2023 INTERIM CORRECTIVE ACTION

PERFORMANCE MONITORING REPORT

EAST HELENA FACILITY

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LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	Above Mean Sea Level
bgs	Below Ground Surface
CAMU	Corrective Action Management Unit
CAPM	Corrective Action Performance Monitoring
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
ORP	Oxidation-Reduction Potential
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

Montana Environmental Trust Group, LLC (METG), Trustee of the Montana Environmental Custodial Trust (the Custodial Trust) submits this 2023 Interim Corrective Action Performance Monitoring Report (Interim CAPM Report) for the Former ASARCO East Helena Facility (the Facility). The 2023 Interim CAPM program is outlined in the 2023 Interim Corrective Action Performance Monitoring Plan (CAPMP), and has been designed to assess the effectiveness of final Corrective Measures (CMs) completed to date at the Facility on an interim basis, since completion of the remaining CM (slag pile capping) is pending. The Interim CAPM program is consistent in scope and purpose with the anticipated Final Corrective Action Performance Monitoring (CAPM) program, to be developed following slag pile capping. Both the Interim and Final CAPM plans have been and will be prepared pursuant to and in accordance with the requirements of the Statement of Basis for Groundwater, Surface Water and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility (USEPA, 2020) and the Former ASARCO East Helena Facility Corrective Measures Implementation (CMI) Work Plan (Hydrometrics, 2021a) conditionally approved by the U.S. Environmental Protection Agency (USEPA) on July 28, 2021. The Interim CAPM program assesses CMs effectiveness by monitoring and evaluating groundwater elevations, surface water flows, and contaminant concentration trends in groundwater and surface water throughout and downgradient of the Facility. The Interim CAPM program builds on the extensive data set collected from investigations and monitoring performed annually at the Facility for nearly 40 years.

The 2023 Interim CAPM Report presents data collected from surface and groundwater sampling events and evaluates water quality status and trends within and downgradient of the Facility. These data are used to evaluate the effectiveness of final CMs as measured by stable or decreasing concentration trends, plume geometry, and plume stability metrics. As outlined in the 2023 Interim CAPMP, the 2023 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 180 monitoring wells, semiannual or annual groundwater quality sampling at 83 monitoring wells, and semiannual water quality monitoring at 20 residential/public water supply wells, including 17 privately-owned residential wells and three wells owned by the City of East Helena (COEH) and used as part of their public water supply system. All water quality samples were analyzed for an extended suite of parameters including general chemistry constituents and trace metals, including the primary constituents of concern (COCs) arsenic and selenium. All 2023 data was reviewed and validated for data quality, with valid data entered into the East Helena Project electronic database.

Residential and water supply well monitoring in 2023 showed no maximum contaminant level (MCL) exceedances for selenium at any of the sampled wells (the selenium MCL is 0.050 mg/L), and arsenic MCL exceedances at four private residential wells (the arsenic MCL is 0.010 mg/L). 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 Facility, or to the west in an area of known naturally occurring groundwater arsenic. The Custodial Trust provides monitoring results to well owners after each monitoring event, and has worked with area residents to abandon eight private residential wells to date. The Custodial Trust also continues to encourage further private well abandonment through a financial compensation program.

Prickly Pear Creek flows were above long-term median values in 2023, due to increased annual precipitation and near-normal snowpack conditions in the drainage in 2023, following three years of low precipitation and snowpack conditions. Stream flow trends and surface water quality results for 2023 were similar to previous observations. Upstream to downstream flow measurements along the reach of Prickly Pear Creek adjacent to the Facility (including the realigned creek segment) continue to indicate no significant net flow gain or loss, suggesting limited interaction between Prickly Pear Creek and the local groundwater system. Downstream of the Facility, the 2023 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. Concentrations of major ions in Prickly Pear Creek (calcium, magnesium, sodium, potassium, sulfate) in 2023 were consistent from upstream of the Facility to downstream near Canyon Ferry Road.

Exceedances of hardness-dependent chronic aquatic life standards in 2023 Prickly Pear Creek samples were observed for total recoverable copper, lead, and zinc at multiple sites in May 2023, and for total recoverable lead at one site in October 2023. In May 2023 copper, lead, and zinc exceedances occurred upstream of the Facility, with copper and lead exceedances also observed within and downstream of the Facility, indicating upstream (non-Facility) contaminant sources were generating these exceedances. During the October 2023 monitoring event, one location downgradient of the Facility showed an exceedance of the chronic standard for lead, while the upstream, on-Facility, and other downstream sites showed no exceedances. The October 2023 lead exceedance could be due to entrainment of historically deposited and resuspended lead-bearing stream sediment; flow and water chemistry data did not indicate any inflow to the creek from groundwater in this reach, and lead concentrations in all 2023 groundwater samples were below detection limits (<0.005 mg/L), indicating no impacts from groundwater-surface water interaction. The occurrence of elevated metals concentrations in Prickly Pear Creek upstream of the Facility has been noted in numerous previous studies, including the watershed total maximum daily load (TMDL) document (USEPA, 2004b). Overall, the 2023 Prickly Pear Creek water quality monitoring results are consistent with past sampling results dating back more than 20 years.

Elevated metals concentrations in a tributary drainage flowing to Prickly Pear Creek through the Facility were documented through previous sampling, resulting in removal of approximately 350 cubic yards of metals-impacted soils in November 2018. The 2023 results from the tributary drainage showed continued State of Montana surface water standard exceedances for arsenic, antimony, cadmium, copper, iron, lead, zinc, and mercury at one sampling location near the soil removal area. No exceedances of the surface water standards were observed at the tributary location where it discharges to Prickly Pear Creek. Although surface water standard exceedances persist in portions of this tributary drainage, most metals concentrations have decreased at the tributary monitoring locations since the 2018 soil removal and metals concentrations at the tributary location where it flows into Prickly Pear Creek are similar to or lower than concentrations in the creek itself.

Groundwater elevations on the Facility have declined by up to 10 feet or more in response to CMs and variations in annual precipitation and recharge, with larger groundwater elevation decreases relative to pre-CM conditions observed during below-average precipitation periods and slightly smaller decreases observed when precipitation is above normal. The groundwater level declines in the former operating area of the Facility have reduced the saturated thickness of contaminated soils by 45 to 66% below the former Acid Plant, West Selenium, and North Plant Arsenic source areas (based on 2023 data), resulting in corresponding reductions in groundwater contaminant flux migrating from the contaminated soil source areas.

In general, groundwater contaminant concentrations have continued to decline at most monitored locations at and downgradient of the Facility in response to CMs implemented to date. Arsenic concentrations at most wells in the Acid Plant, North Plant Arsenic, and Slag Pile source areas and selenium concentrations at most wells in the West Selenium and Slag Pile source areas were observed in 2023 at or near the minimum concentrations since smelter operations ceased in 2001. Some temporary increases in selenium were observed in 2023 in slag pile area wells, attributable in part to the higher precipitation in 2023 leading to increase infiltration and leaching of selenium from the slag to groundwater. Downgradient (north) of the Facility, arsenic and selenium concentrations were generally stable or continued decreasing in 2023, in response to CMs and the associated decreasing source area concentrations noted above.

Arsenic concentrations at two wells along the west margin of the downgradient arsenic plume were observed to increase from 2016 through 2021 and have subsequently stabilized, and remained above historically observed concentrations in 2023. This increase is attributed to a westward shift in the arsenic plume caused by the elimination of a large irrigation ditch to the west (Wilson Ditch), 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 MCL groundwater isocontour and the furthest downgradient observation of groundwater selenium exceeding 0.050 mg/L, has retracted approximately 4,000 feet since the Interim Measures implementation was completed in 2016. Similar to the arsenic plume, the selenium plume showed a slight westward shift following elimination of the irrigation ditch to the west. Since the plume shift, the overall geometry of the selenium plume has shown decreasing concentrations and contraction on the western side of the plume, with decreases attributable to upgradient concentration decreases observed in the West Selenium source area due to desaturation of contaminated soils driven by the South Plant Hydraulic Control Corrective Measure.

Evaluation of plume geometry (plume areas, average plume concentrations, and centroid locations) and contaminant concentration trends continue to demonstrate CMs implemented to date are performing as intended to stabilize or reduce concentrations and contaminant migration. These data show the arsenic plume downgradient of the Facility to be stable and the selenium plume to be receding. Compared with 2016 conditions, the 2023 downgradient arsenic plume stability calculations show approximately the same plume area (64 and 65 acres in 2016 and 2023, respectively) and average concentration (0.167 mg/L in 2016 and 0.188 mg/L in 2023). Since 2016, the downgradient selenium plume has decreased in size and average concentration by about 70% and 40%, respectively. Plume metrics on the Facility in areas identified as contaminant source areas show the plumes continuing to decrease in concentration, with the average arsenic and selenium concentrations decreasing by about 60% for selenium and 70% for arsenic from 2010 to 2023.

Groundwater monitoring in the Corrective Action Management Unit (CAMU) landfill area monitoring wells showed consistent groundwater quality in 2023 compared to previous years. Most CAMU area wells continue to show stable concentrations of arsenic (0.003 to 0.017 mg/L) consistent with naturally occurring background arsenic concentrations in this area; note that some of these naturally occurring arsenic concentrations exceed the 0.010 mg/L arsenic MCL. Monitoring well MW-6, which has shown variable arsenic concentrations above those observed at other CAMU wells (i.e., exceeding the 0.003 to 0.017 mg/L range) and other evidence of influence from the Facility) in the past, decreased from 0.078 mg/L in 2022 to 0.026 mg/L in 2023, near the lower end of the range of prior arsenic concentrations at this well. Selenium concentrations at all CAMU area wells have consistently been less than the 0.050 mg/L selenium MCL. All other trace metal concentrations were near or less than analytical detection limits in all 2023 CAMU well samples, including parameters that have been documented at elevated concentrations in Facility soils and/or groundwater. Antimony (<0.003 mg/L), cadmium (<0.001 mg/L), lead (<0.005 mg/L), zinc (<0.01 mg/L), and thallium (<0.001 mg/L) concentrations were below reporting limits in all 2023 CAMU well samples. Overall, it appears that 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 Facility-impacted groundwater and fluctuating annual precipitation and recharge conditions.

Zinc and cadmium are currently present at concentrations exceeding relevant standards (the MCL of 0.005 mg/L for cadmium and the State of Montana groundwater human health standard (HHS) of 2.0 mg/L for zinc) in some Facility monitoring wells, although concentrations generally remain much lower than those observed during the operational period of the Facility. Zinc is not a primary COC, and cadmium is listed as a constituent of potential concern in the CMI Work Plan. In 2023, an abrupt increase in zinc concentration at Facility source area well DH-17 was observed, similar to previous temporary concentration increases at this well. Currently, relevant standards noted above are exceeded at three wells for zinc and five wells for cadmium on the Facility. Despite the elevated zinc and cadmium groundwater concentrations in certain areas of the Facility, no off-site migration at concentrations above the Montana groundwater HHS of 2.0 mg/L is currently indicated for zinc. Offsite exceedances of the 0.005 mg/L cadmium MCL are limited to one well off-site and north of the Facility (EH-100 at 0.008 mg/L in both 2022 and 2023). No residential wells were observed to exceed the cadmium MCL or the zinc HHS in 2023 with all results near or less than analytical detection limits. 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 2023, monitoring wells proximate to the slag pile were sampled under an Unfumed Slag Processing and Removal Groundwater Monitoring Plan and Sampling Methodology Addendum, separate from the 2023 Interim CAPMP sampling program. These wells were sampled to determine whether unfumed slag (UFS) recovery operations (excavation, processing, and off-site transport) were affecting groundwater quality. The 2023 UFS recovery monitoring program consisted of monthly sampling at eight primary wells for field parameters and a targeted parameter list of COCs (arsenic and selenium) and potential other indicators of slag leaching (chloride, sulfate, potassium, and magnesium). Additional wells were added to the slag monitoring program as warranted to monitor any potential downgradient effects of observed trends at the primary wells. As in 2021 and 2022, the 2023 UFS monitoring results identified no unacceptable water quality impacts to downgradient groundwater from the slag excavation and removal activities. Selenium concentrations at some primary wells showed temporary increases during the spring and early summer, attributable in part to high precipitation in spring 2023 leading to increased selenium leaching from the slag pile.

Finally, the 2023 CAPMP groundwater monitoring program included an evaluation of sample collection techniques and equipment to further evaluate whether the use of low flow/low volume purging and sampling would provide representative data of appropriate quality and comparable to historical data collected using (3 volume) well purging techniques. Based on previous comparisons showing comparable results for the two methods, the low flow/low volume technique was adopted for use as the routine sampling method during 2023 for the Interim CAPM program. A total of eight wells were sampled by both conventional and low flow procedures in 2023. Nearly all analytes in the eight sample pairs showed comparable results, evidenced by agreement to within criteria normally used for comparing field duplicate quality control samples (+/-20% relative percent difference (RPD)), including the primary COCs arsenic (with one exception) and selenium, common indicator parameters such as chloride and sulfate, and major cations calcium, magnesium, sodium, and potassium. Use of low flow/low volume sampling procedures reduces long-term monitoring costs by reducing equipment and labor costs, and reducing the volume of purge water requiring storage and ultimate offsite disposal. Purge comparison sampling will continue to be conducted at selected site wells during future monitoring to verify that the low flow/low volume and the previously used standard well purge technique provide comparable data.

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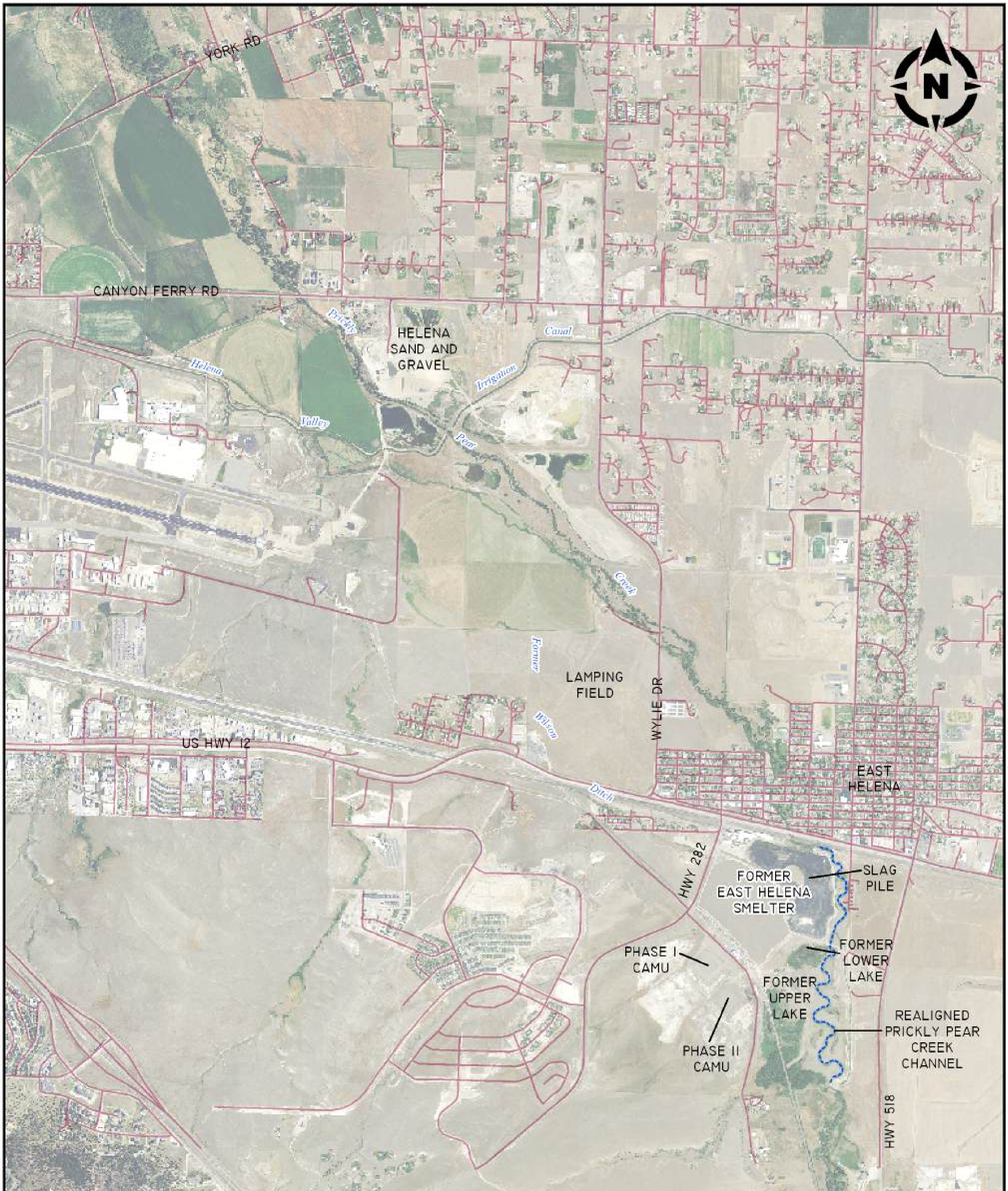
1.0 INTRODUCTION

This report presents a summary of 2023 groundwater and surface water monitoring activities and data collected in accordance with the 2023 Interim Corrective Action Performance Monitoring (CAPM) Plan (Hydrometrics, 2023a). The project area includes the former ASARCO East Helena smelter site or Facility[1], and the surrounding area encompassing two groundwater plumes and the project groundwater monitoring network. The Interim CAPM program has been implemented by the Montana Environmental Trust Group (METG), Trustee of the Montana Environmental Custodial Trust (the Custodial Trust). The 2023 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. The Interim CAPM program assesses Corrective Measures (CMs) effectiveness by monitoring and evaluating groundwater elevations, surface water flows, and contaminant concentration trends in groundwater and surface water throughout and downgradient of the Facility, and the Interim CAPM Plan was prepared pursuant to and in accordance with the requirements of the CMI Work Plan (Hydrometrics, 2021a) and the Statement of Basis (USEPA, 2020). In addition to the groundwater and surface water data collected under the Interim CAPM program, this report summarizes groundwater data collected through 2023 under a separate groundwater monitoring program specific to the unfumed slag (UFS) recovery project initiated in 2021, as outlined in the Unfumed Slag Processing and Removal Groundwater Monitoring Plan (GMP) (Hydrometrics, 2021b and 2022). Information provided in this report will support the planning and implementation of a future Final CAPM program, to be developed following completion of the final selected CM specified in the Statement of Basis, capping of the Facility slag pile (USEPA, 2020).

1.1 PROJECT BACKGROUND

The Facility was formerly a custom lead smelter located in Lewis and Clark County, Montana (Figure 1-1). The Facility 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.



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PROJECT LOCATION AND SITE FEATURES

FIGURE 1-1

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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 Facility 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 contaminant concentrations, 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 arsenic and selenium groundwater plumes from the Facility to the north and northwest. The Custodial Trust implemented several interim corrective measures (IMs) concurrent with a corrective measures study (CMS), including the South Plant Hydraulic Control project, contaminant source removal, and an evapotranspiration (ET) cover (CH2M, 2018; METG, 2020). The IMs were adopted as the final CMs for the East Helena Facility with USEPA'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 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). The CMS involved the completion of several site investigations designed to delineate groundwater contaminant source areas and aid in selection of groundwater (CMs). The Custodial Trust has implemented three CMs to address ongoing groundwater contaminant loading, as described in the Statement of Basis (USEPA, 2020). 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 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 operational area). 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 either placed in the CAMU or beneath the ET Cover and the excavations backfilled with clean soil.

In addition to these CMs, multiple 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), the CMI Work Plan (Hydrometrics, 2021a), and the Statement of Basis (USEPA, 2020). Evaluation of CM effectiveness in terms of the groundwater system response is the primary focus of the East Helena Project monitoring program, as outlined in the 2023 CAPMP.

1.3 CORRECTIVE ACTION PERFORMANCE MONITORING PROGRAM

Groundwater and surface water monitoring activities performed in 2023 were conducted in accordance with the 2023 Interim CAPMP (Hydrometrics, 2023a) to meet the requirements of the CMI Work Plan (Hydrometrics, 2021a) and the Statement of Basis (USEPA, 2020). The CAPMP is designated as "Interim" since the final CM (slag pile capping) is pending. As described in the CAPMP, the overall objective of the 2023 performance monitoring program was to continue assessment of groundwater quality status and trends within and downgradient of the Facility, and to evaluate the effectiveness of the CMs and other remedial measures at reducing concentrations and migration of groundwater contaminants. Consistent with previous post-CM monitoring activities conducted from 2017 through 2022, the 2023 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 in 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 around and downgradient of the Facility;
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 2023 Interim CAPMP (Hydrometrics, 2023a). This data evaluation program forms the basis of the discussion of 2023 monitoring results in Section 3.3.

Based on previous results of purge method comparison sampling, groundwater monitoring in 2023 was conducted utilizing a low-flow/low-volume methodology, replacing the standard three to five well volume purge method. The low-flow/low-volume method has been demonstrated to provide comparable groundwater quality data to the standard method, with significantly lower volumes of purge water requiring disposal, and reduced labor costs. Although not a remedy-related monitoring program objective, comparison sampling of the two purge methods continued in 2023 at selected wells, as outlined in the 2023 CAPMP, to allow additional evaluation of method comparability. The results of the 2023 purge method comparison sampling are discussed in Section 3.3.7 of this report.

1.4 UNFUMED SLAG PROJECT GROUNDWATER MONITORING PROGRAM

Additional groundwater monitoring activities in 2023 were conducted in accordance with the Unfumed Slag Processing and Removal GMP (Hydrometrics, 2021b and 2022). The UFS at the Facility contains economically recoverable amounts of zinc and other non-ferrous metals. 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 was 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, seasonal changes in Prickly Pear Creek flows and stage, 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 unacceptable UFS Project-related impacts to groundwater quality. The UFS monitoring program was initiated in 2021 and continued throughout 2022 and 2023, to assess potential groundwater quality impacts associated with the processing and removal of UFS from the Facility.

This document presents a summary of the 2023 CAPMP groundwater and surface water monitoring activities, data, and performance evaluation results, along with the 2023 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 2023 CAPMP monitoring program included semiannual monitoring at an extensive network of groundwater and surface water locations spanning the Facility and the downgradient contaminant plume areas. The sampling protocol is detailed in the 2023 Interim CAPMP (Hydrometrics, 2023a), 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 2023 monitoring is described below.

2.1 SURFACE WATER MONITORING

The 2023 surface water monitoring program included semiannual surface water elevation or stage measurements, stream flow measurements and water quality sampling in May 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 May and October using a survey grade GPS. 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. Water quality monitoring and stream flow measurements were conducted at nine of the eleven surface water sites during both high flow (May) and low flow (October) conditions (Table 2-1).

Site Trib-1 was not included in the 2023 Interim 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 2023 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 2023 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 2023 validated database is included in Appendix A. Surface water monitoring results for 2023 are discussed in Section 3.1.

Table 2-1. 2023 Surface Water Monitoring Locations and Schedule
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Site ID	Northing	Easting	Description	May/October Water Elevation	May/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 2023 Interim CAPMP)

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Consulting Scientists and Engineers

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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY

2023 SURFACE WATER MONITORING LOCATIONS

FIGURE **2-1**

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Table 2-2. 2023 Surface Water Sample Analytical Parameter List
2023 Interim CAPM 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	HSOP-237/-244	NA
Stream Stage/Elevation	HSOP-005	NA
Water Temperature	HSOP-006	0.1 °C
Dissolved Oxygen (DO)		0.01 mg/L
pH		0.01 s.u.
Specific Conductance (SC)		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 2023 GROUNDWATER MONITORING

The 2023 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 182 wells with well coverage extending from south (upgradient) of the Facility northward approximately four miles, to about 1,600 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, Facility 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 level measurement events included 180 of the 181 total wells in May and September (the Amchem4 well has 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. Water level monitoring events were 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 2023 water level monitoring schedule is included in Table 2-3 with results presented in Section 3.3.

2.2.2 Groundwater Quality Monitoring

The 2023 Interim CAPMP groundwater monitoring program included planned groundwater quality sampling at 30 monitoring wells in May/June and 81 wells in October. The groundwater sampling schedule is summarized in Table 2-3 with well locations shown on Exhibit 1. Two wells could not be sampled in 2023 due to dry conditions or insufficient water for sampling: DH-42 (fall sampling) and DH-77 (spring and fall sampling) (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 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 the semiannual sampling events.

Table 2-3. 2023 Interim CAPMP Monitoring Well Sampling Schedule

2023 Interim CAPM Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[(3)]	MP Elevation	Water Levels	Water Quality Monitoring	
				May / October	May/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	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	X	X
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	X	X
DH-57	23-28	Upper Aquifer	3929.53	X		
DH-58	9-24	Upper Aquifer	3919.33	X	X	X
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. 2023 Interim CAPMP Monitoring Well Sampling Schedule

2023 Interim CAPM Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[3]	MP Elevation	Water Levels	Water Quality Monitoring	
				May / October	May/June	October
DH-65	60-70	Upper Aquifer	3945.85	X		
DH-66	38-48	Upper Aquifer	3919.28	X	X	X
DH-67[2]	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	X	X
DH-80	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	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-58	21-31	Upper Aquifer	3888.15	X		X
EH-59[1][2]	8-18	Upper Aquifer	3876.57	X	X	X
EH-60	22-28	Upper Aquifer	3888.46	X		X
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
EH-70	40-50	Upper Aquifer	3863.48	X		X
EH-100	52-60	Upper Aquifer	3889.83	X		X

Table 2-3. 2023 Interim CAPMP Monitoring Well Sampling Schedule

2023 Interim CAPM Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit[3]	MP Elevation	Water Levels	Water Quality Monitoring	
				May / October	May/June	October
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	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][2]	42-52	Upper Aquifer	3878.07	X	X	X
EH-115	39-49	Upper Aquifer	3883.29	X	X	X
EH-117	33-43	Upper Aquifer	3871.33	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	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	X	X
EH-140	56-86	Valley Fill	3812.08	X		
EH-141[1][2]	60-90	Valley Fill	3813.32	X	X	X
EH-142	80-120	Valley Fill	3804.68	X		
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		

Table 2-3. 2023 Interim CAPMP Monitoring Well Sampling Schedule

2023 Interim CAPM Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit(3)	MP Elevation	Water Levels	Water Quality Monitoring	
				May / October	May/June	October
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	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	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		
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		

Table 2-3. 2023 Interim CAPMP Monitoring Well Sampling Schedule

2023 Interim CAPM Report - East Helena Facility

Well ID	Screen Interval feet bgs	Unit(3)	MP Elevation	Water Levels	Water Quality Monitoring	
				May / October	May/June	October
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	**180**	**30**	**81**

All monitoring locations shown on Exhibit 1.

(1) Well sampled in May/June 2023 using both low-flow/low-volume and standard purge methods for comparison per 2023 CAPMP.

(2) Well sampled in October 2023 using both low-flow/low-volume and standard purge methods for comparison per 2023 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. 2023 Residential/Public Water Supply Well Sampling Sites and Schedule

2023 Interim CAPM Report - East Helena Facility

Map ID[1]	Northing	Easting	Status
Known Active Wells - Scheduled for Spring and Fall Sampling in 2023			
R1	863425.39	1359501.01	Active
R2	863266.68	1359337.84	Active
R3	863296.03	1360955.74	Active
R4	863053.71	1361184.11	Active
R5	864206.53	1358674.56	Active
R6	866156.57	1356934.48	Active
R7	872346.42	1354330.00	Active
R8	872391.53	1354773.24	Active
R9	872086.41	1355030.70	Active
R10	863376.30	1361815.27	Active
R11	863255.39	1358240.44	Active
R12	861502.42	1362101.41	Active
R13	855347.37	1359909.48	Active
R14	863233.58	1359840.14	Active
R15	861784.41	1356574.41	Active
R16	861925.29	1356400.09	Active
R17	861781.59	1356290.54	Active
R18	872558.37	1356681.06	Active
R19	871444.75	1356882.84	Active
R20	868437.60	1356673.10	Active
Inactive/Inoperative/Not Located/No Access Wells - No Sampling in 2023			
A	862450.60	1359157.38	No Access
B	861861.51	1361212.16	No Access
C	861854.50	1361415.54	No Access
D	863069.96	1361069.38	No Access
E	862259.92	1355055.07	No Access
F	862355.37	1362082.87	No Access
G	861830.00	1362540.24	No Access
H	862864.36	1360861.52	No Well Located
I	863109.81	1359725.42	No Well Located
J	863257.08	1358568.29	No Well Located
K	863278.12	1357979.20	No Well Located
L	863327.86	1360948.64	Pump Inoperative
M	863250.07	1358456.08	Pump Inoperative
N	863264.10	1358105.44	Pump Inoperative
O	863671.87	1362422.81	Pump Inoperative
Abandoned Wells			
X1	863237.91	1360019.06	Abandoned
X2	863270.75	1359501.67	Abandoned
X3	862873.52	1360767.10	Abandoned
X4	863250.07	1359185.43	Abandoned
X5	863263.27	1359031.01	Abandoned
X6	863256.45	1359904.15	Abandoned
X7	863256.45	1359757.14	Abandoned

NOTES: (1) See Exhibit 1

Groundwater quality samples collected as part of the 2023 Interim CAPMP were analyzed for the parameters shown in Table 2-5, including field analysis of pH, SC, DO, turbidity, oxidation/reduction potential (ORP), 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 2023 CAPMP 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 are presented in Section 3.3.

2.2.3 Well Purge Method Comparison Sampling

Well purge comparison sampling at selected monitoring wells was conducted in 2023 to further assess the comparability of groundwater quality data collected by the low-flow/low-volume and standard purge methods. Three monitoring wells were sampled using both methods in spring 2023, and five wells were sampled using both methods in fall 2023 (Table 2-3), covering a range of groundwater arsenic and selenium concentrations, as well as a range of standard purge volumes. Previous comparison sampling conducted during 2022 East Helena project sampling activities demonstrated that a low-flow/low-volume purging and sampling method using a Waterra inertial pump generated data comparable to the standard purge submersible pump method (Hydrometrics, 2023b). The representativeness and comparability of the inertial pump and submersible pump methods was also recently verified in wells currently monitored under the ongoing UFS processing and removal project (Hydrometrics, 2021b). 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.

2.2.4 Unfumed Slag Processing and Removal Groundwater Monitoring

The UFS GMP (Hydrometrics, 2021b and 2022) 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, the 2023 UFS project groundwater monitoring network consisted of the wells listed in Table 2-6 and shown on Figure 2-2.

Table 2-5. 2023 Groundwater Sample Analytical Parameter List

2023 Interim CAPM 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	HSOP-110	0.01 ft	NA
Turbidity	HSOP-053	0.1 NTU	NA
Water Temperature	HSOP-006	0.1 °C	NA
Dissolved Oxygen (DO)		0.01 mg/L	NA
pH		0.01 pH standard unit	NA
ORP/Eh		1 mV	NA
Specific Conductance (SC)		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

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Well ID	Screen Interval feet 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-60(2)	22-28	Upper Aquifer	3888.46	Sentinel
EH-61(3)	36-45	Upper Aquifer	3889.77	Sentinel
EH-103	59.5-74.5	Upper Aquifer	3890.54	Sentinel
EH-51(4)	10-30	Upper Aquifer	3880.09	Tier 2
EH-101(4)	34-45	Upper Aquifer	3879.95	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) Well dry from January through May 2023; sampled from June through December 2023.

(2) Well dry from January through March 2023; sampled from April through December 2023.

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

(4) Tier 2 wells EH-51 and EH-101 were added to the monitoring program in August through December 2023 based on trends observed at upgradient sentinel well DH-6.

*Unit refers to hydrostratigraphic unit. Upper Aquifer and Deeper System refer to units on plant site and downgradient through Lamping Field.

Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 3/14/2024 8:46:42 AM	2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	UFS PROJECT GROUNDWATER MONITORING LOCATIONS	FIGURE 2-2

Path: G:\PROJECT\10022\2023 Report\Fig2-2_SlagWells.mxd

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 and 2023. As noted in Table 2-6, wells DH-56 and EH-60 were dry during the first few months of 2023, but have had sufficient water for sampling during subsequent months. Well EH-61 was added to the program as a sentinel well replacement for adjacent well EH-60, and is sampled when EH-60 is dry. In accordance with the UFS GMP, Tier 2 monitoring wells EH-51 and EH-101 were added to the monitoring program beginning in August 2023, based on water quality results at upgradient sentinel well DH-6.

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, 2021b). UFS project groundwater monitoring results are discussed in Section 3.3.6.

2.3 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 2023 Interim CAPMP (Hydrometrics, 2023a), and the UFS GMP (Hydrometrics, 2021b). 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 2023 CAPMP program has been reviewed and validated in accordance with these procedures and all valid data has been entered into the East

[2] The initial phase of slag crushing occurred from September 2021 to March 2022. Crushing resumed from December 2023 to March 1, 2024.

Table 2-7. UFS Project Groundwater Sample Analytical Parameter List
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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.

Helena Project water quality database. The 2023 data validation and verification process resulted in qualification of a small percentage of the total results obtained as estimated due to QC sample exceedances (e.g., field duplicate control limit exceedances). For the spring 2023 data set, 98.5% of the monitoring well results, 98.4% of the surface water results, and 100% of the residential / public water supply well results were accepted without any qualifiers applied. For the fall 2023 data set, 99.3% of the monitoring well results, 99.7% of the surface water results, and 100% of the residential/public water supply well results were accepted without any qualifiers applied.

Following data verification and validation, all data collected during 2023 was designated as usable for Interim CAPMP objective purposes with the following exceptions:

- Three laboratory specific conductance values reported in the spring 2023 data set were rejected due to inconsistency with (1) field specific conductance values for the same samples, (2) historical results for the three locations, and (3) total dissolved solids (TDS) results reported for the three samples.
- All analytical results for two samples collected during the fall 2023 monitoring were rejected due to significant geochemical anomalies indicating the samples were not representative of overall aquifer groundwater quality in these locations. Additional details regarding these samples and the decision to reject the results are provided below in Section 3.3.2.2.

Rejected data are not incorporated into the project database.

3.0 2023 WATER RESOURCES MONITORING RESULTS

3.1 SURFACE WATER MONITORING RESULTS

The 2023 surface water monitoring program included measurement of surface water elevations, stream flow rates, and surface water quality sampling (Section 2.1). The surface water elevation and stream flow data was used in conjunction with concurrent groundwater elevation data to develop groundwater potentiometric maps and evaluate groundwater flow directions, to assess potential groundwater-surface water interactions, and to delineate gaining and losing segments of Prickly Pear Creek. The surface water quality data were used to document current water quality conditions in the project area.

The total precipitation measured in 2023 at the Helena Regional Airport station (12.47 inches) exceeded the long-term average of 11.33 inches, and was about 8% higher than the 2022 total (11.50 inches) and nearly 45% higher than the relatively dry year of 2021 (8.61 inches). The 2023 precipitation total was the highest since the relatively wet years of 2018 (12.92 inches) and 2019 (16.50 inches)[3]. Nearly 25% of the 2023 precipitation total (2.97 inches) occurred in June. The snowpack in 2023 (measured as snow-water equivalents at a SNOTEL station in Tizer Basin, near the headwaters of Prickly Pear Creek) was near normal, tracking closely with the median value for the last thirty years[4]. Peak snowpack in Tizer Basin occurred slightly later than usual in 2023, in late April rather than early April. Annual variability in precipitation and associated Prickly Pear Creek stream flow directly impacts Facility and downgradient groundwater conditions.

3.1.1 Surface Water Elevation and Flow

Stream flow and elevation measurements were recorded in May and October 2023. Stream flow and stream stage data are in Table 3-1 with site locations shown on Figure 2-1. Prickly Pear Creek flows measured in 2023 (Table 3-1) were much higher than those measured in 2021 and 2022. Measured flows for May 2023 were 173 to 225 cubic feet per second (cfs), compared with 95 to 143 cfs in June 2022 and 33 to 73 cfs in June 2021. Similarly, October 2023 flows (46 to 53 cfs) were higher than October 2022 flows (19 to 26 cfs) and September 2021 flows (4 to 16 cfs). Higher than average precipitation in September 2023 (2.7 inches, compared with a long-term average of 1.07 inches) likely increased the October 3, 2023 flow measurements. In addition to these climatic effects, the timing of sampling events can affect measured stream flows 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 and 2023 fall events in October likely occurred after irrigation diversions were terminated for the season.

[3] https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?mt4055
[4] https://nwcc-apps.sc.egov.usda.gov/awdb/site-plots/POR/WTEQ/MT/Tizer%20Basin.html

TABLE 3-1. 2023 PRICKLY PEAR CREEK STREAM FLOW AND STAGE MEASUREMENTS

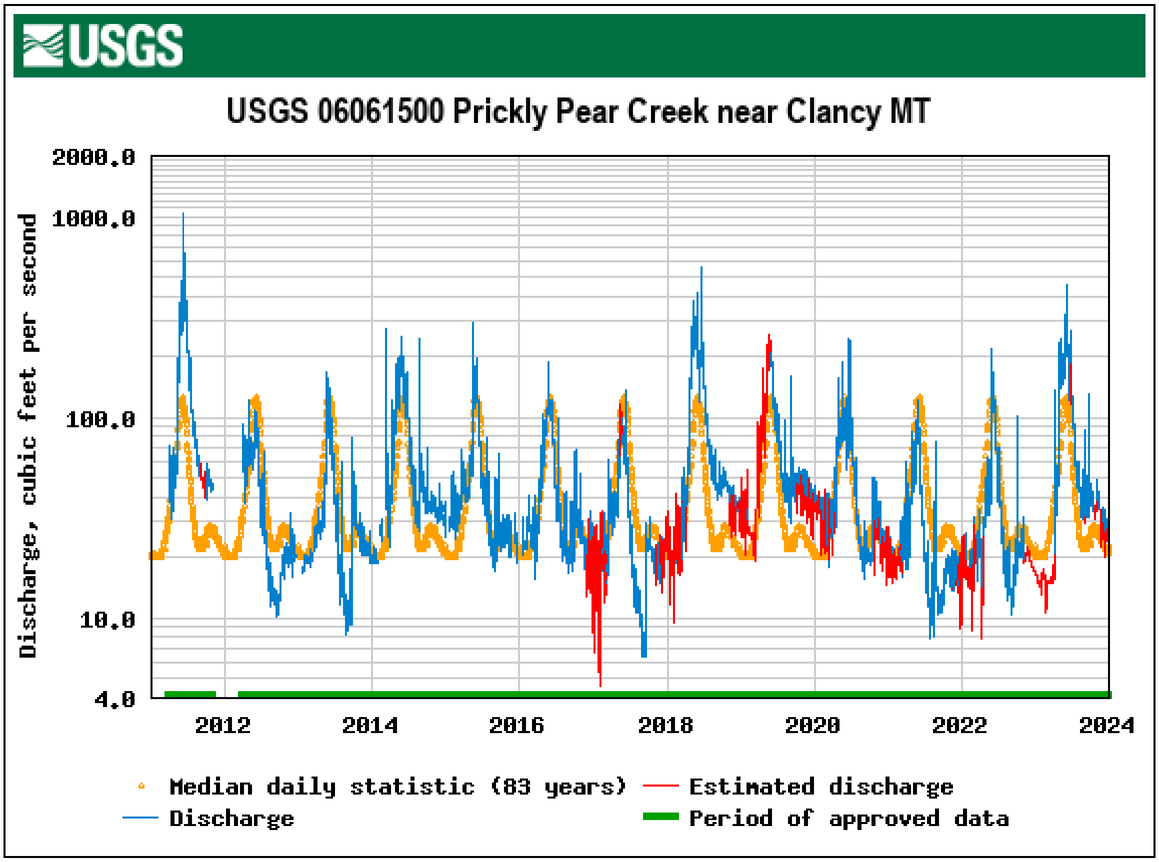
Monitoring Site	Location	Stream Stage – ft AMSL		Stream Flow – cfs	
		5/30/2023	10/3/2023	5/30/2023	10/3/2023
PPC-3A	PPC Upstream of Facility	3928.32	3927.08	221	51.8
PPC-4A	PPC Adjacent to Facility	3911.21	3910.25	223	52.3
Trib-1	Tributary drainage at railroad crossing	3918.03	3917.89	0.3 E	0.083
Trib-1B	Tributary drainage south of Facility	3915.23	3914.60	0.018 E	0.00016 E
Trib-1D	Tributary site at PPC Confluence	3905.35	3905.24	0.111 E	0.012
PPC-5A	PPC Adjacent to Facility	3903.46	3902.30	225	51.7
PPC-7	PPC Downstream Facility Boundary	3883.32	3882.02	NM (U)	53.3
PPC-8	PPC at West Gail St in East Helena	3869.11	3868.26	NM	NM
PPC-36A	PPC 0.7 mi downstream of Facility	3855.99	3855.24	196	51.4
PPC-9A	PPC 1.0 mi downstream of Facility	3846.25	3845.69	NM	NM
SG-16	PPC 2.9 mi downstream of Facility	3767.16	3766.42	173	46.3

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 2023 CAPMP
NM (U) – not measured due to unsafe wading conditions
E – flow estimated

Figure 3-1 shows daily average stream flow data for 2011 through 2023 from a USGS gaging station on Prickly Pear Creek approximately five miles upstream of the Facility. As shown on the hydrograph, 2023 Prickly Pear Creek flows at the gaging station exceeded median flow values throughout most of the year. Peak flows in 2023 at the gaging station were the highest observed since 2018 (Figure 3-1).

The data in Table 3-1 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 2023 seasonal monitoring event (note that flow at PPC-7 was not measured in May 2023 due to unsafe wading conditions). Overall, upstream to downstream flow measurements along this reach differed by less than 5% for both the May and October monitoring events. The 2023 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 a condition of no significant net flow gains or losses adjacent to the Facility. Downstream of the Facility, the 2023 flow data shows stream flow decreases in a downstream direction, indicating both leakage from the creek to groundwater and the effect of irrigation diversions from the creek; this result is also consistent with historic observations. Although irrigation diversion flows were not measured in 2023, 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 2023 PRICKLY PEAR CREEK FLOW HYDROGRAPH UPSTREAM OF FORMER SMELTER



3.1.2 Semiannual Surface Water Quality Results

The 2023 semiannual surface water quality data is summarized in Table 3-2 with the complete 2023 dataset in Appendix A. The data shows Prickly Pear Creek water to be a calcium-bicarbonate type water with slightly alkaline pH and TDS concentrations ranging from 94 to 197 milligrams per liter (mg/L) seasonally. As observed during past monitoring, seasonal concentrations of major ions (calcium, magnesium, sodium, potassium, sulfate) in 2023 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 May high flow concentrations. The tributary sites show higher TDS (287 to 427 mg/L) and major ion concentrations than Prickly Pear Creek, with Trib-1 and Trib-1B typically showing a calcium-bicarbonate signature and Trib-1D showing a calcium-bicarbonate-sulfate signature. The stable major ion concentrations are consistent with a lack of groundwater recharge to the creek as indicated by the downstream flow trends.

Table 3-2. 2023 Surface Water Quality Monitoring Results
2023 Interim CAPM Report - East Helena Facility

Monitoring Site	Prickly Pear Creek							Tributary Drainage		
	PPC-3A	PPC-4A	PPC-5A	PPC-7	PPC-36A	PPC-36A Dup	SG-16	TRIB-1	TRIB-1B	TRIB-1D
Sample Date	5/30/23							5/30/23		
Field Parameters										
pH (s.u.)	7.54	7.55	7.46	7.57	7.62	7.6	7.39	7.27	6.99	7.52
SC (µmhos/cm)	114	114	116	114	114	114	114	398	450	409
Flow (cfs)	221	223	225	NM-U	196	196	173	0.3 (E)	0.018 (E)	0.111 (E)
Laboratory Analyses										
Total Dissolved Solids	101	94	95	101	94	96	97	287	337	341
Calcium	16	16	15	16	16	16	15	56	66	63
Magnesium	3	3	3	3	3	3	3	12	13	15
Sodium	5	5	5	5	5	5	5	20	22	22
Potassium	1	1	1	1	1	1	1	4	5	3
Chloride	2	2	2	2	2	2	2	8	9	7
Sulfate	20	20	20	19	19	19	20	56	62	93
Trace Metals (Total Recoverable)										
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	0.0015	0.0007
Arsenic	0.005	0.004	0.004	0.005	0.005	0.005	0.005	0.007	0.025	0.006
Cadmium	0.00034	0.00024	0.00024	0.00025	0.00030	0.00027	0.00025	0.00011	0.03920	0.00007
Copper	0.007	0.005	0.005	0.006	0.006	0.006	0.006	<0.002	0.061	0.005
Iron	0.85	0.59	0.60	0.69	0.73	0.67	0.63	0.29	0.90	0.12
Lead	0.0144	0.0072	0.0080	0.0084	0.0082	0.0083	0.0084	0.0047	0.0726	0.0004
Manganese	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.05	1.41	0.10
Mercury	0.000014	0.000019	0.000011	0.000014	0.000013	0.000014	0.000013	0.000016	0.00097	0.000007
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.071	0.054	0.058	0.059	0.068	0.062	0.060	<0.008	1.080	<0.008

Monitoring Site	Prickly Pear Creek							Tributary Drainage		
	PPC-3A	PPC-4A	PPC-5A	PPC-5A Dup	PPC-7	PPC-36A	SG-16	TRIB-1	TRIB-1B	TRIB-1D
Sample Date	10/3/23							10/3/23		
Field Parameters										
pH (s.u.)	7.98	8.00	7.98	7.98	7.99	7.93	7.93	7.24	6.96	7.56
SC (µmhos/cm)	287	287	289	289	288	287	288	472	527	624
Flow (cfs)	51.8	52.3	51.7	51.7	53.3	51.4	46.3	0.083	0.00016 (E)	0.012
Laboratory Analyses										
Total Dissolved Solids	191	197	195	196	189	186	193	297	346	427
Calcium	32	32	31	31	31	30	32	57	64	77
Magnesium	8	8	8	8	8	8	8	14	17	18
Sodium	13	14	13	14	13	13	14	23	26	26
Potassium	3	3	3	3	3	3	3	4	6	5
Chloride	7	7	7	7	7	7	7	10	10	10
Sulfate	51	51	52	51	52	51	51	57	96	136
Trace Metals (Total Recoverable)										
Antimony	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0097	<0.0005
Arsenic	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.066	0.006
Cadmium	0.00018	0.00019	0.0002	0.0002	0.0002	0.00022	0.00022	0.00011	0.0422	0.00009
Copper	<0.002	<0.002	0.002	<0.002	0.003	0.003	0.003	<0.002	0.115	0.005
Iron	0.19	0.20	0.22	0.22	0.21	0.27	0.30	0.17	6.87	0.31
Lead	0.0018	0.0019	0.0023	0.0022	0.0022	0.0041	0.0035	0.0041	0.369	0.0014
Manganese	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.02	2.84	0.1
Mercury	<0.000005	<0.000005	0.000006	<0.000005	<0.000005	0.000007	0.000006	0.000016	0.00152	0.000007
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Zinc	0.051	0.053	0.055	0.054	0.054	0.061	0.06	<0.008	1.42	0.008

All concentrations in mg/L unless otherwise noted.

Concentration exceeds applicable surface water quality standard from DEQ Circular 7 (MDEQ, 2019).

Prickly Pear Creek sites listed in upstream to downstream order.

gpm = gallons per minute

NM-U - not measured - unsafe conditions

Complete 2023 database in Appendix A.

Total recoverable trace metal concentrations are also relatively low and consistent from upstream to downstream throughout the sampled reach of Prickly Pear Creek (Table 3-2, Appendix A), with antimony, selenium, and thallium below the laboratory reporting limits in all 2023 creek samples. Exceedances of hardness-dependent chronic aquatic life standards (DEQ-7 surface water standards; MDEQ, 2019) in 2023 Prickly Pear Creek samples were observed for total recoverable copper, lead, and zinc at multiple sites in May 2023, and for total recoverable lead at one site in October 2023 (Table 3-2). In May 2023 copper, lead, and zinc exceedances occurred at the site upstream of the Facility (PPC-3A), with copper and lead exceedances also observed within and downstream of the Facility; these results suggest that during the 2023 high flow monitoring event, upstream (non-Facility) contaminant sources were generating these exceedances.

During the October 2023 monitoring event, one location downgradient of the Facility (PPC-36A; see Figure 2-1) showed an exceedance of the chronic standard for lead, while the upstream, on-Facility, and other downstream sites showed no exceedances (Table 3-2). The slightly higher October 2023 lead concentration at PPC-36A (0.0041 mg/L) compared with other creek monitoring locations (0.0018 to 0.0035 mg/L) could be due to entrainment of historically deposited and resuspended lead-bearing stream sediment into the PPC-36A sample. Flow data does not indicate any inflow to the creek from groundwater in this reach, lead concentrations in all 2023 groundwater samples were below detection limits (<0.005 mg/L), and no changes in creek concentrations in other constituents that are elevated in groundwater (i.e., arsenic and selenium) are apparent at PPC-36A, so there is no evidence the higher 2023 lead concentration is due to groundwater-surface water interaction. The occurrence of elevated metals concentrations in Prickly Pear Creek upstream of the Facility has been noted in numerous studies, including the watershed total maximum daily load (TMDL) document (USEPA, 2004b). Overall, the 2023 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 May 2023 showed water quality standard exceedances for cadmium, copper, lead, and zinc (chronic aquatic criteria), along with Montana surface water HHS exceedances for arsenic and mercury. These constituents also exceeded water quality standards in October 2023 at Trib-1B, along with antimony (HHS exceedance) and iron (chronic aquatic criteria). 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 2023 seasonal monitoring events (Table 3-2). Metals concentrations at Trib-1D are similar to or lower than concentrations in Prickly Pear Creek, although major ion concentrations are higher in the tributary site. Metals concentrations at upstream site Trib-1 are much lower than at Trib-1B. As described below, elevated metals concentrations in the tributary drainage in the vicinity or Trib-1B have been documented through past sampling, leading to the 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 (2019-2023) concentrations at tributary drainage sites Trib-1B and Trib-1D (downstream of the soil removal area) compared to pre-soil removal (2017-2018) concentrations. Average metals concentrations at Trib-1B show appreciable year-to-year variability, and many average concentrations were higher in 2023 than in previous years at this location. Compared with the 2017-2018 pre-soil removal conditions, average 2023 concentrations show overall decreases for sulfate (39%) and zinc (57%), little change for pH (0.2% decrease) and cadmium (8% increase), and substantial increases for arsenic, copper, iron, lead, and manganese (Table 3-3). The increases in iron and manganese concentrations at Trib-1B suggest more reducing conditions in 2023 compared with previous years, since iron and manganese are more soluble in a low redox environment. When iron and manganese in sediments are solubilized under reducing conditions, they release adsorbed constituents into solution, increasing aqueous concentrations. The increases in arsenic, copper, and lead along with iron and manganese in the 2023 Trib-1B samples may be attributable to this reductive dissolution of iron and manganese and release of adsorbed arsenic, copper, and lead into solution under low redox conditions. Alternatively, the higher total suspended solid (TSS) concentrations in 2023 Trib-1B samples (91 mg/L in May and 57 mg/L in October) relative to previous years (near or below the 10 mg/L reporting limit in 2020, 2021, and 2022) could indicate that metals concentrations in the 2023 sample were biased high by entrainment of metals-bearing suspended material into the samples.

