

Former ASARCO East Helena Facility Corrective Measures Implementation Work Plan

Prepared for

Montana Environmental Trust Group, LLC
Trustee of the Montana Environmental
Custodial Trust

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Acronyms and Abbreviations

ANPR	Advanced Notice of Proposed Rule-Making
CAMP	Corrective Action Monitoring Plan
CAPMP	Corrective Action Performance Monitoring Plan
CAMU	Corrective Action Management Unit
CC/RA	Current Conditions/Release Assessment, East Helena Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI	Corrective Measures Implementation
CMI Work Plan	Corrective Measures Implementation Work Plan
CM O&M	Corrective Measures Operation and Maintenance
CMS	Corrective Measures Study
CMS Report	<i>Former ASARCO East Helena Facility Corrective Measures Study Report</i>
COC	constituent of concern
COEH	City of East Helena
COPC	constituent of potential concern
CQAP	Construction Quality Assurance Plan
CRP	Community Relations Plan
Custodial Trust	Montana Environmental Custodial Trust
DMP	Data Management Plan
DEQ-7	Montana Numeric Water Quality Standards, Circular MDEQ-7 (from Montana Department of Environmental Quality)
EC	engineering control
ET	evapotranspiration
EVCGWA	East Valley Controlled Groundwater Area
Facility	also referred to as the former Asarco East Helena Smelter site
First Modification	First Modification to the 1998 Resource Conservation and Recovery Act Consent Decree
IC	institutional control
IM	interim measure
IMWP	Interim Measure Work Plan
MCS	media cleanup standard
MDEQ	Montana Department of Environmental Quality
O&M	operations and maintenance

PPC	Prickly Pear Creek
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SPHC	South Plant Hydraulic Control
Statement of Basis	Statement of Basis for Groundwater, Surface Water and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility and Response to Comments
USEPA	U.S. Environmental Protection Agency

Introduction

1.1 Purpose and Objectives of CMI Work Plan

The Montana Environmental Trust Group, LLC, Trustee of the Montana Environmental Custodial Trust (Custodial Trust), is submitting this Corrective Measures Implementation Work Plan (CMI Work Plan) for the former ASARCO East Helena Smelter Site (Facility) in East Helena, Montana to the U.S. Environmental Protection Agency (USEPA) pursuant to Paragraph 41 of the First Modification to the 1998 Resource Conservation and Recovery Act (RCRA) Consent Decree (First Modification) (Dreher et al., 2012). Paragraph 41 states, “...the CMI Work Plan shall be developed to implement the decisions set forth and supported in the EPA Decision Document and shall detail all work and related requirements and schedules for the timely implementation and completion of such corrective measures.” The “EPA Decision Document” specifying final corrective measures for the Facility is the *Statement of Basis for Groundwater, Surface Water and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility and Response to Comments, July 2020* (Statement of Basis).

This CMI Work Plan outlines the Custodial Trust’s plan to design, construct, operate, monitor, and maintain the final corrective measures for the Facility. This CMI Work Plan meets applicable regulatory requirements and is consistent with USEPA guidance, including the *RCRA Corrective Action Plan* (USEPA, 1994), the *Advanced Notice of Proposed Rule-Making (ANPR)* (USEPA, 1996), the *RCRA Cleanup Reforms* (USEPA, 2013a), *Expectations for Final Remedies at RCRA Corrective Action Facilities, Fact Sheet #2* (USEPA, 2000), and *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (USEPA, 2004).

1.2 Regulatory Background

RCRA provides the regulatory authority for the investigation and cleanup of the Facility and groundwater contamination that originated from the smelter operations. In 1997, USEPA initiated a transfer of responsibility for on-going remedial activities at the Facility from the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) program to the RCRA Corrective Action program. A Consent Decree effective May 5, 1998, between USEPA and ASARCO (Schiffer et al., 1998) initiated the corrective action process. As part of the Consent Decree, ASARCO prepared a RCRA Current Conditions/Release Assessment (CC/RA) report (Hydrometrics, 1999a). The purpose of the CC/RA was to assess the completeness and quality of the existing data used to define, in whole or in part, the nature and extent of hazardous wastes and hazardous constituent releases migrating from the Facility. Based on its review of the CC/RA, USEPA determined that interim remedial measures were necessary and warranted for portions of the Facility, and an Interim Measures Work Plan (IMWP) was prepared (Hydrometrics, 1999b).

The First Modification was filed on January 17, 2012, as Civil Action No. CV 98-3-H-CCL (Dreher et al., 2012) to define the responsibilities and requirements of the Custodial Trust to address contamination at the Facility for the benefit of the U.S. and State of Montana.

1.3 Overview of Final Corrective Measures

The final corrective measures selected by the USEPA and documented in the Statement of Basis consist of source control actions (removal actions and engineering controls [ECs]) that were implemented as Interim

Measures (IMs), the future grading and construction of a cover for the slag pile, and institutional controls (ICs). The final corrective measures elements that were implemented as IMs are:

1. Evapotranspirative (ET) Cover System – constructed in two phases between 2013 and 2016 to reduce the infiltration of precipitation and subsequent leaching of inorganic contaminants in the unsaturated zone soil to groundwater, eliminate the potential for people and ecological receptors to have direct contact with contaminated surface soil, control potential migration of contaminated media through aerial deposition or surface flooding, and reduce the volume of contaminated stormwater that was being collected and treated by the onsite high-density sludge treatment system.
2. South Plant Hydraulic Control (SPHC) – implemented in phases between 2013 and 2020 to reduce the mass and rate of migration of inorganic contaminants in groundwater from the Facility and restore the natural conditions of Prickly Pear Creek (PPC). SPHC elements included draining Upper and Lower Lake and re-routing PPC to lower the groundwater table by 5 to 15 feet, eliminating groundwater contact with approximately 90% of the contaminated soils.
3. Source Removals – completed concurrently with construction of the ET Cover System and the SPHC, to excavate and consolidate highly contaminated soil from accessible areas that presented an ongoing source of inorganic contamination to groundwater.

In addition to the IMs listed above, two Corrective Action Management Units (CAMUs), constructed by ASARCO prior to the Custodial Trust, have been incorporated into the final selected corrective measures for the Facility. The IMs are described in more detail in the Former ASARCO East Helena Facility Corrective Measures Study Report (CMS Report, CH2M, 2018).

Tables 1-1 and 1-2 present a summary of the selected corrective measures to demonstrate how the overall remedy and the remedy elements meet the goals, criteria, and standards defined in the First Modification. **Table 1-1** summarizes the selected corrective measures and associated ICs to be implemented as the final remedy by the Custodial Trust. **Table 1-2** presents a summary of the selected remedy and remedy performance standards by parcel for the former ASARCO properties. **Figure 1-1** provides a conceptual representation of those remedy components.

In addition to the IMs, USEPA has selected a cover system as the final corrective measure for the slag pile. Conceptual slag pile cover designs were presented in the CMS Report, and the final design will be developed to meet the performance criteria and long-term stability detailed in Section 2 and **Table 1-2**. The slag cover design will be submitted to USEPA for review and approval, in accordance with Section 5 of this CMI WP.

Groundwater monitoring, which has been conducted at and downgradient of the Facility since 1984, will continue and will focus on collecting data to evaluate the performance of the corrective measures over time. The details of the proposed media cleanup standards, monitoring scope, evaluation criteria, and reporting will be provided in an updated Corrective Action Performance Monitoring Plan (CAPMP), in accordance with Section 4 of this CMI WP. The anticipated components of the performance monitoring are summarized in **Table 1-3**.

ICs in the form of administrative and legal controls will be implemented by the Custodial Trust on all Trust-owned parcels to further mitigate potential unacceptable risk and ensure conditions remain protective over time. Additional ICs will continue to be implemented by others on non-Custodial Trust owned properties, including groundwater and soil use restrictions as described in **Table 1-1**. The ICs are further detailed in Section 2.5 of this CMI WP.

