Statement of Basis for Groundwater, Surface Water and Soil Corrective Measures (Remedy) Decision at Former ASARCO East Helena Facility and Response to Comments

Former ASARCO East Helena Smelter/ Montana Environmental Trust Group LLC
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Pursuant to Consent Decree – Civil Action No. CV 98-3-H-CCL
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Table of Contents

Tables[1]

Figures[1]

Appendices

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[1] Table and Figure numbering, as referenced throughout, are consistent with the *Former ASARCO East Helena Facility Corrective Measures Study Report* (CMS Report) with the exception of Tables 2-1A and 6-1A, which have been updated from the original Tables found in the 2018 Draft version of the CMS Report.

Acronyms, Abbreviations, and Definitions

ASARCO Properties	formerly owned ASARCO property including the CMS Parcels[2] and Undeveloped Lands
BERA	Baseline Ecological Risk Assessment
CAMU	Corrective Action Management Unit
CC/RA	Current Conditions/Release Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study is defined in the First Modification as "… *the investigation and evaluation of potential alternative remedies to protect human health and/or the environment from the release or potential release of hazardous waste or hazardous constituents, into the environment from and/or at the ASARCO Properties*..."
CMS Report	*Former ASARCO East Helena Facility Corrective Measures Study Report*
COC	constituent of concern
COEH	City of East Helena
CSM	conceptual site model
CMS Parcels	Parcels 10, 11, 12, 15, 16, 18, 18, 19, 23, the portion of Parcel 8 located west of State Highway 518 (8W), and portions of Parcel 2 near Prickly Pear Creek (PPC; Parcel 2a), which are the parcels addressed in the CMS Report and this Statement of Basis
Corrective measures	are those measures or actions appropriate to remediate, control, prevent, or mitigate the release, potential release, or movement of hazardous waste or hazardous constituents into the environment or within or from one media to another
Custodial Trust	Montana Environmental Custodial Trust
DNRC	Montana Department of Natural Resources and Conservation
ET	evapotranspiration
EVCGWA	East Valley Controlled Groundwater Area
Facility	also referred to as the former ASARCO East Helena Smelter site (Site), located in CMS Parcels 16 and 19 consisting of the former operating smelter
HHRA	human health risk assessment
IC	institutional control
IM	interim measure
IMWP	Interim Measures Work Plan

[2] The ASARCO Properties include the CMS Parcels, which incorporate the location of the Facility.

MCL	maximum contaminant level
MCS	media cleanup standard
MDEQ	Montana Department of Environmental Quality
OU-2 ROD	refers to the Record of Decision for East Helena Superfund Site, Operable Unit 2, Residential Soils and Undeveloped Lands, dated September 24, 2009
PPC	Prickly Pear Creek
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RSL	regional screening level
Site	former ASARCO East Helena Smelter site (Facility)
SPHC	South Plant Hydraulic Control
SSL	soil screening level
Undeveloped Lands	Parcels 2, 3, 4, 6, 7, 9, 13, 14, the portion of Parcel 8 located east of State Highway 518 (8E), Parcel 21, and Parcel 22. The final corrective measures for these parcels are the measures set forth in the OU-2 ROD.
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

Introduction

The U.S. Environmental Protection Agency (USEPA) has prepared this Statement of Basis to explain the basis for our decision to select the corrective measures (also referred to as remedy or remedies) described in the *Former ASARCO East Helena Facility Corrective Measures Study (CMS) Report* (CH2M, 2018), prepared for the Montana Environmental Trust Group, LLC Trustee of the Montana Environmental Custodial Trust (Custodial Trust), for groundwater and soil contamination at or migrating from the former ASARCO East Helena Smelter Site (Facility) in East Helena, Montana.

The CMS Report evaluated all former ASARCO properties (**Figure 1-1**). As detailed in the CMS Report, there are two distinct groups of former ASARCO properties – CMS Parcels and Undeveloped Lands. USEPA is selecting the detailed corrective measures for the CMS parcels in this Statement of Basis. As detailed in the First Modification (see 1.3 Regulatory Background), the final corrective measures for the Undeveloped Lands are the measures defined in the *East Helena Superfund Site, Operable Unit No. 2, Residential Soils and Undeveloped Lands, Final Record of Decision* (OU-2 ROD) (USEPA, 2009).

The former ASARCO East Helena Smelter site (Facility; also referred to as Site) is located at 100 Smelter Road in East Helena, Montana (**Figures 1-1 and 1-2**). This Statement of Basis provides summary-level descriptions of the Facility background, human and ecological risks, proposed remedy, scope of the corrective action, the evaluation process and the alternatives evaluated, and the final remedies USEPA is selecting to ensure that human health and the environment are protected at the Site.

1.1 Purpose of Corrective Action Process

The purpose of the corrective action process at the Site is to investigate releases or potential releases of hazardous waste or constituents to environmental media and assess the potential risk of exposure to those hazardous constituents. Appropriate alternatives are then developed, and remedies implemented based on information gathered from the investigation and risk assessment. The Facility has been the focus of environmental investigation, demolition, and remediation since closure of operations in 2001.

1.2 Administrative Record

This document summarizes information that can be found in greater detail in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) reports, CMS Report, human health and ecological risk assessment reports, work plans, national directives, and other documents contained in the Administrative Record file. These documents can be reviewed at USEPA's Helena office, at 10 West 15th Street, Helena, Montana, during normal business hours. Referenced reports and supporting documents are also available electronically at https://www.epa.gov/mt.

1.3 Regulatory Background

RCRA provides the regulatory authority for the investigation and cleanup of the Facility and groundwater contamination that originated from the smelter. 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 (U.S. District Court, 1998) initiated the corrective action process. As part of the Consent Decree, ASARCO prepared a RCRA *Current Conditions/Release Assessment (CC/RA)* report (Hydrometrics, 1999). 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, 1999).

A First Modification was filed on January 17, 2012, as Civil Action No. CV 98-3-H-CCL to modify the 1998 RCRA Consent Decree (Dreher et al., 2012) defining 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.

1.4 Roles and Responsibilities

USEPA is the Lead Agency for the Facility. The Custodial Trust has prepared the Draft CMS Report pursuant to the requirements of the First Modification to the Consent Decree. While the Custodial Trust has taken title to the property, the Custodial Trust is acting solely as a fiduciary for the benefit of the Beneficiaries. The Beneficiaries of the Custodial Trust are the U.S. and the State of Montana. The U.S. is represented by the USEPA, the U.S. Department of Justice, and the U.S. Fish and Wildlife Service (USFWS). The State of Montana is represented by the Montana Department of Environmental Quality (MDEQ) and the Montana Department of Justice. The Custodial Trust must fulfill its responsibilities under the Settlement Agreement consistent with its legal and fiduciary obligations to the Beneficiaries of the Custodial Trust.

1.5 CMS Activities Overview

The scope of the CMS is to evaluate and provide a proposed remedy to address the cleanup of soil and groundwater contamination at and from the East Helena Smelter. The primary purpose of the CMS Report is to describe the process by which remedial action alternatives were developed and evaluated in order to identify recommended remedies for addressing unacceptable risk associated with soil, groundwater, surface water, and sediment contaminated by operations at the former Smelter facility. Corrective action activities performed at the Facility as part of the RCRA process and as required by the Consent Decree included: RFIs; human health and ecological risk assessments; IMWPs; and supplemental investigations and evaluations a part of the interim measures (IMs) and CMS necessary to complete the CMS Report. These activities and processes are described in more detail below.

SECTION 2

Selected Remedy Summary

Several cleanup alternatives were thoroughly examined in the CMS Report, and the selected remedies are presented in this Statement of Basis. Based on the review of the Draft 2018 CMS Report, knowledge of the remedial activities that have been implemented, and understanding of the contamination present at the facility, USEPA has concluded that the remedies recommended by the Custodial Trust will meet the cleanup objectives for the Site. USEPA is selecting the following remedies for soil, surface water, and groundwater, as summarized in this section and discussed in detail later in this document.

The selected remedies consist of multiple elements that work together to protect human health and the environment and meet the remedy performance standards – threshold criteria, balancing criteria, and remedial action objectives. A conceptual model of corrective measures is presented in **Figure 3-25**. Key elements are summarized as follows:

- Evapotranspiration (ET) Cover System (**Figures 3-20 and 3-21**)
  - IM elements consisted of building demolition, utility abandonment, subgrade fill, and final ET Cover system to mitigate infiltration of precipitation at the Facility, control wind erosion, and manage surface water runoff.
- South Plant Hydraulic Control (SPHC) (**Figures 3-18, 3-19**)
  - IM elements consisted of Upper Lake and Lower Lake removal, Prickly Pear Creek (PPC) Bypass, and PPC Realignment. SPHC developed wetlands to reduce surface water loading to groundwater by removing Upper Lake and Lower Lake. SPHC also established natural stream channel flow at a reduced hydraulic profile to lower groundwater elevations beneath the Facility, developed more natural geomorphic conditions within the Smelter reach, and established natural wetland/riparian conditions.
- Source Removal and Corrective Action Management Units (CAMUs) (**Figures 3-16 and 3-17**)
  - IM elements consisted of excavation and removal of impacted media at Tito Park Area, former Acid Plant, and Upper Lake Marsh. These actions reduced areas of impacted soil and sediment that could potentially leach to groundwater or surface water. CAMUs were constructed and covered to contain impacted material and reduce infiltration to groundwater.
- Speiss-Dross Slurry Wall (**Figure 3-6**)
  - The slurry wall isolates contaminated soil and prevent impacts to groundwater.
- Slag Pile Cover (**Figure 6-1** – Conceptual representation of proposed Slag Pile Cover – USEPA is selecting the cover described below)
  - USEPA is selecting a cover as the final corrective measure for the slag pile. The final design will be developed during Corrective Measures Implementation (CMI) and meet the following performance criteria and long-term stability requirements:
    - Minimize future contaminant migration as follows:
      - Control leaching to groundwater by reducing/controlling infiltration, especially in areas with un-fumed slag.
      - Prevent windblown particulate deposition and stormwater runoff particulate transport by providing a clean cover over exposed surfaces to the extent practical.
      - Stabilize the sideslopes to minimize the potential for future sloughing.

    - Prevent exposure to contaminants by human and ecological receptors by providing a cover of clean material to eliminate contact with slag.
    - Accommodate potential future asset recovery by using either an ET cover or appropriately designed soil cover that will allow excavation and removal of slag

- Institutional Controls (ICs) implemented by the Custodial Trust
  - Deed restrictions—The City of East Helena (COEH) Zoning Commission adopted land uses for the Custodial Trust Parcels. Current uses of Custodial Trust land, such as agricultural, are legal, nonconforming uses until a property transfer occurs.
  - Well abandonment program—Residents with existing supply wells have been contacted to abandon existing residential wells and/or to provide domestic water connection to the COEH.
- Supplemental ICs Implemented by Others
  - Lewis and Clark County adopted a soil ordinance in June 2013 to control soil displacement and disposal activities.
  - Restrictions on groundwater use within the COEH and within the designated East Valley Controlled Groundwater Area (EVCGWA) (**Figure 6-4**) until cleanup standards are met.
    - The COEH municipal ordinance (Title 8, Chapter 3, Section 8.3.7) prohibits the installation of new private water wells in the City limits.
    - The EVCGWA was adopted by the Montana Department of Natural Resources and Conservation (DNRC) on February 6, 2016, to restrict withdrawals until groundwater cleanup standards are attained.

Facility Background

3.1 Facility Location and Description

ASARCO's East Helena smelting operations from 1888 to 2001 released significant contamination to the environment. Raw materials delivered to the Facility via rail or truck included crude ore and ore concentrates with recoverable metals concentrations. Although lead bullion was the primary product, the Smelter also produced zinc (from 1927 to 1982), sulfuric acid, and copper-enriched speiss and matte. Products were shipped offsite by rail. (**Figures 1-1 and 1-2**)

Ponds, pits, and pads were processing features that remained after Facility operations ceased. Upper Lake received flow from a diversion on PPC immediately south of the Facility and provided plant make-up water and irrigation water to Wilson Ditch on a seasonal basis. Lower Lake was a man-made pond formed in the 1940s by cutting off the northern portion of Upper Lake with an earthen berm. Prior to 1990, Lower Lake served as a storage/recirculation pond for process waters. In 1990, two one-million-gallon steel storage tanks and associated concrete secondary liners were constructed to replace Lower Lake in the process water circuit.

In the early years of operation, contaminants were released directly to the air and soil. Air emissions from the operating Facility included stack emissions and fugitive emissions from smelting operations. Waste products collected and disposed onsite included fumed and unfumed slag, acid plant sludge, flue dust, and process waters including wastewater from scrubber systems. With the promulgation of environmental regulations, waste management practices changed and included air and water treatment. Bag filters were added to process stacks in the 1970s (Sinter Plant), 1980s (Ore Storage), and 1990s (Dross Plant) to reduce air emissions. A water treatment plant was constructed in 1994 and the Lower Lake served as the permitted discharge point for treated water.

Figure 3-1 presents a conceptual drawing of the historical operations and illustrates how contaminants were released due to operations. Primary transport mechanisms to surface soil on the Facility and other properties were windblown stack emissions and fugitive dust. Transport of contaminants to subsurface soils and groundwater occurred through leaks from process water circuits, use of unlined ponds (such as Lower Lake) where contaminated sediments were in contact with groundwater, and materials handling on the ground surface that leached through soil to groundwater (**Figure 3-1**). Operational sources (process water circuits, stack emissions, and fugitive emissions) were eliminated when Smelter operations ceased in 2001; however, ongoing use of some operational elements, such as Upper Lake and Wilson Ditch for irrigation supply water and Lower Lake for discharge of treated surface water, continued to influence constituent of concern (COC) distribution in groundwater.

3.2 Interim Measures

Between 1989 and 2009, IMs were conducted by ASARCO as either voluntary actions or actions implemented pursuant to the *Consent Decree between EPA and Asarco and Anaconda Minerals Co regarding the removal of hazardous substances and reporting requirements for OU1* (USEPA, 1990), and the Consent Decree between Asarco and US EPA regarding violations of the Clean Water Act and RCRA (U.S. District Court, 1998). A brief description of the IMs (process updates, source removal, and containment activities) is included in the following bullets.

- Process Updates
  - Replacement of selected process ponds, pits, or lakes with storage tanks;

  - Sealing of a concrete pad used for temporary storage of sediments dredged from Lower Lake;
  - Construction of stormwater and process water collection systems and process water treatment facilities; and
  - Replacement of the Former Acid Plant settling pond with a new water reclamation facility.
- Source Material Removal
  - Dredging of Lower Lake sediments performed during Facility operations;
  - Removal of the Acid Plant sediment drying pads and underlying soil;
  - Removal of bottom sediments from a portion of Wilson Ditch and replacement of the Facility segment of the ditch with underground HDPE that was rerouted around the Facility; and
  - Excavation of contaminated soil from Thornock Lake, the Speiss settling pond, the Speiss granulating pit, and the former Acid Plant.
- Source containment
  - Construction of the RCRA CAMU for storage and containment of contaminated sediment and stockpile soil;
  - Smelting of a portion of stored sludges and sediments in the smelter process, with the remaining material placed in the CAMU; and
  - Construction of slurry walls around two areas of contaminated soil, the Acid Plant Sediment Drying Source Area and the Former Speiss-Dross Source Area.