At Trib-1D, where the tributary drainage flows into Prickly Pear Creek, decreases in annual average concentrations have been observed since the 2018 soil removal for sulfate and for all metals listed in Table 3-3, with decreases of more than 90% for both cadmium and zinc and over 70% for manganese, iron, and lead. These decreases persisted in 2023 despite the higher concentrations observed at Trib-1B (upstream of Trib-1D) in 2023 noted above and in Table 3-3. 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 and lower concentrations under oxidizing conditions. Water emerges as a spring from the subsurface at Trib-1B, then forms a surface water drainage that flows to a large wetland area upstream of Trib-1D; thus, redox conditions may be expected to be generally more oxidizing (and metals concentrations lower) at Trib-1D than at Trib-1B. The tributary sites will be included in future monitoring programs to continue the assessment of post-soil removal surface water concentrations in this tributary to Prickly Pear Creek.

3.2 RESIDENTIAL / PUBLIC WATER SUPPLY SAMPLING RESULTS

Table 3-4 summarizes 2023 residential/public water supply well sample arsenic and selenium concentrations, and identifies State of Montana human health standards (HHSs, equivalent to MCLs) for groundwater (MDEQ, 2019). Complete 2023 analytical results, including both total and dissolved metals concentrations, are included in Appendix A with residential well locations shown on Exhibit 1. Except for copper and iron at selected residential wells, total and dissolved metals concentrations are virtually identical. Detectable total iron concentrations ranged from 0.02 to 0.72 mg/L in 2023, and

TABLE 3-3. TRIBUTARY DRAINAGE CONCENTRATION COMPARISON 2017 - 2023

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	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	*0.070*	*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*
2023 Average	*0.009*	*79*	*0.046*	*7.05*	*0.0407*	*0.088*	*3.88*	*0.2208*	*2.13*	*1.25*
% Change		**-39%**	**318%**	**-0.2%**	**8%**	**294%**	**708%**	**751%**	**541%**	**-57%**
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*
2023 Average	*0.061*	*115*	*0.006*	*7.65*	*0.00008*	*0.005*	*0.22*	*0.0009*	*0.10*	*0.008*
% Change		**-48%**	**-59%**	**-11%**	**-96%**	**-30%**	**-81%**	**-89%**	**-75%**	**-96%**

Metals analyses are total recoverable fraction.
% change calculated from 2017/18 average to 2023 average.
2022 average for Trib-1B represents one sample (site was dry in fall 2022).

Table 3-4. Summary of 2023 Residential/Public Water Supply Well Arsenic and Selenium Data

2023 Interim CAPM Report - East Helena Facility

Map Key (see Exhibit 1)	Well Use	# of Samples in 2023	Dissolved Arsenic (mg/L)			Dissolved Selenium (mg/L)		
			Concentration		MCL/HHS Exceedances	Concentration		MCL/HHS Exceedances
			Jun-23	Oct-23		Jun-23	Oct-23	
R1	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R2	Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R3	Drinking	2	<0.002	<0.002	0	0.006	0.004	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	3	<0.002	<0.002/<0.002	0	0.002	0.002/0.002	0
R7	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R8*	Drinking/Irrigation	3	<0.002/<0.002	<0.002	0	<0.001/<0.001	<0.001	0
R9	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R10^	Irrigation	2	<0.002	<0.002	0	0.002	0.001	0
R11	Drinking/Irrigation	2	<0.002	<0.002	0	0.046	0.040	0
R12	Drinking/Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R13	Drinking/Irrigation	2	0.014	0.014	2	<0.001	<0.001	0
R14	Irrigation	2	<0.002	<0.002	0	<0.001	<0.001	0
R15	Drinking/Irrigation	2	0.015	0.016	2	0.002	0.002	0
R16	Drinking/Irrigation	2	0.015	0.016	2	0.002	0.002	0
R17	Drinking/Irrigation	2	0.016	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 2023 (well R8) and October 2023 (well R6) represent sample/field duplicate results

^Fall 2023 sample collected in September 2023 prior to seasonal well shutdown

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

MCL - Federal maximum contaminant level (equivalent to MDEQ HHS for arsenic and selenium) detectable total copper concentrations ranged from 0.001 to 0.040 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 2023 results for cadmium, lead, manganese, mercury, and thallium below detection, and zinc concentrations ranging from <0.01 to 0.03 mg/L.

None of the sampled water supply wells exhibited MCL exceedances for selenium in 2023, while four of the twenty wells sampled showed MCL exceedances for arsenic, consistent with previous results (Table 3-4). Selenium concentrations at well R11 have increased over the last ten years but have stabilized recently and remain below the 0.050 mg/L MCL; dissolved selenium concentrations at this well in 2023 ranged from 0.040 to 0.046 mg/L. The four wells in Table 3-4 exhibiting arsenic exceedances in 2023 (R13, R15, R16, and R17) showed dissolved arsenic concentrations from 0.014 to 0.017 mg/L, comparable with historic results. These wells are located either south (upgradient) of the Facility or cross-gradient to the west in an area of known naturally occurring groundwater arsenic (see Section 3.3). There were no exceedances recorded in 2023 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 final CM, capping the slag pile, is pending) 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 and objectives specific to the East Helena Project (Section 1), the 2023 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 2023 groundwater conditions in the Project area, followed by discussions of the performance monitoring components.

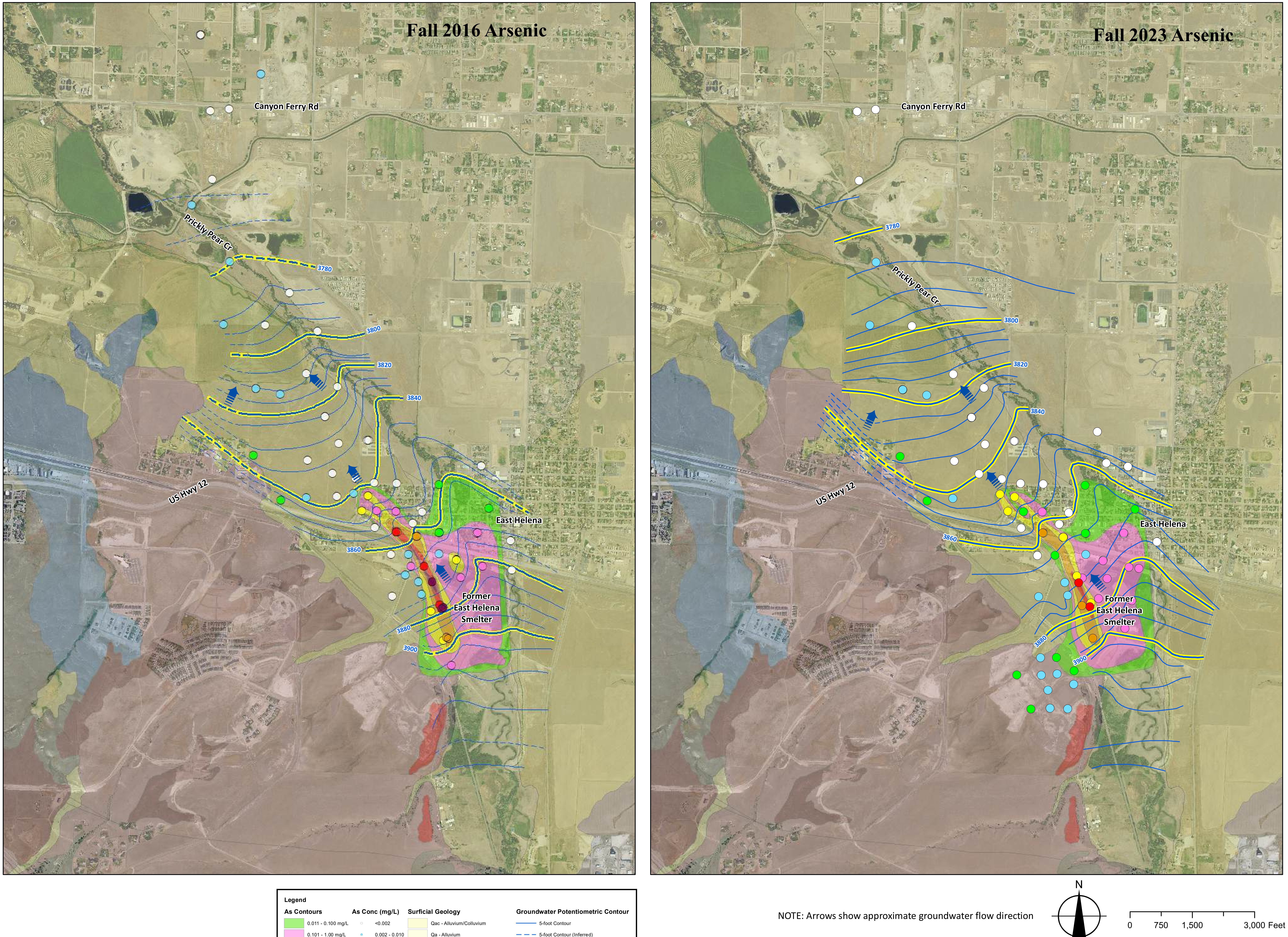
3.3.1 General Groundwater Conditions

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 shallow alluvial aquifer on the Facility, referred to as the Upper Aquifer, extends from the top of the saturated zone or water table, downward to a low permeability Tertiary ash/clay basal layer. On the Facility, post-SPHC groundwater depths vary 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 basal ash/clay layer slopes to the north with depths ranging 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 Upper Aquifer ranges from less than 5 feet in the south, to about 10 to 15 feet in the north of the Facility, 5 to 10 feet lower than pre-SPHC conditions. Groundwater also occurs within the ash/clay layer below the Upper Aquiver as isolated or poorly interconnected sandy zones within the finer-grained Tertiary sediments. The contaminated soils/fill and groundwater plumes are largely restricted to the Upper alluvial aquifer due to the confining nature of the basal ash/clay and general upward hydraulic gradient between the two groundwater systems.

As previously noted, the primary groundwater COCs are arsenic and selenium, both of which exceed applicable MCLs in groundwater beneath and downgradient of the Facility. Secondary COCs exceeding MCLs in portions of the Facility, and infrequently if ever in downgradient groundwater, include antimony, cadmium, and zinc. The 2023 arsenic and selenium groundwater plumes are shown on Figures 3-2 and 3-3, respectively, along with the 2016 plumes for comparison to pre-CM conditions.

Groundwater contaminant source areas have been delineated through multiple studies dating back more than two decades, with the two most recent investigations (2014 and 2015 source area investigations) presented in Hydrometrics, 2015b and 2016. Based on the results of prior investigations, 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 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 removal, 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 following the UFS removal and reprocessing project, is intended to address this source area.



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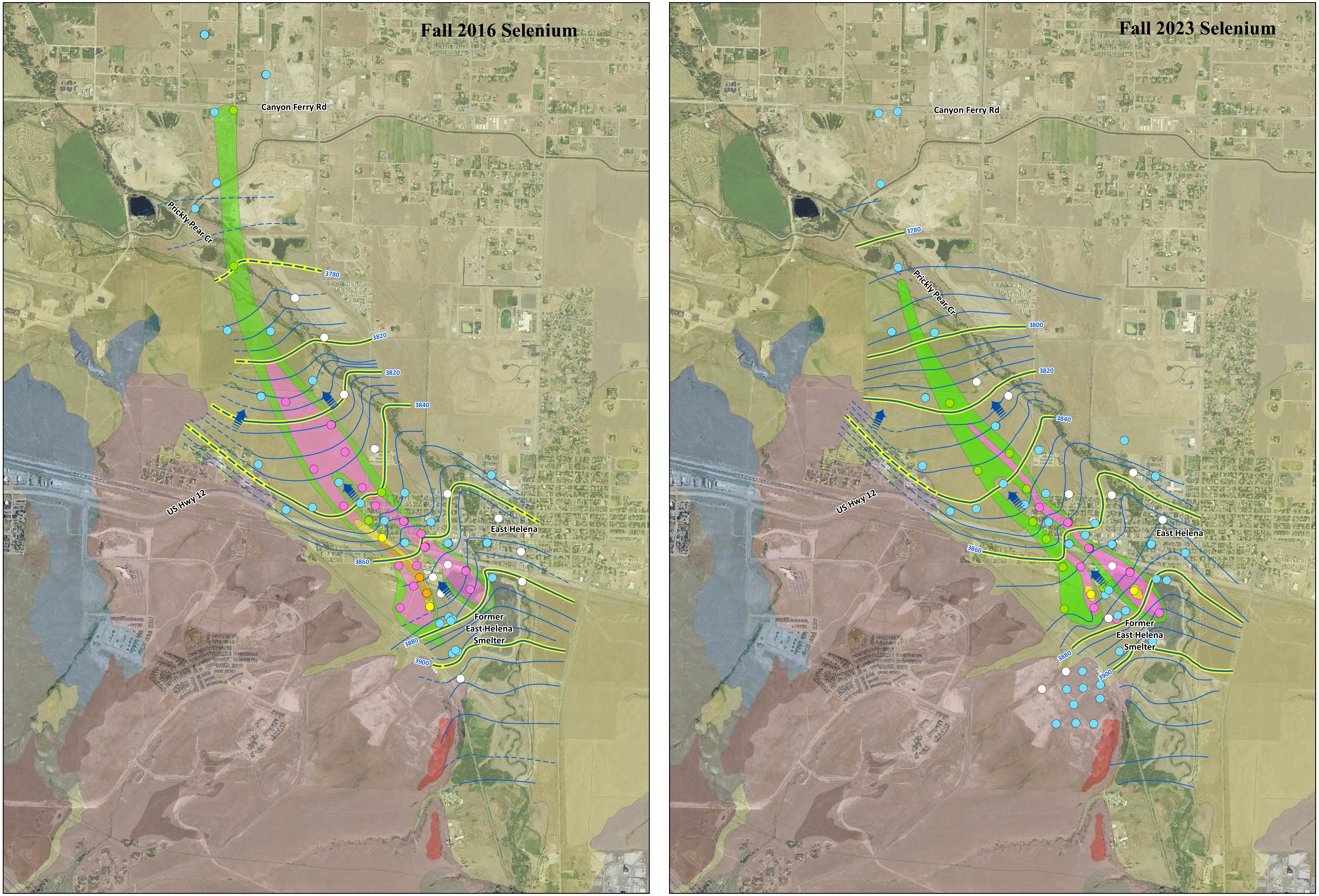
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	2016 AND 2023 GROUNDWATER ARSENIC PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY	FIGURE 3-2



Legend

Se Contours
- 0.051 - 0.100 mg/L
- 0.101 - 0.500 mg/L
- 0.501 - 1.0 mg/L
- 1.01 - 3.0 mg/L
- > 3.0 mg/L

Se Conc (mg/L)
- <0.001
- 0.001-0.050
- 0.051-0.100
- 0.101-0.500
- 0.501-1.0
- 1.01-3.0
- >3.0

Surficial Geology
- Qac - Alluvium/Colluvium
- Qa - Alluvium
- Qt - Terrace Gravel
- QTg - Older Gravel
- OGts - Tuff and Tuffaceous Sediment
- Ys - Spokane Formation

Groundwater Potentiometric Contours
- 5-foot Contour
- 5-foot Contour (Inferred)

NOTE: Arrows show approximate groundwater flor direction

N

0 750 1,500 3,000 Feet

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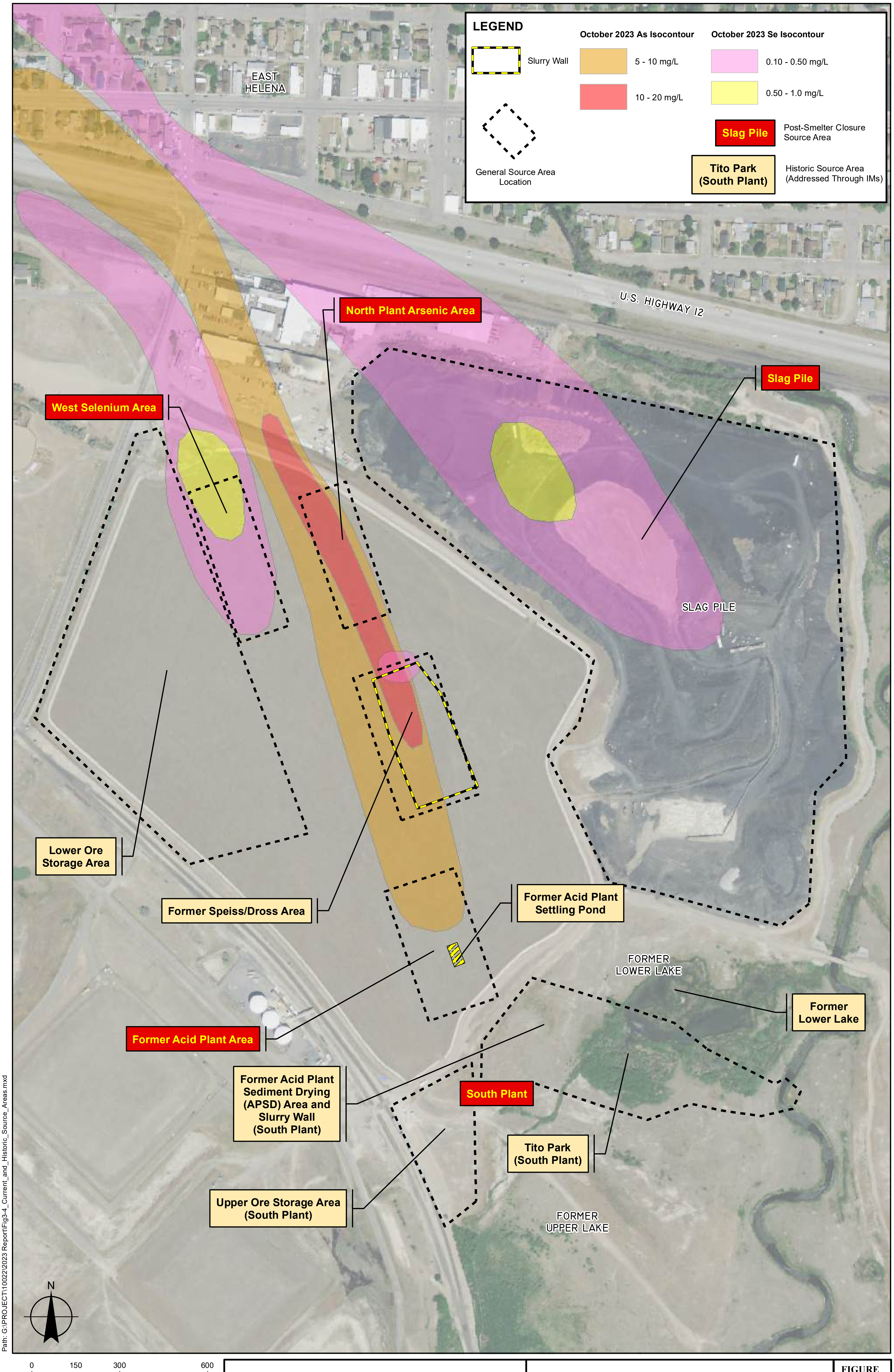
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	2016 AND 2023 GROUNDWATER SELENIUM PLUMES AND POTENTIOMETRIC CONTOURS EAST HELENA FACILITY	FIGURE 3-3



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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY

HISTORIC AND POST-SMELTER CLOSURE GROUNDWATER CONTAMINANT SOURCE AREAS

FIGURE 3-4

Groundwater chemistry across the East Helena monitoring well network as represented by the 2023 Interim CAPMP monitoring data set is variable, with higher constituent concentrations in the Facility source areas noted above, and progressively decreasing concentrations with downgradient distance. All 2023 groundwater monitoring results are in Appendix A, with all monitoring locations shown on Exhibit 1. Field measured groundwater pH values in 2023 ranged from 5.60 (well EH-60, north of the Facility and Highway 12) to 7.70 (well MW-5, west of the Facility), with an overall average of 6.96, and field specific conductance ranged from 256 µmhos/cm at well MW-7 to 5577 µmhos/cm at slag pile well DH-56. Field dissolved oxygen values in 2023 ranged from 0.16 mg/L at well MW-3 to 9.72 mg/L at well EH-66, north of East Helena near Prickly Pear Creek. In terms of major ion concentrations, the highest potassium (541 mg/L), sodium (669 mg/L), and sulfate (2640 mg/L) concentrations observed in 2023 were at slag pile well DH-56, while the highest calcium (543 mg/L) concentration was noted at West Selenium area well DH-8 and the highest chloride concentration at well EH-60. West Selenium wells DH-8 and DH-66 also showed chloride concentrations greater than 200 mg/L. The maximum arsenic concentration observed in 2023 was 19.8 mg/L at well DH-79 in the North Plant Site arsenic source area; the maximum selenium concentration was 1.64 mg/L at well DH-66 in the West Selenium source area.

The configuration and geometry of the current arsenic plume as of October 2023 (Figure 3-2) shows the primary Facility 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 arsenic concentrations in the 10 to 20 mg/L range occur in the central portion of the Facility downgradient of the Speiss/Dross area slurry wall in the North Plant Arsenic Source Area (Figures 3-2 and 3-4). In the higher concentration portion of the arsenic plume migrating to the northwest, concentrations greater than 1 mg/L persist across US Highway 12 and through the western portion of East Helena. The current downgradient boundary of the arsenic plume as defined by the 0.01 mg/L (MCL) concentration contour is located along the north and west edges of East Helena (Figure 3-2), and the overall arsenic plume footprint in 2016 and 2023 is nearly identical. The arsenic plume footprint has remained relatively stable since at least 2001 when the Facility was shut down. An area of groundwater south and west of the Facility 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 for October 2023 (Figure 3-3) extends offsite significantly further than the arsenic plume, due primarily 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 (MCL) selenium plume extending approximately 1.5 to 2 miles northwest of the Facility. Comparison of the 2016 and 2023 selenium plumes on Figure 3-3 shows that the downgradient 0.05 mg/L plume boundary retreated approximately 4,000 feet from 2016 to 2023, and that concentrations within the plume core have decreased as well (i.e., compare the reduction in area of the pink 0.1 to 0.5 mg/L contours from 2016 to 2023 on Figure 3-3). 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

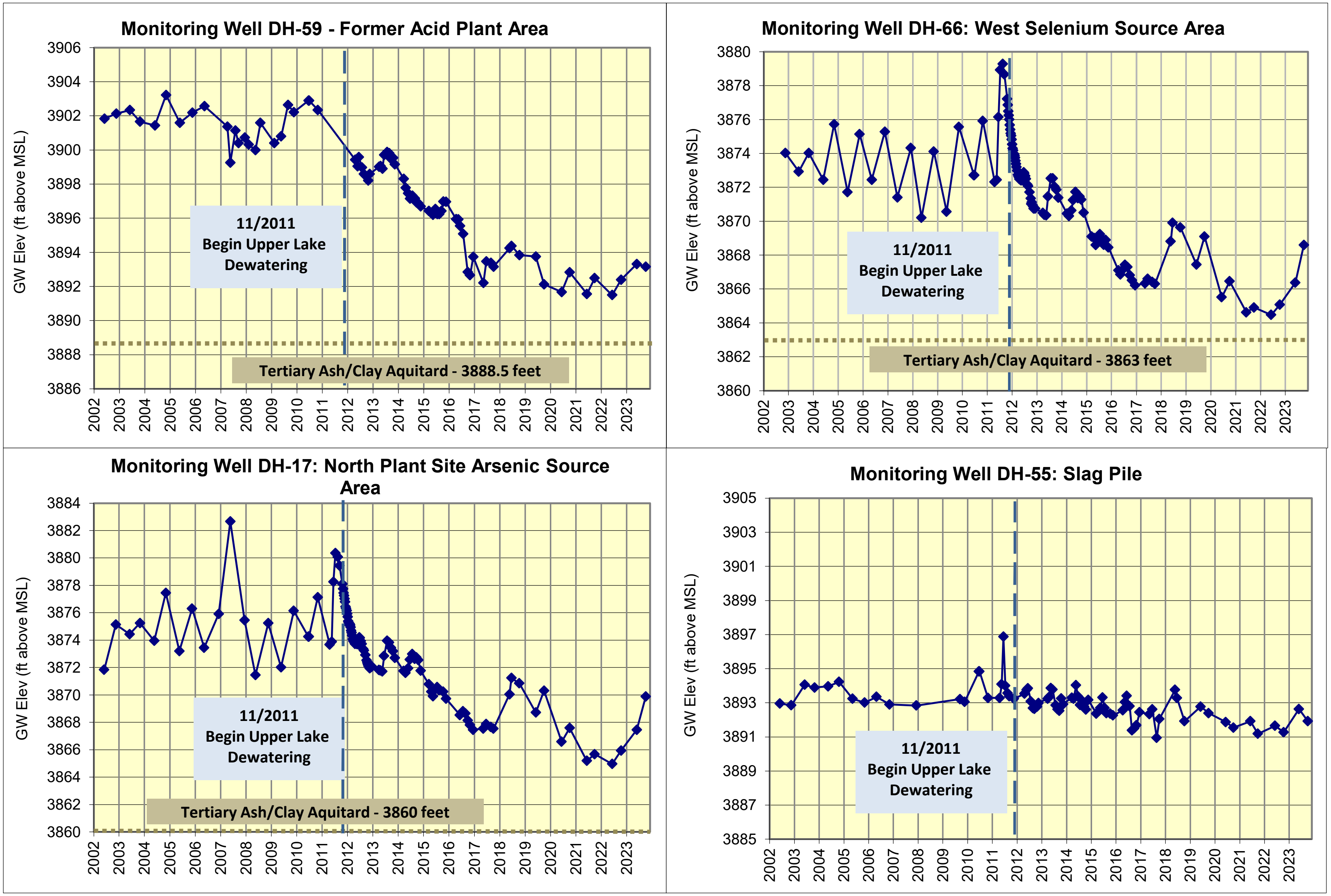
As discussed above in Section 3.1, the 2023 precipitation total in the Project area (12.47 inches) was above the long-term average, higher than in 2022 (11.5 inches) and significantly higher than the exceptionally dry conditions experienced in 2020 (9.87 inches) and 2021 (8.61 inches). This precipitation trend was generally reflected in higher groundwater levels in 2023 compared with recent years. In 2022, lower groundwater levels persisted throughout the monitoring well network, and multiple wells scheduled for sampling in spring (seven wells) and fall (nine wells) could not be sampled due to dry conditions or insufficient water for sampling (Hydrometrics, 2023b). In contrast, in 2023 only one well during the spring monitoring event and two wells during the fall monitoring event were not sampled due to dry conditions (Table 2-3). Water levels in most wells that were dry in 2022 increased sufficiently to allow sample collection in 2023.

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 CMs 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 2023 manual groundwater level measurements from the project area. In 2023, manual water level measurements or dry conditions were recorded at 180 monitoring wells; ten wells were dry during both the May/June and October monitoring events including: DH-9, DH-22, DH-23, DH-57, DH-61, DH-71, EH-128, SP-3, SP-4, and SP-5; two wells (DH-36, PZ-9A) 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 8 to 10 feet from pre-2012 levels, prior to SPHC CM initiation, through 2023. The hydrograph for well DH-66 shows that water levels in the West Selenium Source Area declined 8 to 10 feet from 2012 through 2022, followed by an increase of about 3 feet from 2022 through 2023, for a net decrease of about 5 to 7 feet. In the North Plant Site Arsenic Source Area (well DH-17), water levels declined about 9 feet through 2022, followed by an increase of about 4 feet from 2022 through 2023, for a net decrease of about 5 feet (Figure 3-5). The hydrographs for all three of these source area locations (DH-59, DH-66, and DH-17) show the combined effects of the SPHC CM and the more transitory effects of variable annual precipitation and snowmelt and associated groundwater recharge. The higher 2018 and 2019 precipitation and snowpack increased groundwater levels in those years. Relatively dry conditions in 2020 and 2021 and a return to near average precipitation totals in 2022 resulted in a decrease in groundwater elevations through 2022 to near minimum values. The higher precipitation conditions in 2023 were accompanied by groundwater



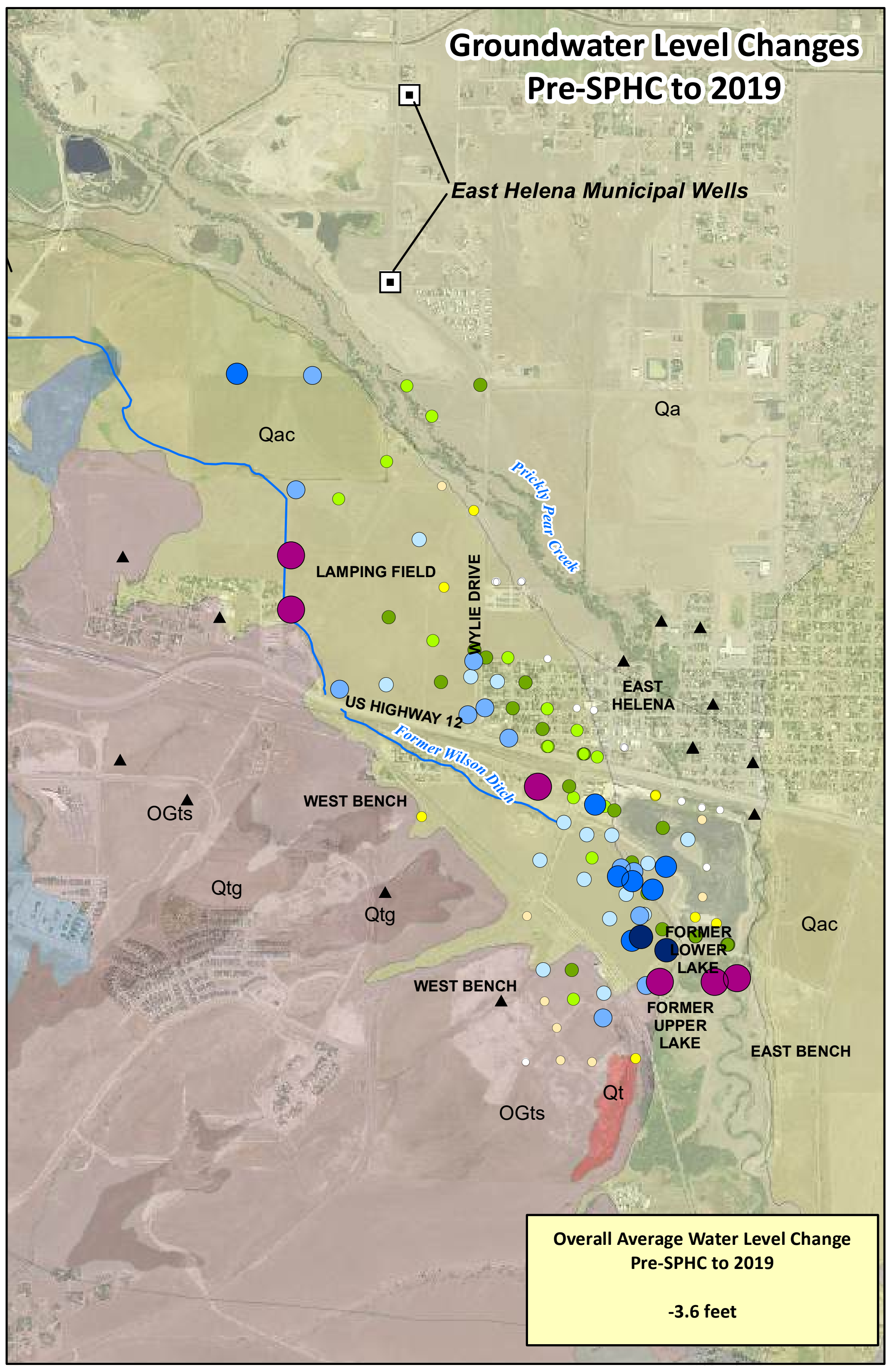
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	**GROUNDWATER LEVEL HYDROGRAPHS FROM FACILITY SOURCE AREA MONITORING WELLS**	FIGURE **3-5**

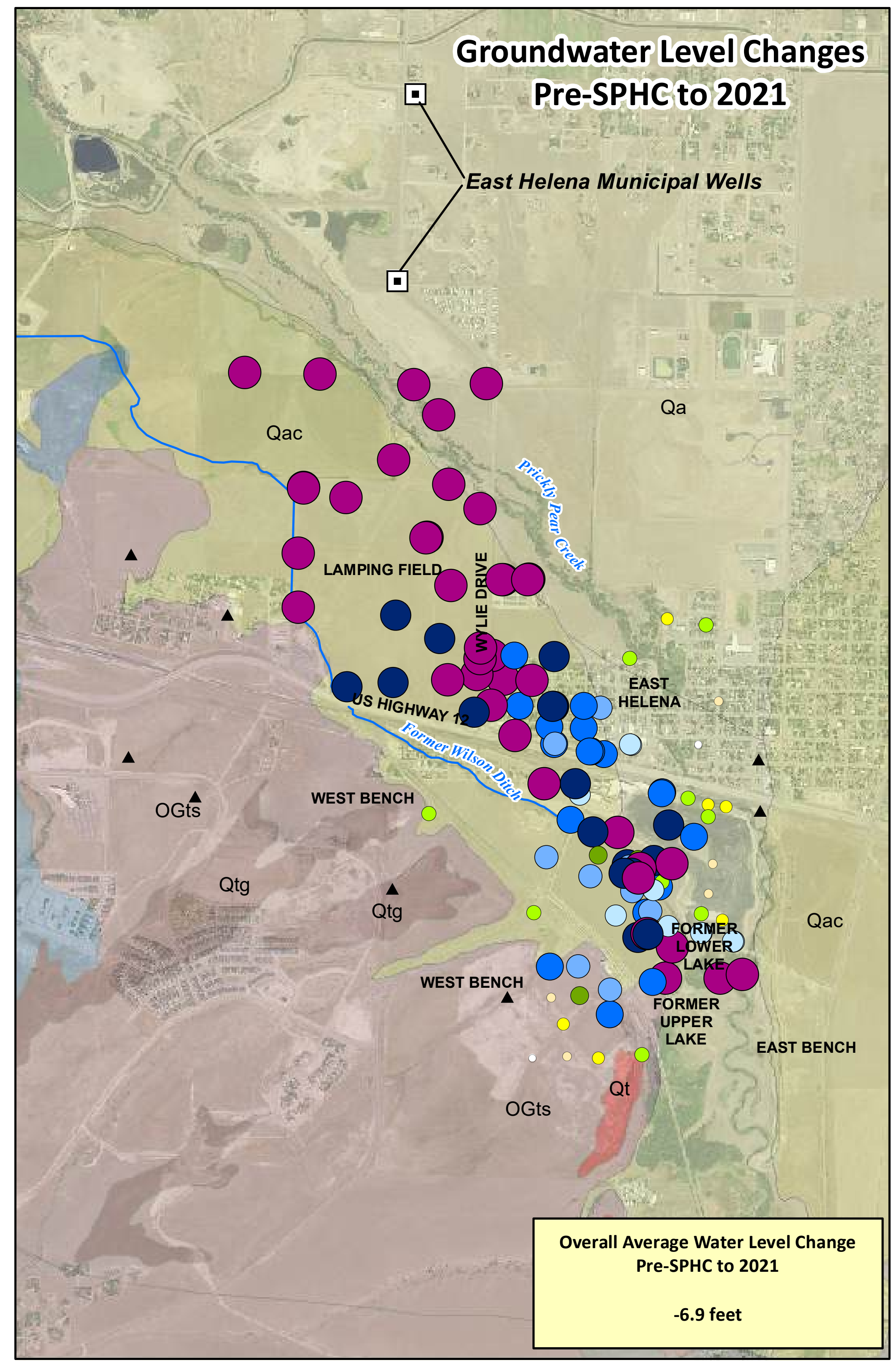
elevation increases compared with 2022, with larger increases in the West Selenium and North Plant Arsenic areas, and a more moderate increase in the Acid Plant area (Figure 3-5). Compared with the changes in Acid Plant, West Selenium, and North Plant Arsenic source areas, water levels beneath the slag pile (well DH-55), have shown relatively minor fluctuations (about 1 to 2 feet) in response to the SPHC CM and precipitation patterns. 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.

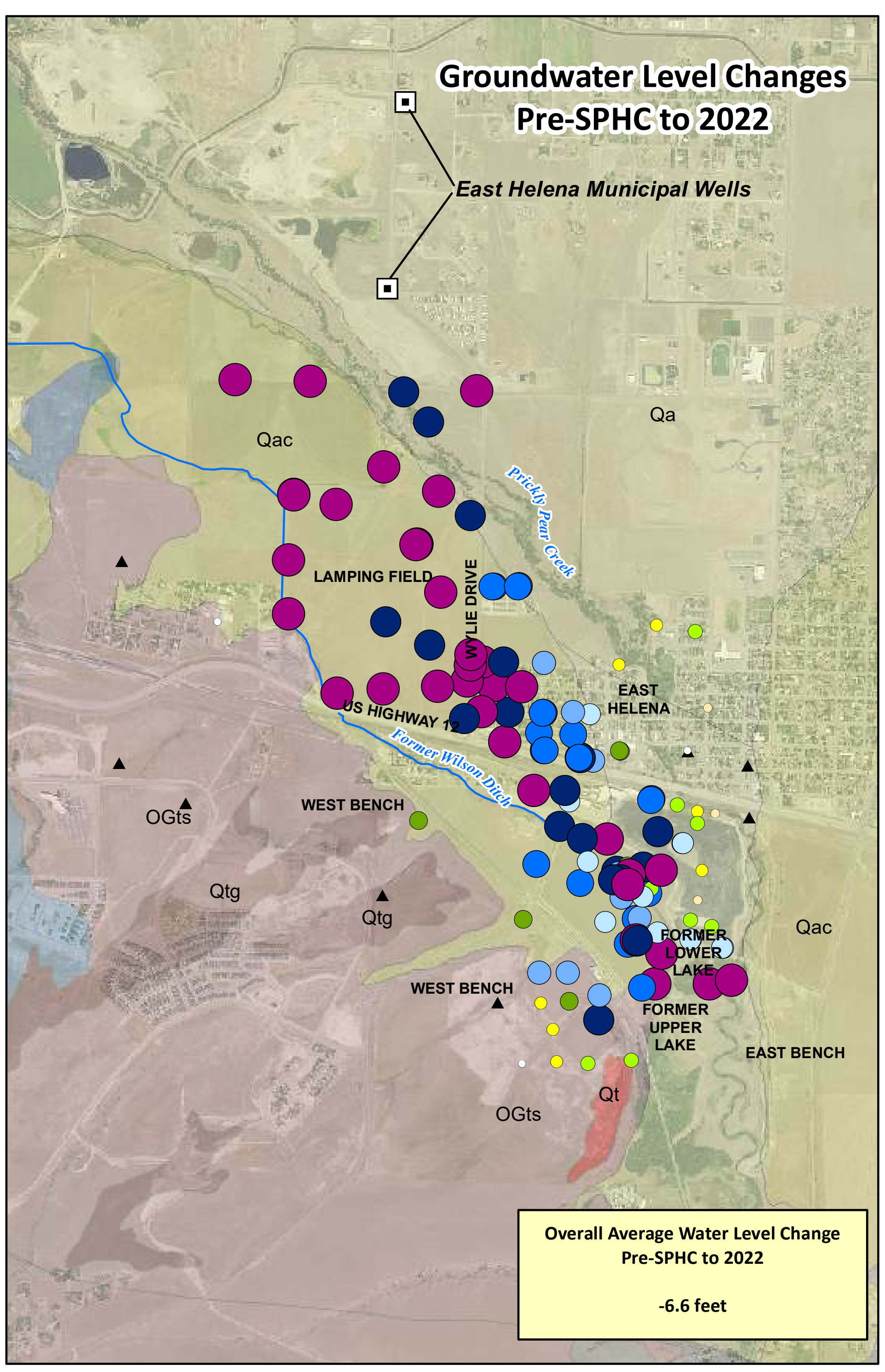
The CM-induced groundwater level declines have resulted in the desaturation of some of the most contaminated Facility soils, thereby reducing groundwater interactions with and potential contaminant leaching from these soils. The Figure 3-5 hydrographs include the elevation of the Tertiary ash/clay layer representing the base of the plume-bearing Upper Aquifer at each location[5]. As of 2023, in the former Acid Plant area groundwater elevations have decreased from about 3,901 feet above mean sea level (AMSL) to about 3,893 feet with the ash/clay layer at about 3,889 feet. This represents a decrease in saturated thickness from 12 feet to 4 feet in this source area. The reduced saturated thickness, assuming a relatively consistent hydraulic gradient over that time, represents an approximate 66% reduction in the groundwater flux through the former Acid Plant area contaminated soils. Using similar comparisons for average 2023 water levels in 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 66% and 45%, respectively, for these areas. Decreasing groundwater levels due to the SPHC CM thus lead to an overall reduction in groundwater flux through the contaminant source areas and a corresponding reduction in the groundwater contaminant load leaving the Facility, thereby reducing downgradient groundwater loads and concentrations. During wetter years such as 2018-2019 and 2023, groundwater levels can increase due to increased upgradient recharge (as seen on Figure 3-5), partially counteracting the effects of the SPHC and temporarily resaturating some portion of the contaminated soils, although the overall trend in groundwater elevations from pre- to post-SPHC remains downward.

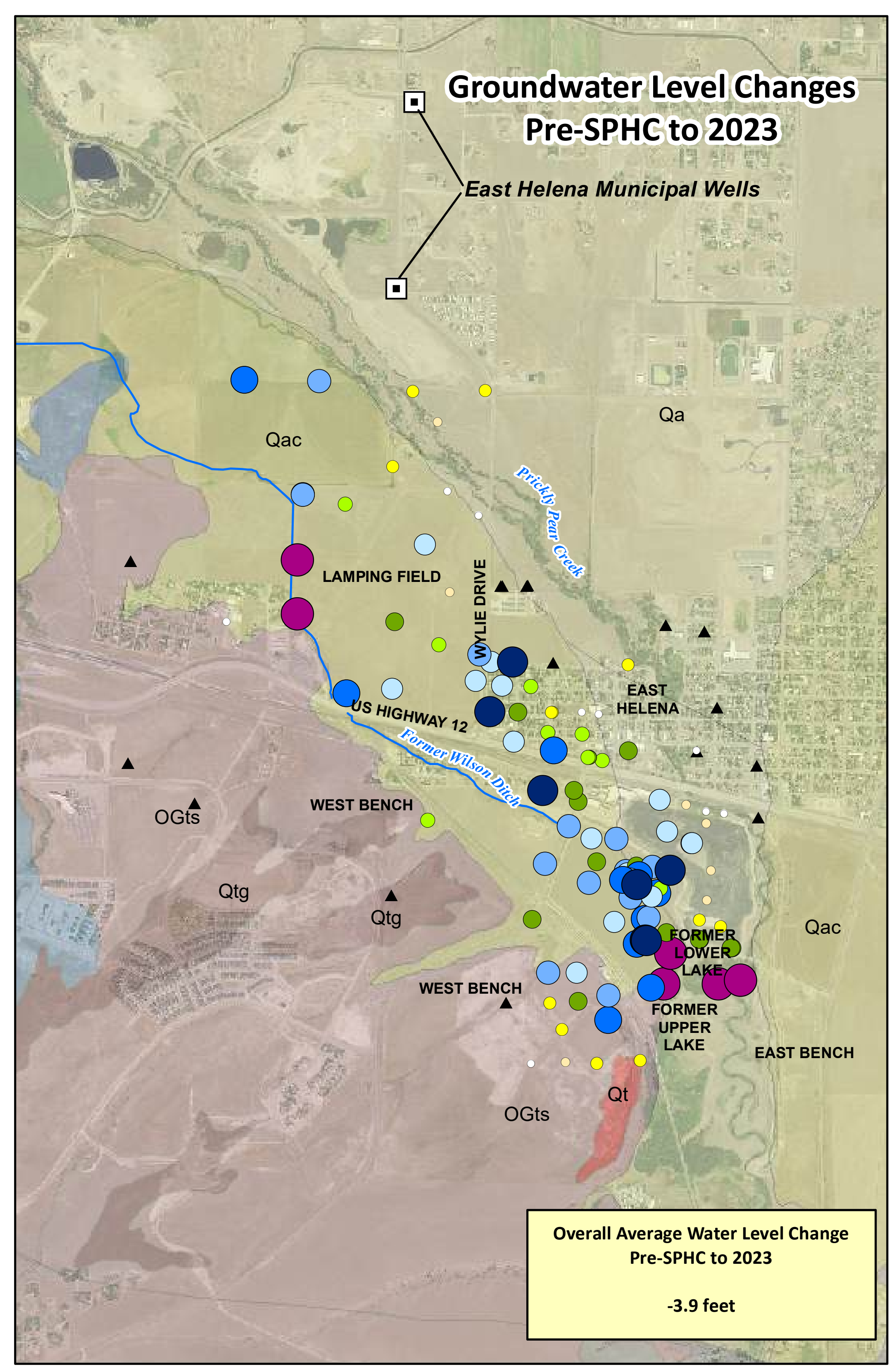
Figure 3-6 summarizes groundwater elevation changes throughout the project area since inception of the CMs in 2011. Water level changes from pre-SPHC conditions (2002-2010 averages) since the inception of the CMs compared to the 2019, 2021, 2022, and 2023 data sets are shown on Figure 3-6, demonstrating not only the effects of the CMs, but also the shorter-term effects of annual precipitation variability: the high precipitation totals in 2018 and 2019 (two-year average of 14.7 inches), the lower precipitation observed in 2020, 2021 and 2022 (three-year average of 10.0 inches), and the higher precipitation total in 2023 (12.47 inches). The overall average water level changes for each of the years shown on Figure 3-6 correlate roughly with recent precipitation trends. The overall average groundwater level change for 2019 of -3.6 feet is negative, but is impacted by the higher

[5] Drilling has not penetrated to sufficient depths to delineate the ash/clay layer elevation beneath the slag pile (well DH-55 hydrograph).







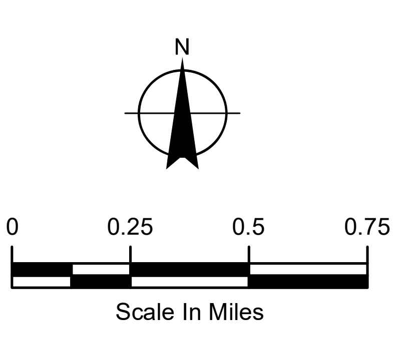


LEGEND

Water Level Decrease
- >9 ft
- 8 - 9 ft
- 7 - 8 ft
- 6 - 7 ft
- 5 - 6 ft
- 4 - 5 ft
- 3 - 4 ft
- 2 - 3 ft
- 1 - 2 ft
- 0 - 1 ft
- WL Increase

Surficial Geology
- Qac - Alluvium/Colluvium
- Qa - Alluvium
- Qt - Terrace Gravel
- QTg - Older Gravel
- OGts - Tuff and Tuffaceous Sediment
- Ys - Spokane Formation

NOTE: Groundwater level changes calculated as the difference between 2002 -2010 average elevations (pre-SPHC) and 2019, 2021, 2022, 2023 average elevations.



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Hydrometrics, Inc. Consulting Scientists and Engineers Date Saved: 3/13/2024 5:15:23 PM	2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	PROJECT AREA GROUNDWATER LEVEL CHANGES 2019, 2021, 2022, 2023	FIGURE 3-6

precipitation in 2018-2019; the 2021 and 2022 average changes of -6.9 and -6.6 feet are greater and reflect the drier conditions from 2020 through 2022. Finally, the average change calculated for 2023 of -3.9 feet was similar to the calculation for 2019, and indicative of the higher precipitation total received in 2023.

Groundwater level declines observed 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. 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 Facility 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 Facility primarily restricted to areas west of the creek. Modest decreases or (in many cases) water level increases over time have also been observed at most of the wells to the west of the Facility, completed in Tertiary sediments.