CMI Management Plan

2.1 Management Approach

The Custodial Trust will manage the CMI activities to meet requirements of the First Modification. As described in below, the Custodial Trust will continue to engage the services of local consultants and contractors to the maximum extent possible to implement the CMI design and construction activities efficiently and cost-effectively. The Custodial Trust management team has significant technical and institutional knowledge of the Facility and the RCRA Corrective Actions to date.

2.2 Organization and Project Roles

The Custodial Trust's management team is shown on the organization chart presented in Appendix A, which identifies the roles and line of communication of key personnel involved.

2.3 Final Slag Pile Corrective Measure Design

As described conceptually in the Final CMS Report, the slag pile will be regraded and covered to minimize leaching to groundwater by reducing infiltration, prevent windblown particulates from being deposited off site, reduce stormwater runoff particulate transport, and prevent the exposure of contaminants by human and ecological receptors. During CMI, the final design will be developed to meet the applicable remedial action objectives and to allow for potential future asset recovery from the slag. Additional details of the slag pile grading and cover to be completed as a part of future CMI activities are described in Section 5.

2.4 Remedy Performance Criteria

Remedy performance criteria will be established to demonstrate that the final corrective measures are achieving the performance standards approved by USEPA in the CMS as shown in **Table 1-2** and based on the three threshold criteria established by USEPA under RCRA: protection of human health and the environment, source control, and media cleanup standards (MCSs).

The threshold criteria for protection of human health and the environment are:

1. Human and ecological receptors—No direct contact (dermal, inhalation, or ingestion) with environmental media having concentrations of constituents of concern (COCs) exceeding relevant risk-based standards (see description of MCSs below).
2. Protection of the environment will appropriately consider the surrounding ecological setting.
3. Surface water—Prevent groundwater from discharging to surface water at concentrations that would cause the surface water to exceed Montana State Surface Water Standards and/or at concentrations that would degrade surface water quality beyond existing upstream water quality.

The threshold criteria established for source control are:

1. Soil:
 - a. Prevent migration of contaminated surface soil via wind-blown deposition or surface water runoff.

- b. Reduce—to the extent practicable—the potential for groundwater to contact soil with COPC concentrations exceeding relevant groundwater protection standards through the following activities:
 - i. Reducing and/or eliminating to the extent practicable infiltration of stormwater through areas of contaminated soil and sediment to groundwater;
 - ii. Reducing to the extent practicable the amount of contaminated soil in contact with groundwater; and
 - iii. Reducing to the extent practicable COC concentrations or mass through source removal where such removal will yield immediate reductions in contaminant loading to groundwater.
- 2. Slag:
 - a. Reduce—to the extent practicable— the potential for unfumed slag to leach COCs to groundwater by:
 - i. Reducing infiltration of stormwater
 - ii. Removal and recovery of recyclable slag

The third threshold criteria are the cleanup standards established for environmental media. For soils, the CMS Report cited the following (CH2M, 2018):

- 1. Surface (0 to 2 feet below ground surface):
 - a. Soil cleanup levels based on protection of human health and the environment for current and/or future new land uses. Note that if numeric standards cannot be achieved, ECs, ICs, or both will be implemented to interrupt pathways for exposure and to maintain protective conditions.
- 2. At depth (greater than 2 feet below ground surface):
 - a. Numeric standards based on protection of groundwater (as shown in Table 2-1), established regional background levels, or
 - b. Non-numeric/concentration objective(s) based on impracticability associated with addressing large source mass (i.e., reduce toxicity, mobility, or ability of groundwater to come into contact with, leachable contaminant mass).

Water resources (groundwater and surface water) will be monitored at and downgradient of the Facility to evaluate the performance of the corrective measures over time. The details of the proposed performance monitoring, including monitoring locations, sampling and analysis methods, data evaluation, and reporting, will be specified in an updated CAPMP) annually as described in Section 4. The CAPMP will include the groundwater and surface water performance monitoring requirements for each of the remedy elements as described in **Table 1-3**. As outlined in the CMS Report (CH2M, 2018), MCSs for water resources have been established as follows:

- 1. Groundwater:
 - a. Return usable groundwater to maximum beneficial uses wherever practicable, within a time that is reasonable considering all property-specific conditions.

- b. Reduce COC concentrations in groundwater within the Facility such that the Montana Numeric Water Quality Standards (as defined in the Montana Department of Environmental Quality's (MDEQ's) Circular MDEQ-7, and hereafter referred to as DEQ-7; MDEQ, 2019) are met at the points of compliance established by USEPA. The point of compliance is the downgradient boundaries of Parcels 15 and 16 (the former Smelter site), as shown on Figure 1-2.
 - c. Reduce COC loading to groundwater from Facility-related sources so that DEQ-7 groundwater standards may be attained downgradient of the site, to the extent practicable, within a reasonable time.
 - d. During the timeframe when attainment of the DEQ-7 standards has not been achieved, minimize further migration of the plumes, prevent exposure to the contaminated groundwater, and evaluate further risk reduction approaches. To the extent practicable, control or eliminate other surface water and subsurface sources of contamination to groundwater within control of the Custodial Trust.
2. Surface Water:
- a. Meet DEQ-7 standards in surface water bodies that may be impacted by the facility, while acknowledging the presence of upstream contaminant sources.

2.5 Implementation of Institutional Controls

The ICs to be implemented as an element of the final corrective measures are summarized in **Table 1-1** of this report. The ICs include deed restrictions required to maintain the land used identified in the CMS Report and upon which the final corrective measures were selected, as well as the ICs required to meet the City of East Helena (COEH) Zoning Commission, which adopted land uses for the Custodial Trust Parcels. Additionally, the Custodial Trust will continue to implement a residential well abandonment program to assist residents in the abandonment of their existing residential wells and provide domestic water connections to the COEH, if necessary.

As noted in the USEPA-approved CMS Report, the institutional controls that have been and will continue to be implemented by others include (1) the Lewis and Clark County soil ordinance adopted by Lewis and Clark County in 2013, and updated in 2020 which controls soil displacement and disposal activities within the Lewis and Clark Administrative Boundary of the East Helena Superfund Site, (2) the East Valley Controlled Groundwater Area (EVCGWA), which restricts groundwater withdrawals until groundwater cleanup standards described in Section 2.4 are met, and (3) the COEH ordinance which prohibits the installation of new private water wells in the City limits.

2.6 Corrective Measures Implementation Schedule

A preliminary schedule for design, operations and maintenance (O&M), and construction of the corrective measures is provided in Appendix B. Elements of this schedule may change depending on the outcome and timing of the potential slag sale, and the review and approval of the required design and work plans to implement the remaining corrective measures. Accordingly, the schedule will be updated as needed, to reflect progress to date, new tasks, and other key changes in the scope or timing in implementation of the final corrective measures.

2.7 Corrective Measures Implementation Cost Estimate

A preliminary estimate of cost is provided in Appendix C and includes construction estimates provided in the CMS report, estimated design costs, and long term operations and maintenance costs. Formal detailed cost estimates for CMI activities will be prepared during the preparation of final corrective measure designs.

Community Relations Plan (Companion Document)

The Draft Community Relations Plan (CRP) (Custodial Trust, 2010) will be updated and provided as a separate document. The CRP will serve as a guide to conduct community relations activities as part of the CMI process at the Facility. This updated CRP will describe the site and its history, past community involvement, current community concerns, and the steps that will be taken to address these concerns. The goal of the CRP is to keep East Helena community members informed about and involved in the CMI process; the document is divided into four sections:

1. Overview of the CRP, goals, standards, and Focus;
2. Custodial Trust Background, purpose, responsibilities, and structure of the Custodial Trust;
3. Community Background which includes a profile of the community surrounding the Facility, a history of community relations at the Facility, and a list of Facility-related concerns and issues raised by community members; and
4. Community Participation and Multi-Stakeholder Communications Plan which includes community relations goals for involving local residents, public officials, and local news media in Facility activities.

