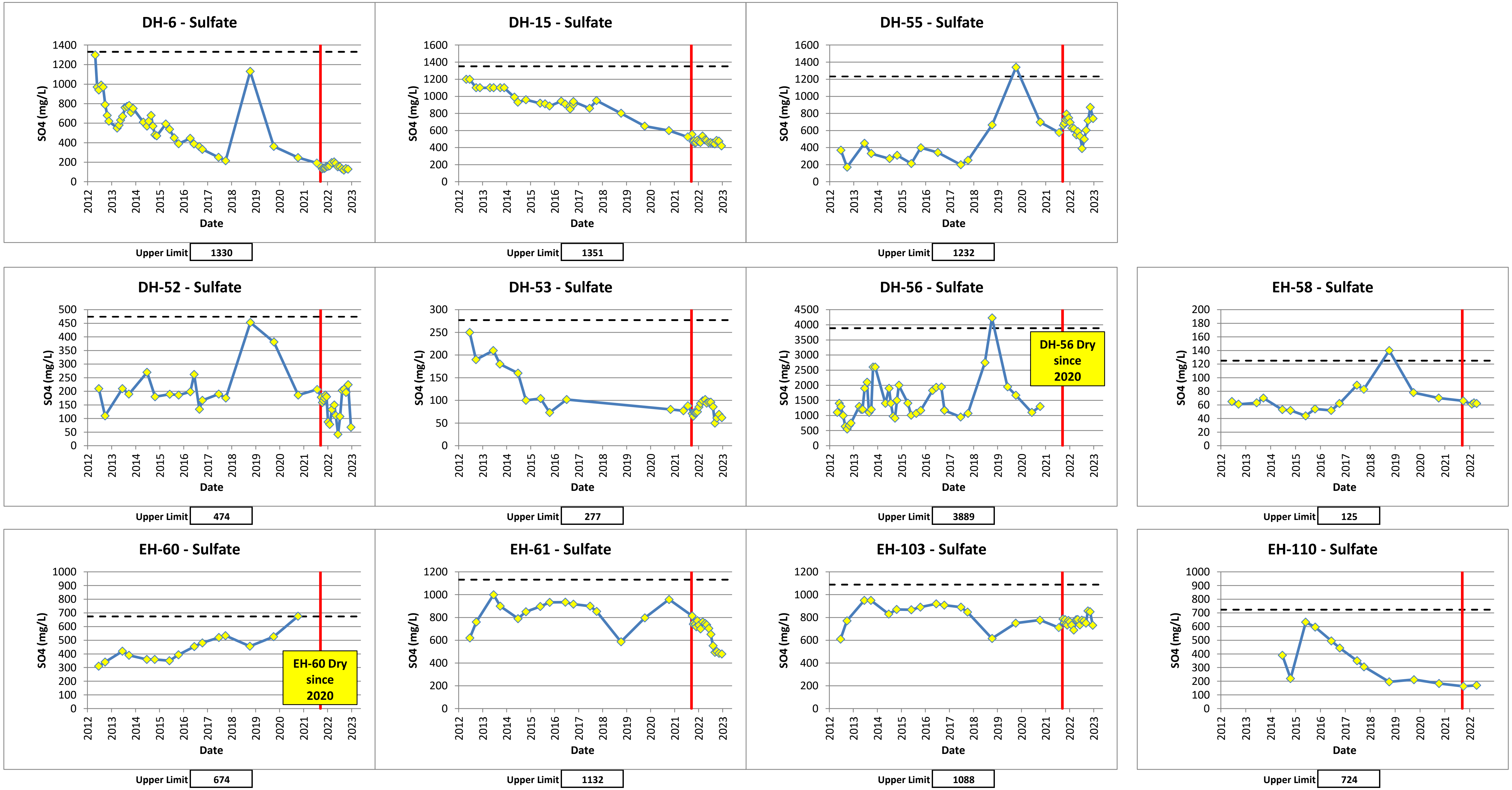
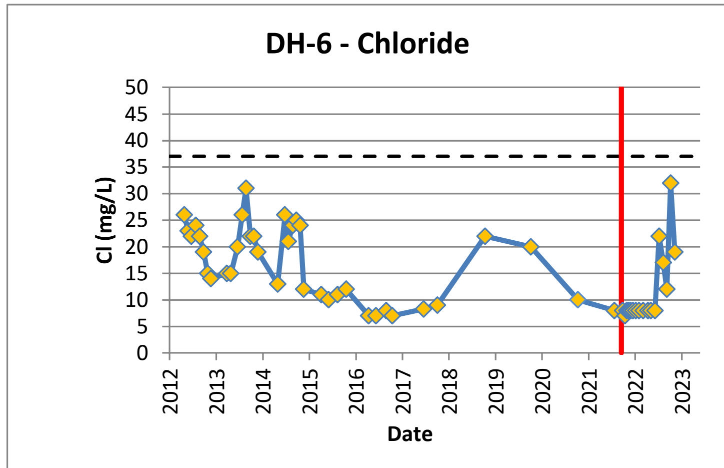
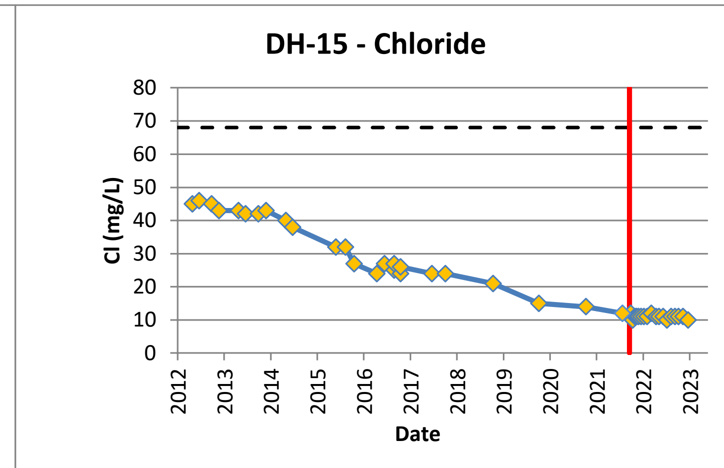


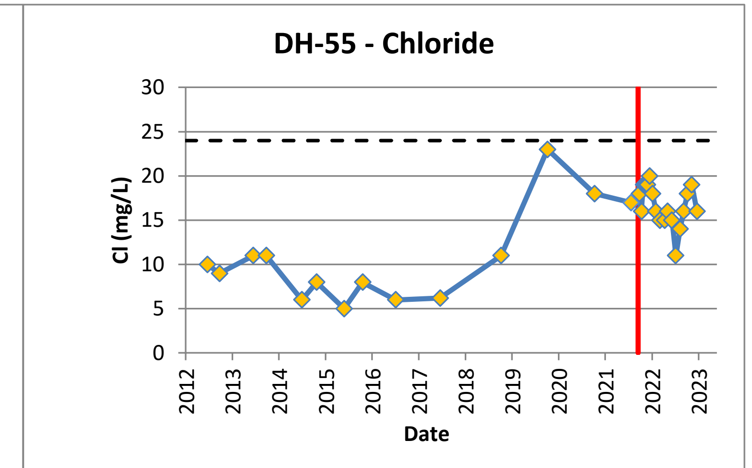
Figure 3-19. Unfumed Slag Well Chloride Trends
2022 Water Resources Monitoring Report



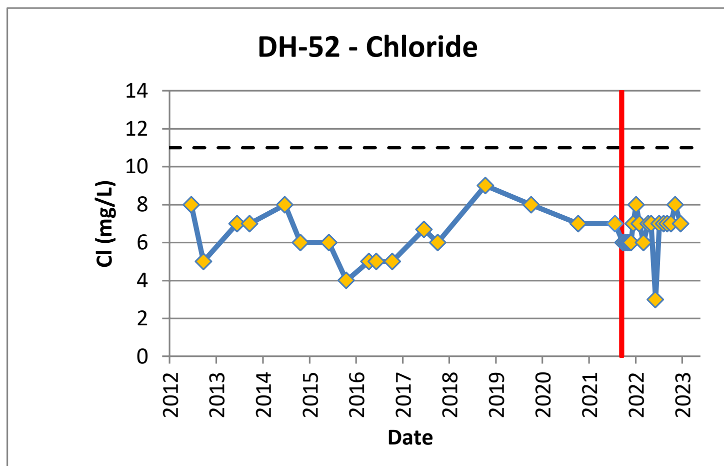
Upper Limit 37



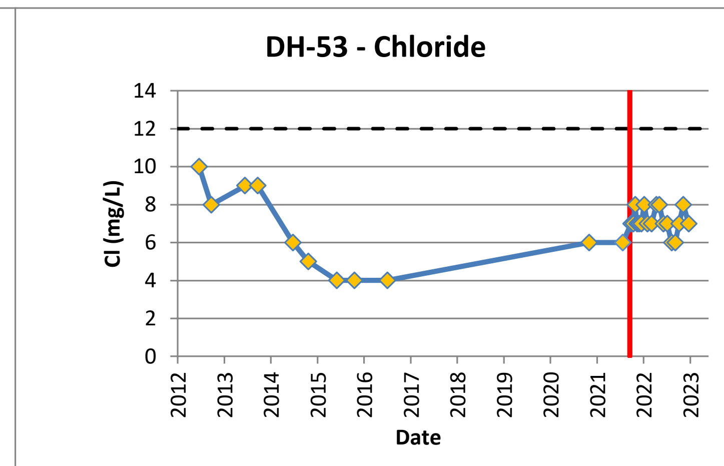
Upper Limit 68



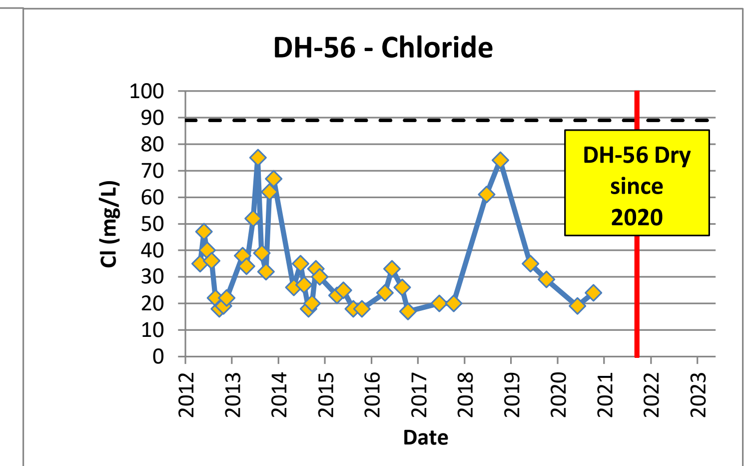
Upper Limit 24



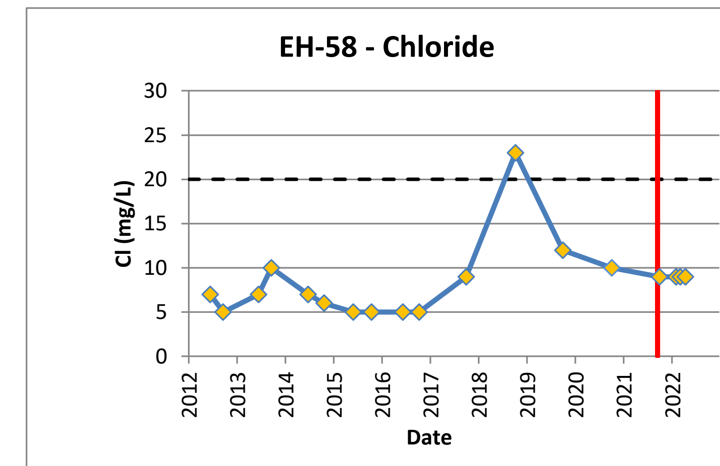
Upper Limit 11



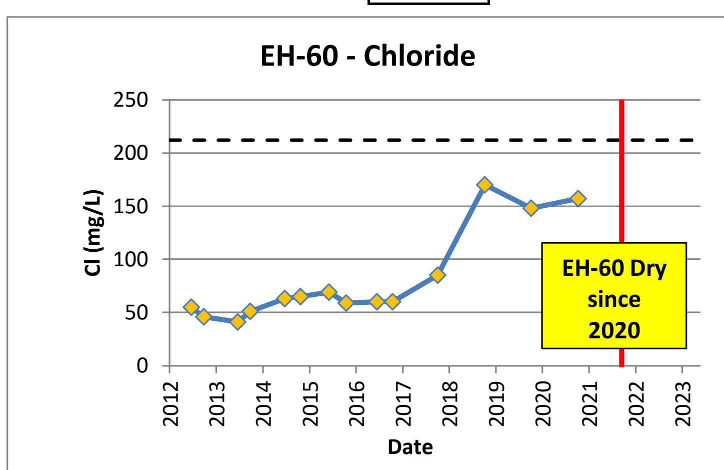
Upper Limit 12



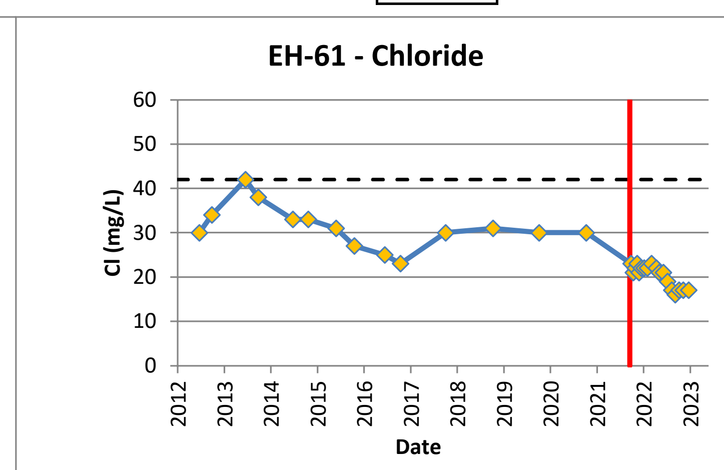
Upper Limit 89



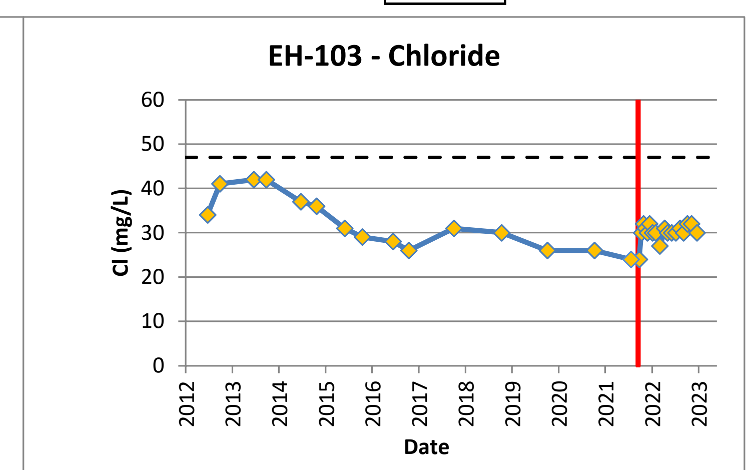
Upper Limit 20



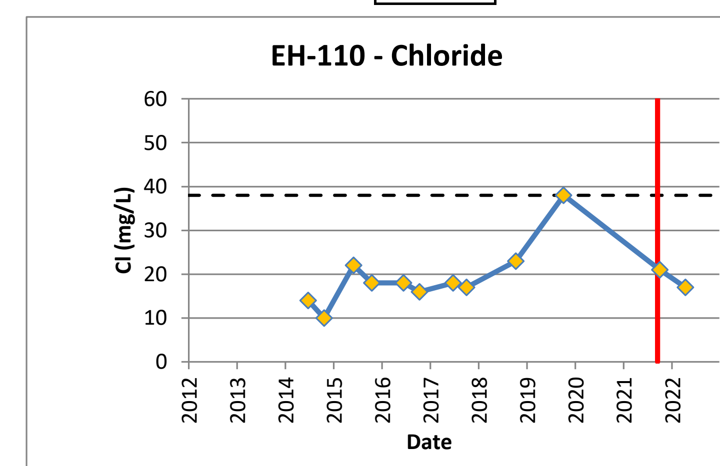
Upper Limit 212



Upper Limit 42

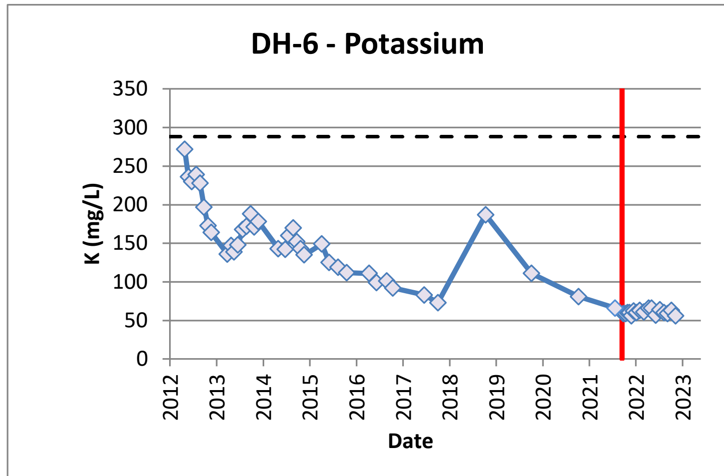


Upper Limit 47

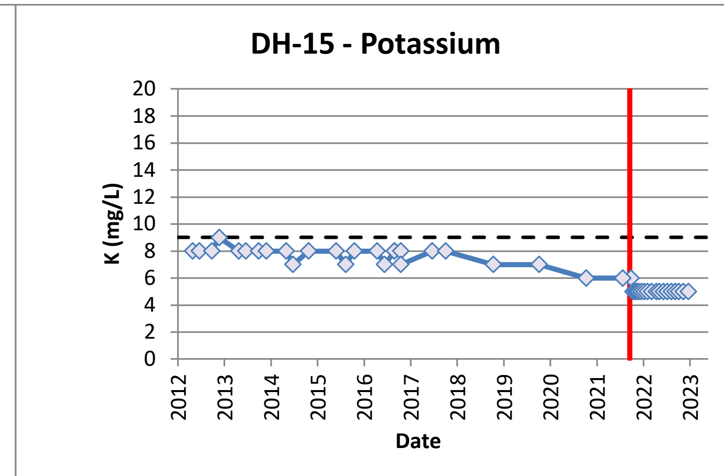


Upper Limit 38

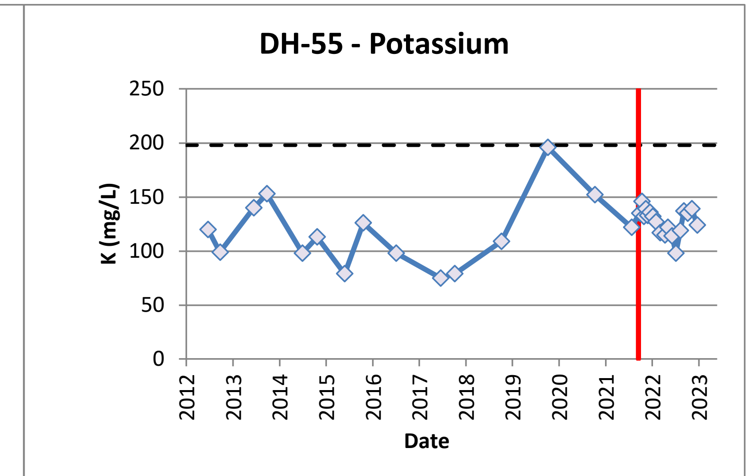
Figure 3-20. Unfumed Slag Well Potassium Trends
2022 Water Resources Monitoring Report