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 from three primary areas of interest are included in the concentration trend analysis: (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:

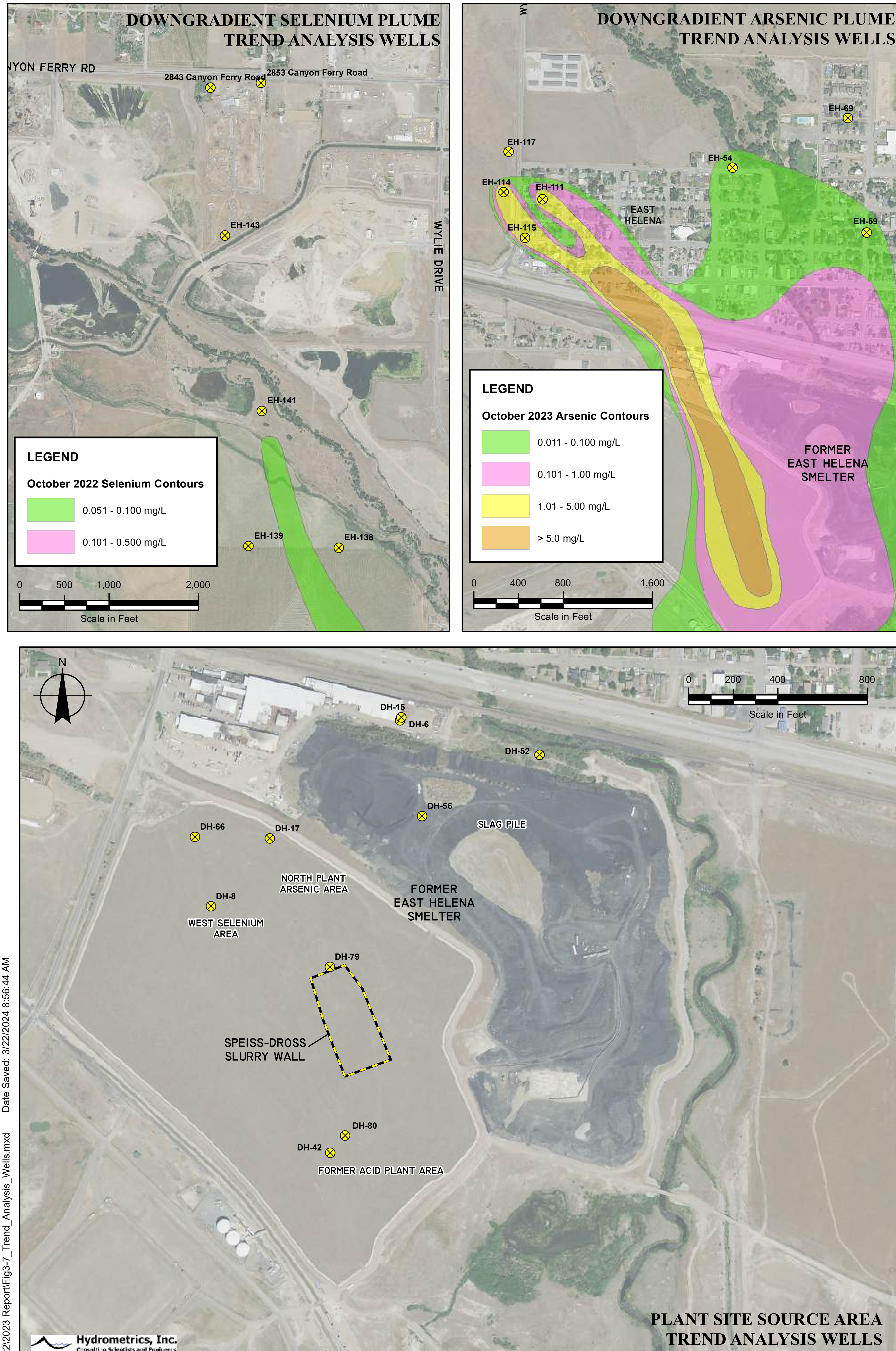
1. RCRA Facility Investigation (RFI) period (2002-October 2011); and
2. RCRA Corrective Measure (CM) implementation period (November 2011-2023).

The complete set of arsenic and selenium trend plots for the trend analysis wells are shown on Figures 3-8 (arsenic trends) and 3-9 (selenium trends), 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 Facility 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 2023 are summarized below. Arsenic and selenium trends and observations are discussed in order from the Facility source areas, through the near downgradient arsenic and selenium plume

Table 3-5. 2023 Concentration Trend Analysis Monitoring Wells

2023 Interim CAPM Report - East Helena Facility

Well	Target Area
DH-42	Acid Plant
DH-80	Acid Plant
DH-17	North Plant Arsenic
DH-79	North Plant Arsenic
DH-6	Slag Pile
DH-15	Slag Pile
DH-52	Slag Pile
DH-56	Slag Pile
DH-66	West Selenium
DH-8	West Selenium
2843 Canyon Ferry Road	Downgradient Selenium Plume
2853 Canyon Ferry Road	Downgradient Selenium Plume
EH-138	Downgradient Selenium Plume
EH-139	Downgradient Selenium Plume
EH-141	Downgradient Selenium Plume
EH-143	Downgradient Selenium Plume
EH-54	Downgradient Arsenic Plume
EH-59	Downgradient Arsenic Plume
EH-69	Downgradient Arsenic Plume
EH-111	Downgradient Arsenic Plume
EH-114	Downgradient Arsenic Plume
EH-115	Downgradient Arsenic Plume
EH-117	Downgradient Arsenic Plume



2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	2023 PERFORMANCE EVALUATION TREND ANALYSIS MONITORING WELLS	FIGURE 3-7

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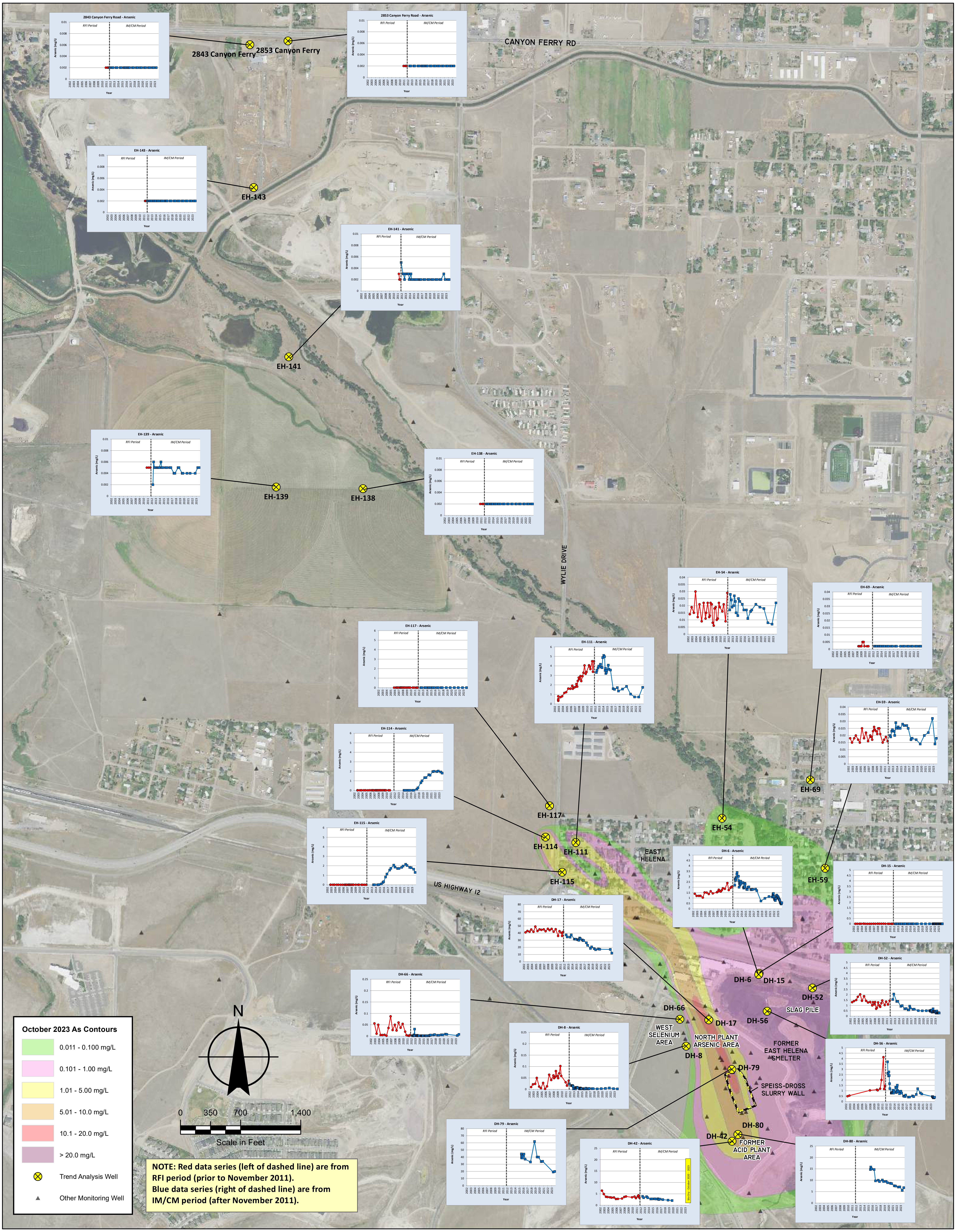

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2023 PERFORMANCE EVALUATION ARSENIC TRENDS

FIGURE 3-8

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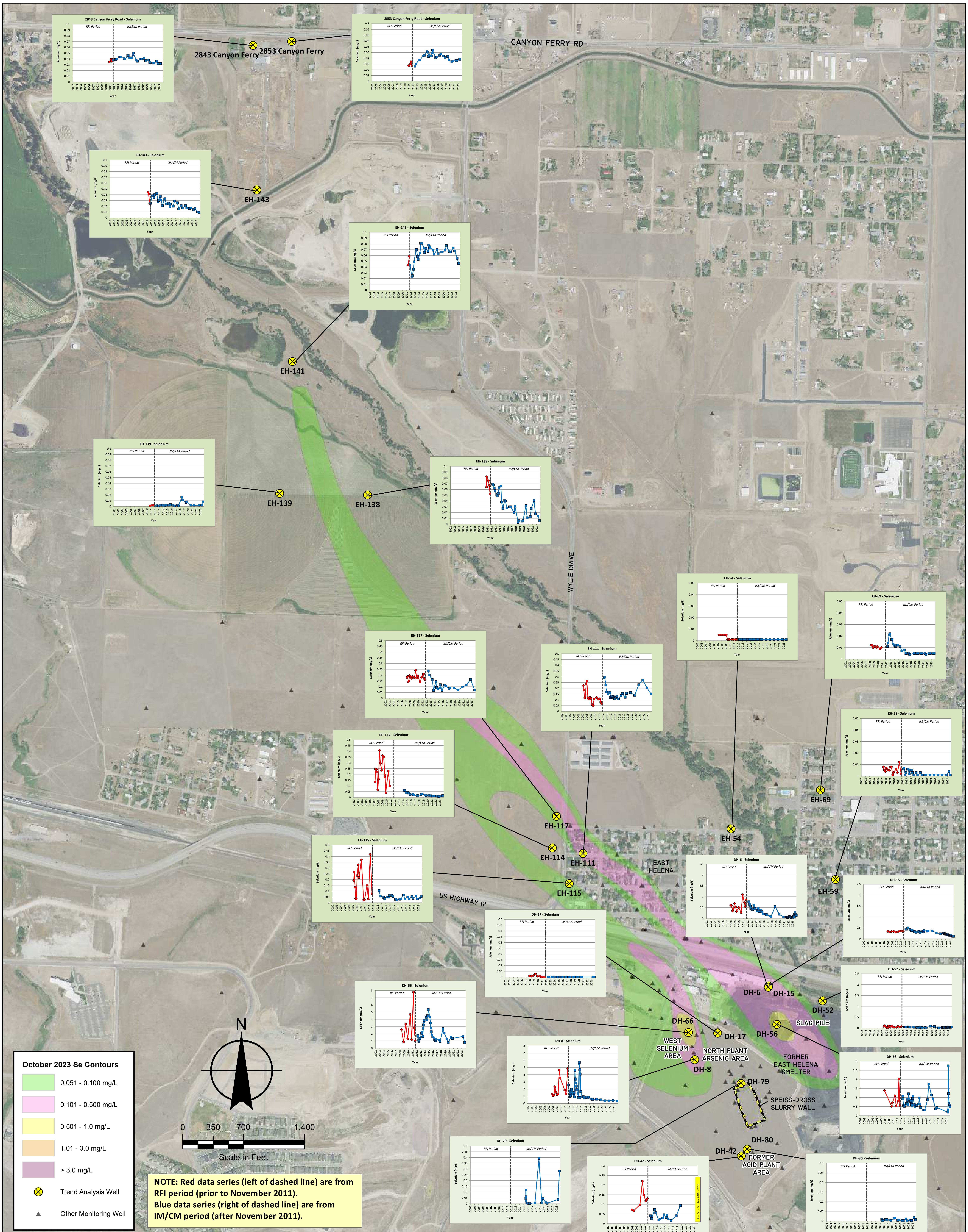

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EAST HELENA FACILITY

2023 PERFORMANCE EVALUATION SELENIUM TRENDS

FIGURE 3-9

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Arsenic Trends

- In the Former Acid Plant area, arsenic concentrations have decreased at well DH-42 during both the 2002 to 2011 RFI phase (after plant shutdown), as well as the subsequent post-2012 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. 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 2023 (5.57 to 6.73 mg/L) (Figure 3-8). Sulfate concentrations have also decreased at well DH-80 concurrently with arsenic (Appendix C).
- Arsenic concentrations at slag pile area wells DH-6, DH-15, DH-52, and DH-56 were either stable or increased during the RFI phase and have decreased during the CM phase (Figure 3-8). For example, the arsenic concentration at DH-6 decreased from a high of 3.38 mg/L in November 2012 to 0.562 mg/L as of December 2023, an 83% reduction. At well DH-52, arsenic has decreased from 2.06 mg/L in September 2012 to 0.288 in December 2023, an 86% reduction. DH-56 arsenic concentrations have decreased from 3.7 to 0.396 mg/L arsenic from 2012 to 2023 (89% reduction). Arsenic concentrations at well DH-15 have been below detection throughout the RFI and CM periods (Figure 3-8).
- Arsenic concentrations in West Selenium source area 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 MCL after 2011 (Figure 3-8). The arsenic concentrations at wells DH-8 and DH-66 ranged from 0.002 to 0.008 mg/L in 2023.
- Both North Plant Arsenic Area wells (DH-17 and DH-79) had sufficient water for sampling in 2023 after several years of dry conditions. Arsenic concentrations at DH-17 decreased to the minimum observed in the post-2011 period in October 2023 at 11.9 mg/L, approximately 25% of the RFI phase concentrations of 40 to 50 mg/L (Figure 3-8). Arsenic concentrations at well DH-79, located immediately north (downgradient) of the Speiss/Dross slurry wall, also decreased in 2023 to the minimum values observed at this well to date (19.0 to 19.8 mg/L). The 2023 concentrations are about one-third of the maximum value of 61.9 mg/L arsenic reported at DH-79 in October 2018.
- Well EH-111, near the leading edge of the primary arsenic plume migrating off-site (with maximum concentrations in the 5 mg/L range), has shown a significant overall decrease from 2015 through 2023 (Figure 3-8). The October 2023 arsenic concentration at EH-111 (1.74 mg/L) is approximately 66% lower than the maximum concentration of 5.1 mg/L in February 2014, although the current concentration is higher than those observed from 2020 through 2022 (0.721 to 1.03 mg/L).

- Water quality trends at wells EH-114 and EH-115 (south and west of EH-111) show evidence of a westward arsenic plume shift during the CM period. Prior to 2011, arsenic concentrations were below detect (Figure 3-8) and selenium, sulfate, and chloride concentrations were highly variable (Figure 3-9 and Appendix C) as these wells received seasonal influxes of water from the West Selenium source area. Since 2016, arsenic concentrations have increased significantly at both wells and selenium concentrations have decreased to near or below the 0.05 mg/L MCL, 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 (elimination of a seasonal influx of oxidizing recharge water), due to the decommissioning of Wilson Ditch in 2012. The increasing arsenic trends at wells EH-114 and EH-115 also contrast with the decreasing arsenic trends in wells to the east, including EH-111 (discussed above) and EH-65 (see trend plots in Appendix D), as the primary arsenic plume has shifted toward EH-114 and EH-115 and away from EH-111 and EH-65. The arsenic concentrations at EH-114 and EH-115 have recently started to decrease after peaking near 2.0 mg/L in 2021 (Figure 3-8); October 2023 arsenic concentrations at these wells were 1.81 mg/L at EH-114 and 1.3 mg/L at EH-115.
- In the eastern, lower concentration portion of the downgradient arsenic plume, October 2023 arsenic concentrations were 0.022 and 0.018 mg/L at EH-54 and EH-59, respectively, and below reporting limits (<0.002 mg/L) at EH-69 (Figure 3-8). The 2023 arsenic concentrations were consistent with previously reported data for these wells.
- Arsenic concentrations in the furthest downgradient trend analysis area (wells EH-138, EH-139, EH-141, EH-143, and 2843 and 2853 Canyon Ferry Road) area are well outside of the arsenic plume emanating from the Facility, and are consistently low, ranging from <0.002 to 0.006 mg/L, less than the 0.01 mg/L MCL, and showing no trends over time (Figure 3-8).

Selenium Trends

- Selenium trends at Former Acid Plant well DH-42 have been variable (Figure 3-9), 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). Selenium concentrations at DH-80 have remained consistently below the 0.05 mg/L MCL, ranging from 0.001 to 0.018 mg/L since the well was installed.
- Selenium concentrations at slag pile wells DH-6 and DH-15 have decreased during the CM period through 2023 apart from temporary increases in 2018 and again in 2023 at DH-6 (Figure 3-9). These temporary increases are believed to be associated at least in part with above average precipitation driving increased infiltration and leaching of selenium from the slag pile. The peak selenium concentration of 1.09 mg/L at DH-6 in October 2010 has decreased to 0.134 mg/L as of December 2023, a decrease of 88%. At DH-15, the peak concentration of 0.50 mg/L (November 2012) has decreased to 0.109 mg/L as of October 2023, or about 78%. The temporary precipitation-driven selenium increases noted for well DH-6 are even more apparent for well DH-56; the selenium concentration at this well

increased rapidly in 2023 to 2.75 mg/L in July 2023, and has subsequently decreased just as rapidly to a value of 0.495 mg/L as of December 2023 (Figure 3-9). Additional discussion of slag pile area water quality related to the UFS project groundwater monitoring program is in Section 3.3.6.

- Selenium concentrations at West Selenium area wells DH-8 and DH-66 were highly variable historically during the RFI period, 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 3-9). Subsequently, selenium concentrations have decreased to a minimum concentration of 0.784 mg/L in October 2023, a decrease of about 90% from the period of record maximum of 7.78 mg/L in September 2011. The October 2023 selenium concentration at source area well DH-8, 0.325 mg/L, is the minimum concentration recorded to date and about 94% lower than the maximum concentration of 5.7 mg/L recorded in July 2014.
- Selenium concentrations remained low at North Plant Arsenic Area well DH-17 in 2023 (0.001 to 0.002 mg/L) while concentrations at DH-79 varied from 0.036 mg/L in June 2023 to 0.282 mg/L in October 2023 (Figure 3-9). The October 2023 increase in DH-79 selenium concentration was similar to that observed in 2018, and is potentially related to the higher precipitation and short-term water level increases in the North Plant Site arsenic area in 2018 and 2023 (see well DH-17 hydrograph on Figure 3-5).
- The selenium concentration range at EH-111 in the RFI period (0.050 to 0.263 mg/L) is 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, followed by a decrease through 2023 (Figure 3-9). A similar selenium trend is also observed 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.
- As noted above, selenium concentrations have decreased to near or below the 0.05 mg/L MCL at EH-114 and EH-115, concurrent with an arsenic concentration increase (Figures 3-8 and 3-9). The arsenic and selenium trends at EH-114, EH-115, EH-111, and EH-65 (Appendix D) all indicate westward shifting of the arsenic and selenium plumes, with arsenic concentrations increasing at EH-114 and EH-115 and decreasing at EH-111 and EH-65, and selenium concentrations showing inverse trends to arsenic.

- Selenium concentrations at EH-59 and EH-69 in the eastern part of East Helena have both decreased during the CM period while groundwater quality at EH-54 has remained relatively consistent (Figure 3-9), with 2023 selenium concentrations at all three wells in the <0.001 to 0.005 mg/L range.
- At well EH-139 on the west side of the downgradient selenium plume, typical selenium concentrations are low, in the <0.001 to 0.003 mg/L range. Slight increases to 0.011 to 0.016 mg/L in 2018, then again to 0.008 mg/L in 2023 (Figure 3-9) may be attributed to a westward plume shift that is more pronounced during wetter years, when leakage from Prickly Pear Creek can shift flow directions to the west.
- At well EH-138, located along the east side of the selenium plume between the plume boundary and East Helena municipal well #3, selenium has decreased from a range of 0.052 to 0.082 mg/L in 2010-2011 (immediately after well installation), to a range of 0.006 to 0.014 mg/L in 2023. Selenium concentrations decreased consistently at EH-138 from 2012 through 2018, but have since shown seasonally variable and relatively abrupt increases and decreases in concentration (Figure 3-9). These trends 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 June 2023 selenium concentration at 2843 Canyon Ferry Road (0.032 mg/L) equaled the lowest recorded to date at this well, and the June 2023 selenium concentration at 2853 Canyon Ferry Road of 0.038 mg/L represents a decrease of about 30% from the 2016 maximum of 0.054 mg/L. At EH-141, the October 2023 selenium concentration of 0.046 mg/L decreased below the 0.05 mg/L groundwater standard for the first time since 2012, and represents a 43% decrease overall from the maximum selenium concentration of 0.081 mg/L reported at this well in 2014.

Wells 2843 and 2853 Canyon Ferry Road are former private water supply wells that have been incorporated into the East Helena project monitoring program. These wells have historically defined the furthest downgradient occurrence of selenium concentrations above the 0.05 mg/L MCL. When the wells were still in service and being pumped regularly, samples were collected from hose attachments or hydrants; after the wells were taken out of service, a pump contractor was retained to install a submersible pump capable of purging large volumes (400+ gallons) at high rates to provide adequate purge volumes since the wells were not completed as monitoring wells, but as water supply wells with typical slotted steel casing completion. In June 2023, these two wells were sampled using the pump contractor and a high volume purge. In October 2023, 2-inch PVC well screen and blank casing were installed manually in both wells, in an attempt to retrofit the wells for sampling using the Waterra low-flow/low-volume method being used as the routine method for monitoring well sampling. The wells were purged and sampled using the Waterra system in October 2023; however, geochemical anomalies in the October 2023 samples compared with previous samples collected using high purge rates and volumes (including June 2023) indicate that the Waterra method did not provide representative samples. The following table compares the June and October 2023 samples collected at the 2843 and 2853 Canyon Ferry Road wells:

	2843 Canyon Ferry	AEH-2310-200			**2853 Canyon Ferry**	AEH-2310-201
	Jun-23	Oct-23			Jun-23	Oct-23
Purge Method	H&L Pump	Waterra		Purge Method	H&L Pump	Waterra
Volume	400+ gal	~3 gal		Volume	400+ gal	~5 gal
pH	**7.4**	**9.3**		pH	7.4	8.0
SC	**567**	**259**		SC	609	419
DO	**5.46**	**0.56**		**DO**	**4.89**	**0.41**
ORP	**-8**	**-180**		**ORP**	**34**	**-144**
TDS	357	153		TDS	399	284
Alk	130	47		Alk	130	80
HCO3	**150**	**44**		**HCO3**	**150**	**97**
Cl	14	14		Cl	15	15
SO4	**140**	**53**		**SO4**	**157**	**111**
Br	0.45	0.49		Br	0.54	0.61
Ca	**66**	**9**		**Ca**	**72**	**38**
Mg	**15**	**6**		Mg	15	14
Na	28	30		Na	27	31
K	4	4		K	4	4
Se	**0.032**	**0.001**		**Se**	**0.038**	**0.011**

The magnitude of geochemical variation shown in these sets of samples from June to October 2023 is much greater than probable from seasonal or remediation-driven factors, particularly for those constituents shown in bold font in the comparison table. The data comparison suggests the following:

- Localized reducing conditions at these former water supply wells, possibly related to aging of the steel well casing, are indicated by the lower volume samples obtained in October 2023, based on the significant decreases in dissolved oxygen and ORP from June to October. Higher purge volumes draw in more oxidized water representative of overall aquifer conditions.
- Large decreases in bicarbonate, calcium, and sulfate concentrations from June to October and geochemical saturation calculations indicate that calcite was near saturation in the June samples and slightly oversaturated in the October samples, implying potential calcite precipitation occurring in October, as well as possible sulfate reduction to sulfide.
- Concentrations changes in some major ions (decreases in calcium, sulfate, bicarbonate) but not others (chloride, bromide, sodium) suggest that dilution is not responsible for the observed changes between June and October, but that a chemical reaction is occurring.
- The combination of localized reducing conditions and calcite/sulfide precipitation could both act to artificially reduce selenium concentrations, as selenium is less mobile under reducing conditions and can also coprecipitate with calcite.

Based on this analysis and the highly anomalous geochemistry of the October 2023 samples from 2843 and 2853 Canyon Ferry Road compared with previous sampling, the data review process concluded that the October 2023 samples were not representative, and the results have therefore not been included in the East Helena database. Future sampling at these wells should again be conducted using the high-volume purge method rather than the Waterra method. Collection of samples during the beginning, middle, and end of the purging process is also recommended to further evaluate the apparent changes in geochemistry with increasing purge volume.

Overall, visual review of the arsenic and selenium concentration trends shown on Figures 3-8 and 3-9 show predominantly decreasing COC trends at most source area wells and a mixture of 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 Facility, given the overall decreases in saturated thickness and contaminant concentrations. Based on these trends and the 2023 monitoring results at wells along the downgradient end of the selenium plume, the extent of the selenium plume defined by the 2023 data has receded by approximately 4,000 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:

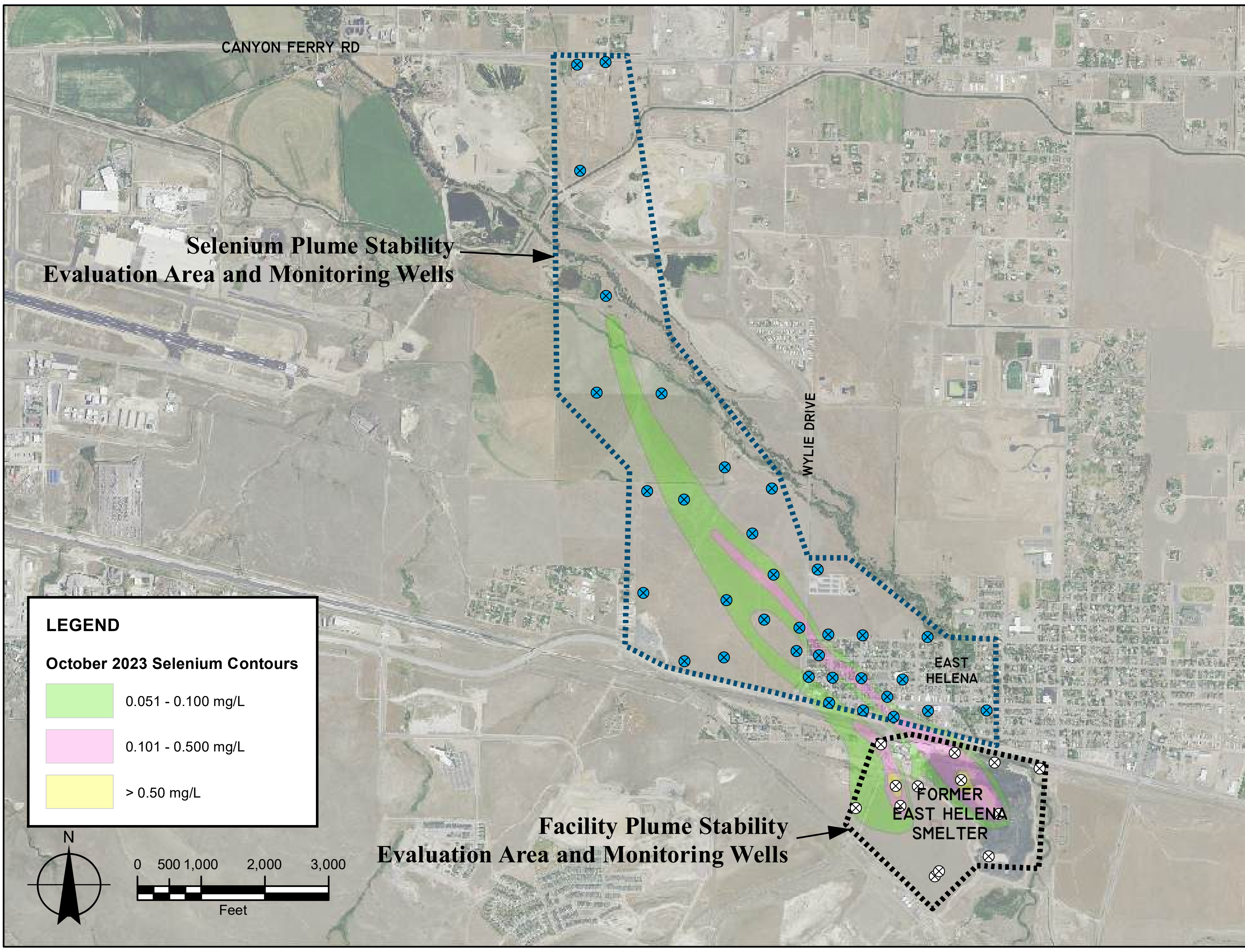
1. Define the areas for which plume characteristics will be calculated. As in previous years, for the purposes of performance evaluation monitoring described in the 2023 CAPMP, arsenic and selenium plume areas on the former operating areas of the Facility ("Facility plume stability"), and in the downgradient plume areas in the COEH, Lamping Field, and north to Canyon Ferry Road were selected, to allow integration of results from multiple monitoring points into a single calculated measure of plume characteristics. The arsenic and selenium

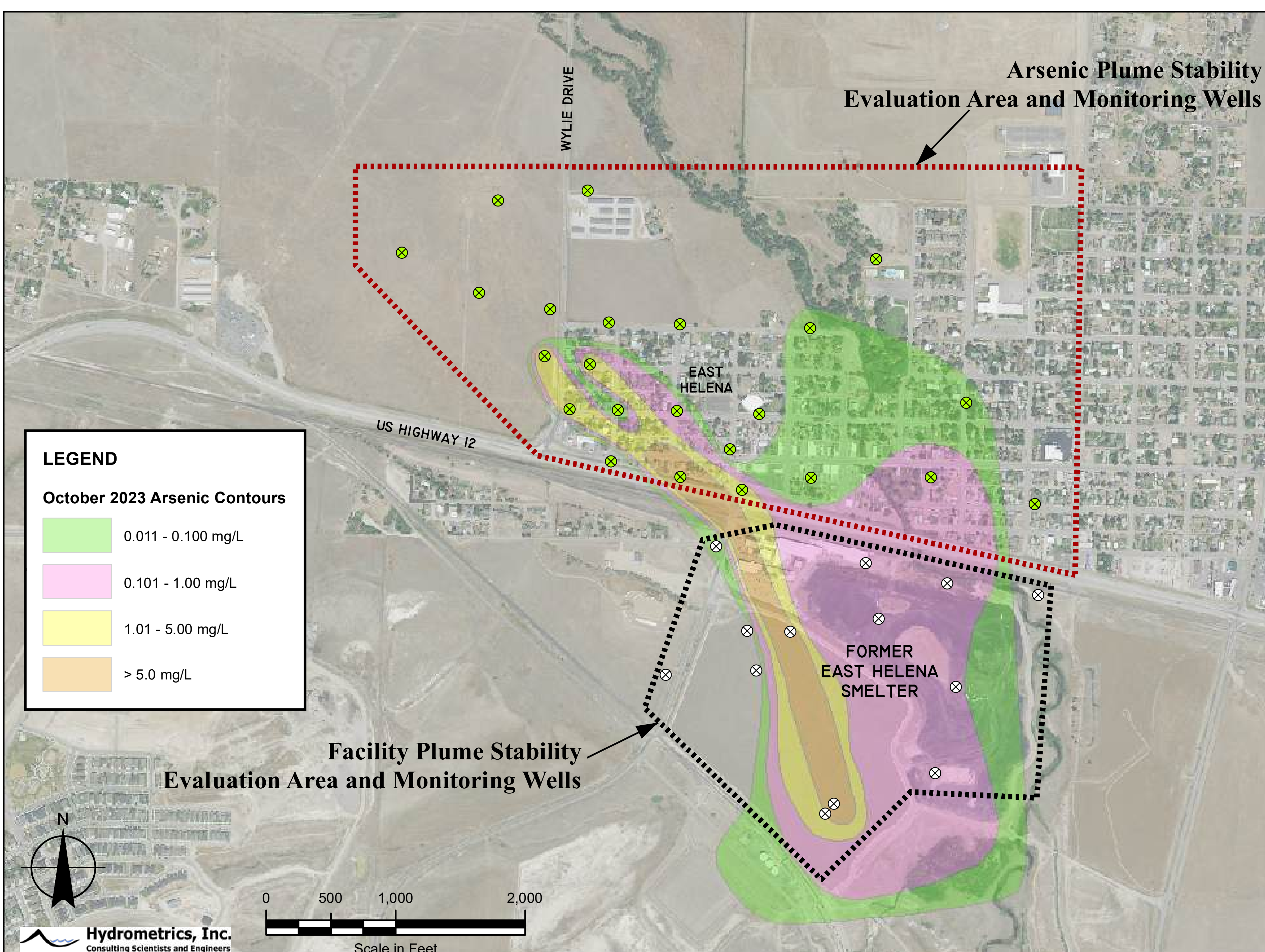
plume stability evaluation areas are shown on Figure 3-10. Separate plume stability calculations are performed for selenium and arsenic in the Facility area and in the downgradient plume areas, to independently evaluate the plume characteristic responses to CMs in the Facility source areas and the downgradient migration areas.

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 can be 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.

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 2022 Water Resources Monitoring (WRM) Report (Hydrometrics, 2023b), about 30% the wells used to derive the Facility plume stability metrics were dry in 2021 and 2022 (including many in the highest concentration arsenic and selenium areas), precluding calculation of updated metrics for these years. With the wetter conditions and associated increases in groundwater levels, most of these wells again had sufficient water for sampling in 2023; therefore, Facility plume stability calculations were conducted again for 2023, with the results presented in Section 3.3.3.3.





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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	2023 PLUME STABILITY EVALUATION AREAS AND MONITORING WELLS	FIGURE 3-10

Table 3-6. 2023 Plume Stability Analysis Monitoring Wells

2023 Interim CAPM Report - East Helena Facility

Arsenic Plume Stability Analysis Wells

Well/Well Set*
EH-104
EH-106
EH-110
EH-111
EH-114
EH-115
EH-117
EH-119
EH-120
EH-124
EH-50/100
EH-51/101
EH-52/102
EH-53
EH-54
EH-57A
EH-58
EH-59
EH-60/61/103
EH-62
EH-63
EH-65/107
EH-66/121
EH-69

Selenium Plume Stability Analysis Wells

Well/Well Set*
EH-104
EH-106
EH-110
EH-111
EH-114
EH-115
EH-117
EH-119
EH-120
EH-123
EH-124
EH-126
EH-129/134
EH-132
EH-135
EH-206
EH-50/100
EH-51/101
EH-52/102
EH-53
EH-54
EH-57A
EH-60/61/103
EH-62
EH-63
EH-65/107
EH-66/121
EH-70/125
EH-130
EH-135
EH-138
EH-139
EH-141
EH-143
2843 Canyon Ferry
2853 Canyon Ferry

Facility Plume Stability Analysis Wells

Well/Well Set*
DH-6/15
DH-7**
DH-8
DH-17
DH-42
DH-52
DH-55
DH-56
DH-66
DH-67
DH-69
EH-204

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.

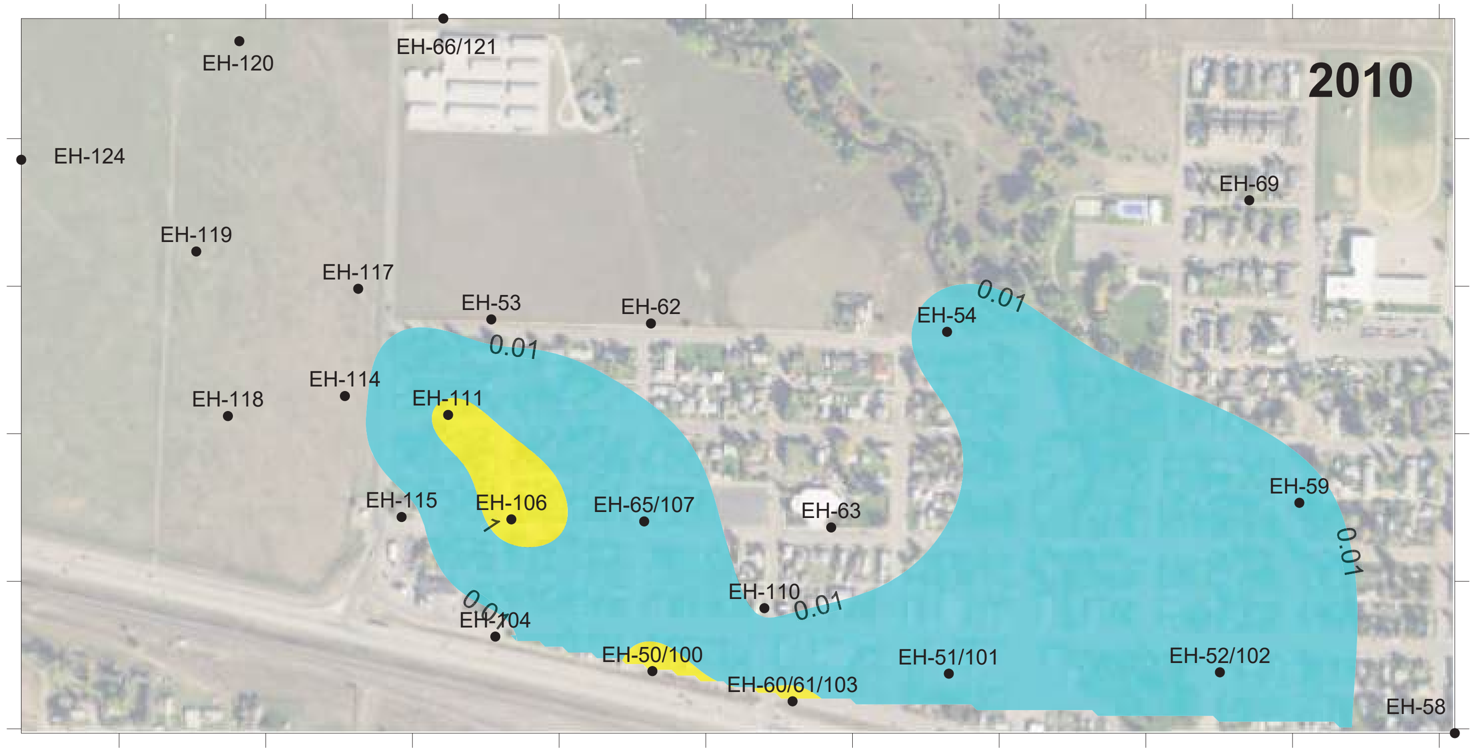
3.3.3.1 Downgradient Arsenic Plume Stability Results

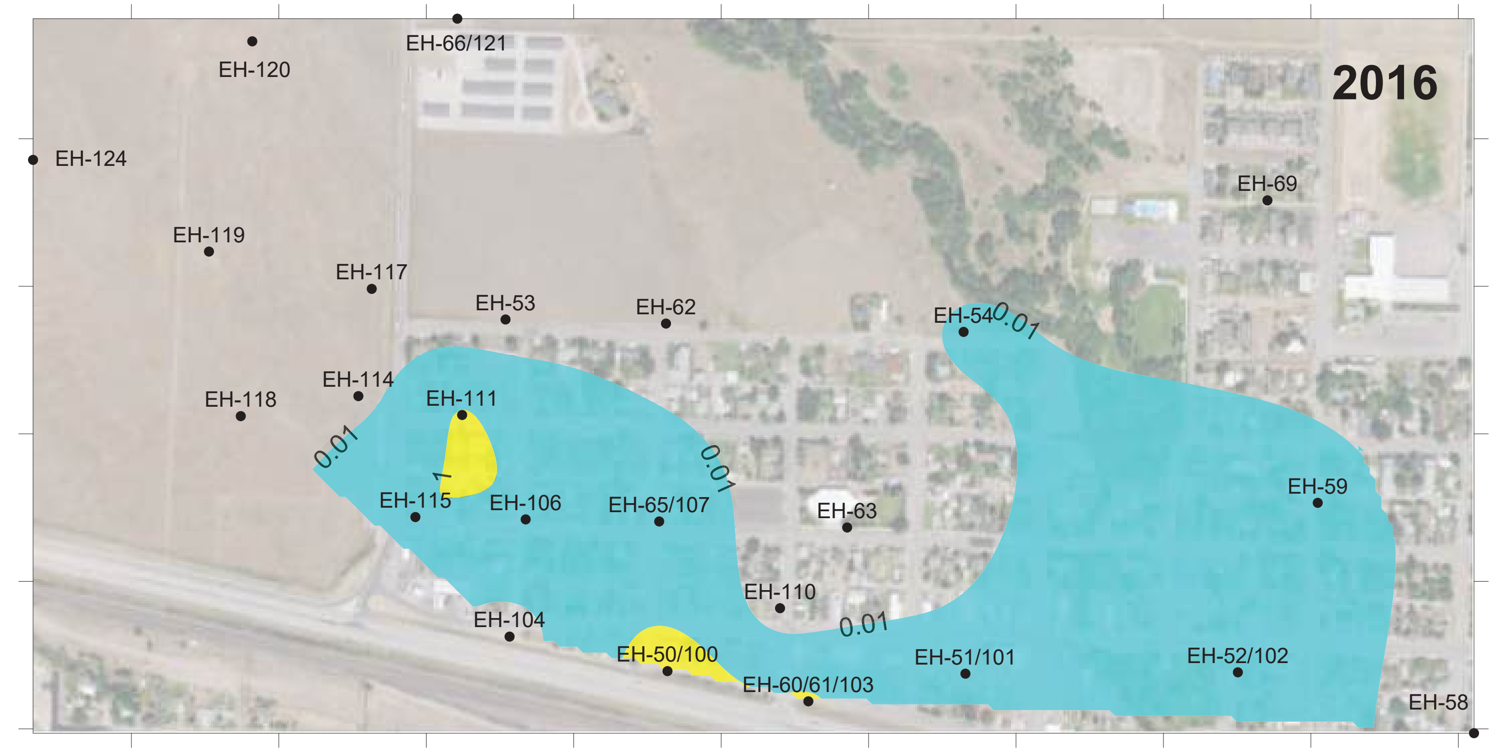
Arsenic plume stability analysis results for the area downgradient of the Facility are summarized on Figure 3-11, including tabulated results for 2010 (representing conditions prior to implementation of CMs), 2016 (following completion of all CMs except for the slag pile cap), and 2021 through 2023. Software-generated arsenic contours are shown for 2010, 2016, and 2023. The overall plume area with arsenic concentrations above the 0.01 mg/L groundwater standard has remained virtually unchanged from 2010 to 2016 to 2023 (66, 64, and 65 acres, respectively). Average arsenic concentrations within the 0.01 mg/L contour have declined overall from 0.203 mg/L in 2010 to a range of 0.167 to 0.188 mg/L during subsequent years. The locations of the calculated plume centroids show a distinctive westward shift from 2010 through 2023 (Figure 3-11). This shift is responsible for 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 further to the east such as EH-111, EH-65, EH-100, and EH-60 (see trend plots in Appendix D).

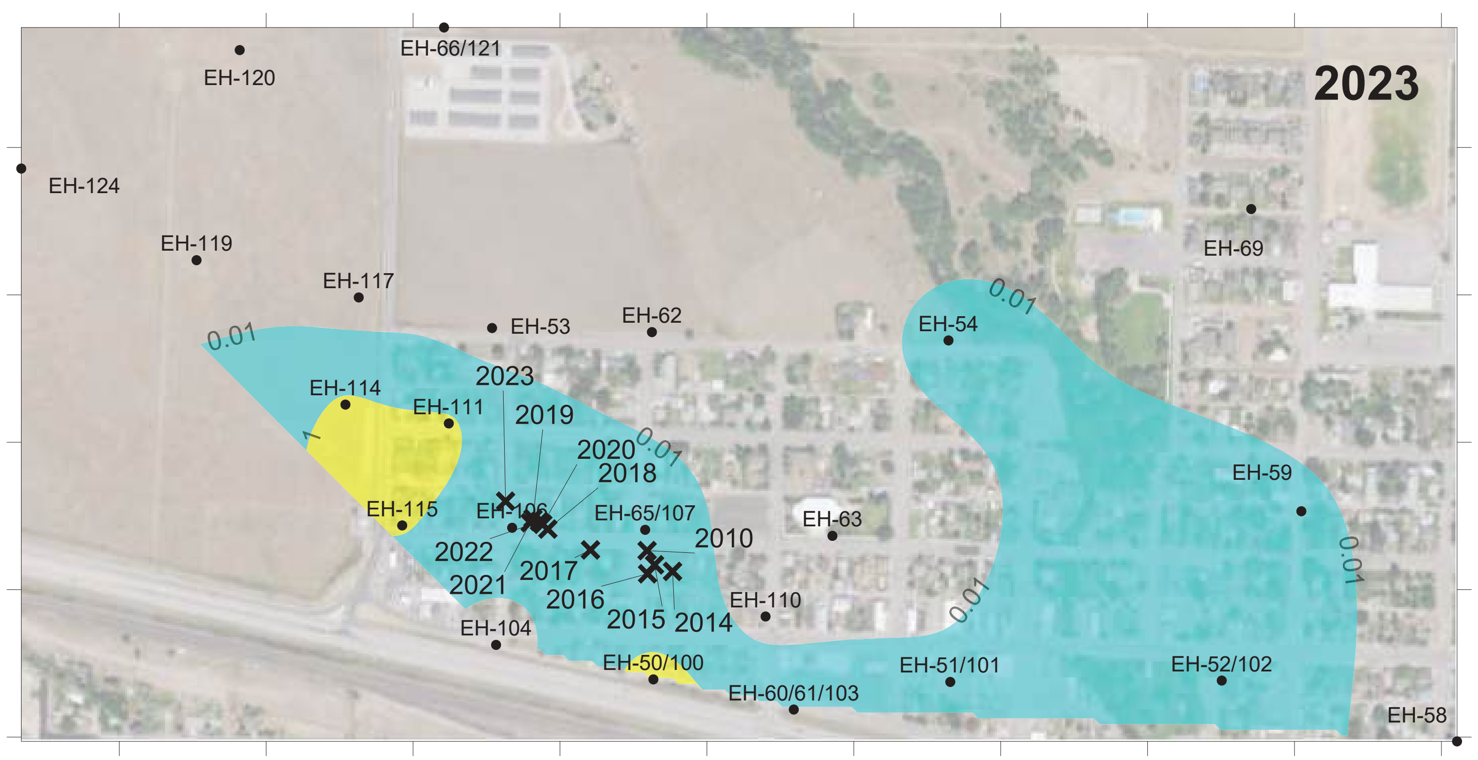
The arsenic plume stability metrics suggest that the arsenic plume is relatively stable with a slight westward shift in the plume centroid over time attributable to the decommissioning of Wilson Ditch and associated loss of a recharge source west of the plumes (Section 3.3.2.1). The stability in downgradient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

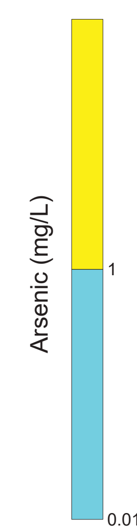
3.3.3.2 Downgradient Selenium Plume Stability Results

Off-site selenium plume metrics including the area from Highway 12 north to Canyon Ferry Road have been calculated for 2010-2011, 2016, and 2021 through 2023, based on data availability for wells within this area, with the selenium plume stability analysis results summarized on Figure 3-12. The overall Surfer-calculated plume area with selenium concentrations above the 0.05 mg/L groundwater standard increased from 2010-2011 (75 acres) to 2016 (125 acres), along with the average concentration within the plume area (0.111 mg/L in 2010-2011 and 0.126 mg/L in 2016). This increase is likely attributable to the consistent increase in selenium concentrations at upgradient West Selenium source area well DH-66 from 2013 through 2015, believed to be attributable to remediation construction activities in the area at that time (see Figure 3-9). Since 2016, however, significant









Year	Arsenic Plume Area Exceeding 0.01 mg/L (acres)	Average Arsenic Concentration Within 0.01 mg/L Contour (mg/L)
2010	66	0.203
2016	64	0.167
2021	57	0.186
2022	59	0.172
2023	**65**	**0.188**

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

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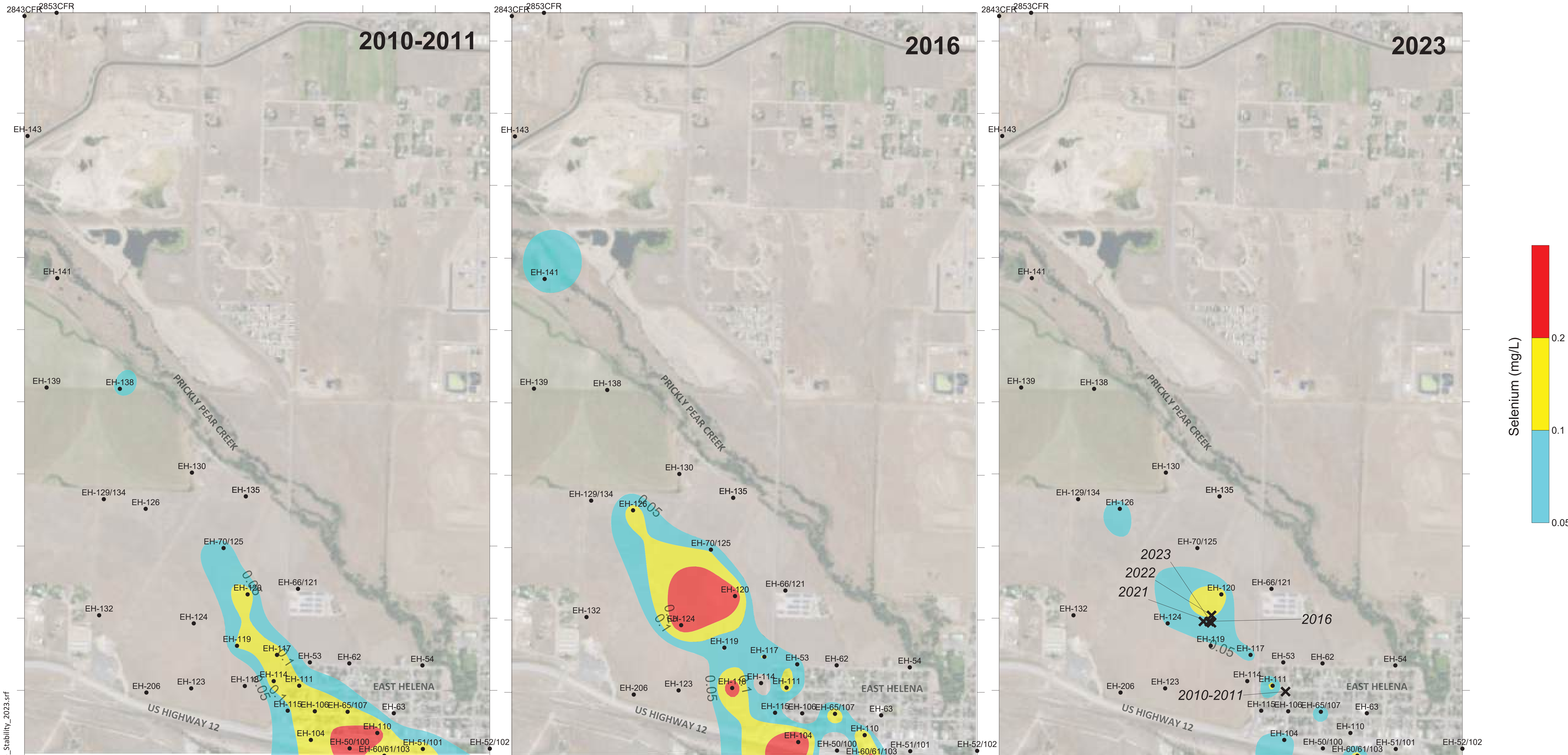
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME STABILITY EVALUATION RESULTS	FIGURE 3-11



Year	Selenium Plume Area Exceeding 0.05 mg/L (acres)	Average Selenium Concentration Within 0.05 mg/L Contour (mg/L)
2010-2011	75	0.111
2016	125	0.126
2021	76	0.079
2022	50	0.074
2023	**34**	**0.073**

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

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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT SELENIUM PLUME STABILITY EVALUATION RESULTS	FIGURE 3-12

selenium concentration decreases have been observed in the upgradient West Selenium source area, and the downgradient selenium plume area above 0.05 mg/L and the average concentration within the 0.05 mg/L plume contour have also consistently decreased, with calculated values of 34 acres and 0.073 mg/L in 2023. The 2023 calculated plume metrics represent decreases of about 70% in plume area and about 40% in average plume concentration from the 2016 values. The plume centroid location for selenium moved downgradient from 2010-2011 to 2016, and has since remained stable through 2023.