Additionally, the Custodial Trust will prepare and distribute public notices and updated fact sheets, as necessary, to update the community of East Helena at specific milestones in the CMI phase including, but not limited to, the completion of engineering design and subsequent construction. The Custodial Trust will coordinate with the Beneficiaries to conduct public information meetings and/or information sessions to convey updates on the Facility throughout the CMI process.

Corrective Action Performance Monitoring Plan (Companion Document)

The CAPMP, Quality Assurance Project Plan (QAPP) and Data Management Plan (DMP) will be prepared in accordance with applicable USEPA guidance to develop the information necessary to demonstrate that the final corrective measures are meeting the relevant performance criteria described in Section 2.4 and that conditions remain protective of human health and the environment. The performance monitoring components of the 2019 Corrective Action Monitoring Plan (CAMP) (Hydrometrics, 2019), including COC trend analyses and contaminant plume stability analyses, will be updated, modified, and supplemented as necessary to apply to the requirements stipulated in the CMI Work Plan.

In the Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (USEPA, 2004), USEPA defines performance monitoring as “the periodic measurement of physical and/or chemical parameters to evaluate whether a remedy is performing as expected.” Other USEPA guidance on groundwater remediation completion strategies (USEPA, 2013b, 2014a, 2014b) includes a discussion of recommended performance monitoring strategies. USEPA recommends evaluating groundwater data and information on a well-by-well basis to monitor remedial action effectiveness during two distinct phases of groundwater restoration activities (USEPA, 2013b), including:

1. The remediation phase, referring to the phase of the remedy where remedial activities are being actively implemented and groundwater data are used to monitor progress toward groundwater cleanup levels specified in a remedy decision document. The remediation phase is typically completed when monitoring data and evaluations demonstrate that the groundwater has reached the cleanup levels for all COCs set forth in the USEPA Decision Document; and
2. The attainment monitoring phase, occurring after the remediation monitoring phase is complete and groundwater has reached cleanup levels for all COCs.

The Facility has been in the remediation phase since the completion of the SPHC and ET Cover System implementation in 2016. During the remediation phase, groundwater data “typically are collected to evaluate contaminant migration and changes in COC concentration over time” (USEPA, 2014a), to address the following questions:

Are groundwater elevations and flow directions as expected and have temporal and seasonal influences been assessed and considered?

Are there changes (trends) in groundwater COC concentrations?

Is there evidence of attenuation, degradation, and/or stabilization of COCs?

Is the spatial (lateral and vertical) extent of contaminated groundwater changing?

The CAPMP will include the performance criteria, the data to be collected from groundwater and surface water performance monitoring, and to describe the data evaluation process. The CAPMP will be prepared in accordance with applicable USEPA guidance to direct the collection and will propose the criteria to be used to determine whether modifications to the monitoring well network, the monitoring program, and/or the corrective measures are warranted.

Performance monitoring will include collection of groundwater levels and elevations, surface water elevations, and groundwater and surface water quality sampling at selected monitoring locations. Data

collection will focus on the information needed to evaluate the performance of specific corrective measures, including:

1. Groundwater elevation data will be used to confirm that the SPHC corrective measure is meeting its performance objective to lower the groundwater table, thereby reducing groundwater contact with contaminated subsurface soil and offsite mass flux of COCs.
2. Groundwater quality data will be used to evaluate concentration trends locally throughout the Facility area and offsite, in response to (1) reduced infiltration through slag and contaminated soil due to placement of the slag pile cover and ET Cover System, (2) targeted source removals, (3) continued functioning of the Speiss-Dross slurry wall and CAMUs, and (4) reduction in loading from subsurface soils to groundwater due to the SPHC. Offsite wells will be monitored to quantify the combined effectiveness of these corrective measures, in particular to evaluate (1) COC trends, (2) plume configuration and stability, (3) reduction of offsite mass flux, and (4) continued appropriateness of the boundaries of the EVCOWA. Downgradient residential wells and COEH water supply wells will be monitored to ensure that they are not contaminated by plume migration or shift.
3. Surface water flows and elevations will be monitored to determine if changes in groundwater to surface water interaction are occurring which could result in contaminated groundwater impacting PPC. Surface water quality data will also be collected to confirm the lack of impacts to the creek from SPHC, as well as to confirm that PPC is not adversely impacted from slag sloughing, storm water runoff, or potential loading from tributary sources.

The following plans will be prepared and submitted for USEPA's review and approval in accordance with the schedule described below:

1. CAPMP – the CAPMP will consist of an updated version of the current CAPMP (Hydrometrics, 2019). The CAPMP will outline water resources monitoring objectives, quantitative and qualitative performance monitoring metrics, sampling locations and frequency, sampling methodologies, analytical parameters, methods, and detection limits, data verification and validation requirements, and data evaluation and reporting requirements. The CAPMP will be reviewed and updated annually and submitted to USEPA for review each May.
2. QAPP – the QAPP will consist of an updated version of the current QAPP (Hydrometrics, 2015). The QAPP will be consistent with USEPA requirements and guidance (USEPA 2001, 2002), and will include sections on project organization, data quality objectives, data acquisition and measurement requirements, including quality assurance and quality control (QA/QC) requirements, project assessment and oversight responsibilities, and data validation and usability. The QAPP will be reviewed annually and if updates are needed will be submitted to USEPA for review along with the CAPMP each May.
3. DMP – the DMP will also consist of an updated version of the current DMP (Hydrometrics, 2011), and will comprise a plan to document and track investigation data and results. The purpose of the DMP is to ensure that all data collected in support of the performance monitoring is properly documented, recorded, and distributed. The DMP will include specifications for field and laboratory data documentation and reduction procedures, maintenance and retention of project files and of the water resources database, provisions for modifying the database and providing certified copies of the database to interested parties, and reporting procedures. The DMP will be reviewed annually and if updates are needed will be submitted to USEPA for review along with the CAPMP each May.

Performance monitoring field activities conducted under the CAPMP and associated documents will also be governed by an updated Sitewide Health and Safety Plan. If additional environmental investigations outside the scope of the CAPMP are deemed necessary during CMI, Supplemental Field Investigation Work Plans will be prepared for these additional activities as warranted.

Final Remedy Design and Construction Plan

5.1 Slag Pile Corrective Measure Design

A grading and cover plan for the slag pile will be developed to describe the criteria and construction requirements for that element of the final corrective measures. The primary objective of this corrective measure is to further reduce the potential for contaminants to leach from the slag pile to ground water, using engineered controls to minimize infiltration.

The Custodial Trust is currently working with USEPA and the beneficiaries to evaluate a proposal from a third party that would remove approximately 2,000,000 tons (956,000 cubic yards) of unfumed slag for zinc recovery. The removal of the 2,000,000 tons of unfumed slag would significantly reduce the potential source of contamination to groundwater by eliminating the need to consolidate the upper lift of unfumed slag, and eliminating the need for a low permeability or ET Cover cap. The removal and recovery operation would also reduce the height of the pile and minimize the amount of grading needed for slope stabilization. This action would also reduce the cost to implement the grading and cover corrective measure. However, because unfumed slag removal activities would impact a significant area of the slag pile footprint, development of the final grading and cover plan would not start until the unfumed slag removal is complete. At this time, the removal and recovery operation is estimated to be approximately 10 years.

In the event that the third party proposal is not approved, the Custodial Trust will proceed with development of the slag pile grading and cover plan and incorporate the following:

1. Demolition of the existing water storage infrastructure;
2. Regrading of the steep outer slopes to be stable and minimize the potential for future sloughing;
3. Removal of approximately 144,000 cubic yards of fumed slag from the American Chemet Property for incorporation into the regrading of the slag pile on the Custodial Trust Facility property;
4. Consolidation of the unfumed slag in the upper lift to the southern plateau under a low permeability or ET cover¹;
5. Utilization of swales and ditches to manage and direct storm water off the slag pile and towards the wetlands to the south;
6. Placement of a vegetated soil cap cover over the slag pile utilizing soils from the East Fields; and
7. Consideration of access to the fumed slag along the northern portion of the slag pile for future commercial removal purposes.