Three additional IMs have been completed by the Custodial Trust for the Facility and are incorporated into the Facility remedy to prevent and minimize the spread of hazardous waste and hazardous constituents while long-term remedies were being evaluated. Based on the 2011 conceptual site model (CSM), three interrelated, interdependent, and sustainable IMs (source removal, SPHC, and the ET Cover System) were proposed in the *Former ASARCO East Helena Facility Interim Measures Work Plan – Conceptual Overview of Proposed Interim Measures and Details of 2012 Activities* (CH2M HILL, 2012) and approved by USEPA in August 2012. After the overall IM objectives and approach were approved, the specific objectives, plans, and designs for each phase of construction were provided in annual IMWPs in accordance with the Consent Decree. The IMWPs were prepared by the Custodial Trust; EPA conducted public meetings for review and input before implementation. The three IMs were designed to work together to protect human health and the environment, take actions towards tangible environmental improvements, and achieve efficiencies and cost savings during implementation. The IMs work together to control potential human and ecological exposure to contaminated soils and reduce mass loading and subsequent migration of Facility derived contaminants in groundwater. The performance goals for the IMs are as follows:

- Lower groundwater levels across the Facility to reduce the amount of groundwater in contact with contaminated media and lower the hydraulic gradient across the Facility thereby reducing the mass flux and concentration of contaminants migrating offsite.
- Reduce mass loading of inorganic contaminants to groundwater by excavating accessible areas with elevated levels of inorganic contamination that act as an ongoing localized, high concentration sources to groundwater (localized source areas).
- Eliminate or substantially reduce the amount of precipitation that infiltrates through contaminated media that can then leach and further impact groundwater.
- Establish surface soil concentrations within the Facility that are protective of human health and ecological receptors.

The results of the IMs to date:

- Groundwater levels in the south plant area have dropped an average of 7 feet;
- Groundwater levels in the highly contaminated former Acid Plant area have dropped an average of 5 feet;
- As a result of the lower groundwater levels, dissolved arsenic and selenium concentrations in groundwater have decreased in localized areas;
- SPHC IM and Source Control/Removal IM have significantly reduced contaminant loading to groundwater;
- Improved quality of stormwater; and
- Surface water areas with concentrations of metals above surface water protection screening levels have been addressed by the IMs.

The IMs were developed to be both protective and sustainable, requiring minimal long-term maintenance and work together to eliminate potential exposures for human and ecological receptors. Key elements of the IMs' sustainability are:

- The natural grass surface layer of the ET Cover System stores stormwater and provides a clean surface for the limited amount of surface water run-off. This obviates the need for stormwater containment treatment, storage, and disposal. Long-term maintenance of the ET Cover System is minimal because, once established, the vegetative surface is self-sustaining.
- The relocated PPC channel has been restored to a natural meandering pattern over 1.25 miles. Relocation of the PPC channel has created more than 100 acres of new floodplain and provides significant additional riparian habitat and flood storage capacity to mitigate flooding in the downstream, flood-prone areas of the COEH. New, enhanced wetlands have replaced the manmade Upper and Lower Lakes. Smelter Dam, installed to keep water in Upper and Lower Lakes, has been removed as an impediment to fish passage between the PPC headwaters and Lake Helena.
- Contaminated soils and sediments located within the riparian zone of the creek were removed, consolidated, and isolated beneath the ET Cover System. These areas have now been restored to a viable and protective wetland habitat.

3.3 RCRA Facility Investigation

The East Helena Smelter conducted multiple field investigations between 2000 and 2015 to characterize soil, groundwater, and surface water conditions. Results of the field investigations are included in the following reports:

- *Phase I RCRA Facility Investigation Site Characterization Report, East Helena Facility* (Asarco Consulting, Inc., 2005);
- *Phase II RCRA Facility Investigation—East Helena Facility* (Phase II RFI; GSI Water Solutions, Inc., 2014);
- *CMS Investigations – Ref CMS Report*; and
- *Summary of Supplemental RFI Soil Sampling* (CH2M, 2018 – CMS Report).

These investigations included extensive sampling and analysis of soil, sediment, surface water, and groundwater, and are summarized in the CMS Report. A system of groundwater monitoring wells was installed to support a groundwater monitoring program for both the Facility characterization investigations and the IM implementation and evaluation.

3.4 HHRA, BERA, and Wetland Assessments

Human health and ecological risk assessments were completed per the Consent Decree. The human health risk assessment (HHRA) was initiated with the preparation of the screening-level HHRA in 2011 (CH2M Hill, 2011). The HHRA was then updated and finalized with the supplemental RFI soil and sediment sampling data. The Baseline Ecological Risk Assessment (BERA) was completed in 2011 (Gradient, 2011) and updated in the CMS Report to reflect current, post-IM conditions. The BERA was conducted to estimate the likelihood and magnitude of unacceptable risks to ecological receptors posed by current or likely future exposure to metals in soil, water, sediment, plants, and biota at and immediately surrounding the Facility as observed in the Phase II RFI.

The Custodial Trust completed a baseline wetlands assessment prior to completion of the Phase II RFI at the Facility (Pioneer Technical Services, Inc. and Morrison Maierle, 2012). The report was used to establish the baseline conditions at the Facility that were then used to define the wetlands replacement requirements associated with the corrective measures for the Facility. The PPC floodplain and channel were designed to replace all disturbed wetlands on a 1 to 1 basis as approved in the Section 404 Permit (Nationwide Permit 38 – Cleanup of Hazardous and Toxic Waste). The 404 Permit stipulates the monitoring requirements for the Facility and presented a draft monitoring plan and methods to demonstrate compliance. Construction of the creek, floodplain, and revegetation efforts were completed in late 2017. The Custodial Trust is preparing an operations, monitoring, maintenance, and reporting plan for the Facility and will perform monitoring and reporting in accordance with the 404 Permit requirements and stipulations, and the approved plans.

3.5 Conceptual Site Model

The CSM provides a holistic picture of the Facility that is used to develop and evaluate remedial alternatives. The CSM integrates current information on the sources of COCs identified and their migration pathways, as well as information on the IMs, current and anticipated future land uses, and potential human and ecological receptors. **Figures 3-1, 3-6, and 3-25** illustrate the CSM for three points in time – the historical operating period, post-operation of the smelter, and the present including the completion of IMs, respectively. Accordingly, surficial soil risks have been addressed through the implementation of the SPHC IM, Source Removal IMs, and the ET Cover System IM. Implementation of IMs has addressed all of the areas on the ASARCO Properties where contaminants have been observed in sediment with the exception of Parcel 2a, which will be addressed with remediation and subsequent restoration for upland bird habitat as prescribed in the *Restoration Plan and Environmental Assessment for the East Helena Smelter Site, Lewis and Clark County, East Helena, Montana* (USDOI and USFWS, 2020). These areas include several former process areas (the Acid Plant settling pond, Speiss granulating pond and Speiss pit, Thornock Lake, and Lower Lake, Upper Lake, Upper Lake Marsh, Lower Lake, and the reach of PPC adjacent to Lower Lake). For surface water, all of the areas previously identified as having concentrations of metals above surface water protection screening levels or background concentrations have been addressed by the IMs. The *Phase II RFI* (GSI Water Solutions, Inc., 2014) provides a detailed description of the hydrogeologic CSM with respect to Facility geology, hydrostratigraphic units, and the groundwater occurrence and flow. The CSM presented in **Figure 3-25** is the result of the supplemental groundwater data collected during and following IM implementation and focuses on groundwater characteristics and groundwater quality observations for arsenic and selenium to support remedy evaluations.

3.6 Environmental Conditions and Land Use

Based on results of the human health and ecological risk assessments, concentrations of COCs in surface soil, groundwater, and surface water are above risk-based target levels. The COCs which exceed cleanup levels for human and ecological receptors are listed in **Table 2-1A**. Remediation of these areas will be required to reduce COC concentrations to the cleanup levels described below.

For the purposes of the CMS, current land and groundwater uses were assumed to be the "reasonably anticipated future use" of the former ASARCO Properties. Reasonably anticipated land uses are shown on **Figure 2-1**. The Custodial Trust has investigated potential future use of these properties, taking into consideration market conditions, community goals and objectives, and other stakeholder interests. As a result of the investigations and in cooperation with the COEH, the Custodial Trust, and the City Zoning Commission adopted the proposed land uses for the Custodial Trust Parcels as shown on **Figure 2-1**. Current uses of Custodial Trust land, such as agricultural, are legal, nonconforming uses until a property changes ownership.

Additional ordinances and ICs that impact land use include a Soil Ordinance adopted by Lewis and Clark County in June 2013 to control soil displacement and disposal activities. Future property owners and operators will have the option to conduct additional investigations and cleanup to achieve the surface soil cleanup standard associated with the newly intended use.

For groundwater, the highest potential future use at and downgradient of the Facility is as a drinking water source. However, existing ICs currently restrict any modifications to groundwater use within the COEH and within the recently designated East Valley Controlled Groundwater Area (EVCGWA) until cleanup standards are met. The COEH municipal ordinance (Title 8, Chapter 3, Section 8.3.7) prohibits the installation of new private water wells within the City limits where municipal water system service is available. The EVCGWA was adopted by the DNRC on February 6, 2016, to restrict new withdrawals until groundwater cleanup standards are attained.

SECTION 4

Facility Risks

The final risk assessment for human health and ecological risks are comprised of the following: (1) screening-level HHRA, (2) BERA, and (3) updates to the assessments based on data collected during the CMS. The CMS is required to develop and evaluate remedial action alternatives. The objective is to address areas where media is expected to pose a threat to human health and the environment that exceeds the upper bound of the CERCLA risk range. The general conclusions derived from risk data are pertinent to remedy selection and are organized by parcel in **Table 4-3**.

4.1 Human Health Risk Assessment

4.1.1 Exposure Pathways

An exposure pathway refers to the way in which a person may come into contact with a contaminant. The following exposure pathways were used in the risk assessment:

- Direct contact to surface and sub-surface soil, sediment, surface water, and groundwater;
- Surface runoff to surface water and sediment;
- Leaching of constituents from soil into groundwater; and
- Groundwater discharge to surface water and sediment.

4.1.2 Constituents of Concern

COCs were evaluated in the human health and ecological risk assessments. Through the risk evaluation, a list of COCs which exceeded target carcinogenic and non-carcinogenic risk levels was developed. These final COCs, listed in **Table 2-1A**, will be used as the basis for cleanup.

4.1.3 Conclusions of the Human Health Risk Assessment

In summary, potential unacceptable risk to human health from groundwater is present in areas where the MCLs are exceeded and private wells continue to be used to provide drinking water:

- Concentrations of arsenic and selenium in groundwater beneath and downgradient of the Facility are higher than the respective MCLs of 10 µg/L for arsenic and 50 µg/L for selenium.
- Potential exposure pathways to groundwater with concentrations of arsenic and selenium higher than MCLs are present where existing wells are providing water for drinking or other uses from those plume areas.
- As discussed in USEPA's corrective action guidance (USEPA, 1996), concentrations higher than MCLs establish a basis for potential action through groundwater corrective measures.

The results from the final HHRA demonstrate that current surface soil and sediment conditions do not pose an unacceptable risk to human health:

- The evaluation indicates that contamination and potential risk at the majority of the CMS Parcels are being addressed through IM implementation.
- Human health risks associated with arsenic in soil and sediment in areas not remediated as part of the IMs (Parcels 2a, 15, and 23) are estimated to fall within USEPA's target cancer risk range of 1×10^{-6} to 1×10^{-4}. Concentrations of lead in soil and sediment in these parcels are estimated to be lower than those associated with USEPA's current blood-lead target level range of 2 - 8 µg/dL. (**Table**

4-1) Parcel 2a will be addressed with remediation and subsequent restoration for upland bird habitat as prescribed in the *Restoration Plan and Environmental Assessment for the East Helena Smelter Site, Lewis and Clark County, East Helena, Montana* (USDOI and USFWS, 2020).

4.2 Ecological Risk Assessment

4.2.1 Baseline Ecological Risk Assessment

The BERA was conducted to estimate the likelihood and magnitude of unacceptable risks to ecological receptors posed by current or likely future exposure to metals in soil, water, sediment, plants, and biota at and immediately surrounding the Facility as observed in the Phase II RFI (**Figure 4-1**).

4.2.2 Conclusions of the Ecological Risk Assessment

The results from the final BERA demonstrate that current surface soil and sediment conditions do not pose an unacceptable risk to the environment:

- The evaluation indicates that contamination and potential risk at the majority of the CMS Parcels are being addressed through IM implementation.
- Concentrations of lead in soil in Parcels 2a and 15 were slightly higher than the media cleanup standard (MCS) protective of passerine species. However, these results do not indicate an unacceptable ecological risk, when taking into consideration USEPA's principle of protecting populations or communities from ecological risks (USEPA, 1998), the nature of ecological risks at the Facility as presented in the BERA (Gradient, 2011), and the degree of conservatism in estimating potential exposures or effects to wildlife species incorporated into the MCSs. (**Table 4-2**)
- Although concentrations of lead in isolated locations in sediment downstream of the Facility exceed some ecological benchmarks, the concentrations do not pose an unacceptable ecological risk and do not warrant remediation at these locations given the ongoing contribution of metals to sediment from sources upstream of the Facility.

Media Cleanup Standards

Table 2-1A summarizes the selected numeric MCSs for the Facility. The table identifies by media, the COC, land use, proposed cleanup standard, the basis for the standard, and examples of how each standard would be applied. Key considerations in the identification of numeric standards are summarized as follows:

5.1 Groundwater and Surface Water

Current, risk-based criteria established by USEPA and the State of Montana will be applied for groundwater and surface water (i.e., Montana's DEQ-7 standards, USEPA maximum contaminant levels [MCLs]). Surface water concentrations above screening levels have been addressed by the Facility IMs, specifically the source material removal and SPHC.

5.2 Ecological

The *Supplemental Ecological Risk Assessment for the East Helena Smelter Site* (USEPA, 2005a; Hooper et al., 2002) stated that a soil lead level exceeding 650 milligrams per kilogram (mg/kg) may adversely impact passerine insectivores. Based on the Custodial Trust's discussions to date with USFWS, the BERA (Gradient, 2011) conducted by the Custodial Trust, as well as ecological risk evaluations from other smelter facilities in Montana (e.g., Anaconda Smelter Superfund Site, Anaconda, Montana) (USEPA, 2015), lead is proposed as the primary indicator parameter for surface soil and a soil lead level of 650 mg/kg is proposed as the MCS considered protective of ecological receptors.

5.3 Surface Soil

For the purpose of establishing risk-based MCSs for surface soil, protective of human receptors:

- Lead and arsenic are considered the primary indicator parameters for soil. Existing data and CSMs have shown inorganic contaminants from the Facility to be co-located with these COCs, such that remedial actions taken to address these COCs can be reasonably expected to address all other Facility-related COPCs (CH2M Hill, 2011). This is also consistent with findings of the OU-2 ROD.
- The regional screening levels (RSLs) for lead and arsenic levels in soil shown in **Table 2-1A** are concentration levels currently being applied as MCSs at mining and smelter facilities in Montana, and across the country.
- USEPA's Soil Screening Levels (SSLs) are selected as the MCSs for COCs in subsurface soil to represent soil concentrations considered to be protective of groundwater. Since a site-specific background level for arsenic has not been determined, the mean soil concentration of 22.5 mg/kg[3] is used as the screening level for background concentrations of arsenic.

3 MDEQ uses 22.5 mg/kg (the background value) as a screening value for arsenic. Reference is found at: https://deq.mt.gov/Land/StateSuperfund/FrequentlyAskedQuestions#soil

SECTION 6

Scope of Corrective Action

The scope of the CMS is to evaluate and provide a proposed remedy to address the cleanup of the soil and groundwater contamination that originated from the East Helena Smelter. The primary purpose of the CMS Report is to describe the process by which remedial action alternatives were developed and evaluated in order to identify recommended remedies for addressing soil, groundwater, surface water, and sediment contaminated by the Facility. **Figure 1-1** presents the geographic boundary of the CMS.

The strategy for remediation of the Facility was to complete the RFIs, develop IMWPs each year (from 2011 – 2016) to implement early corrective measures, and complete the CMS. This included source area investigations, supplemental soil sampling, groundwater modeling, CSM development, Facility building demolition of all legacy smelter structures, source removal, and closure of the CAMU. These activities have been completed and presented in the CMS Report as components of the overall Facility remediation and selected remedy. **Figures 3-1, 3-6, and 3-25** present the conceptual model as the Facility has progressed through the investigations and IMs completion - operational smelter (through 2001 conditions), post-operation smelter (2011 conditions), and current conditions, respectively.