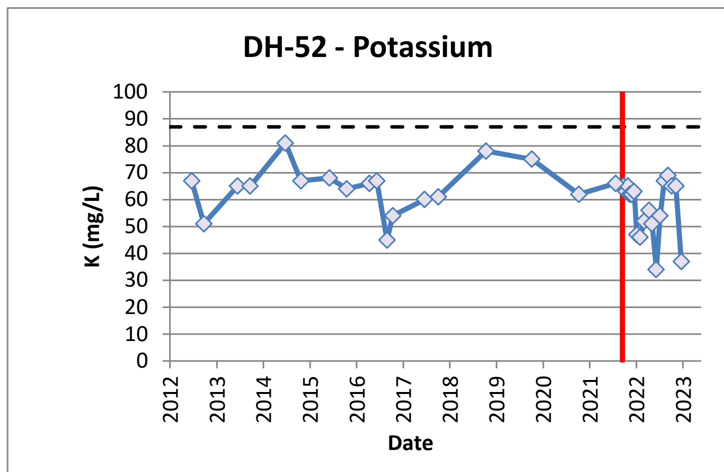
Upper Limit 288



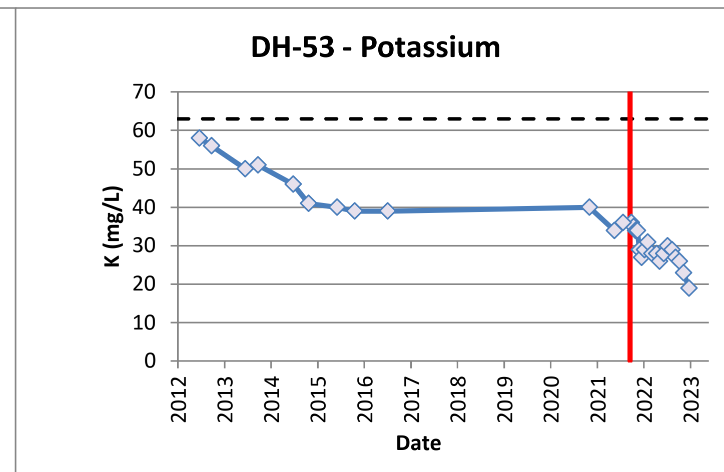
Upper Limit 9



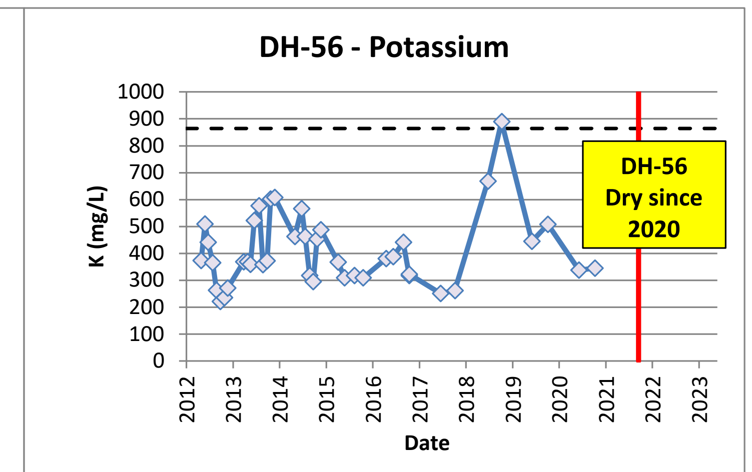
Upper Limit 198



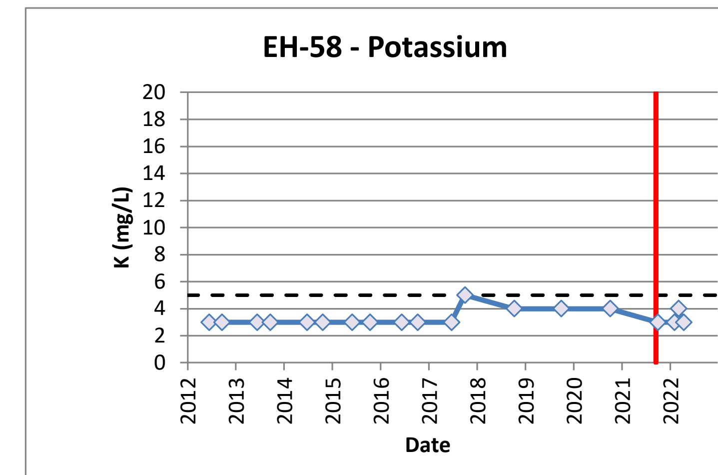
Upper Limit 87



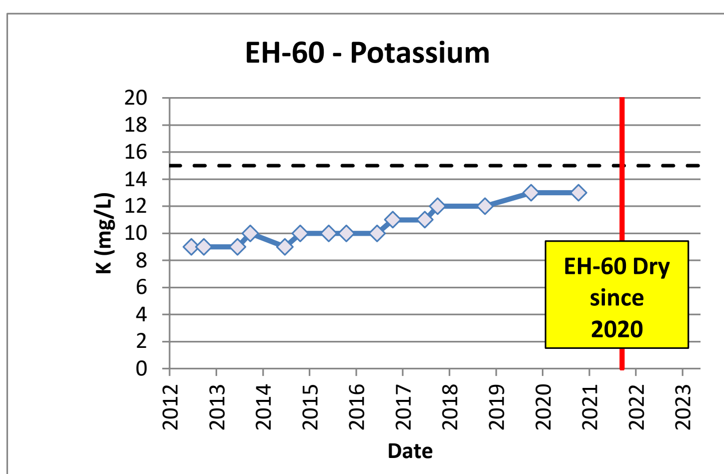
Upper Limit 63



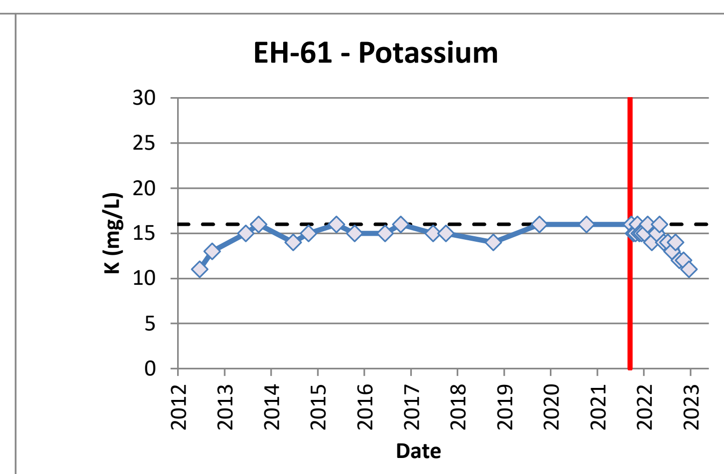
Upper Limit 864



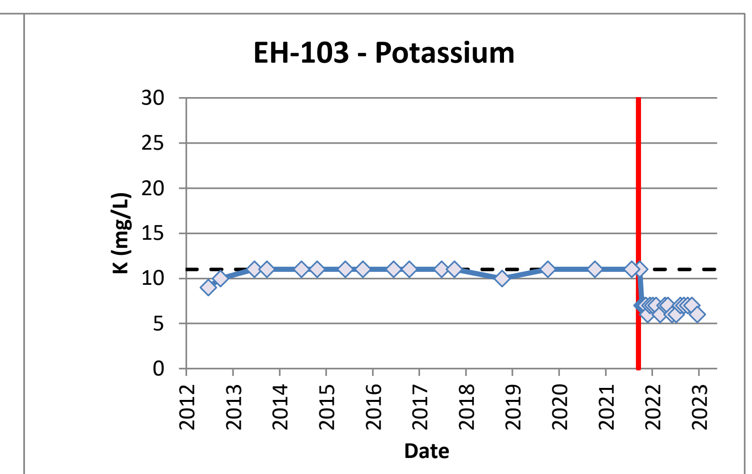
Upper Limit 5



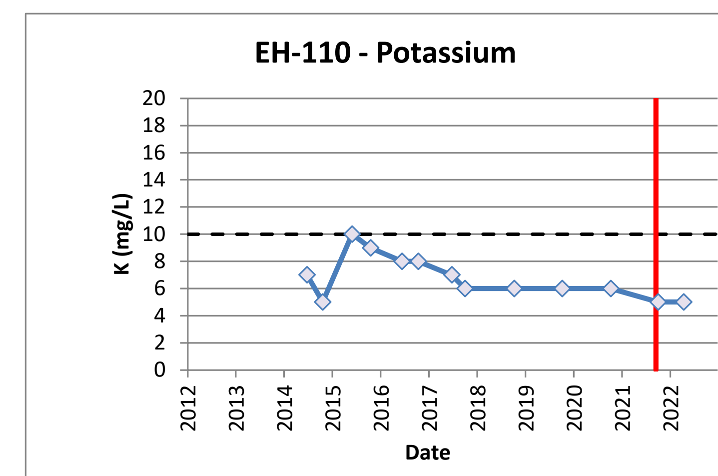
Upper Limit 15



Upper Limit 16

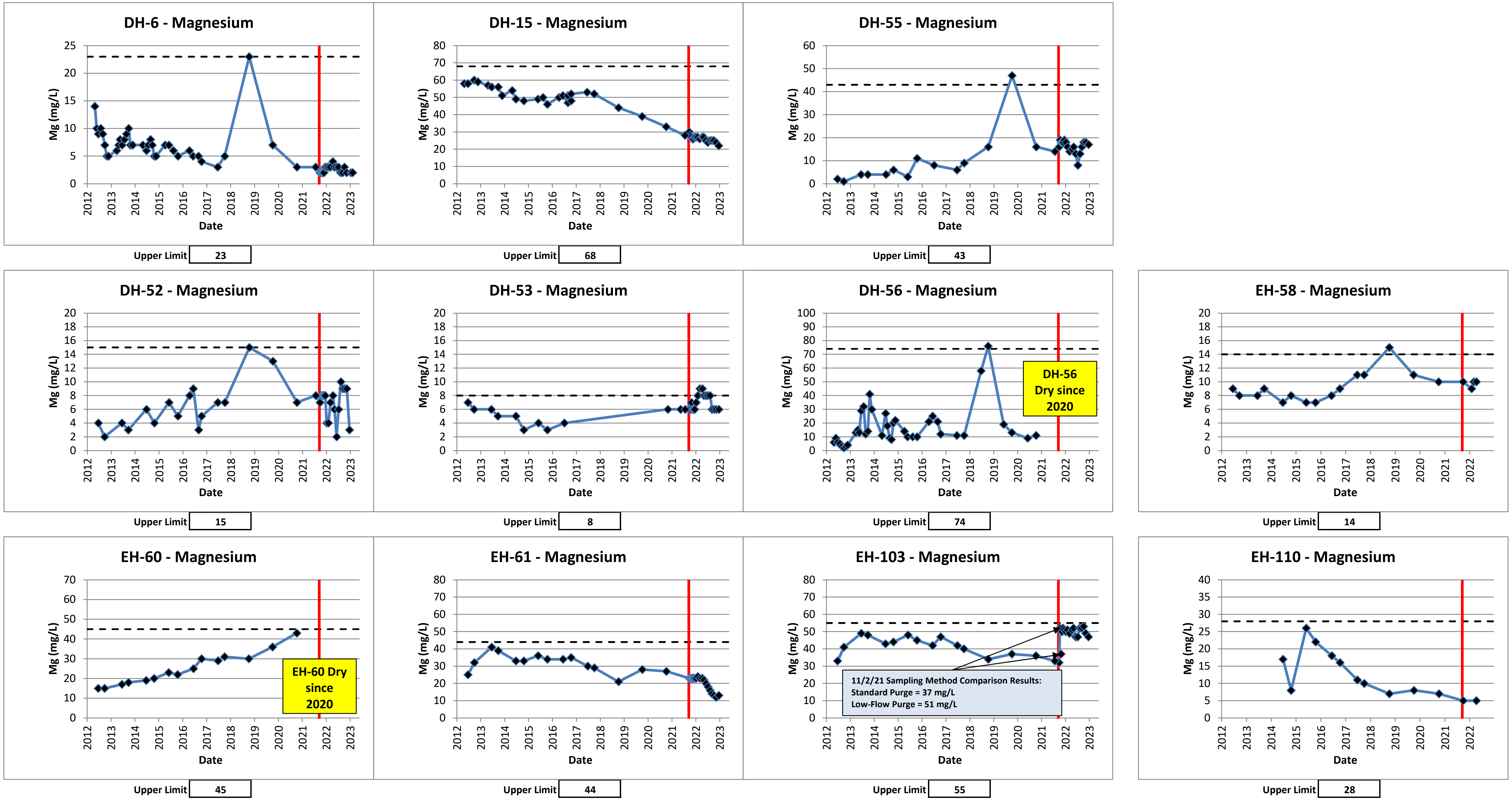


Upper Limit 11



Upper Limit 10

Figure 3-21. Unfumed Slag Well Magnesium Trends
2022 Water Resources Monitoring Report



standard) (Appendix E). Periodic selenium USL exceedances were noted throughout 2022 at well DH-53, but concentrations in the fall and winter 2022 (September through December) decreased substantially to a range of 0.003 to 0.010 mg/L, consistent with the October through December 2021 results, suggesting appreciable seasonal variability in concentrations at this location. Wells DH-52 and DH-53 are located near Prickly Pear Creek (Figure 2-2), and short-term fluctuations in groundwater quality are likely related to changes in creek levels due to freezing and thawing cycles, as well as seasonal runoff patterns. Magnesium concentrations also slightly exceeded the 8 mg/L USL at well DH-53 during March and April 2022, with results of 9 mg/L. Downgradient Tier 2 well EH-58 was sampled in February, March, and April 2022 based on the observed trends at well DH-53. All results for EH-58 were consistent with historic observations and were below the associated USLs (Figures 3-16 through 3-21, Appendix E), indicating that the variable selenium concentrations at DH-53 have not affected selenium concentrations at downgradient well EH-58 to date.

Selenium and sulfate concentrations increased slightly at well DH-55 toward the end of 2022, but have remained well below the respective USLs and thus within the expected range of concentrations for well DH-55 (Figures 3-17 and 3-18).

The arsenic concentration in the March 2022 sample from well EH-61 of 0.004 mg/L exceeded the USL calculated from the 2012-2020 data set (<0.002 mg/L) but is less than the human health standard of 0.01 mg/L. The comprehensive database shows that prior to 2012, low concentrations of arsenic were frequently detected at EH-61, ranging from 0.003 to 0.021 mg/L. The arsenic concentration at EH-61 returned to <0.002 mg/L for the remainder of 2022. Based on the slight arsenic increase at EH-61, downgradient Tier 2 well EH-110 was sampled in April 2022. Analytical results for EH-110 were well below USLs and consistent with previous observations (Table 3-8, Appendix E), indicating no water quality changes related to the UFS project.

The magnesium concentration at well EH-103 increased during October 2021, and has subsequently remained stable (Figure 3-21, Appendix E). Magnesium is considered a potential indicator of UFS project impacts due to the use of magnesium chloride for dust suppression. Given the distance of EH-103 from the slag pile, the lack of a similar magnesium concentration increase at wells DH-6 and DH-15 (between EH-103 and the slag pile), and the correspondence of the higher magnesium concentration with the low-flow/low-volume well sampling method (see EH-103 data for November 2021 comparison sampling in Figure 3-21 and Appendix E), the magnesium concentration increase is attributable to the change in sampling method.

Overall, the UFS project groundwater monitoring results obtained through 2022 have indicated no unacceptable water quality impacts, and minimal if any changes in groundwater quality. As noted above, for this project "unacceptable impacts" are defined as changes resulting in exceedances of one or more of the human health water quality standards listed in Circular DEQ-7 (MDEQ, 2019) in downgradient residential or public water supply wells. Some variability in water quality has been observed at a few of the monitoring wells, as discussed above; however, no systematic longer-term increases in COCs or indicator parameter concentrations above USLs have been apparent. UFS slag project groundwater monitoring will continue in 2023 in accordance with the UFS GMP and Addendum.

3.3.7 2022 CAPMP Well Purge Comparison Sampling Results

As outlined in the 2022 CAPMP (Hydrometrics, 2022a) and described above in Section 2.2.2, well purge method comparison sampling was conducted in 2022 to assess the comparability of groundwater quality data collected by low-flow/low-volume purging using a Waterra inertial pump versus standard purge methods. Adopting a low-flow sampling methodology in lieu of the standard purge method for groundwater sampling on the East Helena project would reduce the volume of sampling-derived water requiring disposal and associated costs, and would require less time and equipment than the standard three- to five-volume purge method.

Three wells were sampled using both purge methods during the June 2022 sampling, and nine wells were sampled using both methods during the October sampling (Table 2-3), comprising approximately 10% of the total number of wells sampled during each monitoring event. Low-flow/low-volume samples were collected first, followed by standard purge samples. Complete analytical results for the purge method comparison sampling in June and October 2022 are tabulated in Appendix F. To facilitate evaluation, each paired set of sample results was compared using criteria typically applied to field duplicate samples. Relative percent difference (RPD) values were calculated when both results were greater than or equal to 5 times the laboratory reporting limit, with a target of ≤ 20% RPD indicating good agreement. When one or both results were less than 5 times the laboratory reporting limit, an absolute difference of ± the reporting limit was used as the target. Non-detect values were replaced with the detection limit for purge method comparison purposes.

The purge method comparison sampling results in Appendix F indicate generally good agreement between results obtained using the low-flow/low-volume purge method and the standard purge method. For laboratory analytical parameters, exceedances of the duplicate sample criteria were observed only for total suspended solids (TSS) in five sample pairs, and for dissolved iron in two of the 12 sample pairs. All other paired results from the two methods for laboratory constituents were within the duplicate sample criteria, including the primary COCs arsenic and selenium, common indicator parameters such as chloride and sulfate, and major cations calcium, magnesium, sodium, and potassium. For field parameters, multiple sample pairs showed RPD values exceeding the 20% threshold for DO and turbidity, with some samples also exceeding 20% RPD for oxidation-reduction potential (ORP). Based on the results in Appendix F, the Waterra low-flow/low-volume method tended to generate higher suspended solids concentrations and slightly higher DO concentrations than the standard submersible pump method during purging in some (but not all) wells. In most cases, the differences in dissolved oxygen, while exceeding the 20% RPD criteria, were not particularly significant in absolute terms; for example, RPD exceedances included paired samples with 0.45 and 0.25 mg/L, 0.50 and 0.25 mg/L, and 5.72 and 7.31 mg/L DO, indicating that the status of generally low versus high DO concentrations was unchanged between the two purge methods. Only one sample (at EH-117, with 1.16 mg/L low-flow and 7.97 mg/L standard purge DO values) appeared to differ substantially between the two purge methods (Appendix F).

Overall, the two purge methods provided comparable water quality data for the wells sampled during the 2022 monitoring events, for all laboratory analytical parameters and for most field parameters, including pH, SC, E_H, water temperature, and (with few exceptions) dissolved oxygen. The differences in turbidity and TSS concentrations in samples collected using the two methods is attributable to the oscillation of the Waterra pump agitating water within the well screen and generating higher suspended solids compared with the submersible pump. This difference did not, however, translate into observable differences in concentrations of other physical parameters, major ions, or dissolved metals. In addition, total purge volumes generated by the low-flow method were approximately 85% lower in June and 60% lower in October than the total purge volumes generated by the standard purge method. Based on these results, the low-flow/low-volume Waterra purge method appears to be a reasonable option for sampling East Helena project wells, maintaining data comparability while reducing overall monitoring costs and minimizing purge water handling and disposal requirements, and may be adopted for all CAPMP monitoring well sampling in 2023.

4.0 REFERENCES

CH2M, 2018. Former ASARCO East Helena Facility Corrective Measures Study Report. Public Review Draft. Prepared for Montana Environmental Trust Group, LLC, Trustee of the Montana Environmental Custodial Trust. March 2018.

GSI Water Solutions, Inc. (GSI), 2014. *Phase II RCRA Facility Investigation*, *East Helena Facility*. April 29.

Hydrometrics, Inc. 1999. Current Conditions/Release Assessment, East Helena Facility. September 1998; Revised January 1999.

Hydrometrics, Inc., 2010. Phase II RCRA Facility Investigation Site Characterization Work Plan. May 2010.

Hydrometrics, Inc., 2011. Data Management Plan for Environmental Data Collection Activities, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. Revised August 2011.

Hydrometrics, Inc., 2015a. Quality Assurance Project Plan for Environmental Data Collection Activities, East Helena Facility (Draft). Prepared for Montana Environmental Trust Group, LLC. Revised August 2011.

Hydrometrics, Inc., 2015b. 2014 Supplemental Contaminant Source Area Investigation at the Former East Helena Smelter. Prepared for Montana Environmental Trust Group, LLC. February 2015.

Hydrometrics, Inc., 2016. 2015 Supplemental Contaminant Source Area Investigation at the Former East Helena Smelter. Prepared for Montana Environmental Trust Group, LLC. March 2016.

Hydrometrics, Inc., 2017. 2015/2016 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. December 2017.

Hydrometrics, Inc., 2018. 2017 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. December 2018.

Hydrometrics, Inc., 2021a. Unfumed Slag Processing and Removal Groundwater Monitoring Plan, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. August 2021.

Hydrometrics, Inc., 2021b. Former ASARCO East Helena Facility Corrective Measures Implementation Work Plan. Prepared for Montana Environmental Trust Group, LLC. August 2021.

Hydrometrics, Inc., 2021c. 2020 Water Resources Monitoring Report, East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. June 2021.

Hydrometrics, Inc., 2022a. 2022 Groundwater and Surface Water Corrective Action Performance Monitoring Plan, East Helena Facility (Final). Prepared for Montana Environmental Trust Group, LLC. December 2022.

Hydrometrics, Inc., 2022b. 2021 Water Resources Monitoring Report, East Helena Facility (Final). Prepared for Montana Environmental Trust Group, LLC. December 2022.

Hydrometrics, Inc., 2022c. Sampling Methodology Addendum – Unfumed Slag Processing and Removal Groundwater Monitoring Plan – East Helena Facility. Prepared for Montana Environmental Trust Group, LLC. February 2022.

MDEQ, 2019. Circular DEQ-7, Montana Numeric Water Quality Standards. Prepared by: Water Quality Planning Bureau, Water Quality Standards Section, Helena, Montana. June 2019.

METG, 2020. Transmittal of Former ASARCO East Helena Facility, Corrective Measures Study Report Addendum. Letter from Cindy Brooks (METG) to Betsy Burns (USEPA). October 8, 2020.

Ricker, J.A., 2008. A Practical Method to Evaluate Ground Water Contaminant Plume Stability. *Ground Water Monitoring & Remediation* 28(4): 85-94. Fall 2008.

US District Court, 2012. First Modification to the 1998 Consent Decree. Civil Action No. CV 98-3-H-CCL. Case 6:98-cv-00003-CCL. Document 38. Filed January 17, 2012.

USEPA, 2004a. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action. EPA 530-R-04-030. April 2004.

USEPA, 2004b. Water Quality Restoration Plan and Total Maximum Daily Loads for the Lake Helena Watershed Planning Area: V1 Watershed Characterization and Water Quality Status Review. December 30, 2004.

USEPA, 2013. Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions. OSWER 9355.0-129. Office of Superfund Remediation and Technology Innovation. November 2013.

USEPA, 2014a. Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Actions at a Groundwater Monitoring Well. OSWER 9283.1-44. August 2014.

USEPA, 2014b. Groundwater Remedy Completion Strategy – Moving Forward With the End in Mind. OSWER Directive 9200.2-144. Office of Solid Waste and Emergency Response. May 2014.

USEPA, 2020. Statement of Basis for Groundwater, Surface Water and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility and Response to Comments. Pursuant to Consent Decree – Civil Action No. CV 98-3-H-CCL. July 2020.

APPENDIX A

2022 SURFACE WATER AND GROUNDWATER DATABASE

APPENDIX A1

2022 MONITORING WELL
WATER QUALITY DATABASE

			Field Parameters							General Chemistry				
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids
2843 Canyon Ferry Rd	6/17/2022	31.95	7.36	594	4.91	26	247	3.8	10.0	7.4	594	130	10 U	407
2843 Canyon Ferry Rd	10/19/2022	29.55	7.30	576	5.20	1	222	3.2	10.3	7.4	529	130	10 U	368
2853 Canyon Ferry Rd	6/17/2022		7.28	604	4.55	38	259	2.2	10.1	7.4	604	130	10 U	408
2853 Canyon Ferry Rd	10/19/2022		7.26	602	4.83	28	248	1.1	10.3	7.3	565	130	10 U	395
Amchem4	6/16/2022		7.33	311	4.00	-70	146	8.7	16.4	7.3	300	110	10 U	228
Amchem4	10/20/2022		7.24	323	4.51	100	315	7.8	17.5	7.2	283	110	10 U	225
DARTMAN WELL	6/17/2022		7.39	354	1.34	10	232	5.0	8.7	7.1	355	98	10 U	241
DARTMAN WELL	10/20/2022		7.00	355	1.44	-10	212	4.8	8.9	7.1	326	98	10 U	218
DH-6	10/13/2022	21.20	7.48	706	4.30	222	443	160.0	10.8	7.5	672	130	141	429
DH-6	11/23/2022	21.50	7.47	592	3.75	287	508	16.8	9.7					
DH-8	10/21/2022	52.75	7.26	3782	1.69	105	322	4.8	14.5	7.3	3610	320	10 U	3180
DH-15	10/13/2022	21.21	7.11	1131	0.31	152	373	4.4	10.1	7.2	1080	120	10 U	805
DH-17	June 2022 - No Sample - Insufficient Water													
DH-17	October 2022 - No Sample - Insufficient Water													
DH-42	October 2022 - No Sample - Insufficient Water													
DH-52	10/13/2022	8.52	7.23	706	0.58	134	354	7.7	11.0	7.3	677	140	10 U	457
DH-52 (Dup)	10/13/2022	8.52	7.23	706	0.59	134	354	7.4	11.0	7.3	682	140	10 U	451
DH-53	10/13/2022	11.21	7.18	383	0.52	174	393	9.7	12.8	7.2	368	120	10 U	219
DH-55	10/13/2022	81.50	7.32	1767	2.22	164	386	13.2	8.6	7.3	1700	180	10 U	1230
DH-56	June 2022 - No Sample - Insufficient Water													
DH-56	October 2022 - No Sample - Insufficient Water													
DH-58	June 2022 - No Sample - Insufficient Water													
DH-58	October 2022 - No Sample - Insufficient Water													
DH-66	June 2022 - No Sample - Insufficient Water													
DH-66	October 2022 - No Sample - Insufficient Water													
DH-67	10/20/2022	38.25	6.29	1050	1.07	65	283	8.8	12.7	6.4	965	130	12	728
DH-69	10/21/2022	36.08	7.10	963	0.21	-126	94	14.5	11.9	6.9	909	190	39	610
DH-77	June 2022 - No Sample - Insufficient Water													
DH-77	October 2022 - No Sample - Insufficient Water													
DH-79	June 2022 - No Sample - Insufficient Water													
DH-79	October 2022 - No Sample - Insufficient Water													
DH-80	6/9/2022	50.03	5.31	650	1.77	158	377	13.3	12.6	5.4	651	28	33	425
DH-80 (Low Flow)	10/21/2022	50.38	5.51	645	0.45	147	366	92.7	11.8	5.7	634	34	137	425
DH-80	10/21/2022	50.38	5.50	645	0.25	144	363	5.8	12.8	5.6	632	32	22	413
EH-50	10/19/2022	32.21	6.43	1977	0.77	198	417	4.4	12.1	6.5	1900	160	10 U	1430
EH-51	10/18/2022	18.49	6.98	423	5.74	166	387	1.0	10.6	7.0	414	90	10 U	259
EH-52 (Low Flow)	10/17/2022	8.55	6.77	384	1.79	65	282	7.5	15.3	6.8	364	110	20	245
EH-52	10/17/2022	8.55	6.79	383	2.00	98	315	1.1	14.7	6.8	363	110	10 U	247
EH-53	10/17/2022	34.69	7.04	562	9.35	136	354	1.0	12.9	7.1	537	150	10 U	366
EH-54	10/17/2022	11.44	7.03	327	1.46	123	342	8.2	12.3	7.1	312	100	28	210
EH-57A	October 2022 - No Sample - Insufficient Water													
EH-58	10/17/2022	15.03	6.86	368	2.78	153	373	0.3	11.3	6.9	352	110	10 U	250
EH-58 (Dup)	10/17/2022	15.03	6.86	367	2.78	153	373	0.3	11.3	6.9	351	100	10 U	237
EH-59	10/17/2022	8.88	7.02	407	3.16	-4	214	3.1	13.3	7.0	382	140	10 U	254
EH-60	October 2022 - No Sample - Insufficient Water													

			Field Parameters							General Chemistry				
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids
EH-61	10/13/2022	29.57	7.08	1327	0.96	156	374	98.1	14.0	7.1	1260	170	169	904
EH-62	10/17/2022	30.71	7.05	364	5.97	136	356	0.7	10.6	7.1	347	110	10 U	231
EH-63	10/18/2022	24.67	6.94	400	6.89	143	364	2.2	10.8	7.0	398	110	10 U	252
EH-65 (Low Flow)	10/18/2022	30.35	6.58	1500	4.16	166	384	7.5	14.2	6.6	1450	150	10 U	1070
EH-65	10/18/2022	30.35	6.56	1493	4.44	169	388	11.6	13.2	6.6	1440	150	17	1050
EH-66	10/13/2022	34.38	7.15	305	9.07	142	363	6.3	10.1	7.2	303	90	10 U	197
EH-68	6/8/2022	11.69	6.67	387	8.50	309	531	2.0	9.0	6.9	394	110	14	252
EH-68	10/17/2022	11.22	6.81	438	4.31	164	382	1.0	13.8	6.8	415	150	10 U	275
EH-69	6/8/2022	24.74	6.81	380	4.43	260	480	6.3	10.8	7.0	387	110	31	270
EH-69	10/17/2022	21.80	6.89	427	6.24	122	342	4.5	11.5	6.9	406	120	11	275
EH-70	10/14/2022	40.65	7.04	658	6.57	124	344	3.4	11.3	7.1	620	100	10 U	427
EH-100 (Low Flow)	10/19/2022	32.67	6.57	2228	0.21	125	343	18.1	12.6	6.6	2080	180	41	1700
EH-100	10/19/2022	32.67	6.54	2261	0.07	141	360	0.8	12.5	6.6	2040	180	10 U	1690
EH-101	10/18/2022	17.95	7.01	379	4.64	162	383	0.5	10.2	7.1	374	88	10 U	237
EH-102	10/18/2022	10.22	6.95	391	2.47	174	395	0.6	10.8	7.0	386	100	10 U	237
EH-103	10/13/2022	30.17	6.83	1727	0.38	163	383	1.9	12.1	6.9	1620	150	10 U	1400
EH-104 (Low Flow)	10/18/2022	40.26	6.97	1318	5.72	25	245	10.7	12.0	7.0	1300	200	12	926
EH-104	10/18/2022	40.26	6.96	1398	6.15	66	286	1.1	11.9	7.0	1350	210	10 U	975
EH-106	10/18/2022	33.29	6.57	1474	2.16	131	350	4.5	12.2	6.6	1440	170	10 U	1070
EH-107	10/18/2022	26.98	6.89	1151	0.80	140	359	5.8	12.7	6.9	1120	160	11	780
EH-110	10/18/2022	25.40	7.27	686	3.10	147	366	0.8	12.4	7.3	672	150	10 U	430
EH-111	10/19/2022	35.44	6.52	2370	0.13	208	427	2.5	11.7	6.6	2190	150	10 U	1760
EH-114 (Dup)	6/10/2022	41.15	6.52	1802	0.25	184	403	2.3	11.9	6.5	1800	170	10 U	1370
EH-114 (Low Flow)	6/10/2022	41.15	6.54	1773	0.50	172	392	6.9	11.5	6.5	1790	160	26	1350
EH-114	6/10/2022	41.15	6.52	1800	0.25	184	403	2.3	11.9	6.5	1800	170	10 U	1370
EH-114	10/17/2022	39.02	6.54	1836	0.11	178	398	2.0	11.7	6.6	1730	160	10 U	1380
EH-115	6/8/2022	43.28	6.39	1211	1.28	210	429	2.3	12.2	6.5	1230	170	13	901
EH-115 (Low Flow)	10/19/2022	41.11	6.49	1340	0.57	208	428	2.9	11.1	6.6	1240	170	10 U	928
EH-115	10/19/2022	41.11	6.47	1348	0.43	197	417	1.2	12.0	6.6	1250	180	10 U	932
EH-115 (Dup)	10/19/2022	41.11	6.47	1347	0.42	197	417	1.2	12.0	6.5	1260	190	10 U	914
EH-117 (Low Flow)	10/14/2022	34.70	6.62	1697	1.16	165	385	17.0	11.3	6.7	1560	150	25	1220
EH-117	10/14/2022	34.70	6.60	1712	7.97	174	393	13.7	11.7	6.7	1540	140	56	1190
EH-118	10/17/2022	42.73	6.70	1205	4.75	216	436	21.0	11.2	6.8	1150	190	120	878
EH-119	10/17/2022	39.16	6.63	1559	2.06	161	380	1.0	11.5	6.7	1470	180	10 U	1180
EH-120	6/8/2022	38.09	6.68	1333	0.21	215	435	1.9	11.6	6.8	1360	150	11	1010
EH-120	10/14/2022	36.32	6.75	1349	0.74	156	376	4.9	12.0	6.8	1240	150	11	934
EH-121	10/13/2022	34.69	7.08	295	5.07	147	368	1.3	9.9	7.1	310	84	18	200
EH-123 (Dup)	6/8/2022	49.89	7.11	568	5.64	216	435	1.6	12.2	7.3	579	160	10 U	405
EH-123	6/8/2022	49.89	7.11	569	5.64	217	436	1.6	12.2	7.3	577	150	10 U	415
EH-123	10/13/2022	48.71	7.23	563	6.24	135	354	2.5	12.6	7.3	558	160	15	390
EH-124	10/13/2022	42.01	7.38	762	6.48	138	358	1.5	11.5	7.4	744	180	10 U	509
EH-124 (Dup)	10/13/2022	42.01	7.39	741	6.50	138	358	1.5	11.5	7.4	728	180	10 U	503
EH-125	10/14/2022	41.14	7.07	411	4.77	140	360	2.2	11.5	7.1	379	97	10 U	250
EH-126 (Low Flow)	10/14/2022	60.24	7.17	1257	4.21	190	411	9.4	10.5	7.2	1160	200	18	896
EH-126	10/14/2022	60.24	7.13	1284	3.66	168	388	4.4	11.5	7.2	1180	200	15	932