Additionally, a limited number of field activities are anticipated in order to complete the design of the slag pile cover. An investigation of potential cover soil borrow areas will be performed to determine where material meeting final design specifications can be obtained. The investigations which will be further defined while the final designs are being developed, are anticipated to include sampling borrow materials for metals, gradation, texture, atterberg limits, and organic matter.

¹ Because the unfumed slag has a higher potential to leach contaminants to groundwater, a low permeability or ET cover would be placed over the unfumed portion of the slag pile to reduce infiltration and minimize the potential for leaching to groundwater.

5.2 Construction Quality Assurance Plan for Slag Pile Corrective Measure

A Construction Quality Assurance Plan (CQAP) will be developed as a separate document to be included with the final design of the slag pile regrading and cover. The CQAP will contain the quality assurance protocols for attaining and maintaining high quality construction and to provide confidence the slag pile cover system is constructed in accordance with the approved final design plans and specifications.

The CQAP will focus on the most critical elements of the slag pile grading and cover, and will provide specific details related to quality assurance and quality control measures, responsibilities, maintenance of project records, data management and control, project meetings, and reporting.

Corrective Measures Operation and Maintenance Plans (Separate Documents)

A Corrective Measures Operation and Maintenance (CM O&M) plan for each final corrective measures will be prepared to ensure the measures remain protective over time. A CM O&M plan for the SPHC and ET Cover will be drafted and provided to USEPA for review and approval within 90 days of approval of this CMI Work Plan. CM O&M Plans for ICs and the slag pile cover corrective measures elements will be drafted and provided to USEPA for review and approval within 90 days of implementation completion. Operation and Maintenance of the Facility's two Corrective Action Management Units is specified in an USEPA-approved Post Closure Plan (Hydrometrics & Crowley Consultants, 2007).

The CM O&M plan will identify roles and responsibilities for all O&M activities identify features of the corrective measure requiring O&M, address health and safety requirements for O&M personnel, identify recordkeeping and reporting procedures, develop contingency and mitigation procedures for unforeseen conditions, and identify performance requirements for variances, modifications, or termination of O&M activities. Specific O&M elements anticipated for the final O&M plans for the SPHC, ET Cover and Slag Pile Cover are described in the following sections.

6.1 SPHC

The SPHC was designed to reduce groundwater elevations through the southern portion of the Facility over time, passively and sustainably, without the need for active operation and maintenance. The relocation of Prickly Pear Creek was designed to return the creek to a natural condition and eliminate the need for long-term O&M; however, short-term monitoring and possible repairs may be necessary to ensure that the new corridor is well established. Activities to be included in the SPHC section of the CM O&M plan include:

1. Identification of the establishment criteria to ensure that the SPHC IM is meeting the of the following 404 Permit (Permit No. NOW-2011-02083-MTH) and regulatory requirements:
 - a. Mitigation of wetlands at a 1:1 ratio (impacted to mitigated);
 - b. Development of stream and wetland functions and values equal to or better to those of impacted; and
 - c. Temporary bypass channel removal decisions, per the vegetation monitoring assessments and stream channel function inspections.
2. Appropriately detailed procedures for routine inspections and repair of corridor components in PPC during the period of time the PPC corridor is being established to meet permit requirements will continue for a period of up to 10 years or more and include:
 - a. Vegetation monitoring and assessments;
 - b. Stream channel function inspections; and
 - c. Infrastructure and engineered controls inspections.
3. Direction for formal wetland and vegetation surveys to ensure the establishment of vegetation in the enhanced wetland and riparian corridor.

4. Recordkeeping to ensure proper documentation for regulatory reporting.
5. Description of specific contingency measures for unforeseen events during the establishment period.
6. Identification of emergency contacts, including those personnel implementing the O&M and any regulatory agency personnel that should be notified to ensure compliance with the effective permits.

6.2 ET Cover

O&M elements anticipated to be included in the ET Cover section of the CM O&M plan will include:

1. Identification of performance metrics and the monitoring needed to gather that information.
2. Appropriately detailed procedures for the activities including:
 - a. Vegetation monitoring;
 - b. Settlement inspections;
 - c. Erosion inspections and repair; and
 - d. Vegetation mowing and maintenance.
3. Recordkeeping to ensure proper documentation for reporting.
4. Identification of potential contingency measures for unforeseen events.
5. Identification of emergency contacts, including those personnel implementing the O&M.

6.3 Slag Pile Cover

O&M elements anticipated to be included in the final slag pile cover CM O&M plan include:

1. Identification of performance goals and monitoring.
2. Appropriately detailed procedure remedy components including:
 - a. Vegetation monitoring and assessment;
 - b. Settlement inspections; and
 - c. Erosion inspections and repair.
3. Recordkeeping to ensure proper documentation for regulatory reporting.
4. Identification of potential contingency measures for unforeseen events.
5. Identification of emergency contacts, including those personnel implementing the O&M.

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Tables

Table 1-1. Summary of Selected Corrective Measures and Supplemental Institutional Controls

From Table 6-1A *Corrective Measures Study Report, Former ASARCO East Helena Facility*

Selected Remedy Elements	Engineering/Activity Components	Applicable Parcels	Applicable Media or Pathway
ENGINEERING CONTROLS			
ET Cover System - Building Demolition, Utility Abandonment, Subgrade Fill, Final ET Cover	ET Cover to mitigate infiltration of precipitation, control wind erosion	Facility (Parcels 16,19)	Groundwater
	Surface water/stormwater collection		Soil
South Plant Hydraulic Controls: Upper Lake and Lower Lake Removal; PPC Bypass; PPC Realignment; wetland construction	Reduce surface water loading to groundwater by removing Upper Lake and Lower Lake	Facility (Parcels 16,19)	Sediment
	Establish natural stream channel flow and geomorphic conditions within Smelter reach		Surface water
	Establish natural wetland/riparian conditions		Sediment
Speiss Dross Slurry Wall	Isolate impacted soil and prevent impacts to groundwater		Groundwater
Source removals - Excavation and Removal of Impacted Media at Tito Park Area, former Acid Plant, and Upper Lake Marsh	Remove through excavation impacted soil/sediment that could potentially leach to groundwater or surface water	Facility (Parcels 16,19)	Groundwater
	Protectively manage removed soil under ET cover system		Soil
CAMU 1 and CAMU 2	Isolate impacted soil, sediment and remediation waste and prevent impacts to groundwater	Facility (Parcels 16,19)	Surface water
	Surface water/stormwater collection		Sediment
Slag Pile - Grade and Cover	ET Cover over unfumed slag to reduce infiltration	Facility (Parcels 16,19)	Groundwater
	Slag pile regrading		Soil/Slag
	Surface water/stormwater collection		Sediment
INSTITUTIONAL CONTROLS IMPLEMENTED BY CUSTODIAL TRUST			
Custodial Trust Well Abandonment Program	Contact all residents with existing supply wells; Abandon existing residential wells and/or provide alternative water supply	Non Trust-Owned Properties	Groundwater
Custodial Trust Deed Restrictions	Implement deed restriction on Trust-owned property to restrict use to commercial/industrial only and prohibit groundwater use	Trust-Owned Properties including Facility (Parcels 16, 19)	Soil and Groundwater

Table 1-1. Summary of Selected Corrective Measures and Supplemental Institutional ControlsFrom Table 6-1A *Corrective Measures Study Report, Former ASARCO East Helena Facility*

Selected Remedy Elements	Engineering/Activity Components	Applicable Parcels	Applicable Media or Pathway
SUPPLEMENTAL INSTITUTIONAL CONTROLS IMPLEMENTED BY OTHERS			
East Valley Controlled Groundwater Area (CGWA)	Implement and maintain program through CGWA process	CMS Parcels (including Facility), Undeveloped Lands, Non Trust-Owned Properties	Groundwater
	Apply groundwater use restriction areas		
City of East Helena Well Restrictions	Implement and maintain program through COEH process	CMS Parcels (including Facility), Undeveloped Lands, Non Trust-Owned Properties	Groundwater
	Apply groundwater use restriction areas		
Lewis and Clark County and City of East Helena Soil Ordinance	Implement and maintain lead education and abatement program through COEH process	Non Trust-Owned Properties	Soil
	Apply property use restrictions		