The selected remedy provides a set of corrective measures that address (1) unacceptable risk to human health and the environment, (2) prevent or mitigate the continuing migration of or future release of hazardous waste or hazardous constituents at or from the Facility, and (3) facilitate restoration of contaminated media to standards acceptable to USEPA. Consistent with the USEPA-approved CMS Work Plan (CH2M HILL, 2015) and USEPA guidance, the CMS alternatives analysis evaluated corrective measure alternatives appropriate for site-specific conditions, the performance of IMs for suitability as components of final corrective measures, and the predicted benefit of potential additional source control measures.

Tables 6-1A and 6-2 present a summary of the selected remedy to demonstrate how the overall remedy and the remedy elements meet the goals, criteria, and standards defined in the Consent Decree First Modification. **Table 6-1A** summarizes the selected remedies and associated ICs selected as the final remedy by the USEPA. **Table 6-2** presents a summary of the selected remedy and remedy performance standards by parcel for the former ASARCO Properties.

SECTION 7

Evaluation of Selected Remedy and Alternatives

The CMS evaluated multiple cleanup alternatives for soil and groundwater. The CMS Report documents the process for developing and evaluating corrective measures alternatives to address groundwater and soil and contamination identified at the Facility and the Undeveloped Lands and describes the recommended corrective measures. The multistep evaluation consisted of the following steps: (1) initial source area removal evaluations conducted using mass distribution modeling, (2) groundwater contaminant fate and transport modeling, (3) a detailed and comparative analysis of the alternatives against the threshold and balancing criteria (**Table 5-4**), and (4) compilation of the remedy alternative evaluation recommendations (**Table 5-5**).

7.1 Identification and Evaluation of Corrective Measures Alternatives

The identification and evaluation of corrective measures alternatives was initiated with a list of potentially applicable technologies based on a preliminary screening of a larger list of possible technologies and scoring against numerous factors as presented in **Tables 5-1, 5-2, and 5-3**. Low scoring technologies were dropped from consideration. The retained technologies and administrative approaches used in the evaluation of corrective measures alternatives are listed in **Table 5-3**. In addition to the tables, CMS Report Appendices A, B, C, and F present detailed information on the groundwater modeling, source control measures/groundwater remedy evaluations, soil removal alternatives, and slag pile cover concepts, respectively.

The retained technologies were then carried forward into the evaluation of corrective measures alternatives. A series of corrective measures alternatives were developed including technologies and administrative approaches, or combinations of technologies and administrative approaches, designed to meet cleanup objectives. These alternatives were ranked using technical, human health, environmental, and institutional criteria. Cost of implementation was considered as well.

The overall process and results from the source control remedy evaluation, which builds upon the framework of the CMS goals, objectives, and scope, is provided below. **Figure 5-1** shows the CMS evaluation program elements, which are summarized as follows:

- In 2013 an initial screening effort was performed via the MVS tool to evaluate whether it was practical or cost-effective to consider relatively large-scale source removal over the majority of the contaminated areas in the Facility to meet DEQ-7 groundwater quality standards. Results from this initial screening analysis using the MVS tool demonstrated/supported that is was impractical (or cost prohibitive) to consider large-scale source removal alternatives, and that development of more focused/smaller-scale source area remedy alternatives were needed to reduce risks to human health and the environment, and/or minimize or control the leaching of COCs into groundwater.
- In 2014, the source area inventory compiled by Hydrometrics (2014) was used to help evaluate and prioritize key source areas as part of the source area evaluation process. The source area inventory was based on results from previous investigations and IMs performed under Asarco, the Phase II RFI, and 2014 investigations with respect to identifying potential source areas which could contribute leachable COCs to groundwater above DEQ-7 groundwater quality standards. The source area inventory identified the following general areas:

  - West Selenium Source Area, with subareas including the Rail Corridor Soils, Former Speiss-Dross Area, and Acid Plant;
  - North Plant Source Area;
  - Monier Flue;
  - Former Thornock Lake; and
  - South Plant Source Area, with subareas including Upper Ore Storage area, Former Acid Plant Sediment Drying Area, and Lower Lake/Tito Park Area
- In 2014 and 2015, focused source area investigations were performed to provide data needed to support the source area evaluation process.
- IMs implemented over the period 2012 through 2016 (including SPHC, ET Cover, and focused source removal) were monitored to assess IM performance and to support the source control remedy evaluation process. Performance data on the IMs, including the monitoring of changes in groundwater levels and reductions in COCs in groundwater, were used to update the CSM and to refine the groundwater contaminant fate and transport model.
- The groundwater flow model was used as the framework to develop the contaminant fate and transport model to support predictions in IM effectiveness as a comparative baseline condition to evaluate the potential incremental benefit from supplemental alternatives.
- In 2015, an initial screening-level source control alternative evaluation was performed on four primary source areas inferred to have the most effect on groundwater quality. These source areas included site-wide groundwater, West Selenium Source Area, North Plant Source Area, and the Former Speiss-Dross Area. For the screening-level evaluation, these four source areas were evaluated against three of the five USEPA balancing criteria including long-term effectiveness, implementability, and cost.
- In 2016, a focused source control remedy evaluation was performed on the retained source control areas and respective alternatives recommended from the screening-level evaluation (noted above). The source areas and respective alternatives were evaluated against the five USEPA balancing criteria including long-term effectiveness, reduction in toxicity, short term effectiveness, implementability, and cost. The evaluation included the following source areas and alternatives:
  - West Selenium Source Area and four potential source control alternatives, including:
    - Source Removal;
    - PRB for selenium;
    - Slurry Wall Enclosure (of primary source area COCs); and
    - Focused Pump and Treat (extraction system spanning the width of selenium plume with onsite treatment).
  - North Plant Arsenic Source Area and three potential source control alternatives, including:
    - PRB for arsenic;
    - Slurry Wall Enclosure (of primary source area COCs); and
    - In-situ Injections of Ferric Iron (in conjunction with Slurry Wall Enclosure).

7.2 Selected Remedy and Corrective Measures Elements

Tables 6-1A and 6-2 present a summary of the selected remedy to demonstrate how the overall remedy and the remedy elements meet the goals, criteria, and standards defined in the Consent Decree First Modification. **Table 6-1A** summarizes the selected corrective measures and associated ICs proposed as the final remedy by the Custodial Trust. **Table 6-2** presents a summary of the selected remedy and remedy performance standards by parcel for the former ASARCO properties. **Figure 3-25** provides a conceptual representation of those remedy components.

Groundwater monitoring will continue to evaluate the performance of the proposed corrective measures over time. The details of the proposed monitoring, evaluation, and reporting will be provided in an updated Corrective Action Monitoring Plan during Corrective Measures Implementation. Performance monitoring will be conducted through the Corrective Action Monitoring Plan until MCSs are met at the points of compliance. The anticipated components of the performance monitoring are summarized in **Table 6-3**.

In addition to the proposed remedies detailed in the CMS Report, EPA is selecting a cover as the final corrective measure for the slag pile. The final design will be developed during Corrective Measures Implementation (CMI) and meet the performance criteria and long-term stability detailed in Section 2 and **Table 6-2**.

In summary, the selected remedy will achieve the Site corrective measures objectives. The proposed remedy elements meet the three remedy performance standards established by USEPA under RCRA—protection of human health and the environment, source control, and media cleanup objective.

SECTION 8

Response to Public Comment

USEPA has consulted with the State beneficiaries and sought public comment on the proposed Corrective measures to select a final remedy for the Site. The comment period began on March 28, 2018 and ended on May 29, 2018. The EPA held a public meeting on the proposed decisions on April 11, 2018, to discuss the remedy decisions and provide an opportunity for public comment. The EPA Response to Comments is in **Appendix A**. The USEPA and Custodial Trust will continue to provide regular and timely updates on significant activities, including implementation of the CMS at public meetings.

8.1 Public Record Availability

Information in this document has been summarized from several reports and supporting documents. The complete public record, including these documents can be reviewed at USEPA's Helena office, at 10 West 15th Street, Helena, Montana, during normal business hours. Referenced reports and supporting documents are also available electronically at https://www.epa.gov/mt.

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Tables

Tables

Table 2-1A CMS Parcels - Media Cleanup Standards for Primary Inorganic Constituents in Soil *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]	Establishes concentration threshold for remedy implementation on undeveloped properties when land use changes
		Industrial - Commercial	800		
		Recreational	3,245	OU-2 ROD	
	Arsenic	Residential	35	Hegeler Zinc ROD[c]	
		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

Table 4-1. Summary of Human Health Risk Assessment Exposure Point Concentrations in Soil and Sediment

Corrective Measures Study Report, Former ASARCO East Helena Facility

Parcel	Medium	Depth Grouping	Exposure Scenario	Analyte	EPC (mg/kg)	Commercial/ Industrial MCS	Recreational MCS	EPC Exceeds MCS?	Notes	Arsenic Risk
2a	Sediment	Surface	Recreational	Arsenic	45.47	na	794	no	EPC < MCS	8.6E-06
				Lead	306.2		3245	no	EPC < MCS	
	Soil	Surface	Commercial/ Industrial	Arsenic	133.5	573	na	no	EPC < MCS	3.5E-05
				Lead	1169	800		yes	**EPC > Commercial/Industrial MCS**	
		Subsurface	Commercial/	Arsenic	29.8	573		no	EPC < MCS	
15	Soil	Surface	Commercial/ Industrial	Arsenic	64.07	573	na	no	EPC < MCS	1.7E-05
				Lead	1028	800		no	EPC < MCS	
23	Sediment	Surface	Recreational	Arsenic	29.91	na	794	no	EPC < MCS	5.6E-06
				Lead	204		3245	no	EPC < MCS	
	Soil	Surface	Commercial/ Industrial	Arsenic	69.31	573	na	no	EPC < MCS	1.8E-05
				Lead	465.2	800		no	EPC < MCS	
Parcels 8W, 10, 11, 12, 17 and 18	Soil	Surface	Commercial/Industrial	These parcels were remediated as part of the SPHC IM and do not exceed a EPC compared to MCS; significant excavation was needed to relocate PPC and excavated areas outside the new creek channel were backfilled using soil with concentrations below the MCSs. Potential human exposures to concentrations in soil higher than MCSs are therefore not expected to occur at these parcels.						
		Subsurface	Commercial/Industrial							

Notes:
mg/kg = milligrams per kilogram
EPC = Exposure Point Concentration. Note that the maximum Chebyshev-based UCL was selected as the EPC for ISM samples (ITRC, 2012) and the maximum recommended UCL was selected for discrete samples.
EPC values considered the potential exposure pathways for soil ingestion (direct contact) and inhalation of dust suspended into the air
MCS = Media Cleanup Standard
na = not applicable
ND = non-detect
UCL = 95 percent Upper Confidence Limit
Subsurface = greater than 2 feet below ground surface
Surface = 0 to 2 feet below ground surface
Arsenic risks are characterized by calculating lifetime cancer risks. See Appendix E for details of the calculation.
Lead risks are characterized by directly comparing the EPC with the MCS. The MCSs for lead are based on a blood-lead level of 10 µg/dL.
µg/dL = micrograms per deciliter

Table 4-2. Summary of Ecological Risk Assessment Exposure Point Concentrations in Soil

Corrective Measures Study Report, Former ASARCO East Helena Facility

Parcel	Medium	Depth Grouping	Analyte	EPC (mg/kg)	MCS (mg/kg)	Receptor for MCS	HQ	Explanatory Notes
2a	Soil	Surface	Lead	1169	650	Passerine birds	1.8	Population-level effects are unlikely with an HQ slightly elevated above one
				1169	955	Cattle	1.2	
15	Soil	Surface	Lead	1028	650	Passerine birds	1.6	
				1028	955	Cattle	1.1	
23	Soil	Surface	Lead	465.2	650	Passerine birds	0.7	HQ < 1
				465.2	955	Cattle	0.5	
8W, 10, 11, 12, 17, and 18	Soil	Surface						These parcels were remediated as part of the South Plant Hydraulic Control interim measure and do not exceed an EPC compared to MCS; significant excavation was needed to relocate Prickly Pear Creek and excavated areas outside the new creek channel were backfilled using soil with concentrations below the MCSs. Potential human exposures to concentrations in soil higher than MCSs are therefore not expected to occur at these parcels.

Notes:

mg/kg = milligrams per kilogram

EPC = exposure point concentration. Note that the maximum Chebyshev-based upper confidence limit (UCL) was selected as the EPC for ISM samples (ITRC, 2012) and the maximum recommended UCL was selected for discrete samples.

HQ = hazard quotient

MCS = media cleanup standard

Table 4-3. Remaining Unacceptable Risk Post-Interim Measure Construction

Corrective Measures Study Report, Former ASARCO East Helena Facility

CMS Parcel	Exposure Media	Receptors	Potential Exposure Pathway	Assessment of Potential Exposure	Assessment of Risks
2a	Soil	Industrial/ Commercial Recreational	Direct contact	Pathways potentially complete under current or future land uses	Overall lead exposures are lower than levels protective of human health (i.e., blood-lead levels are less than 10 µg/dL). Concentrations of arsenic fall within target risk range.
		Ecological (passarine)	Direct contact	Pathway potentially complete	Risk from concentrations of lead are minimal and do not require remediation.
	Sediment	Recreational	Direct Contact	Pathways potentially complete under current or future land uses	Overall lead exposures are lower than levels protective of human health (i.e., blood-lead levels less than 10 µg/dL). Concentrations of arsenic fall within target risk range.
	Groundwater	Residential	Ingestion	Potentially complete[a]	None: concentration of arsenic and selenium are below MCS (i.e., drinking water MCLs).
8W, 10, 11, 12, 17, 18	Soil Sediment Surface water	Recreational	Direct contact	Potentially complete	Risk unlikely to be present due to implementation of SPHC IM to meet MCSs.
15	Soil	Industrial/ Commercial	Direct contact	Pathway complete under current or future land use	Lead concentrations fall below MCS and levels protective of human health; lifetime cancer risk from arsenic falls within target risk range.
		Ecological (passarine)	Direct contact	Pathway potentially complete	Risk from concentrations of lead are minimal and do not require remediation.
	Groundwater	Residential	Ingestion	Potentially complete[a]	Concentration of arsenic (West Arsenic Source Area) higher than MCS (i.e., drinking water MCLs).
16, 19	Soil	Ecological (passarine)	Direct contact	Potentially complete	Risk unlikely to be present due to implementation of ET Cover System IM to meet MCSs.
	Groundwater	None	None	Incomplete	None: groundwater use is prohibited within the Facility.
	Unfumed Slag	Trespasser	Direct contact	Potentially complete	Risk not quantified due to ongoing evaluation of corrective measures.
23	Soil	Recreational	Direct contact	Pathways potentially complete under current or future land uses	Concentrations of lead and arsenic are lower than MCSs; overall lead exposures are lower than levels protective of human health; concentrations of arsenic fall within target risk range.
		Ecological (passarine)	Direct contact	Pathway potentially complete	Risk from concentrations of lead is minimal and requires no remediation.
	Sediment	Recreational	Direct contact	Pathways potentially complete under current or future land uses	Concentrations of lead and arsenic are lower than MCSs; overall lead exposures are lower than levels protective of human health; concentrations of arsenic fall within target risk range.

Note:

[a] Groundwater pathway potentially complete if used as a drinking water source.