			Field Parameters								General Chemistry				
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids
EH-129	6/7/2022	65.07	7.32	526	6.40	187	406	1.8	12.6	7.4	533	150	10 U	373
EH-129	10/13/2022	60.89	7.42	567	6.10	143	362	2.5	12.7	7.5	554	160	18	389
EH-130	6/7/2022	52.72	6.95	306	5.51	125	345	5.4	10.7	7.1	310	85	10 U	197
EH-130	10/13/2022	50.18	7.08	295	4.96	195	415	3.7	10.5	7.1	294	84	10 U	176
EH-132	10/14/2022	63.44	7.36	679	4.88	166	384	3.6	13.7	7.4	623	130	10 U	464
EH-134	6/7/2022	63.86	7.43	465	6.52	98	316	2.8	14.2	7.5	470	140	577	316
EH-134	10/13/2022	60.61	7.53	459	6.93	131	349	2.8	13.9	7.6	450	140	21	322
EH-135	10/13/2022	34.84	7.10	301	6.13	158	380	4.1	9.5	7.2	302	84	16	191
EH-138	6/7/2022	52.91	7.03	686	7.00	130	350	3.8	10.7	7.1	692	130	115	452
EH-138	10/13/2022	48.33	7.27	493	6.91	148	369	2.4	10.0	7.3	480	120	11	317
EH-139	June 2022 - No Sample - Insufficient Water													
EH-139	10/13/2022	53.58	7.31	605	8.30	128	347	2.0	11.7	7.3	591	190	10 U	410
EH-141 (Low Flow)	6/9/2022	37.24	7.23	878	4.73	189	409	0.9	11.5	7.3	884	180	10 U	628
EH-141	6/9/2022	37.24	7.24	876	5.07	176	396	1.2	11.0	7.3	883	180	10 U	629
EH-141	10/14/2022	33.53	7.27	887	5.80	198	418	0.9	11.0	7.3	824	170	10 U	595
EH-143	6/7/2022	37.36	7.18	437	6.35	159	380	2.1	10.2	7.3	442	110	10 U	286
EH-143	10/13/2022	33.94	7.27	435	6.27	148	369	1.4	10.4	7.3	435	110	10 U	285
EH-204	6/8/2022	58.00	7.07	1786	2.87	165	385	3.6	11.5	7.2	1810	260	13	1410
EH-204	10/19/2022	58.25	7.16	1834	3.55	129	349	2.2	11.8	7.2	1730	250	10 U	1380
EH-206	10/14/2022	52.25	7.54	803	5.37	134	352	3.3	13.6	7.6	738	220	15	517
EH-210	6/8/2022	40.52	7.11	989	6.76	196	415	3.2	12.1	7.3	1000	140	17	746
EH-210 (Low Flow)	10/19/2022	39.86	7.27	1035	5.72	154	372	134.0	13.7	7.3	982	140	508	731
EH-210	10/19/2022	39.86	7.26	1046	7.31	139	358	3.9	12.5	7.3	993	140	10	728
MW-1	10/20/2022	53.17	7.46	463	7.97	267	487	18.2	11.3	7.5	430	120	37	334
MW-2	10/20/2022	41.18	7.04	964	0.08	130	350	0.4	10.8	7.1	886	250	10 U	653
MW-3	10/20/2022	36.63	7.02	1061	0.35	167	387	0.3	10.8	7.1	976	240	10 U	738
MW-4	10/20/2022	50.27	7.45	536	7.95	170	390	6.5	11.3	7.5	501	160	10 U	360
MW-4 (Dup)	10/20/2022	50.27	7.46	537	8.02	170	390	6.5	11.3	7.5	496	160	10 U	362
MW-5	10/20/2022	54.80	7.75	395	7.98	153	371	5.8	13.3	7.8	366	140	11	271
MW-6	10/20/2022	32.99	7.10	981	0.20	160	380	1.8	11.2	7.1	909	280	10 U	672
MW-7	10/20/2022	54.88	7.68	261	8.24	144	362	4.2	14.0	7.7	246	87	14	210
MW-8	10/20/2022	53.95	7.38	491	6.42	146	365	7.7	12.1	7.4	460	160	42.00	338
MW-9	10/20/2022	52.08	7.57	458	8.40	142	362	34.8	11.6	7.6	425	150	23	308
MW-10	10/20/2022	45.44	7.35	742	3.76	165	385	2.2	11.4	7.4	689	240	10 U	487
MW-11	10/20/2022	63.04	7.71	689	8.48	161	381	2.1	11.8	7.7	640	110	10 U	465
PBTW-2 (Low Flow)	6/10/2022	43.63	6.83	1338	0.37	19	238	21.2	12.6	6.9	1340	280	14	948
PBTW-2	6/10/2022	43.63	6.84	1345	0.28	20	239	3.5	12.5	6.8	1350	270	10 U	954
PBTW-2	10/21/2022	41.62	6.83	1251	0.14	27	247	3.0	12.2	6.9	1220	280	10 U	841
PBTW-2 (Dup)	10/21/2022	41.62	6.83	1252	0.13	27	246	3.0	12.2	7.0	1220	270	10 U	844
PRB-2	6/9/2022	41.36	6.85	1249	0.28	185	403	9.4	13.3	6.9	1260	260	32	865
PRB-2	10/21/2022	39.46	6.86	1389	0.11	110	329	4.8	12.0	7.0	1350	250	10 U	973
SDMW-1	6/9/2022	53.82	6.81	1596	0.12	35	253	2.4	13.7	7.0	1610	270	10 U	1130
SDMW-1	10/21/2022	53.06	6.91	1591	0.07	72	290	3.3	13.6	7.0	1540	270	10	1110
SDMW-5	6/9/2022	55.63	5.67	661	1.05	78	297	6.1	13.0	5.9	666	65	13	416
SDMW-5	10/21/2022	55.60	5.87	668	0.20	72	290	3.4	13.0	6.1	650	73	13	404

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit

		Major Ions								Dissolved (D) Metals										
Station ID	Sample Date	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Chloride	Sulfate	Bromide	Sb (D)	As (D)	Cd (D)	Cu (D)	Fe (D)	Pb (D)	Mn (D)	Hg (D)	Se (D)	Tl (D)	Zn (D)
2843 Canyon Ferry Rd	6/17/2022	67	15	29	4	160	13	141	0.47	0.003 U	0.002 U	0.001 U	0.001 U	0.05	0.005 U	0.01 U	0.001 U	0.036	0.001 U	0.01 U
2843 Canyon Ferry Rd	10/19/2022	66	14	28	4	160	14	145	0.48	0.003 U	0.002 U	0.001 U	0.001 U	0.06	0.005 U	0.01 U	0.001 U	0.032	0.001 U	0.01 U
2853 Canyon Ferry Rd	6/17/2022	69	16	29	4	160	14	148	0.51	0.003 U	0.002 U	0.001 U	0.001 U	0.04	0.005 U	0.01 U	0.001 U	0.036	0.001 U	0.01 U
2853 Canyon Ferry Rd	10/19/2022	66	15	28	4	160	15	159	0.57	0.003 U	0.002 U	0.001 U	0.001 U	0.03	0.005 U	0.01 U	0.001 U	0.036	0.001 U	0.01 U
Amchem4	6/16/2022	32	8	15	4	130	3	35	0.17	0.003 U	0.002 U	0.001 U	0.001 U	1.47	0.005 U	0.09	0.001 U	0.001 U	0.001 U	0.01 U
Amchem4	10/20/2022	32	8	15	4	140	4	41	0.17	0.003 U	0.005	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
DARTMAN WELL	6/17/2022	40	9	16	3	120	4	69	0.11	0.003 U	0.002 U	0.001 U	0.001 U	0.2	0.005 U	0.02	0.001 U	0.001	0.001 U	0.01 U
DARTMAN WELL	10/20/2022	40	8	15	3	120	4	72	0.12	0.003 U	0.002 U	0.001 U	0.001 U	0.22	0.005 U	0.02	0.001 U	0.001	0.001 U	0.01 U
DH-6	10/13/2022	15	3	93	63	160	32	136	0.18	0.049	1.08	0.001 U	1.44	0.15	0.010	0.01	0.001 U	0.046	0.001 U	0.02
DH-6	11/23/2022						16						0.070							
DH-8	10/21/2022	562	127	159	17	390	295	1490	23.1	0.003 U	0.003	0.001	0.002	0.02 U	0.005 U	0.01 U	0.001	0.409	0.002	0.01 U
DH-15	10/13/2022	114	25	110	5	150	11	483	0.48	0.003 U	0.002 U	0.001 U	0.006	0.02 U	0.005 U	0.01	0.001 U	0.172	0.001 U	0.01 U
DH-17		June 2022 - No Sample - Insufficient Water																		
DH-17		October 2022 - No Sample - Insufficient Water																		
DH-42		October 2022 - No Sample - Insufficient Water																		
DH-52	10/13/2022	53	9	46	65	170	7	196	0.1	0.025	0.406	0.001 U	0.002	0.02 U	0.005 U	0.02	0.001 U	0.019	0.001 U	0.01
DH-52 (Dup)	10/13/2022	52	9	47	66	170	7	197	0.1	0.025	0.402	0.001 U	0.002	0.02 U	0.005 U	0.02	0.001 U	0.019	0.001 U	0.01 U
DH-53	10/13/2022	35	6	19	26	140	7	61	0.05 U	0.009	0.153	0.001 U	0.002	0.02 U	0.005 U	1.83	0.001 U	0.003	0.001 U	0.01 U
DH-55	10/13/2022	103	18	189	135	210	18	716	0.6	0.024	0.121	0.002	0.004	0.02 U	0.005 U	0.36	0.001 U	0.087	0.011	0.91
DH-56		June 2022 - No Sample - Insufficient Water																		
DH-56		October 2022 - No Sample - Insufficient Water																		
DH-58		June 2022 - No Sample - Insufficient Water																		
DH-58		October 2022 - No Sample - Insufficient Water																		
DH-66		June 2022 - No Sample - Insufficient Water																		
DH-66		October 2022 - No Sample - Insufficient Water																		
DH-67	10/20/2022	82	28	93	6	150	33	336	1.82	0.003 U	0.122	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.027	0.001 U	0.01 U
DH-69	10/21/2022	87	12	63	18	240	11	250	0.2	0.003 U	0.309	0.001 U	0.001 U	16.6	0.005 U	5.53	0.001 U	0.001	0.001 U	0.03
DH-77		June 2022 - No Sample - Insufficient Water																		
DH-77		October 2022 - No Sample - Insufficient Water																		
DH-79		June 2022 - No Sample - Insufficient Water																		
DH-79		October 2022 - No Sample - Insufficient Water																		
DH-80	6/9/2022	52	15	34	6	33	12	242	0.21	0.003 U	7	2.46	0.001 U	2.17	0.005 U	2.33	0.001 U	0.004	0.142	2.06
DH-80 (Low Flow)	10/21/2022	53	15	36	6	41	13	243	0.23	0.003 U	7.06	2	0.002	1.78	0.005 U	2.25	0.001 U	0.002	0.146	1.76
DH-80	10/21/2022	54	15	36	6	39	13	241	0.23	0.003 U	7.09	1.73	0.002	1.89	0.005 U	2.25	0.001 U	0.001	0.146	1.73
EH-50	10/19/2022	137	47	249	11	190	37	848	1.8	0.003 U	5.65	0.001 U	0.002	0.02 U	0.005 U	0.14	0.001 U	0.003	0.001 U	0.01 U
EH-51	10/18/2022	35	7	25	22	110	14	81	0.05 U	0.003 U	0.024	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-52 (Low Flow)	10/17/2022	36	8	18	20	130	9	61	0.05 U	0.014	0.288	0.001 U	0.001	0.23	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-52	10/17/2022	36	8	18	20	140	9	60	0.05 U	0.014	0.282	0.001 U	0.001	0.04	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-53	10/17/2022	34	10	69	4	180	12	106	0.1	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.016	0.001 U	0.01 U
EH-54	10/17/2022	38	8	17	3	120	7	56	0.05 U	0.003 U	0.007	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-57A		October 2022 - No Sample - Insufficient Water																		
EH-58	10/17/2022	42	10	18	4	130	9	69	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-58 (Dup)	10/17/2022	42	10	18	4	130	9	69	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-59	10/17/2022	47	11	20	9	170	7	61	0.05 U	0.007	0.032	0.001 U	0.001 U	0.03	0.005 U	0.06	0.001 U	0.001	0.001 U	0.01 U
EH-60		October 2022 - No Sample - Insufficient Water																		

		Major Ions								Dissolved (D) Metals										
Station ID	**Sample Date**	**Calcium**	**Magnesium**	**Sodium**	**Potassium**	**Bicarbonate**	**Chloride**	**Sulfate**	**Bromide**	**Sb (D)**	**As (D)**	**Cd (D)**	**Cu (D)**	**Fe (D)**	**Pb (D)**	**Mn (D)**	**Hg (D)**	**Se (D)**	**Tl (D)**	**Zn (D)**
EH-61	10/13/2022	75	13	212	12	200	17	502	0.47	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.06	0.001 U	0.155	0.001 U	0.01 U
EH-62	10/17/2022	43	10	17	4	130	9	61	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-63	10/18/2022	44	10	17	5	130	11	73	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-65 (Low Flow)	10/18/2022	105	26	177	8	180	52	518	0.63	0.003 U	0.118	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.181	0.001 U	0.01 U
EH-65	10/18/2022	103	25	174	8	180	52	516	0.62	0.003 U	0.129	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.178	0.001 U	0.01 U
EH-66	10/13/2022	35	8	14	3	110	7	59	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-68	6/8/2022	47	11	15	3	130	8	67	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-68	10/17/2022	56	13	19	4	190	9	63	0.05 U	0.003 U	0.002 U	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-69	6/8/2022	37	8	28	4	130	9	65	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-69	10/17/2022	44	10	31	5	140	11	78	0.05	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-70	10/14/2022	45	14	69	3	130	21	187	0.47	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.038	0.001 U	0.01 U
EH-100 (Low Flow)	10/19/2022	153	57	239	15	220	30	992	1.9	0.003 U	6.54	0.008	0.004	0.05	0.005 U	25	0.001 U	0.002	0.001	0.7
EH-100	10/19/2022	156	57	236	14	210	31	1010	1.9	0.003 U	6.45	0.008	0.004	0.02 U	0.005 U	24.2	0.001 U	0.002	0.001	0.62
EH-101	10/18/2022	33	6	22	16	110	11	77	0.05 U	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-102	10/18/2022	28	6	38	7	120	10	75	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.006	0.001 U	0.01 U
EH-103	10/13/2022	238	53	104	7	180	32	858	2.9	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.345	0.001 U	0.01 U
EH-104 (Low Flow)	10/18/2022	143	36	91	6	250	86	347	2.2	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01	0.001 U	0.211	0.001 U	0.01 U
EH-104	10/18/2022	144	37	92	6	250	92	352	2.42	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.223	0.001 U	0.01 U
EH-106	10/18/2022	117	26	160	6	210	64	487	1.26	0.003 U	0.071	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.008	0.001 U	0.01 U
EH-107	10/18/2022	80	18	134	5	190	40	378	0.41	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.11	0.001 U	0.123	0.001 U	0.01 U
EH-110	10/18/2022	23	5	114	5	180	19	159	0.08	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.031	0.001 U	0.01 U
EH-111	10/19/2022	208	50	252	9	180	39	1110	1.9	0.003 U	0.721	0.001 U	0.001	0.02 U	0.005 U	5.55	0.001 U	0.204	0.001 U	0.01 U
EH-114 (Dup)	6/10/2022	129	37	215	9	200	34	704	1.7	0.003 U	1.95	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.009	0.001 U	0.01 U
EH-114 (Low Flow)	6/10/2022	132	37	214	9	200	34	695	1.7	0.003 U	1.95	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.01	0.001 U	0.01 U
EH-114	6/10/2022	132	37	213	9	210	34	704	1.7	0.003 U	1.97	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.01	0.001 U	0.01 U
EH-114	10/17/2022	144	41	229	9	200	39	807	1.95	0.003 U	2.03	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.008	0.001 U	0.01 U
EH-115	6/8/2022	93	26	136	6	210	32	382	1.7	0.003 U	1.83	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.057	0.001 U	0.01 U
EH-115 (Low Flow)	10/19/2022	94	28	149	7	210	35	463	1.7	0.003 U	1.74	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.032	0.001 U	0.01 U
EH-115	10/19/2022	97	29	153	7	220	39	462	1.6	0.003 U	1.8	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.03	0.001 U	0.01 U
EH-115 (Dup)	10/19/2022	95	28	150	7	240	38	458	1.6	0.003 U	1.74	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.03	0.001 U	0.01 U
EH-117 (Low Flow)	10/14/2022	141	32	190	6	180	42	739	2.5	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.162	0.001 U	0.01 U
EH-117	10/14/2022	138	32	186	6	170	42	722	2.4	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.155	0.001 U	0.01 U
EH-118	10/17/2022	125	38	91	7	240	62	388	2.05	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.097	0.001 U	0.01 U
EH-119	10/17/2022	140	40	172	7	220	35	655	1.94	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.022	0.001 U	0.01 U
EH-120	6/8/2022	137	30	119	5	180	33	479	0.8	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.198	0.001 U	0.01 U
EH-120	10/14/2022	136	30	113	5	180	37	527	1.44	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.186	0.001 U	0.01 U
EH-121	10/13/2022	34	8	14	3	100	8	60	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-123 (Dup)	6/8/2022	55	15	38	7	190	18	99	0.14	0.003 U	0.01	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-123	6/8/2022	56	15	37	7	190	18	99	0.14	0.003 U	0.01	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-123	10/13/2022	60	16	38	7	190	21	114	0.16	0.003 U	0.006	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-124	10/13/2022	88	25	43	6	220	40	167	0.43	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.037	0.001 U	0.01 U
EH-124 (Dup)	10/13/2022	84	23	42	6	220	39	168	0.43	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.037	0.001 U	0.01 U
EH-125	10/14/2022	33	8	35	3	120	11	87	0.09	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.007	0.001 U	0.01 U
EH-126 (Low Flow)	10/14/2022	126	46	76	5	250	38	436	1.65	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.129	0.001 U	0.01 U
EH-126	10/14/2022	128	45	81	5	240	37	462	1.71	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.125	0.001 U	0.01 U

		Major Ions								Dissolved (D) Metals										
Station ID	Sample Date	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Chloride	Sulfate	Bromide	Sb (D)	As (D)	Cd (D)	Cu (D)	Fe (D)	Pb (D)	Mn (D)	Hg (D)	Se (D)	Tl (D)	Zn (D)
EH-129	6/7/2022	52	16	30	6	180	15	93	0.24	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.016	0.001 U	0.01 U
EH-129	10/13/2022	62	20	34	7	190	19	121	0.38	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.026	0.001 U	0.01 U
EH-130	6/7/2022	32	8	16	2	100	7	56	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-130	10/13/2022	34	8	17	3	100	7	60	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-132	10/14/2022	65	20	36	8	160	29	160	0.72	0.003 U	0.02	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-134	6/7/2022	47	14	23	6	170	13	73	0.13	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-134	10/13/2022	52	15	26	7	170	14	83	0.14	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-135	10/13/2022	37	9	15	3	100	6	67	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-138	6/7/2022	65	18	50	3	160	20	180	0.62	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.041	0.001 U	0.01 U
EH-138	10/13/2022	46	13	43	3	140	14	119	0.25	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.018	0.001 U	0.01 U
EH-139		June 2022 - No Sample - Insufficient Water																		
EH-139	10/13/2022	57	25	39	10	230	15	123	0.1	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-141 (Low Flow)	6/9/2022	96	26	47	7	210	23	235	0.95	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.072	0.001 U	0.01 U
EH-141	6/9/2022	95	26	47	7	210	23	237	0.95	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.073	0.001 U	0.01 U
EH-141	10/14/2022	96	26	48	7	210	24	254	1.01	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.068	0.001 U	0.01 U
EH-143	6/7/2022	42	11	27	3	130	10	91	0.19	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.014	0.001 U	0.01 U
EH-143	10/13/2022	52	13	29	4	140	12	104	0.24	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.016	0.001 U	0.01 U
EH-204	6/8/2022	252	58	76	11	320	79	623	2.1	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.067	0.001 U	0.01 U
EH-204	10/19/2022	235	56	78	11	310	81	645	2	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.059	0.001 U	0.01 U
EH-206	10/14/2022	96	24	21	10	260	69	95	0.24	0.003 U	0.026	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-210	6/8/2022	120	27	47	10	170	39	289	3.59	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.111	0.001 U	0.01 U
EH-210 (Low Flow)	10/19/2022	113	26	48	10	170	42	316	3.86	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.11	0.001 U	0.01 U
EH-210	10/19/2022	113	27	49	10	170	43	329	3.93	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.113	0.001 U	0.01 U
MW-1	10/20/2022	51	11	28	5	150	15	87	0.13	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-2	10/20/2022	136	30	28	7	300	38	214	0.23	0.003 U	0.012	0.001 U	0.001 U	0.02 U	0.005 U	0.53	0.001 U	0.001 U	0.001 U	0.01 U
MW-3	10/20/2022	149	34	30	8	290	55	243	0.36	0.003 U	0.011	0.001 U	0.001 U	0.02 U	0.005 U	0.05	0.001 U	0.012	0.001 U	0.01 U
MW-4	10/20/2022	60	13	36	7	200	13	92	0.09	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-4 (Dup)	10/20/2022	60	13	35	7	190	12	87	0.09	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-5	10/20/2022	42	9	27	4	170	6	45	0.05	0.003 U	0.007	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-6	10/20/2022	141	31	32	6	340	28	211	0.17	0.003 U	0.078	0.001 U	0.001 U	0.02 U	0.005 U	2.68	0.001 U	0.003	0.001 U	0.01 U
MW-7	10/20/2022	20	6	22	5	110	2	34	0.05 U	0.003 U	0.019	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
MW-8	10/20/2022	56	11	25	7	190	11	73	0.07	0.003 U	0.008	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-9	10/20/2022	49	10	28	6	180	10	61	0.07	0.003 U	0.006	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-10	10/20/2022	91	22	37	7	290	14	129	0.1	0.003 U	0.008	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-11	10/20/2022	57	14	67	11	140	25	181	0.22	0.003 U	0.017	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
PBTW-2 (Low Flow)	6/10/2022	114	24	131	20	340	22	382	2.1	0.003 U	3.9	0.001 U	0.001 U	0.43	0.005 U	3.44	0.001 U	0.001 U	0.001 U	0.25
PBTW-2	6/10/2022	116	24	135	20	330	22	390	2.1	0.003 U	3.99	0.001 U	0.001 U	0.43	0.005 U	3.31	0.001 U	0.002	0.001 U	0.27
PBTW-2	10/21/2022	109	22	126	19	340	19	346	2	0.003 U	3.47	0.001 U	0.001 U	0.31	0.005 U	2.65	0.001 U	0.065	0.001 U	0.28
PBTW-2 (Dup)	10/21/2022	108	22	128	20	330	19	340	1.9	0.003 U	3.46	0.001 U	0.001 U	0.31	0.005 U	2.71	0.001 U	0.061	0.001 U	0.28
PRB-2	6/9/2022	110	21	129	14	320	20	357	2	0.009	1.16	0.002	0.001	0.02 U	0.005 U	0.96	0.001 U	0.003	0.001 U	0.11
PRB-2	10/21/2022	129	24	136	15	300	23	447	2.07	0.009	1.13	0.003	0.001	0.02 U	0.005 U	1.16	0.001 U	0.005	0.001 U	0.13
SDMW-1	6/9/2022	116	22	188	34	330	33	501	2.6	0.013	3.68	1.09	0.001 U	0.02	0.005 U	4.28	0.001 U	0.002	0.001 U	0.01 U
SDMW-1	10/21/2022	119	23	182	34	330	33	492	2.78	0.013	3.46	1.19	0.002	0.03	0.005 U	4.27	0.001 U	0.002	0.001 U	0.01 U
SDMW-5	6/9/2022	35	11	45	21	79	13	211	0.4	0.003 U	8.81	0.379	0.001 U	7.92	0.005 U	3.48	0.001 U	0.001	0.038	4.86
SDMW-5	10/21/2022	37	11	46	21	88	14	212	0.43	0.003 U	9.31	0.36	0.001 U	7.88	0.005 U	3.47	0.001 U	0.001 U	0.043	4.72