Notes:

ET = evapotranspiration

PPC = Prickly Pear Creek

COEH = City of East Helena

Facility - Parcels 16, 19

CMS Parcels - Parcels 10, 11, 12, 15, 16, 17, 18, 19, 23, the portion of 8 located west of State Highway 518 (8W), and portions of Parcel 2 near Prickly Pear Creek (PPC; Parcel 2a)

Undeveloped Lands - Parcels 7, 9, 13, 14, 21, the portion of 8 located east of State Highway 518 (8E), and the portion of 2 located east of Wylie Drive

Non Trust-Owned Properties include those Undeveloped Lands sold by Custodial Trust since 2016 for redevelopment, corrective measures are set forth in the OU2 ROD - Parcels 3, 4, 6, 22, the portion of 2 located west of Wylie Drive

Table 1-2. Summary of Remedy Performance Standards by Parcel
From Table 6-2A Corrective Measures Study Report, Former ASARCO East Helena Facility

Remedy Performance Standards						
CMS Parcel	Selected Remedy	Media with Potential Unacceptable Risk	Protect HH and Environment	Achieve MCSs	Control Sources	Meets Current and Future Exposure/Use
2a	Operable Unit 2 Record of Decision, Undeveloped Lands	Soil	No unacceptable risk (Table 4-1)	To be evaluated upon transfer of property ownership	Windborne deposition mitigated by ET Cover	Currently land is undeveloped similar to Operable Unit 2 Record of Decision parcels
	South Plant Hydraulic Control and ET Cover	Groundwater		Yes	Interrelated IMs to reduce downgradient concentrations	
8W, 10, 11, 12, 17, 18	South Plant Hydraulic Control: Upper Lake and Lower Lake Removal, Prickly Pear Creek Bypass and Realignment, wetland construction	Soil	No unacceptable risk (Table 4-1); IMs are reducing contaminant mass loadings and remedy is protective in combination with CGWA and COEH restrictions	Yes - contaminated soil and sediments were removed and replaced with clean materials	N/A - sources removed	Constructed riparian corridor appropriate for industrial (future) or recreational use (current)
		Sediment				
		Surface water				
15	Operable Unit 2 Record of Decision	Soil	No unacceptable risk (Table 4-1)	To be evaluated upon transfer of property ownership	Windborne deposition mitigated by ET Cover	Meets industrial MCSs (future use); no risk to ecological receptors (current use)
	CGWA (supplemental institutional control implemented by others)	Groundwater	Reduce potential for contact with and ingestion of impacted groundwater	Contaminant concentrations are expected to decrease over time due to reductions in mass loading from remedy implementation	No source: plume in this area is attributed to naturally occurring arsenic	Protected by the CGWA
16, 19	ET Cover, Source Removal, Speiss Dross Slurry Wall, CGWA (supplemental institutional control implemented by others)	Soil	- Prevent contact with impacted media through removal or under protective ET Cover - Locally improve water quality through removal	Yes	Removed or under protective ET Cover	Meets industrial MCSs
		Groundwater		Contaminant concentrations are expected to decrease over time due to reductions in mass loading from remedy implementation	Excavated where possible, reduce infiltration, prevent migration from slurry wall, lower water levels (South Plant Hydraulic Control IM)	Use prohibited by CGWA
	Grade and Cover	Unfumed Slag	- Improve downgradient water quality over	Yes	Reduce potential for slag and stormwater runoff to discharge in Prickly Pear Creek	Fumed slag available for recovery and industrial use
23	Operable Unit 2 Record of Decision	Soil	No unacceptable risk (Table 4-1)	Yes	Windborne deposition mitigated by ET Cover	Currently land is undeveloped similar to Operable Unit 2 Record of Decision parcels
Undeveloped Land	Proposed Remedy	Exposure Media	Protect HH and Environment	Achieve MCSs	Control Sources	Meets Current and Future Exposure/Use
2E, 7, 9, 13, 14, 8E, and 21	Operable Unit 2 Record of Decision, COEH Soil Ordinance, COEH Well Restrictions	Groundwater	Reduce potential for human contact with and ingestion of impacted groundwater	Contaminant concentrations are expected to decrease over time due to reductions in mass loading from remedy implementation	Reduced concentrations at Facility will eventually propagate downgradient	Ensures protection until groundwater meets MCSs
	Operable Unit 2 Record of Decision, COEH Soil Ordinance	Soil	Reduce potential for human contact with impacted soil	MCS will be achieved by adherence to COEH soil ordinance or a Trust institutional control if not within COEH	Windborne deposition mitigated by ET Cover	Ensures property use is appropriate to existing conditions
Non-Custodial-Trust-Owned Properties	Proposed Remedy	Exposure Media	Protect HH and Environment	Achieve MCSs	Control Sources	Meets Current and Future Exposure/Use
(including 2W, 3, 4, 6, 22) ¹	Custodial Trust Well Abandonment Program; COEH Well Restrictions; CGWA (supplemental institutional control implemented by others)	Groundwater	Reduce potential for human contact with and ingestion of impacted groundwater	Contaminant concentrations are expected to decrease over time due to reductions in mass loading from remedy implementation	Reduced concentrations at Facility will eventually propagate downgradient	Ensures protection until groundwater meets MCSs
	Operable Unit 2 Record of Decision, COEH Soil Ordinance	Soil	Reduce potential for human contact with impacted soil	MCS will be achieved by adherence to COEH soil ordinance or a Trust institutional control if not within COEH	Windborne deposition mitigated by ET Cover	Ensures property use is appropriate to existing conditions

Notes:

2E = the portion of parcel 2 located east of Wylie Drive

2W = the portion of parcel 2 located west of Wylie Drive

8E = the portion of parcel 8 located east of Highway 518

8W = the portion of parcel 8 located west of Highway 518

CGWA = Controlled Groundwater Area (supplemental institutional control implemented by others)

COEH = City of East Helena

ET = evapotranspiration

IM = interim measure

MCS = media cleanup standard

NA = not applicable

¹Undeveloped land parcels sold by the Custodial Trust since 2016. Remedy is determined based on future use of parcel.

Table 1-3. Preliminary Summary of Performance Monitoring Requirements
From Table 6-3 *Corrective Measures Study Report, Former ASARCO East Helena Facility*