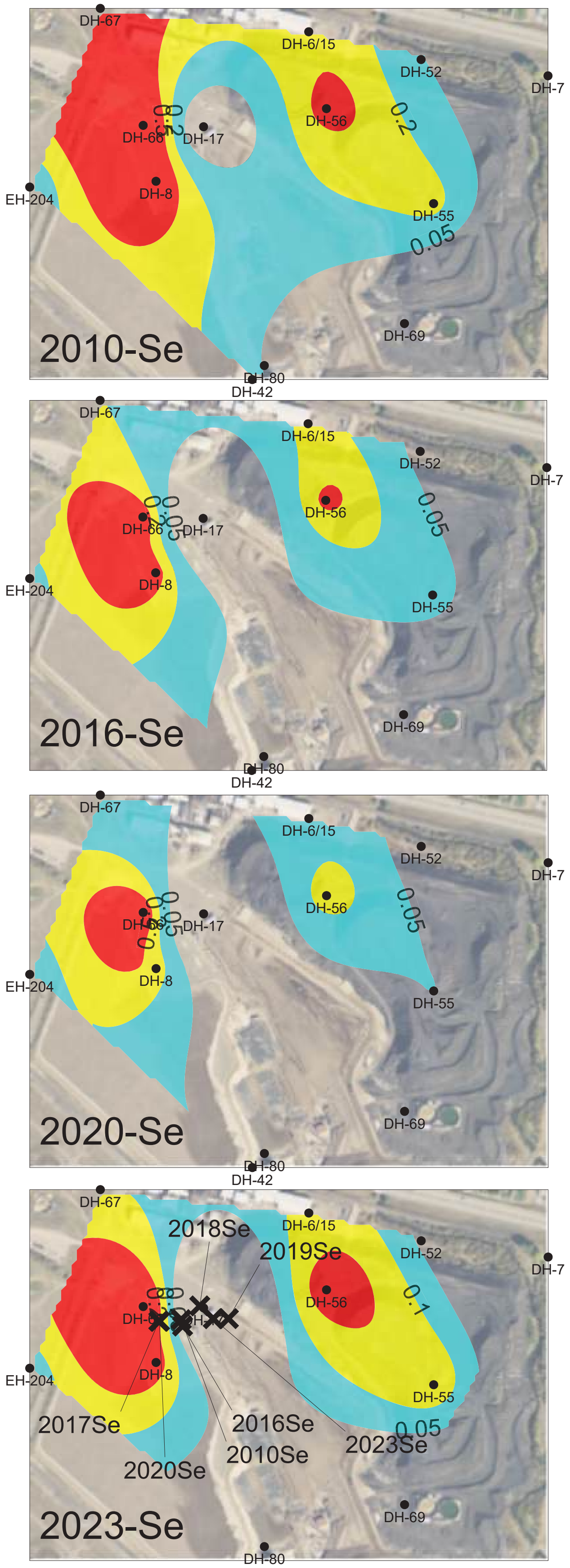
Also shown in Figure 3-12 is an apparent fragmentation of the plume between the Facility and Lamping Field, based on software-generated contours. While the software-generated contours on Figure 3-12 likely understate the overall true area of the plume (i.e., by not connecting the "islands" of 0.05 mg/L exceedances), they do accurately reflect the decreasing selenium concentrations since 2016 in the southern portion of the plume stability area and the associated plume contraction, also visible on the hand-drawn plume maps shown on Figure 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 4,000 feet from 2016 to 2023 (Section 3.3.2.2) and the decrease in average plume selenium concentration over the same period indicate a receding plume.

3.3.3.3 Facility Arsenic and Selenium Plume Stability Results

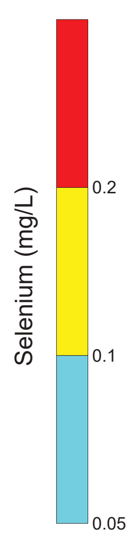
Figure 3-13 summarizes calculated 2023 Facility plume stability metrics for both selenium and arsenic, along with results of 2010, 2016, and 2020. As described previously, about 30% of the wells used to calculate Facility plume stability metrics were dry in both 2021 and 2022 due to water level decreases driven by the SPHC CM and local precipitation and recharge patterns, therefore, updated plume stability metrics were not calculated for those years.

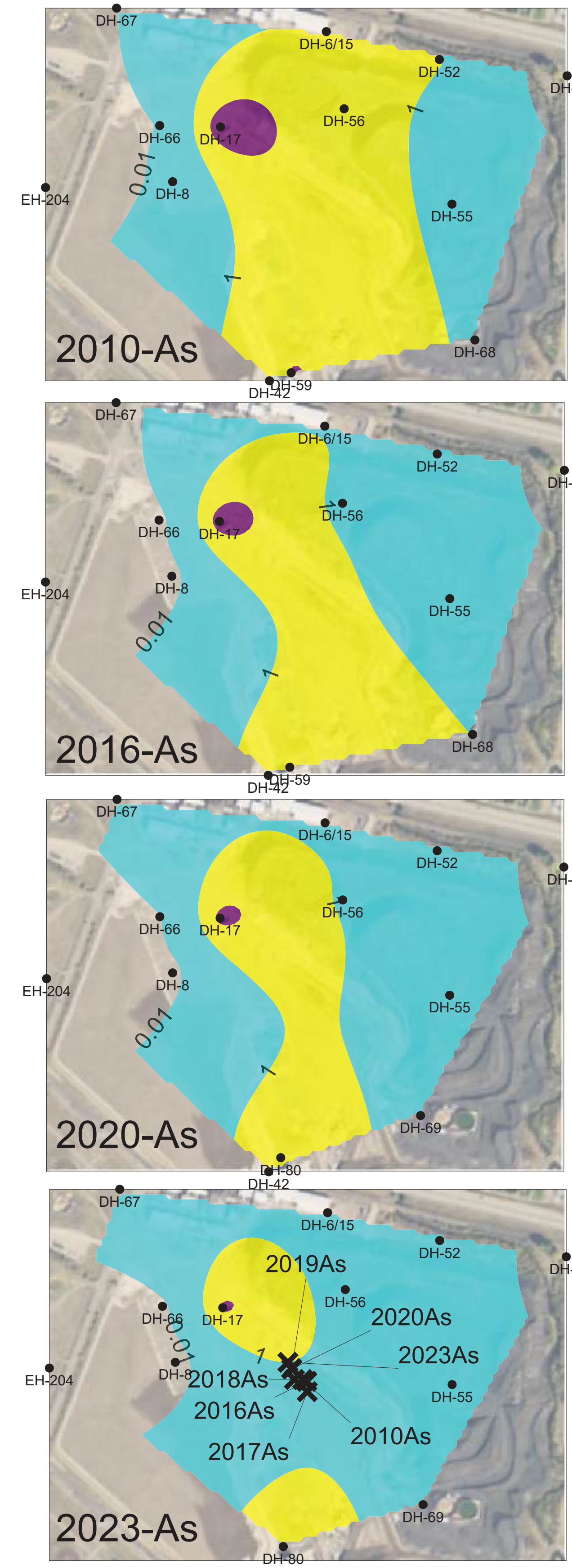
Plume stability results have shown a 2010 to 2023 reduction in overall selenium plume area from 67 to 46 acres, and a reduction in the arsenic plume area of 82 to 69 acres. Average concentrations have decreased by approximately 60% for selenium (from 0.451 to 0.177 mg/L), and 70% for arsenic (from 2.25 to 0.68 mg/L) from 2010 to 2023. These trends reflect the generally decreasing concentration trends for arsenic and selenium observed in most Facility source areas (Section 3.3.2.2, Appendices C and D). The locations of the calculated arsenic plume centroids were virtually unchanged from 2010 to 2023, while the selenium plume centroid showed an eastward shift in 2018-2019, a shift back to the west in 2020, and another shift to the east in 2023. The slight eastward shifts in the selenium plume centroid during certain years are due to a greater relative influence from the slag pile source area as the West Selenium source area concentrations continue to decrease. The slag pile is scheduled to be regraded and partially capped to address this ongoing source.

As evidenced by the high number of dry Facility 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 about 40 to 60% on the Facility, resulting in decreased mass flux of arsenic and selenium migrating

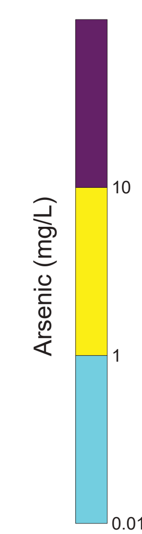


Year	Selenium Plume Area Exceeding 0.05 mg/L (acres)	Average Selenium Concentration Within 0.05 mg/L Contour (mg/L)
2010	67	0.451
2016	48	0.270
2020	33	0.220
2021-2022	NC*	NC*
2023	**46**	**0.177**





Year	Arsenic Plume Area Exceeding 0.01 mg/L (acres)	Average Arsenic Concentration Within 0.01 mg/L Contour (mg/L)
2010	82	2.25
2016	77	1.29
2020	72	1.04
2021-2022	NC*	NC*
2023	**69**	**0.68**



***NC = not calculated in 2021 - 2022 due to dry conditions in >30% of wells in plant site stability well set**

Software-generated contours are shown on each plot

X = calculated plume centroid for given year

Plume stability metrics calculated using method of Ricker (2008)

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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

FACILITY PLUME STABILITY EVALUATION RESULTS

FIGURE

3-13

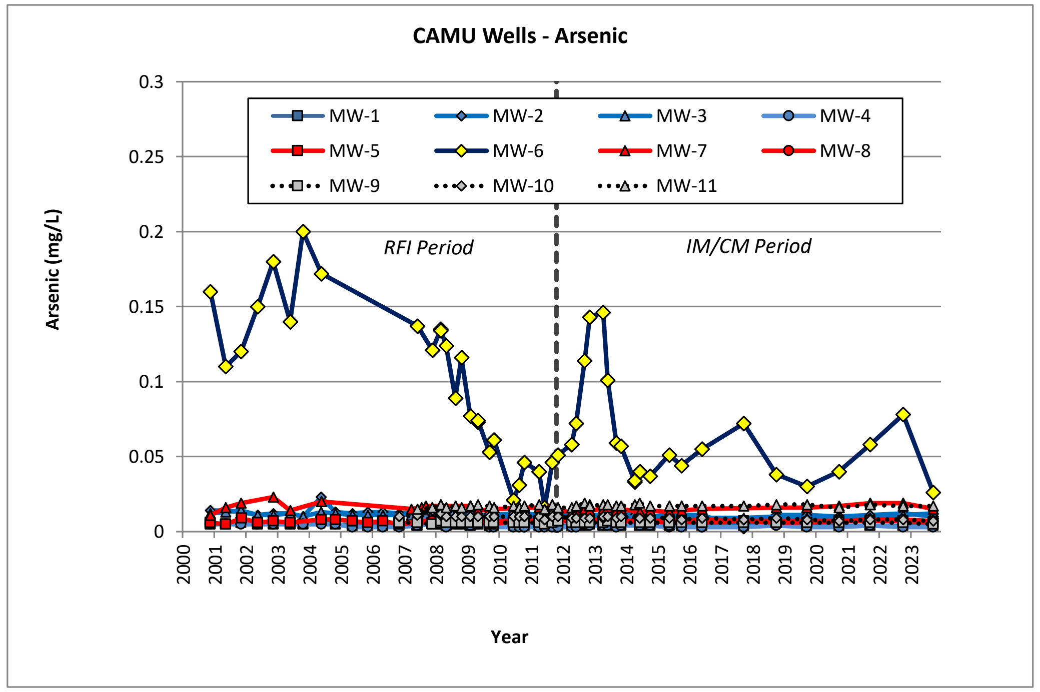
off-site. In time, the decreasing source area concentration trends and declining water levels should lead to further decreases in the downgradient arsenic and selenium plume concentrations and extents, although that process is expected to take much longer for arsenic than for selenium due to the greater attenuation affinity and slower migration rate for arsenic.

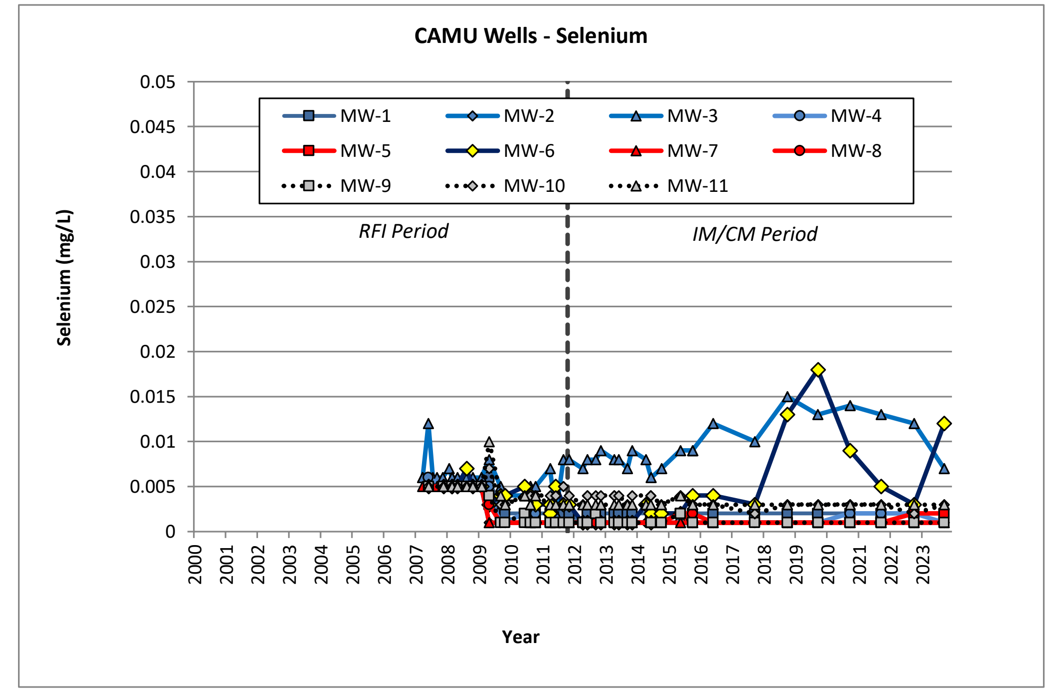
3.3.4 CAMU Area Monitoring Results

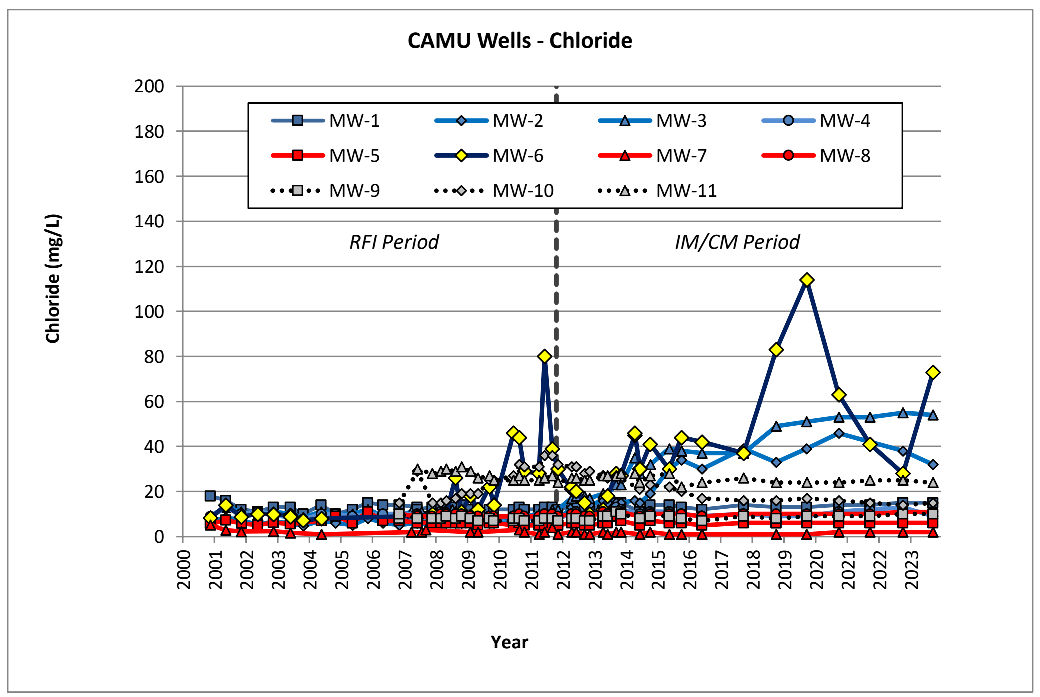
An additional objective of the 2023 performance monitoring program is to continue to evaluate groundwater quality in the vicinity of the two RCRA landfills, the CAMUs, located immediately southwest of the Facility (Figure 1-1). The CAMU groundwater monitoring network includes 11 monitoring wells ranging from 40 to 72 feet deep. All 11 wells were sampled in October 2023 to document current groundwater quality. Trend plots for arsenic, selenium, chloride, and sulfate at the CAMU wells through October 2023 are shown on Figure 3-14.

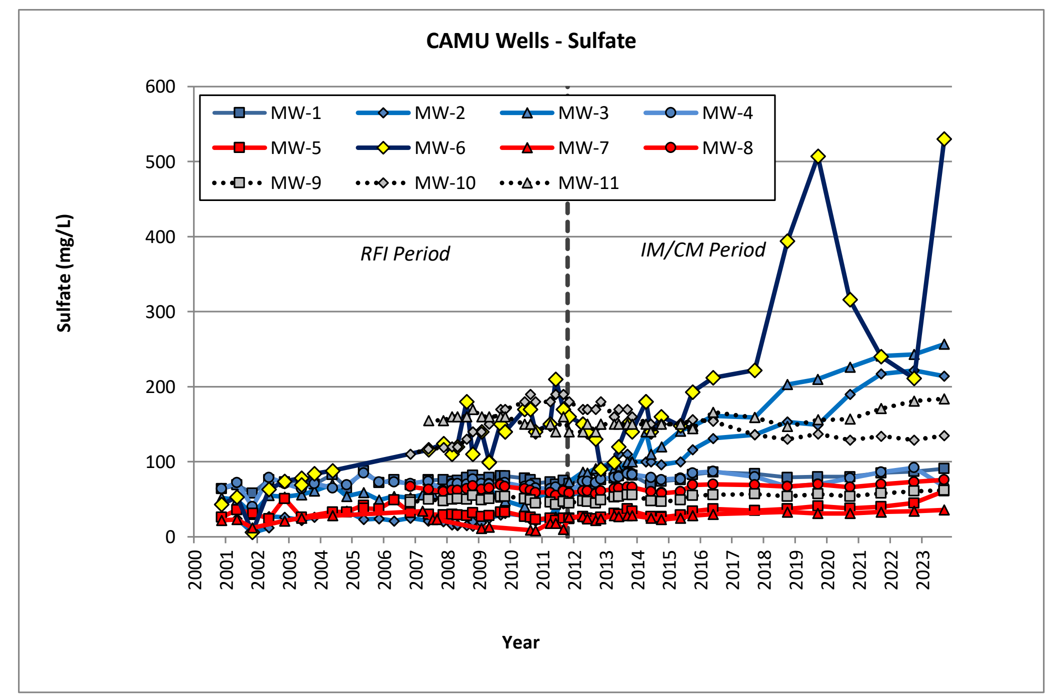
Overall, the 2023 CAMU monitoring results are consistent with previous monitoring results. For example, arsenic concentrations at all CAMU wells except well MW-6 ranged from 0.003 to 0.017 mg/L in 2023 (compared with the groundwater MCL of 0.01 mg/L). These results are consistent with previous observations (see Figure 3-14) and attributable to naturally occurring groundwater arsenic derived from the Tertiary volcanoclastic sediments in this area. Arsenic at well MW-6 (0.026 mg/L in October 2023) was higher in concentration than other CAMU wells, but substantially lower than in October 2022 (0.078 mg/L). Arsenic concentrations at well MW-6 have been higher than other wells since the beginning of the monitoring record (Figure 3-14), suggesting some Facility influence on groundwater quality. Selenium concentrations at all CAMU monitoring wells were well below the 0.05 mg/L MCL in October 2023, ranging from <0.001 to 0.012 mg/L. Selenium concentrations at wells MW-3 and MW-6 increased in 2015-2019, but have declined overall in the last several years. Selenium concentrations at MW-6 peaked at 0.018 mg/L in 2019, decreased to 0.003 mg/L in 2022, and increased again in 2023 to 0.012 mg/L. At MW-3, selenium peaked in 2018 at 0.015 mg/L and was reported at 0.007 mg/L in October 2023.

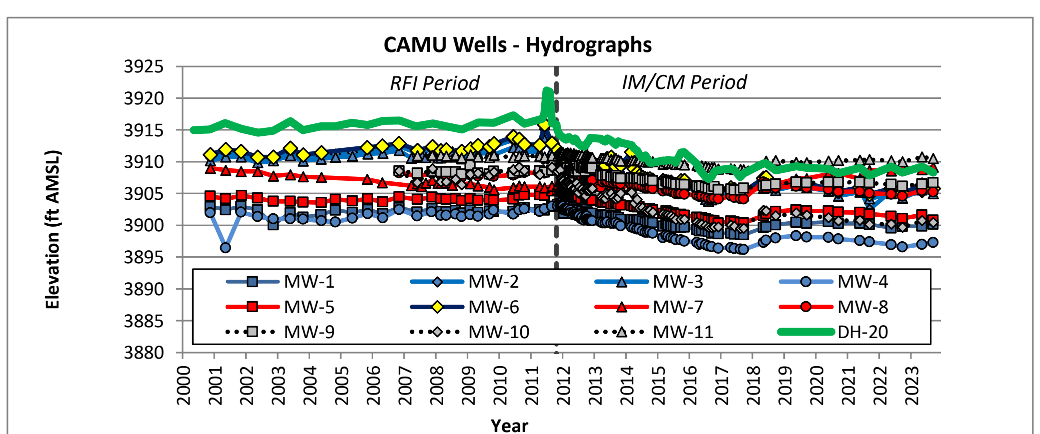
As shown on Figure 3-14, arsenic and selenium concentrations have shown inverse trends at well MW-6 over the last five years, with higher arsenic concentrations associated with lower selenium concentrations, and vice versa. Since arsenic is more mobile under lower redox conditions, and selenium is more mobile under oxidizing conditions, these trends could reflect variations in groundwater redox status. Changes in groundwater concentrations of manganese, another redox sensitive constituent, appear to support this hypothesis. Occurrences of higher arsenic concentrations at MW-6 (e.g., 0.078 mg/L in 2022) have been associated with higher manganese concentrations as well (2.68 mg/L in 2022); both these constituents are more mobile under low redox conditions. In contrast, occurrences of higher selenium concentrations (e.g., 0.018 mg/L in 2019 and 0.012 mg/L in 2023) have been associated with lower manganese concentrations (0.70 mg/L in 2019 and 0.04 mg/L in 2023), and selenium is more mobile and manganese less mobile under oxidizing conditions.











*Well locations shown on Exhibit 1

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

Hydrometrics, Inc.

2023 INTERIM CORRECTIVE MEASURES PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	CAMU AREA GROUNDWATER QUALITY AND WATER LEVEL TRENDS	FIGURE 3-14

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All other metals were near or less than analytical detection limits in all 2023 CAMU well samples, including parameters that have been documented at elevated concentrations in Facility soils and/or groundwater. All 2023 CAMU well results were below detection limits for antimony, cadmium, 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 Facility groundwater and fluctuating annual precipitation and recharge conditions.

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 CAPMP 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 annual monitoring 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 Facility 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 2023 Interim CAPMP 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.

Zinc

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 of acidic water 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. The 2023 data in Appendix A show elevated zinc concentrations above the 2.0 mg/L groundwater HHS at three monitoring wells (DH-17, DH-80, and SDMW-5), and lower concentrations from 0.13 to 0.62 mg/L at wells DH-55, DH-66, DH-69, EH-100, PRB-2, and PBTW-2; all of the remaining 2023 groundwater samples from both on and off-site monitoring wells and residential wells had zinc concentrations from <0.01 to 0.05 mg/L.

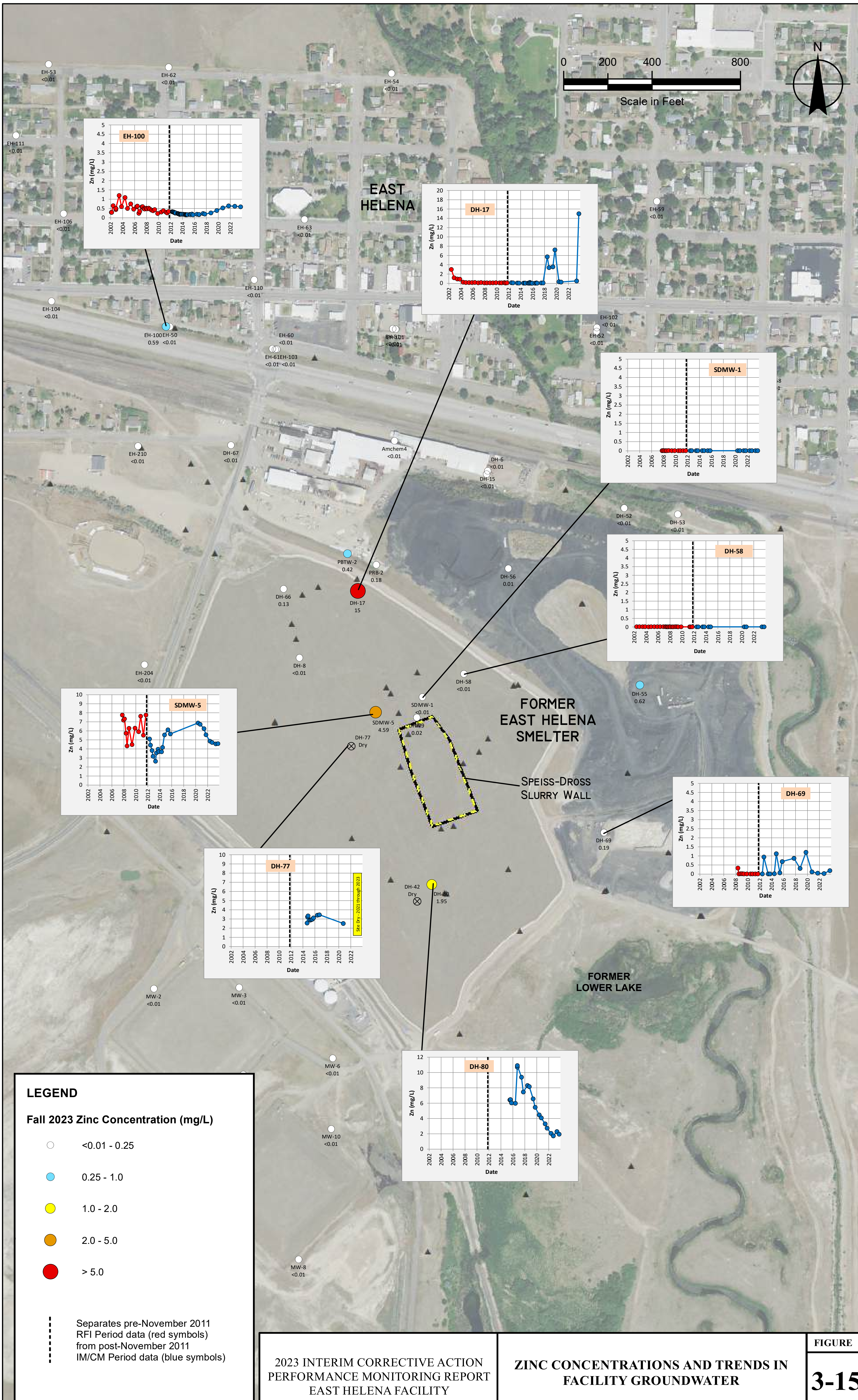
Figure 3-15 shows October 2023 zinc concentrations along with updated temporal trends from 2002 (post-plant shutdown) through 2023 for selected wells. As shown on Figure 3-15, zinc concentrations at monitoring well DH-17, located in the North Plant Arsenic Source Area, showed an abrupt increase from typical values of less than 0.1 mg/L to 5.72 mg/L in June 2018, in October 2019 to 7.21 mg/L, and again in October 2023 to 15 mg/L. Note that 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 0.6 mg/L has occurred since 2018, likely influenced by the short-term increase at upgradient well DH-17. At well DH-80 in the former Acid Plant area and downgradient of the 2016 soil removal CM, the October 2023 zinc concentration of 1.95 mg/L is near the minimum recorded to date at this well, representing a substantial decrease 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, and remained relatively low at 0.19 mg/L in October 2023 (Figure 3-15). Wells DH-77 (2.51 mg/L zinc in October 2020) and SDMW-5 (4.59 mg/L zinc in October 2023), 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 3-15). Well DH-77 has been dry since October 2021.

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, and again in 2023 are likely attributable to the higher groundwater levels during those years, and/or varying geochemical conditions related to fluctuations in groundwater recharge. For example, in 2023, the zinc concentration at DH-17 increased from 0.51 mg/L in May to 15 mg/L in October; this abrupt increase was accompanied by a pH decrease from 7.08 in May to 6.49 in October. This slight change in pH could have a significant impact on the adsorption behavior of zinc, with lower pH conditions leading to decreased adsorption and higher groundwater concentrations. The current elevated zinc concentrations observed in other Facility wells are also associated with lower pH conditions, including DH-80 (pH ~5.7 in 2023) and SDMW-5 (pH ~5.9). Zinc will continue to be monitored at Facility and off-site wells to evaluate the persistence of the 2023 increase at DH-17 and the continued relatively elevated concentrations at DH-80 and SDMW-5, as well as any effects on downgradient groundwater quality.

Cadmium

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. Migration of cadmium downgradient, however, was historically 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



2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

ZINC CONCENTRATIONS AND TRENDS IN FACILITY GROUNDWATER

FIGURE
3-15

Hydrometrics, Inc.
Consulting Scientists and Engineers

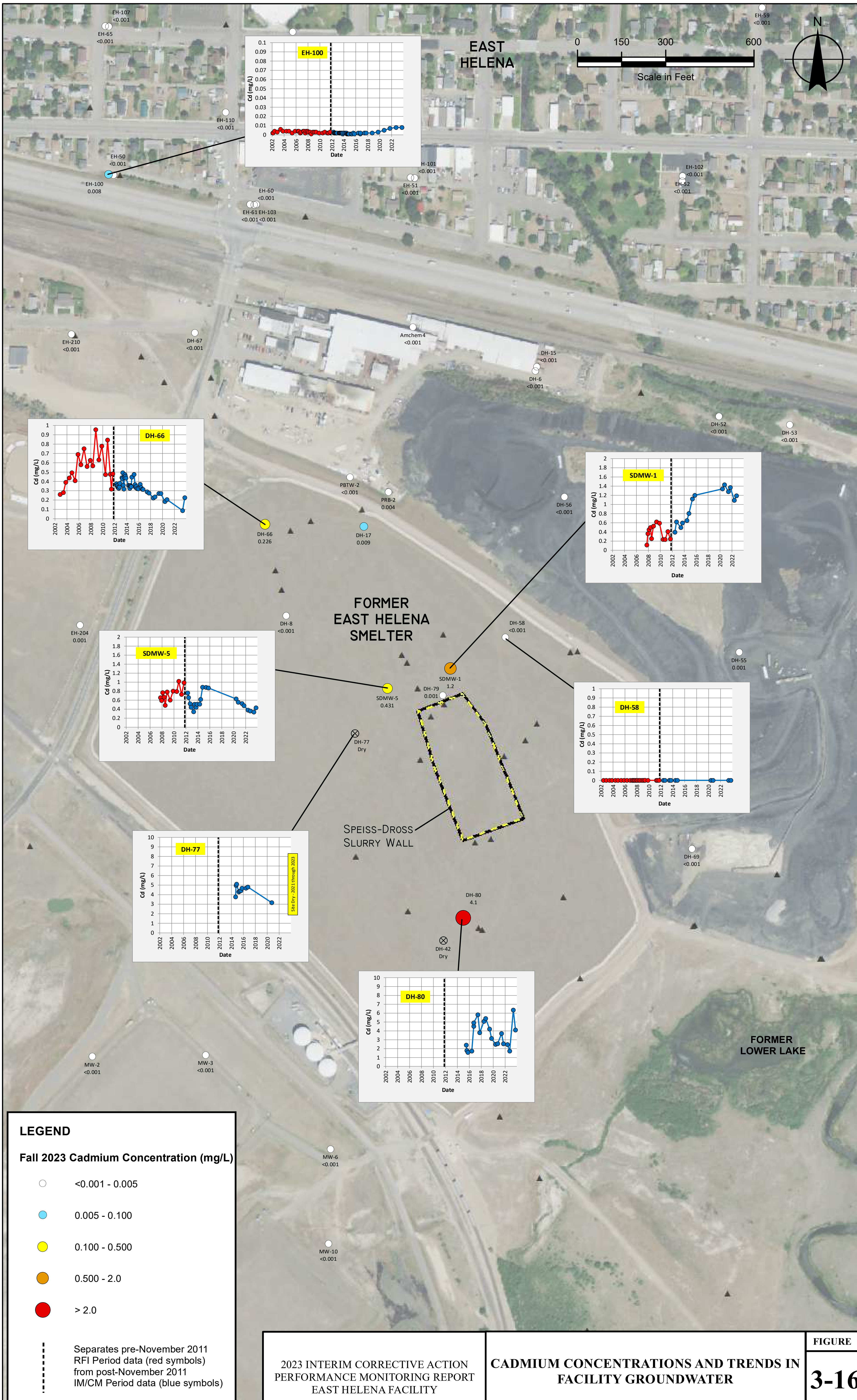
Path: G:\PROJECT\10022\2023 Report\Fig3-15_ZnTrends.mxd Date Saved: 8/13/2024 4:26:05 PM cadmium concentrations decreased, with isolated areas of higher concentrations remaining at present (Figure 3-16). The 2023 groundwater monitoring data in Appendix A show elevated cadmium concentrations above 1.0 mg/L at two wells (DH-80 and SDMW-1), concentrations above 0.1 mg/L at two additional wells (DH-66 and SDMW-5), and concentrations from 0.001 to 0.009 mg/L at DH-17, DH-55, DH-79, PRB-2, EH-100, and EH-204. All the remaining 2023 groundwater samples from both on and off-site monitoring wells and residential wells had nondetect cadmium concentrations (<0.001 mg/L). Detectable cadmium concentrations were lower than the 0.005 mg/L groundwater MCL at DH-55, DH-79, EH-204, and PRB-2 and above the MCL at DH-17 and EH-100.

Figure 3-16 presents updated cadmium concentration trends through October 2023 for selected wells, and the most recent cadmium concentration observed at each well. The highest cadmium concentrations in Facility groundwater occur in and downgradient of the former Acid Plant area at wells DH-80 (4.1 to 6.35 mg/L in 2023) and DH-77 (dry in 2023; 3.16 mg/L in 2020), with slightly lower concentrations in the Speiss-Dross area at wells SDMW-1 and SDMW-5 (0.337 to 1.44 mg/L in 2023) (Figure 3-16). This area is generally coincident with the area of elevated zinc concentrations, with the exception of well DH-17, where cadmium concentrations have remained relatively low (<0.001 to 0.009 mg/L) even during the periods of highly elevated zinc concentrations in 2018-2019 and 2023 discussed above (<0.001 to 0.002 mg/L). Cadmium concentration trends on the Facility indicate decreasing trends at wells DH-66 and SDMW-5, an increasing trend at SDMW-1, and variable concentrations but no clear long-term trend at DH-80 (Figure 3-16).

Along other groundwater contaminants, zinc and cadmium concentrations and migration patterns in groundwater beneath the Facility are a combined function of historic plant processes and source areas, changes in 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 Facility, no off-site migration at concentrations above the groundwater HHS of 2.0 mg/L is currently indicated for zinc, and exceedances for cadmium (MCL of 0.005 mg/L) are limited to EH-100 north of the Facility (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 2023 are tabulated in Appendix E. UFS project monitoring locations are shown on Figure 2-2. 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 2012-2023 are in Figures 3-17 through 3-22. As described in the UFS GMP (Hydrometrics, 2021b), 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



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2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	CADMIUM CONCENTRATIONS AND TRENDS IN FACILITY GROUNDWATER	FIGURE 3-16

Hydrometrics, Inc.
Consulting Scientists and Engineers

Figure 3-17. Unfumed Slag Well Arsenic Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility

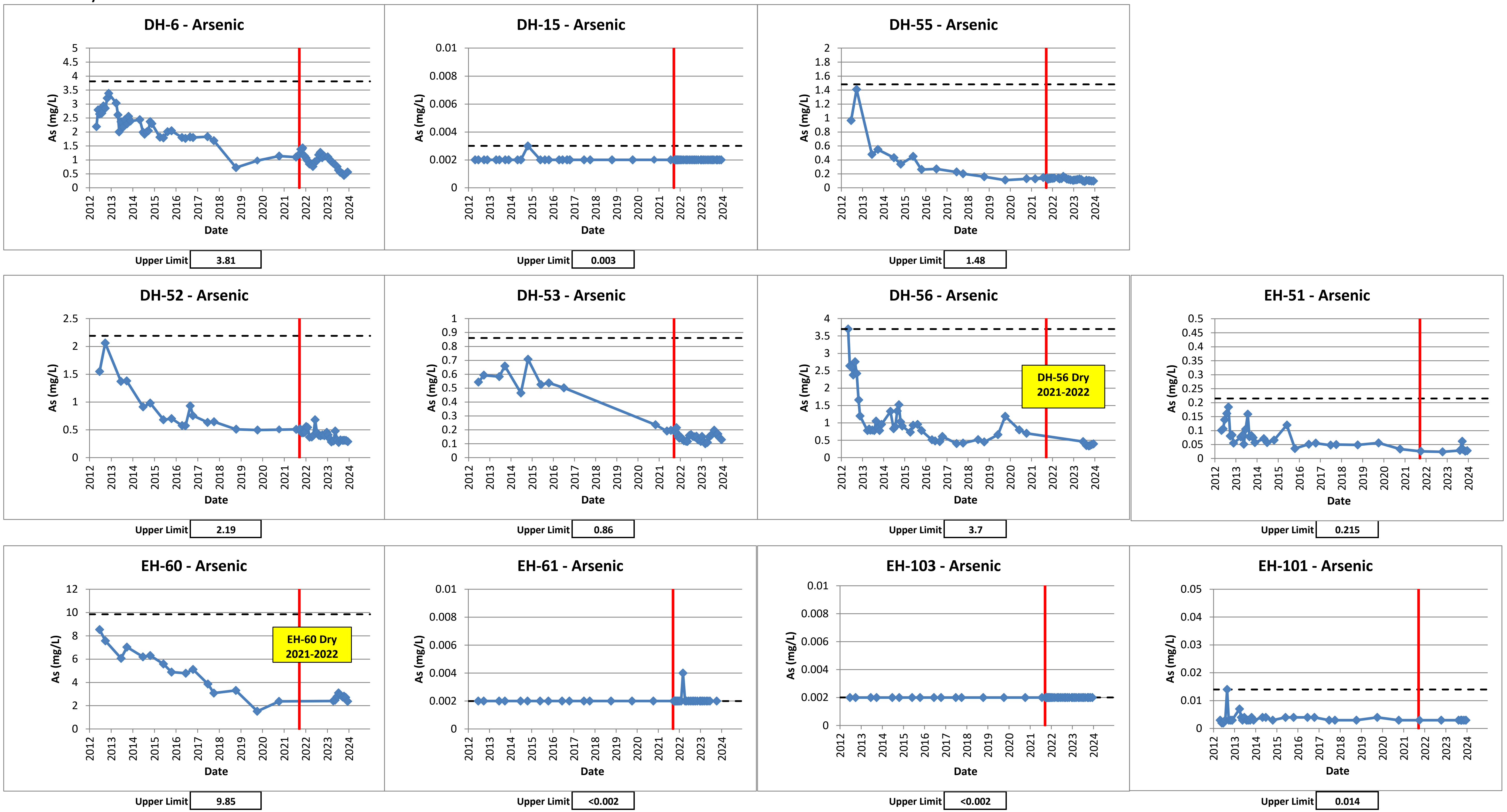


Figure 3-18. Unfumed Slag Well Selenium Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility

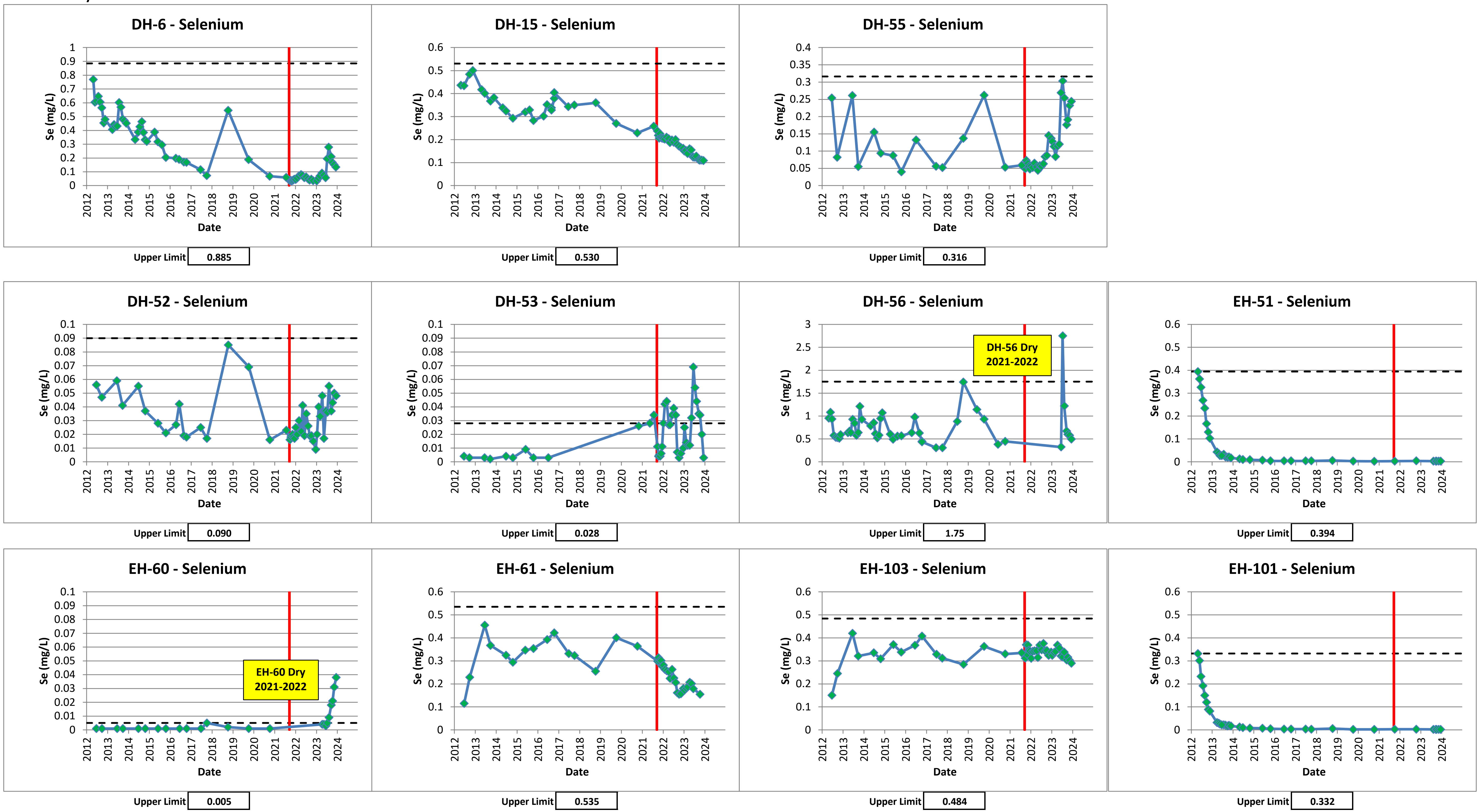


Figure 3-19. Unfumed Slag Well Sulfate Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility

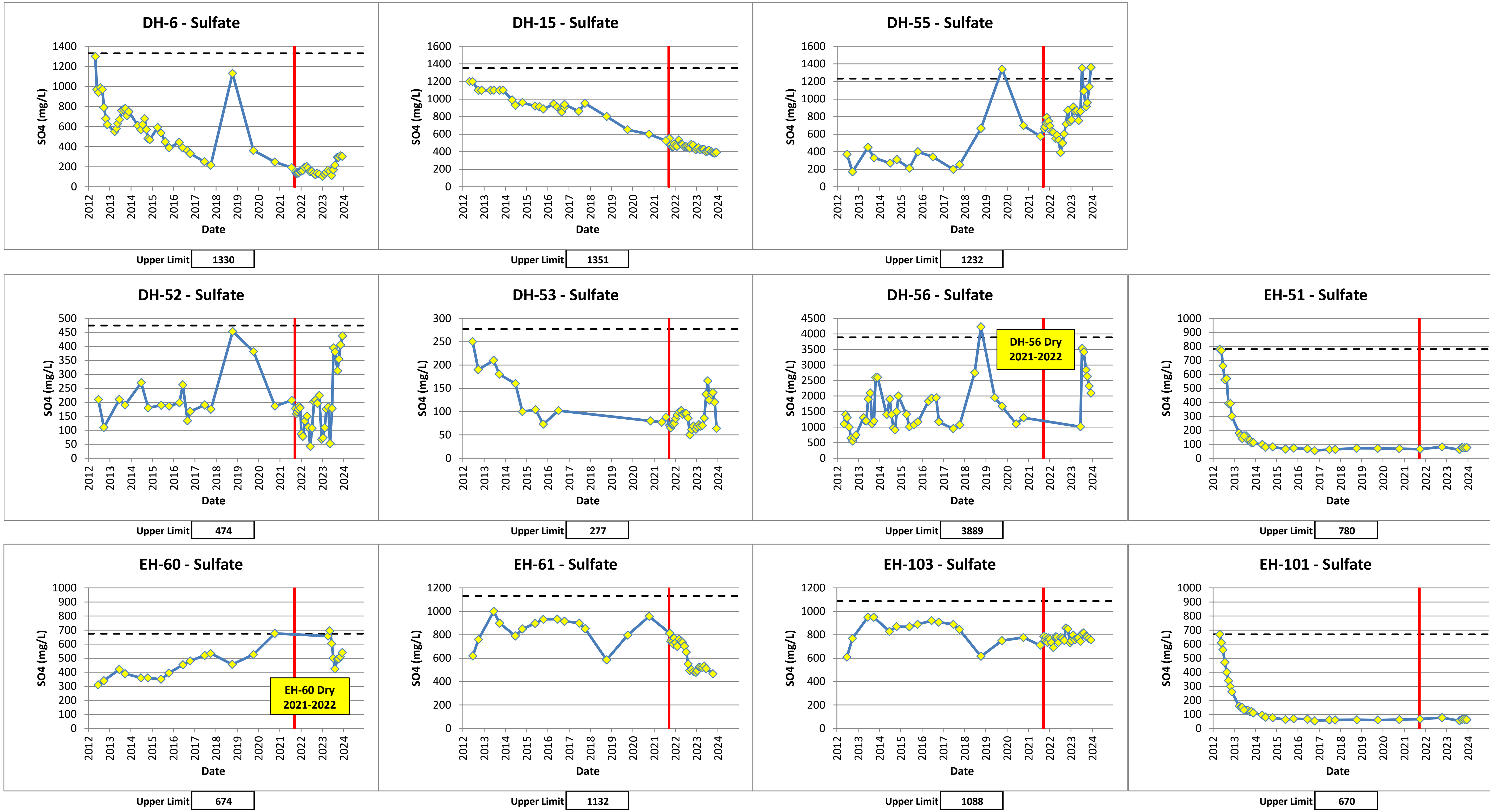


Figure 3-20. Unfumed Slag Well Chloride Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility

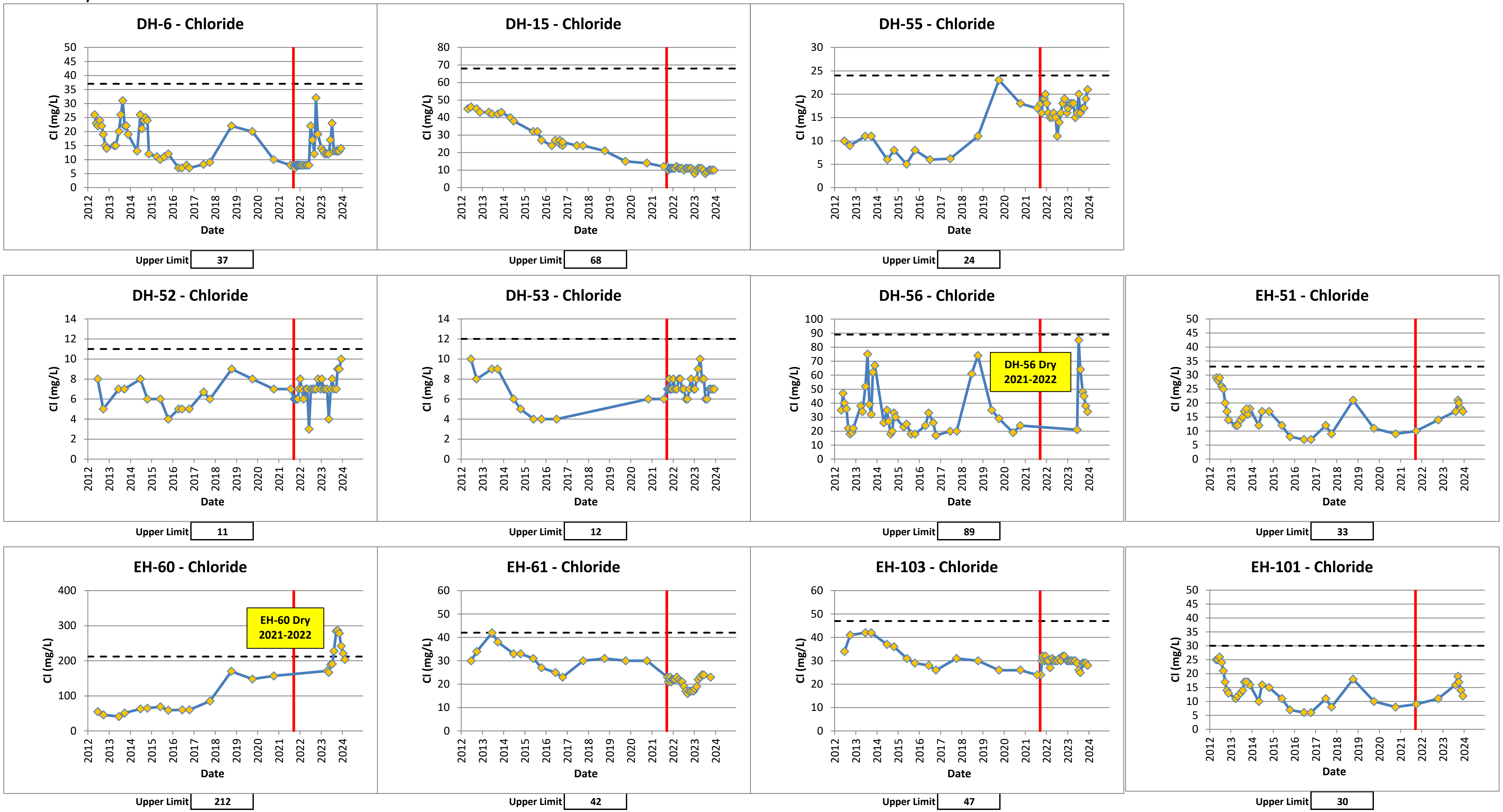


Figure 3-21. Unfumed Slag Well Potassium Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility

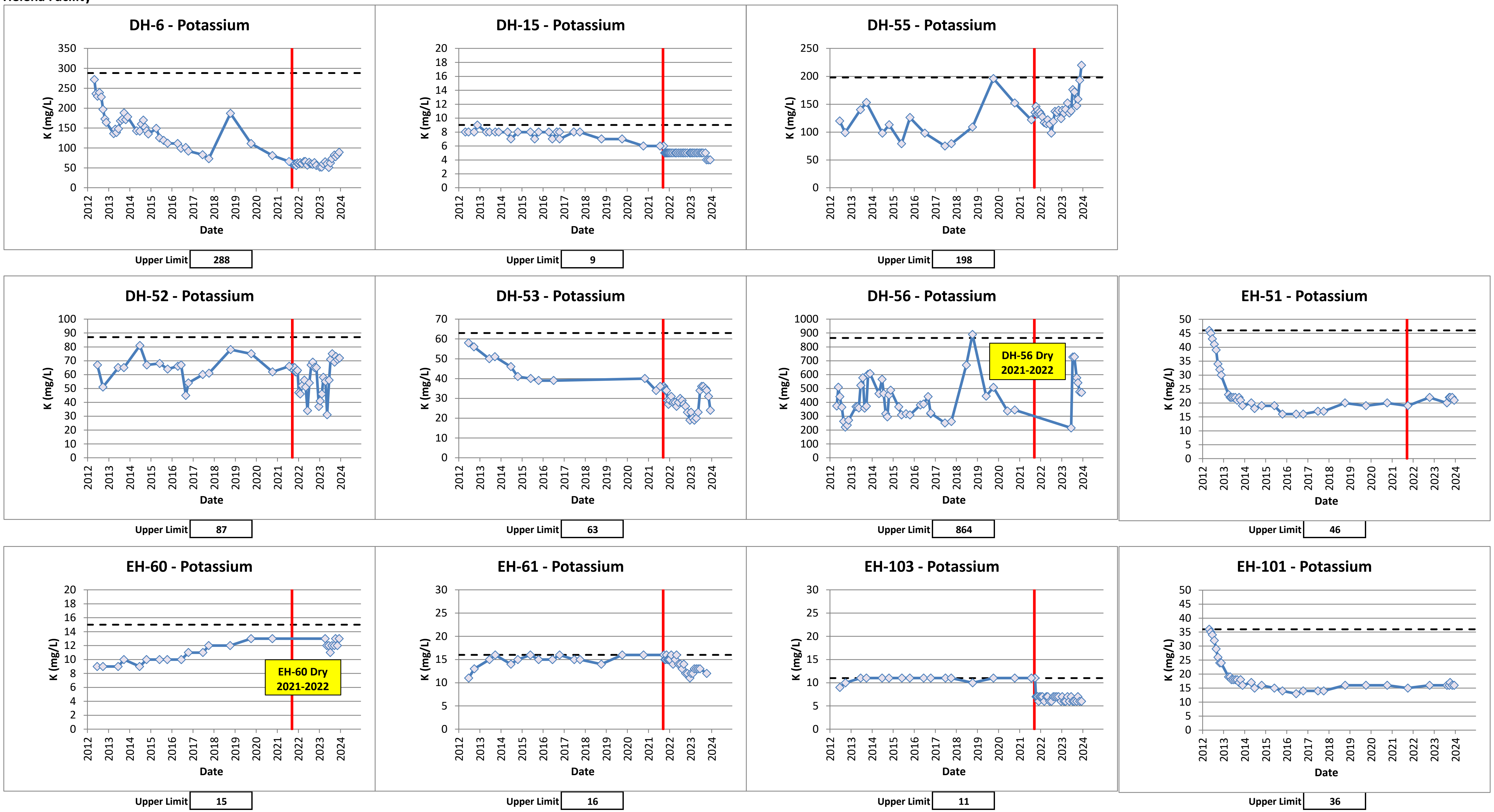
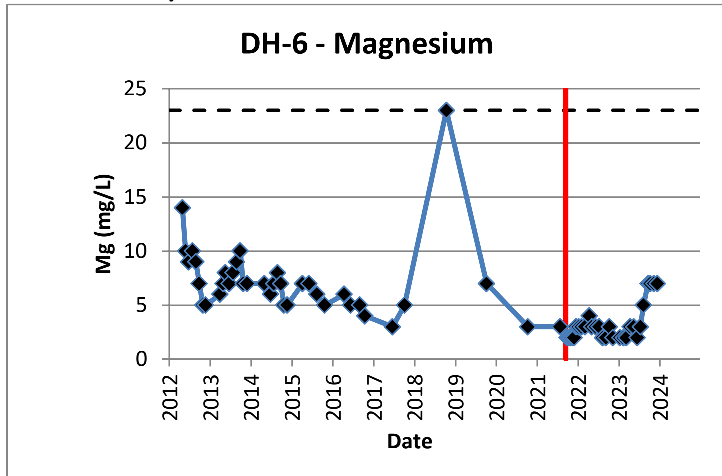
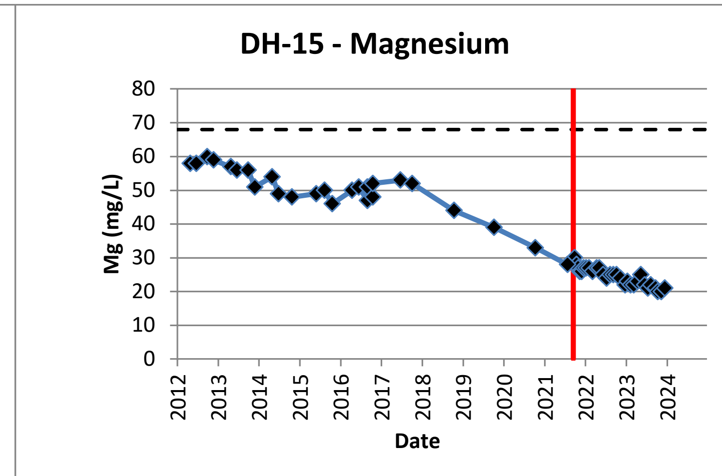


Figure 3-22. Unfumed Slag Well Magnesium Trends
2023 Interim Corrective Action Performance Monitoring Report
East Helena Facility



Upper Limit 23



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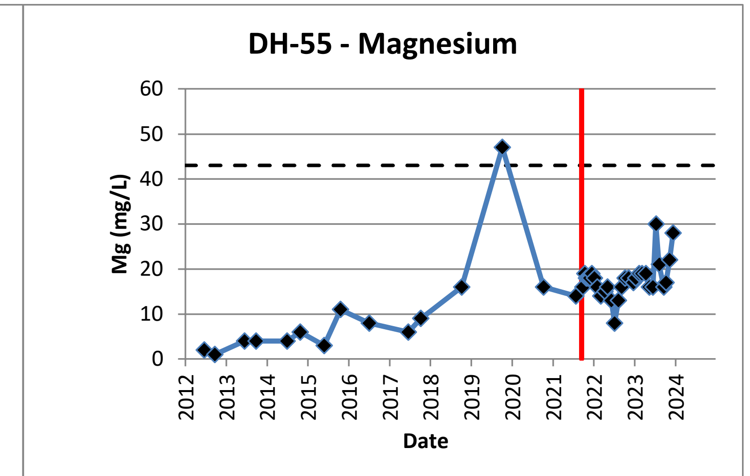
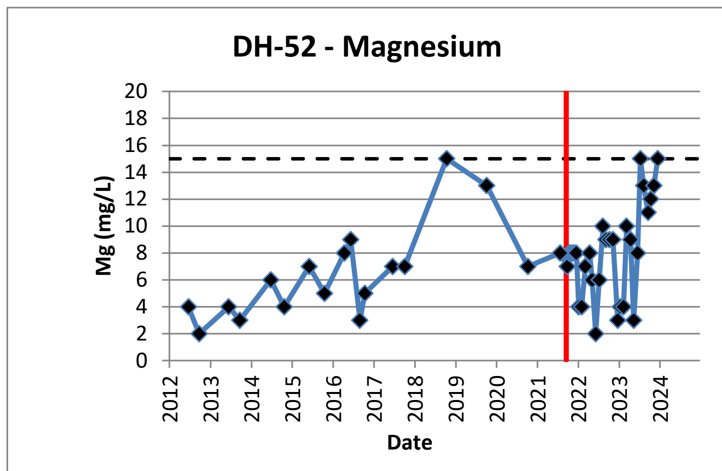


Upper Limit 43



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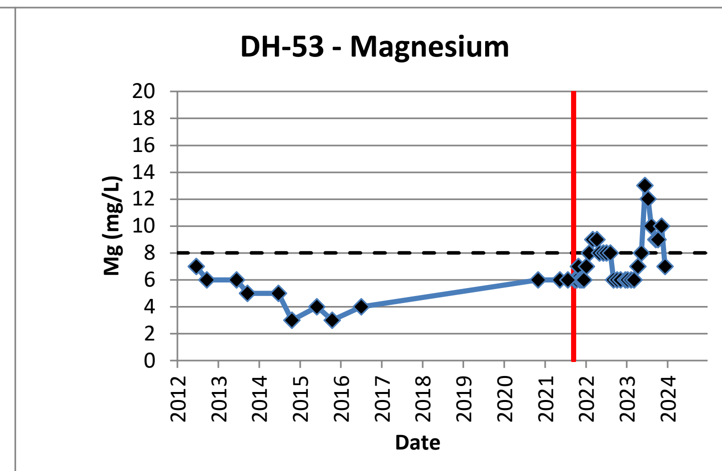
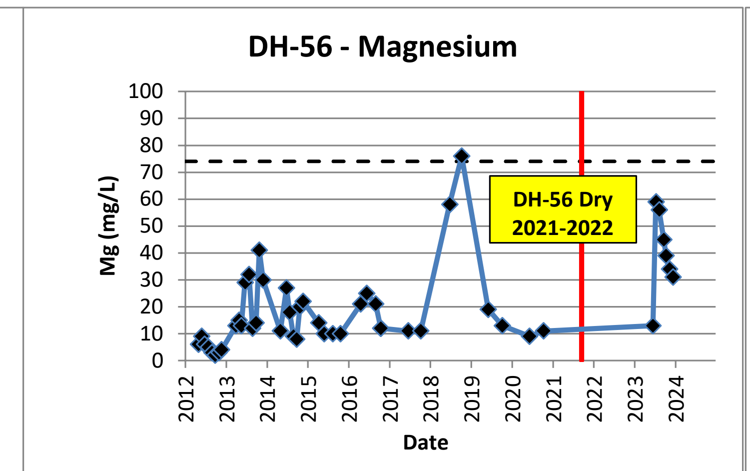
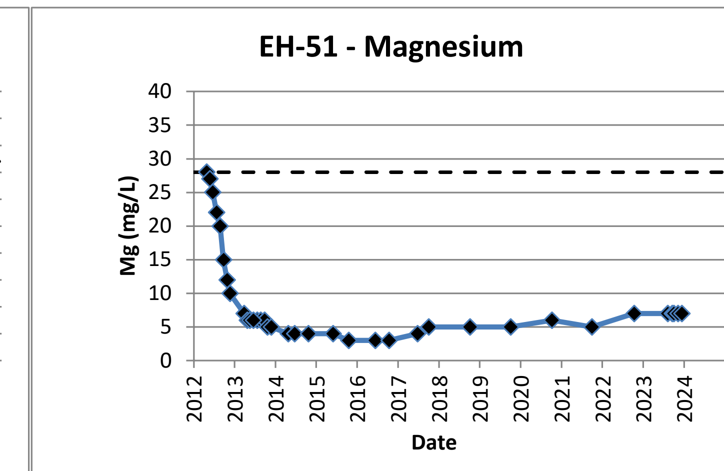


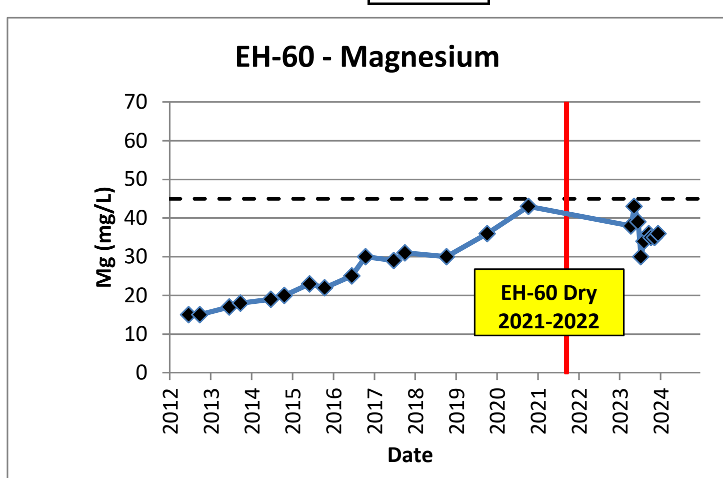
Upper Limit 8



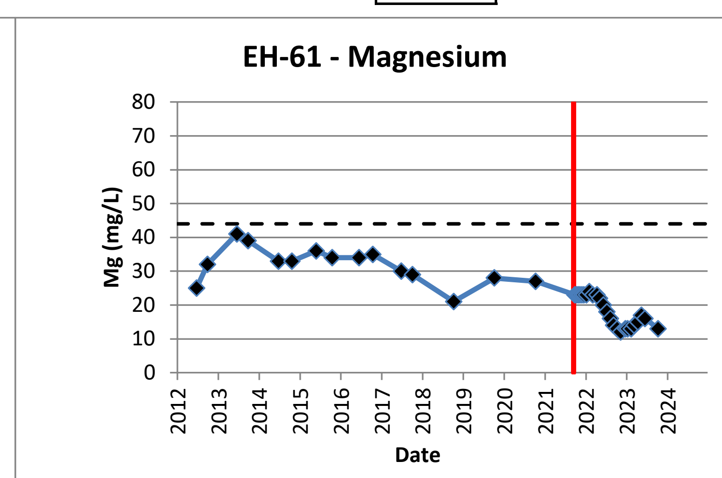
Upper Limit 74



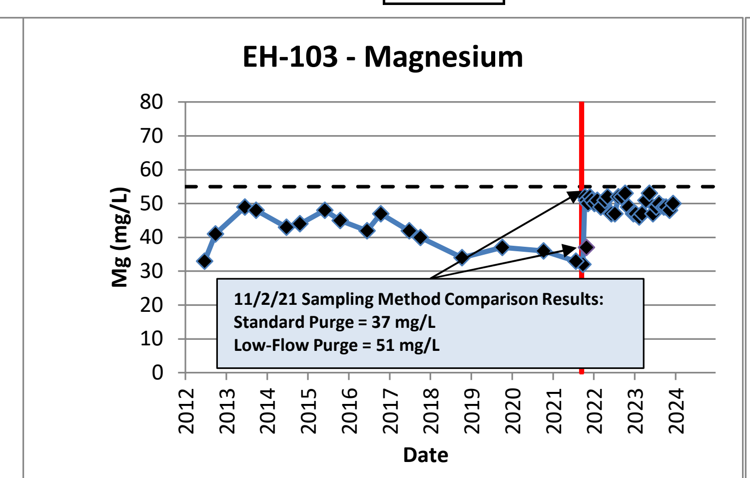
Upper Limit 28



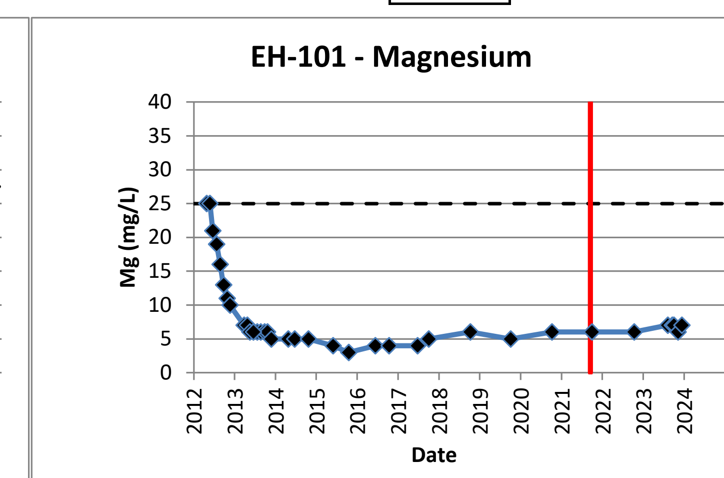
Upper Limit 45



Upper Limit 44



Upper Limit 55



Upper Limit 25

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, 2022). 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 some 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, with trend plots showing continuations of the trends apparent prior to the initiation of the slag recovery project (Figures 3-17 through 3-22; Appendix E). Some periodic USL exceedances have been noted, however, as discussed below.

- Arsenic concentrations have remained below calculated USLs throughout the slag monitoring project, and at many locations are currently near the minimum concentrations observed in the comparison period as of the end of 2023 (Figure 3-17).
- Selenium concentrations have periodically trended above the USL at well DH-53. However, the December 2023 selenium concentration at DH-53 decreased to 0.003 mg/L, just above the 0.001 mg/L detection limit. The low selenium concentration at DH-53 in December 2023 was similar to lower concentrations observed previously during fall and early winter months the last several years: from 0.004 to 0.007 mg/L in October through December 2021, and from 0.003 to 0.007 mg/L from September through November 2022 (Figure 3-18). Wells DH-53 and DH-52 are both located near Prickly Pear Creek and variability in groundwater quality at these wells is likely related to changes in creek levels, along with local groundwater levels and flow directions due to freezing and thawing cycles, seasonal runoff, and local precipitation patterns. The June 2023 peak in selenium concentration at DH-53 (0.069 mg/L), followed by a decrease through December 2023 (Figure 3-18) suggests that the 2023 USL exceedances for selenium are likely attributable to the high precipitation in spring 2023 discussed previously, leading to increased selenium leaching from the slag pile and increased concentrations at well DH-55 upgradient of DH-53 (see Figure 2-2), along with the creek influences noted above.

- At well DH-56, the selenium concentration increased rapidly in 2023 from 0.323 mg/L in June 2023 to 2.75 mg/L in July 2023 (Appendix E, Figure 3-18), exceeding the USL; concentrations subsequently decreased through the end of 2023 to 0.495 mg/L. This temporary increase is also attributed to a seasonal increase in slag leaching during the higher precipitation conditions in spring 2023.
- Selenium concentrations at well EH-60 increased from 0.004 mg/L to 0.038 mg//L in 2023 (Appendix E, Figure 3-18). The chloride concentration at EH-60 also exceeded the USL for much of the year, although concentrations have recently decreased (Figure 3-20). The increasing selenium concentration at EH-60 is potentially related to the precipitation and infiltration-related selenium increases at well DH-56 upgradient of EH-60 (see discussion above). However, other water chemistry results at EH-60 are not consistent with a current slag pile leaching source. For example, the chloride concentration at EH-60 in December 2023 (242 mg/L) was substantially higher than at slag pile indicator wells DH-55 and DH-56 (21 to 34 mg/L in December 2023), which have shown historic, pre-slag processing water quality impacts from slag leaching. In addition, the common slag leaching constituents potassium and sulfate, which are highly elevated at DH-55 and DH-56 (200 to 500 mg/L potassium and 1000 to 2000 mg/L sulfate in December 2023), are much lower at EH-60 (13 mg/L potassium and 540 mg/L sulfate in December 2023), and have not shown increasing trends concurrent with the EH-60 selenium concentration increase (Figures 3-19 and 3-21). Therefore, indicator parameter water quality suggests the selenium trend at EH-60 may be attributable to a source unrelated to the slag pile. Note that selenium concentrations in deeper groundwater near EH-60 have historically been higher than in the shallower groundwater represented by this well. Deeper well EH-103, adjacent to EH-60, showed a selenium concentration of 0.290 mg/L in December 2023, and the selenium USL for EH-103 is 0.484 mg/L. No trend is currently apparent in selenium concentrations at EH-103 (Figure 3-18).
- Potassium and sulfate USL exceedances at well DH-55 in 2023 were also noted during several monitoring events (Appendix E, Figures 3-19 and 3-21), and selenium concentrations generally increased as well, although they remained below the USL (Figure 3-18). Selenium, sulfate, and potassium are all key indicators of slag leaching, and the 2023 trends in these constituents indicated an increase in slag leaching near DH-55, likely driven by precipitation and infiltration.
- Tier 2 wells EH-51 and EH-101 (see Figure 2-2) were added to the slag monitoring program from August through December 2023, to assess any downgradient effects of the selenium and other concentrations changes noted during spring and summer 2023 at upgradient indicator wells DH-55 and DH-56. Concentrations of all slag monitoring parameters at wells EH-51 and EH-101 remained below USLs in 2023 (Figures 3-17 through 3-22). Arsenic and selenium concentrations at EH-51 and EH-101 have generally decreased since 2012 and remain at or near minimum values for the 2012-2023 period.

Overall, the UFS project groundwater monitoring results obtained through 2023 have indicated some short-term changes in concentration, but no unacceptable water quality impacts. 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, some of which are likely due to increased slag leaching following periods of higher precipitation and associated infiltration through the slag pile; however, no systematic longer-term increases in COCs or indicator parameter concentrations above USLs have been apparent to date.

3.3.7 2023 CAPMP Well Purge Comparison Sampling Results

As outlined in the 2023 Interim CAPMP (Hydrometrics, 2023a) and described above in Section 2.2.3, well purge method comparison sampling was conducted in 2023 to continue assessment of the comparability of groundwater quality data collected by low-flow/low-volume purging using a Waterra inertial pump versus the standard three- to five-well volume purge method. The low-flow/low-volume purge method was adopted in 2023 as the routine method for well sampling after several years of comparison sampling, in order to reduce project costs by decreasing the volume of sampling-derived water requiring handling and disposal, as well as requiring less time and equipment than the standard three- to five-volume purge method.

Three wells were sampled using both purge methods during the May/June 2023 sampling, and five wells were sampled using both methods during the October sampling (Table 2-3). For the comparison sampling locations, low-flow/low-volume samples were collected first, followed by standard purge samples. Complete analytical results for the 2023 purge method comparison sampling 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 field parameters, multiple sample pairs showed RPD values exceeding the 20% threshold for DO and/or turbidity, with some samples also exceeding 20% RPD for ORP and E_H. These results are consistent with previous comparison sampling (Hydrometrics, 2023b). 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 DO, while exceeding the 20% RPD criteria, were not particularly significant in absolute terms; for example, RPD exceedances included paired samples with 0.37 and 0.29 mg/L, 0.45 and 0.17 mg/L, 3.49 and 1.90 mg/L, and 3.00 and 1.55 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 DH-67, with 7.41 mg/L low-flow and 2.24 mg/L standard purge DO values) appeared to differ substantially between the two purge methods (Appendix F).

For laboratory analytical parameters, exceedances of the duplicate sample criteria were limited to dissolved arsenic in one June 2023 sample (EH-59) and multiple parameters in one October 2023 sample (DH-67) (Appendix F). The June 2023 exceedance (0.014 and 0.020 mg/L arsenic, with an RPD of 35.3%) was obtained on a relatively low concentration sample, where analytical methods are inherently less accurate and precise. The sample from DH-67 showed slight exceedances of the 20% RPD criterion for TSS, total alkalinity, bicarbonate, and selenium (21.1% to 25.0%), and a much higher RPD for arsenic (0.075 mg/L and 0.200 mg/L, an RPD of 90.9%). One potential cause of the unusual level of discrepancy between the two purge methods at well DH-67 is the location of the well near the border between the selenium plume migrating from the West Selenium source area and the arsenic plume migrating from the North Plant Arsenic source area (see both plumes on Exhibit 1). The higher purge rate and volume Grundfos pump method sample at DH-67 had higher concentrations of both arsenic (0.200 mg/L) and selenium (0.132 mg/L) than the lower purge rate and volume Waterra method (0.075 mg/L arsenic and 0.106 mg/L selenium) (Appendix F). This suggests that the higher purge rate method may have been drawing higher concentration arsenic groundwater from the east and higher concentration selenium water from the west into the DH-67 well bore during sampling, potentially introducing a positive bias to both constituents relative to the actual groundwater quality conditions at the well. In this case, the lower purge rate and volume Waterra method would provide a more accurate and representative sample for a well located on a boundary between plumes. Consistent with previous comparison sampling, none of the other paired samples collected in 2023 showed evidence of significant bias toward higher or lower COC concentrations in low-flow/low-volume samples compared with standard purge samples. With the exceptions discussed above, 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.

Overall, the two purge methods provided comparable laboratory water quality data for the wells sampled during the 2023 monitoring events, for all locations except one, as well as for most field parameters, including pH, SC, E_H, water temperature, and (with few exceptions) DO. Differences in turbidity and TSS concentrations in samples collected using the two methods are 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 any systematic or significant differences in concentrations of other physical parameters, major ions, or dissolved metals. In addition, based on previous calculations (Hydrometrics, 2023a) total purge volumes generated by the low-flow method are approximately 60 to 85% lower than the total purge volumes generated by the standard purge method. The low-flow/low-volume Waterra purge method will continue to be used as the routine sampling method for sampling East Helena project wells.

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

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

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

Hydrometrics, Inc., 2023a. 2023 Groundwater and Surface Water Interim Corrective Action Performance Monitoring Plan, East Helena Facility (Final). Prepared for Montana Environmental Trust Group, LLC. December 2023.

Hydrometrics, Inc., 2023b. 2022 Water Resources Monitoring Report, East Helena Facility (Final). Prepared for Montana Environmental Trust Group, LLC. December 2023.

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

2023 SURFACE WATER

AND GROUNDWATER DATABASE

APPENDIX A1

2023 MONITORING WELL

WATER QUALITY DATABASE

			Field Parameters								General Chemistry					Major Cations			
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	Calcium	Magnesium	Sodium	Potassium
2843 Canyon Ferry Rd	6/1/2023	31.04	7.05	567	5.46	-8	212	2.3	10.6	7.4	284 R	130	20 U	357	66	15	28	4
2843 Canyon Ferry Rd	10/13/2023	Analytical Results Rejected As Not Representative																
2853 Canyon Ferry Rd	6/1/2023	32.55	7.00	609	4.89	34	254	3.3	10.5	7.4	304 R	130	20 U	399	72	15	27	4
2853 Canyon Ferry Rd	10/13/2023	Analytical Results Rejected As Not Representative																
Amchem4	10/5/2023	No Access	7.11	309	3.97	4	223	2.0	12.5	7.2	304	120	10 U	240	33	7	13	4
Dartman Well	6/1/2023	28.54	6.69	352	1.34	-12	210	5.8	9.0	7.2	172 R	95	10 U	221	41	9	16	3
Dartman Well	10/5/2023	26.11	6.82	354	1.54	5	227	4.5	8.9	7.1	351	98	10 U	238	40	8	14	2
DH-6	10/17/2023	20.56	7.23	1011	3.30	251	470	20.9	11.9	7.3	998	150	21	670	38	7	106	78
DH-8	10/12/2023	51.51	7.28	3631	4.17	123	344	5.9	10.1	7.4	3160	340	10 U	2870	543	117	163	16
DH-15	10/17/2023	18.03	7.07	1023	0.59	243	464	2.6	10.6	7.1	1010	130	10 U	717	94	20	93	4
DH-17	5/30/2023	49.92	7.08	1732	2.06	215	434	64.4	12.7	7.1	1830	430	19	1230	90	20	246	28
DH-17	10/12/2023	47.80	6.49	1511	3.27	140	360	9.1	10.9	6.6	1490	250	11	995	44	13	253	13
DH-42	10/11/2023	No Sample - Insufficient Water																
DH-52	10/17/2023	7.48	7.08	1011	6.88	269	488	5.4	11.9	7.2	1000	130	10 U	699	74	12	72	73
DH-53	10/17/2023	10.43	7.01	575	6.27	247	466	4.9	12.6	7.2	567	130	10 U	390	55	9	24	34
DH-53 (Dup)	10/17/2023	10.43	7.01	575	6.17	247	466	4.3	12.6	7.2	568	130	10 U	366	52	9	23	33
DH-55	10/17/2023	80.94	7.32	2290	4.14	211	432	7.1	9.6	7.3	2250	170	10 U	1580	102	17	255	159
DH-56	5/30/2023	84.15	7.68	2432	5.32	173	395	NM	9.0	7.7	2580	230	2480	1750	63	13	345	238
DH-56	10/17/2023	83.05	7.55	5577	6.82	216	436	151.0	11.7	7.7	5500	320	121	4100	217	39	669	541
DH-58	5/30/2023	44.73	6.58	1136	2.10	260	479	1.8	12.2	6.7	1190	240	10 U	791	100	16	108	17
DH-58	10/11/2023	42.89	6.60	1188	0.31	38	258	5.5	11.4	6.8	1160	240	10 U	795	100	15	108 J+	19
DH-66	5/30/2023	52.76	6.91	1482	5.58	250	468	504.0	12.7	6.9	1770	170	395	1280	218	58	56	7
DH-66	10/12/2023	50.75	6.68	2825	5.47	131	352	34.2	10.5	6.8	2550	220	26	2230	405	115	83	10
DH-67 (Low-Flow)	10/11/2023	34.24	6.48	1368	7.41	77	297	9.3	10.9	6.6	1340	180	21	953	119	39	93	6
DH-67 (3 Vol Purge)	10/11/2023	34.24	6.26	1408	2.24	113	332	7.6	11.9	6.4	1380	140	27	985	122	40	100	7
DH-69	10/11/2023	35.68	7.06	1290	5.59	-112	108	725.0	11.6	7.0	1160	200	63	814	128	11	61	56
DH-77	5/30/2023	No Sample - Insufficient Water																
DH-77	10/12/2023	No Sample - Insufficient Water																
DH-79	5/31/2023	55.47	7.34	1552	1.06	-30	189	35.0	12.5	7.4	1560	330	24	1040	55	18	256	16
DH-79	10/12/2023	53.80	7.52	2772	1.21	121	341	25.6	10.9	7.6	2760	470	28	1840	53	20	591	23
DH-80	5/31/2023	49.56	5.65	693	0.76	146	365	550.0	11.8	5.8	701	45	429	469	63	17	35	6
DH-80	10/11/2023	49.65	5.76	722	1.27	121	341	93.1	11.7	5.9	697	65	72	467	67	18	35	6
EH-50	10/11/2023	28.17	6.51	1762	3.83	133	352	9.4	11.9	6.6	1720	180	35	1200	123	36	178	8
EH-51	10/10/2023	15.13	6.97	446	6.47	110	330	5.2	11.0	7.1	446	100	10 U	269	36	7	26	22
EH-52	10/10/2023	7.53	6.81	389	1.50	33	251	7.8	13.3	7.0	389	110	13	233	37	8	18	18
EH-53	10/4/2023	26.69	7.03	543	8.81	156	375	6.4	12.4	7.2	535	180	10 U	336	37	13	53	3
EH-54	10/4/2023	7.56	6.72	314	4.25	104	322	8.9	13.4	6.9	312	100	14	210	34	8	14	3
EH-58	10/4/2023	13.65	6.55	545	6.28	236	455	27.0	12.1	6.7	539	150	21	349	60	15	22	4
EH-59 (Low-Flow)	6/2/2023	7.48	6.92	435	4.76	252	474	4.5	9.5	7.0	444	120	10 U	276	47	11	20	8
EH-59 (3 Vol Purge)	6/2/2023	7.48	6.96	417	5.09	141	363	1.4	8.9	7.0	427	110	10 U	258	47	11	19	7
EH-59 (Low-Flow)	10/4/2023	7.45	6.76	443	3.49	-99	120	11.3	12.9	7.0	443	150	10 U	278	45	11	21	8
EH-59 (3 Vol Purge)	10/4/2023	7.45	6.74	440	1.90	-88	131	1.1	13.0	7.0	439	150	10 U	282	44	11	22	8
EH-60	10/17/2023	24.01	5.60	2014	6.45	252	469	38.5	14.6	5.8	2010	38	48	1320	114	35	245	13
EH-61	10/17/2023	25.71	7.04	1358	1.69	201	420	133.0	11.9	7.1	1350	180	88	918	73	13	195	12
EH-62	10/4/2023	24.15	6.84	403	6.82	142	362	4.9	11.3	7.0	402	120	10 U	259	44	11	16	4
EH-63	10/5/2023	19.78	6.89	432	6.21	253	474	17.5	10.4	7.0	428	110	12	275	48	10	17	4

			Field Parameters							General Chemistry					Major Cations			
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	Calcium	Magnesium	Sodium	Potassium
EH-65 (Low-Flow)	10/10/2023	25.08	6.58	1379	3.00	152	371	91.2	12.3	6.6	1370	140	57	946	87	22	165	9
EH-65 (3 Vol Purge)	10/10/2023	25.08	6.59	1399	1.55	164	383	25.9	12.8	6.6	1370	140	49	967	91	22	166	9
EH-66	10/4/2023	26.42	7.27	502	9.72	245	466	161.0	10.0	7.4	498	170	203	328	60	14	16	3
EH-68	6/1/2023	8.43	6.81	403	7.17	311	534	23.3	8.0	6.9	410	130	44 J+	255	46	11	14	2
EH-68	10/4/2023	9.38	6.65	455	2.71	241	459	38.1	14.1	6.9	455	160	61	303	50	13	19	4
EH-69	6/1/2023	20.52	6.80	424	5.11	317	536	7.9	11.3	6.9	435	110	10 U	267	41	9	27	4
EH-69	10/4/2023	17.87	6.71	514	6.59	247	467	54.0	11.4	6.9	517	140	65	344	50	12	30	4
EH-70	10/6/2023	32.63	7.01	733	9.00	104	324	29.4	11.3	7.1	722	130	25	494	52	17	69	4
EH-100	10/11/2023	28.65	6.60	2142	1.95	103	323	65.4	11.6	6.7	2080	200	95	1560	151	52	238	14
EH-101	10/10/2023	15.41	7.00	390	5.40	110	330	9.3	11.7	7.1	392	90	15	231	35	7	21	17
EH-102	10/24/2023	9.07	7.02	387	2.92	261	482	9.5	9.9	7.1	397	98	10	239	30	7	38	8
EH-103	10/17/2023	26.28	6.85	1703	1.26	177	396	0.7	12.1	6.9	1700	150	10 U	1420	223	49	98	7
EH-104	10/10/2023	35.42	7.05	1222	7.06	-34	186	29.9	11.7	7.1	1220	230	17	808	114	30	93	6
EH-104 (Dup)	10/10/2023	35.42	7.05	1222	7.01	-33	187	29.9	11.7	7.1	1220	230	21	826	116	30	95	6
EH-106	10/10/2023	29.21	6.76	1213	6.37	125	344	17.4	12.1	6.8	1220	210	26	836	98	24	128	5
EH-107	10/10/2023	22.20	6.89	1143	0.46	22	238	64.3	16.7	7.1	1090	160	24	736	76	17	116	5
EH-110	10/10/2023	21.32	7.23	650	6.71	203	423	33.4	11.8	7.4	648	140	12	387	21	4	104	5
EH-111	10/10/2023	29.35	6.72	2091	1.90	73	292	30.2	13.1	6.8	2080	160	59	1550	168	42	215	11
EH-114 (Low-Flow)	6/1/2023	36.65	6.45	1874	0.37	307	526	6.3	11.8	6.6	1910	160	15 J+	1400	143	40	209	9
EH-114 (3 Vol Purge)	6/1/2023	36.65	6.44	1892	0.29	278	498	4.4	11.8	6.5	1950	150	10 U	1430	146	41	213	9
EH-114 (Low-Flow)	10/5/2023	33.28	6.50	1910	0.45	215	435	5.1	11.3	6.6	1890	160	10 U	1420	149	40	202	9
EH-114 (3 Vol Purge)	10/5/2023	33.28	6.50	1913	0.17	206	426	5.2	11.8	6.6	1880	160	10 U	1450	145	39	200	9
EH-115	5/31/2023	38.68	6.46	1345	0.59	164	383	14.8	12.2	6.6	1360	180	18	983	102	29	136	6
EH-115	10/10/2023	35.39	6.59	1421	1.29	94	313	9.4	12.8	6.7	1400	190	29	951	111	31	136	7
EH-117	10/20/2023	28.10	6.86	1274	8.73	404	624	3.9	10.9	6.9	1320	160	175	905	93	24	144	6
EH-119	10/6/2023	33.96	6.55	1910	0.43	108	328	56.8	11.3	6.6	1850	160	13	1460	163	44	189	7
EH-120	6/1/2023	30.80	6.76	1076	3.16	287	507	75.8	10.9	6.8	1110	140	302	751	100	22	95	4
EH-120	10/6/2023	29.09	6.81	955	3.49	155	375	19.8	11.4	7.0	931	140	49	660	82	18	88	4
EH-121	10/4/2023	26.89	6.91	312	7.17	255	476	8.3	9.9	7.1	314	90	11	195	34	8	13	2
EH-123	6/1/2023	46.99	7.16	624	5.35	288	508	31.5	11.6	7.3	639	160	29 J+	424	63	16	35	7
EH-123	10/5/2023	44.25	7.17	707	7.57	203	423	10.9	11.6	7.3	700	170	28	472	71	18	38	8
EH-124	10/6/2023	37.47	7.10	1252	3.03	147	367	24.7	11.1	7.2	1210	240	30	903	146	40	62	7
EH-125	10/6/2023	33.20	7.01	365	7.01	125	344	7.3	12.0	7.2	362	100	16	232	26	7	35	3
EH-126	10/6/2023	52.67	7.34	1005	8.19	166	386	9.0	11.5	7.5	977	210	11	701	94	45	51	4
EH-129	5/31/2023	59.01	7.29	621	5.07	210	429	10.7	13.3	7.4	630	160	29	431	64	20	34	6
EH-129 (Dup)	5/31/2023	59.01	7.29	621	5.06	211	429	10.7	13.3	7.4	626	160	28	431	64	20	33	6
EH-129	10/6/2023	53.57	7.35	656	8.85	204	424	8.3	11.5	7.4	650	170	10 U	441	63	23	36	7
EH-130	6/1/2023	45.36	7.00	312	5.63	286	507	13.6	10.8	7.1	319	84	12 J+	199	33	8	15	2
EH-130	10/5/2023	42.66	7.01	318	6.99	233	454	4.4	9.5	7.1	317	88	10 U	199	32	8	14	2
EH-132	10/6/2023	60.26	7.31	726	4.94	209	428	NM	12.0	7.5	709	150	615	502	69	24	40	9
EH-134	5/31/2023	59.09	7.44	473	6.00	199	418	12.5	12.6	7.5	478	140	20	336	49	14	23	6
EH-134	10/6/2023	53.60	7.48	476	7.16	173	393	16.9	11.8	7.6	469	150	12	325	46	15	25	6
EH-135	10/5/2023	26.81	7.03	300	5.29	239	461	5.0	9.1	7.2	299	88	10 U	198	32	7	15	3
EH-138	6/1/2023	47.81	7.20	470	8.28	272	493	6.7	10.9	7.3	478	120	469.00	298	40	11	35	2
EH-138	10/5/2023	42.10	7.22	416	8.80	223	444	11.7	9.4	7.3	418	120	10 U	270	36	10	30	2
EH-139	6/1/2023	55.68	7.31	650	7.84	234	454	5.5	10.5	7.4	662	200	15 J+	437	57	23	33	8
EH-139	10/5/2023	47.10	7.28	740	8.62	196	417	5.4	9.9	7.3	736	260	10 U	480	61	33	33	7

			Field Parameters							General Chemistry					Major Cations			
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	Calcium	Magnesium	Sodium	Potassium
EH-141 (Low-Flow)	6/1/2023	34.29	7.24	798	4.70	272	492	0.9	10.4	7.3	813	160	10 U	542	84	23	43	6
EH-141 (3 Vol Purge)	6/1/2023	34.29	7.23	799	4.80	260	481	2.5	10.7	7.3	814	160	10 U	548	81	22	42	6
EH-141 (Low-Flow)	10/5/2023	28.70	7.26	801	4.90	203	424	0.4	9.7	7.3	794	170	10 U	549	81	22	45	6
EH-141 (3 Vol Purge)	10/5/2023	28.70	7.26	801	4.86	184	404	4.4	11.0	7.3	793	170	10 U	542	82	22	44	6
EH-143	6/1/2023	35.02	7.12	401	7.53	257	476	15.6	12.2	7.2	408	99	72	253	41	11	20	2
EH-143	10/5/2023	30.37	7.19	415	6.04	200	421	6.4	9.9	7.3	416	110	10 U	278	42	10	21	3
EH-143 (Dup)	10/5/2023	30.37	7.19	415	6.08	200	421	6.4	9.9	7.3	415	110	10 U	267	42	11	22	3
EH-204	6/2/2023	57.67	7.14	1791	3.42	228	448	69.9	10.7	7.2	1790	260	121 J	1400	240	57	74	11
EH-204	10/11/2023	57.22	7.14	1829	3.58	75	295	74.7	11.3	7.2	1770	270	122	1350	246	54	69	11
EH-206	10/6/2023	49.61	7.54	809	6.39	197	417	133.0	11.4	7.6	793	220	122	563	100	26	22	10
EH-210	6/2/2023	35.76	7.32	724	7.86	186	406	114.0	11.3	7.4	744	130	356 J	512	84	19	40	8
EH-210 (Dup)	6/2/2023	35.76	7.32	724	7.81	187	407	114.0	11.3	7.4	754	130	282 J	515	85	19	41	8
EH-210	10/11/2023	37.52	7.29	809	7.58	186	406	34.9	10.8	7.3	798	140	165	563	91	20	40	9
MW-1	10/3/2023	52.88	7.40	458	9.55	263	484	816 J	10.4	7.5	462	120	131	320	49	10	25	5
MW-2	10/3/2023	40.54	7.05	910	2.18	-80	140	16.2	11.1	7.1	915	260	21	640	118	27	27	7
MW-3	10/3/2023	35.95	6.99	1056	0.16	125	345	6.3	11.2	7.0	1050	240	13	753	140	33	30	8
MW-4	10/3/2023	49.76	7.29	459	8.53	159	378	75.3	12.0	7.4	467	160	142	313	49	10	26	6
MW-5	10/3/2023	54.40	7.70	437	8.92	166	386	6.4	11.5	7.8	423	150	32	290	42	9	28	4
MW-6	10/3/2023	32.33	7.04	1607	1.40	128	347	17.7	11.9	7.1	1560	280	18	1200	223	49	38	8
MW-6 (Dup)	10/3/2023	32.33	7.04	1599	1.38	129	348	17.7	11.9	7.0	1520	280	13	1160	212	57	36	7
MW-7	10/3/2023	54.50	7.53	256	9.10	225	445	22.6	11.3	7.7	258	90	17	201	21	6	18	5
MW-8	10/3/2023	53.35	7.35	483	7.00	224	444	22.9	10.9	7.4	489	160	27	332	54	13	22	6
MW-9	10/3/2023	52.36	7.51	451	8.21	220	440	134.0	10.8	7.6	454	160	126	310	49	10	24	5
MW-10	10/3/2023	45.81	7.40	746	5.41	254	474	82.3	10.7	7.4	752	250	44	493	86	22	38	8
MW-11	10/3/2023	63.85	7.68	675	9.57	243	463	9.8	11.1	7.7	682	120	10 U	471	49	12	62	11
PBTW-2	6/2/2023	39.73	6.82	1166	0.78	24	244	26.4	11.2	6.9	1190	260	21 J	796	98	20	122	19
PBTW-2	10/12/2023	37.82	6.80	1318	1.37	8	229	78.8	10.2	6.9	1280	260	16	893	117	23	122	19
PRB-2	6/2/2023	37.59	6.82	1422	0.27	88	308	88.7	11.2	6.9	1450	240	165 J	1030	138	26	137	15
PRB-2	10/11/2023	35.57	6.80	1820	4.23	143	363	75.5	11.4	6.9	1790	230	80	1340	192	35	156	17
SDMW-1	6/2/2023	52.29	6.80	1502	0.50	57	277	78.3	11.5	6.9	1530	260	90 J	1050	113	22	174	33
SDMW-1	10/12/2023	50.46	6.82	1473	0.18	-7	213	87.7	11.2	6.9	1470	280	103 J-	999	109	22	166	33
SDMW-1 (Dup)	10/12/2023	50.46	6.82	1476	0.19	-7	213	87.7	11.1	6.9	1460	270	134 J-	1010	105	21	164	32
SDMW-5	6/2/2023	55.12	5.89	631	0.72	62	282	21.9	11.1	6.0	643	67	14 J	386	35	11	44	21
SDMW-5	10/12/2023	54.18	5.80	650	1.18	65	285	99.4	10.9	6.0	662	67	21	389	35	11	47	21

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
NM = not measured
J = QC criterion exceeded (estimated value with bias direction not indicated)
J- = QC criterion exceeded (estimated value with potential low bias)
J+ = QC criterion exceeded (estimated value with potential high bias)
R = value rejected during validation