MCS = media cleanup standard (see Table 2-1)

µg/dL = microgram(s) per deciliter

Table 5-1. Overview of Source Area Screening-Level Evaluation

Corrective Measures Study Report, Former ASARCO East Helena Facility

	Remedy Screening Evaluation		
Source Area[a]	**Preliminary Alternative**	**Notes on Scoring**	**Recommended for Further Evaluation (Y/N)**
Affected Groundwater Area	Baseline action: includes planned IMs, CGWA, and MNA	Baseline action will be implemented regardless of recommendation of the evaluation. All other potential groundwater remedies and their associated costs are considered supplemental.	NA
	Pump and treat onsite and offsite groundwater	Not cost-effective.	No
	Pump and treat onsite groundwater	Not cost-effective.	No
	Pump and treat combined with slurry wall	Uncertain effects on downgradient plume stability and geometry and not cost effective.	No
West Selenium Source Area	Source Removal	Recommend using the groundwater flow model to determine effectiveness in comparison to other remedies. Moderate cost.	Yes
	PRB, with funnel-and-gate system	Favorable effectiveness and implementability with low cost.	Yes
	Slurry Wall (hydraulic enclosure of source area)	Slurry walls have been shown to be effective and appears to be cost-effective.	Yes
	Focused pump and treat	Reasonably effective, and favorable implementability with potential for low cost.	Yes
North Plant Arsenic Source Area	Source Removal	Not cost-effective.	No
	PRB, with funnel-and-gate system	Effective, technology is readily available, reasonably cost-effective.	Yes
	Slurry Wall (hydraulic enclosure of source area)	Slurry walls have been observed to be effective and appears to be cost-effective.	Yes
	In-situ treatment (dosing of aquifer with Fe), to augment slurry wall	Can be effective if used in conjunction with slurry wall.	Yes
	In-situ treatment (to augment slurry wall)	High costs and difficult to implement.	No
Former Speiss/Dross Source Area	No Further Action (includes existing slurry walls)	Already implemented, and is cost-effective.	NA
	Source Removal	Additional cost not justified when existing slurry wall appears generally to be effective.	No
	Expand slurry wall system to encompass former Speiss Storage and Handling Area	Technologies are available but high implementation factor due to technology being installed close to the Ore Storage Building.	No
	In-situ treatment (dosing of aquifer with Fe), to augment slurry wall	Would be effective with another technology such as a slurry wall, but not effective alone.	No

[a] Further investigation and evaluation of the former Acid Plant and Slag Pile areas was deferred.

Notes:

CBS = combined balancing score

CGWA = Controlled Groundwater Area

Fe = ferrous sulfate

IM = interim measure

NA = not applicable

O&M = operations and maintenance

PRB = permeable reactive barrier

Se = selenium

Table 5-2. RCRA Balancing Criteria, Definitions, and Interpretation/Application to Remedy Evaluations

Corrective Measures Study Report, Former ASARCO East Helena Facility

Balancing Criteria	Definition (per RCRA [USEPA, 2000])	Interpretation and Application of Balancing Criteria to Remedy Evaluation	Scoring Logic [+ positive, 0 neutral, - negative]
1. Long-term Effectiveness and Permanence	Decision-makers should evaluate remedies based on the long-term reliability and effectiveness they afford, along with the degree of certainty that they will remain protective of human health and the environment. Additional considerations include the magnitude of risks that will remain at a site from untreated hazardous wastes, hazardous wastes and hazardous constituents, and treatment residuals; and the reliability of any containment systems and institutional controls. A remedial option should include a description of the approaches and facilities that will be used to assess long-term performance and effectiveness.	Criteria evaluated as the relative improvement in groundwater concentrations for the COPC of interest (selenium for West Selenium and arsenic in North Plant) as a result of implementing the alternative in addition to interim measures; and also the permanence the alternative provides. Model simulations (by Newfields) will be used to quantify effectiveness considering the following metrics: (1) mass removal (in weight and percent), (2) plume geometry/volume reductions below DEQ-7 water quality standards, and (3) the temporal timeframe to achieve stable ('steady-state') conditions following implementation. Alternatives providing the highest degree of long-term effectiveness are those that achieve the most mass and volume reductions, have the highest degree of permanence, leave little or no waste (source), do not require long-term maintenance, and minimize the need for institutional controls.	"+" = Highest degree or substantive improvements in groundwater metrics (reductions in mass and plume reduction); alternative is permanent over the long-term. "0" = Moderate or marginal improvement in groundwater metrics; and/or some uncertainties or risks relative to permanence. "-" = No substantive improvement in groundwater metrics and/or the alternative is lacking permanence or considered a high-risk, unproven technology.
2. Toxicity, Mobility, and Volume Reduction	Decision-makers should evaluate remedies based on the degree to which they employ treatment, including treatment of principal threats, that reduces the toxicity, mobility, or volume of hazardous wastes and hazardous constituents, considering, as appropriate: the treatment processes to be used and the amount of hazardous waste and hazardous constituents that will be treated; the degree to which treatment is irreversible; and the types of treatment residuals that will be produced.	Criteria focus on the degree to which an alternative does or does not employ a treatment technology. For alternatives that require treatment technology (such as PRB, pump and treat, and injections), the evaluation will describe (1) quantities and quality (i.e., concentrations) of groundwater requiring treatment, (2) degree in which treatment is irreversible, and (3) types and volumes of treatment residuals. For alternatives that do not require a geochemical alteration/treatment technology (such as source removal and slurry wall), the volume of source material will be estimated.	"+" = Alternative reduces toxicity and mobility of hazardous material; irreversible with limited or no residuals management. "0" = Alternative reduces toxicity, mobility, or volume; irreversible but with some residuals for management. "-" = Alternative has limited effect on toxicity, mobility, or volume reduction; reversible or has significant residual management.
3. Short-term Effectiveness	Decision-makers should evaluate remedies based on the short-term effectiveness and short-term risks that remedies pose, along with the amount of time it will take for remedy design, construction, and implementation.	Criteria address the effects during construction and implementation (i.e., short-term) and will focus on (1) short-term impacts/risks to human health (related to construction), (2) short-term impacts (i.e., releases) to the environment related to implementation of remedy, and (3) and how long it will take to design, construct, and implement the alternative.	"+" = No substantive risks/impacts to human health or environment. Short duration to establish effectiveness. "0" = Moderate risks/impacts to human health or environment. Longer duration to establish effectiveness. "-" = High-degree of risks/impact to human health or environmental impacts. Requires significant duration to establish effectiveness.
4. Implementability	Decision-makers should evaluate remedies based on the ease or difficulty of remedy implementation, considering as appropriate: the technical feasibility of constructing, operating, and monitoring the remedy; the administrative feasibility of coordinating with and obtaining necessary approvals and permits from other agencies; and the availability of services and materials, including capacity and location of needed treatment, storage, and disposal services.	Criteria focus on (1) administrative components, (2) regulatory coordination and approvals, and (3) overall ease or difficulty of constructing, operating, and monitoring the remedy; including availability of services relative of the types of alternatives and/or complexity of specialty services needed. Alternatives that are considered easiest or most favorable to implement are those which (1) do not require substantive agency approval or permits, (2) do not require long-term O&M, and (3) do not rely on specialty technologies, services, or materials.	"+" = Administrative items, regulatory approvals, construction, operation, and monitoring are considered relatively easy, feasible, or readily implementable. No long-term O&M. Short duration to implement alternative. "0" = Neutral score if not easy or "complex." Longer duration to establish effectiveness. "-" = Alternative requires agency substantive or nonstandard approvals or permits, substantive long-term O&M, specialty technology, and/or significant duration to implement alternative.
5. Cost	Decision-makers should evaluate remedies based on capital and O&M costs, and the net present value of the capital and O&M costs.	Estimated costs have been developed for each alternative using Study or Feasibility Class 4 guidance (Association for the Advancement of Cost Engineering, 2005) with expected accuracy of -30 to +50 percent. Costs reflect both capital and long-term O&M (when applicable) assuming a 30-year period net present worth at 5 percent rate of return (unless specified otherwise). The total cost reflects capital and long-term O&M (if applicable). Costs are based on conceptual designs and are not considered final designs; if an alternative is selected, a final design will be developed before implementation.	"+" = Relatively low. Cost is less than $2M. "0" = Moderate. Cost ranges from $2 to $5M. "-" = Relatively high. Cost is greater than $5M.
6. Community Acceptance	Decision-makers should evaluate remedies based on the degree to which they are acceptable to the interested community.	The evaluation is based on the first five technical criteria (listed above). Community acceptance will be evaluated as part of the public involvement process.	
7. State Acceptance	Decision-makers should evaluate remedies based on the degree to which they are acceptable to the state in which the subject facility is located. This is particularly important where the U.S. Environmental Protection Agency, not the state, selects the remedy.	The evaluation is based on the first five technical criteria (listed above). State acceptance will be evaluated as part of the public involvement process.	

Notes:

COC = constituent of concern

COPC = constituent of potential concern

M = million

MCL = maximum contaminant level

O&M = operations and maintenance

RCRA = Resource Conservation and Recovery Act

Reference: U.S. Environmental Protection Agency (USEPA). 2009. *Fact Sheet #3: Final Remedy Selection for Results-based RCRA Corrective Action*. RCRA Corrective Action Workshop on Results-Based Project Management: Fact Sheet Series. March.

Table 5-3. Description of Remedial Alternatives Retained for Detailed Evaluation
Corrective Measures Study Report, Former ASARCO East Helena Facility

Area	Alternative	Technology Description/Assumptions	Dimensions/Unit Quantities	Construction Approach and Key Assumptions
West Selenium Area (COPC is selenium)	1 – Source Removal	Assumes physical excavation and relocation of saturated zone source materials to an onsite location that is beneath the future ET cover but above the saturated zone. The alternative is expected to reduce ongoing mobilization and leaching of selenium from the primary source area to groundwater. Primary source area boundaries assumed to capture an estimated 70 percent of source/mass (personal communication with Bob Anderson/Hydrometrics, January 9, 2015).	Area 100 x 200 x 48 ft bgs. Quantity estimates: • Interim measure cover: 2,222 yd^3 • Unsaturated zone: 29,629 yd^3 • Saturated zone (source removal): 4,444 yd^3 • Backfill of clean borrow material: 4,444 yd^3 (West Bench)	• Saturated zone material placed under ICS-2 (and ET cover). • Clean borrow material via West Bench placed in saturated zone. • Unsaturated zone soils placed back into excavation in unsaturated zone. • Dewatering limited because of soldier pile-sheet pile walls; sump-pump used to dewater saturated zone, groundwater pumped to temporary tank and hauled to existing treatment plant. • All earthwork done onsite; no offsite hauling or disposal.
	2 – PRB for Selenium	Technology assumes passive groundwater flow through the reactive media to treat selenium. PRB media consist of 90 percent organic mulch and 10 percent limestone sand placed across saturated interval. Influent selenium concentrations assume 3.0 mg/L; treatment targets assume 0.05 mg/L (MDEQ-7 groundwater standard). Media will have finite life and will require monitoring to determine when media needs replacement.	100-ft-long PRB with 25-ft funnels (slurry walls) at either end. PRB installed across saturated interval, wall width of 12 ft (perpendicular to flow) designed to achieve residence time of 2 days. Funnel walls installed from ash/clay to ground surface and designed to have limited influence on groundwater flow patterns.	• Passive treatment of selenium considered 'pilot study'; long-term viability/effectiveness uncertain. Limited formal research/documentation on full-scale studies over long-term. • Construction approach assumes long-arm excavator to install PRB and funnel ends. • Long-term O&M assumes full replacement of PRB media in years 10 and 20; actual replacement schedule determined from monitoring/effectiveness. • Spent media disposed of offsite; volume estimated at 444 yd^3.
	3 – Slurry Wall Enclosure	Technology assumes an effective, low-permeability enclosure "wall" located around the primary source area saturated zone; design assumptions are to reduce the mobility/flux from within the enclosure area. Design assumes slurry wall permeability of $1x10^{-6}$ cm/sec or lower.	Perimeter of 1,100 linear feet based on enclosure dimensions of 100 x 450 ft in plan view. Depth of slurry wall assumes 48 ft bgs down to ash/clay layer. Typical construction approach assumes slurry wall installed from ash/clay layer to ground surface.	• Construction approach assumes long-arm excavator to install slurry wall and use of excavated soil in soil-bentonite blend. • Permeability options: soil-bentonite wall $1x10^{-7}$ cm/sec or cement-bentonite wall $1x10^{-6}$ cm/sec; difference in cost is about $3/VSF. Costing approach is conservative and assumes soil-bentonite wall.
	4 – Pump and Treat (P&T)	Technology assumes a long-term groundwater extraction system extending across a width of about 100 ft (approximate width of plume) and then conveyance of groundwater to passive treatment system, which includes: • Biochemical reactor beds consisting of organic mulch, limestone, and sand • Aeration channel • Oxidation/settling ponds • Discharge to existing wetlands and Prickly Pear Creek	Groundwater Extraction System: • Three wells – combined total flow of 30 gallons per minute • Buried conveyance pipe: about 4,800 ft Treatment System: • Dual biochemical reactor beds: total volume 12,400 yd^3 • Dual oxidation ponds: total volume 584 yd^3 • See process flow diagram in Appendix C for details	• P&T option will require regulatory approvals and discharge permit to set monitoring requirements and effluent/discharge limits • Treatment system will require routine maintenance (weekly), monitoring, and intermittent replacement of spent media. Costing approach assumes biochemical reactor beds are replaced at years 10 and 20; actual replacement cycle depends on monitoring. • Treatment system will require winterization design for year-round operation (such as buried conveyance line, buried biochemical reactor beds, heat-traced lines, and heated blower or mechanical agitator). These items will add capital costs and also replacement costs to replace media.

Notes:

Alternative 7 (in-situ injections) is assumed supplemental to Alternative 6 (injections within the slurry wall). If Alternative 6 is selected, then the need for Alternative 7 may be evaluated and decided on after the slurry wall is constructed and the effectiveness evaluated, among other criteria.

Abbreviations:

bgs = below ground surface
cm/sec = centimeter(s) per second
COPC = constituent of potential concern
ET = evapotranspiration
ft = foot/feet
ICS = Interim Cover System
MDEQ = Montana Department of Environmental Quality
mg/L = milligram(s) per liter
P&T = pump and treat
PRB = permeable reactive barrier
VSF = vertical square foot
yd^3 = cubic yard
ZVI = zero-valent iron

Table 5-3. Description of Remedial Alternatives Retained for Detailed Evaluation
Corrective Measures Study Report, Former ASARCO East Helena Facility

Area	Alternative	Technology Description/Assumptions	Dimensions/Unit Quantities	Construction Approach and Key Assumptions
North Plant (COPC is arsenic)	5 – PRB for Arsenic	Technology assumes passive groundwater flow through the reactive media to treat arsenic. PRB media consist of 100 percent pure ZVI (granular iron) placed across saturated interval. Influent arsenic concentrations assume 20 to 25 mg/L; treatment targets assume 0.01 mg/L (MDEQ-7 groundwater standard). Media will have finite life and will require monitoring to determine when media needs replacement.	400-ft-long PRB with 125-ft funnels at either end; alignment is adjusted to stay on Custodial Trust-owned property. PRB is 8 ft thick to achieve residence time of 2+ days. Funnel walls installed from ash/clay to ground surface and designed to have limited influence on groundwater flow patterns.	• Construction approach assumes long-arm excavator to install PRB and funnel ends • Long-term O&M assumes full replacement of PRB media in year 10 and 20; actual replacement schedule determined from monitoring/effectiveness. • Spent media disposed of offsite; volume assumed at 2,370 yd^3. • Unit cost of pure ZVI is $1,020/ton; volume estimates assume the PRB will require approximately 5,000 tons, which is about 75 percent of the overall cost.
	6 – Slurry Wall Enclosure	Technology assumes an effective, low-permeability enclosure "wall" located around source area saturated zone; design assumptions are to reduce mobility/flux from within the enclosure area. Design assumes slurry wall permeability of $1x10^{-6}$ cm/sec or lower.	Perimeter of 1,560 linear feet. Depth of wall to 51 ft bgs to ash/clay layer. Alignment of wall adjusted to stay within Custodial Trust-owned property.	• Construction approach assumes long-arm excavator to install slurry wall and use of excavated soil in soil-bentonite blend. • Permeability options: soil-bentonite wall $1x10^{-7}$ cm/sec or cement-bentonite wall $1x10^{-6}$cm/sec; difference in cost is about $3/VSF. Costing approach is conservative and assumes soil-bentonite wall.
	7 - In-Situ Injections (in conjunction with Alternative 6 slurry wall enclosure).	Technology assumes installation of injection wells within slurry walls to deliver (via injection) nanoslurry mixture within slurry wall enclosure. ZVI nanoparticles have relatively high-surface area to volume ratio and are demonstrated to be effective at binding arsenic in solution.	Design assumes five injection wells placed within the slurry wall enclosure. Injections assume ZVI micro/ nanoparticles placed (injected) via slurry form. Treatment assumes 2.4M gallons within the slurry walls.	• Conceptual-design estimates of weight/volume of ZVI nanoparticles assume 2 tons; however, actual volume needed for treatment dependent on batch testing and effectiveness monitoring after the first of four proposed injections. • Unit cost of ZVI nanoparticles in dry form (to be mixed into slurry) assumed at $40 per pound. • Costs assume that the 2 tons (total) applied over four separate injection events.