Proposed Remedy Elements	Engineering/Activity Components	Applicable Media or Pathway	Remedial Objectives	Performance Monitoring Requirements	
				Monitoring (Media)	Engineering Components Monitoring
ENGINEERING CONTROLS					
Slag Pile - Grade and Cover	ET Cover over unfumed slag to reduce infiltration	Groundwater	- Reduce infiltration through unfumed Slag and subsequent leaching of metals from unfumed Slag	CAMP Program (Groundwater)	Cover Inspections and Maintenance
	Slag pile regrading	Soil/Slag Sediment	- Maintain access to slag for sale - Reduce potential for slag discharge to Prickly Pear Creek	Slag pile slope grading plan	Slope inspections and comparison to design parameters
	Surface water/stormwater collection	Surface water	- Reduce potential for slag and stormwater runoff from discharging to Prickly Pear Creek	CAMP Program (Surface Water)	Cover Inspections and Maintenance
ET Cover System - Building Demolition, Utility Abandonment, Subgrade Fill, Final ET Cover	ET Cover to mitigate infiltration of precipitation, control wind erosion	Groundwater	- Reduce infiltration of precipitation through impacted soil to groundwater - Eliminate uncontrolled water collection and discharge to groundwater through buried utilities - Improve Site and down-gradient groundwater quality	CAMP Program (Groundwater)	Cover Inspections and Maintenance
		Soil Sediment	- Reduce potential for direct contact of impacted media with human and ecological receptors	Not Applicable	
	Surface water/stormwater collection	Surface water	- Reduce volume of stormwater and prevent stormwater contact with impacted media	CAMP Program (Surface Water)	
South Plant Hydraulic Controls: Upper Lake and Lower Lake Removal; PPC Bypass; PPC Realignment; wetland construction	Reduce surface water loading to groundwater by removing Upper Lake and Lower Lake	Groundwater	- Lower groundwater table to reduce groundwater contact with impacted subsurface soil - Reduce offsite flux	CAMP Program (Groundwater)	Not applicable
	Establish natural stream channel flow and geomorphic conditions within Smelter reach	Surface water	- Improve surface water quality of PPC by reducing loading from tributary sources	CAMP Program (Surface Water)	
	Establish natural wetland/riparian conditions	Sediment	- Reduce impacted sediment discharge to PPC within Smelter reach - Prevent flooding	Not Applicable	
Source removals - Excavation and Removal of Impacted Media at Tito Park Area, Acid Plant, Upper Lake Marsh, and Speiss Disposal Area	Remove through excavation impacted soil/sediment that could potentially leach to groundwater or surface water	Groundwater	- Improve localized groundwater conditions within removal areas - Improve down-gradient groundwater quality	CAMP Program (Groundwater)	Not applicable (see ET Cover System)
		Soil	- Reduce potential for human contact with impacted soil	Not Applicable	
	Protectively manage removed soil under ET cover system	Surface water	- Improve surface water quality of PPC by reduced loading from tributary sources	CAMP Program (Surface Water)	
		Sediment	- Reduce impacted sediment discharge to PPC within Smelter reach	Not Applicable	
Speiss Dross Slurry Wall	Isolate impacted soil and prevent impacts to groundwater	Groundwater	- Improve localized groundwater conditions outside of slurry wall area - Improve down-gradient groundwater quality	CAMP Program (Groundwater)	Not applicable
INSTITUTIONAL CONTROLS (ICs)					
Custodial Trust Well Abandonment Program	Contact all residents with existing supply wells; Abandon existing residential wells and/or provide alternative water supply	Groundwater	- Reduce potential for human contact with and ingestion of impacted groundwater	Verification of Alternative Water Supply or Treatment System	Formally confirm all residents with existing supply wells are notified
SUPPLEMENTAL ICs IMPLEMENTED BY OTHERS					
Controlled Groundwater Area (CGWA)	Implement and maintain program through CGWA process Apply groundwater use restriction areas	Groundwater	- Reduce potential for human contact with and ingestion of impacted groundwater	CAMP Program (Groundwater)	Maintain CGWA program until conditions are met
COEH Well Restrictions	Implement and maintain program through COEH process Apply groundwater use restriction areas	Groundwater	- Reduce potential for human contact with and ingestion of impacted groundwater	CAMP Program (Groundwater)	Monitored through COEH program
COEH Soil Ordinance	Implement and maintain program through COEH process Apply property use restrictions	Soil	- Reduce potential for human contact with impacted soil - Ensure that property use is appropriate to existing conditions	Not Applicable	Monitored through COEH LEAP program

Table 2-1 CMS Parcels- Media Cleanup Standards for Primary Inorganic Constituents in Soil

From 2-1A Corrective Measures Study Report, Former ASARCO East Helena Facility

Media	Constituent of Potential Concern	Land Use	Cleanup Standard (µg/L groundwater, mg/kg soil) ^d	Basis of Standard	Applications for Standard
Groundwater	Arsenic	All	0.010	MCL	Exceedance of MCS indicates need for remedial action and will be considered in identification of areal extent of institutional controls (Controlled Groundwater Area)
	Cadmium		0.005		
	Selenium		0.05		
Surface Soil	Lead	Ecological	650	Concentration established to be protective of ecological receptors (passerines) at other MT remediation sites ^a	Will be applied as a design criterion for IM and final remedy construction (final surface site work associated with Prickly Pear Creek and Tito Park excavation, surface layer of ET Cover System, etc.)
		Residential	400	USEPA RSL ^b	
		Industrial - Commercial	800		
		Recreational	3,245	OU-2 ROD	
	Arsenic	Residential	35	Hegeler Zinc ROD ^c	Establishes concentration threshold for remedy implementation on undeveloped properties when land use changes
		Industrial - Commercial	572	OU-2 ROD	
		Recreational	794	OU-2 ROD	
Soil at Depth	Arsenic		22.5	MDEQ	Establishes extent of remedial action required to prevent groundwater contact with contaminated soil and to control infiltration
	Cadmium		0.38	USEPA MCL-based SSL ^b (concentration needed to achieve MCLs in groundwater)	
	Selenium		0.26	USEPA MCL-based SSL ^b (concentration needed to achieve MCLs in groundwater)	

^a Recommended based on its consistency with action levels developed at other similar smelter/mining sites: OU2 Record of Decision (ROD) East Helena, MT; Anaconda Smelter Superfund Site, Anaconda, MT; Bunker Hill Superfund Site, Coeur d'Alene, ID; and Tri-State Mining District (Oklahoma, Kansas, and Missouri) Superfund Site.

^b USEPA June 2015 RSL or MCL-based soil screening level (SSL) where indicated

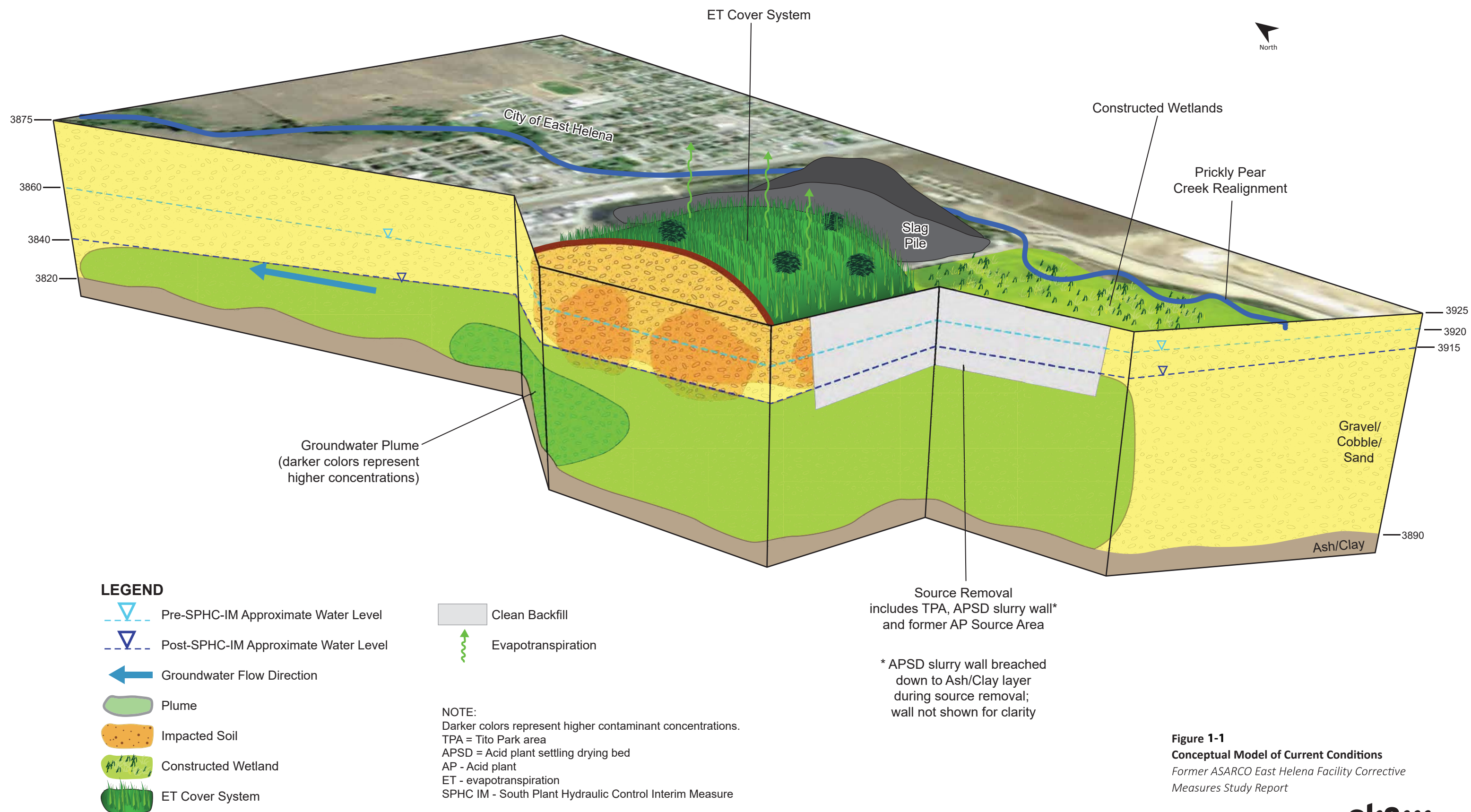
^c The arsenic cleanup level is recommended based on risk-based concentrations currently being approved by USEPA at former smelter sites and similar facilities across the country. The Hegeler Zinc ROD is cited as an example of current practice (USEPA, 2014).