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit

			Field Parameters				General Chemistry				Dissolved (D) Metals	
Station ID	**Sample Date**	**Depth To Water (ft)**	**pH (s.u.)**	**SC (μmhos/cm)**	**Diss O_2 (mg/L)**	**Water Temp (°C)**	**Magnesium**	**Potassium**	**Chloride**	**Sulfate**	**As (D)**	**Se (D)**
DH-15	1/12/2022	23.24	7.08	1204	0.24	8.8	27	5	11	469	0.002 U	0.205
DH-15	2/7/2022	23.35	7.06	1228	0.19	9.2	27	5	11	460	0.002 U	0.202
DH-15	3/11/2022	23.73	7.23	1132	0.49	8.5	26	5	12	535	0.002 U	0.21
DH-15	4/18/2022	23.89	7.33	1103	0.39	9.5	27	5	11	488	0.002 U	0.204
DH-15	5/11/2022	23.70	6.92	1201	0.59	10.3	27	5	11	484	0.002 U	0.187
DH-15 (Dup)	5/11/2022	23.70	6.92	1200	0.57	10.3	27	5	11	484	0.002 U	0.186
DH-15	6/13/2022	22.75	7.08	1196	0.53	9.8	25	5	11	457	0.002 U	0.198
DH-15	7/14/2022	21.34	7.11	1146	0.35	10.8	24	5	10	458	0.002 U	0.188
DH-15	8/16/2022	21.46	7.13	1136	0.46	12.5	25	5	11	452	0.002 U	0.200
DH-15	9/14/2022	21.77	7.10	1151	0.25	10.8	25	5	11	442	0.002 U	0.18
DH-15	11/15/2022	21.57	7.11	1135	0.37	8.6	24	5	11	475	0.002 U	0.166
DH-15	12/27/2022	20.56	7.04	1104	0.35	9.1	22	5	10	420	0.002 U	0.162
DH-52	1/12/2022	7.74	7.37	463	7.00	8.2	4	47	8	87	0.558	0.025
DH-52	2/7/2022	8.03	7.40	441	7.15	6.7	4	46	7	78	0.544	0.02
DH-52	3/11/2022	8.85	7.24	558	1.84	6.5	7	52	6	133	0.367	0.03
DH-52	4/18/2022	3.81	7.40	571	1.78	7.0	8	56	7	150	0.371	0.022
DH-52 (Dup)	4/18/2022	3.81	7.41	569	1.76	7.0	8	56	7	150	0.371	0.022
DH-52	5/11/2022	8.12	6.69	557	1.57	7.7	6	51	7	111	0.396	0.041
DH-52	6/13/2022	6.78	7.52	298	4.85	8.7	2	34	3	42	0.68	0.019
DH-52	7/13/2022	7.64	7.21	534	0.96	10.3	6	54	7	107	0.448	0.035
DH-52	8/16/2022	8.36	7.15	736	0.73	11.4	10	67	7	203	0.401	0.026
DH-52	9/13/2022	8.72	7.27	747	2.54	12.1	9	69	7	208	0.392	0.019
DH-52	11/15/2022	8.40	7.32	764	1.32	9.7	9	65	8	224	0.396	0.015
DH-52	12/27/2022	6.28	7.15	382	9.74	7.6	3	37	7	68	0.456	0.009
DH-52 (Dup)	12/27/2022	6.28	7.15	382	9.71	7.6	4	38	7	67	0.469	0.009
DH-53	1/12/2022	10.22	7.22	431	0.42	8.6	7	29	8	85	0.148	0.028
DH-53	2/7/2022	10.74	7.20	493	0.63	7.0	8	31	7	93	0.136	0.042
DH-53 (Dup)	2/7/2022	10.74	7.20	495	0.62	7.0	8	31	7	93	0.134	0.042
DH-53	3/11/2022	11.18	7.16	473	0.54	6.4	9	28	7	99	0.121	0.044
DH-53	4/18/2022	11.22	7.42	453	0.65	6.5	9	28	8	102	0.118	0.027
DH-53	5/11/2022	10.50	6.88	482	1.48	7.3	8	26	8	94	0.116	0.027
DH-53	6/13/2022	9.13	7.26	505	0.76	8.3	8	28	7	96	0.159	0.034
DH-53	7/13/2022	10.22	7.11	506	0.36	10.5	8	30	7	96	0.165	0.039
DH-53 (Dup)	7/13/2022	10.22	7.11	507	0.38	10.5	9	30	7	96	0.166	0.039
DH-53	8/16/2022	11.03	7.27	478	0.49	11.3	8	29	6	86	0.152	0.034
DH-53	9/13/2022	11.43	7.25	386	4.78	12.8	6	27	6	50	0.15	0.007
DH-53 (Dup)	9/13/2022	11.43	7.25	386	4.78	12.8	6	28	6	50	0.151	0.007
DH-53	11/15/2022	10.26	7.14	368	0.45	11.0	6	23	8	69	0.127	0.006
DH-53	12/27/2022	9.14	6.93	350	0.41	9.1	6	19	7	62	0.116	0.01
DH-55	1/12/2022	81.26	7.28	1880	1.29	7.3	18	132	18	694	0.135	0.057
DH-55	2/7/2022	81.22	7.38	1752	1.71	6.5	16	127	16	628	0.139	0.052
DH-55	3/11/2022	81.11	7.41	1565	1.62	6.8	14	117	15	622	0.129	0.065
DH-55	4/18/2022	81.52	7.63	1399	3.09	9.2	15	115	15	549	0.141	0.054
DH-55	5/11/2022	81.52	7.18	1653	2.86	9.0	16	122	16	587	0.128	0.044
DH-55	6/13/2022	81.01	7.30	1573	3.00	9.3	13	114	15	533	0.134	0.058
DH-55 (Dup)	6/13/2022	81.01	7.34	1573	3.34	9.4	13	114	15	542	0.134	0.058
DH-55	7/13/2022	81.14	7.39	1198	1.22	9.2	8	98	11	389	0.163	0.056
DH-55	8/16/2022	81.41	7.23	1421	1.63	10.3	13	119	14	499	0.144	0.063
DH-55	9/13/2022	81.83	7.33	1576	1.42	9.0	16	137	16	602	0.125	0.084
DH-55	11/15/2022	81.48	7.30	2029	1.33	7.0	18	139	19	871	0.113	0.145
DH-55	12/27/2022	81.17	7.23	1959	4.67	7.8	17	124	16	740	0.107	0.137

			Field Parameters				General Chemistry				Dissolved (D) Metals	
Station ID	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	Water Temp (°C)	Magnesium	Potassium	Chloride	Sulfate	As (D)	Se (D)
DH-6	2/7/2022	23.42	7.56	721	3.37	9.2	3	63	8	162	0.975	0.054
DH-6	3/11/2022	23.76	7.66	708	3.86	8.2	3	61	8	196	0.854	0.07
DH-6	4/18/2022	23.88	7.68	720	3.93	9.5	4	66	8	203	0.809	0.08
DH-6	5/11/2022	23.72	7.35	775	4.49	11.4	3	66	8	188	0.767	0.073
DH-6	6/13/2022	22.80	7.62	678	4.50	10.1	3	57	8	153	0.933	0.057
DH-6	7/14/2022	21.29	7.46	754	4.59	11.0	3	64	22	153	0.966	0.063
DH-6	8/16/2022	27.46	7.30	658	5.15	13.5	2	60	17	133	1.18	0.049
DH-6	9/14/2022	21.77	7.57	597	4.08	10.7	2	59	12	119	1.27	0.039
DH-6	11/15/2022	21.60	7.45	612	3.59	9.6	2	56	19	128	1.14	0.036
DH-6 (Dup)	11/15/2022	21.60	7.45	612	3.62	9.6	2	57	19	126	1.17	0.036
DH-60	1/12/2022	23.25	7.57	687	3.39	9.4	3	60	8	158	1.07	0.044
EH-103	1/12/2022	31.79	6.84	1722	0.21	10.4	50	7	30	762	0.002 U	0.311
EH-103 (Dup)	1/12/2022	31.79	6.85	1720	0.19	10.4	51	7	30	766	0.002 U	0.318
EH-103	2/7/2022	31.89	6.84	1757	0.23	10.4	51	7	30	733	0.002 U	0.342
EH-103	3/11/2022	32.07	6.96	1629	0.43	8.0	49	6	27	690	0.002 U	0.344
EH-103	4/18/2022	32.23	7.10	1576	0.44	11.3	51	7	31	781	0.002 U	0.344
EH-103	5/11/2022	32.34	6.76	1725	0.80	12.0	52	7	30	782	0.002 U	0.315
EH-103	6/14/2022	31.87	6.97	1744	1.35	10.9	47	6	30	734	0.002 U	0.369
EH-103	7/14/2022	30.84	6.97	1702	0.62	11.7	47	6	30	777	0.002 U	0.348
EH-103	8/16/2022	30.13	6.75	1706	0.48	13.9	52	7	31	771	0.002 U	0.376
EH-103 (Dup)	8/16/2022	30.13	6.75	1705	0.46	13.8	53	7	31	777	0.002 U	0.372
EH-103	9/13/2022	30.31	6.84	1735	0.72	11.6	52	7	30	751	0.002 U	0.344
EH-103	11/15/2022	30.31	6.83	1731	0.48	9.1	49	7	32	850	0.002 U	0.324
EH-103	12/27/2022	29.85	6.74	1700	2.23	10.5	47	6	30	731	0.002 U	0.338
EH-110	4/18/2022	27.44	7.56	653	2.60	10.2	5	5	17	170	0.002 U	0.046
EH-58	2/7/2022	16.39	7.23	374	4.88	8.6	9	3	9	61	0.002 U	0.002
EH-58	3/11/2022	16.90	7.00	352	2.22	9.1	10	4	9	63	0.002 U	0.002
EH-58	4/18/2022	17.02	7.19	342	2.34	7.8	10	3	9	62	0.002 U	0.002
EH-61	1/12/2022	31.20	7.08	1853	1.57	10.0	23	15	22	732	0.002 U	0.281
EH-61	2/7/2022	31.29	7.01	1894	0.35	10.3	24	16	22	700	0.002 U	0.263
EH-61	3/11/2022	31.47	7.04	1731	0.44	10.1	22	14	23	761	0.004	0.257
EH-61 (Dup)	3/11/2022	31.47	7.04	1731	0.45	10.1	23	15	22	757	0.004	0.253
EH-61	4/18/2022	31.62	7.27	1664	0.49	11.4	23	15	22	747	0.002 U	0.252
EH-61	5/11/2022	31.72	6.92	1805	0.72	12.0	22	16	21	736	0.002 U	0.224
EH-61	6/14/2022	31.29	7.07	1799	1.18	10.8	20	14	21	704	0.002 U	0.263
EH-61	7/14/2022	30.25	7.08	1641	0.79	11.8	18	14	19	652	0.002 U	0.225
EH-61	8/16/2022	29.63	6.95	1483	0.90	16.6	16	13	17	552	0.002 U	0.206
EH-61	9/13/2022	29.75	7.10	1377	7.78	12.3	14	14	16	494	0.002 U	0.161
EH-61	11/15/2022	29.68	7.08	1318	0.91	10.0	12	12	17	486	0.002 U	0.157
EH-61	12/27/2022	29.28	6.98	1373	1.80	10.5	13	11	17	479	0.002 U	0.18

All concentrations in mg/L except as indicated.
U = value below reporting limit

APPENDIX A2

2022 RESIDENTIAL WELL

WATER QUALITY DATABASE

			Field Parameters							General Chemistry					Major Ions							
Map Key (see Exhibit 1)	Sample Date	Depth To Water (ft)	pH (s.u.)	SC (µmhos/cm)	Diss O_2 (mg/L)	ORP (mV)	E_H (mV)	Turbidity (NTU)	Water Temp (°C)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Suspended Solids	Total Dissolved Solids	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Chloride	Sulfate	Bromide
R1	6/15/2022		6.96	349	5.92	125	346	2.42	10.1	7.1	356	90	10 U	216	39	9	15	3	110	8	67	0.05 U
R1	10/17/2022		7.02	306	4.03	80	302	2.1	9.0	7.1	293	83	7 U	195	33	7	14	3	100	5	57	0.05 U
R2	6/14/2022		7.10	333	3.39	104	326	1.25	9.5	7.2	344	97	10 U	208	37	8	14	3	120	7	56	0.05 U
R3	6/16/2022		6.77	405	2.83	292	512	0.36	11.4	6.9	402	110	10 U	259	40	8	21	14	140	9	64	0.05 U
R3 (Dup)	6/16/2022		6.78	405	2.80	292	511	0.22	11.4	6.9	402	110	10 U	247	40	8	20	14	140	9	65	0.05 U
R3	10/17/2022		6.71	441	1.45	156	373	0.73	15.0	6.9	417	120	10 U	244	43	9	22	15	150	15	69	0.05
R4	6/14/2022		7.02	362	3.11	93	314	1.7	9.6	7.2	376	98	10 U	225	34	8	27	3	120	7	68	0.1
R4	10/18/2022		6.97	377	3.38	69	290	0.6	10.1	7.1	362	96	10 U	238	33	7	27	3	120	8	73	0.09
R5	6/15/2022		7.09	318	5.69	111	333	1.37	8.6	7.2	324	88	10 U	192	34	8	14	3	110	7	56	0.05 U
R5	10/20/2022		7.09	331	7.14	65	287	1.44	8.8	7.1	302	86	10 U	197	34	8	13	2	100	7	65	0.05 U
R6	6/15/2022		7.19	436	3.73	153	374	0.49	9.3	7.2	440	110	10 U	297	50	11	17	4	130	6	92	0.15
R6	10/17/2022		7.19	426	13.13	169	390	0.61	9.7	7.3	408	100	10 U	281	48	10	16	4	130	6	92	0.14
R7	6/17/2022	33.52	7.28	308	4.67	133	354	3.01	10.3	7.3	315	91	10 U	206	34	8	16	3	110	6	52	0.05 U
R7	10/19/2022		7.25	312	5.32	54	275	1.42	10.3	7.3	284	87	10 U	194	31	7	16	3	110	7	56	0.05 U
R8	6/17/2022	34.62	7.22	295	4.48	104	324	0.57	10.9	7.2	298	85	10 U	193	32	7	14	3	100	6	50	0.05 U
R8	10/19/2022		7.19	302	4.60	41	261	1.12	10.7	7.2	277	84	10 U	183	33	7	13	3	100	7	54	0.05 U
R9	6/17/2022		7.22	322	4.03	119	339	0.32	12.0	7.2	326	96	10 U	205	36	8	14	3	120	8	52	0.05 U
R9	10/19/2022	34.22	7.16	336	3.09	104	323	0.47	11.9	7.3	306	94	10 U	199	36	8	14	3	110	7	63	0.05 U
R10	6/16/2022		6.95	408	3.40	76	296	3.01	11.4	7.1	407	110	10 U	259	46	11	16	3	140	13	62	0.05 U
R11	6/14/2022		7.00	782	1.75	177	397	1.11	11.5	7.3	803	130	10 U	542	103	22	25	6	160	22	226	2.49
R11	10/18/2022		6.90	811	1.85	157	377	1.68	11.7	7.1	766	130	10 U	543	100	22	26	6	150	24	247	2.72
R12	6/16/2022		7.38	320	3.92	132	353	0.42	9.9	7.5	319	91	10 U	199	35	8	15	2	110	6	53	0.05 U
R12	10/17/2022	19.48	7.39	336	5.64	157	378	0.45	9.9	7.5	321	92	10 U	192	35	8	15	3	110	7	58	0.05 U
R13	6/16/2022	19.47	7.28	581	4.65	124	346	0.42	9.2	7.3	576	220	10 U	373	68	14	30	6	270	12	64	0.07
R13	10/19/2022	20.38	7.27	540	4.40	97	318	0.63	9.4	7.3	486	190	10 U	332	59	12	26	6	230	11	77	0.06
R14	6/14/2022	15.91	7.01	351	6.47	124	345	1.04	10.0	7.2	365	94	10 U	215	40	9	15	3	110	8	66	0.05 U
R14	10/17/2022	15.66	7.05	330	4.33	106	328	2.6	8.9	7.2	316	92	10 U	204	35	8	14	3	110	6	58	0.05 U
R15	6/16/2022		7.66	729	7.74	156	376	0.28	11.5	7.7	721	200	10 U	510	75	20	39	14	240	27	116	0.21
R15	10/19/2022		7.62	676	7.87	130	350	0.37	11.8	7.7	613	190	10 U	443	64	17	35	13	230	26	112	0.21
R15 (Dup)	10/19/2022		7.62	680	7.85	130	350	0.26	11.8	7.7	626	190	10 U	450	65	17	35	13	230	26	111	0.21
R16	6/16/2022		7.70	738	11.50	48	268	12.9	11.4	7.7	734	180	10 U	524	72	19	43	14	220	31	127	0.23
R16	10/18/2022		7.62	735	13.48	28	248	30	11.5	7.7	711	180	10 U	478	70	19	44	14	210	33	136	0.26
R17	6/16/2022		7.75	529	9.04	139	358	0.19	12.1	7.8	530	140	10 U	370	48	13	34	12	170	17	93	0.15
R17	10/18/2022	85.27	7.69	522	8.88	124	343	0.42	12.3	7.8	505	140	10 U	360	46	13	34	13	170	18	97	0.17
R18	6/15/2022		7.19	281	6.34	256	475	0.49	12.3	7.4	288	89	10 U	167	30	7	14	3	110	6	40	0.05 U
R18	10/18/2022		7.11	328	4.54	146	365	0.56	12.1	7.4	311	99	10 U	190	34	8	14	3	120	9	46	0.05 U
R19	6/15/2022		7.13	316	5.40	227	448	0.65	9.6	7.3	317	92	10 U	188	35	8	13	3	110	6	50	0.05 U
R19	10/18/2022		7.07	318	6.62	147	368	0.35	9.9	7.4	304	87	10 U	184	33	8	14	3	110	7	55	0.05 U
R20	6/15/2022		7.19	302	4.77	187	408	0.58	10.5	7.3	307	93	10 U	179	32	7	13	3	110	7	43	0.05 U
R20	10/18/2022		7.07	306	7.54	146	368	0.43	8.5	7.2	294	81	10 U	179	31	7	14	3	98	6	55	0.05 U

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
J = estimated value due to QC criterion exceedance
Locations shown on Exhibit 1

		Dissolved (D) and Total (T) Metals																					
Map Key (see Exhibit 1)	**Sample Date**	**Sb (D)**	**Sb (T)**	**As (D)**	**As (T)**	**Cd (D)**	**Cd (T)**	**Cu (D)**	**Cu (T)**	**Fe (D)**	**Fe (T)**	**Pb (D)**	**Pb (T)**	**Mn (D)**	**Mn (T)**	**Hg (D)**	**Hg (T)**	**Se (D)**	**Se (T)**	**Tl (D)**	**Tl (T)**	**Zn (D)**	**Zn (T)**
R1	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.011	0.011	0.08	0.20	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R1	10/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.007	0.007	0.07	0.14	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R2	6/14/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.08	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R3	6/16/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.050	0.050	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.003	0.003	0.001 U	0.001 U	0.02	0.01
R3 (Dup)	6/16/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.051	0.051	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.003	0.003	0.001 U	0.001 U	0.01	0.01
R3	10/17/2022	0.004	0.004	0.002 U	0.002 U	0.001 U	0.001 U	0.043	0.043	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.003	0.003	0.001 U	0.001 U	0.01	0.01
R4	6/14/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.03	0.10	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R4	10/18/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.04	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R5	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.12	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01
R5	10/20/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.10	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02	0.02
R6	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.012	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R6	10/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.005	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R7	6/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.014	0.017	0.02 U	0.13	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R7	10/19/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.13	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R8	6/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.07	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R8	10/19/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.011	0.07	0.63	0.005 U	0.005 U	0.01 U	0.01	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R9	6/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R9	10/19/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.004	0.02 U	0.24	0.005 U	0.005 U	0.02	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R10	6/16/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.006	0.13	0.27	0.005 U	0.005 U	0.01 U	0.02	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01	0.01
R11	6/14/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.009	0.02 U	0.08	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.043	0.041	0.001 U	0.001 U	0.02	0.02
R11	10/18/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.003	0.02 U	0.08	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.044	0.043	0.001 U	0.001 U	0.01	0.01
R12	6/16/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.002	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R12	10/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.016	0.015	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R13	6/16/2022	0.003 U	0.003 U	0.016	0.015	0.001 U	0.001 U	0.015	0.016	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.02	0.02
R13	10/19/2022	0.003 U	0.003 U	0.015	0.015	0.001 U	0.001 U	0.008	0.009	0.02 U	0.03	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01
R14	6/14/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.002	0.02 U	0.92	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R14	10/17/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.002	0.02 U	0.56	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01
R15	6/16/2022	0.003 U	0.003 U	0.016	0.016	0.001 U	0.001 U	0.001	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R15	10/19/2022	0.003 U	0.003 U	0.016	0.017	0.001 U	0.001 U	0.002	0.002	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R15 (Dup)	10/19/2022	0.003 U	0.003 U	0.017	0.017	0.001 U	0.001 U	0.002	0.002	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R16	6/16/2022	0.003 U	0.003 U	0.017	0.019	0.001 U	0.001 U	0.001 U	0.002	0.05	0.64	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.02	0.02
R16	10/18/2022	0.003 U	0.003 U	0.016	0.019	0.001 U	0.001 U	0.001 U	0.001	0.05	0.82	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01	0.01
R17	6/16/2022	0.003 U	0.003 U	0.018	0.018	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R17	10/18/2022	0.003 U	0.003 U	0.017	0.018	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.002	0.001 U	0.001 U	0.01 U	0.01 U
R18	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R18	10/18/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R19	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R19	10/18/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R20	6/15/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01 U	0.01 U
R20	10/18/2022	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.002	0.02 U	0.02 U	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.01	0.01

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
J = estimated value due to QC criterion exceedance
Locations shown on Exhibit 1

APPENDIX A3

2022 SURFACE

WATER QUALITY DATABASE

Station ID	Sample Date	Water Elevation (ft AMSL)*	Field pH (s.u.)	Field SC (µmhos/cm)	Diss O2 (mg/L)	Water Temp (°C)	Flow (cfs)	Lab pH (s.u.)	Lab SC (µmhos/cm)	Total Alkalinity as CaCO3	Total Dissolved Solids	Total Suspended Solids	Ca (TR)	Mg (TR)	Na (TR)	K (TR)
PPC-3A	6/14/2022	3928.23	7.77	133	10.42	7.7	136.3	7.6	140	41	140 J	20	15	3	6	1
PPC-3A (Dup)	6/14/2022	3928.23	7.77	133	10.42	7.7	136.3	7.8	142	42	98 J	12	15	3	6	1
PPC-3A	10/13/2022	3927.05	8.13	285	10.12	11.0	25.4	8.1	310	92	198	10 U	35	8	17	3
PPC-4A	6/14/2022	3911.07	7.87	132	10.41	7.8	142.3	7.8	140	42	100 J	11	16	3	6	1
PPC-4A	10/13/2022	3910.02	8.25	285	10.60	10.9	25.6	8.2	316	92	207	10 U	35	8	17	3
PPC-5A	6/14/2022	3903.58	7.85	134	10.45	7.7	142.8	7.8	140	42	103 J	12	16	3	7	2
PPC-5A	10/13/2022	3902.26	8.25	288	10.94	9.8	24.9	8.2	316	90	204	10 U	36	8	17	3
PPC-5A (Dup)	10/13/2022	3902.26	8.26	288	10.94	9.8	24.9	8.2	316	91	205	10 U	35	8	17	3
PPC-7	6/14/2022	3883.21	7.77	132	10.43	7.7	138.4	7.7	140	41	101 J	12	16	3	6	2
PPC-7	10/13/2022	3881.74	8.22	286	11.04	8.2	25.8	8.2	316	92	196	10 U	36	9	17	3
PPC-8	6/6/2022	3868.86	ELEVATION MEASUREMENT ONLY													
PPC-8	10/13/2022	3867.81	ELEVATION MEASUREMENT ONLY													
PPC-36A	6/14/2022	3855.92	7.66	132	10.43	7.6	105.1	7.6	139	41	97 J	12	16	3	6	2
PPC-36A	10/13/2022	3854.68	8.17	287	10.89	7.7	24.5	8.1	316	90	199	10 U	35	9	17	3
PPC-9	6/6/2022	3846.10	ELEVATION MEASUREMENT ONLY													
PPC-9	10/13/2022	3845.40	ELEVATION MEASUREMENT ONLY													
SG-16	6/14/2022	3767.37	7.77	132	10.42	7.7	94.9	7.7	140	41	104 J	13	15	3	6	2
SG-16	10/13/2022	3765.90	7.92	287	10.75	7.1	18.9	8.1	317	89	212	10 U	35	8	17	3
Trib-1	6/14/2022	3919.18	7.56	425	6.19	8.8	0.1	7.6	455	180	282	10 U	53	13	22	4
Trib-1	10/13/2022	3917.83	7.56	439	5.85	8.1	0.009 E	7.5	472	180	302	59	60	15	25	4
Trib-1B	6/14/2022	3914.69	6.88	479	1.71	11.2	0.004 E	7.0	516	200	326	10 U	60	14	23	4
Trib-1B	10/13/2022	SITE DRY - NO SAMPLE														
Trib-1D	6/14/2022	3905.34	7.73	494	7.20	10.8	0.04	7.8	510	160	339	10 U	56	16	23	3
Trib-1D	10/13/2022	3905.20	7.62	684	6.20	8.5	0.012	7.6	747	170	531	10 U	101	22	31	8

NOTES: All concentrations in mg/L except as indicated

(TR) = total recoverable

U = value below reporting limit

J = estimated value (QC criterion exceeded)

E = Estimated

NM = not measured

*June 2022 elevation measurements all obtained on 6/6/2022; June 2022 water quality samples all collected on 6/14/2022