Notes:

Alternative 7 (in-situ injections) is assumed supplemental to Alternative 6 (injections within the slurry wall). If Alternative 6 is selected, then the need for Alternative 7 may be evaluated and decided on after the slurry wall is constructed and the effectiveness evaluated, among other criteria.

Abbreviations:

bgs = below ground surface
cm/sec = centimeter(s) per second
COPC = constituent of potential concern
ET = evapotranspiration
ft = foot/feet
ICS = Interim Cover System
MDEQ = Montana Department of Environmental Quality
mg/L = milligram(s) per liter
P&T = pump and treat
PRB = permeable reactive barrier
VSF = vertical square foot
yd^3 = cubic yard
ZVI = zero-valent iron

Table 5-4. Combined Balancing Criteria Evaluation

Corrective Measures Study Report, Former ASARCO East Helena Facility

Area	Alternative	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Cost ($millions) (total cost includes capital and long-term O&M [if applicable])	Combined Balancing Criteria Score (CBS)	Comments
West Selenium (COPC is selenium)	1 – Source Removal	+	+	0	0	0 **Total Cost: $2.8M** Capital: $2.8M Long-term O&M: none	+2	
	2 – PRB for Selenium	0	0	+	0	0 **Total Cost: $2.8M** Capital: $1.5M Long-term O&M: $1.3M	+1	
	3 – Slurry Wall Enclosure	+	0	+	+	+ **Total Cost: $1.7M** Capital: $1.7M Long-term O&M: none	+4	
	4 – Pump and Treat	0	0	+	-	0 **Total Cost: $4.1M** Capital: $2.4M Long-term O&M: $1.7	0	
North Plant (COPC is arsenic)	5 – PRB for Arsenic	0	-	+	0	- **Total Cost: $20M** Capital: $10M Long-term O&M: $10	-1	
	6 – Slurry Wall Enclosure	0	-	+	+	0 **Total Cost: $2.1M** Capital: $2.1M Long-term O&M: none	+1	
	7 – Slurry Wall Enclosure with Injections	0	-	+	+	0 **Total Cost: $2.5M** ALT6: $2.1M ALT7 Capital: $0.1M (wells) ALT7 Long-term O&M: $0.3M (injections)	+1	

Notes:

Cost assumptions: long-term O&M assumed 30 years with Net Present Worth at 5 percent rate of return; refer to *Tier II Source Control Measure/Groundwater Remedy Evaluation—Phase 2 Results and Recommendations* (CH2M, 2015), included in Appendix C of the CMS Report, for supporting ROM Class 4 costing information.

Refer to Table 5-3 for alternative descriptions, Table 5-4 for balancing criteria and definitions, and Appendix B for tables that show details on the individual balancing criteria evaluation.

Alternative 7 is slurry wall with injections. If Alternative 6 is selected, then the need for Alternative 7 may be decided after the slurry wall is constructed and the effectiveness is evaluated.

CBS = combined balancing score

COPC = constituent of potential concern

M = million

O&M = operations and maintenance

P&T = pump and treat

PRB = permeable reactive barrier

Table 5-5. Overview of Source Area Remedy Evaluation Results

Corrective Measures Study Report, Former ASARCO East Helena Facility

		Remedy Evaluation	
Source Area	**Carried Forward from Screening-level Evaluation**	**Notes on Scoring**	**Evaluation Results**
West Selenium Source Area	Source Removal	CBS of plus two (+2); would be more effective at reducing toxicity, mobility, or volume through treatment; with uncertainty of source capture and cost limiting the overall score.	Recommend supplemental data and additional modeling to support continued evaluation.
	PRB, with funnel-and-gate system	CBS of plus one (+1); a positive score for short-term effectiveness, but with lack of proven Se removal effectiveness and cost requirements for O&M limit the overall score.	Not evaluated further.
	Slurry Wall (hydraulic enclosure of source area)	Highest CBS of plus four (+4); long-term effectiveness and permanence, short-term effectiveness, implementability, and cost.	Recommend supplemental data and additional modeling to support continued evaluation.
	Focused pump and treat	Combined balancing score at neutral (0); negative scoring based on implementation with moderate cost effectiveness.	Not evaluated further.
North Plant Arsenic Area	PRB, with funnel-and-gate system	CBS of negative one (-1); with positive score for short-term effectiveness, but negative scores on reduction in toxicity, mobility, or volume through treatment; the lack of significant contaminant mass and plume volume reduction and the cost limit the score.	Not evaluated further.
	Slurry Wall (hydraulic enclosure of source area)	CBS of plus two (+2); positive scores for short-term effectiveness and implementability; the lack of significant contaminant mass and plume volume reduction and contaminated groundwater that remains within the slurry wall long-term limits the score.	Recommend supplemental data and additional modeling to support continued evaluation.
	Slurry Wall Enclosure with In-situ treatment	CBS of plus three (+3); positive scores for reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, and implementability. The remaining criteria were scored 0 (neutral).	To be considered based on evaluation results of previous alternative (Slurry Wall).

Notes:

CBS = combined balancing score
CGWA = Controlled Groundwater Area
Fe = ferrous sulfate
IM = interim measure
NA = not applicable
O&M = operations and maintenance
PRB = permeable reactive barrier
Se = selenium

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

Proposed 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
			Soil
			Sediment
	Surface water/stormwater collection		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	Facility (Parcels 16,19)	Groundwater
	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
			Soil
	Protectively manage removed soil under ET cover system		Surface water
			Sediment
CAMU 1 and CAMU 2	Isolate impacted soil, sediment and remediation waste and prevent impacts to groundwater	Facility (Parcels 16,19)	Groundwater
	Surface water/stormwater collection		Surface water
Slag Pile - Grade and Cover	ET Cover over unfumed slag to reduce infiltration	Facility (Parcels 16,19)	Groundwater
	Slag pile regrading		Soil/Slag
			Sediment
	Surface water/stormwater collection		Surface water
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 6-1A. Summary of Selected Corrective Measures and Supplemental Institutional Controls

Corrective Measures Study Report, Former ASARCO East Helena Facility

Proposed 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 2, 3, 4, 6, 7, 9, 13, 14, the portion of 8 located east of State Highway 518 (8E), 21, and 22

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

			Remedy Performance Standards			
CMS Parcel	**Proposed 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 Sediment Surface water	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)
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 - Improve downgradient water quality over time	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		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**
2, 3, 4, 6, 7, 9, 13, 14, 8E, 21, and 22	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 propogate 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**
	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 propogate 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:

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

Table 6-3. Preliminary Summary of Performance Monitoring Requirements

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)	Performance Monitoring Requirements: 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

Figures

Figures

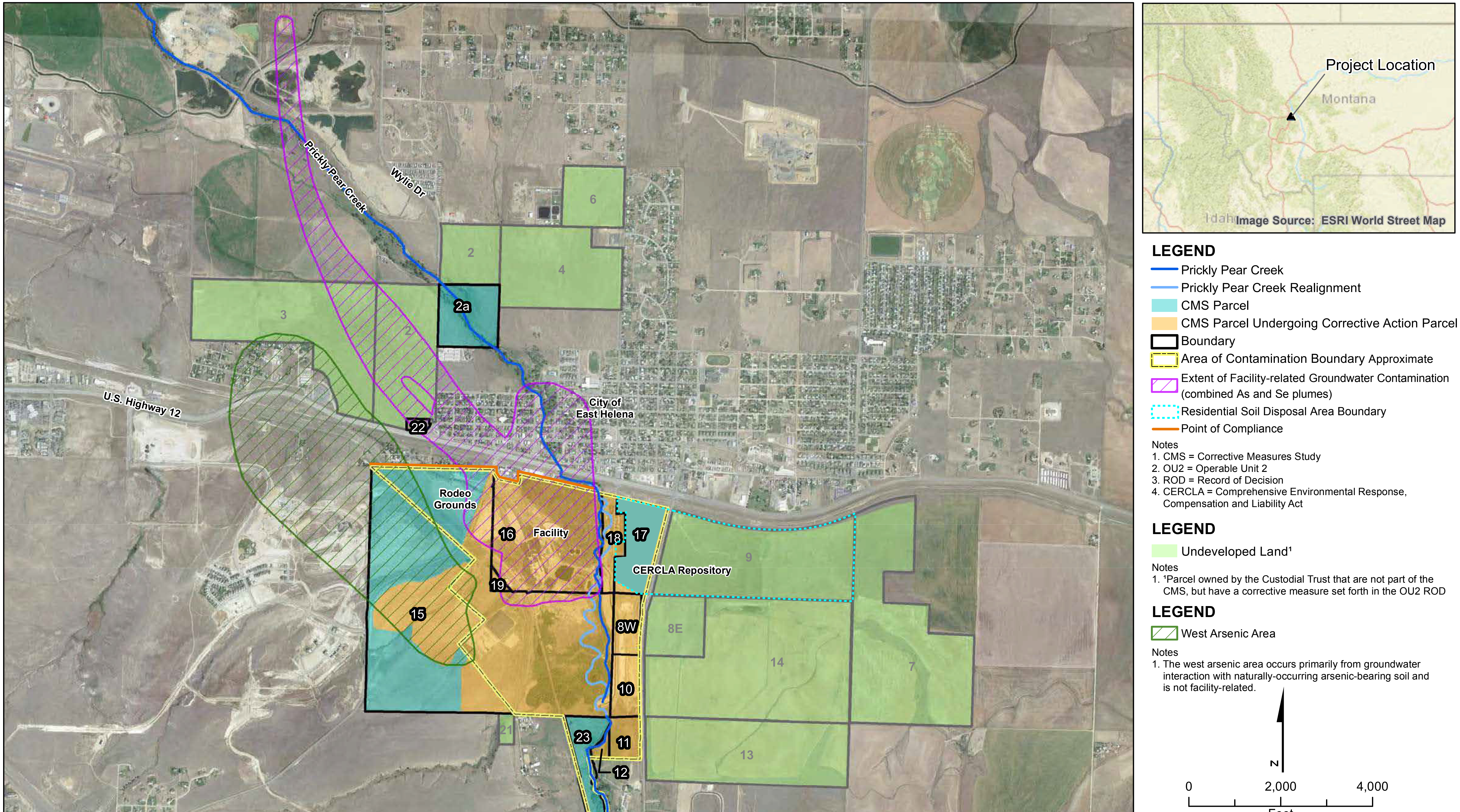

Figure 1-1
Geographic Boundaries of the CMS
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

ch2m:

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Aerial photo date: September 2015

Figure 1-2
Site Areas and Features
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

ch2m:

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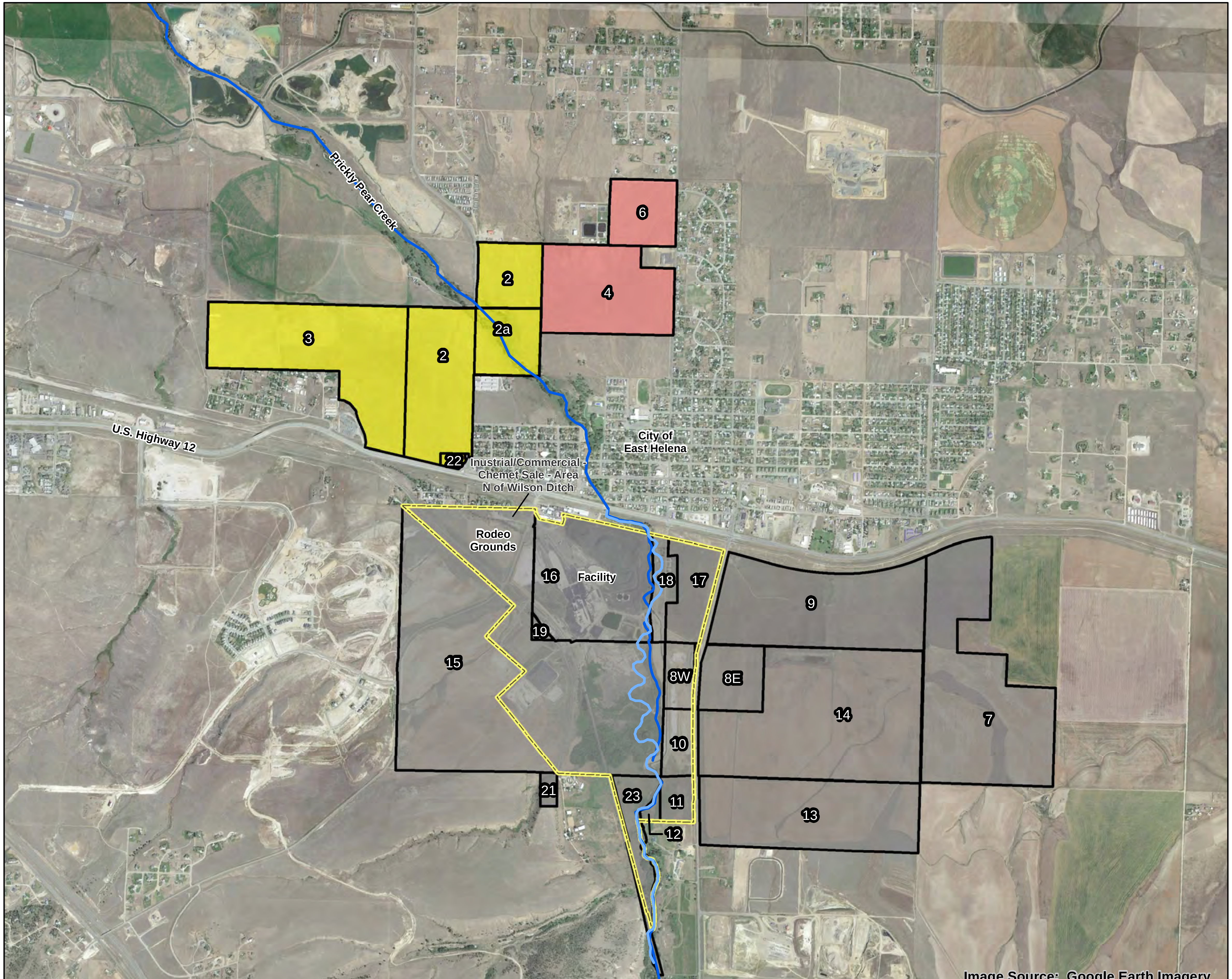

LEGEND

- Prickly Pear Creek
- Prickly Pear Creek Realignment
- Parcel Boundary
- Area of Contamination Boundary

Land Use Areas

- Commercial
- Industrial
- Residential

Note:
Land uses shown are consistent with COEH zoning as approved by the Zoning Commision in November 2016. Effective December 15, 2016. Current use of Custodial Trust Parcels are legal non-conforming until the properties change hands.