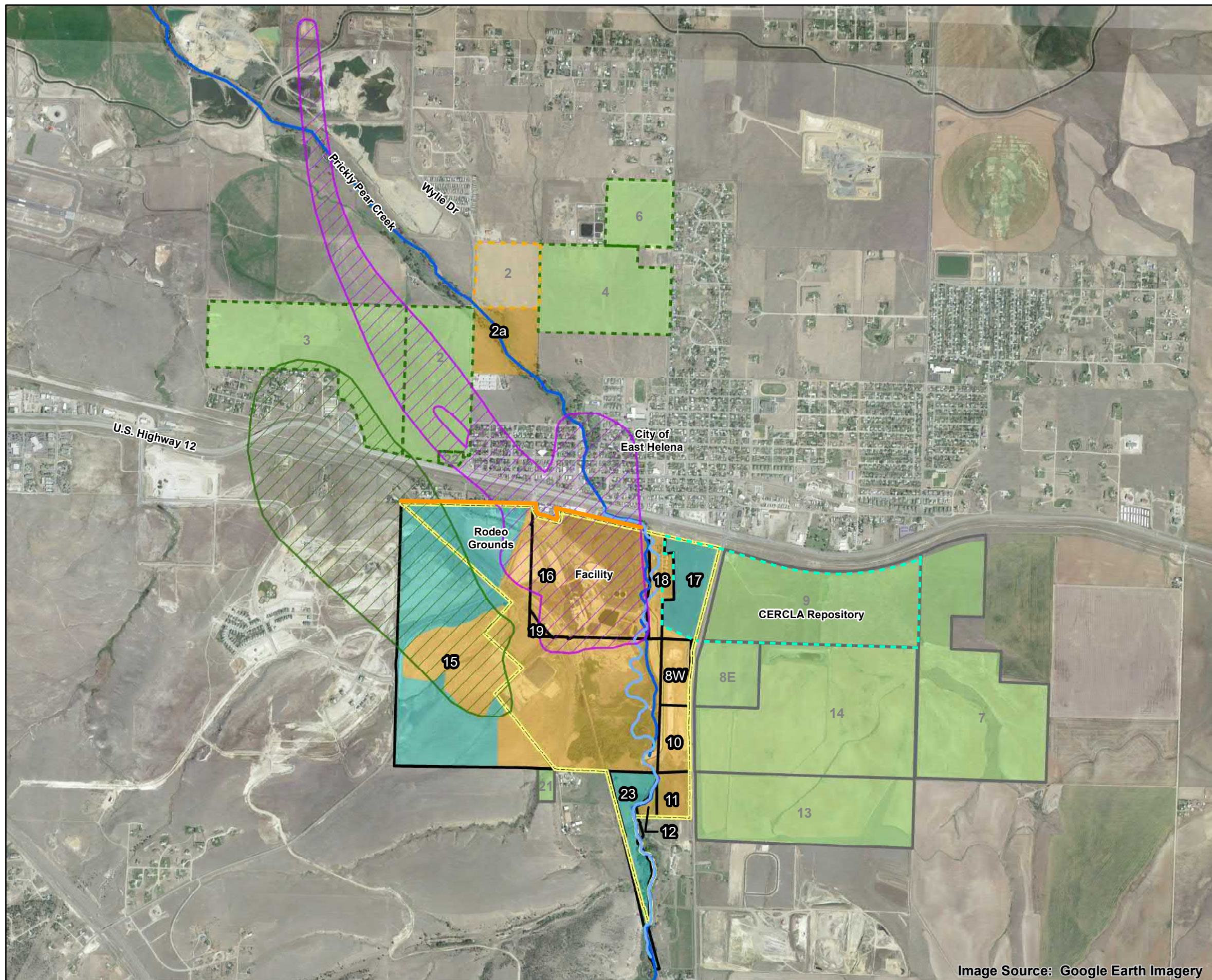
^d Media cleanup standards for CMS Parcels as presented in the CMS Workplan (EPA Approval, October 22, 2015); OU-2 ROD standards will be applied to the Undeveloped Lands.

Abbreviations:

µg/L	=	micrograms per liter
ET	=	evapotranspiration
IM	=	interim measure
MCL	=	maximum contaminant level
MDEQ	=	Montana Department of Environmental Quality
mg/kg	=	milligrams per kilogram
OU2 ROD	=	Record of Decision for Operable Unit 2
RSL	=	regional screening level

Figures





LEGEND

- Prickly Pear Creek
- Prickly Pear Creek Realignment
- Point of Compliance
- CMS Parcel
- CMS Parcel Undergoing Corrective Action
- Parcel Boundary
- Residential Soil Disposal Area Boundary
- Area of Contamination Boundary
- Extent of Facility-related Groundwater Contamination (combined As and Se plumes)

Notes:

1. CMS = Corrective Measures Study
2. OU2 = Operable Unit 2
3. ROD = Record of Decision
4. CERCLA = Comprehensive Environmental Response, Compensation and Liability Act

LEGEND

- Undeveloped Land¹
- Undeveloped Land Sold by Custodial Trust²
- Undeveloped Land Undergoing Corrective Action³

Notes:

1. Parcel owned by the Custodial Trust that is not part of the CMS, but has a corrective measure set forth in the OU2 ROD.
2. Parcel sold by the Custodial Trust since 2016 for redevelopment; corrective measure set forth in the OU2 ROD.
3. Corrective measure implemented in tandem with 2a.

LEGEND

- West Arsenic Area

Notes:

1. The west arsenic area occurs primarily from groundwater interaction with naturally-occurring arsenic-bearing soil and is not facility-related.