		Anions				Dissolved (D) Metals										
Station ID	**Sample Date**	**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	6/1/2023	150	14	140	0.45	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
2843 Canyon Ferry Rd	10/13/2023	Analytical Results Rejected As Not Representative														
2853 Canyon Ferry Rd	6/1/2023	150	15	157	0.54	0.003 U	0.002 U	0.001 U	0.001 U	0.02	0.005 U	0.01 U	0.001 U	0.038	0.001 U	0.01 U
2853 Canyon Ferry Rd	10/13/2023	Analytical Results Rejected As Not Representative														
Amchem4	10/5/2023	140	3	38	0.15	0.003 U	0.003	0.001 U	0.001 J+	0.03 J+	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
Dartman Well	6/1/2023	110	4	73	0.11	0.003 U	0.002 U	0.001 U	0.001 U	0.2	0.005 U	0.02	0.001 U	0.002	0.001 U	0.01 U
Dartman Well	10/5/2023	120	4	73	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
DH-6	10/17/2023	190	13	296	0.21	0.026	0.442	0.001 U	0.063	0.02 U	0.005 U	0.01 U	0.001 U	0.168	0.001 U	0.01 U
DH-8	10/12/2023	420	273	1440	21.9	0.003 U	0.002	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.325	0.002	0.01 U
DH-15	10/17/2023	160	10	387	0.32	0.003 U	0.002 U	0.001 U	0.011	0.02 U	0.005 U	0.01	0.001 U	0.11	0.001 U	0.01 U
DH-17	5/30/2023	520	26	453	1.9	0.003 U	17.1	0.003	0.004	0.06	0.005 U	1.86	0.001 U	0.001	0.001 U	0.51
DH-17	10/12/2023	310	20	451	1.69	0.003 U	11.9	0.009	0.016	0.02 U	0.005 U	1.32	0.001 U	0.002	0.003	15.0
DH-42	10/11/2023	No Sample - Insufficient Water														
DH-52	10/17/2023	150	9	354	0.22	0.023	0.311	0.001 U	0.002	0.02 U	0.005 U	0.01	0.001 U	0.043	0.001 U	0.01 U
DH-53	10/17/2023	160	7	141	0.05 U	0.01	0.17	0.001 U	0.002	0.02 U	0.005 U	2.82	0.001 U	0.034	0.001 U	0.01 U
DH-53 (Dup)	10/17/2023	160	7	141	0.05 U	0.01	0.169	0.001 U	0.002	0.02 U	0.005 U	2.8	0.001 U	0.034	0.001 U	0.01 U
DH-55	10/17/2023	200	17	956	0.65	0.025	0.102	0.001	0.005	0.02 U	0.005 U	0.35	0.001 U	0.191	0.01	0.62
DH-56	5/30/2023	280	18	945	0.8	0.024	0.459	0.001 U	0.015	0.02 U	0.005 U	0.01 U	0.001 U	0.188	0.001 U	0.01
DH-56	10/17/2023	390	45	2640	2.8	0.021	0.349	0.001 U	0.005	0.05	0.005 U	0.01 U	0.001 U	0.6	0.001 U	0.01 U
DH-58	5/30/2023	290	19	327	0.9	0.029	0.596	0.001 U	0.002	0.02 U	0.005 U	1.27	0.001 U	0.006	0.001 U	0.01 U
DH-58	10/11/2023	290	20	347	1.18	0.024	0.513	0.001 U	0.002	0.03	0.005 U	1.65	0.001 U	0.012	0.001 U	0.01 U
DH-66	5/30/2023	210	137	525	8.1	0.003 U	0.003	0.087	0.001	0.02	0.005 U	0.01 U	0.001 U	1.64	0.001 U	0.05
DH-66	10/12/2023	260	227	1050	17.6	0.003 U	0.008	0.226	0.003	0.02 U	0.005 U	0.01 U	0.001	0.784	0.001 U	0.13
DH-67 (Low-Flow)	10/11/2023	210	71	394	2.74	0.003 U	0.075	0.001 U	0.002	0.02 U	0.005 U	0.02	0.001 U	0.106	0.001 U	0.01 U
DH-67 (3 Vol Purge)	10/11/2023	170	71	442	3.3	0.003 U	0.200	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.132	0.001 U	0.01 U
DH-69	10/11/2023	240	9	395	0.24	0.006	0.193	0.001 U	0.001 U	10.8	0.005 U	4.11	0.001 U	0.007	0.003	0.19
DH-77	5/30/2023	No Sample - Insufficient Water														
DH-77	10/12/2023	No Sample - Insufficient Water														
DH-79	5/31/2023	400	27	406	1.2	0.003 U	19.0	0.001 U	0.001 U	0.08	0.005 U	2.63	0.001 U	0.036	0.001 U	0.01
DH-79	10/12/2023	570	56	874	2.48	0.003	19.8	0.001	0.008	0.02 U	0.005 U	1.89	0.001 U	0.282	0.001 U	0.02
DH-80	5/31/2023	55	12	267	0.21	0.003 U	5.57	6.35	0.035	0.96	0.005 U	2.56	0.001 U	0.018	0.151	2.3
DH-80	10/11/2023	79	12	268	0.22	0.003 U	6.73	4.1	0.022	0.72	0.005 U	2.37	0.001 U	0.007	0.139	1.95
EH-50	10/11/2023	220	97	569	1.53	0.003 U	4.23	0.001 U	0.002	0.02 U	0.005 U	0.02	0.001 U	0.012	0.001 U	0.01 U
EH-51	10/10/2023	120	20	75	0.05	0.003 U	0.032	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-52	10/10/2023	140	8	60	0.05 U	0.013	0.251	0.001 U	0.003	0.11	0.005 U	0.01 U	0.001 U	0.003	0.001 U	0.01 U
EH-53	10/4/2023	220	15	60	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	0.005	0.001 U	0.01 U
EH-54	10/4/2023	130	7	46	0.05 U	0.003 U	0.022	0.001 U	0.003 J+	0.02 U	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-58	10/4/2023	180	16	110	0.06	0.003 U	0.002 U	0.001 U	0.002 J+	0.07	0.005 U	0.05	0.001 U	0.002	0.001 U	0.01 U
EH-59 (Low-Flow)	6/2/2023	140	13	77	0.05 U	0.005	0.014	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-59 (3 Vol Purge)	6/2/2023	130	12	75	0.05 U	0.005	0.02	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.004	0.001 U	0.01 U
EH-59 (Low-Flow)	10/4/2023	180	8	72	0.05	0.003 U	0.018	0.001 U	0.001 J+	0.1	0.005 U	0.12	0.001 U	0.001 U	0.001 U	0.01 U
EH-59 (3 Vol Purge)	10/4/2023	180	8	71	0.05	0.004	0.018	0.001 U	0.001 J+	0.08	0.005 U	0.14	0.001 U	0.001	0.001 U	0.01 U
EH-60	10/17/2023	46	287	495	1.14	0.003 U	2.82	0.001 U	0.001	0.02 U	0.005 U	0.02	0.001 U	0.021	0.001 U	0.01 U
EH-61	10/17/2023	220	23	468	0.63	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-62	10/4/2023	140	11	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-63	10/5/2023	130	18	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

		Anions				Dissolved (D) Metals										
Station ID	Sample Date	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-65 (Low-Flow)	10/10/2023	180	37	468	0.48	0.003 U	0.193	0.001 U	0.001	0.02 U	0.005 U	0.02	0.001 U	0.125	0.001 U	0.01 U
EH-65 (3 Vol Purge)	10/10/2023	170	37	476	0.48	0.003 U	0.199	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.122	0.001 U	0.01 U
EH-66	10/4/2023	210	5	57	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.13	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
EH-68	6/1/2023	160	7	60	0.05 U	0.003 U	0.002 U	0.001 U	0.005	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.02
EH-68	10/4/2023	200	9	64	0.05 U	0.003 U	0.002 U	0.001 U	0.003 J+	0.03 J+	0.005 U	0.01 U	0.001 U	0.001 U	0.001 U	0.01 U
EH-69	6/1/2023	130	11	74	0.05 U	0.003 U	0.002 U	0.001 U	0.001 U	0.04	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-69	10/4/2023	180	16	83	0.09	0.003 U	0.002 U	0.001 U	0.001 U	0.04 J+	0.005 U	0.01 U	0.001 U	0.005	0.001 U	0.01 U
EH-70	10/6/2023	160	20	207	0.44	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.04	0.001 U	0.01 U
EH-100	10/11/2023	240	30	929	1.78	0.003 U	6.49	0.008	0.004	0.02	0.005 U	25.8	0.001 U	0.003	0.001	0.59
EH-101	10/10/2023	110	17	65	0.05 U	0.003 U	0.003	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
EH-102	10/24/2023	120	16	66	0.05 U	0.003 U	0.002 U	0.001 U	0.006	0.07	0.005 U	0.01 U	0.001 U	0.006	0.001 U	0.01 U
EH-103	10/17/2023	180	29	782	2.53	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.316	0.001 U	0.01 U
EH-104	10/10/2023	280	63	288	1.05	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.094	0.001 U	0.01 U
EH-104 (Dup)	10/10/2023	280	62	292	1.04	0.003 U	0.002 U	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.094	0.001 U	0.01 U
EH-106	10/10/2023	250	42	356	0.82	0.003 U	0.071	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-107	10/10/2023	190	32	331	0.31	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.18	0.001 U	0.105	0.001 U	0.01 U
EH-110	10/10/2023	170	24	124	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	0.018	0.001 U	0.01 U
EH-111	10/10/2023	190	32	944	1.6	0.003 U	1.74	0.001 U	0.001	0.02 U	0.005 U	9.9	0.001 U	0.152	0.001 U	0.01 U
EH-114 (Low-Flow)	6/1/2023	190	36	817	1.6	0.003 U	1.93	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.011	0.001 U	0.01 U
EH-114 (3 Vol Purge)	6/1/2023	190	36	841	1.6	0.003 U	1.97	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.011	0.001 U	0.01 U
EH-114 (Low-Flow)	10/5/2023	200	36	809	1.67	0.003 U	1.81	0.001 U	0.002 J+	0.03 J+	0.005 U	0.01 U	0.001 U	0.015	0.001 U	0.01 U
EH-114 (3 Vol Purge)	10/5/2023	200	36	816	1.66	0.003 U	1.84	0.001 U	0.001 J+	0.02 U	0.005 U	0.01 U	0.001 U	0.015	0.001 U	0.01 U
EH-115	5/31/2023	210	46	452	1.7	0.003 U	1.64	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.041	0.001 U	0.01 U
EH-115	10/10/2023	230	72	418	1.62	0.003 U	1.3	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.054	0.001 U	0.01 U
EH-117	10/20/2023	200	63	374	1.63	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.07	0.001 U	0.01 U
EH-119	10/6/2023	200	37	857	1.62	0.003 U	0.002 U	0.001 U	0.001	0.02 U	0.005 U	0.01	0.001 U	0.046	0.001 U	0.01 U
EH-120	6/1/2023	170	29	367	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	0.154	0.001 U	0.01 U
EH-120	10/6/2023	180	23	312	0.58	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.071	0.001 U	0.01 U
EH-121	10/4/2023	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-123	6/1/2023	190	24	117	0.17	0.003 U	0.006	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-123	10/5/2023	210	34	136	0.23	0.003 U	0.005	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-124	10/6/2023	290	43	390	1.48	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.056	0.001 U	0.01 U
EH-125	10/6/2023	120	8	66	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	0.002	0.001 U	0.01 U
EH-126	10/6/2023	260	35	275	0.87	0.003 U	0.003	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.094	0.001 U	0.01 U
EH-129	5/31/2023	190	19	126	0.4	0.003 U	0.005	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.03	0.001 U	0.01 U
EH-129 (Dup)	5/31/2023	190	19	126	0.4	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.029	0.001 U	0.01 U
EH-129	10/6/2023	200	20	140	0.44	0.003 U	0.004	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.027	0.001 U	0.01 U
EH-130	6/1/2023	100	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-130	10/5/2023	110	7	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-132	10/6/2023	180	31	163	0.77	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	5/31/2023	170	13	75	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	10/6/2023	180	13	76	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-135	10/5/2023	110	5	55	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	6/1/2023	140	11	97	0.17	0.003 U	0.002 U	0.001 U	0.001 U	0.03	0.005 U	0.01 U	0.001 U	0.014	0.001 U	0.01 U
EH-138	10/5/2023	140	9	79	0.1	0.003 U	0.002 U	0.001 U	0.001 J+	0.02 U	0.005 U	0.01 U	0.001 U	0.006	0.001 U	0.01 U
EH-139	6/1/2023	250	14	111	0.09	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-139	10/5/2023	310	16	112	0.18	0.003 U	0.005	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

		Anions				Dissolved (D) Metals										
Station ID	Sample Date	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-141 (Low-Flow)	6/1/2023	200	20	219	0.73	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.055	0.001 U	0.01 U
EH-141 (3 Vol Purge)	6/1/2023	190	20	222	0.74	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.055	0.001 U	0.01 U
EH-141 (Low-Flow)	10/5/2023	210	20	217	0.7	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.046	0.001 U	0.01 U
EH-141 (3 Vol Purge)	10/5/2023	210	20	220	0.7	0.003 U	0.002	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.045	0.001 U	0.01 U
EH-143	6/1/2023	120	10	82	0.16	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.01	0.001 U	0.01 U
EH-143	10/5/2023	130	9	84	0.12	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.009	0.001 U	0.01 U
EH-143 (Dup)	10/5/2023	130	9	84	0.12	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.009	0.001 U	0.01 U
EH-204	6/2/2023	320	76	639	1.7	0.003 U	0.002 U	0.001 U	0.002	0.02 U	0.005 U	0.01 U	0.001 U	0.064	0.001 U	0.01 U
EH-204	10/11/2023	330	75	644	1.74	0.003 U	0.004	0.001	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.058	0.001 U	0.01 U
EH-206	10/6/2023	270	69	93	0.19	0.003 U	0.024	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	6/2/2023	160	24	196	1.73	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.06	0.001 U	0.01 U
EH-210 (Dup)	6/2/2023	160	25	200	1.8	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.059	0.001 U	0.01 U
EH-210	10/11/2023	160	28	217	2.35	0.003 U	0.002 U	0.001 U	0.001 U	0.02 U	0.005 U	0.01 U	0.001 U	0.062	0.001 U	0.01 U
MW-1	10/3/2023	150	15	91	0.14	0.003 U	0.004	0.001 U	0.001 U	0.04	0.005 U	0.01 U	0.001 U	0.002	0.001 U	0.01 U
MW-2	10/3/2023	320	32	201	0.2	0.003 U	0.01	0.001 U	0.001 U	0.02 U	0.005 U	0.48	0.001 U	0.001 U	0.001 U	0.01 U
MW-3	10/3/2023	300	54	257	0.33	0.003 U	0.012	0.001 U	0.002	0.02 U	0.005 U	0.07	0.001 U	0.007	0.001 U	0.01 U
MW-4	10/3/2023	200	9	67	0.07	0.003 U	0.003	0.001 U	0.001	0.02 U	0.005 U	0.01 U	0.001 U	0.001	0.001 U	0.01 U
MW-5	10/3/2023	180	6	61	0.06	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
MW-6	10/3/2023	340	73	530	0.39	0.003 U	0.026	0.001 U	0.001	0.02 U	0.005 U	0.04	0.001 U	0.012	0.001 U	0.01 U
MW-6 (Dup)	10/3/2023	350	70	530	0.38	0.003 U	0.025	0.001 U	0.001	0.02 U	0.005 U	0.04	0.001 U	0.012	0.001 U	0.01 U
MW-7	10/3/2023	110	2	36	0.05 U	0.003 U	0.015	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	10/3/2023	200	11	76	0.08	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	0.001 U	0.01 U
MW-9	10/3/2023	190	10	62	0.07	0.003 U	0.005	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	10/3/2023	300	15	135	0.12	0.003 U	0.007	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
MW-11	10/3/2023	140	24	184	0.21	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	6/2/2023	320	18	325	1.6	0.003 U	3.4	0.001 U	0.001 U	0.25	0.005 U	2.53	0.001 U	0.118	0.001 U	0.27
PBTW-2	10/12/2023	320	20	390	1.72	0.003 U	2.66	0.001 U	0.001	0.27	0.005 U	2.61	0.001 U	0.073	0.001 U	0.42
PRB-2	6/2/2023	290	23	496	1.7	0.008	1.1	0.003	0.002	0.03	0.005 U	1.48	0.001 U	0.009	0.001 U	0.14
PRB-2	10/11/2023	280	25	745	1.6	0.006	0.948	0.004	0.002	0.02 U	0.005 U	2.05	0.001 U	0.021	0.001 U	0.18
SDMW-1	6/2/2023	310	30	471	2.3	0.011	3.42	1.44	0.001 U	0.06	0.005 U	3.95	0.001 U	0.003	0.001 U	0.01 U
SDMW-1	10/12/2023	340	23	463	1.66	0.008	3.6	1.2	0.001 U	0.48	0.005 U	3.83	0.001 U	0.014	0.001 U	0.01 U
SDMW-1 (Dup)	10/12/2023	330	23	460	1.64	0.008	3.59	1.22	0.001 U	0.5	0.005 U	3.69	0.001 U	0.014	0.001 U	0.01 U
SDMW-5	6/2/2023	81	13	201	0.39	0.003 U	9.58	0.337	0.001 U	6.88	0.005 U	3.5	0.001 U	0.001 U	0.039	4.56
SDMW-5	10/12/2023	81	13	209	0.49	0.003 U	7.68	0.431	0.002	5.26	0.005 U	3.29	0.001 U	0.001 U	0.036	4.59

NOTES: All concentrations in mg/L except as indicated.
U = value below reporting limit
NM = not measured
J = QC criterion exceeded (estimated value with low/high bias not indicated)
J- = QC criterion exceeded (estimated value with potential low bias)
J+ = QC criterion exceeded (estimated value with potential high bias)
R = value rejected during validation

			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	1/18/2023	21.90	7.33	560	3.85	9.2	2	52	14	104	1.11	0.033
DH-6	2/16/2023	22.35	7.53	612	3.79	9.0	2	52	13	128	1.02	0.054
DH-6	3/16/2023	22.64	7.22	630	4.61	8.7	2	60	12	145	0.946	0.070
DH-6	4/20/2023	22.46	7.32	750	3.93	8.0	3	65	12	166	0.881	0.090
DH-6	5/19/2023	20.95	7.31	692	4.08	9.3	3	60	12	155	0.829	0.075
DH-6 (Dup)	5/19/2023	20.95	7.30	691	4.08	9.3	3	60	12	154	0.823	0.075
DH-6	6/22/2023	18.38	7.28	588	5.05	10.1	2	51	17	113	0.757	0.057
DH-6	7/19/2023	19.90	7.24	759	NM	10.4	3	62	23	170	0.637	0.194
DH-6	8/15/2023	20.35	7.17	1228	5.46	11.9	5	73	13	214	0.559	0.278
DH-6	9/26/2023	19.84	7.26	1000	4.06	14.7	7	82	13	294	0.502	0.210
DH-6	10/17/2023	20.56	7.23	1011	3.30	11.9	7	78	13	296	0.442	0.168
DH-6	11/16/2023	21.15	7.14	1051	3.37	9.9	7	83	13	308	0.500	0.152
DH-6	12/19/2023	22.17	7.11	1045	3.48	9.5	7	89	14	304	0.562	0.134
DH-15	1/18/2023	20.85	6.99	1099	0.30	8.9	23	5	8	437	<0.002	0.150
DH-15	2/16/2023	21.30	7.14	1109	0.52	7.9	22	5	10	448	<0.002	0.153
DH-15	3/16/2023	21.70	6.95	1051	2.54	8.0	22	5	11	423	<0.002	0.139
DH-15	4/20/2023	21.39	7.03	1125	0.36	8.3	23	5	11	427	<0.002	0.160
DH-15	5/19/2023	19.81	7.00	1100	0.12	9.8	25	5	11	426	<0.002	0.155
DH-15	6/22/2023	17.27	6.97	1056	0.18	9.9	22	5	10	402	<0.002	0.124
DH-15	7/19/2023	17.35	6.96	1051	NM	10.5	21	5	8	408	<0.002	0.123
DH-15	8/15/2023	17.73	6.96	1110	0.62	11.8	22	5	9	416	<0.002	0.128
DH-15	9/26/2023	17.24	7.09	1023	0.08	10.6	21	5	10	398	<0.002	0.112
DH-15	10/17/2023	18.03	7.07	1023	0.59	10.6	20	4	10	387	<0.002	0.110
DH-15	11/16/2023	18.84	6.98	1030	0.08	9.5	20	4	10	384	<0.002	0.111
DH-15	12/19/2023	19.84	6.97	1042	0.20	9.2	21	4	10	395	<0.002	0.109
DH-15 (Dup)	12/19/2023	19.84	6.97	1042	0.19	9.2	22	5	10	396	<0.002	0.109
DH-52	1/18/2023	7.50	7.08	397	7.97	6.2	4	41	8	73	0.411	0.020
DH-52	2/16/2023	8.32	7.29	516	2.82	5.4	4	46	7	109	0.339	0.040
DH-52	3/16/2023	8.75	6.88	657	NM	5.3	10	58	7	176	0.281	0.033
DH-52	4/20/2023	8.25	7.17	709	1.33	5.1	9	55	7	183	0.301	0.048
DH-52	5/19/2023	5.35	7.28	289	4.52	7.1	3	31	4	52	0.478	0.017
DH-52	6/22/2023	5.28	6.95	660	2.18	9.6	8	56	7	178	0.314	0.037
DH-52 (Dup)	6/22/2023	5.28	6.95	659	2.19	9.6	8	56	7	178	0.311	0.037
DH-52	7/18/2023	6.32	7.02	1164	0.74	11.6	15	71	8	394	0.273	0.036
DH-52	8/16/2023	7.04	7.07	1014	0.93	11.8	13	75	7	380	0.318	0.055
DH-52 (Dup)	8/16/2023	7.04	7.07	1013	0.94	11.8	13	75	7	381	0.314	0.055
DH-52	9/26/2023	7.03	7.11	922	0.56	12.6	11	69	7	312	0.309	0.037
DH-52	10/17/2023	7.48	7.08	1011	6.88	11.9	12	73	9	354	0.311	0.043
DH-52	11/16/2023	8.02	7.08	1114	0.75	9.8	13	71	9	405	0.308	0.050
DH-52	12/19/2023	8.53	7.10	1200	0.90	8.0	15	72	10	437	0.288	0.048

			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-53	1/18/2023	10.50	6.94	385	0.34	8.1	6	23	7	68	0.152	0.025
DH-53	2/16/2023	11.16	7.20	394	0.65	6.8	6	20	8	72	0.115	0.014
DH-53	3/16/2023	11.42	6.92	364	0.52	6.0	6	19	9	69	0.100	0.012
DH-53 (Dup)	3/16/2023	11.42	6.92	364	0.51	6.0	6	20	9	69	0.100	0.010
DH-53	4/20/2023	10.67	7.13	408	1.16	4.2	7	20	10	70	0.109	0.012
DH-53	5/19/2023	7.95	7.02	456	0.20	7.1	8	23	8	86	0.148	0.032
DH-53	6/22/2023	8.26	6.92	671	5.67	10.0	13	34	8	137	0.160	0.069
DH-53	7/18/2023	9.43	6.97	747	0.41	11.1	12	36	6	166	0.172	0.054
DH-53	8/16/2023	10.18	7.03	572	3.28	11.9	10	36	6	125	0.197	0.044
DH-53	9/26/2023	9.98	7.02	567	0.30	13.2	9	35	7	137	0.166	0.035
DH-53	10/17/2023	10.43	7.01	575	6.27	12.6	9	34	7	141	0.170	0.034
DH-53 (Dup)	10/17/2023	10.43	7.01	575	6.17	12.6	9	33	7	141	0.169	0.034
DH-53	11/16/2023	10.96	6.93	566	1.55	11.1	10	31	7	120	0.144	0.020
DH-53 (Dup)	11/16/2023	10.96	6.93	565	1.52	11.1	10	30	7	117	0.146	0.020
DH-53	12/19/2023	11.48	6.95	407	0.40	9.8	7	24	7	64	0.130	0.003
DH-55	1/18/2023	81.36	7.22	1968	0.93	7.0	18	139	17	761	0.112	0.128
DH-55	2/16/2023	81.72	7.32	2149	2.18	6.9	19	134	18	910	0.113	0.113
DH-55 (Dup)	2/16/2023	81.72	7.32	2145	2.13	6.9	19	134	18	922	0.112	0.110
DH-55	3/16/2023	81.86	7.13	2006	0.91	7.4	19	141	18	862	0.118	0.084
DH-55	4/20/2023	81.36	7.39	2100	1.05	7.3	19	152	18	868	0.126	0.114
DH-55 (Dup)	4/20/2023	81.36	7.39	2101	1.04	7.3	18	147	18	863	0.123	0.112
DH-55	5/19/2023	80.22	7.24	1928	0.50	9.5	16	134	15	754	0.119	0.120
DH-55	6/22/2023	79.57	7.22	2079	4.63	8.6	16	138	16	856	0.097	0.269
DH-55	7/18/2023	80.25	7.12	2889	3.96	10.8	30	176	20	1350	0.090	0.303
DH-55 (Dup)	7/18/2023	80.25	7.17	2906	4.44	9.3	30	177	20	1350	0.090	0.305
DH-55	8/16/2023	80.82	7.20	2465	0.71	9.8	21	172	16	1090	0.110	0.254
DH-55	9/27/2023	80.97	7.33	2187	0.74	8.5	16	147	17	914	0.104	0.176
DH-55	10/17/2023	80.94	7.32	2290	4.14	9.6	17	159	17	956	0.102	0.191
DH-55	11/16/2023	81.19	7.28	2685	5.16	8.3	22	193	19	1140	0.097	0.232
DH-55	12/19/2023	81.44	7.24	3011	0.92	7.7	28	220	21	1360	0.097	0.244
DH-56	6/22/2023	82.01	7.77	2737	NM	10.8	13	215	21	1010	0.461	0.323
DH-56	7/18/2023	80.75	7.49	7970	NM	13.7	59	727	85	3530	0.413	2.75
DH-56	8/16/2023	82.50	7.45	6639	4.15	11.0	56	728	64	3420	0.346	1.22
DH-56	9/26/2023	82.81	7.57	5790	2.35	11.2	45	577	48	2840	0.338	0.672
DH-56 (Dup)	9/26/2023	82.81	7.57	5789	2.33	11.2	45	570	48	2880	0.344	0.690
DH-56	10/17/2023	83.05	7.55	5577	6.82	11.7	39	541	45	2640	0.349	0.600
DH-56	11/16/2023	83.52	7.62	5209	2.81	9.5	34	476	38	2320	0.374	0.576
DH-56	12/19/2023	84.36	7.59	4808	2.81	9.5	31	471	34	2090	0.396	0.495

			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)
EH-51	8/15/2023	14.58	6.80	418	6.66	10.9	7	20	17	61	0.029	0.003
EH-51	9/26/2023	14.34	6.91	437	6.51	11.5	7	22	21	75	0.062	0.003
EH-51	10/10/2023	15.13	6.97	446	6.47	11.0	7	22	20	75	0.032	0.003
EH-51	11/16/2023	17.13	6.79	437	5.53	9.1	7	22	18	75	0.026	0.003
EH-51	12/19/2023	18.79	6.77	443	5.07	9.3	7	21	17	76	0.028	0.003
EH-60	4/20/2023	26.85	5.56	1962	7.38	7.9	38	13	171	657	2.41	0.004
EH-60	5/19/2023	26.05	5.36	1975	1.43	10.5	43	12	167	695	2.48	0.004
EH-60	6/22/2023	24.30	5.48	1891	4.15	11.5	39	12	189	604	2.79	0.003
EH-60	7/18/2023	23.82	5.54	1747	5.73	14.0	30	11	191	500	3.10	0.005
EH-60	8/15/2023	23.89	5.53	1967	5.13	12.8	34	12	228	424	2.94	0.009
EH-60	9/26/2023	23.79	5.55	2036	6.49	12.0	36	12	284	492	2.75	0.018
EH-60	10/17/2023	24.01	5.60	2014	6.45	14.6	35	13	287	495	2.82	0.021
EH-60	11/16/2023	24.49	5.53	2048	5.74	9.8	35	12	278	511	2.72	0.031
EH-60	12/19/2023	25.13	5.56	1962	3.59	9.6	36	13	242	540	2.37	0.038
EH-61	1/18/2023	29.01	7.00	1374	1.53	9.6	13	12	18	495	<0.002	0.173
EH-61	2/16/2023	28.95	7.12	1412	1.93	9.3	13	12	19	524	<0.002	0.181
EH-61	3/16/2023	28.85	6.96	1390	1.20	7.5	14	13	22	521	<0.002	0.187
EH-61	4/20/2023	28.25	7.12	1468	1.49	9.4	15	13	23	518	<0.002	0.207
EH-61	5/19/2023	27.44	6.93	1488	0.94	11.1	17	13	24	533	<0.002	0.201
EH-61	6/22/2023	25.93	6.96	1465	1.23	11.5	16	13	24	512	<0.002	0.179
EH-61	10/17/2023	25.71	7.04	1358	1.69	11.9	13	12	23	468	<0.002	0.155
EH-101	8/15/2023	14.88	6.77	383	6.15	11.0	7	16	16	55	0.003	0.002
EH-101	9/26/2023	14.72	6.93	382	5.55	11.3	7	16	19	66	0.003	0.002
EH-101	10/10/2023	15.41	7.00	390	5.40	11.7	7	17	17	65	0.003	0.002
EH-101	11/16/2023	17.41	6.82	373	4.45	8.9	6	16	14	64	0.003	0.002
EH-101	12/19/2023	19.02	6.80	368	4.54	9.0	7	16	12	63	0.003	0.002
EH-103	1/18/2023	29.63	6.78	1695	3.29	9.8	47	7	30	747	<0.002	0.324
EH-103 (Dup)	1/18/2023	29.63	6.78	1694	3.27	9.8	47	7	30	760	<0.002	0.331
EH-103	2/16/2023	29.55	6.86	1720	0.80	9.4	46	6	30	798	<0.002	0.337
EH-103	3/16/2023	29.52	6.72	1622	0.37	10.6	47	6	30	757	<0.002	0.341
EH-103	4/20/2023	28.89	6.88	1696	1.27	9.1	51	7	30	770	<0.002	0.369
EH-103	5/19/2023	28.06	6.74	1700	0.16	11.2	53	6	30	773	<0.002	0.356
EH-103	6/22/2023	26.58	6.76	1688	0.24	11.1	47	7	29	743	<0.002	0.321
EH-103	7/18/2023	26.13	6.79	1707	0.69	12.3	49	6	26	808	<0.002	0.317
EH-103	8/15/2023	26.20	6.77	1783	0.49	12.8	50	6	25	815	<0.002	0.338
EH-103	9/26/2023	26.11	6.83	1695	0.72	11.3	49	6	29	785	<0.002	0.304
EH-103	10/17/2023	26.28	6.85	1703	1.26	12.1	49	7	29	782	<0.002	0.316
EH-103	11/16/2023	26.80	6.76	1711	0.42	10.4	48	6	29	769	0.002	0.303
EH-103	12/19/2023	27.44	6.76	1709	0.36	10.0	50	6	28	756	<0.002	0.290

All concentrations in mg/L except as indicated.

NM = not measured due to air entrainment/meter malfunction

APPENDIX A2

2023 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	6/21/2023		6.74	317	5.56	99	320	1.5	10.5	7.3	328	85	10 U	207	35	8	14	3	100	8	61	0.05 U
R1	10/3/2023		6.83	306	5.31	106	327	1.2	9.4	7.0	305	90	10 U	184	32	8	14	3	110	6	54	0.05 U
R2	6/21/2023		6.79	338	4.02	110	331	1.55	10.1	7.3	349	94	10 U	218	38	9	15	3	110	8	64	0.05 U
R2	9/5/2023		6.81	350	4.70	120	341	5.8	10.1	7.0	353	94	10 U	218	37	8	15	3	110	8	62	0.05 U
R3	6/21/2023		6.63	542	4.55	141	360	0.45	12.4	7.2	554	130	10 U	348	58	12	26	14	150	25	107	0.06
R3	10/3/2023		6.75	518	2.21	194	411	0.14	15.2	6.9	511	150	10 U	308	50	11	25	15	180	14	98	0.07
R4	6/21/2023		6.75	368	3.01	88	309	0.75	10.1	7.7	378	100	10 U	241	34	8	28	3	120	8	72	0.08
R4	10/4/2023		6.81	385	3.19	68	289	0.4	10.1	7.5	384	100	10 U	246	34	8	26	3	130	8	74	0.08
R5	6/20/2023		6.85	313	4.74	79	301	1.61	9.3	7.1	314	83	10 U	186	34	8	14	2	100	7	59	0.05 U
R5	10/3/2023		6.92	319	6.53	82	304	0.54	9.2	7.1	318	88	10 U	187	32	8	15	3	110	7	61	0.05 U
R6	6/20/2023		6.99	401	4.13	113	335	0.4	9.2	7.2	404	100	10 U	279	46	10	16	4	120	6	87	0.12
R6	10/3/2023		7.05	424	4.05	154	375	0.18	9.4	7.2	422	110	10 U	286	46	11	17	5	130	6	96	0.15
R6 (Dup)	10/3/2023		7.05	424	4.07	153	374	0.22	9.4	7.2	421	110	10 U	289	46	11	17	5	130	6	96	0.15
R7	6/20/2023	23.49	6.99	311	5.04	79	300	2.02	10.2	7.2	314	90	10 U	196	34	8	17	3	110	7	55	0.05 U
R7	10/3/2023	26.98	7.08	323	5.52	72	293	1.1	10.2	7.3	322	93	10 U	195	32	8	17	3	110	7	56	0.05 U
R8	6/20/2023	30.90	6.90	313	4.16	97	317	3.78	11.6	7.2	313	86	10 U	186	33	8	15	3	100	7	56	0.05 U
R8 (Dup)	6/20/2023		6.91	313	4.16	97	317	3.16	11.5	7.2	314	87	10 U	188	33	8	14	3	110	7	56	0.05 U
R8	10/3/2023	28.21	6.98	323	4.90	90	311	0.79	10.4	7.2	320	92	10 U	198	33	8	15	3	110	7	58	0.05 U
R9	6/20/2023	33.00	6.93	313	2.06	102	322	0.68	11.6	7.2	314	96	10 U	187	34	8	14	3	120	7	47	0.05 U
R9	10/3/2023	30.40	7.02	303	1.99	119	339	0.16	11.2	7.3	302	96	10 U	181	32	8	14	3	120	6	48	0.05 U
R10	6/21/2023		6.73	374	3.11	88	308	2.17	11.4	7.4	384	100	10 U	246	42	10	16	3	130	10	67	0.08
R10	9/5/2023		6.74	383	3.26	88	308	2.5	11.5	7.0	383	100	10 U	235	42	9	16	3	130	10	66	0.09
R11	6/21/2023		6.79	772	1.78	126	346	2.67	11.8	7.3	789	120	10 U	555	98	22	26	6	150	23	239	2.56
R11	10/10/2023		6.81	787	1.76	281	501	1.8	11.7	7.0	787	130	10 U	568	103	23	26	6	160	23	233	2.69
R12	6/23/2023	17.55	7.09	327	3.37	157	378	0.33	10.0	7.5	342	95	10 U	202	38	8	14	2	120	6	61	0.05 U
R12	10/3/2023	18.36	7.21	333	3.90	195	416	0.15	9.8	7.4	332	97	10 U	188	35	9	16	3	120	7	61	0.05 U
R13	6/23/2023		7.08	562	3.02	107	328	0.56	9.4	7.4	569	200	10 U	340	67	14	33	6	250	12	65	0.07
R13	10/4/2023	19.64	7.14	646	2.28	116	337	0.46	9.4	7.2	626	270	20 U	396	77	16	29	7	330	13	53	0.11
R14	6/23/2023	10.21	6.77	344	7.25	125	347	1.1	9.2	7.2	354	91	10 U	207	38	9	15	3	110	9	62	0.05 U
R14	10/3/2023	11.84	6.87	322	5.09	116	338	0.72	8.7	7.1	321	95	10 U	191	33	8	14	3	120	7	56	0.05 U
R15	6/23/2023		7.49	750	8.21	101	321	0.51	11.8	7.6	757	200	10 U	507	70	19	37	14	240	29	125	0.24
R15	10/4/2023		7.55	714	8.33	155	375	0.14	11.6	7.6	693	190	20 U	478	69	18	35	13	240	28	119	0.22
R16	6/23/2023		7.50	755	15.72	44	264	6.35	11.5	7.7	770	190	10 U	507	73	20	44	14	230	33	135	0.27
R16	10/4/2023		7.59	759	14.52	8	228	4.5	11.4	7.7	743	190	20 U	513	72	19	42	14	230	34	141	0.25
R17	6/23/2023	85.18	7.52	539	9.91	92	311	0.4	12.3	7.8	546	140	10 U	368	49	13	33	12	160	18	97	0.17
R17	10/4/2023	84.58	7.60	545	9.34	151	370	0.14	12.3	7.8	527	140	20 U	384	47	13	32	12	170	18	100	0.17
R18	6/20/2023		6.91	294	4.88	118	337	0.89	12.1	7.4	299	89	10 U	181	32	7	14	3	110	7	46	0.05 U
R18	10/4/2023		7.02	333	4.67	191	410	0.14	11.9	7.4	325	100	20 U	211	36	8	14	3	130	9	48	0.05 U
R19	6/20/2023		6.86	303	6.25	11.5	232	1.01	10.2	7.2	308	89	10 U	185	34	8	13	3	110	7	51	0.05 U
R19	10/4/2023		6.94	320	7.57	179	400	0.89	9.9	7.2	315	93	20 U	208	35	8	12	3	110	6	56	0.05 U
R20	6/20/2023		6.83	303	6.91	113	334	1.28	9.5	7.3	311	82	10 U	189	32	8	14	3	100	7	58	0.05 U
R20	10/4/2023		6.96	327	6.88	171	390	0.53	12.3	7.2	321	99	20 U	207	35	8	13	3	120	8	52	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)
R1	6/21/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.008	0.009	0.05	0.12
R1	10/3/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.008	0.008	0.05	0.12
R2	6/21/2023	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	0.08
R2	9/5/2023	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	0.07
R3	6/21/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.037	0.04	0.02 U	0.02 U
R3	10/3/2023	0.004	0.004	0.002 U	0.002 U	0.001 U	0.001 U	0.03	0.03	0.02 U	0.02 U
R4	6/21/2023	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	0.07
R4	10/4/2023	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	0.07
R5	6/20/2023	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	0.08
R5	10/3/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.001	0.03	0.31
R6	6/20/2023	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	0.02 U
R6	10/3/2023	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	0.02 U
R6 (Dup)	10/3/2023	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	0.02 U
R7	6/20/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.001 U	0.07	0.12
R7	10/3/2023	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	0.16
R8	6/20/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.003	0.02 U	0.25
R8 (Dup)	6/20/2023	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	0.26
R8	10/3/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.003	0.02 U	0.72
R9	6/20/2023	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	0.08
R9	10/3/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.002	0.003	0.02 U	0.16
R10	6/21/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.004	0.005	0.04	0.16
R10	9/5/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.003	0.005	0.03	0.17
R11	6/21/2023	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	0.17
R11	10/10/2023	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	0.22
R12	6/23/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.007	0.01	0.02 U	0.03
R12	10/3/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.012	0.013	0.02 U	0.13
R13	6/23/2023	0.003 U	0.003 U	0.014	0.015	0.001 U	0.001 U	0.009	0.01	0.02 U	0.02 U
R13	10/4/2023	0.003 U	0.003 U	0.014	0.014	0.001 U	0.001 U	0.011	0.013	0.02 U	0.03
R14	6/23/2023	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	0.06
R14	10/3/2023	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	0.23
R15	6/23/2023	0.003 U	0.003 U	0.015	0.015	0.001 U	0.001 U	0.001	0.002	0.02 U	0.02 U
R15	10/4/2023	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
R16	6/23/2023	0.003 U	0.003 U	0.015	0.018	0.001 U	0.001 U	0.001 U	0.003	0.05	0.59
R16	10/4/2023	0.003 U	0.003 U	0.016	0.018	0.001 U	0.001 U	0.001	0.004	0.06	0.59
R17	6/23/2023	0.003 U	0.003 U	0.016	0.017	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U
R17	10/4/2023	0.003 U	0.003 U	0.017	0.017	0.001 U	0.001 U	0.001 U	0.001 U	0.02 U	0.02 U
R18	6/20/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001 U	0.003	0.02 U	0.02 U
R18	10/4/2023	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
R19	6/20/2023	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
R19	10/4/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.001	0.02 U	0.02 U
R20	6/20/2023	0.003 U	0.003 U	0.002 U	0.002 U	0.001 U	0.001 U	0.001	0.005	0.02 U	0.02 U
R20	10/4/2023	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

Map Key (see Exhibit 1)	Sample Date	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	6/21/2023	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	10/3/2023	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	6/21/2023	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	9/5/2023	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	6/21/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.006	0.005	0.001 U	0.001 U	0.01 U	0.01 U
R3	10/3/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.004	0.004	0.001 U	0.001 U	0.01 U	0.01 U
R4	6/21/2023	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	10/4/2023	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	6/20/2023	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	10/3/2023	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	6/20/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R6	10/3/2023	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 (Dup)	10/3/2023	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	6/20/2023	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
R7	10/3/2023	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	6/20/2023	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 (Dup)	6/20/2023	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	10/3/2023	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	6/20/2023	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	10/3/2023	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
R10	6/21/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.002	0.001	0.001 U	0.001 U	0.01 U	0.01 U
R10	9/5/2023	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
R11	6/21/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.046	0.043	0.001 U	0.001 U	0.02	0.01
R11	10/10/2023	0.005 U	0.005 U	0.01 U	0.01 U	0.001 U	0.001 U	0.040	0.039	0.001 U	0.001 U	0.02	0.01
R12	6/23/2023	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	10/3/2023	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	6/23/2023	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
R13	10/4/2023	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
R14	6/23/2023	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	10/3/2023	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	0.01
R15	6/23/2023	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	10/4/2023	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	6/23/2023	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	0.03
R16	10/4/2023	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
R17	6/23/2023	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	10/4/2023	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	6/20/2023	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	10/4/2023	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	6/20/2023	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	10/4/2023	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	6/20/2023	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
R20	10/4/2023	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

2023 SURFACE
WATER QUALITY DATABASE

2023 Surface Water Quality Database -- East Helena Facility

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	5/30/2023	3928.32	7.54	114	10.03	11.4	221	7.7	138	39	101	24	16	3	5	1
PPC-3A	10/3/2023	3927.08	7.98	287	9.71	11.3	51.8	8.1	288	85	191	20 U	32	8	13	3
PPC-4A	5/30/2023	3911.21	7.55	114	10.22	11.4	223	7.7	137	38	94	16	16	3	5	1
PPC-4A	10/3/2023	3910.25	8.00	287	9.68	11.2	52.3	8.1	288	86	197	20 U	32	8	14	3
PPC-5A	5/30/2023	3903.46	7.46	116	10.02	10.4	225	7.7	137	39	95	15	15	3	5	1
PPC-5A	10/3/2023	3902.30	7.98	289	9.87	11.4	51.7	8.1	289	84	195	20 U	31	8	13	3
PPC-5A (Dup)	10/3/2023	3902.30	7.98	289	9.86	11.4	51.7	8.1	289	84	196	20 U	31	8	14	3
PPC-7	5/30/2023	3883.32	7.57	114	10.56	10.3	NM	7.7	137	39	101	16	16	3	5	1
PPC-7	10/3/2023	3882.02	7.99	287	10.08	10.5	53.3	8.1	288	85	189	20 U	31	8	13	3
PPC-8	5/30/2023	3869.11	Elevation Measurement Only - No Water Quality Sampling													
PPC-8	10/3/2023	3868.26	Elevation Measurement Only - No Water Quality Sampling													
PPC-36A	5/30/2023	3855.99	7.62	114	10.34	9.5	196	7.7	136	38	94	16	16	3	5	1
PPC-36A (Dup)	5/30/2023	3855.99	7.60	114	10.25	9.5	196	7.7	136	38	96	17	16	3	5	1
PPC-36A	10/3/2023	3855.24	7.93	287	9.78	9.5	51.4	8.0	288	85	186	20 U	30	8	14	3
PPC-9A	5/30/2023	3846.25	Elevation Measurement Only - No Water Quality Sampling													
PPC-9A	10/3/2023	3845.69	Elevation Measurement Only - No Water Quality Sampling													
SG-16	5/30/2023	3767.16	7.39	114	10.31	9.4	173	7.7	138	38	97	16	15	3	5	1
SG-16	10/3/2023	3766.42	7.93	288	10.22	9.5	46.3	8.1	290	85	193	10 U	32	8	13	3
Trib-1	5/30/2023	3918.03	7.27	398	4.51	17.4	0.3 J	7.4	471	170	287	10 U	56	12	20	4
Trib-1	10/3/2023	3917.89	7.24	472	2.72	10.2	0.083	7.3	476	180	297	10 U	57	14	23	4
Trib-1B	5/30/2023	3915.23	6.99	450	2.60	12.6	0.018 J	7.1	534	190	337	91	66	13	22	5
Trib-1B	10/3/2023	3914.60	6.96	527	2.51	11.5	0.00016 J	7.0	530	170	346	57	64	17	26	6
Trib-1D	5/30/2023	3905.35	7.52	409 J-	16.76	19.8	0.111 J	7.7	541	170	341	10 U	63	15	22	3
Trib-1D	10/3/2023	3905.24	7.56	624	5.92	11.3	0.012	7.6	627	190	427	10 U	77	18	26	5

NOTES:
All concentrations in mg/L except as indicated
(TR) = total recoverable
U = value below reporting limit
J = estimated value; J- = estimated value with potential low bias
NM = not measured (unsafe wading conditions)

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	5/30/2023	47	2	20	0.0005 U	0.005	0.00034	0.007	0.85	0.0144	0.08	0.000014	0.001 U	0.0002 U	0.071
PPC-3A	10/3/2023	100	7	51	0.0005 U	0.004	0.00018	0.002 U	0.19	0.0018	0.04	0.000005 U	0.001 U	0.0002 U	0.051
PPC-4A	5/30/2023	46	2	20	0.0005 U	0.004	0.00024	0.005	0.59	0.0072	0.06	0.000019	0.001 U	0.0002 U	0.054
PPC-4A	10/3/2023	100	7	51	0.0005 U	0.004	0.00019	0.002 U	0.20	0.0019	0.04	0.000005 U	0.001 U	0.0002 U	0.053
PPC-5A	5/30/2023	47	2	20	0.0005 U	0.004	0.00024	0.005	0.60	0.0080	0.06	0.000011	0.001 U	0.0002 U	0.058
PPC-5A	10/3/2023	100	7	52	0.0005 U	0.004	0.00020	0.002	0.22	0.0023	0.04	0.000006	0.001 U	0.0002 U	0.055
PPC-5A (Dup)	10/3/2023	100	7	51	0.0005 U	0.004	0.00020	0.002 U	0.22	0.0022	0.04	0.000005 U	0.001 U	0.0002 U	0.054
PPC-7	5/30/2023	47	2	19	0.0005 U	0.005	0.00025	0.006	0.69	0.0084	0.06	0.000014	0.001 U	0.0002 U	0.059
PPC-7	10/3/2023	100	7	52	0.0005 U	0.004	0.00020	0.003	0.21	0.0022	0.04	0.000005 U	0.001 U	0.0002 U	0.054
PPC-8	5/30/2023	Elevation Measurement Only - No Water Quality Sampling													
PPC-8	10/3/2023	Elevation Measurement Only - No Water Quality Sampling													
PPC-36A	5/30/2023	46	2	19	0.0005 U	0.005	0.00030	0.006	0.73	0.0082	0.06	0.000013	0.001 U	0.0002 U	0.068
PPC-36A (Dup)	5/30/2023	46	2	19	0.0005 U	0.005	0.00027	0.006	0.67	0.0083	0.06	0.000014	0.001 U	0.0002 U	0.062
PPC-36A	10/3/2023	100	7	51	0.0005 U	0.004	0.00022	0.003	0.27	0.0041	0.05	0.000007	0.001 U	0.0002 U	0.061
PPC-9A	5/30/2023	Elevation Measurement Only - No Water Quality Sampling													
PPC-9A	10/3/2023	Elevation Measurement Only - No Water Quality Sampling													
SG-16	5/30/2023	46	2	20	0.0005 U	0.005	0.00025	0.006	0.63	0.0084	0.06	0.000013	0.001 U	0.0002 U	0.06
SG-16	10/3/2023	100	7	51	0.0005 U	0.005	0.00022	0.003	0.30	0.0035	0.04	0.000006	0.001 U	0.0002 U	0.06
Trib-1	5/30/2023	200	8	56	0.0006	0.007	0.00011	0.002 U	0.29	0.0047	0.05	0.000016	0.001 U	0.0002 U	0.008 U
Trib-1	10/3/2023	220	10	57	0.0005 U	0.004	0.00011	0.002 U	0.17	0.0041	0.02	0.000016	0.001 U	0.0002 U	0.008 U
Trib-1B	5/30/2023	240	9	62	0.0015	0.025	0.03920	0.061	0.90	0.0726	1.41	0.000970	0.001 U	0.0006	1.08
Trib-1B	10/3/2023	210	10	96	0.0097	0.066	0.04220	0.115	6.87	0.369	2.84	0.00152	0.002	0.0012	1.42
Trib-1D	5/30/2023	200	7	93	0.0007	0.006	0.00007	0.005	0.12	0.0004	0.1	0.000007	0.001 U	0.0002 U	0.008 U
Trib-1D	10/3/2023	230	10	136	0.0005 U	0.006	0.00009	0.005	0.31	0.0014	0.1	0.000007	0.001 U	0.0002 U	0.008

NOTES: All concentrations in mg/L except as indicated

(TR) = total recoverable

U = value below reporting limit

J = estimated value; J- = estimated value with potential low bias

APPENDIX B

2023 GROUNDWATER ELEVATION DATA

2023 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**May-23**	**Oct-23**	**May-23**	**Oct-23**
2843 Canyon Ferry	Not Available	31.91	25.9	Not Calculated	Not Calculated
2853 Canyon Ferry	Not Available	33.44	28.2	Not Calculated	Not Calculated
ASIW-1	3915.99	18.94	19.46	3897.05	3896.53
ASIW-2	3909.13	34.15	38.00	3874.98	3871.13
Dartman	3863.03	29.22	25.75	3833.81	3837.28
DH-1	3910.89	43.37	43.76	3867.52	3867.13
DH-2	3936.91	63.38	62.94	3873.53	3873.97
DH-3	3947.48	30.72	31.37	3916.76	3916.11
DH-4	3917.26	14.13	14.65	3903.13	3902.61
DH-5	3921.18	17.82	17.50	3903.36	3903.68
DH-6	3890.91 / 3992.32*	20.49	20.11	3869.36	3869.74
DH-7	3898.66	15.99	16.91	3882.67	3881.75
DH-8	3923.38	52.27	51.50	3871.11	3871.88
DH-9	3918.08	DRY	DRY	DRY	DRY
DH-10A	3886.97	6.56	8.84	3880.41	3878.13
DH-13	3923.91	52.34	50.49	3871.57	3873.42
DH-14	3916.06	13.16	13.69	3902.90	3902.37
DH-15	3889.82	19.37	17.61	3870.45	3872.21
DH-17	3917.56	50.11	47.68	3867.45	3869.88
DH-18	3924.93	50.06	49.38	3874.87	3875.55
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	55.63	55.53	3890.58	3890.68
DH-30	3943.24	51.71	51.77	3891.53	3891.47
DH-36	3920.66	45.94	DRY	3874.72	DRY
DH-42	3942.63	49.19	49.33	3893.44	3893.30
DH-47	3926.82	20.65	21.54	3906.17	3905.28
DH-48	3905.96	33.88	35.73	3872.08	3870.23
DH-52	3889.18	5.10	7.19	3884.08	3881.99
DH-53	3892.87	7.74	10.19	3885.13	3882.68
DH-54	3890.27	26.59	24.73	3863.68	3865.54
DH-55	3972.76	80.12	80.83	3892.64	3891.93
DH-56	3958.17	84.44	82.85	3873.73	3875.32
DH-57	3929.53	DRY	DRY	DRY	DRY
DH-58	3919.33	44.88	42.93	3874.45	3876.40
DH-59	3937.44	44.13	44.29	3893.31	3893.15
DH-5A	3921.92	18.42	18.16	3903.50	3903.76
DH-61	3926.84	DRY	DRY	DRY	DRY
DH-62	3926.95	57.48	56.98	3869.47	3869.97
DH-63	3905.37	41.12	39.14	3864.25	3866.23
DH-65	3945.85	61.82	63.50	3884.03	3882.35
DH-66	3919.28	52.91	50.69	3866.37	3868.59