Station ID	Sample Date	HCO3	Cl	SO4	Sb (TR)	As (TR)	Cd (TR)	Cu (TR)	Fe (TR)	Pb (TR)	Mn (TR)	Hg (TR)	Se (TR)	Tl (TR)	Zn (TR)
PPC-3A	6/14/2022	50	2	20	0.0005 U	0.004	0.00020	0.004	0.54	0.0058	0.05	0.000013	0.001 U	0.0002 U	0.051
PPC-3A (Dup)	6/14/2022	50	2	20	0.0005 U	0.004	0.00020	0.004	0.49	0.0057	0.05	0.000011	0.001 U	0.0002 U	0.049
PPC-3A	10/13/2022	110	8	64	0.0005 U	0.004	0.00008	0.002 U	0.14	0.0010	0.04	0.000005 U	0.001 U	0.0002 U	0.040
PPC-4A	6/14/2022	51	2	19	0.0005 U	0.004	0.00021	0.004	0.54	0.0061	0.05	0.000012	0.001 U	0.0002 U	0.053
PPC-4A	10/13/2022	110	8	64	0.0005 U	0.005	0.00008	0.002 U	0.15	0.0011	0.04	0.000005 U	0.001 U	0.0002 U	0.038
PPC-5A	6/14/2022	51	2	19	0.0005 U	0.004	0.00018	0.004	0.50	0.0058	0.05	0.000014	0.001 U	0.0002 U	0.050
PPC-5A	10/13/2022	110	8	64	0.0005 U	0.005	0.00008	0.002 U	0.16	0.0011	0.04	0.000005 U	0.001 U	0.0002 U	0.037
PPC-5A (Dup)	10/13/2022	110	8	63	0.0005 U	0.005	0.00008	0.002 U	0.16	0.0011	0.04	0.000005 U	0.001 U	0.0002 U	0.036
PPC-7	6/14/2022	49	2	19	0.0005 U	0.004	0.00020	0.005	0.53	0.0063	0.05	0.000013	0.001 U	0.0002 U	0.052
PPC-7	10/13/2022	110	8	64	0.0005 U	0.005	0.00009	0.002	0.16	0.0011	0.04	0.000005 U	0.001 U	0.0002 U	0.037
PPC-8	6/6/2022	ELEVATION MEASUREMENT ONLY													
PPC-8	10/13/2022	ELEVATION MEASUREMENT ONLY													
PPC-36A	6/14/2022	49	2	19	0.0005 U	0.004	0.00021	0.005	0.53	0.0064	0.06	0.000012	0.001 U	0.0002 U	0.053
PPC-36A	10/13/2022	110	8	64	0.0005 U	0.005	0.00008	0.002	0.15	0.0011	0.03	0.000005 U	0.001 U	0.0002 U	0.039
PPC-9	6/6/2022	ELEVATION MEASUREMENT ONLY													
PPC-9	10/13/2022	ELEVATION MEASUREMENT ONLY													
SG-16	6/14/2022	49	2	19	0.0005 U	0.004	0.00023	0.005	0.57	0.0066	0.05	0.000014	0.001 U	0.0002 U	0.053
SG-16	10/13/2022	110	8	65	0.0005 U	0.005	0.00010	0.002	0.18	0.0017	0.03	0.000005 U	0.001 U	0.0002 U	0.039
Trib-1	6/14/2022	210	6	50	0.0005 U	0.006	0.00008	0.002 U	0.26	0.0053	0.03	0.000011	0.001 U	0.0002 U	0.008 U
Trib-1	10/13/2022	220	9	72	0.0005 U	0.005	0.00039	0.002 U	0.24	0.0067	0.02	0.000021	0.001 U	0.0002 U	0.008 U
Trib-1B	6/14/2022	250	6	56	0.0011	0.011	0.02040	0.025	0.14	0.0104	1.02	0.000178	0.001 U	0.0005	0.85
Trib-1B	10/13/2022	SITE DRY - NO SAMPLE													
Trib-1D	6/14/2022	190	5	92	0.0006	0.009	0.00008	0.004	0.51	0.0025	0.24	0.000008	0.001 U	0.0002 U	0.008
Trib-1D	10/13/2022	200	15	241	0.0005 U	0.005	0.00007	0.003	0.17	0.0010	0.02	0.000005	0.001 U	0.0002 U	0.008 U

NOTES: All concentrations in mg/L except as indicated

(TR) = total recoverable

U = value below reporting limit

J = estimated value (QC criterion exceeded)

E = Estimated

NM = not measured

APPENDIX B

2022 GROUNDWATER ELEVATION DATA

2022 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-22**	**Oct-22**	**Jun-22**	**Oct-22**
2843 Canyon Ferry	Not Available	34.62	30.25	Not Calculated	Not Calculated
2853 Canyon Ferry	Not Available	35.75	31.65	Not Calculated	Not Calculated
ASIW-1	3915.99	18.97	19.18	3897.02	3896.81
ASIW-2	3909.13	36.14	34.66	3872.99	3874.47
DH-1	3910.89	46.07	45.97	3864.82	3864.92
DH-2	3936.91	63.47	63.87	3873.44	3873.04
DH-3	3947.48	31.15	31.94	3916.33	3915.54
DH-4	3917.26	14.50	14.93	3902.76	3902.33
DH-5	3921.18	18.19	17.80	3902.99	3903.38
DH-6	3889.85	23.15	21.02	3866.70	3868.83
DH-7	3898.66	17.01	17.58	3881.65	3881.08
DH-8	3923.38	52.83	52.88	3870.55	3870.50
DH-9	3918.08	DRY	DRY	DRY	DRY
DH-10A	3886.97	9.29	10.91	3877.68	3876.06
DH-13	3923.91	53.36	52.94	3870.55	3870.97
DH-14	3916.06	13.48	13.88	3902.58	3902.18
DH-15	3889.82	23.14	21.11	3866.68	3868.71
DH-17	3917.56	52.60	51.62	3864.96	3865.94
DH-18	3924.93	50.80	50.84	3874.13	3874.09
DH-20	3927.09	17.86	18.80	3909.23	3908.29
DH-22	3948.63	DRY	DRY	DRY	DRY
DH-23	3931.82	DRY	DRY	DRY	DRY
DH-27	3946.21	56.02	56.60	3890.19	3889.61
DH-30	3943.24	52.12	52.48	3891.12	3890.76
DH-36	3920.66	DRY	DRY	DRY	DRY
DH-42	3942.63	49.62	DRY	3893.01	DRY
DH-47	3926.82	21.72	DRY	3905.10	DRY
DH-48	3905.96	35.76	DRY	3870.20	DRY
DH-52	3889.18	6.81	8.49	3882.37	3880.69
DH-53	3892.87	8.95	11.17	3883.92	3881.70
DH-54	3890.27	DRY	28.81	DRY	3861.46
DH-55	3972.76	81.11	81.48	3891.65	3891.28
DH-56	3958.17	DRY	DRY	DRY	DRY
DH-57	3929.53	DRY	DRY	DRY	DRY
DH-58	3919.33	DRY	DRY	DRY	DRY
DH-59	3937.44	45.95	45.05	3891.49	3892.39
DH-5A	3921.92	18.81	18.51	3903.11	3903.41
DH-61	3926.84	DRY	DRY	DRY	DRY
DH-62	3926.95	58.11	58.35	3868.84	3868.60
DH-63	3905.37	41.14	DRY	3864.23	DRY
DH-65	3945.85	63.64	64.96	3882.21	3880.89
DH-66	3919.28	54.81	54.21	3864.47	3865.07

2022 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-22**	**Oct-22**	**Jun-22**	**Oct-22**
DH-67	3899.77	40.32	38.31	3859.45	3861.46
DH-68	3943.28	45.18	45.24	3898.10	3898.04
DH-69	3934.49	35.94	36.01	3898.51	3898.44
DH-70	3933.91	33.84	33.99	3900.07	3899.92
DH-71	3944.88	56.44	DRY	3888.44	DRY
DH-72	3939.67	44.45	44.90	3895.22	3894.77
DH-73	3918.08	41.81	41.38	3876.27	3876.70
DH-74	4006.44	126.04	126.27	3880.40	3880.17
DH-75	4006.54	126.45	126.68	3880.09	3879.86
DH-76	3994.28	77.87	78.00	3895.23	3895.10
DH-77	3932.20	54.27	54.38	3877.93	3877.82
DH-78	3921.12	53.64	DRY	3867.48	DRY
DH-79	3928.80	56.49	56.04	3872.31	3872.76
DH-80	3942.36	50.00	50.45	3892.36	3891.91
DH-82	3908.18	47.77	45.69	3860.41	3862.49
DH-83	3922.14	53.64	53.56	3868.50	3868.58
East-PZ-1	3911.93	25.50	24.88	3886.43	3887.05
East-PZ-2	3924.58	24.87	24.62	3899.71	3899.96
East-PZ-4	3935.66	30.46	20.54	3905.20	3915.12
East-PZ-6	3943.83	23.77	23.85	3920.06	3919.98
East-PZ-7	3928.83	18.33	18.61	3910.50	3910.22
EH-50	3889.39	34.20	32.22	3855.19	3857.17
EH-51	3880.09	20.40	18.21	3859.69	3861.88
EH-52	3880.50	8.08	8.35	3872.42	3872.15
EH-53	3872.82	DRY	34.72	DRY	3838.10
EH-54	3869.66	11.16	11.13	3858.50	3858.53
EH-57	3885.05	DRY	DRY	DRY	DRY
EH-57A	3885.45	DRY	DRY	DRY	DRY
EH-58	3888.15	14.71	14.97	3873.44	3873.18
EH-59	3876.57	10.20	8.60	3866.37	3867.97
EH-60	3888.46	DRY	DRY	DRY	DRY
EH-61	3889.77	31.58	29.58	3858.19	3860.19
EH-62	3875.07	32.83	30.52	3842.24	3844.55
EH-63	3878.32	27.04	24.40	3851.28	3853.92
EH-64	3882.67	33.96	30.90	3848.71	3851.77
EH-65	3879.96	33.28	30.18	3846.68	3849.78
EH-66	3869.48	35.29	34.46	3834.19	3835.02
EH-67	3869.46	31.91	31.99	3837.55	3837.47
EH-68	3867.60	12.01	10.96	3855.59	3856.64
EH-69	3869.10	24.96	21.87	3844.14	3847.23
EH-70	3863.48	42.69	40.73	3820.79	3822.75
EH-100	3889.83	34.61	32.70	3855.22	3857.13

2022 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-22**	**Oct-22**	**Jun-22**	**Oct-22**
EH-101	3879.95	20.81	18.63	3859.14	3861.32
EH-102	3880.45	10.34	8.51	3870.11	3871.94
EH-103	3890.54	32.16	30.19	3858.38	3860.35
EH-104	3887.83	42.62	40.30	3845.21	3847.53
EH-106	3882.07	35.40	33.31	3846.67	3848.76
EH-107	3880.15	29.34	26.72	3850.81	3853.43
EH-109	3885.67	31.74	29.82	3853.93	3855.85
EH-110	3884.05	27.38	25.42	3856.67	3858.63
EH-111	3876.50	37.70	35.45	3838.80	3841.05
EH-112	3875.78	38.18	34.53	3837.60	3841.25
EH-113	3871.34	37.14	33.82	3834.20	3837.52
EH-114	3878.07	41.23	39.07	3836.84	3839.00
EH-115	3883.29	43.31	41.14	3839.98	3842.15
EH-116	3874.52	39.31	36.94	3835.21	3837.58
EH-117	3871.33	37.28	34.68	3834.05	3836.65
EH-118	3879.95	44.65	42.75	3835.30	3837.20
EH-119	3873.75	40.82	39.22	3832.93	3834.53
EH-120	3865.78	38.42	36.41	3827.36	3829.37
EH-121	3869.49	35.10	34.74	3834.39	3834.75
EH-122	3868.08	29.92	30.87	3838.16	3837.21
EH-123	3885.71	49.93	48.82	3835.78	3836.89
EH-124	3874.46	43.34	41.98	3831.12	3832.48
EH-125	3863.22	43.12	41.18	3820.10	3822.04
EH-126	3870.00	64.28	60.31	3805.72	3809.69
EH-127	3860.75	33.98	35.92	3826.77	3824.83
EH-128	3892.17	DRY	DRY	DRY	DRY
EH-129	3870.21	65.19	60.95	3805.02	3809.26
EH-130	3858.55	52.96	50.19	3805.59	3808.36
EH-131	3834.44	39.92	37.34	3794.52	3797.10
EH-132	3893.90	64.38	63.48	3829.52	3830.42
EH-133	3884.36	60.45	59.74	3823.91	3824.62
EH-134	3870.21	63.98	60.66	3806.23	3809.55
EH-135	3852.25	35.08	34.78	3817.17	3817.47
EH-136	3838.59	34.64	34.30	3803.95	3804.29
EH-137	3839.66	44.11	41.95	3795.55	3797.71
EH-138	3839.70	53.05	48.38	3786.65	3791.32
EH-139	3839.78	DRY	53.61	DRY	3786.17
EH-140	3812.08	30.62	26.60	3781.46	3785.48
EH-141	3813.32	37.90	33.66	3775.42	3779.66
EH-142	3804.68	37.00	33.15	3767.68	3771.53
EH-143	3803.37	37.59	33.94	3765.78	3769.43
EH-144D	3778.86	26.42	22.34	3752.44	3756.52

2022 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-22**	**Oct-22**	**Jun-22**	**Oct-22**
EH-144M	3778.95	29.39	24.85	3749.56	3754.10
EH-144S	3778.70	30.93	26.18	3747.77	3752.52
EH-145D	3789.60	34.30	30.27	3755.30	3759.33
EH-145S	3790.09	35.35	31.29	3754.74	3758.80
EH-200	3953.33	28.81	27.82	3924.52	3925.51
EH-201	3973.48	80.24	79.89	3893.24	3893.59
EH-202	3930.56	66.35	66.77	3864.21	3863.79
EH-203	4003.92	102.54	102.64	3901.38	3901.28
EH-204	3925.69	58.06	58.34	3867.63	3867.35
EH-205	3900.66	36.69	DRY	3863.97	DRY
EH-206	3898.10	52.20	52.31	3845.90	3845.79
EH-208	3910.58	56.03	57.46	3854.55	3853.12
EH-209	3898.34	42.51	43.77	3855.83	3854.57
EH-210	3901.19	40.54	39.97	3860.65	3861.22
EH-211	3905.75	51.32	51.71	3854.43	3854.04
EH-212	3905.90	51.41	51.82	3854.49	3854.08
EHMW-3	3825.45	47.50	43.38	3777.95	3782.07
EHTW-3	3827.66	50.42	46.03	3777.24	3781.63
IW-01	3888.28	67.43	66.93	3820.85	3821.35
IW-02	3871.08	53.60	53.34	3817.48	3817.74
MW-1	3953.05	53.48	53.22	3899.57	3899.83
MW-2	3945.97	40.56	41.25	3905.41	3904.72
MW-3	3940.95	35.94	36.67	3905.01	3904.28
MW-4	3947.06	50.10	50.48	3896.96	3896.58
MW-5	3956.18	54.76	55.11	3901.42	3901.07
MW-6	3938.14	32.32	33.06	3905.82	3905.08
MW-7	3963.67	55.12	54.63	3908.55	3909.04
MW-8	3958.65	53.77	54.08	3904.88	3904.57
MW-9	3959.01	52.58	52.84	3906.43	3906.17
MW-10	3946.28	46.06	46.58	3900.22	3899.70
MW-11	3973.33	63.14	63.33	3910.19	3910.00
PBTW-1	3914.59	50.82	48.93	3863.77	3865.66
PBTW-2	3906.73	43.71	41.68	3863.02	3865.05
Plant Road Test Well	3838.72	64.73	61.57	3773.99	3777.15
PPCRPZ-02	3919.76	7.33	8.26	3912.43	3911.50
PRB-1	3918.37	55.03	53.11	3863.34	3865.26
PRB-2	3905.34	41.43	39.52	3863.91	3865.82
PRB-3	3919.19	55.57	53.87	3863.62	3865.32
PZ-36A	3858.96	13.94	18.96	3845.02	3840.00
PZ-36B	3858.75	DRY	DRY	DRY	DRY
PZ-36C	3859.60	DRY	DRY	DRY	DRY
PZ-9A	3850.70	DRY	DRY	DRY	DRY

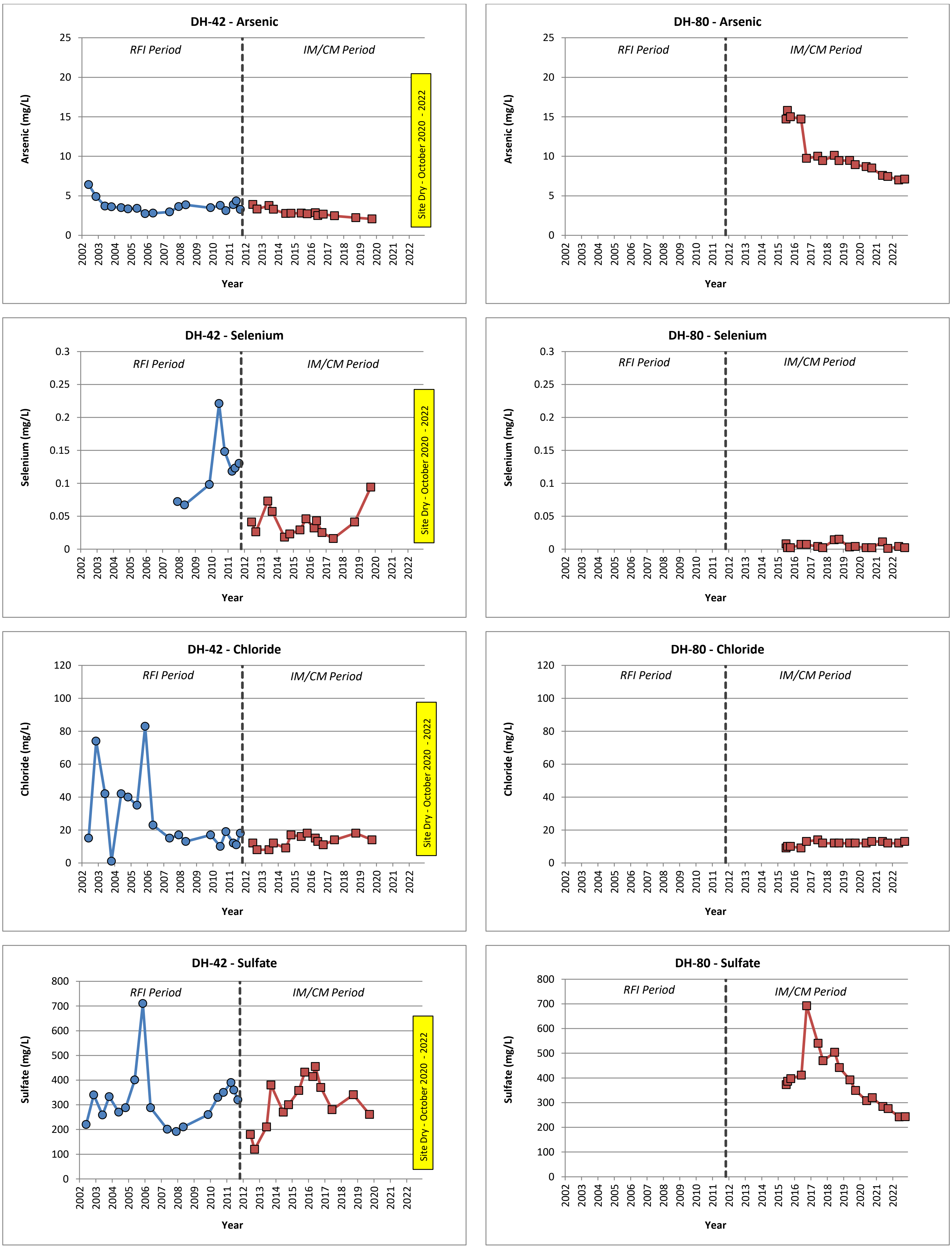
2022 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**Jun-22**	**Oct-22**	**Jun-22**	**Oct-22**
PZ-9B	3849.43	15.81	15.74	3833.62	3833.69
SC-1	3890.42	36.26	35.15	3854.16	3855.27
SDMW-1	3925.11	53.81	53.12	3871.30	3871.99
SDMW-2	3928.09	55.20	55.04	3872.89	3873.05
SDMW-3	3935.14	53.64	53.82	3881.50	3881.32
SDMW-4	3936.10	51.95	51.98	3884.15	3884.12
SDMW-5	3929.86	55.61	55.61	3874.25	3874.25
SP-3	3905.91	DRY	DRY	DRY	DRY
SP-4	3908.16	DRY	DRY	DRY	DRY
SP-5	3903.52	27.73	DRY	3875.79	DRY
TW-1	3930.10	53.03	52.78	3877.07	3877.32
TW-2	3931.44	54.85	54.37	3876.59	3877.07
ULM-PZ-1	3924.40	5.18	5.99	3919.22	3918.41
ULTP-1	3919.63	PONDED	6.33	PONDED	3913.30
ULTP-2	3921.23	5.92	6.69	3915.31	3914.54

APPENDIX C

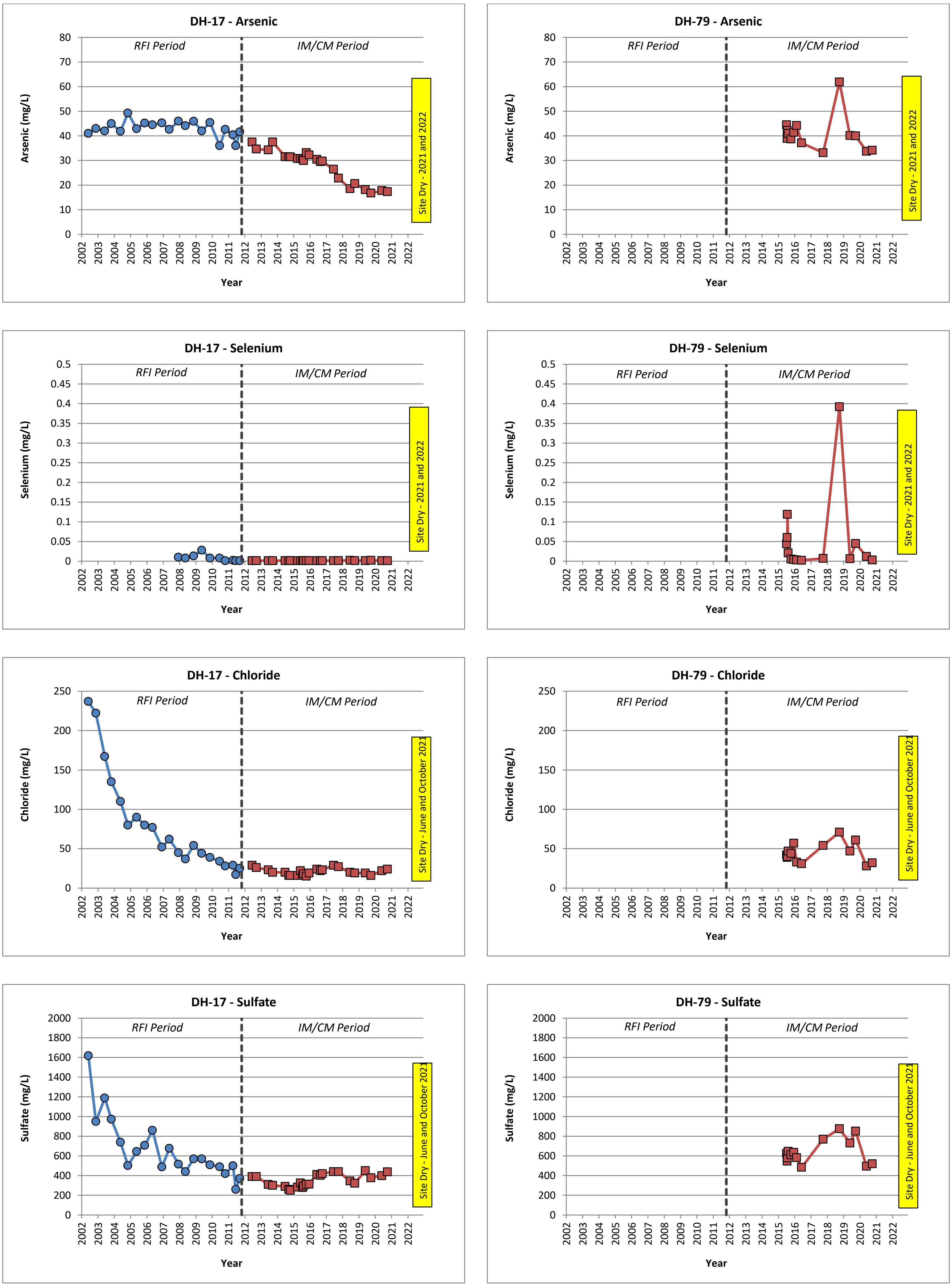
SITE-WIDE GROUNDWATER

CONCENTRATION TREND GRAPHS



Hydrometrics, Inc.

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	FORMER ACID PLANT AREA GROUNDWATER QUALITY TRENDS	FIGURE C-1

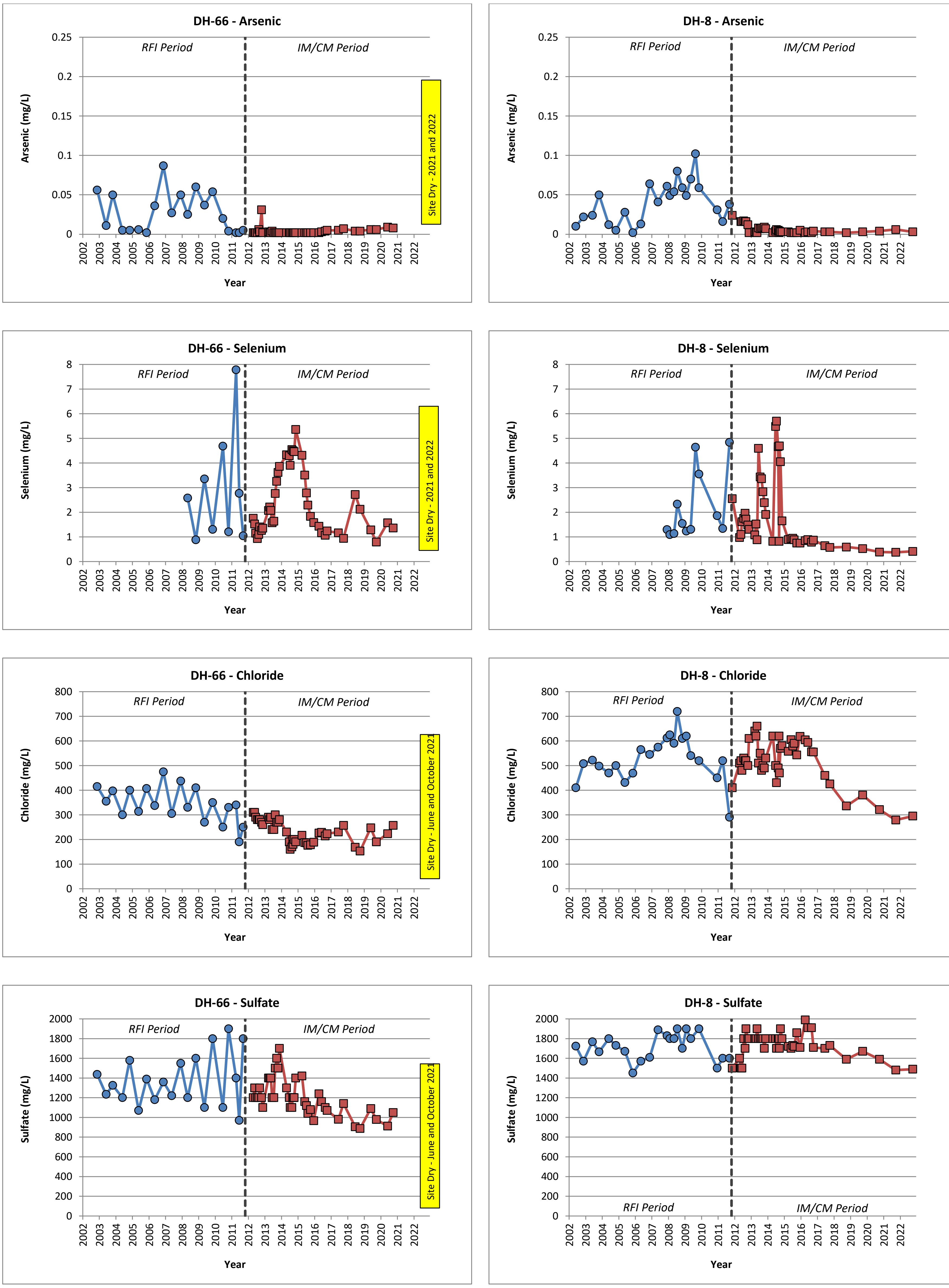


Hydrometrics, Inc.