COEH = City of East Helena

N

0 2,000 4,000
Feet

Figure 2-1
Reasonably Anticipated Land Use
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

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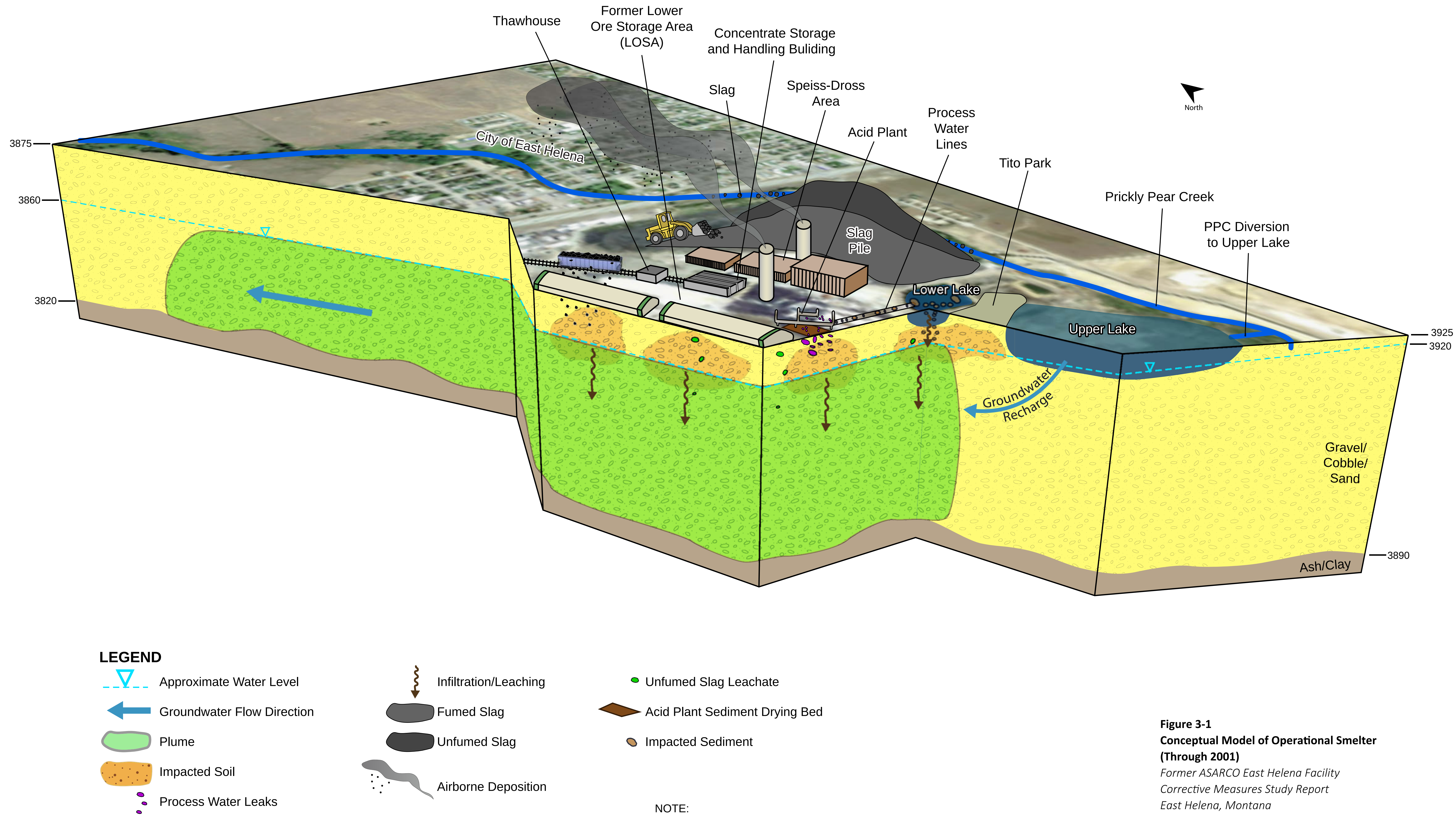


NOTE:
Darker colors represent higher contaminant concentrations.

Figure 3-1
Conceptual Model of Operational Smelter (Through 2001)
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

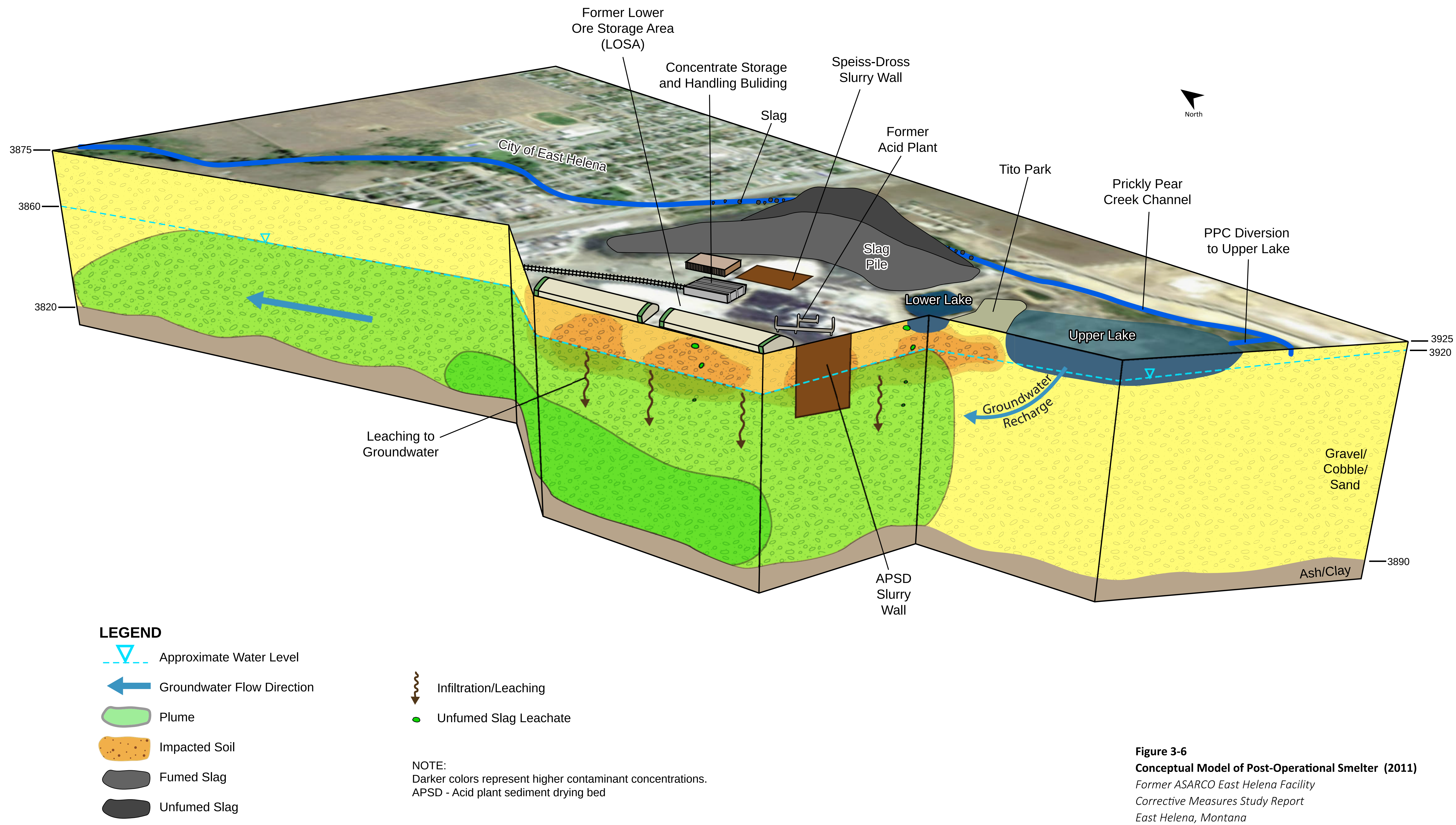
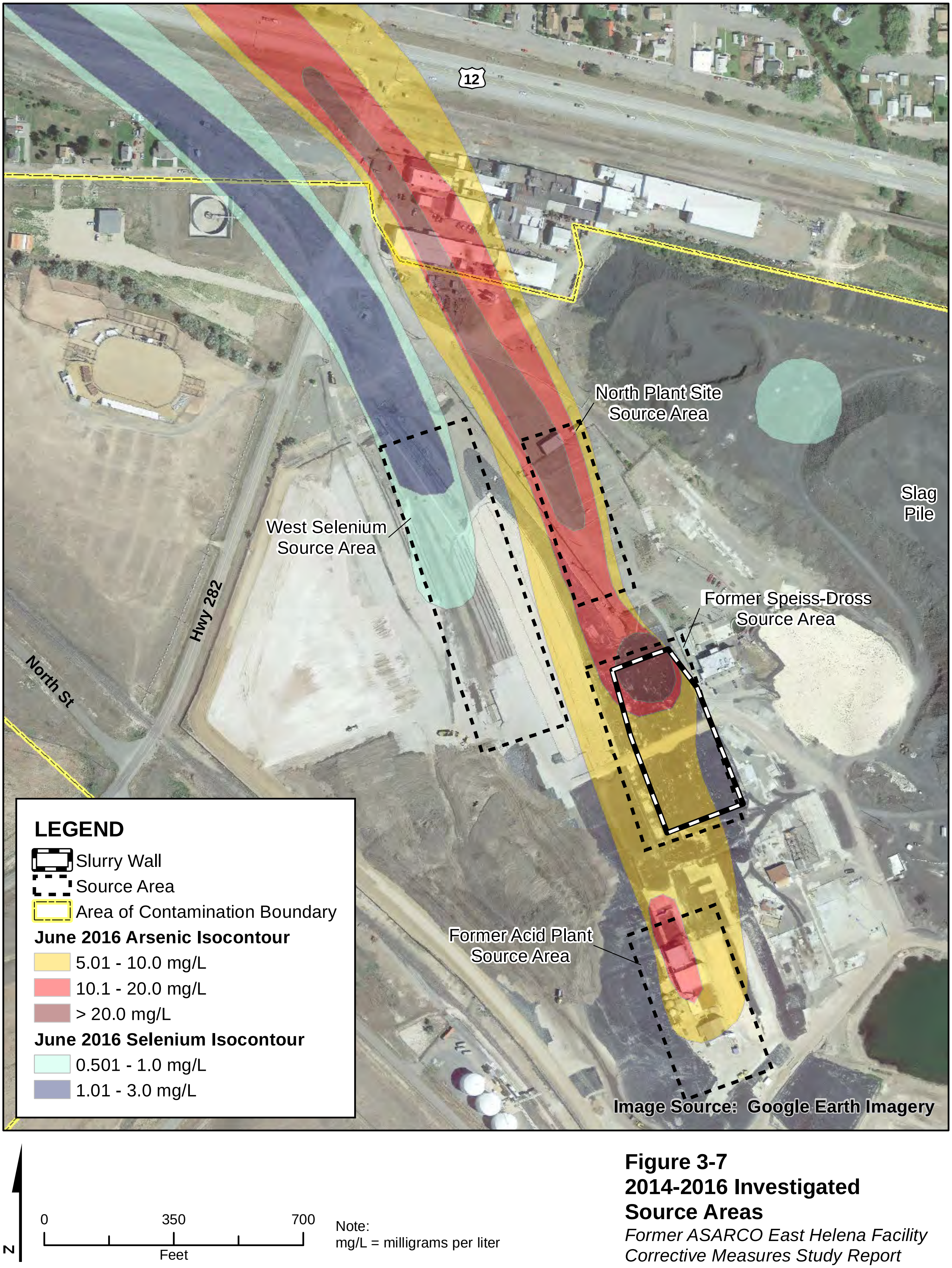


Figure 3-6
Conceptual Model of Post-Operational Smelter (2011)
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

ch2m

SCO671189.64.07.01 east_helena_CSM2_may2017.ai 5/17



Note:
mg/L = milligrams per liter

Figure 3-7
2014-2016 Investigated Source Areas
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

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ch2m

Notes:
1. Demolition of all site structures was conducted as part of the construction of the ET Cover System IM
2. ET = Evapotranspiration
3. IM = Interim Measure

Figure 3-16
Tito Park Excavation Area
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

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ch2m.

Notes:
1. AOC = Area of Contamination
2. HDS = High Density Sludge

Figure 3-17
Former Acid Plant Excavation Area
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

Modified from Hydrometrics, Inc., 10/11/2012

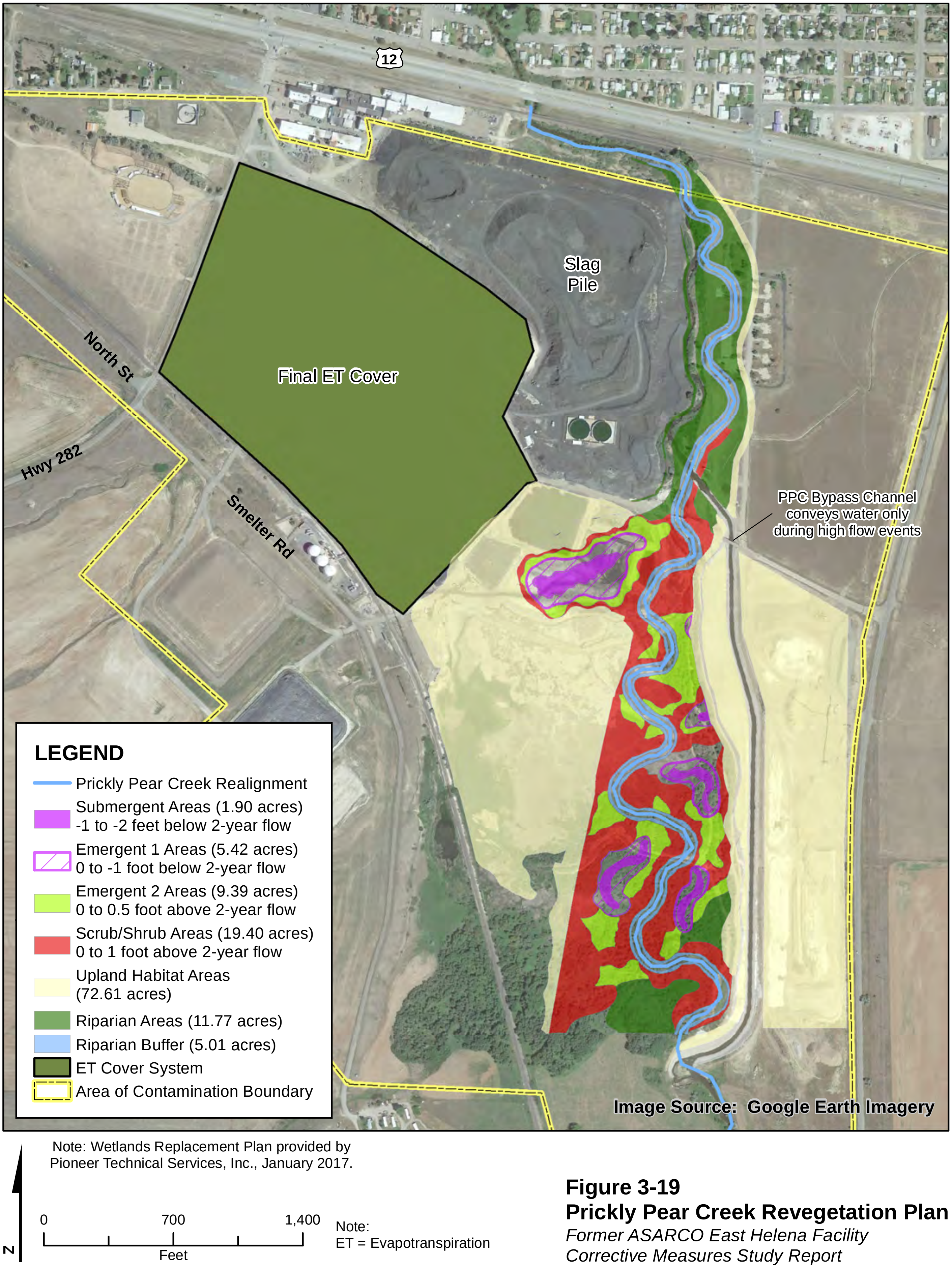
\\galt\proj\METG\486085\MapFiles\CMS\Fig_3-12_Acid_Plant_Excavation_Area.mxd AESPEJO 11/6/2016 11:36:20 PM

ch2m

Note:
ET = Evapotranspiration

Figure 3-18
Prickly Pear Creek Realignment
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

ch2m:



Note: Wetlands Replacement Plan provided by Pioneer Technical Services, Inc., January 2017.