2023 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**May-23**	**Oct-23**	**May-23**	**Oct-23**
DH-67	3899.77	35.85	34.25	3863.92	3865.52
DH-68	3943.28	44.77	44.90	3898.51	3898.38
DH-69	3934.45	35.51	35.63	3898.94	3898.82
DH-70	3933.91	33.45	33.58	3900.46	3900.33
DH-71	3944.88	DRY	DRY	DRY	DRY
DH-72	3939.67	43.92	44.57	3895.75	3895.10
DH-73	3918.08	40.42	38.89	3877.66	3879.19
DH-74	4006.44	123.49	123.90	3878.00	3882.54
DH-75	4006.54	124.00	124.38	3877.55	3882.16
DH-76	3973.10	77.33	77.58	3895.77	3895.52
DH-77	3932.20	54.08	53.88	3878.12	3878.32
DH-78	3921.12	53.37	51.82	3867.75	3869.30
DH-79	3928.80	55.54	53.76	3873.26	3875.04
DH-80	3942.36	49.56	49.71	3892.80	3892.65
DH-82	3908.18	43.51	41.57	3864.67	3866.61
DH-83	3922.14	52.93	51.76	3869.21	3870.38
East-PZ-1	3911.93	24.54	25.29	3887.39	3886.64
East-PZ-2	3924.58	25.22	25.49	3899.36	3899.09
East-PZ-4	3935.66	19.70	20.31	3915.96	3915.35
East-PZ-6	3943.83	21.22	22.36	3922.61	3921.47
East-PZ-7	3928.83	18.41	19.01	3910.42	3909.82
EH-50	3889.39	29.52	28.06	3859.87	3861.33
EH-51	3880.09	15.74	14.76	3864.35	3865.33
EH-52	3880.50	6.94	7.36	3873.56	3873.14
EH-53	3872.82	32.18	26.58	3840.64	3846.24
EH-54	3869.66	5.74	7.48	3863.92	3862.18
EH-58	3888.15	13.89	13.57	3874.26	3874.58
EH-59	3876.57	7.70	7.36	3868.87	3869.21
EH-60	3888.46	25.73	23.75	3862.73	3864.71
EH-61	3889.77	27.61	25.44	3862.16	3864.33
EH-62	3875.07	24.98	23.92	3850.09	3851.15
EH-63	3878.32	20.83	19.42	3857.49	3858.90
EH-64	3882.67	27.18	25.48	3855.49	3857.19
EH-65	3879.96	26.94	24.71	3853.02	3855.25
EH-66	3869.48	26.28	26.17	3843.20	3843.31
EH-67	3869.46	22.28	23.54	3847.18	3845.92
EH-68	3867.60	8.62	9.28	3858.98	3858.32
EH-69	3869.10	20.09	17.72	3849.01	3851.38
EH-70	3863.48	34.65	32.27	3828.83	3831.21
EH-100	3889.83	29.93	28.56	3859.90	3861.27
EH-101	3879.95	16.00	15.18	3863.95	3864.77
EH-102	3880.45	8.37	8.54	3872.08	3871.91
EH-103	3890.54	27.74	26.13	3862.80	3864.41
EH-104	3887.83	37.18	35.40	3850.65	3852.43

2023 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	MP Elevation	May-23	Oct-23	May-23	Oct-23
EH-106	3882.07	31.50	29.28	3850.57	3852.79
EH-107	3880.15	23.58	21.90	3856.57	3858.25
EH-109	3885.67	27.20	25.66	3858.47	3860.01
EH-110	3884.05	22.83	21.27	3861.22	3862.78
EH-111	3876.50	33.37	29.41	3843.13	3847.09
EH-112	3875.78	32.03	26.54	3843.75	3849.24
EH-113	3871.34	31.58	26.12	3839.76	3845.22
EH-114	3878.07	36.85	33.15	3841.22	3844.92
EH-115	3883.29	38.82	No Access	3844.47	NM
EH-117	3871.33	31.94	Well Buried	3839.39	NM
EH-119	3873.75	37.34	33.87	3836.41	3839.88
EH-120	3865.78	31.35	28.80	3834.43	3836.98
EH-121	3869.49	26.49	26.65	3843.00	3842.84
EH-122	3868.08	21.75	22.93	3846.33	3845.15
EH-123	3885.71	47.05	44.18	3838.66	3841.53
EH-124	3874.46	40.46	37.41	3834.00	3837.05
EH-125	3863.22	35.29	32.87	3827.93	3830.35
EH-126	3870.00	58.15	52.38	3811.85	3817.62
EH-127	3860.75	25.56	27.02	3835.19	3833.73
EH-128	3892.17	DRY	DRY	DRY	DRY
EH-129	3870.21	59.65	53.29	3810.56	3816.92
EH-130	3858.55	46.18	42.30	3812.37	3816.25
EH-131	3834.44	34.42	30.18	3800.02	3804.26
EH-132	3893.90	62.50	60.19	3831.40	3833.71
EH-133	3884.36	59.18	56.70	3825.18	3827.66
EH-134	3870.21	59.60	53.31	3810.61	3816.90
EH-135	3852.25	26.52	26.39	3825.73	3825.86
EH-136	3838.59	27.94	26.89	3810.65	3811.70
EH-137	3839.66	37.10	33.54	3802.56	3806.12
EH-138	3839.70	48.90	41.81	3790.80	3797.89
EH-139	3839.78	56.54	46.92	3783.24	3792.86
EH-140	3812.08	27.25	21.07	3784.83	3791.01
EH-141	3813.32	35.52	28.42	3777.80	3784.90
EH-142	3804.68	35.33	29.24	3769.35	3775.44
EH-143	3803.37	36.07	30.12	3767.30	3773.25
EH-144D	3778.86	25.45	19.48	3753.41	3759.38
EH-144M	3778.95	28.50	22.11	3750.45	3756.84
EH-144S	3778.70	30.00	23.67	3748.70	3755.03
EH-145D	3789.60	33.61	26.91	3755.99	3762.69
EH-145S	3790.09	34.68	27.91	3755.41	3762.18
EH-200	3953.33	28.26	27.31	3925.07	3926.02
EH-201	3973.48	78.28	79.34	3895.20	3894.14
EH-202	3930.56	65.97	65.80	3864.59	3864.76
EH-203	4003.92	102.19	101.76	3901.73	3902.16

2023 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**May-23**	**Oct-23**	**May-23**	**Oct-23**
EH-204	3925.69	57.64	57.25	3868.05	3868.44
EH-205	3900.66	20.21	35.74	3880.45	3864.92
EH-206	3898.10	51.07	49.60	3847.03	3848.50
EH-208	3910.58	56.40	56.38	3854.18	3854.20
EH-209	3898.34	42.94	42.54	3855.40	3855.80
EH-210	3901.19	35.51	37.62	3865.68	3863.57
EH-211	3905.75	50.95	50.65	3854.80	3855.10
EH-212	3905.90	51.13	50.79	3854.77	3855.11
EHMW-3	3825.45	44.85	39.82	3780.60	3785.63
EHTW-3	3827.66	47.48	41.07	3780.18	3786.59
IW-01	3888.28	66.82	65.43	3821.46	3822.85
IW-02	3871.08	53.20	52.00	3817.88	3819.08
MW-1	3953.05	53.21	52.90	3899.84	3900.15
MW-2	3945.97	40.82	40.54	3905.15	3905.43
MW-3	3940.95	35.37	35.94	3905.58	3905.01
MW-4	3947.06	50.05	49.76	3897.01	3897.30
MW-5	3956.18	54.57	55.34	3901.61	3900.84
MW-6	3938.14	31.81	32.35	3906.33	3905.79
MW-7	3963.67	54.90	54.48	3908.77	3909.19
MW-8	3958.65	53.19	53.43	3905.46	3905.22
MW-9	3959.01	52.50	52.31	3906.51	3906.70
MW-10	3946.28	45.53	45.80	3900.75	3900.48
MW-11	3973.33	63.08	62.79	3910.25	3910.54
PBTW-1	3914.59	47.36	44.99	3867.23	3869.60
PBTW-2	3906.73	39.98	37.66	3866.75	3869.07
Plant Road Test Well	3838.72	62.10	56.40	3776.62	3782.32
PPCRPZ-02	3919.76	7.01	7.78	3912.75	3911.98
PRB-1	3918.37	51.51	49.21	3866.86	3869.16
PRB-2	3905.34	37.91	35.59	3867.43	3869.75
PRB-3	3919.19	52.44	50.14	3866.75	3869.05
PZ-36A	3858.96	6.85	11.67	3852.11	3847.29
PZ-36B	3858.75	5.25	10.70	3853.50	3848.05
PZ-36C	3859.60	5.46	9.96	3854.14	3849.64
PZ-9A	3850.70	7.05	DRY	3843.65	DRY
PZ-9B	3849.43	5.78	12.63	3843.65	3836.80
SC-1	3890.42	32.00	32.05	3858.42	3858.37
SDMW-1	3925.11	52.45	50.42	3872.66	3874.69
SDMW-2	3928.09	54.60	53.18	3873.49	3874.91
SDMW-3	3935.14	53.44	53.22	3881.70	3881.92
SDMW-4	3936.10	51.77	51.36	3884.33	3884.74
SDMW-5	3929.86	55.17	54.17	3874.69	3875.69
SP-3	3905.91	DRY	DRY	DRY	DRY
SP-4	3908.16	DRY	DRY	DRY	DRY
SP-5	3903.52	DRY	DRY	DRY	DRY

2023 PROJECT-WIDE GROUNDWATER LEVEL MEASUREMENTS
EAST HELENA PROJECT

		Depth to Water		Groundwater Elevation	
SiteID	**MP Elevation**	**May-23**	**Oct-23**	**May-23**	**Oct-23**
TW-1	3930.10	52.46	51.45	3877.64	3878.65
TW-2	3931.44	54.43	52.85	3877.01	3878.59
ULM-PZ-1	3924.40	5.18	5.65	3919.22	3918.75
ULTP-1	3919.63	4.96	5.85	3914.67	3913.78
ULTP-2	3921.23	5.74	5.93	3915.49	3915.30

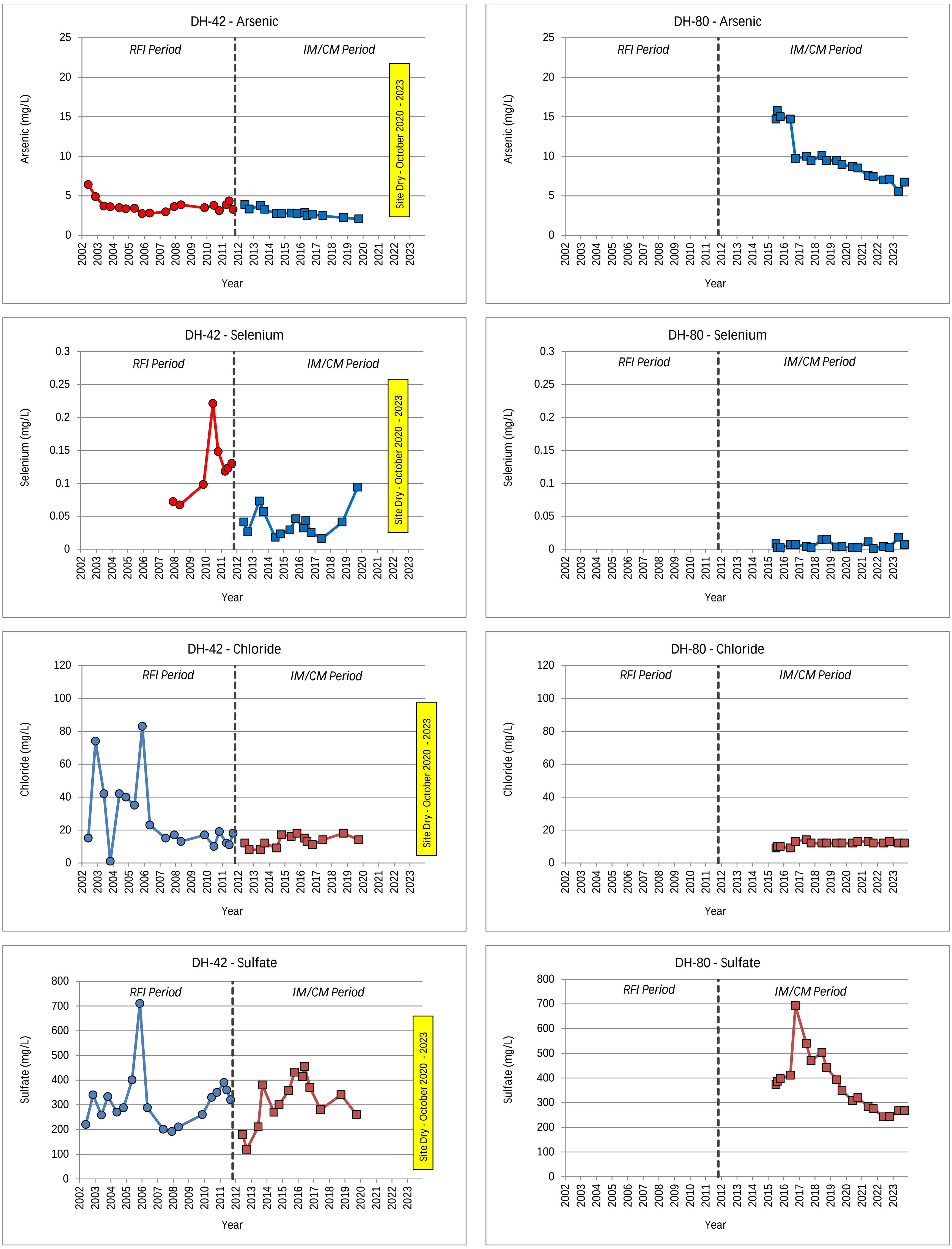
All measurements in feet; elevations relative to mean sea level.

* DH-6 equipped with temporary PVC riser in December 2022 at elevation 3890.91; permanent steel casing and PVC MP completed in July 2023 at elevation 3892.32.

APPENDIX C

SITE-WIDE GROUNDWATER

CONCENTRATION TREND GRAPHS

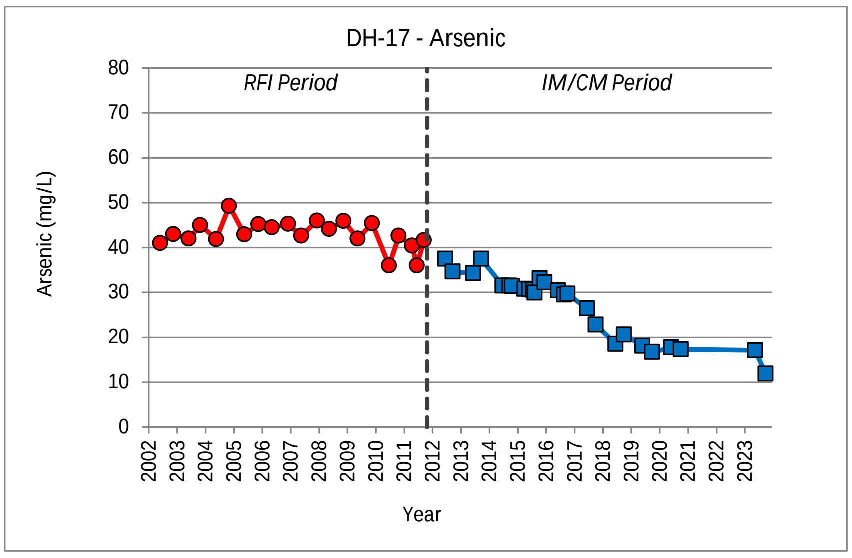


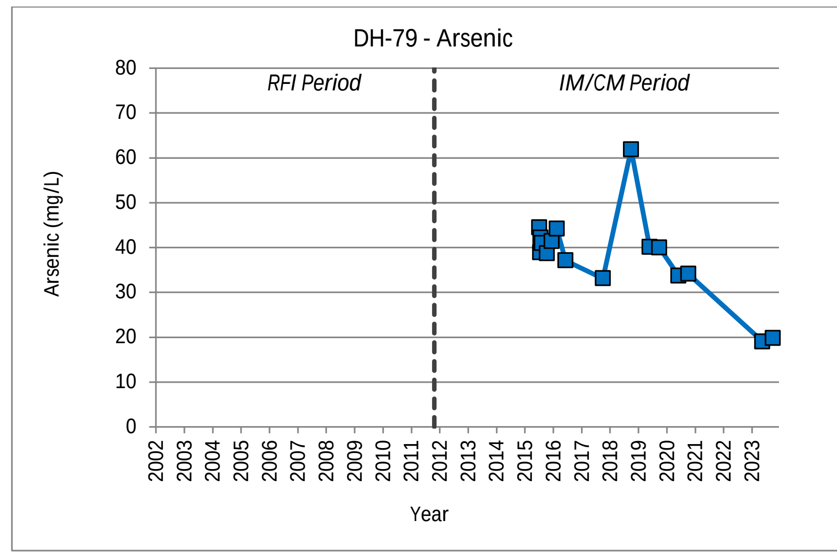
Hydrometrics, Inc.

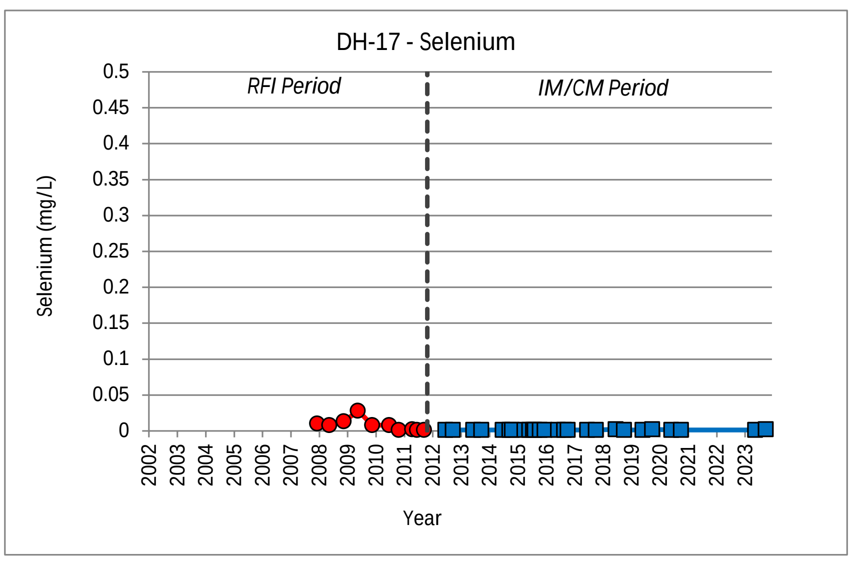
2023 INTERIM CORRECTIVE ACTION
PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

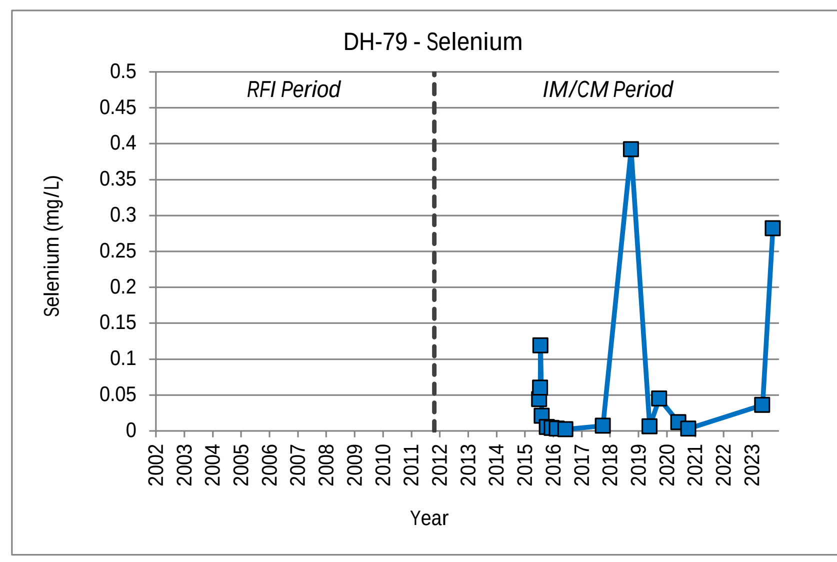
FORMER ACID PLANT AREA
GROUNDWATER QUALITY TRENDS

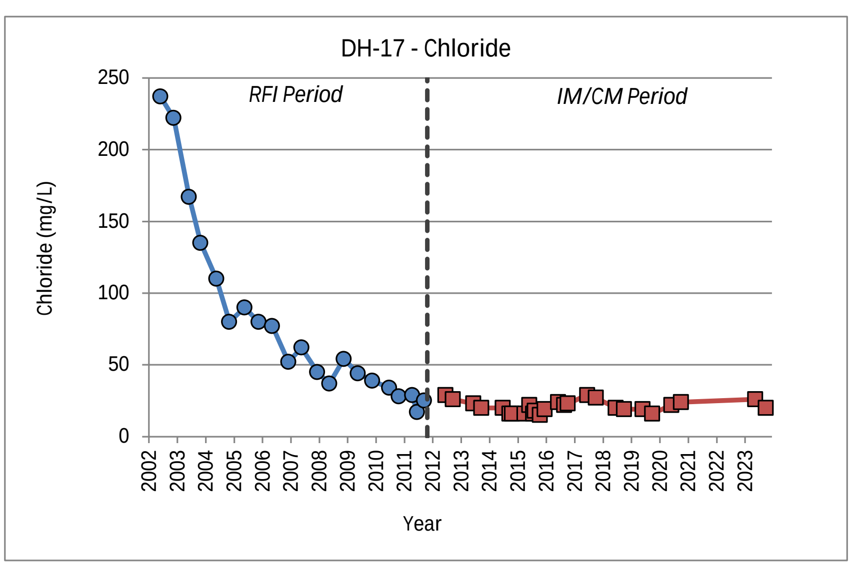
FIGURE
C-1

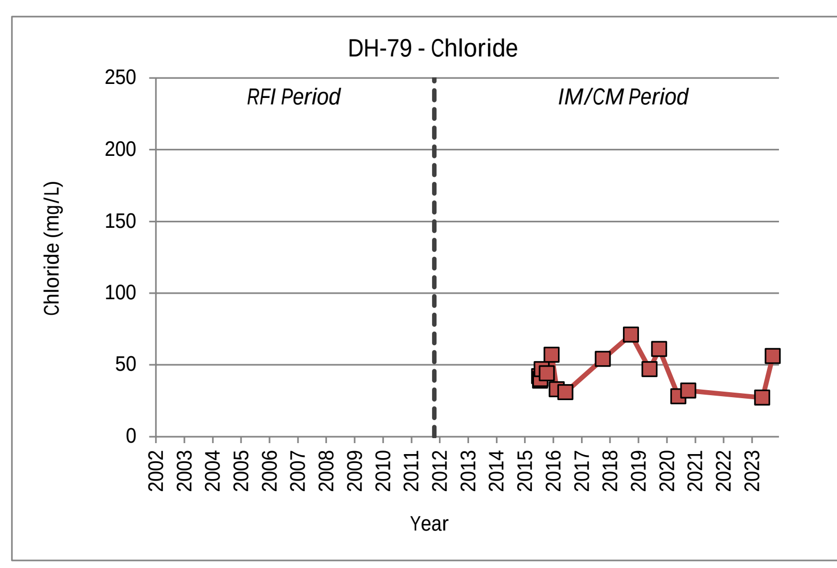


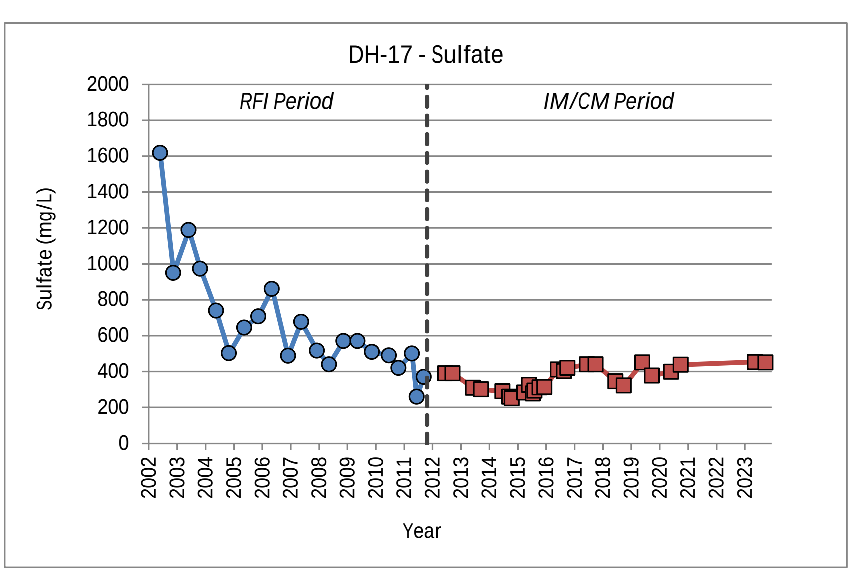


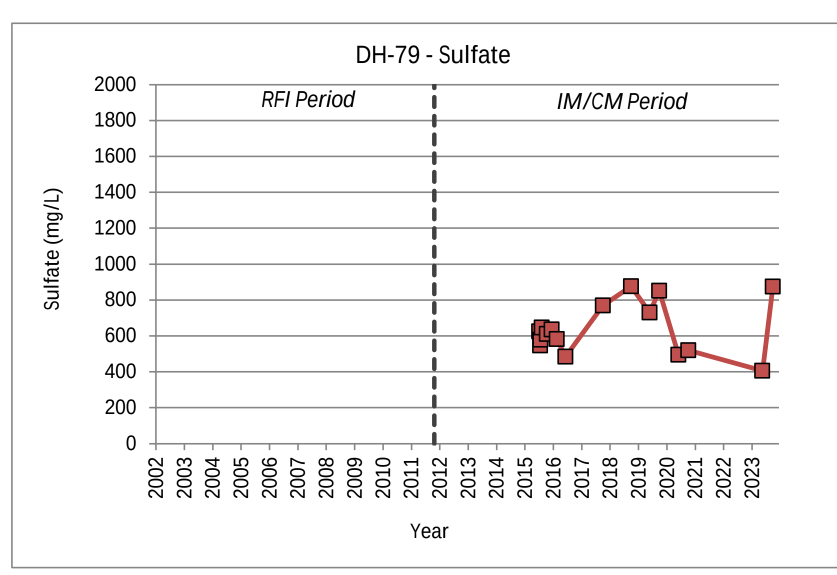




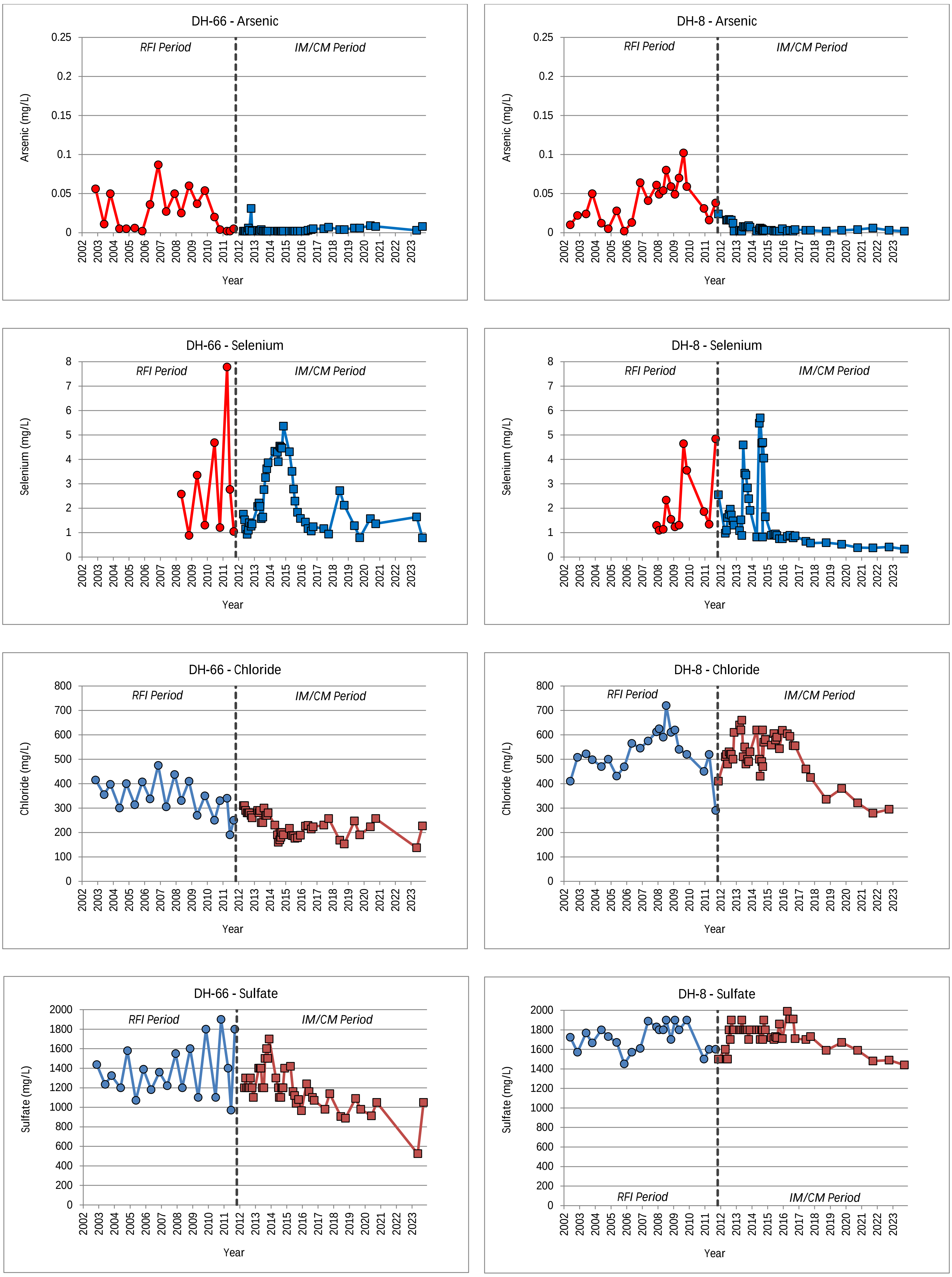




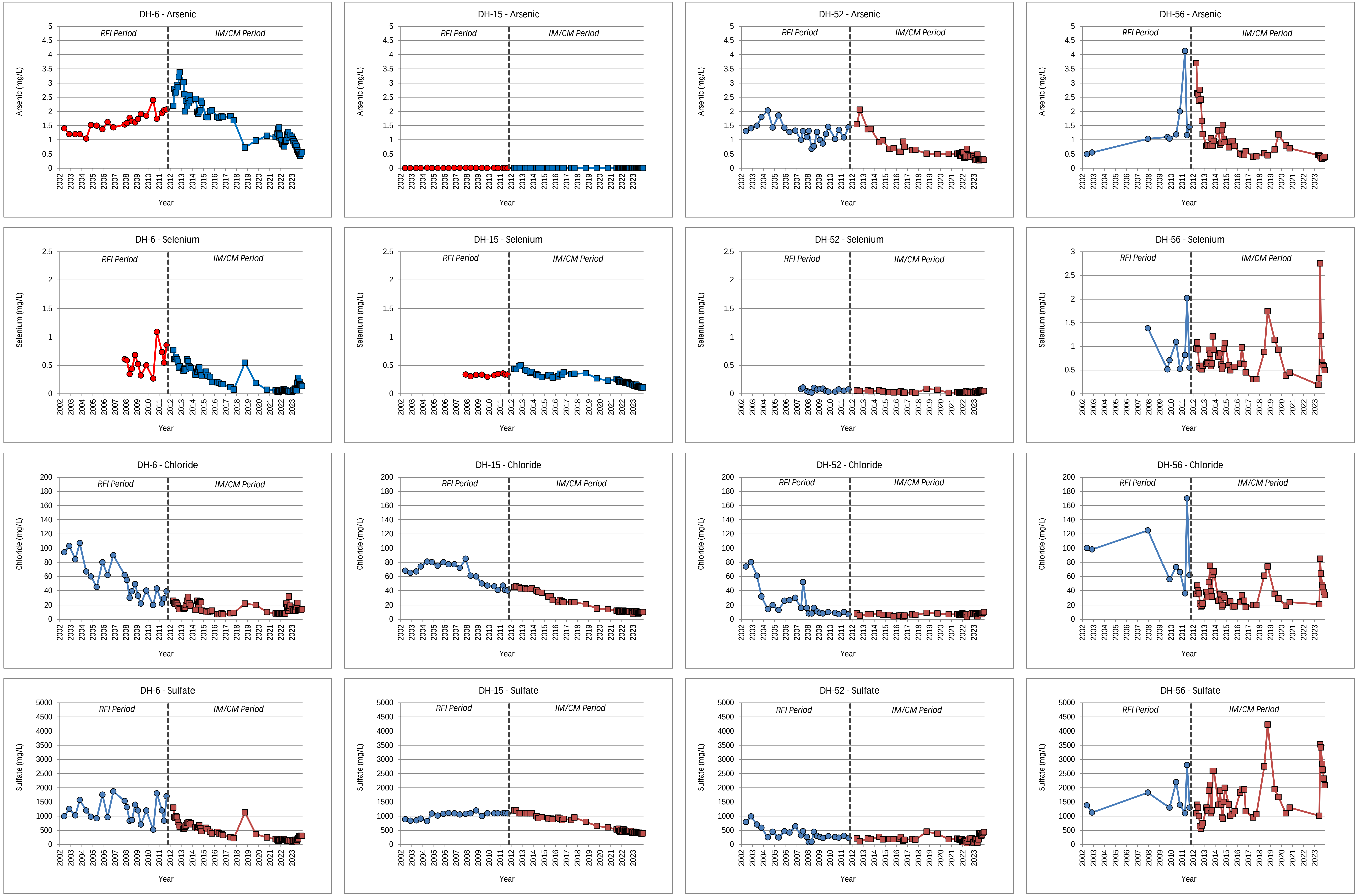




Hydrometrics, Inc.	2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	**NORTH PLANT ARSENIC AREA GROUNDWATER QUALITY TRENDS**	FIGURE **C-2**



Hydrometrics, Inc.	2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	WEST SELENIUM AREA GROUNDWATER QUALITY TRENDS	FIGURE C-3

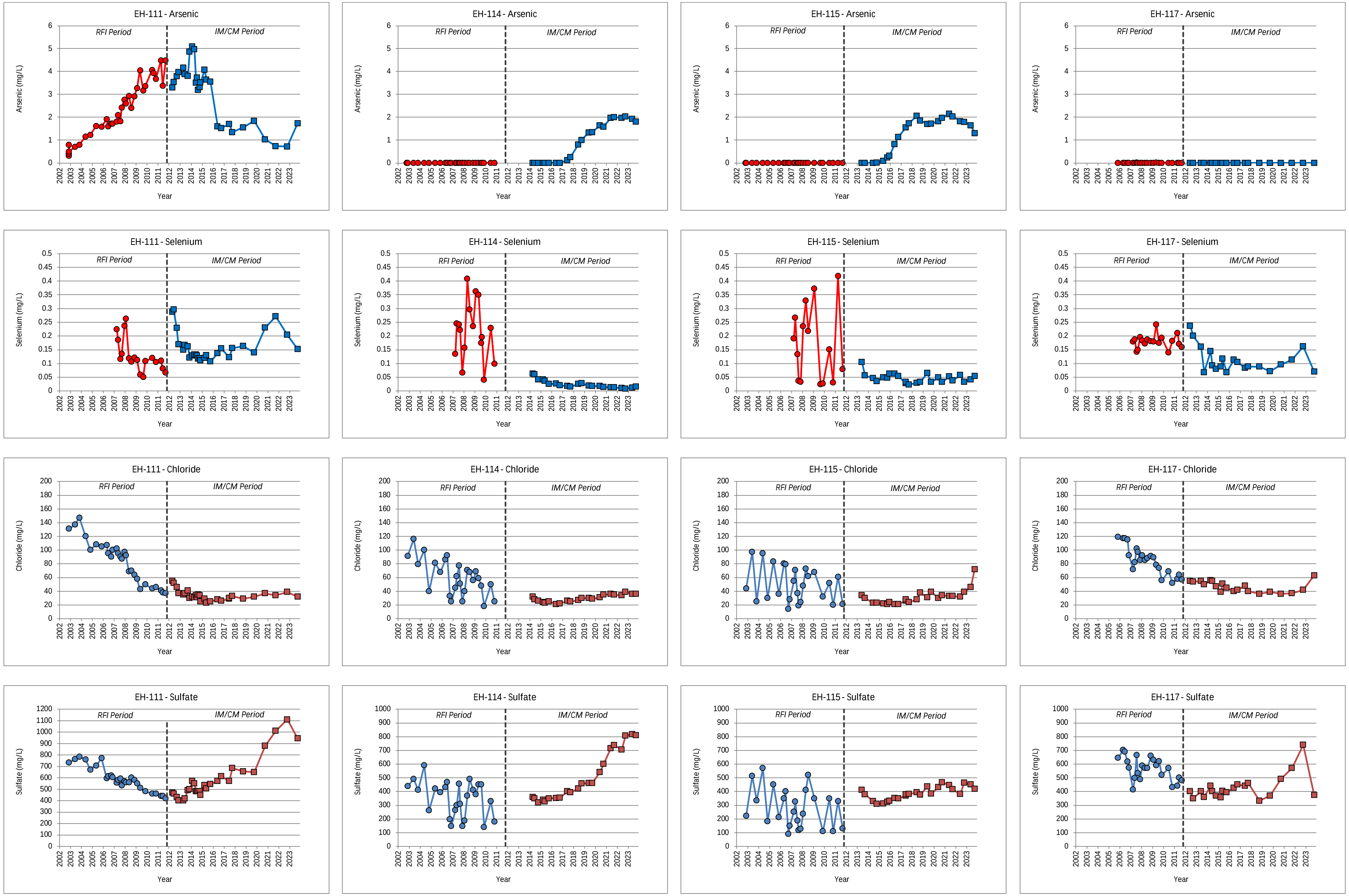


Hydrometrics, Inc.

2023 INTERIM CORRECTIVE ACTION
PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

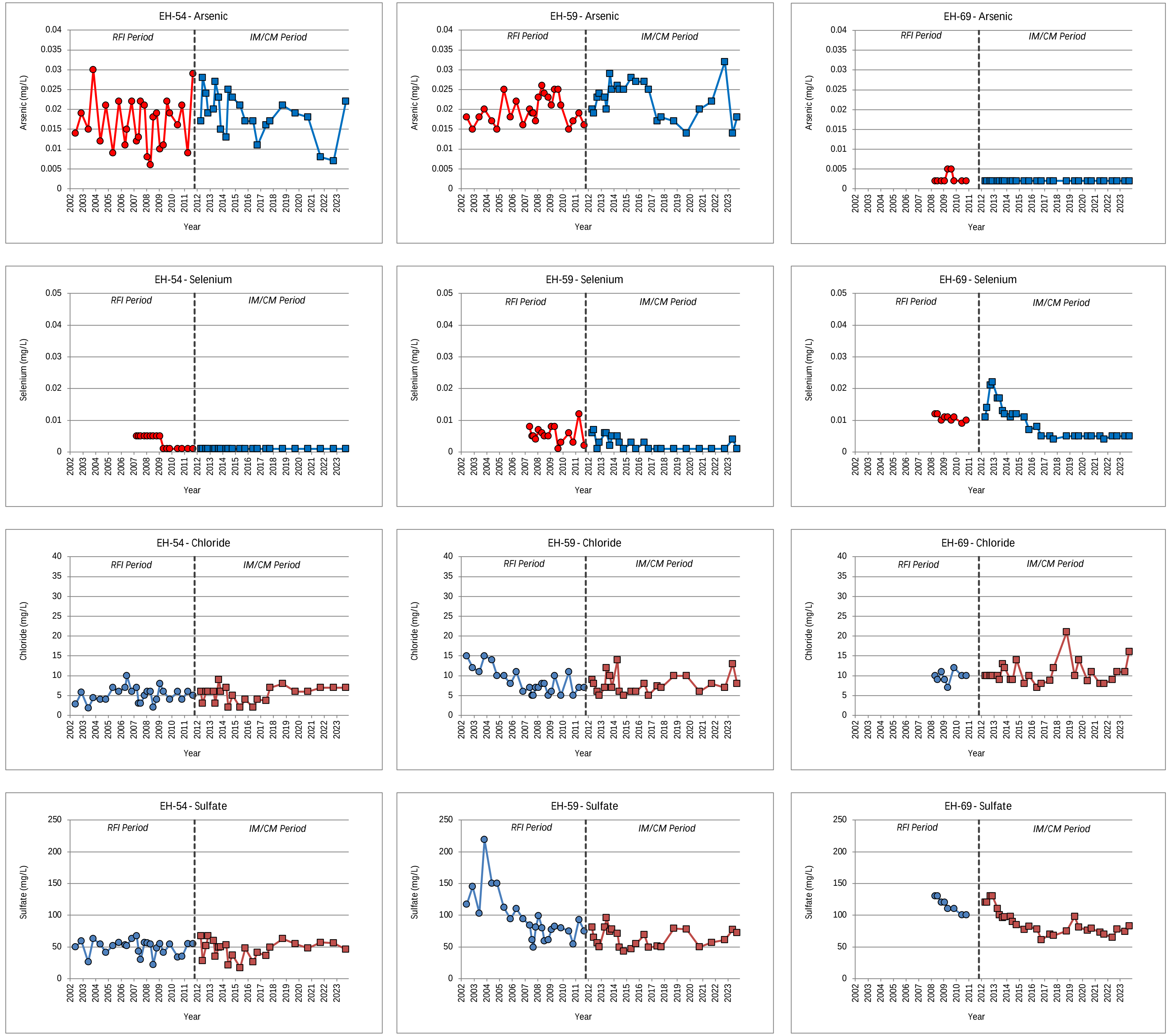
SLAG PILE AREA
GROUNDWATER QUALITY TRENDS

FIGURE
C-4

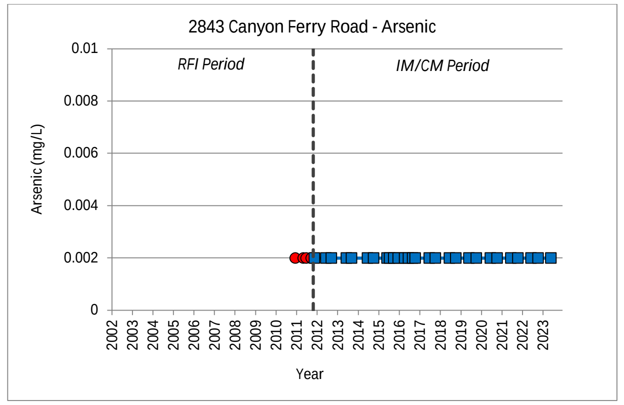


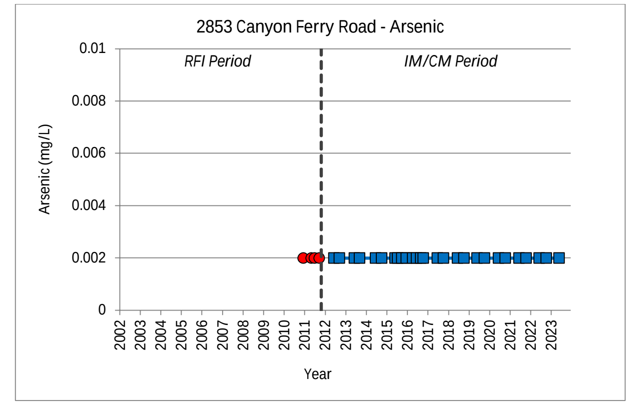
Hydrometrics, Inc.