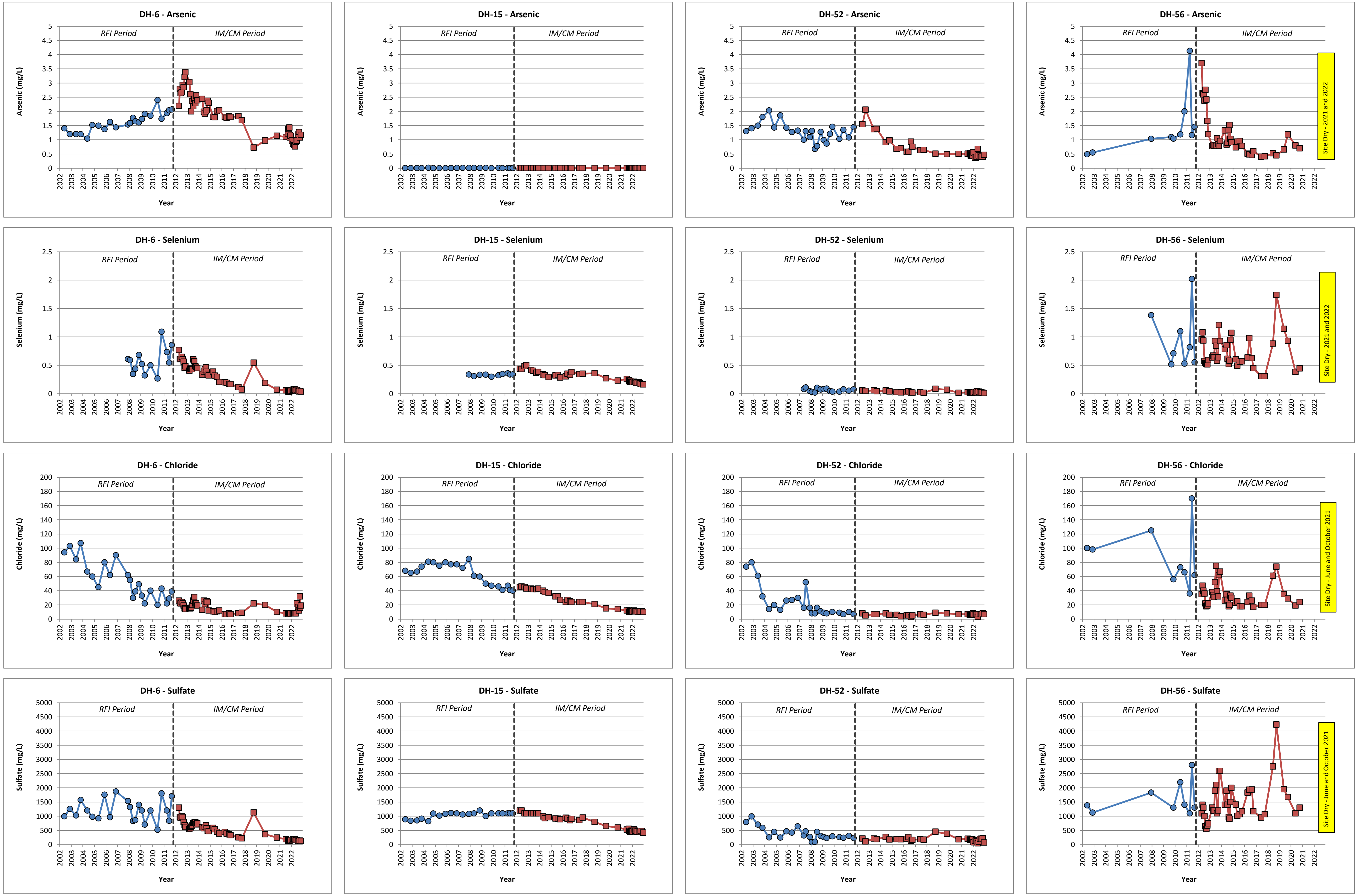
2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

NORTH PLANT ARSENIC AREA
GROUNDWATER QUALITY TRENDS

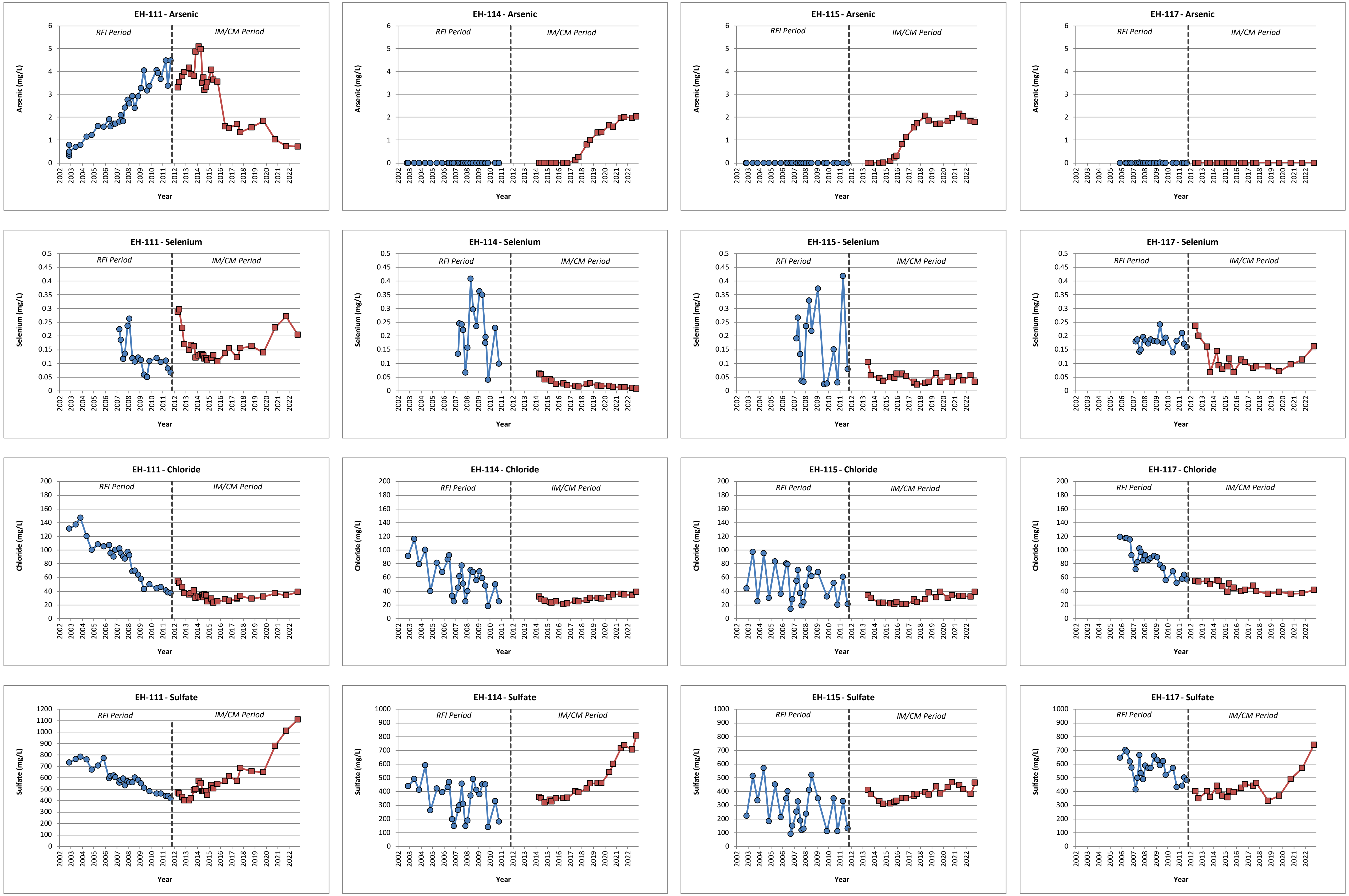
FIGURE
C-2



Hydrometrics, Inc.	2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	**WEST SELENIUM AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-3**

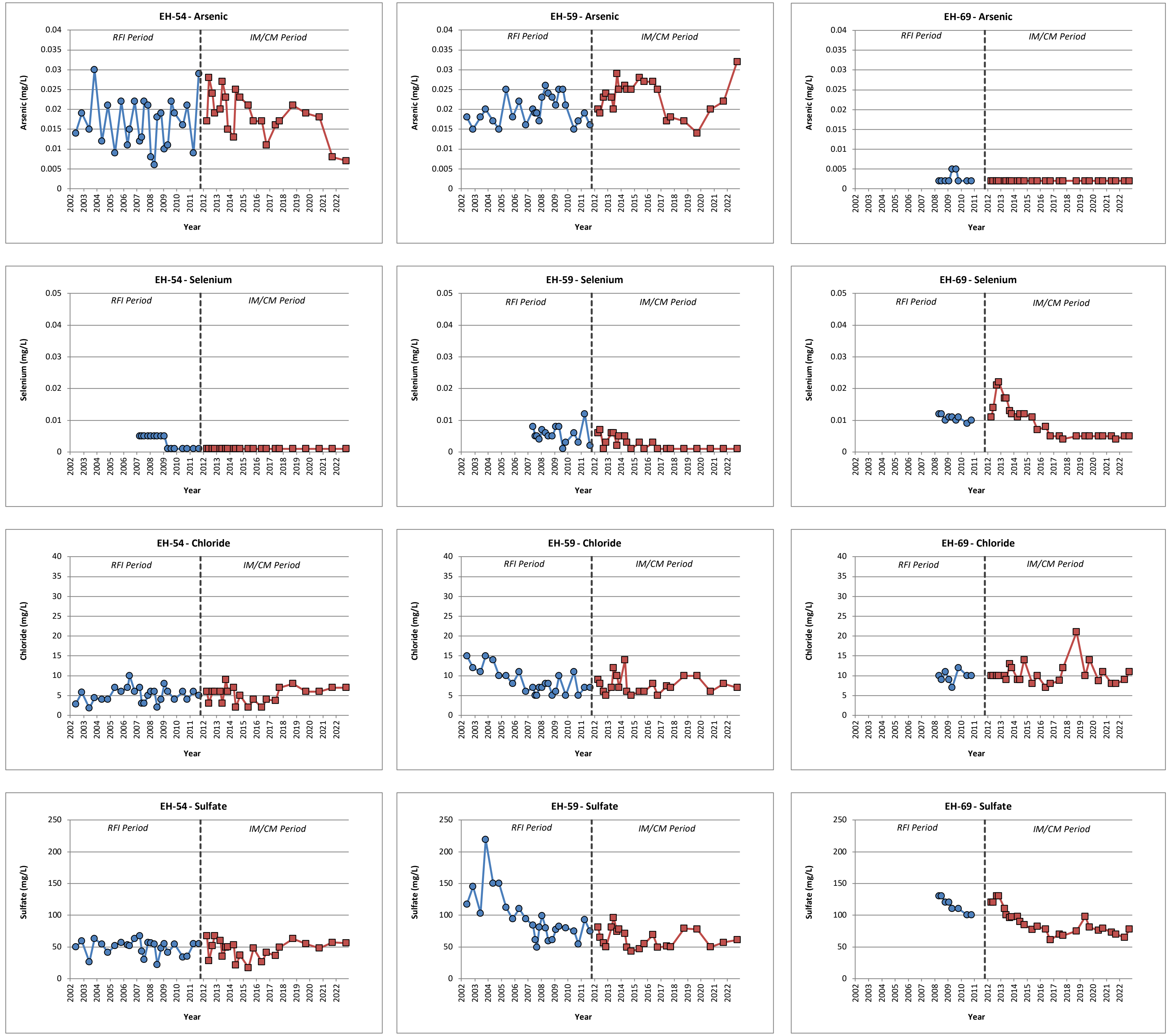


2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	SLAG PILE AREA GROUNDWATER QUALITY TRENDS	FIGURE C-4



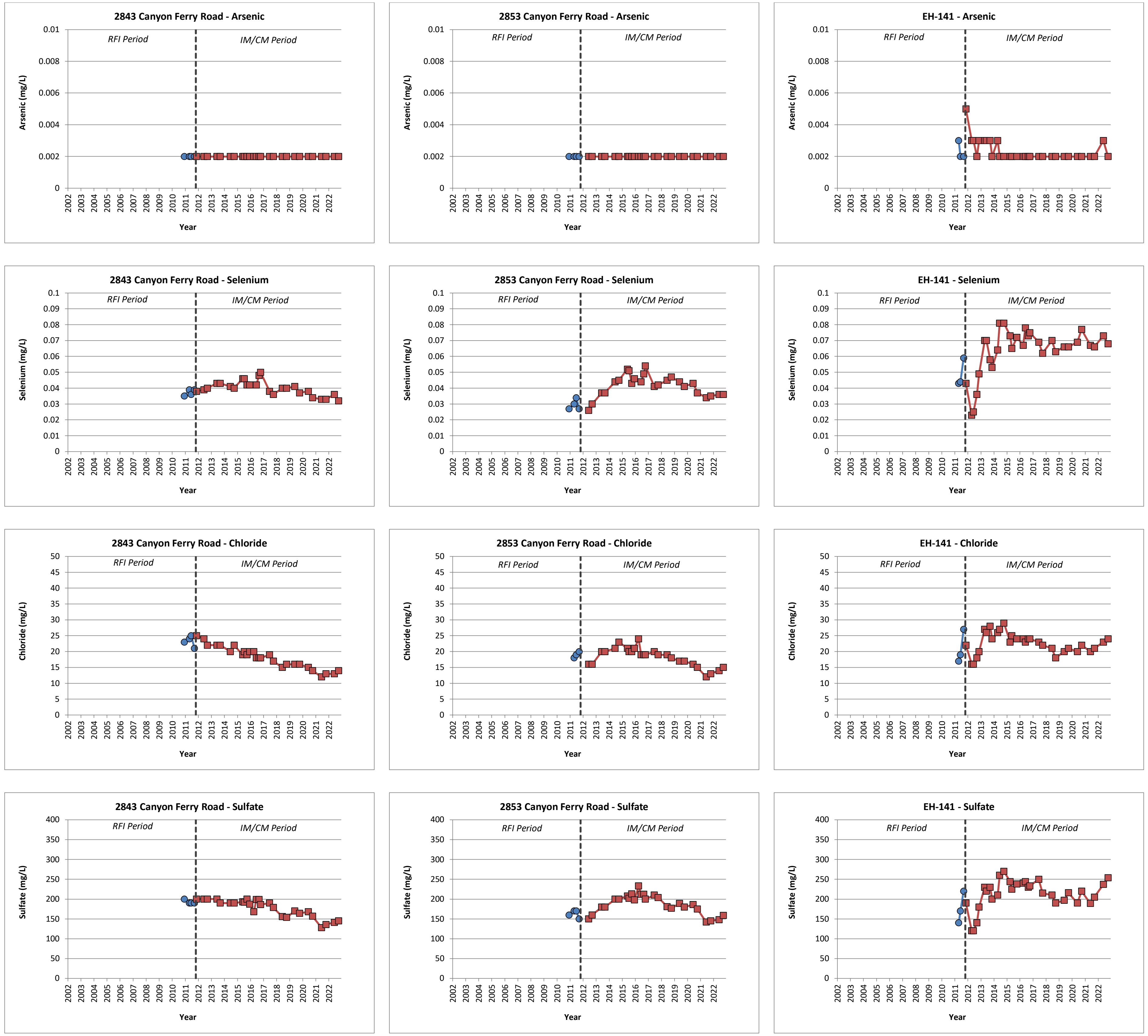
Hydrometrics, Inc.

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (WEST) GROUNDWATER QUALITY TRENDS	FIGURE C-5



Hydrometrics, Inc.

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (EAST) GROUNDWATER QUALITY TRENDS	FIGURE C-5



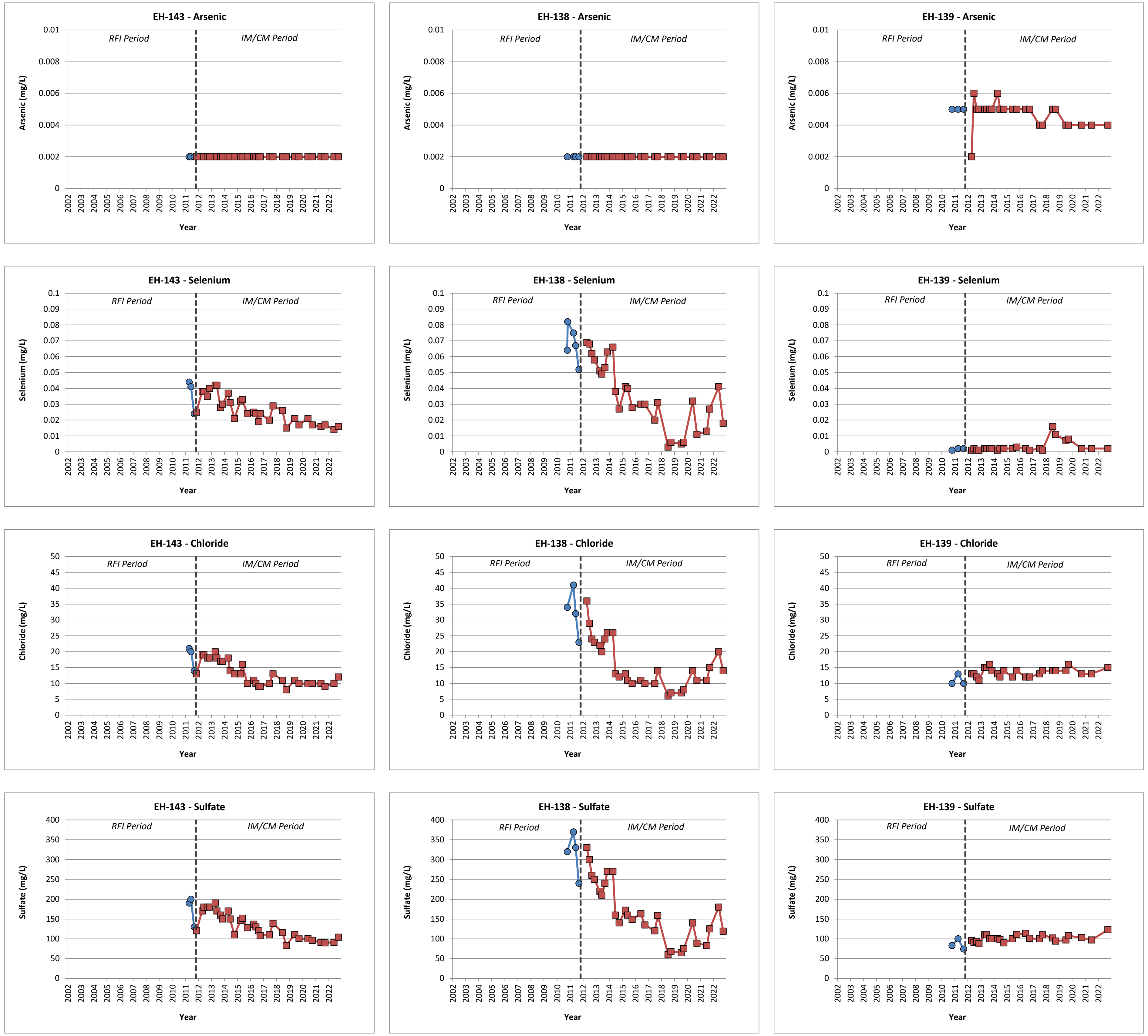
Hydrometrics, Inc.

2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS

FIGURE

C-6



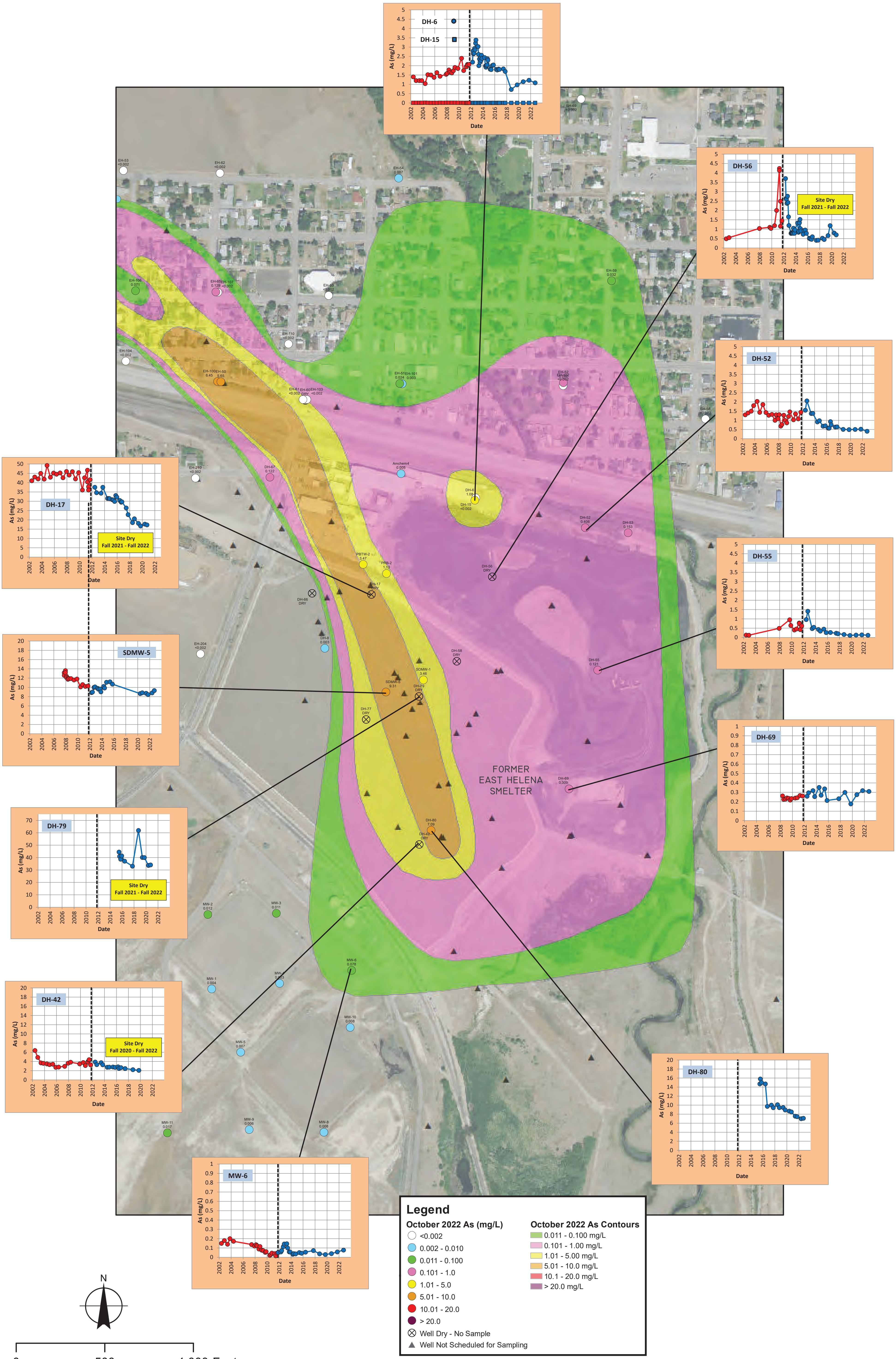
Hydrometrics, Inc.