Note:
ET = Evapotranspiration

Figure 3-19
Prickly Pear Creek Revegetation Plan
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

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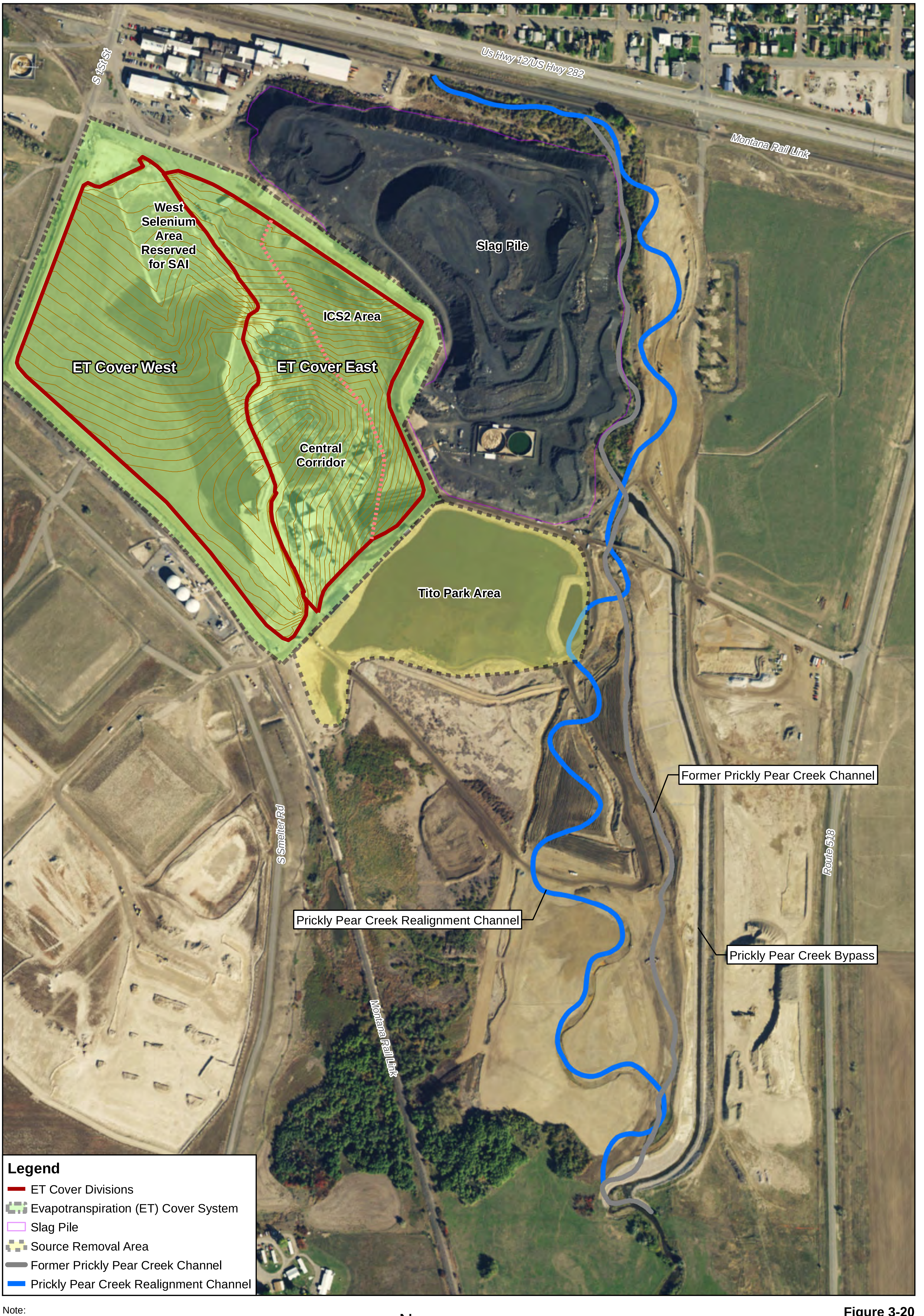
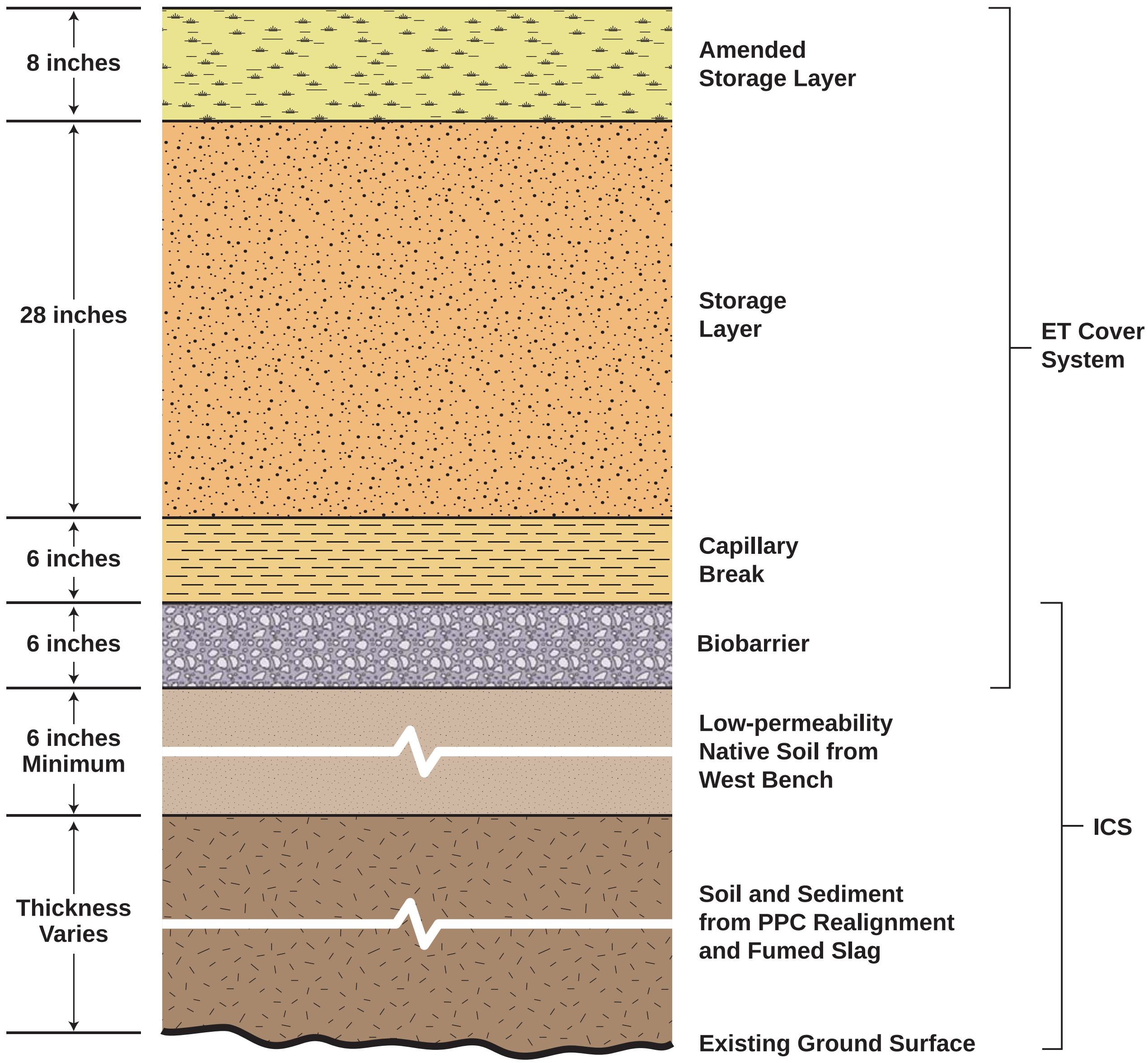


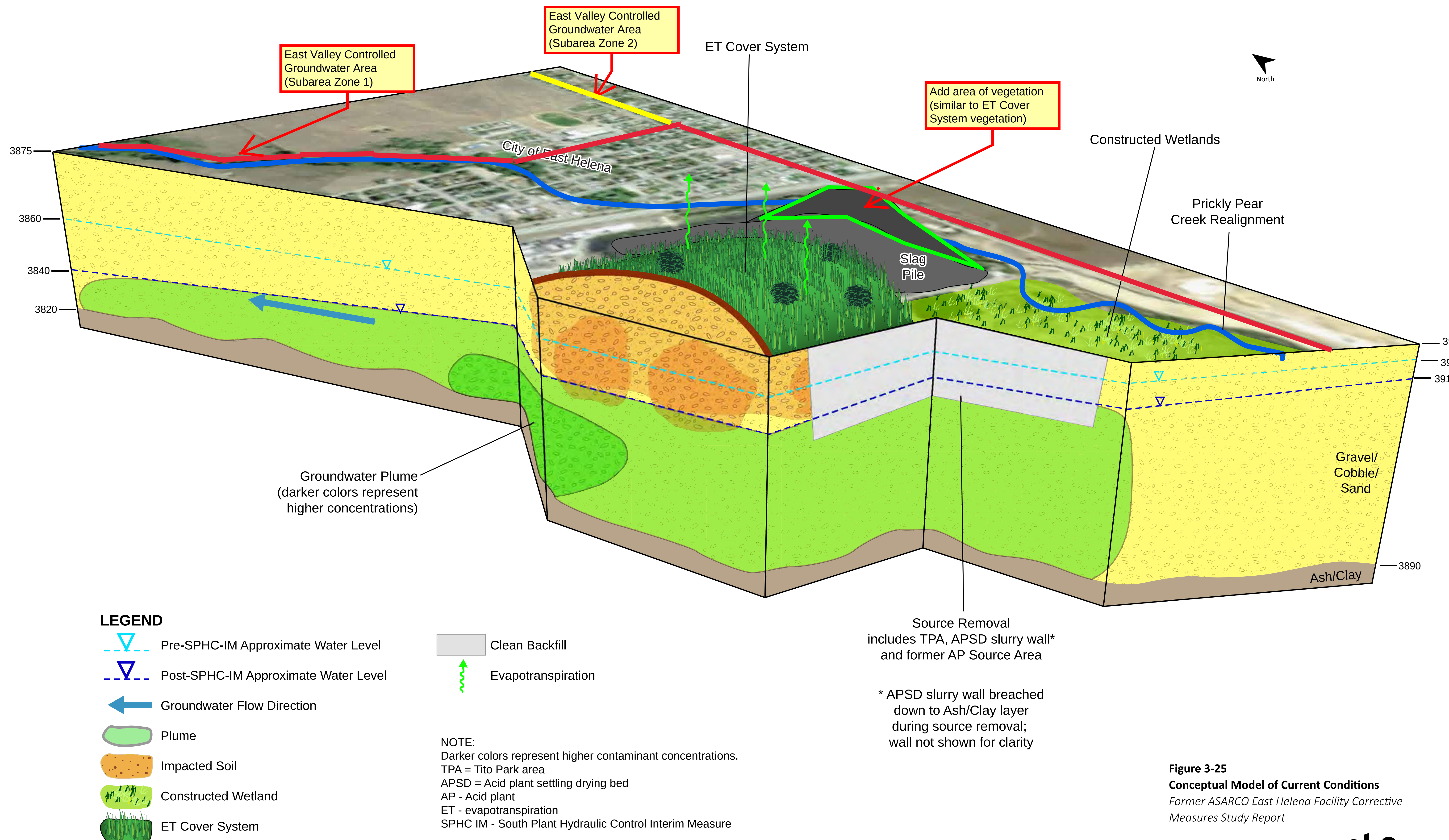
Note:
1) SAI - Source Area Investigation

Figure 3-20
ET Cover System
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana



Notes:
ET = Evapotranspiration
ICS = Interim Cover System
PPC = Prickly Pear Creek

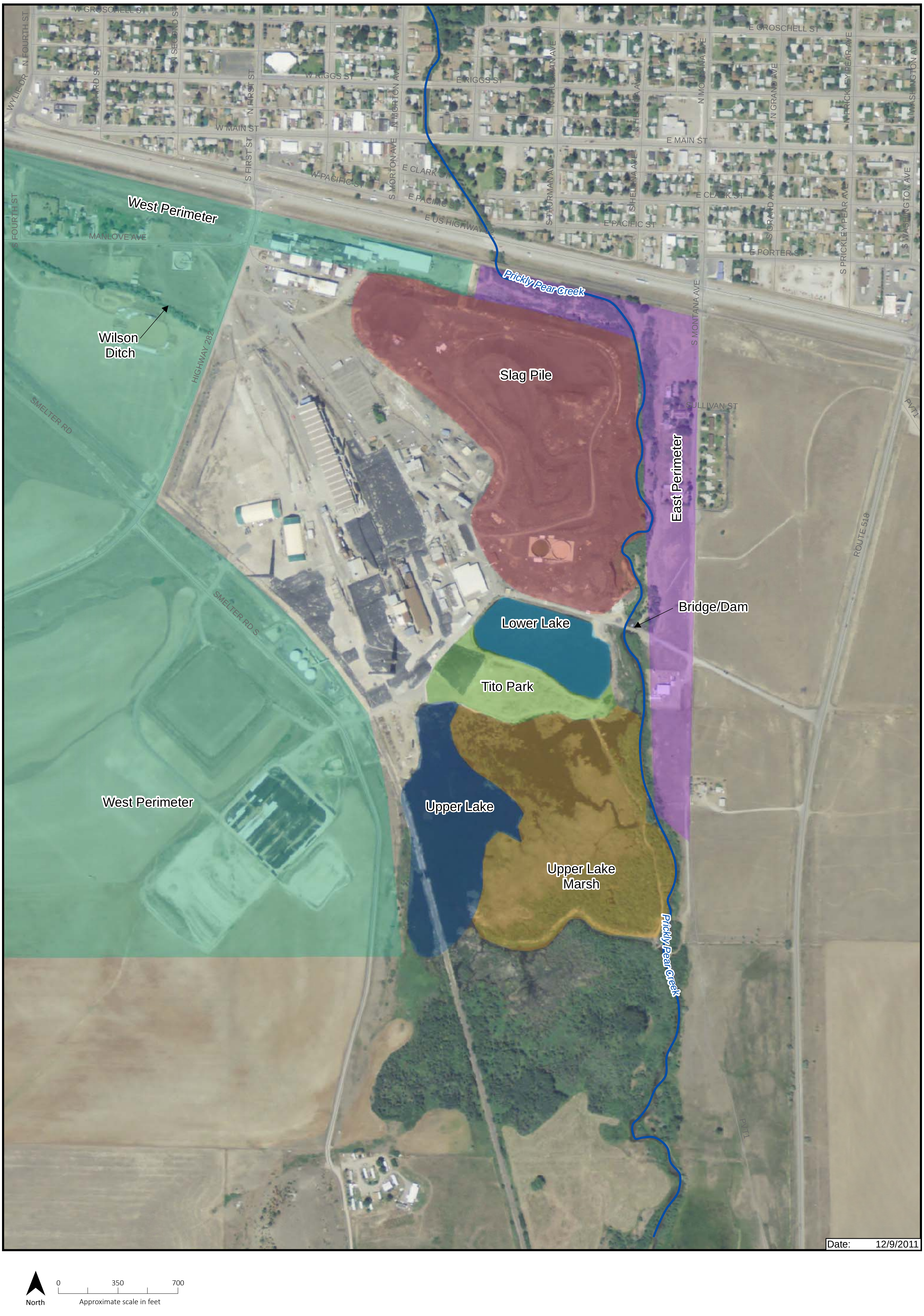
Figure 3-21
ET Cover Cross-Section
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana



NOTE:
Darker colors represent higher contaminant concentrations.
TPA = Tito Park area
APSD = Acid plant settling drying bed
AP - Acid plant
ET - evapotranspiration
SPHC IM - South Plant Hydraulic Control Interim Measure

Figure 3-25
Conceptual Model of Current Conditions
Former ASARCO East Helena Facility Corrective Measures Study Report

ch2m.