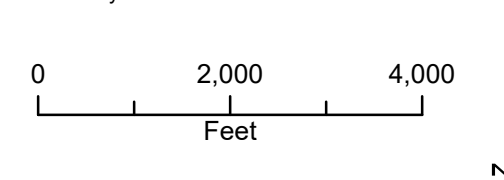


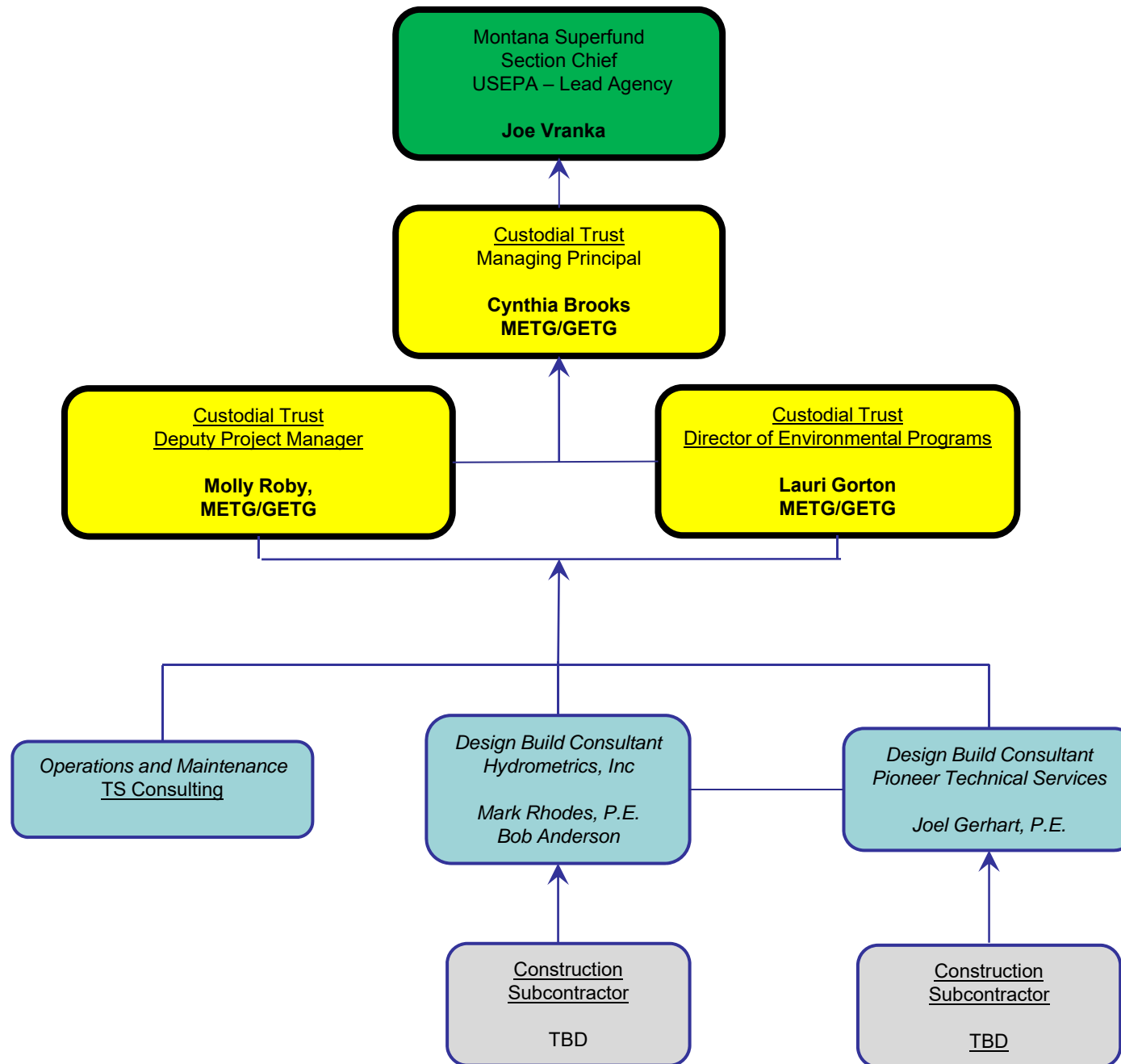
Figure 1-2
Geographic Boundaries of the CMS
 Former ASARCO East Helena Facility
 Corrective Measures Study Report
 East Helena, Montana

Image Source: Google Earth Imagery

Appendix A

Organization Chart

Corrective Measures Implementation Organization and Lines of Communication



Appendix B

Corrective Measures Implementation Schedule

Corrective Measures Implementation Schedule

Task Name		Start	End
ET Cover System		October 2013	November 2016
South Plant Hydraulic Controls			
	<i>PPC Realignment</i>	October 2013	October 2020
	<i>PPC Temporary Bypass Removal</i>	July 2024*	April 2025*
Corrective Action Management Units (CAMU)			
	<i>CAMU 1</i>	April 2001	December 2001
	<i>CAMU 2</i>	April 2009	November 2016
Slag Pile Cover Design			
	<i>Borrow Source Material Investigation</i>	To begin 90 days after approval of CMI Workplan	120 days after commencement of work
	<i>Preparation of Design Drawings and Specifications</i>	To begin 90 days after approval of CMI Workplan	360 days after commencement of work
	<i>Slag Pile Cover Construction</i>	To begin within 45 days of approval of Final Design	Approximately 3 years after commencement of work.*
Slag Pile Cover Design (If Asset Recovery Performed by Others)*			
	<i>Borrow Source Material Investigation</i>	To begin 30 days after completion of unfumed slag removal	120 days after commencement of work
	<i>Preparation of Design Drawings and Specifications</i>	To begin 30 days after completion of unfumed slag removal	360 days after commencement of work
	<i>Slag Pile Cover Construction</i>	To begin within 45 days of approval of Final Design	Approximately 3 years after commencement of work.*
Corrective Measures O&M			
	<i>Final ET Cover O&M Plan</i>	To be submitted within 90 days after approval of CMI Workplan	To be finalized within 30 days of receiving comments
	<i>ET Cover O&M Monitoring</i>	November 2016	December 2046
	<i>Final SPHC O&M Plan</i>	To be submitted within 90 days after completion of Prickly Pear Creek Bypass Removal	To be finalized within 30 days of receiving comments
	<i>SPHC O&M Monitoring</i>	November 2016	December 2046
	<i>CAMU Post Closure Care</i>	April 2009	December 2046
Remedy Performance Monitoring		November 2016	December 2046

*Subject to change if circumstances arise beyond the control of the Custodial Trust

Updates to this schedule will be provided in the RCRA Quarterly Reports

Appendix C

Corrective Measures Implementation Cost Estimate

Corrective Measures Implementation Preliminary Estimate of Cost													
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031 - 2046	Totals
Removal of Temporary PPC Bypass													
Design	\$ -	\$ -	\$ -	\$ 258,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 258,000.00
Construction	\$ -	\$ -	\$ -		\$ 875,000.00	\$ 875,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,750,000.00
Slag Pile Cover													
Design	\$ -	\$ 250,000.00	\$ 100,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 350,000.00
Construction (Unfumed Slag remains at Site)	\$ -	\$ -	\$ 5,310,000.00	\$ 5,100,000.00	\$ 1,040,000.00								\$ 11,450,000.00
Corrective Measures Performance Monitoring ¹	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 4,480,000.00	\$ 7,560,000.00
Corrective Measures O&M ²	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 4,880,000.00	\$ 8,235,000.00
¹ Assumes continued semi-annual monitoring of remedy performance for years 2020-2046 (30 year monitoring period began in 2016)													
Total													\$ 29,603,000.00

¹ Assumes continued semi-annual monitoring of remedy performance for years 2020-2046 (30 year monitoring period began in 2016)

² Includes remaining annual O&M costs for: Controlled Groundwater Control Area (CGWA), PPC, ET Cover, CAMUs, Slag Pile (30 year O&M period began in 2016)

Corrective Measures Implementation Preliminary Estimate of Cost with Asset Recovery Performed by Others													
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031 - 2046	Totals
Removal of Temporary PPC Bypass													
Design	\$ -	\$ -	\$ -	\$ 258,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 258,000.00
Construction	\$ -	\$ -	\$ -		\$ 875,000.00	\$ 875,000.00	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,750,000.00
Slag Pile Cover													
Design	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 250,000.00	\$ 100,000.00	\$ -	\$ -	\$ -	\$ 350,000.00
Construction (Unfumed Slag removed from Site)	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 1,500,000.00	\$ 2,655,000.00	\$ 3,155,000.00	\$ -	\$ 7,310,000.00
Corrective Measures Performance Monitoring ¹	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 280,000.00	\$ 4,480,000.00	\$ 7,560,000.00
Corrective Measures O&M ²	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 305,000.00	\$ 4,880,000.00	\$ 8,235,000.00
¹ Assumes continued semi-annual monitoring of remedy performance for years 2020-2046 (30 year monitoring period began in 2016)													Total \$ 25,463,000.00

¹ Assumes continued semi-annual monitoring of remedy performance for years 2020-2046 (30 year monitoring period began in 2016)

² Includes remaining annual O&M costs for: Controlled Groundwater Control Area (CGWA), PPC, ET Cover, CAMUs, Slag Pile (30 year O&M period began in 2016)

Note: These tables present those costs estimated for the implementation of the final components of remedy, as described in this CMI WP; administrative and management costs are not included in the tables.