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS	FIGURE C-6

APPENDIX D

ARSENIC AND SELENIUM

TREND PLOT MAPS



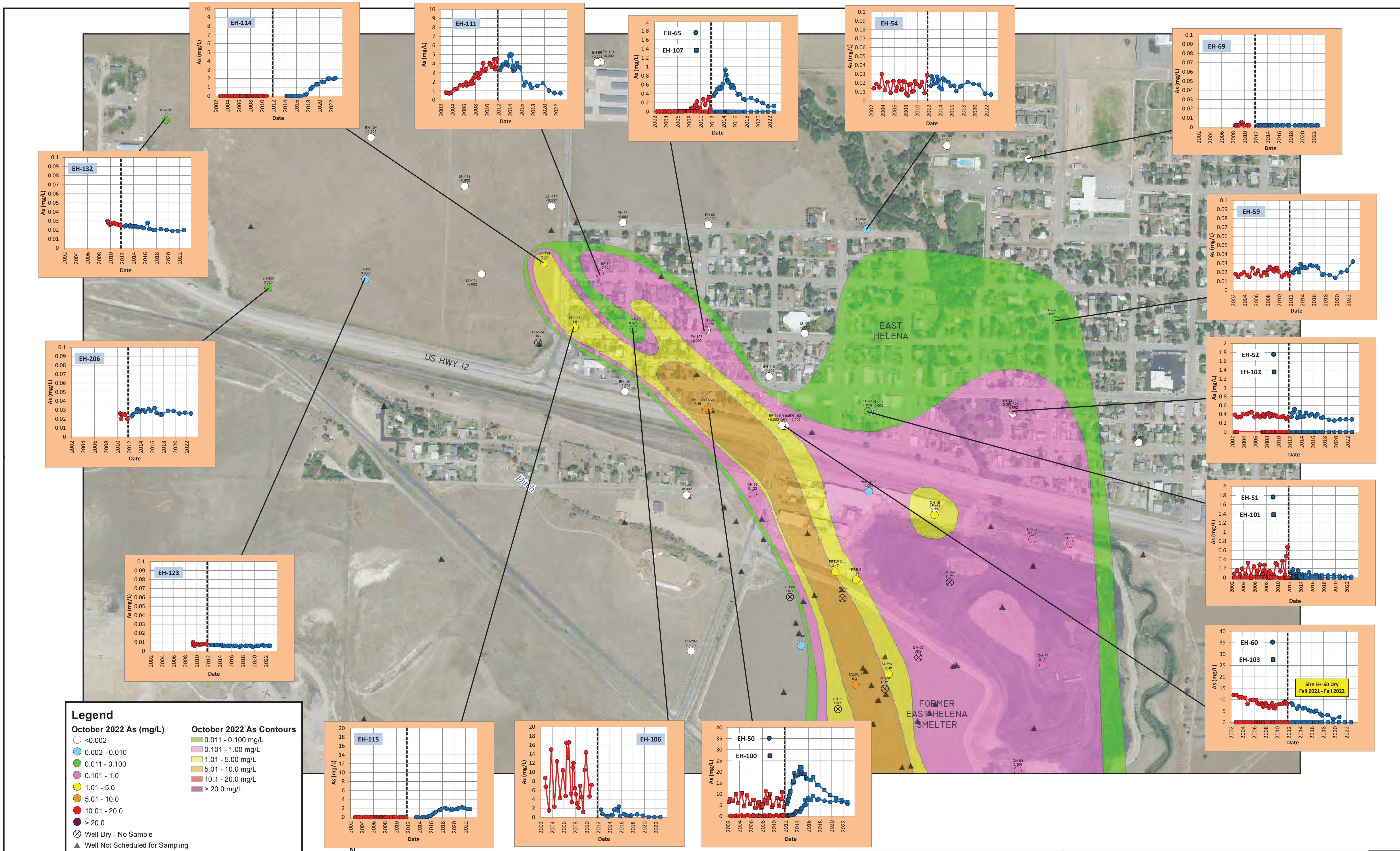
Hydrometrics, Inc.
Consulting Scientists and Engineers

G:\PROJECT\10022\WQUpdates\Plant_Area_As_Plume_and_Trends.mxd

2022 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY

ARSENIC TRENDS THROUGH OCTOBER 2022 PLANT AREA WELLS

FIGURE **D-1**



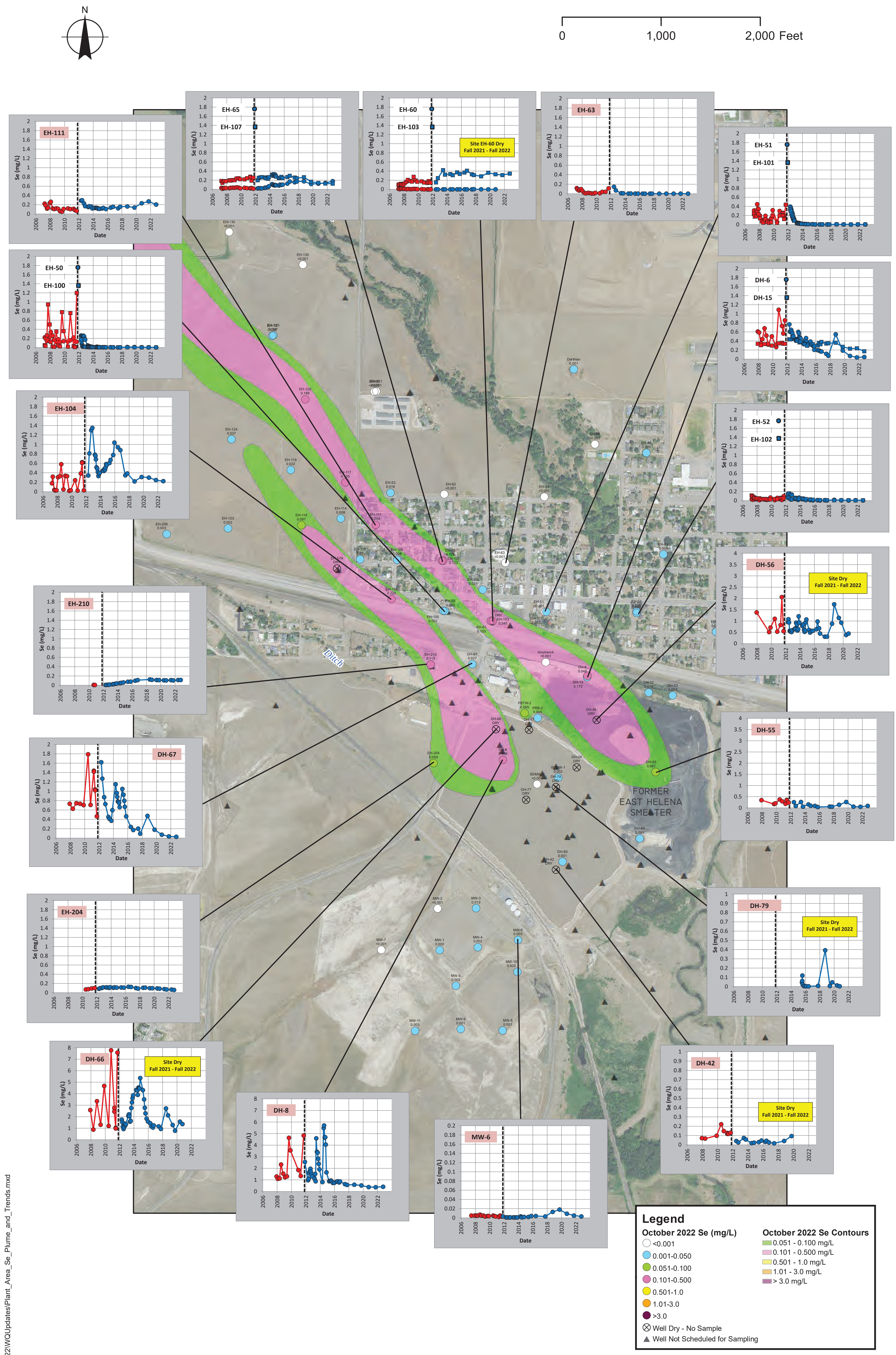
Hydrometrics, Inc.
Consulting Scientists and Engineers

G:\PROJECT\10022\WQUpdates\EH_Area_As_Plume_and_Trends.mxd

2022 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

ARSENIC TRENDS THROUGH OCTOBER 2022
EAST HELENA AREA WELLS

FIGURE
D-2



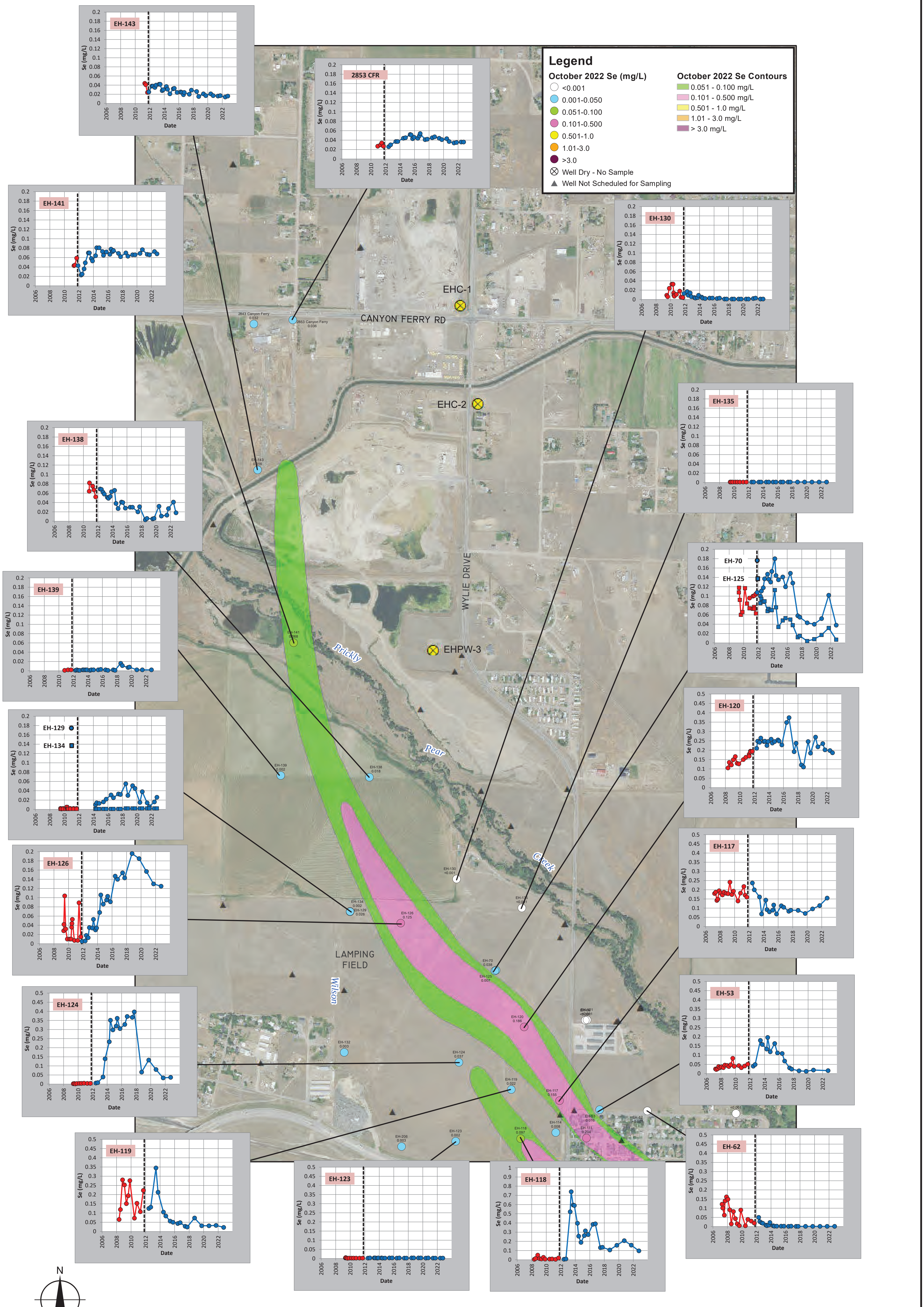
G:\PROJECT\10022\WQUpdates\Plant_Area_Se_Plume_and_Trends.mxd

Hydrometrics, Inc.
Consulting Scientists and Engineers

2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

SELENIUM TRENDS THROUGH OCTOBER 2022
PLANT AREA WELLS

FIGURE
D-3



Hydrometrics, Inc.
Consulting Scientists and Engineers

G:\PROJECT\10022\WQUpdates\Downgradient_Se_Plume_and_Trends.mxd

2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY

SELENIUM TRENDS THROUGH OCTOBER 2022
DOWNGRADIENT AREA

FIGURE
D-4

APPENDIX E

UNFUMED SLAG WELL

DATA TABLE

Appendix E - Unfumed Slag Indicator and Sentinel Well Data Table

Site	Sample Date	Purge Method	SWL (ft bmp)	pH (s.u.)	SC (µmhos/cm)	Dissolved O2 (mg/L)	Temperature (°C)	Arsenic (mg/L)	Selenium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Potassium (mg/L)	Magnesium (mg/L)
DH-6	*7/29/2021 (Pre-Crushing)*	*Standard*	*22.07*	*7.47*	*786*	*2.55*	*9.9*	*1.1*	*0.059*	*192*	*8*	*66*	*3*
DH-6	10/1/2021	Standard	22.04	7.61	656	2.14	10.4	1.22	0.036	153	8	59	2
DH-6	10/18/2021	Low-Flow	22.36	7.58	655	2.90	10.9	1.38	0.038	133	7	59	2
DH-6	11/3/2021	Low-Flow	22.63	7.54	644	4.61	10.1	1.38	0.033	141	8	60	2
DH-6	11/17/2021	Low-Flow	22.97	7.60	651	3.83	9.7	1.43	0.037	135	8	60	2
DH-6	12/2/2021	Low-Flow	23.23	7.57	654	3.60	10.5	1.17	0.041	142	8	56	2
DH-6	12/2/2021	Standard	23.23	7.52	656	2.56	10.7	1.08	0.043	142	8	54	2
DH-6	12/21/2021	Low-Flow	23.45	7.66	697	3.82	9.6	1.14	0.046	158	8	62	3
DH-6	1/12/2022	Low-Flow	23.25	7.57	687	3.39	9.4	1.07	0.044	158	8	60	3
DH-6	2/7/2022	Low-Flow	23.42	7.56	721	3.37	9.2	0.975	0.054	162	8	63	3
DH-6	3/11/2022	Low-Flow	23.76	7.66	708	3.86	8.2	0.854	0.070	196	8	61	3
DH-6	4/18/2022	Low-Flow	23.88	7.68	720	3.93	9.5	0.809	0.080	203	8	66	4
DH-6	5/11/2022	Low-Flow	23.72	7.35	775	4.49	11.4	0.767	0.073	188	8	66	3
DH-6	6/13/2022	Low-Flow	22.80	7.62	678	4.50	10.1	0.933	0.057	153	8	57	3
DH-6	7/14/2022	Low-Flow	21.29	7.46	754	4.59	11.0	0.966	0.063	153	22	64	3
DH-6	8/16/2022	Low-Flow	21.46	7.30	658	5.15	13.5	1.18	0.049	133	17	60	2
DH-6	9/14/2022	Low-Flow	21.77	7.57	597	4.08	10.7	1.27	0.039	119	12	59	2
DH-6	10/13/2022	Low-Flow	21.20	7.48	706	4.30	10.8	1.08	0.046	136	32	63	3
DH-6	11/15/2022	Low-Flow	21.60	7.45	612	3.59	9.6	1.14	0.036	128	19	56	2
DH-6	12/27/2022	No Sample - Surface Leakage into Wellhead due to Plowed Snow and Ice - Placed Temporary Extended Casing											
DH-6	1/18/2023	Low-Flow	21.90	7.33	560	3.85	9.2	1.11	0.033	104	14	52	2
DH-6	2/16/2023	Low-Flow	22.35	7.53	612	3.79	9.0	1.02	0.054	128	13	52	2
DH-6	**95% USL**		**--**	**--**	**--**	**--**	**--**	**3.81**	**0.885**	**1330**	**37**	**288**	**23**
DH-15	*7/29/2021 (Pre-Crushing)*	*Standard*	*22.08*	*7.00*	*1324*	*0.03*	*11.2*	*<0.002*	*0.258*	*525*	*12*	*6*	*28*
DH-15	10/1/2021	Standard	22.10	7.05	1311	0.04	11.0	<0.002	0.237	554	12	6	30
DH-15	10/18/2021	Low-Flow	22.37	7.14	1231	0.58	10.5	<0.002	0.218	471	10	5	28
DH-15	11/3/2021	Low-Flow	22.63	7.00	1211	0.59	9.5	<0.002	0.206	480	11	5	27
DH-15	11/17/2021	Low-Flow	22.98	6.99	1223	0.16	9.2	<0.002	0.225	453	11	5	26
DH-15	12/2/2021	Low-Flow	23.25	6.99	1200	0.22	10.1	<0.002	0.209	459	11	5	26
DH-15	12/21/2021	Low-Flow	23.44	7.12	1226	0.22	9.2	<0.002	0.206	487	11	5	27
DH-15	1/12/2022	Low-Flow	23.24	7.08	1204	0.24	8.8	<0.002	0.205	469	11	5	27
DH-15	2/7/2022	Low-Flow	23.35	7.06	1228	0.19	9.2	<0.002	0.202	460	11	5	27
DH-15	3/11/2022	Low-Flow	23.73	7.23	1132	0.49	8.5	<0.002	0.210	535	12	5	26
DH-15	4/18/2022	Low-Flow	23.89	7.33	1103	0.39	9.5	<0.002	0.204	488	11	5	27
DH-15	5/11/2022	Low-Flow	23.70	6.92	1201	0.59	10.3	<0.002	0.187	484	11	5	27
DH-15	6/13/2022	Low-Flow	22.75	7.08	1196	0.53	9.8	<0.002	0.198	457	11	5	25
DH-15	7/14/2022	Low-Flow	21.34	7.11	1146	0.35	10.8	<0.002	0.188	458	10	5	24
DH-15	8/16/2022	Low-Flow	21.46	7.13	1136	0.46	12.5	<0.002	0.200	452	11	5	25
DH-15	9/14/2022	Low-Flow	21.77	7.10	1151	0.25	10.8	<0.002	0.180	442	11	5	25
DH-15	10/13/2022	Low-Flow	21.21	7.11	1131	0.31	10.1	<0.002	0.172	483	11	5	25
DH-15	11/15/2022	Low-Flow	21.57	7.11	1135	0.37	8.6	<0.002	0.166	475	11	5	24
DH-15	12/27/2022	Low-Flow	20.56	7.04	1104	0.35	9.1	<0.002	0.162	420	10	5	22
DH-15	1/18/2023	Low-Flow	20.85	6.99	1099	0.30	8.9	<0.002	0.150	437	8	5	23
DH-15	2/16/2023	Low-Flow	21.30	7.14	1109	0.52	7.9	<0.002	0.153	448	10	5	22
DH-15	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.003**	**0.530**	**1351**	**68**	**9**	**68**

Site	Sample Date	Purge Method	SWL (ft bmp)	pH (s.u.)	SC (µmhos/cm)	Dissolved O2 (mg/L)	Temperature (°C)	Arsenic (mg/L)	Selenium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Potassium (mg/L)	Magnesium (mg/L)
DH-52	*7/29/2021 (Pre-Crushing)*	*Standard*	*8.28*	*7.30*	*766*	*0.26*	*11.0*	*0.508*	*0.023*	*207*	*7*	*66*	*8*
DH-52	10/1/2021	Standard	8.82	7.41	676	0.32	11.5	0.517	0.016	178	6	65	7
DH-52	10/18/2021	Low-Flow	8.77	7.31	689	0.90	12.1	0.487	0.018	159	6	63	8
DH-52	11/2/2021	Low-Flow	8.98	6.92	660	2.10	9.6	0.445	0.019	166	6	65	8
DH-52	11/17/2021	Low-Flow	9.15	7.28	707	1.40	9.8	0.463	0.020	175	6	62	8
DH-52	12/2/2021	Low-Flow	9.19	7.19	709	1.38	10.1	0.450	0.018	186	6	62	8
DH-52	12/21/2021	Low-Flow	7.82	7.37	709	1.27	8.9	0.457	0.017	180	7	63	8
DH-52	1/12/2022	Low-Flow	7.74	7.37	463	**	8.2	0.558	0.025	87	8	47	4
DH-52	2/7/2022	Low-Flow	8.03	7.40	441	**	6.7	0.544	0.020	78	7	46	4
DH-52	3/11/2022	Low-Flow	8.85	7.24	558	1.84	6.5	0.367	0.030	133	6	52	7
DH-52	4/18/2022	Low-Flow	8.81	7.40	571	1.78	7.0	0.371	0.022	150	7	56	8
DH-52	5/11/2022	Low-Flow	8.12	6.69	557	1.57	7.7	0.396	0.041	111	7	51	6
DH-52	6/13/2022	Low-Flow	6.78	7.52	298	4.85	8.7	0.680	0.019	42	3	34	2
DH-52	7/13/2022	Low-Flow	7.64	7.21	534	0.96	10.3	0.448	0.035	107	7	54	6
DH-52	8/16/2022	Low-Flow	8.36	7.15	736	0.73	11.4	0.401	0.026	203	7	67	10
DH-52	9/13/2022	Low-Flow	8.72	7.27	747	2.54	12.1	0.392	0.019	208	7	69	9
DH-52	10/13/2022	Low-Flow	8.52	7.23	706	0.58	11.0	0.406	0.019	196	7	65	9
DH-52	11/15/2022	Low-Flow	8.40	7.32	764	1.32	9.7	0.396	0.015	224	8	65	9
DH-52	12/27/2022	Low-Flow	6.28	7.15	382	9.74	7.6	0.456	0.009	68	7	37	3
DH-52	1/18/2023	Low-Flow	7.50	7.08	397	7.97	6.2	0.411	0.020	73	8	41	4
DH-52	2/16/2023	Low-Flow	8.32	7.29	516	2.82	5.4	0.339	0.040	109	7	46	4
DH-52	**95% USL**		**--**	**--**	**--**	**--**	**--**	**2.19**	**0.090**	**474**	**11**	**87**	**15**
DH-53	*7/29/2021 (Pre-Crushing)*	*Standard*	*10.83*	*7.20*	*468*	*0.22*	*10.7*	*0.196*	*0.034*	*88*	*6*	*36*	*6*
DH-53	10/1/2021	Standard	11.25	7.27	444	0.10	13.1	0.188	0.011	71	7	36	6
DH-53	10/18/2021	Low-Flow	11.34	7.19	454	0.54	13.6	0.186	0.004	65	7	35	6
DH-53	11/2/2021	Low-Flow	11.49	6.96	439	0.90	11.5	0.215	0.005	73	8	34	7
DH-53	11/17/2021	Low-Flow	11.63	7.18	434	0.57	10.8	0.170	0.004	72	7	34	6
DH-53	12/2/2021	Low-Flow	11.65	7.15	412	0.27	11.5	0.150	0.006	73	7	29	6
DH-53	12/2/2021	Standard	11.65	7.12	416	0.05	12.1	0.168	0.007	72	7	29	6
DH-53	12/21/2021	Low-Flow	10.39	7.37	403	0.27	9.9	0.140	0.011	75	7	27	6
DH-53	1/12/2022	Low-Flow	10.22	7.27	431	0.42	8.6	0.148	0.028	85	8	29	7
DH-53	2/7/2022	Low-Flow	10.74	7.20	493	0.63	7.0	0.136	**0.042**	93	7	31	8
DH-53	3/11/2022	Low-Flow	11.18	7.16	473	0.54	6.4	0.121	**0.044**	99	7	28	**9**
DH-53	4/18/2022	Low-Flow	11.22	7.42	453	0.65	6.5	0.118	0.027	102	8	28	**9**
DH-53	5/11/2022	Low-Flow	10.50	6.88	482	1.48	7.3	0.116	0.027	94	8	26	8
DH-53	6/13/2022	Low-Flow	9.13	7.26	505	0.76	8.3	0.159	**0.034**	96	7	28	8
DH-53	7/13/2022	Low-Flow	10.22	7.11	506	0.36	10.5	0.165	**0.039**	96	7	30	8
DH-53	8/16/2022	Low-Flow	11.03	7.27	478	0.49	11.3	0.152	**0.034**	86	6	29	8
DH-53	9/13/2022	Low-Flow	11.43	7.25	386	4.78	12.8	0.150	0.007	50	6	27	6
DH-53	10/13/2022	Low-Flow	11.21	7.18	383	0.52	12.8	0.153	0.003	61	7	26	6
DH-53	11/15/2022	Low-Flow	10.26	7.14	368	0.45	11.0	0.127	0.006	69	8	23	6
DH-53	12/27/2022	Low-Flow	9.14	6.93	350	0.41	9.1	0.116	0.010	62	7	19	6
DH-53	1/18/2023	Low-Flow	10.50	6.94	385	0.34	8.1	0.152	0.025	68	7	23	6
DH-53	2/16/2023	Low-Flow	11.16	7.20	394	0.65	6.8	0.115	0.014	72	8	20	6
DH-53	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.86**	**0.028**	**277**	**12**	**63**	**8**

Site	Sample Date	Purge Method	SWL (ft bmp)	pH (s.u.)	SC (µmhos/cm)	Dissolved O2 (mg/L)	Temperature (°C)	Arsenic (mg/L)	Selenium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Potassium (mg/L)	Magnesium (mg/L)
DH-55	*7/29/2021 (Pre-Crushing)*	*Standard*	*81.37*	*7.25*	*1611*	*0.57*	*9.9*	*0.148*	*0.059*	*576*	*17*	*122*	*14*
DH-55	10/1/2021	Standard	81.59	7.31	1741	0.61	9.5	0.142	0.049	660	18	135	16
DH-55	10/18/2021	Low-Flow	81.69	7.19	1950	0.82	9.3	0.124	0.073	686	16	146	19
DH-55	11/2/2021	Low-Flow	81.67	7.19	1820	1.26	7.6	0.128	0.056	728	19	132	18
DH-55	11/2/2021	Standard	81.76	7.24	1915	0.53	9.4	0.132	0.064	760	19	137	19
DH-55	11/17/2021	Low-Flow	81.82	7.23	1946	0.68	7.6	0.132	0.064	792	19	139	18
DH-55	12/2/2021	Low-Flow	81.85	7.22	1917	0.54	8.8	0.132	0.056	734	19	133	18
DH-55	12/21/2021	Low-Flow	81.85	7.33	1960	1.34	7.6	0.138	0.048	747	20	136	19
DH-55	1/12/2022	Low-Flow	81.26	7.28	1880	1.29	7.3	0.135	0.057	694	18	132	18
DH-55	2/7/2022	Low-Flow	81.22	7.38	1752	1.71	6.5	0.139	0.052	628	16	127	16
DH-55	3/11/2022	Low-Flow	81.11	7.41	1565	1.62	6.8	0.129	0.065	622	15	117	14
DH-55	4/18/2022	Low-Flow	81.52	7.63	1399	3.09	9.2	0.141	0.054	549	15	115	15
DH-55	5/11/2022	Low-Flow	81.52	7.18	1653	2.86	9.0	0.128	0.044	587	16	122	16
DH-55	6/13/2022	Low-Flow	81.01	7.30	1573	3.00	9.3	0.134	0.058	533	15	114	13
DH-55	7/13/2022	Low-Flow	81.14	7.39	1198	1.22	9.2	0.163	0.056	389	11	98	8
DH-55	8/16/2022	Low-Flow	81.41	7.23	1421	1.63	10.3	0.144	0.063	499	14	119	13
DH-55	9/13/2022	Low-Flow	81.83	7.33	1576	1.42	9.0	0.125	0.084	602	16	137	16
DH-55	10/13/2022	Low-Flow	81.50	7.32	1767	2.22	8.6	0.121	0.087	716	18	135	18
DH-55	11/15/2022	Low-Flow	81.48	7.30	2029	1.33	7.0	0.113	0.145	871	19	139	18
DH-55	12/27/2022	Low-Flow	81.17	7.23	1959	4.67	7.8	0.107	0.137	740	16	124	17
DH-55	1/18/2023	Low-Flow	81.36	7.22	1968	0.93	7.0	0.112	0.128	761	17	139	18
DH-55	2/16/2023	Low-Flow	81.72	7.32	2149	2.18	6.9	0.113	0.113	910	18	134	19
DH-55	**95% USL**		**--**	**--**	**--**	**--**	**--**	**1.48**	**0.316**	**1232**	**24**	**198**	**43**
EH-61	10/1/2021	Standard	30.00	6.95	1900	0.08	11.7	<0.002	0.299	814	23	16	23
EH-61	10/18/2021	Low-Flow	30.28	6.79	1838	**	11.0	<0.002	0.314	742	21	15	23
EH-61	11/3/2021	Low-Flow	30.47	7.01	1861	**	10.6	<0.002	0.299	755	22	15	23
EH-61	11/17/2021	Low-Flow	30.71	6.90	1884	0.29	9.9	<0.002	0.305	740	23	16	23
EH-61	12/2/2021	Low-Flow	30.90	6.87	1848	0.45	11.4	<0.002	0.301	719	21	15	23
EH-61	12/21/2021	Low-Flow	31.05	7.14	1866	2.45	10.5	<0.002	0.277	772	22	15	23
EH-61	1/12/2022	Low-Flow	31.20	7.08	1853	1.57	10.0	<0.002	0.281	732	22	15	23
EH-61	2/7/2022	Low-Flow	31.29	7.01	1894	0.35	10.3	<0.002	0.263	700	22	16	24
EH-61	3/11/2022	Low-Flow	31.47	7.04	1731	0.44	8.0	**0.004**	0.257	761	23	14	23
EH-61	4/18/2022	Low-Flow	31.62	7.27	1664	0.49	11.4	<0.002	0.252	747	22	15	23
EH-61	5/11/2022	Low-Flow	31.72	6.92	1805	0.72	12.0	<0.002	0.224	736	21	16	22
EH-61	6/14/2022	Low-Flow	31.29	7.07	1799	1.18	10.8	<0.002	0.263	704	21	14	20
EH-61	7/14/2022	Low-Flow	30.25	7.08	1641	0.79	11.8	<0.002	0.225	652	19	14	18
EH-61	8/16/2022	Low-Flow	29.63	6.95	1483	0.9	16.6	<0.002	0.206	552	17	13	16
EH-61	9/13/2022	Low-Flow	29.75	7.10	1377	7.78	12.3	<0.002	0.161	494	16	14	14
EH-61	10/13/2022	Low-Flow	29.57	7.08	1327	0.96	14.0	<0.002	0.155	502	17	12	13
EH-61	11/15/2022	Low-Flow	29.68	7.08	1318	0.91	10.0	<0.002	0.157	486	17	12	12
EH-61	12/27/2022	Low-Flow	29.28	6.98	1373	1.80	10.5	<0.002	0.180	479	17	11	13
EH-61	1/18/2023	Low-Flow	29.01	7.00	1374	1.53	9.6	<0.002	0.173	495	18	12	13
EH-61	2/16/2023	Low-Flow	28.95	7.12	1412	1.93	9.3	<0.002	0.181	524	19	12	13
EH-61	**95% USL**		**--**	**--**	**--**	**--**	**--**	**<0.002**	**0.535**	**1132**	**42**	**16**	**44**