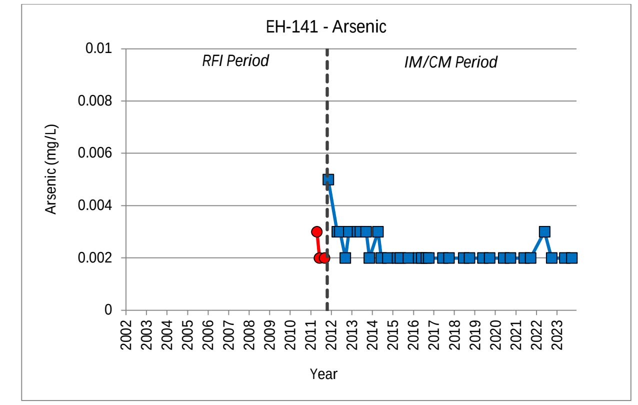
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (WEST) GROUNDWATER QUALITY TRENDS	FIGURE C-5

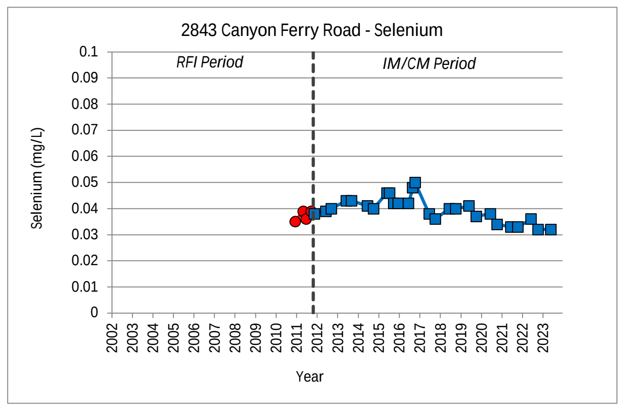


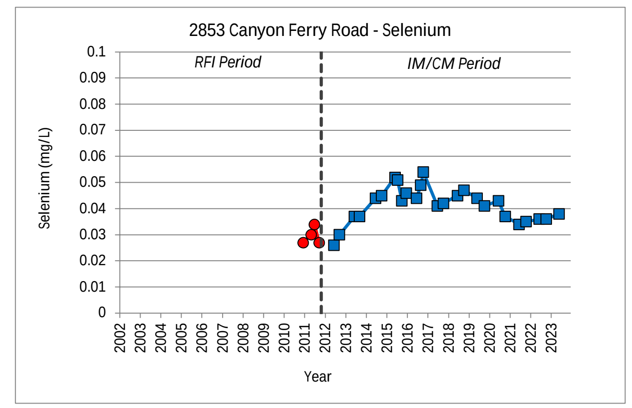
2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY	DOWNGRADIENT ARSENIC PLUME AREA (EAST) GROUNDWATER QUALITY TRENDS	FIGURE C-5

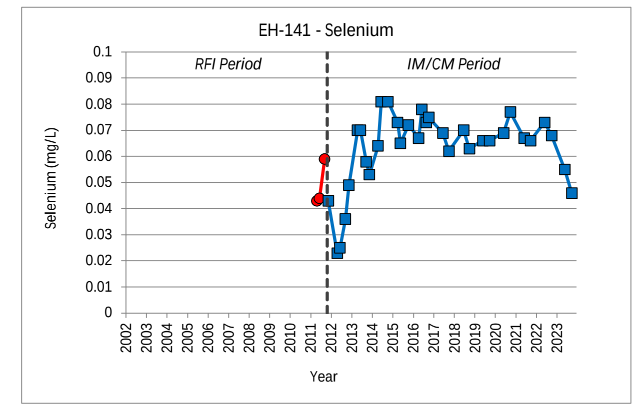


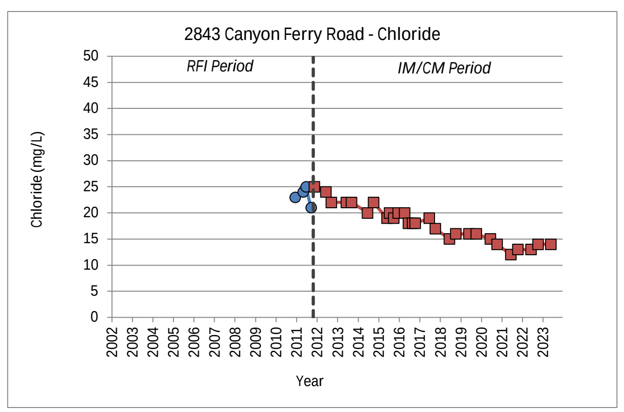


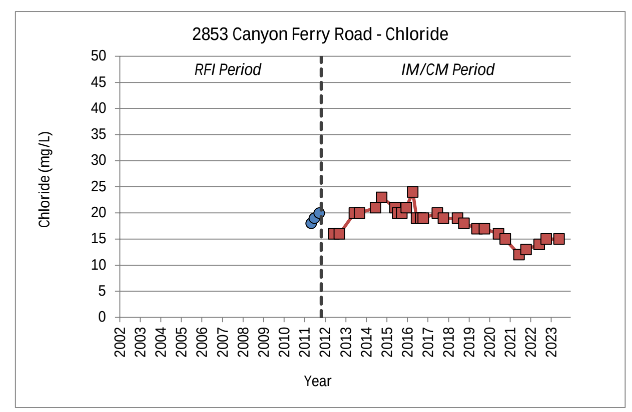


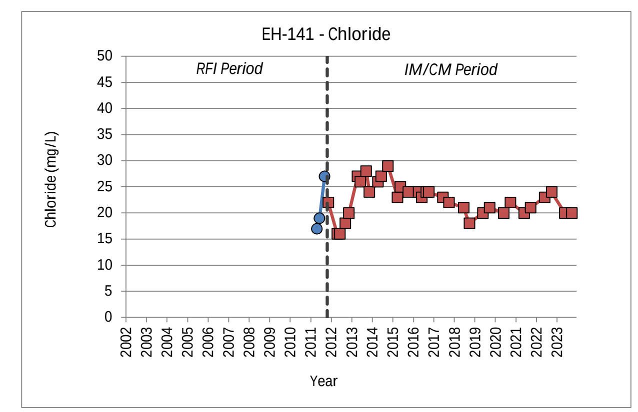


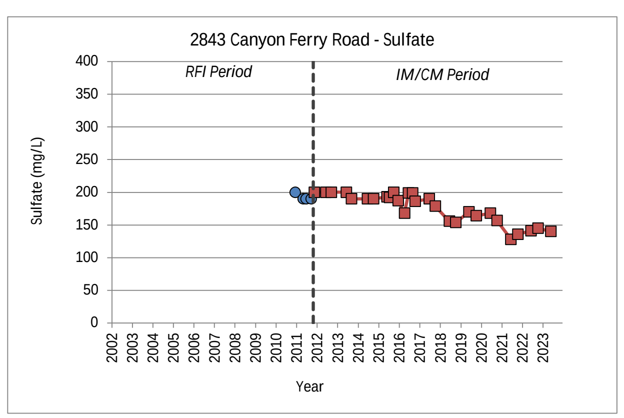


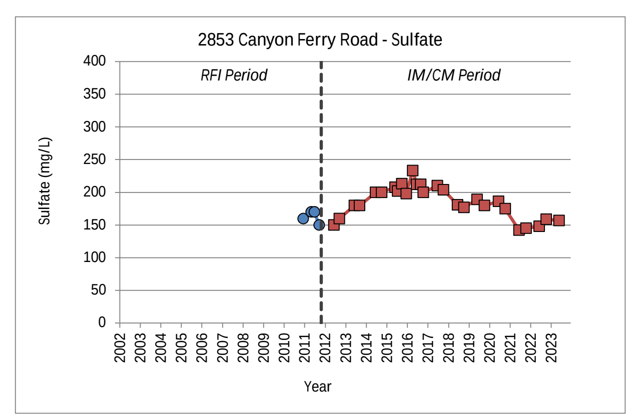


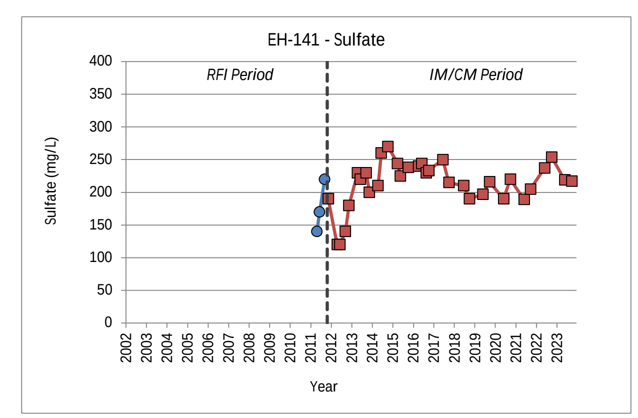












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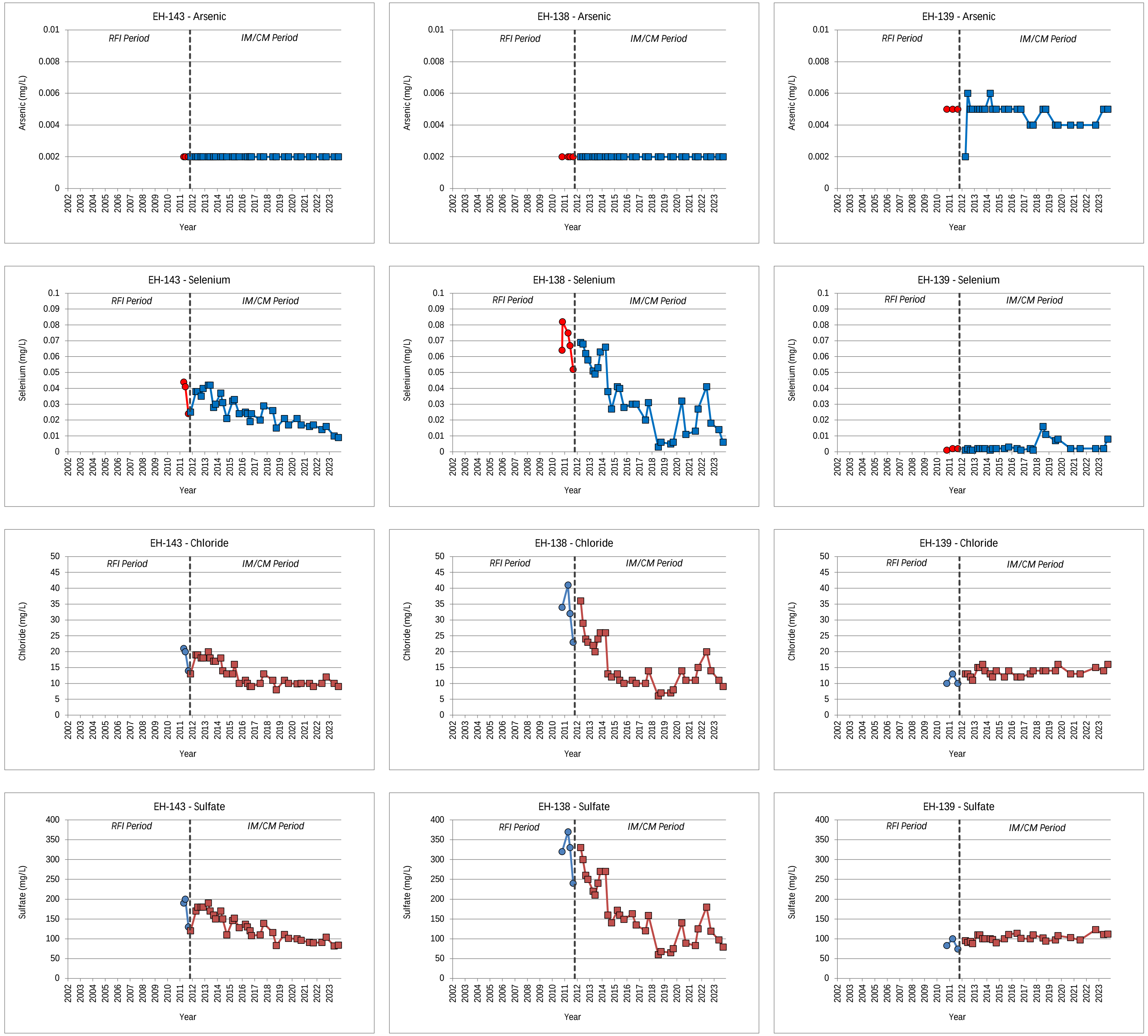
2023 INTERIM CORRECTIVE ACTION
PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS

FIGURE
C-6



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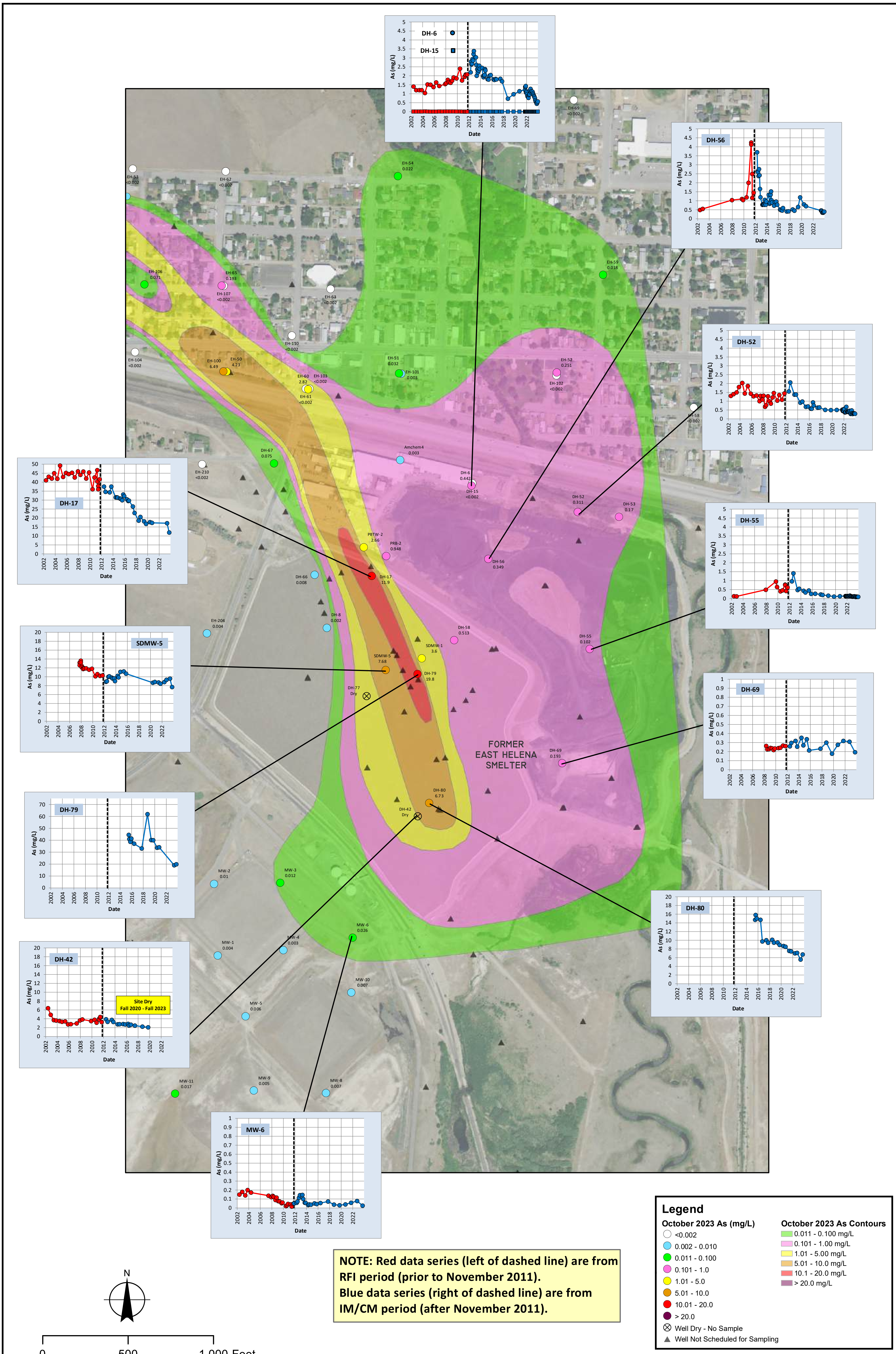
2023 INTERIM CORRECTIVE ACTION
PERFORMANCE MONITORING REPORT
EAST HELENA FACILITY

DOWNGRADIENT SELENIUM PLUME AREA GROUNDWATER QUALITY TRENDS

FIGURE
C-6

APPENDIX D

ARSENIC AND SELENIUM
TREND PLOT MAPS



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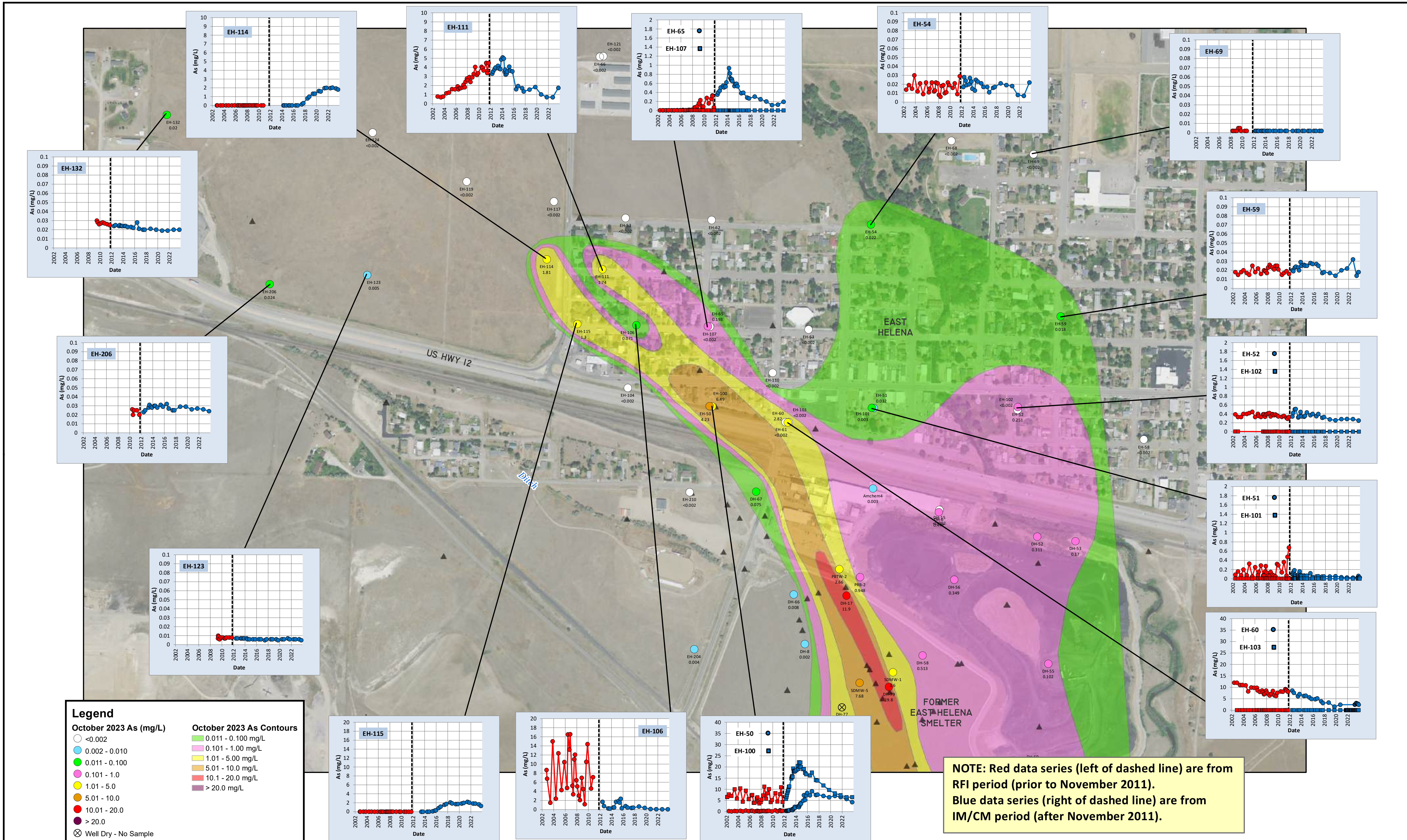
2023 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY	ARSENIC TRENDS THROUGH OCTOBER 2023 PLANT AREA WELLS	FIGURE D-1



NOTE: Red data series (left of dashed line) are from RFI period (prior to November 2011).
Blue data series (right of dashed line) are from IM/CM period (after November 2011).

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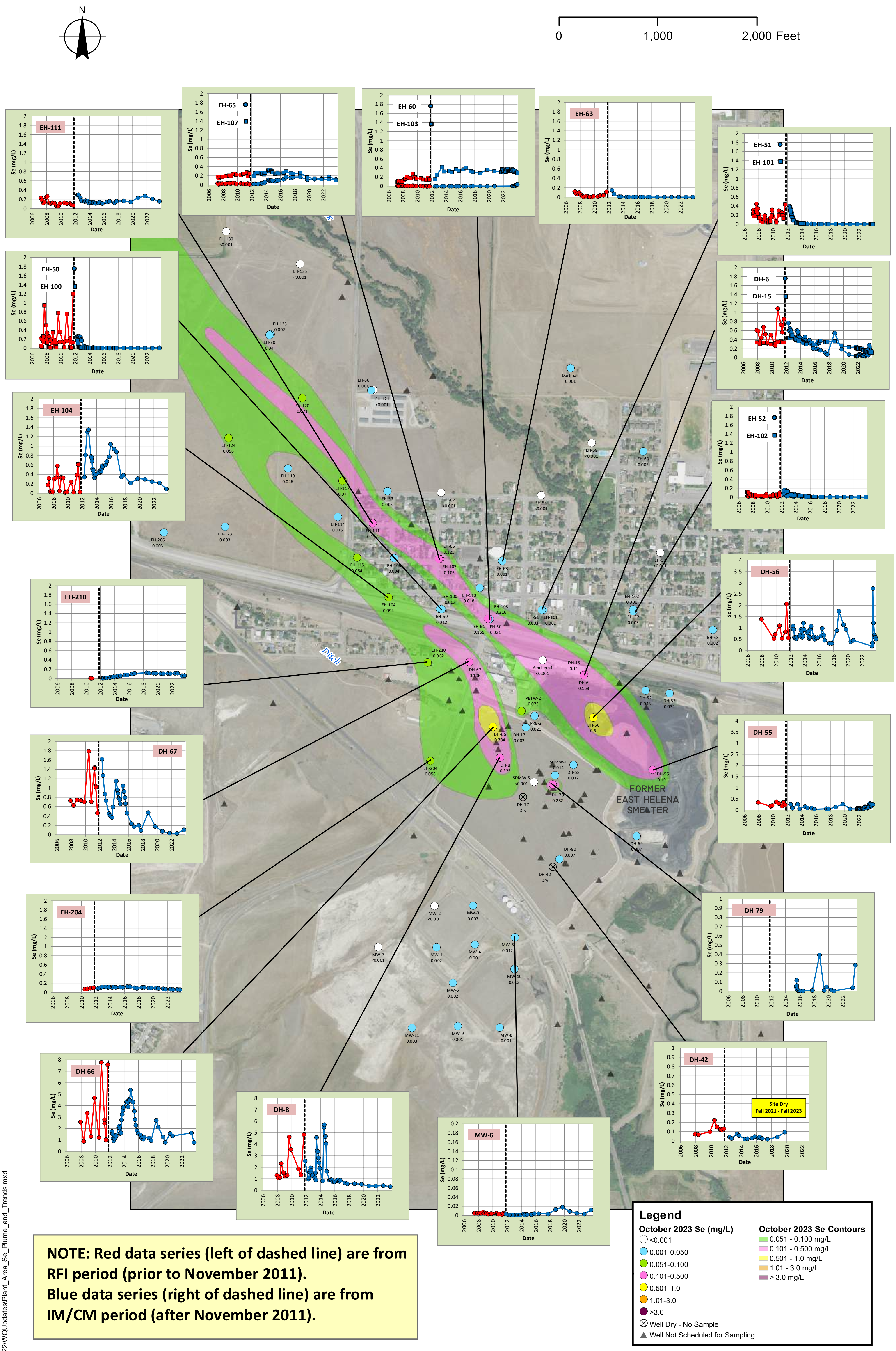
2023 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

ARSENIC TRENDS THROUGH OCTOBER 2023
EAST HELENA AREA WELLS

FIGURE
D-2



NOTE: Red data series (left of dashed line) are from RFI period (prior to November 2011). Blue data series (right of dashed line) are from IM/CM period (after November 2011).

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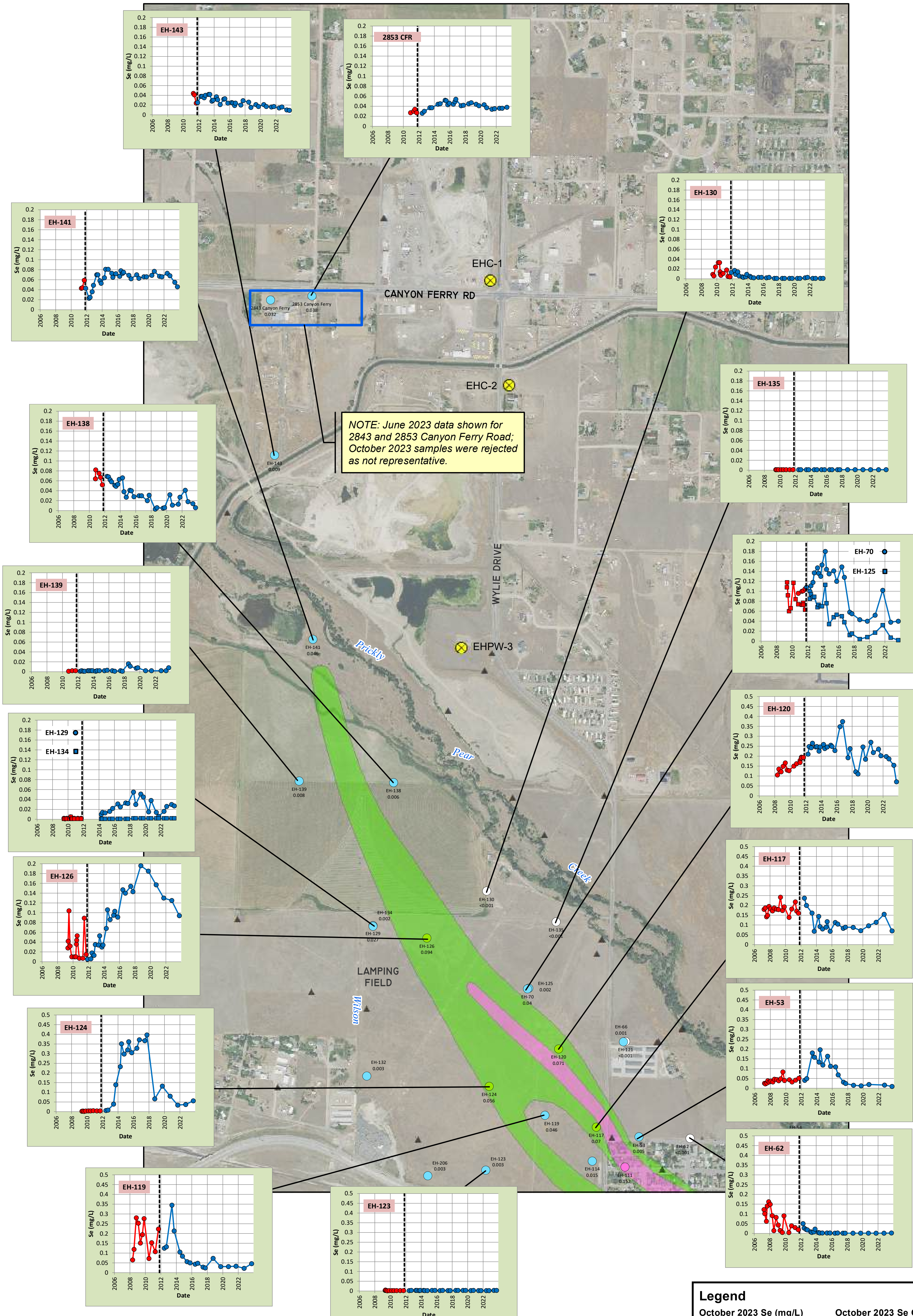
2023 WATER RESOURCES MONITORING REPORT EAST HELENA FACILITY

SELENIUM TRENDS THROUGH OCTOBER 2023 PLANT AREA WELLS

FIGURE **D-3**



NOTE: Red data series (left of dashed line) are from RFI period (prior to November 2011).
Blue data series (right of dashed line) are from IM/CM period (after November 2011).

Legend

October 2023 Se (mg/L)	October 2023 Se Contours
<0.001	0.051 - 0.100 mg/L
0.001-0.050	0.101 - 0.500 mg/L
0.051-0.100	0.501 - 1.0 mg/L
0.101-0.500	1.01 - 3.0 mg/L
0.501-1.0	> 3.0 mg/L
1.01-3.0	
>3.0	
Well Dry - No Sample	
Well Not Scheduled for Sampling	

N

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0 1,000 2,000 Feet

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2023 WATER RESOURCES MONITORING REPORT
EAST HELENA FACILITY

SELENIUM TRENDS THROUGH OCTOBER 2023
DOWNGRADIENT AREA

FIGURE
D-4

APPENDIX E

UNFUMED SLAG WELL

DATA TABLE

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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	3/16/2023	Low-Flow	22.64	7.22	630	4.61	8.7	0.946	0.070	145	12	60	2
DH-6	4/20/2023	Low-Flow	22.46	7.32	750	3.93	8.0	0.881	0.090	166	12	65	3
DH-6	5/19/2023	Low-Flow	20.95	7.31	692	4.08	9.3	0.829	0.075	155	12	60	3
DH-6	6/22/2023	Low-Flow	18.38	7.28	588	5.05	10.1	0.757	0.057	113	17	51	2
DH-6	7/19/2023	Low-Flow	19.90	7.24	759	**	10.4	0.637	0.194	170	23	62	3
DH-6	8/15/2023	Low-Flow	20.35	7.17	1228	5.46	11.9	0.559	0.278	214	13	73	5
DH-6	9/26/2023	Low-Flow	19.84	7.26	1000	4.06	14.7	0.502	0.210	294	13	82	7
DH-6	10/17/2023	Low-Flow	20.56	7.23	1011	3.30	11.9	0.442	0.168	296	13	78	7
DH-6	11/16/2023	Low-Flow	21.15	7.14	1051	3.37	9.9	0.500	0.152	308	13	83	7
DH-6	12/19/2023	Low-Flow	22.17	7.11	1045	3.48	9.5	0.562	0.134	304	14	89	7
DH-6	**95% USL**		**--**	**--**	**--**	**--**	**--**	**3.81**	**0.885**	**1330**	**37**	**288**	**23**

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-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	3/16/2023	Low-Flow	21.70	6.95	1051	2.54	8.0	<0.002	0.139	423	11	5	22
DH-15	4/20/2023	Low-Flow	21.39	7.03	1125	0.36	8.3	<0.002	0.160	427	11	5	23
DH-15	5/19/2023	Low-Flow	19.81	7.00	1100	0.12	9.8	<0.002	0.155	426	11	5	25
DH-15	6/22/2023	Low-Flow	17.27	6.97	1056	0.18	9.9	<0.002	0.124	402	10	5	22
DH-15	7/19/2023	Low-Flow	17.35	6.96	1051	**	10.5	<0.002	0.123	408	8	5	21
DH-15	8/15/2023	Low-Flow	17.73	6.96	1110	0.62	11.8	<0.002	0.128	416	9	5	22
DH-15	9/26/2023	Low-Flow	17.24	7.09	1023	0.08	10.6	<0.002	0.112	398	10	5	21
DH-15	10/17/2023	Low-Flow	18.03	7.07	1023	0.59	10.6	<0.002	0.110	387	10	4	20
DH-15	11/16/2023	Low-Flow	18.84	6.98	1030	0.08	9.5	<0.002	0.111	384	10	4	20
DH-15	12/19/2023	Low-Flow	19.84	6.97	1042	0.20	9.2	<0.002	0.109	395	10	4	21
DH-15	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.003**	**0.530**	**1351**	**68**	**9**	**68**

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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	3/16/2023	Low-Flow	8.75	6.88	657	**	5.3	0.281	0.033	176	7	58	10
DH-52	4/20/2023	Low-Flow	8.25	7.17	709	1.33	5.1	0.301	0.048	183	7	55	9
DH-52	5/19/2023	Low-Flow	5.35	7.28	289	4.52	7.1	0.478	0.017	52	4	31	3
DH-52	6/22/2023	Low-Flow	5.28	6.95	660	2.18	9.6	0.314	0.037	178	7	56	8
DH-52	7/18/2023	Low-Flow	6.32	7.02	1164	0.74	11.6	0.273	0.036	394	8	71	15
DH-52	8/16/2023	Low-Flow	7.04	7.07	1014	0.93	11.8	0.318	0.055	380	7	75	13
DH-52	9/26/2023	Low-Flow	7.03	7.11	922	0.56	12.6	0.309	0.037	312	7	69	11
DH-52	10/17/2023	Low-Flow	7.48	7.08	1011	6.88	11.9	0.311	0.043	354	9	73	12
DH-52	11/16/2023	Low-Flow	8.02	7.08	1114	0.75	9.8	0.308	0.050	405	9	71	13
DH-52	12/19/2023	Low-Flow	8.53	7.10	1200	0.90	8.0	0.288	0.048	437	10	72	15
DH-52	95% USL		--	--	--	--	--	2.19	0.090	474	11	87	15

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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-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	3/16/2023	Low-Flow	11.42	6.92	364	0.52	6.0	0.100	0.012	69	9	19	6
DH-53	4/20/2023	Low-Flow	10.67	7.13	408	1.16	4.2	0.109	0.012	70	10	20	7
DH-53	5/19/2023	Low-Flow	7.95	7.02	456	0.20	7.1	0.148	**0.032**	86	8	23	8
DH-53	6/22/2023	Low-Flow	8.26	6.92	671	5.67	10.0	0.160	**0.069**	137	8	34	**13**
DH-53	7/18/2023	Low-Flow	9.43	6.97	747	0.41	11.1	0.172	**0.054**	166	6	36	**12**
DH-53	8/16/2023	Low-Flow	10.18	7.03	572	3.28	11.9	0.197	**0.044**	125	6	36	**10**
DH-53	9/26/2023	Low-Flow	9.98	7.02	567	0.30	13.2	0.166	**0.035**	137	7	35	**9**
DH-53	10/17/2023	Low-Flow	10.43	7.01	575	6.27	12.6	0.170	**0.034**	141	7	34	**9**
DH-53	11/16/2023	Low-Flow	10.96	6.93	566	1.55	11.1	0.144	0.020	120	7	31	**10**
DH-53	12/19/2023	Low-Flow	11.48	6.95	407	0.40	9.8	0.130	0.003	64	7	24	7
DH-53	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.86**	**0.028**	**277**	**12**	**63**	**8**

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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	3/16/2023	Low-Flow	81.86	7.13	2006	0.91	7.4	0.118	0.084	862	18	141	19
DH-55	4/20/2023	Low-Flow	81.36	7.39	2100	1.05	7.3	0.126	0.114	868	18	152	19
DH-55	5/19/2023	Low-Flow	80.22	7.24	1928	0.50	9.5	0.119	0.120	754	15	134	16
DH-55	6/22/2023	Low-Flow	79.57	7.22	2079	4.63	8.6	0.097	0.269	856	16	138	16
DH-55	7/18/2023	Low-Flow	80.25	7.12	2889	3.96	10.8	0.090	0.303	**1350**	20	176	30
DH-55	8/16/2023	Low-Flow	80.82	7.20	2465	0.71	9.8	0.110	0.254	1090	16	172	21
DH-55	9/27/2023	Low-Flow	80.97	7.33	2187	0.74	8.5	0.104	0.176	914	17	147	16
DH-55	10/17/2023	Low-Flow	80.94	7.32	2290	4.14	9.6	0.102	0.191	956	17	159	17
DH-55	11/16/2023	Low-Flow	81.19	7.28	2685	5.16	8.3	0.097	0.232	1140	19	193	22
DH-55	12/19/2023	Low-Flow	81.44	7.24	3011	0.92	7.7	0.097	0.244	**1360**	21	**220**	28
DH-55	**95% USL**		**--**	**--**	**--**	**--**	**--**	**1.48**	**0.316**	**1232**	**24**	**198**	**43**

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-56	6/22/2023	Bailer	82.01	7.77	2737	**	10.8	0.461	0.323	1010	21	215	13
DH-56	7/18/2023	Bailer	80.75	7.49	7970	**	13.7	0.413	**2.75**	3530	85	727	59
DH-56	8/16/2023	Low-Flow	82.50	7.45	6639	4.15	11.0	0.346	1.22	3420	64	728	56
DH-56	9/26/2023	Low-Flow	82.81	7.57	5790	2.35	11.2	0.338	0.672	2840	48	577	45
DH-56	10/17/2023	Low-Flow	83.05	7.55	5577	6.82	11.7	0.349	0.600	2640	45	541	39
DH-56	11/16/2023	Low-Flow	83.52	7.62	5209	2.81	9.5	0.374	0.576	2320	38	476	34
DH-56	12/19/2023	Low-Flow	84.36	7.59	4808	2.81	9.5	0.396	0.495	2090	34	471	31
DH-56	**95% USL**		**--**	**--**	**--**	**--**	**--**	**3.70**	**1.75**	**3889**	**89**	**864**	**74**
EH-51	10/5/2021	Standard	19.95	6.99	354	5.21	10.8	0.026	0.003	64	10	19	5
EH-51	10/18/2022	Standard	18.49	6.98	423	5.74	10.6	0.024	0.004	81	14	22	7
EH-51	8/15/2023	Low-Flow	14.58	6.80	418	6.66	10.9	0.029	0.003	61	17	20	7
EH-51	9/26/2023	Low-Flow	14.34	6.91	437	6.51	11.5	0.062	0.003	75	21	22	7
EH-51	10/10/2023	Low-Flow	15.13	6.97	446	6.47	11.0	0.032	0.003	75	20	22	7
EH-51	11/16/2023	Low-Flow	17.13	6.79	437	5.53	9.1	0.026	0.003	75	18	22	7
EH-51	12/19/2023	Low-Flow	18.79	6.77	443	5.07	9.3	0.028	0.003	76	17	21	7
EH-51	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.215**	**0.394**	**780**	**33**	**46**	**28**
EH-60	4/20/2023	Low-Flow	26.85	5.56	1962	7.38	7.9	2.41	0.004	657	171	13	38
EH-60	5/19/2023	Low-Flow	26.05	5.36	1975	1.43	10.5	2.48	0.004	**695**	167	12	43
EH-60	6/22/2023	Low-Flow	24.30	5.48	1891	4.15	11.5	2.79	0.003	604	189	12	39
EH-60	7/18/2023	Low-Flow	23.82	5.54	1747	5.73	14.0	3.10	0.005	500	191	11	30
EH-60	8/15/2023	Low-Flow	23.89	5.53	1967	5.13	12.8	2.94	**0.009**	424	**228**	12	34
EH-60	9/26/2023	Low-Flow	23.79	5.55	2036	6.49	12.0	2.75	**0.018**	492	**284**	12	36
EH-60	10/17/2023	Low-Flow	24.01	5.60	2014	6.45	14.6	2.82	**0.021**	495	**287**	13	35
EH-60	11/16/2023	Low-Flow	24.49	5.53	2048	5.74	9.8	2.72	**0.031**	511	**278**	12	35
EH-60	12/19/2023	Low-Flow	25.13	5.56	1962	3.59	9.6	2.37	**0.038**	540	**242**	13	36
EH-60	**95% USL**		**--**	**--**	**--**	**--**	**--**	**9.85**	**0.005**	**674**	**212**	**15**	**45**

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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-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	3/16/2023	Low-Flow	28.85	6.96	1390	1.20	7.5	<0.002	0.187	521	22	13	14
EH-61	4/20/2023	Low-Flow	28.25	7.12	1468	1.49	9.4	<0.002	0.207	518	23	13	15
EH-61	5/19/2023	Low-Flow	27.44	6.93	1488	0.94	11.1	<0.002	0.201	533	24	13	17
EH-61	6/22/2023	Low-Flow	25.93	6.96	1465	1.23	11.5	<0.002	0.179	512	24	13	16
EH-61	10/17/2023	Low-Flow	25.71	7.04	1358	1.69	11.9	<0.002	0.155	468	23	12	13
EH-61	**95% USL**		**--**	**--**	**--**	**--**	**--**	**<0.002**	**0.535**	**1132**	**42**	**16**	**44**
EH-101	10/5/2021	Standard	20.45	7.00	346	4.35	10.3	0.003	0.003	66	9	15	6
EH-101	10/18/2022	Standard	17.95	7.01	379	4.64	10.2	0.003	0.003	77	11	16	6
EH-101	8/15/2023	Low-Flow	14.88	6.77	383	6.15	11.0	0.003	0.002	55	16	16	7
EH-101	9/26/2023	Low-Flow	14.72	6.93	382	5.55	11.3	0.003	0.002	66	19	16	7
EH-101	10/10/2023	Low-Flow	15.41	7.00	390	5.40	11.7	0.003	0.002	65	17	17	7
EH-101	11/16/2023	Low-Flow	17.41	6.82	373	4.45	8.9	0.003	0.002	64	14	16	6
EH-101	12/19/2023	Low-Flow	19.02	6.80	368	4.54	9.0	0.003	0.002	63	12	16	7
EH-101	**95% USL**		**--**	**--**	**--**	**--**	**--**	**0.215**	**0.394**	**780**	**33**	**46**	**28**

Appendix E - Unfumed Slag Indicator, Sentinel, and Tier 2 Well Data Table
2021-2023

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	3/16/2023	Low-Flow	29.52	6.72	1622	0.37	10.6	<0.002	0.341	757	30	6	47
EH-103	4/20/2023	Low-Flow	28.89	6.88	1696	1.27	9.1	<0.002	0.369	770	30	7	51
EH-103	5/19/2023	Low-Flow	28.06	6.74	1700	0.16	11.2	<0.002	0.356	773	30	6	53
EH-103	6/22/2023	Low-Flow	26.58	6.76	1688	0.24	11.1	<0.002	0.321	743	29	7	47
EH-103	7/18/2023	Low-Flow	26.13	6.79	1707	0.69	12.3	<0.002	0.317	808	26	6	49
EH-103	8/15/2023	Low-Flow	26.20	6.77	1783	0.49	12.8	<0.002	0.338	815	25	6	50
EH-103	9/26/2023	Low-Flow	26.11	6.83	1695	0.72	11.3	<0.002	0.304	785	29	6	49
EH-103	10/17/2023	Low-Flow	26.28	6.85	1703	1.26	12.1	<0.002	0.316	782	29	7	49
EH-103	11/16/2023	Low-Flow	26.80	6.76	1711	0.42	10.4	**0.002**	0.303	769	29	6	48
EH-103	12/19/2023	Low-Flow	27.44	6.76	1709	0.36	10.0	<0.002	0.290	756	28	6	50
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/meter malfunction.

APPENDIX F

2023 WELL PURGE METHOD

COMPARISON SAMPLING RESULTS

Table F-1. June 2023 Groundwater Purge/Sample Method Comparison

Monitoring Site	EH-114			EH-141			EH-59		
	Waterra Low Flow	**Grundfos Submersible**	**RPD**	**Waterra Low Flow**	**Grundfos Submersible**	**RPD**	**Waterra Low Flow**	**Grundfos Submersible**	**RPD**
Sample ID	AEH-2306-112	AEH-2306-113		AEH-2306-122	AEH-2306-123		AEH-2306-127	AEH-2306-128	
Sample Date	6/1/2023			6/1/2023			6/2/2023		
Field Parameters									
pH (s.u.)	6.45	6.44	0.2%	7.24	7.23	0.1%	6.92	6.96	0.6%
SC (µmhos/cm)	1874	1892	1.0%	798	799	0.1%	435	417	4.2%
Diss O_2	0.37	0.29	**24.2%**	4.70	4.80	2.1%	4.76	5.09	6.7%
Water Temp (°C)	11.8	11.8	0.0%	10.4	10.7	2.8%	9.5	8.9	6.5%
ORP (mV)	306.8	278.2	9.8%	271.8	260.1	4.4%	252.4	141	**56.6%**
E_H (mV)	526	498	5.5%	492	481	2.3%	474	363	**26.5%**
Turbidity (NTU)	6.3	4.4	**35.5%**	0.9	2.5	**94.1%**	4.5	1.4	**105.1%**
Laboratory Analyses									
pH (s.u.)	6.6	6.5	1.5%	7.3	7.3	0.0%	7.0	7.0	0.0%
SC (µmhos/cm)	1910	1950	2.1%	813	814	0.1%	444	427	3.9%
Total Suspended Solids	15	*10*	±RL	*10*	*10*	±RL	*10*	*10*	±RL
Total Dissolved Solids	1400	1430	2.1%	542	548	1.1%	276	258	6.7%
Total Alkalinity as CaCO3	160	150	6.5%	160	160	0.0%	120	110	8.7%
Bicarbonate as HCO3	190	190	0.0%	200	190	5.1%	140	130	7.4%
Calcium	143	146	2.1%	84	81	3.6%	47	47	0.0%
Magnesium	40	41	2.5%	23	22	4.4%	11	11	0.0%
Sodium	209	213	1.9%	43	42	2.4%	20	19	5.1%
Potassium	9	9	0.0%	6	6	0.0%	8	7	13.3%
Chloride	36	36	0.0%	20	20	0.0%	13	12	8.0%
Sulfate	817	841	2.9%	219	222	1.4%	77	75	2.6%
Bromide	1.6	1.6	0.0%	0.73	0.74	1.4%	*0.05*	*0.05*	±RL
Trace Metals (Dissolved)									
Antimony	*0.003*	*0.003*	±RL	*0.003*	*0.003*	±RL	0.005	0.005	±RL
Arsenic	1.93	1.97	2.1%	0.002	0.002	±RL	0.014	0.020	**35.3%**
Cadmium	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Copper	0.002	0.001	±RL	*0.001*	*0.001*	±RL	0.002	0.001	±RL
Iron	*0.02*	*0.02*	±RL	*0.02*	*0.02*	±RL	*0.02*	*0.02*	±RL
Lead	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL
Manganese	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL
Mercury	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Selenium	0.011	0.011	0.0%	0.055	0.055	0.0%	0.004	0.004	±RL
Thallium	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Zinc	*0.010*	*0.010*	±RL	*0.010*	*0.010*	±RL	*0.010*	*0.01*	±RL

All concentrations in mg/L unless otherwise noted.

Italicized results are nondetect 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 = results agree to within plus or minus the laboratory reporting limit

[yellow highlight] Comparison value exceeds duplicate criteria (>20% RPD or > ±RL.

Table F-2. October 2023 Groundwater Purge/Sample Method Comparison

Monitoring Site	EH-114			EH-141			EH-59			EH-65			DH-67		
	Waterra Low Flow	Grundfos Submersible	RPD	Waterra Low Flow	Grundfos Submersible	RPD	Waterra Low Flow	Grundfos Submersible	RPD	Waterra Low Flow	Grundfos Submersible	RPD	Waterra Low Flow	Grundfos Submersible	RPD
Sample ID	AEH-2310-148	AEH-2310-149		AEH-2310-145	AEH-2310-146		AEH-2310-133	AEH-2310-134		AEH-2310-171	AEH-2310-172		AEH-2310-180	AEH-2310-181	
Sample Date	10/5/2023			10/5/2023			10/4/2023			10/10/2023			10/11/2023		
Field Parameters															
pH (s.u.)	6.5	6.5	0.0%	7.26	7.26	0.0%	6.76	6.74	0.3%	6.58	6.59	0.2%	6.48	6.26	3.5%
SC (µmhos/cm)	1910	1913	0.2%	801	801	0.0%	443	440	0.7%	1379	1399	1.4%	1368	1408	2.9%
Diss O_2	0.45	0.17	90.3%	4.90	4.86	0.8%	3.49	1.90	59.0%	3.00	1.55	63.7%	7.41	2.24	107.2%
Water Temp (°C)	11.3	11.8	4.3%	9.7	11	12.6%	12.9	13	0.8%	12.3	12.8	4.0%	10.9	11.9	8.8%
ORP (mV)	215	206	4.3%	203	184	9.8%	-99	-88	11.8%	152	164	7.6%	77	113	37.9%
E_H (mV)	435	426	2.2%	424	404	4.8%	120	131	8.7%	371	383	3.1%	297	332	11.2%
Turbidity (NTU)	5.1	5.2	1.9%	0.4	4.4	166.7%	11.3	1.1	164.5%	91	25.9	111.4%	9.3	7.6	20.1%
Laboratory Analyses															
pH (s.u.)	6.6	6.6	0.0%	7.3	7.3	0.0%	7.0	7.0	0.0%	6.6	6.6	0.0%	6.6	6.4	3.1%
SC (µmhos/cm)	1890	1880	0.5%	794	793	0.1%	443	439	0.9%	1370	1370	0.0%	1340	1380	2.9%
Total Suspended Solids	*10*	*10*	±RL	*10*	*10*	±RL	*10*	*10*	±RL	57	49	15.1%	21	27	25.0%
Total Dissolved Solids	1420	1450	2.1%	549	542	1.3%	278	282	1.4%	946	967	2.2%	953	985	3.3%
Total Alkalinity as CaCO3	160	160	0.0%	170	170	0.0%	150	150	0.0%	140	140	0.0%	180	140	25.0%
Bicarbonate as HCO3	200	200	0.0%	210	210	0.0%	180	180	0.0%	180	170	5.7%	210	170	21.1%
Calcium	149	145	2.7%	81	82	1.2%	45	44	2.2%	87	91	4.5%	119	122	2.5%
Magnesium	40	39	2.5%	22	22	0.0%	11	11	0.0%	22	22	0.0%	39	40	2.5%
Sodium	202	200	1.0%	45	44	2.2%	21	22	4.7%	165	166	0.6%	93	100	7.3%
Potassium	9	9	0.0%	6	6	0.0%	8	8	0.0%	9	9	0.0%	6	7	15.4%
Chloride	36	36	0.0%	20	20	0.0%	8	8	0.0%	37	37	0.0%	71	71	0.0%
Sulfate	809	816	0.9%	217	220	1.4%	72	71	1.4%	468	476	1.7%	394	442	11.5%
Bromide	1.67	1.66	0.6%	0.7	0.7	0.0%	0.05	0.05	±RL	0.48	0.48	0.0%	2.74	3.3	18.5%
Trace Metals (Dissolved)															
Antimony	*0.003*	*0.003*	±RL	*0.003*	*0.003*	±RL	*0.003*	0.004	±RL	*0.003*	*0.003*	±RL	*0.003*	*0.003*	±RL
Arsenic	1.81	1.84	1.6%	0.002	0.002	±RL	0.018	0.018	0.0%	0.193	0.199	3.1%	0.075	0.200	90.9%
Cadmium	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Copper	0.002	0.001	±RL	*0.001*	*0.001*	±RL	0.001	0.001	±RL	0.001	0.002	±RL	0.002	0.001	±RL
Iron	0.03	0.02	±RL	*0.02*	*0.02*	±RL	0.10	0.08	±RL	*0.02*	*0.02*	±RL	*0.02*	*0.02*	±RL
Lead	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL	*0.005*	*0.005*	±RL
Manganese	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL	0.12	0.14	15.4%	0.02	*0.01*	±RL	0.02	*0.01*	±RL
Mercury	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Selenium	0.015	0.015	0.0%	0.046	0.045	2.2%	0.001	0.002	±RL	0.125	0.122	2.4%	0.106	0.132	21.8%
Thallium	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL	*0.001*	0.001	±RL	*0.001*	*0.001*	±RL	*0.001*	*0.001*	±RL
Zinc	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL	*0.01*	*0.01*	±RL

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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.

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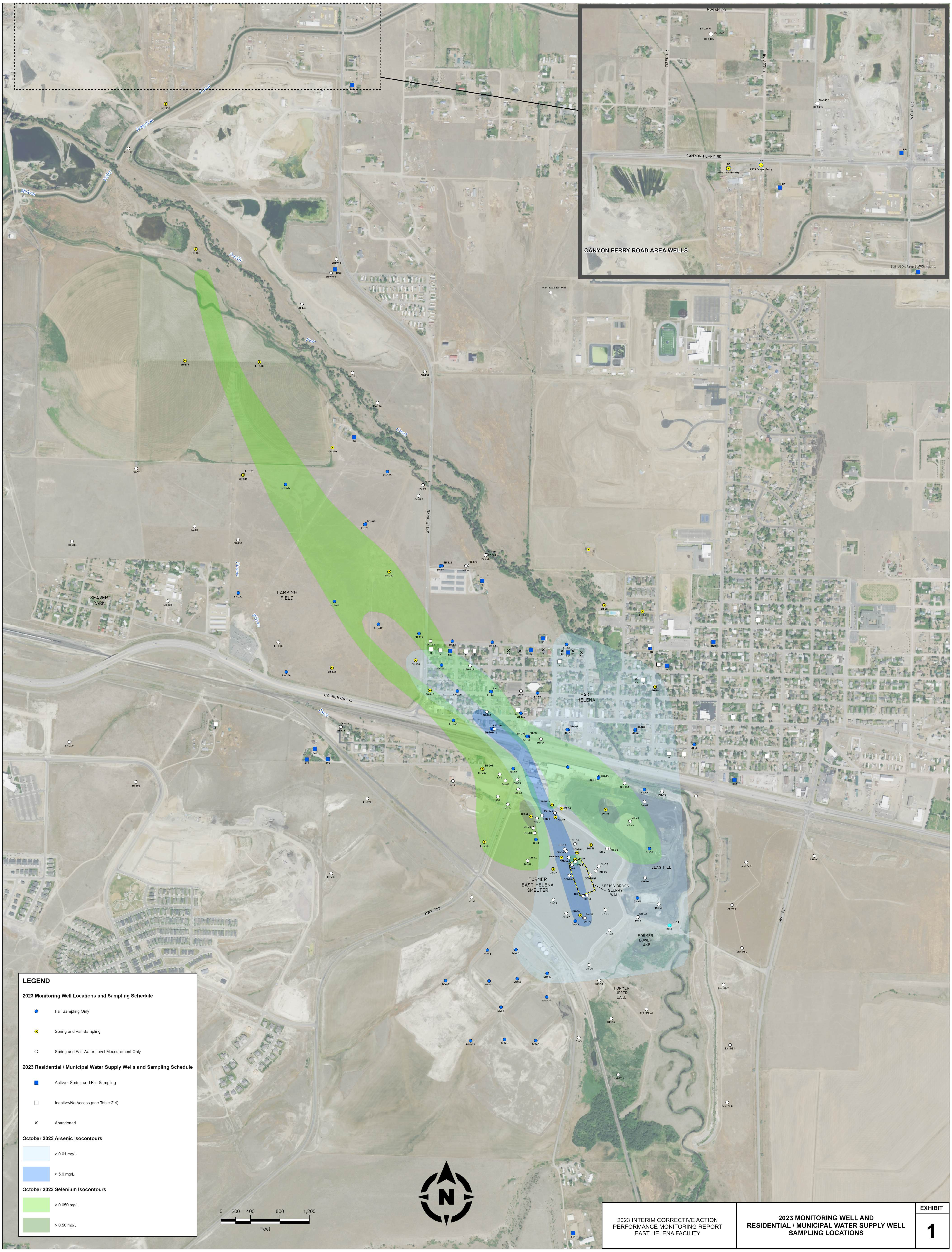
[Yellow highlighted box] Comparison value exceeds duplicate criteria (>20% RPD or > ±RL.

EXHIBITS



2023 INTERIM CORRECTIVE ACTION PERFORMANCE MONITORING REPORT EAST HELENA FACILITY

2023 MONITORING WELL AND RESIDENTIAL / MUNICIPAL WATER SUPPLY WELL SAMPLING LOCATIONS

EXHIBIT

1

Updated by: mwalker 4/24/2024 9:58 AM
G:\PROJECT\10022\2023 Report\2023_Int_CAPM_Report.aprx [Exhibit1; Exhibit1_2023_Wells]

Hydrometrics, Inc.