Site	Sample Date	Purge Method	SWL (ft bmp)	pH (s.u.)	SC (µmhos/cm)	Dissolved O2 (mg/L)	Temperature (°C)	Arsenic (mg/L)	Selenium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Potassium (mg/L)	Magnesium (mg/L)
EH-103	*7/29/2021 (Pre-Crushing)*	*Standard*	*30.58*	*6.91*	*1768*	*0.02*	*12.3*	*<0.002*	*0.335*	*711*	*24*	*11*	*33*
EH-103	10/1/2021	Standard	30.58	6.93	1741	0.06	11.9	<0.002	0.312	787	24	11	32
EH-103	10/18/2021	Low-Flow	30.85	6.85	1867	**	11.6	<0.002	0.370	753	30	7	52
EH-103	11/2/2021	Low-Flow	31.02	6.84	1711	0.49	10.6	<0.002	0.328	780	32	7	51
EH-103	11/2/2021	Standard	31.02	6.86	1709	0.22	11.8	<0.002	0.311	753	25	10	37
EH-103	11/17/2021	Low-Flow	31.29	6.71	1755	0.20	9.8	<0.002	0.369	743	31	7	50
EH-103	12/2/2021	Low-Flow	31.50	6.69	1728	0.17	11.4	<0.002	0.347	733	30	6	52
EH-103	12/21/2021	Low-Flow	31.64	6.90	1748	0.29	10.5	<0.002	0.343	773	32	7	51
EH-103	1/12/2022	Low-Flow	31.79	6.84	1722	0.21	10.4	<0.002	0.311	762	30	7	50
EH-103	2/7/2022	Low-Flow	31.89	6.84	1757	0.23	10.4	<0.002	0.342	733	30	7	51
EH-103	3/11/2022	Low-Flow	32.07	6.96	1629	0.43	8.0	<0.002	0.344	690	27	6	49
EH-103	4/18/2022	Low-Flow	32.23	7.10	1576	0.44	11.3	<0.002	0.344	781	31	7	51
EH-103	5/11/2022	Low-Flow	32.34	6.76	1725	0.80	12.0	<0.002	0.315	782	30	7	52
EH-103	6/14/2022	Low-Flow	31.87	6.97	1744	1.35	10.9	<0.002	0.369	734	30	6	47
EH-103	7/14/2022	Low-Flow	30.84	6.97	1702	0.62	11.7	<0.002	0.348	777	30	6	47
EH-103	8/16/2022	Low-Flow	30.13	6.75	1706	0.48	13.9	<0.002	0.376	771	31	7	52
EH-103	9/13/2022	Low-Flow	30.31	6.84	1735	0.72	11.6	<0.002	0.344	751	30	7	52
EH-103	10/13/2022	Low-Flow	30.17	6.83	1727	0.38	12.1	<0.002	0.345	858	32	7	53
EH-103	11/15/2022	Low-Flow	30.31	6.83	1731	0.48	9.1	<0.002	0.324	850	32	7	49
EH-103	12/27/2022	Low-Flow	29.85	6.74	1700	2.23	10.5	<0.002	0.338	731	30	6	47
EH-103	1/18/2023	Low-Flow	29.63	6.78	1695	3.29	9.8	<0.002	0.324	747	30	7	47
EH-103	2/16/2023	Low-Flow	29.55	6.86	1720	0.80	9.4	<0.002	0.337	798	30	6	46
EH-103	**95% USL**		**--**	**--**	**--**	**--**	**--**	**<0.002**	**0.484**	**1088**	**47**	**11**	**55**

Purge method comparison samples (low-flow and standard sampling methods) were collected at wells DH-55 and EH-103 on 11/2/2021, and at wells DH-6 and DH-53 on 12/2/2021.
Field parameters (pH, SC, dissolved oxygen, water temperature) are monitored as groundwater purging/stabilization indicators.
**Dissolved oxygen not recorded due to air entrainment in flowthrough cell.

APPENDIX F

2022 WELL PURGE METHOD

COMPARISON SAMPLING RESULTS

Appendix F - Well Purge Method Comparison Results
June 2022 Sampling Event

			Field Parameters							General Chemistry/Anions								
Location	**Purge Method**	**Purge Vol (gal)**	**pH (s.u.)**	**SC (µS/cm)**	**Diss O2**	**Temp (°C)**	**ORP (mV)**	**Eh (mV)**	**Turb (NTU)**	**pH (s.u.)**	**SC (µS/cm)**	**TSS**	**TDS**	**Alk as CaCO3**	**bicarbonate**	**chloride**	**sulfate**	**bromide**
EH-114	**Low Flow**	**1.8**	6.54	1773	0.5	11.5	172	392	6.9	6.5	1790	26	1350	160	200	34	695	1.7
EH-114	**Standard**	**10**	6.52	1800	0.25	11.9	184	403	2.3	6.5	1800	*10*	1370	170	210	34	704	1.7
	RPD		**0.3%**	**1.5%**	**66.7%**	**3.4%**	**6.7%**	**2.8%**	**100.0%**	**0.0%**	**0.6%**	**> ±RL**	**1.5%**	**6.1%**	**4.9%**	**0.0%**	**1.3%**	**0.0%**
EH-141	**Low Flow**	**1.3**	7.23	878	4.73	11.5	189	409	0.9	7.3	884	*10*	628	180	210	23	235	0.95
EH-141	**Standard**	**30**	7.24	876	5.07	11.0	176	396	1.2	7.3	883	*10*	629	180	210	23	237	0.95
	RPD		**0.1%**	**0.2%**	**6.9%**	**4.4%**	**7.1%**	**3.2%**	**28.6%**	**0.0%**	**0.1%**	**±RL**	**0.2%**	**0.0%**	**0.0%**	**0.0%**	**0.8%**	**0.0%**
PBTW-2	**Low Flow**	**2.9**	6.83	1338	0.37	12.6	19	238	21.2	6.9	1340	14	948	280	340	22	382	2.1
PBTW-2	**Standard**	**10**	6.84	1345	0.28	12.5	20	239	3.5	6.8	1350	*10*	954	270	330	22	390	2.1
	RPD		**0.1%**	**0.5%**	**27.7%**	**0.8%**	**5.1%**	**0.4%**	**143.3%**	**1.5%**	**0.7%**	**±RL**	**0.6%**	**3.6%**	**3.0%**	**0.0%**	**2.1%**	**0.0%**

			Major Cations (Dissolved)				Trace Constituents (Dissolved)										
Location	**Purge Method**	**Purge Vol (gal)**	**calcium**	**magnesium**	**sodium**	**potassium**	**antimony**	**arsenic**	**cadmium**	**copper**	**iron**	**lead**	**manganese**	**mercury**	**selenium**	**thallium**	**zinc**
EH-114	**Low Flow**	**1.8**	132	37	214	9	*0.003*	1.95	*0.001*	0.001	*0.02*	*0.005*	*0.01*	*0.001*	0.010	*0.001*	*0.01*
EH-114	**Standard**	**10**	132	37	213	9	*0.003*	1.97	*0.001*	0.001	*0.02*	*0.005*	*0.01*	*0.001*	0.010	*0.001*	*0.01*
	RPD		**0.0%**	**0.0%**	**0.5%**	**0.0%**	**±RL**	**1.0%**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**0.0%**	**±RL**	**±RL**
EH-141	**Low Flow**	**1.3**	96	26	47	7	*0.003*	0.003	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.072	*0.001*	*0.01*
EH-141	**Standard**	**30**	95	26	47	7	*0.003*	0.003	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.073	*0.001*	*0.01*
	RPD		**1.0%**	**0.0%**	**0.0%**	**0.0%**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**±RL**	**1.4%**	**±RL**	**±RL**
PBTW-2	**Low Flow**	**2.9**	114	24	131	20	*0.003*	3.90	*0.001*	*0.001*	0.43	*0.005*	3.44	*0.001*	*0.001*	*0.001*	0.25
PBTW-2	**Standard**	**10**	116	24	135	20	*0.003*	3.99	*0.001*	*0.001*	0.43	*0.005*	3.31	*0.001*	0.002	*0.001*	0.27
	RPD		**1.7%**	**0.0%**	**3.0%**	**0.0%**	**±RL**	**2.3%**	**±RL**	**±RL**	**0.0%**	**±RL**	**3.9%**	**±RL**	**±RL**	**±RL**	**7.7%**

NOTES:
All values in mg/L except as indicated
Italicized results are non-detect values, replaced with the detection limit for comparison purposes.
RPD = relative percent difference
Typical duplicate sample quality control limits are ≤20% RPD for values ≥ 5x reporting limits, or ± the reporting limit for one or both values < 5x the reporting limit
±RL = sample/duplicate results agree to within ± the reporting limit
Comparison value exceeds duplicate criteria (>20% RPD or > ±RL)

Appendix F - Well Purge Method Comparison Results
October 2022 Sampling Event

			Field Parameters							General Chemistry/Anions								
Location	**Purge Method**	**Purge Vol (gal)**	**pH (s.u.)**	**SC (µS/cm)**	**Diss O2**	**Temp (°C)**	**ORP (mV)**	**Eh (mV)**	**Turb (NTU)**	**pH (s.u.)**	**SC (µS/cm)**	**TSS**	**TDS**	**Alk as CaCO3**	**bicarbonate**	**chloride**	**sulfate**	**bromide**
DH-80	**Low Flow**	**8**	5.51	645	0.45	11.8	147	366	92.7	5.7	634	137	425	34	41	13	243	0.23
DH-80	**Standard**	**5**	5.50	645	0.25	12.8	144	363	5.8	5.6	632	22	413	32	39	13	241	0.23
	RPD		**0.2%**	**0.0%**	**57.1%**	**8.1%**	**2.1%**	**0.8%**	**176.4%**	**1.8%**	**0.3%**	**144.7%**	**2.9%**	**6.1%**	**5.0%**	**0.0%**	**0.8%**	**0.0%**
EH-52	**Low Flow**	**3**	6.77	384	1.79	15.3	65	282	7.5	6.8	364	20	245	110	130	9	61	*0.05*
EH-52	**Standard**	**10**	6.79	383	2.00	14.7	98	315	1.1	6.8	363	*10*	247	110	140	9	60	*0.05*
	RPD		**0.3%**	**0.3%**	**11.1%**	**4.0%**	**40.5%**	**11.1%**	**148.8%**	**0.0%**	**0.3%**	**±RL**	**0.8%**	**0.0%**	**7.4%**	**0.0%**	**1.7%**	**±RL**
EH-65	**Low Flow**	**8**	6.58	1500	4.16	14.2	166	384	7.5	6.6	1450	*10*	1070	150	180	52	518	0.63
EH-65	**Standard**	**5**	6.56	1493	4.44	13.2	169	388	11.6	6.6	1440	17	1050	150	180	52	516	0.62
	RPD		**0.3%**	**0.5%**	**6.5%**	**7.3%**	**1.8%**	**1.0%**	**42.9%**	**0.0%**	**0.7%**	**±RL**	**1.9%**	**0.0%**	**0.0%**	**0.0%**	**0.4%**	**1.6%**
EH-100	**Low Flow**	**4.6**	6.57	2228	0.21	12.6	125	343	18.1	6.6	2080	41	1700	180	220	30	992	1.9
EH-100	**Standard**	**60**	6.54	2261	0.07	12.5	141	360	0.8	6.6	2040	*10*	1690	180	210	31	1010	1.9
	RPD		**0.5%**	**1.5%**	**100.0%**	**0.8%**	**12.0%**	**4.8%**	**183.1%**	**0.0%**	**1.9%**	**> ±RL**	**0.6%**	**0.0%**	**4.7%**	**3.3%**	**1.8%**	**0.0%**
EH-104	**Low Flow**	**4**	6.97	1318	5.72	12	25	245	10.7	7.00	1300	12	926	200	250	86	347	2.2
EH-104	**Standard**	**10**	6.96	1398	6.15	11.9	66	286	1.1	7.00	1350	*10*	975	210	250	92	352	2.42
	RPD		**0.1%**	**5.9%**	**7.2%**	**0.8%**	**90.1%**	**15.4%**	**162.7%**	**0.0%**	**3.8%**	**±RL**	**5.2%**	**4.9%**	**0.0%**	**6.7%**	**1.4%**	**9.5%**
EH-115	**Low Flow**	**11**	6.49	1340	0.57	11.1	208	428	2.9	6.6	1240	*10*	928	170	210	35	463	1.7
EH-115	**Standard**	**10**	6.47	1348	0.43	12	197	417	1.2	6.6	1250	*10*	932	180	220	39	462	1.6
	RPD		**0.3%**	**0.6%**	**28.0%**	**7.8%**	**5.4%**	**2.6%**	**82.9%**	**0.0%**	**0.8%**	**±RL**	**0.4%**	**5.7%**	**4.7%**	**10.8%**	**0.2%**	**6.1%**
EH-117	**Low Flow**	**6.6**	6.62	1697	1.16	11.3	165	385	17	6.7	1560	25	1220	150	180	42	739	2.5
EH-117	**Standard**	**10**	6.6	1712	7.97	11.7	174	393	13.7	6.7	1540	56	1190	140	170	42	722	2.4
	RPD		**0.3%**	**0.9%**	**149.2%**	**3.5%**	**5.3%**	**2.1%**	**21.5%**	**0.0%**	**1.3%**	**76.5%**	**2.5%**	**6.9%**	**5.7%**	**0.0%**	**2.3%**	**4.1%**
EH-126	**Low Flow**	**6**	7.17	1257	4.21	10.5	190	411	9.4	7.2	1160	18	896	200	250	38	436	1.65
EH-126	**Standard**	**14**	7.13	1284	3.66	11.5	168	388	4.4	7.2	1180	15	932	200	240	37	462	1.71
	RPD		**0.6%**	**2.1%**	**14.0%**	**9.1%**	**12.3%**	**5.8%**	**72.5%**	**0.0%**	**1.7%**	**18.2%**	**3.9%**	**0.0%**	**4.1%**	**2.7%**	**5.8%**	**3.6%**
EH-210	**Low Flow**	**4.6**	7.27	1035	5.72	13.7	154	372	134	7.3	982	508	731	140	170	42	316	3.86
EH-210	**Standard**	**18**	7.26	1046	7.31	12.5	139	358	3.9	7.3	993	10	728	140	170	43	329	3.93
	RPD		**0.1%**	**1.1%**	**24.4%**	**9.2%**	**10.2%**	**3.8%**	**188.7%**	**0.0%**	**1.1%**	**192.3%**	**0.4%**	**0.0%**	**0.0%**	**2.4%**	**4.0%**	**1.8%**

Appendix F - Well Purge Method Comparison Results
October 2022 Sampling Event

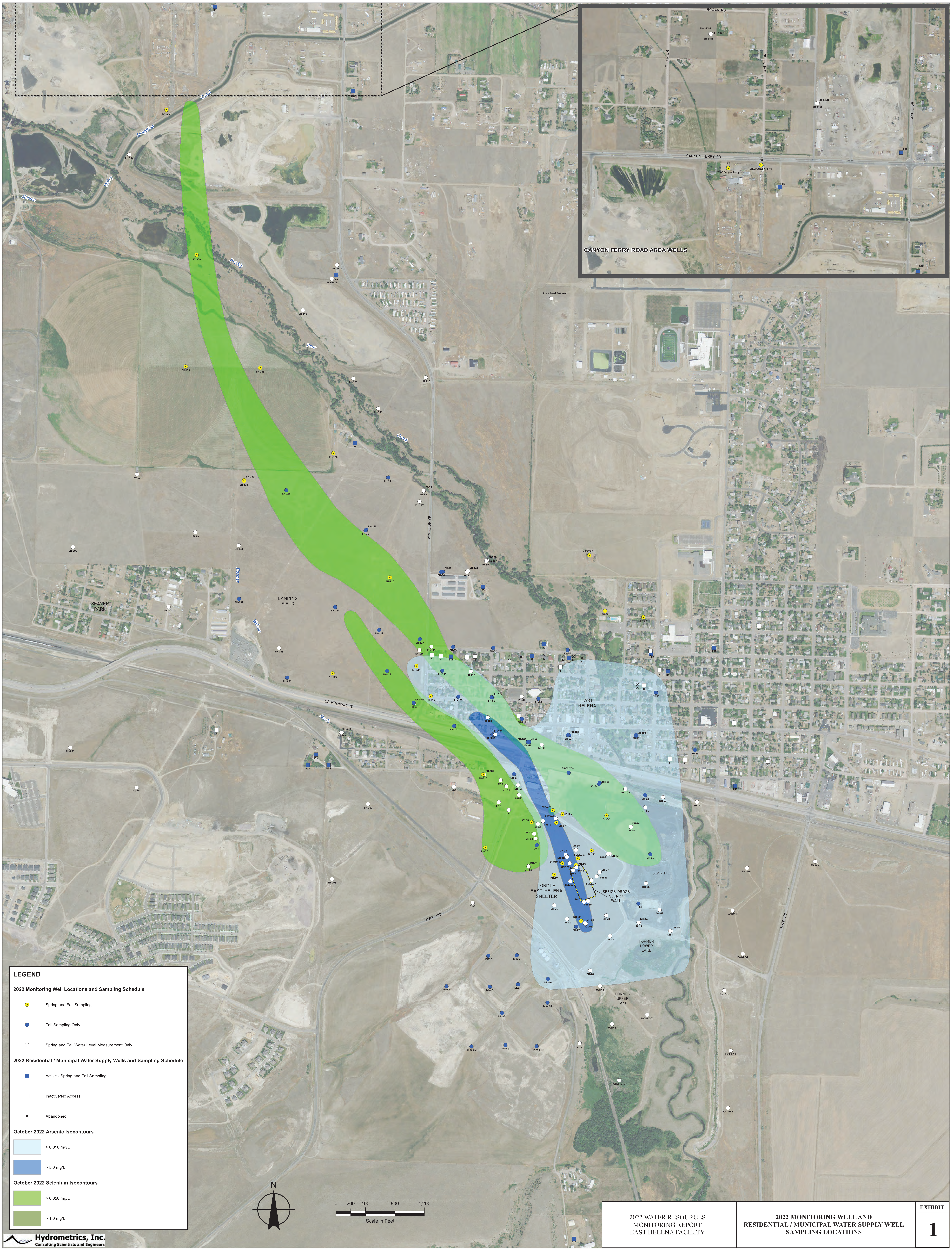
			Major Cations (Dissolved)				Trace Constituents (Dissolved)										
Location	Purge Method	Purge Vol (gal)	calcium	magnesium	sodium	potassium	antimony	arsenic	cadmium	copper	iron	lead	manganese	mercury	selenium	thallium	zinc
DH-80	Low Flow	8	53	15	36	6	*0.003*	7.06	2.00	0.002	1.78	*0.005*	2.25	*0.001*	0.002	0.146	1.76
DH-80	Standard	5	54	15	36	6	*0.003*	7.09	1.73	0.002	1.89	*0.005*	2.25	*0.001*	0.001	0.146	1.73
	RPD		1.9%	0.0%	0.0%	0.0%	±RL	0.4%	14.5%	±RL	6.0%	±RL	0.0%	±RL	±RL	0.0%	1.7%
EH-52	Low Flow	3	36	8	18	20	0.014	0.288	*0.001*	0.001	0.23	*0.005*	*0.01*	*0.001*	0.004	*0.001*	*0.01*
EH-52	Standard	10	36	8	18	20	0.014	0.282	*0.001*	0.001	0.04	*0.005*	*0.01*	*0.001*	0.004	*0.001*	*0.01*
	RPD		0.0%	0.0%	0.0%	0.0%	±RL	2.1%	±RL	±RL	> ±RL	±RL	±RL	±RL	±RL	±RL	±RL
EH-65	Low Flow	8	105	26	177	8	*0.003*	0.118	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.181	*0.001*	*0.01*
EH-65	Standard	5	103	25	174	8	*0.003*	0.129	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.178	*0.001*	*0.01*
	RPD		1.9%	3.9%	1.7%	0.0%	±RL	8.9%	±RL	±RL	±RL	±RL	±RL	±RL	1.7%	±RL	±RL
EH-100	Low Flow	4.6	153	57	239	15	*0.003*	6.54	0.008	0.004	0.05	*0.005*	25	*0.001*	0.002	0.001	0.7
EH-100	Standard	60	156	57	236	14	*0.003*	6.45	0.008	0.004	*0.02*	*0.005*	24.2	*0.001*	0.002	0.001	0.62
	RPD		1.9%	0.0%	1.3%	6.9%	±RL	1.4%	0.0%	±RL	> ±RL	±RL	3.3%	±RL	±RL	±RL	12.1%
EH-104	Low Flow	4	143	36	91	6	*0.003*	*0.002*	*0.001*	0.001	*0.02*	*0.005*	0.01	*0.001*	0.211	*0.001*	*0.01*
EH-104	Standard	10	144	37	92	6	*0.003*	*0.002*	*0.001*	0.001	*0.02*	*0.005*	*0.01*	*0.001*	0.223	*0.001*	*0.01*
	RPD		0.7%	2.7%	1.1%	0.0%	±RL	±RL	±RL	±RL	±RL	±RL	±RL	±RL	5.5%	±RL	±RL
EH-115	Low Flow	11	94	28	149	7	*0.003*	1.74	*0.001*	0.002	*0.02*	*0.005*	*0.01*	*0.001*	0.032	*0.001*	*0.01*
EH-115	Standard	10	97	29	153	7	*0.003*	1.8	*0.001*	0.001	*0.02*	*0.005*	*0.01*	*0.001*	0.03	*0.001*	*0.01*
	RPD		3.1%	3.5%	2.6%	0.0%	±RL	3.4%	±RL	±RL	±RL	±RL	±RL	±RL	6.5%	±RL	±RL
EH-117	Low Flow	6.6	141	32	190	6	*0.003*	*0.002*	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.162	*0.001*	*0.01*
EH-117	Standard	10	138	32	186	6	*0.003*	*0.002*	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.155	*0.001*	*0.01*
	RPD		2.2%	0.0%	2.1%	0.0%	±RL	±RL	±RL	±RL	±RL	±RL	±RL	±RL	4.4%	±RL	±RL
EH-126	Low Flow	6	126	46	76	5	*0.003*	0.002	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.129	*0.001*	*0.01*
EH-126	Standard	14	128	45	81	5	*0.003*	*0.002*	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.125	*0.001*	*0.01*
	RPD		1.6%	2.2%	6.4%	0.0%	±RL	±RL	±RL	±RL	±RL	±RL	±RL	±RL	3.1%	±RL	±RL
EH-210	Low Flow	4.6	113	26	48	10	*0.003*	0.002	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.11	*0.001*	*0.01*
EH-210	Standard	18	113	27	49	10	*0.003*	*0.002*	*0.001*	*0.001*	*0.02*	*0.005*	*0.01*	*0.001*	0.113	*0.001*	*0.01*
	RPD		0.0%	3.8%	2.1%	0.0%	±RL	±RL	±RL	±RL	±RL	±RL	±RL	±RL	2.7%	±RL	±RL

NOTES:
All values in mg/L except as indicated
Italicized results are non-detect values, replaced with the detection limit for comparison purposes.
RPD = relative percent difference
Typical duplicate sample quality control limits are ≤20% RPD for values ≥ 5x reporting limits, or ± the reporting limit for one or both values < 5x the reporting limit
±RL = sample/duplicate results agree to within ± the reporting limit
[shaded cell] Comparison value exceeds duplicate criteria (>20% RPD or > ±RL)

EXHIBITS

EXHIBIT 1

2022 MONITORING WELL AND RESIDENTIAL / MUNICIPAL WATER SUPPLY WELL SAMPLING LOCATIONS



CANYON FERRY ROAD AREA WELLS
ROGAN RD
CANYON FERRY RD
WYLIE DRIVE
US HIGHWAY 12
HWY 282
HWY 518
SEAVER PARK
LAMPING FIELD
EAST HELENA
FORMER EAST HELENA SMELTER
SPEISS-DROSS SLURRY WALL
SLAG PILE
FORMER LOWER LAKE
FORMER UPPER LAKE
LEGEND
2022 Monitoring Well Locations and Sampling Schedule
Spring and Fall Sampling
Fall Sampling Only
Spring and Fall Water Level Measurement Only
2022 Residential / Municipal Water Supply Wells and Sampling Schedule
Active - Spring and Fall Sampling
Inactive/No Access
Abandoned
October 2022 Arsenic Isocontours
> 0.010 mg/L
> 5.0 mg/L
October 2022 Selenium Isocontours
> 0.050 mg/L
> 1.0 mg/L
N
0 200 400 800 1,200
Scale in Feet
Hydrometrics, Inc.
Consulting Scientists and Engineers
2022 WATER RESOURCES
MONITORING REPORT
EAST HELENA FACILITY
2022 MONITORING WELL AND
RESIDENTIAL / MUNICIPAL WATER SUPPLY WELL
SAMPLING LOCATIONS
EXHIBIT
1
Date Saved: 2/24/2023 11:13:13 AM