MAP REFERENCES:
1) Montana NRIS, 2009.

Notes:
2009 aerial photography.
Figure developed by Gradient (2010).

Figure 4-1
Areas Evaluated in the Baseline Ecological Risk Assessment
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

SCO671189.64.07.01 east_helena_ecological_risk_assessment.ai 10/16

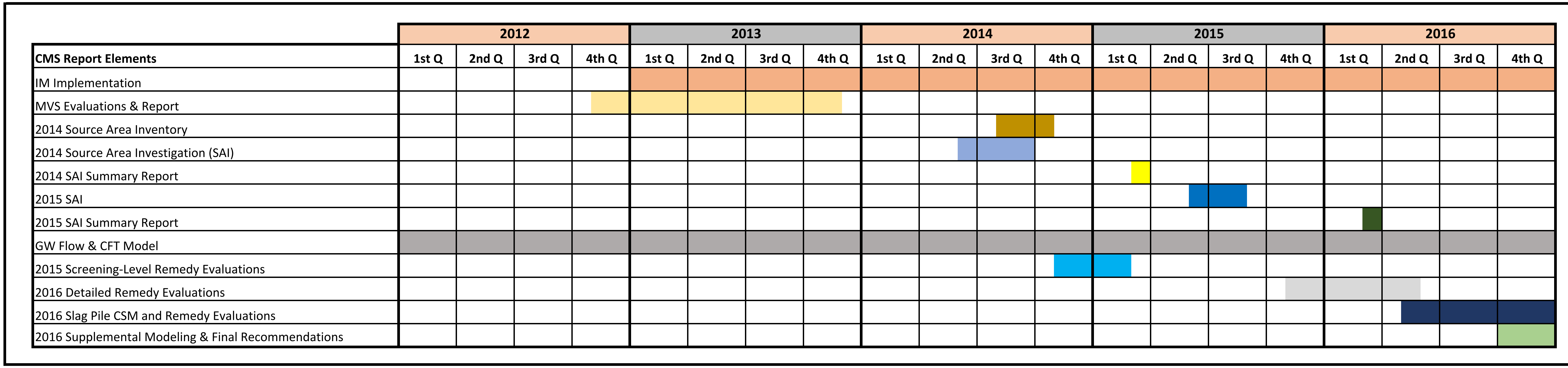
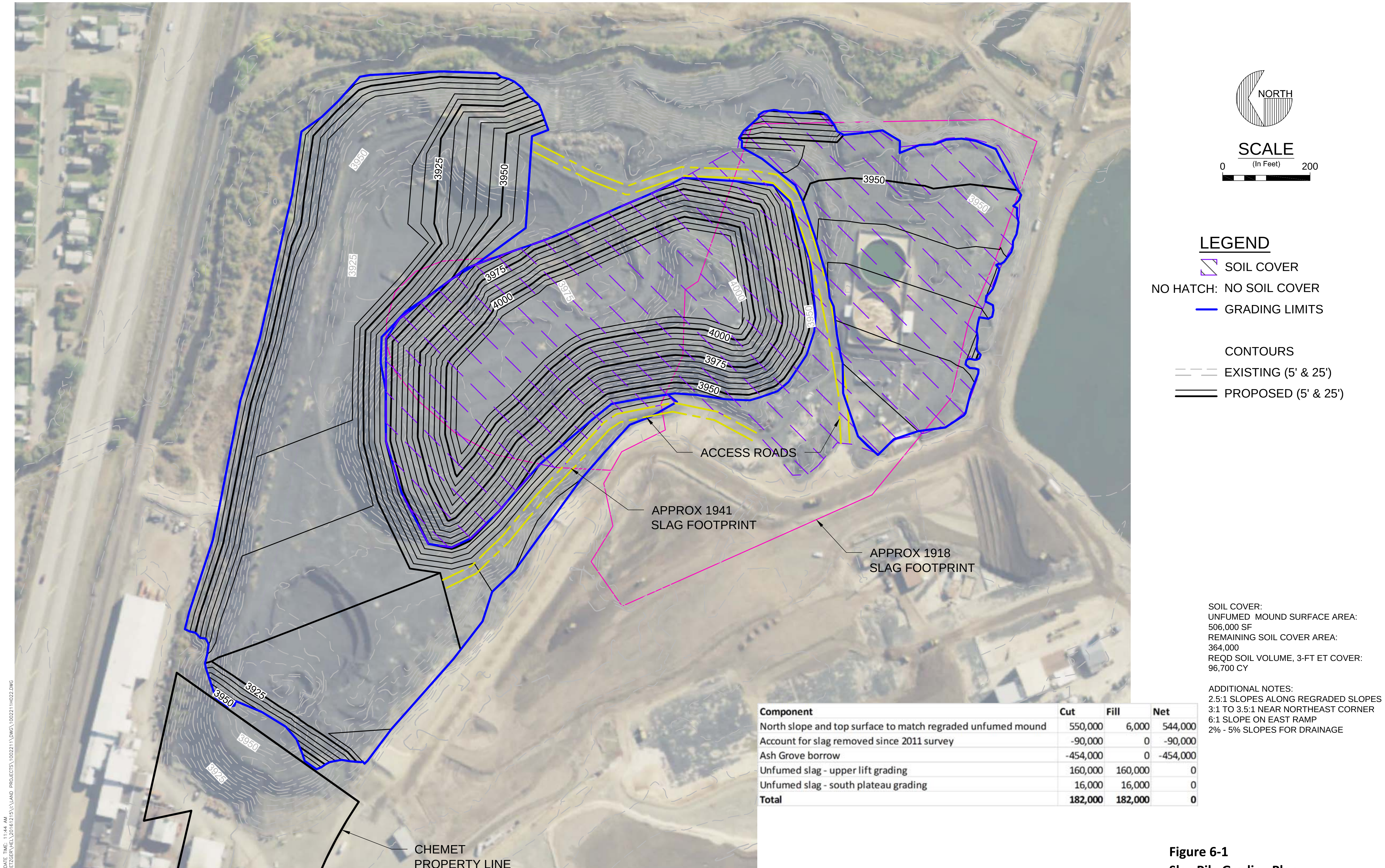


Figure 5-1
CMS Report Program Elements
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana



Component	Cut	Fill	Net
North slope and top surface to match regraded unfumed mound	550,000	6,000	544,000
Account for slag removed since 2011 survey	-90,000	0	-90,000
Ash Grove borrow	-454,000	0	-454,000
Unfumed slag - upper lift grading	160,000	160,000	0
Unfumed slag - south plateau grading	16,000	16,000	0
Total	**182,000**	**182,000**	**0**

SOIL COVER:
UNFUMED MOUND SURFACE AREA:
506,000 SF
REMAINING SOIL COVER AREA:
364,000
REQD SOIL VOLUME, 3-FT ET COVER:
96,700 CY

ADDITIONAL NOTES:
2.5:1 SLOPES ALONG REGRADED SLOPES
3:1 TO 3.5:1 NEAR NORTHEAST CORNER
6:1 SLOPE ON EAST RAMP
2% - 5% SLOPES FOR DRAINAGE

Figure 6-1
Slag Pile Grading Plan
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

Produced by:
Hydrometrics, Inc.
Consulting Scientists and Engineers

ch2m

SCO671189.64.07.01 EH_slag_pile_grading_plan.ai 1/17

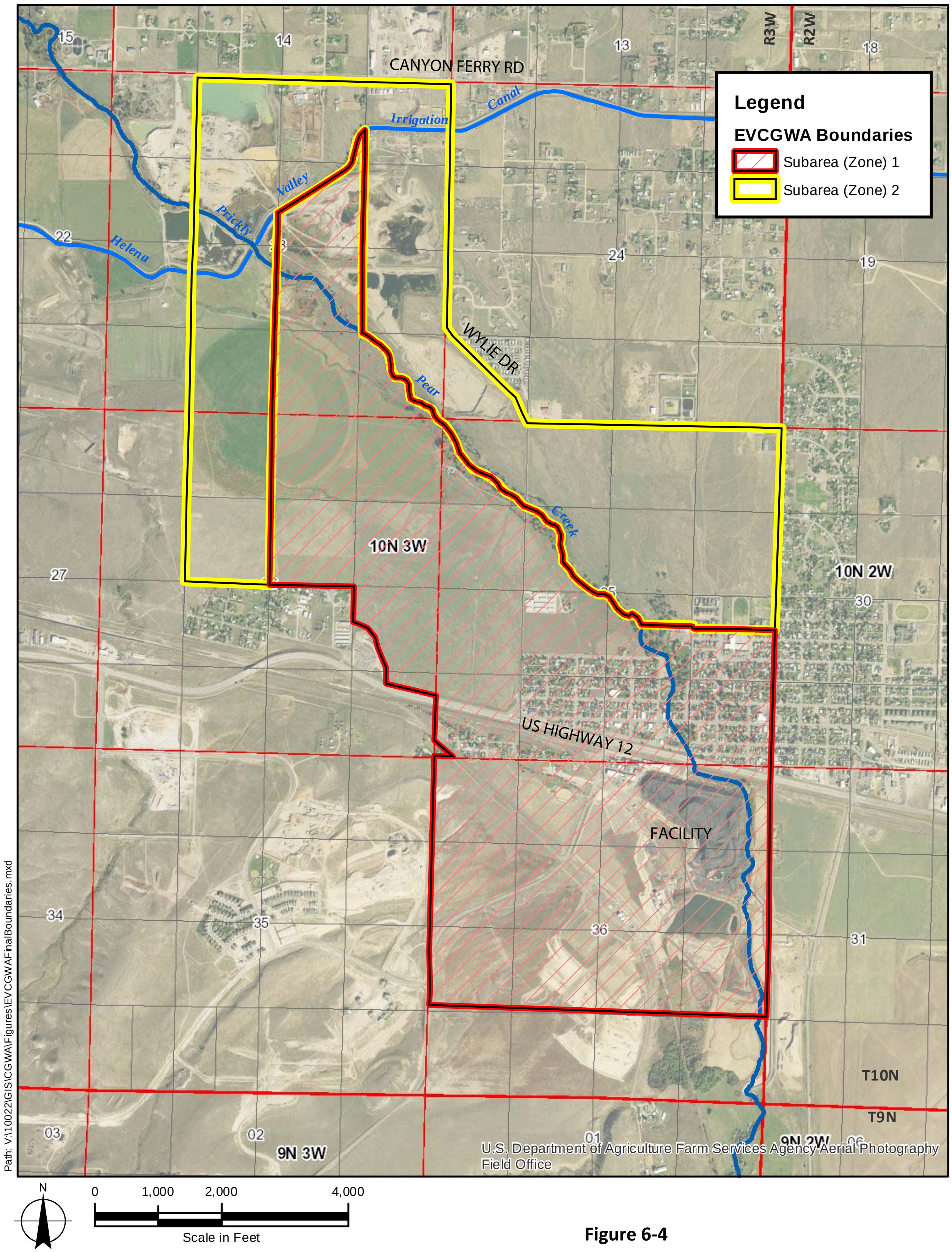


Figure 6-4
East Valley Controlled Groundwater Area
Former ASARCO East Helena Facility
Corrective Measures Study Report
East Helena, Montana

Created by Hydrometrics, Inc.: 11/18/2016 11:50:08 AM

Hydrometrics, Inc.
Consulting Scientists and Engineers

ch2m

Appendices

Appendices

A USEPA Response to Comments

Appendix A - EPA Response to Comments

A. Written comments submitted by Lewis and Clark County Water Quality Protection District
B. Written comments submitted by Robert Rasmussen
C. Transcript of Public Comment Period – April 11, 2018 – Responses provided to:
    1. Jean Riley
    2. Council Member Mike Misowic
    3. Jean Riley
    4. Jill Cohenour
    5. Representative Mary Ann Dunwell
    6. Luke Serati
    7. John Herrin
    8. Luke Serati

Lewis and Clark County
Water Quality Protection District

316 North Park, Room 220
Helena, MT 59623
(406) 457-8927 Fax: (406) 447-8398

May 29, 2018

Betsy Burns
USEPA Region 8 Montana Office 10 West
15th Street, Suite 3200
Helena, Montana 59626

Re: Comments on Former ASARCO East Helena Facility Corrective Measure Study Report

Dear Betsy,

The Lewis & Clark Water Quality Protection District (LCWQPD) is pleased that the cleanup actions at the former ASARCO facility in East Helena (site) are nearing completion. The following are comments on the above referenced Corrective Measure Study Report (CMS) represent concerns related to the implemented measures, and the long-term disposition of the site. While LCWQPD is part of Lewis & Clark Public Health, these comments focus on the issues related to surface and ground water in accordance with the mission of the district “to preserve, protect and improve water quality.” The comments are presented with general comments, which reflect larger issues related to the site and CMS approach; and specific comments which address specific sections of the CMS document.

As background to these comments, LCWQPD has been working with the Montana Bureau of Mines and Geology (MBMG) on developing regional datasets characterizing local water resources. From this work, we are addressing the occurrence of background concentrations of arsenic, uranium and fluoride in local groundwater at concentrations exceeding state and federal drinking water standards. Ongoing studies are characterizing the relationship between local geology and groundwater quality from a regional perspective. With the work at the former ASARCO facility providing additional data to characterize local conditions within a regional context, some comments reflect requests to integrate the datasets to address specific concerns for local water users. The most important issue is ensuring the long-term integrity of groundwater resources developed for potable water downgradient from the site, including numerous public water supply (PWS) source wells in the southeast Helena Valley. Long term water level monitoring by LCWQPD has identified areas where groundwater depletion appears present increasing the gradient away from the site. A groundwater potentiometric surface map of the southeast Helena Valley with PWS source well locations, depicted in Figure 1, shows the estimated extent of the cone of depression. The depletion problem shows that there is a strong gradient from Prickly Pear Creek and the site directly towards the PWS sources – suggesting primary recharge to groundwater occurs from the stream.

General Comments

1. *1.a*: The dataset characterizing the interaction of Prickly Pear Creek with the groundwater system, specifically as the primary recharge source to the southeast Helena Valley groundwater system, does not appear to identifying the recharge mechanisms. This may reflect the conclusions derived from semi-annual synoptic stream measurements used to assess gaining and losing characteristics of the stream. *1.b*: With the turbulent nature of streamflow, and the variable geometry of streambeds, there is a significant amount of error in these types of measurements without stream gauging. *1.c*: ***With this memorandum, LCWQPD requests permission to access the stream piezometers to install instrumentation needed to help characterize the connection with the local groundwater system.*** Piezometers were installed to monitor groundwater adjacent to the streams; however, only hand measurements of water levels were collected to compare with stream height measurements. LCWQPD wishes to construct datasets characterizing the relationship between surface and groundwater as depicted in Figure 2, an example of data taken from a memo prepared by LCWQPD dated January 7, 2016 to the East Helena Ground Water Working Group Members on the Downgradient Fate of the Ground Water Plume(s).

EPA Responses – The comment has been divided into three questions.

1.a. The complete dataset supports the CMS Report conclusion that groundwater recharge from the creek strongly influences groundwater flow and plume migration. This point has been stressed in the multiple Public and Groundwater Working Group meeting presentations. The supporting information is provided in the Phase II RFI report as referenced in the CMS Report, the 2015/2016 Water Resources Monitoring Report (distributed to the Groundwater Working Group in 2017), and the various meeting presentations previously distributed to the Groundwater Working Group and available on the METG website.

1.b. It is not clear what exactly the comment is referring to since the conclusion that recharge from the creek influences groundwater flow is based on multiple factors, including stream gaging data showing a decrease in flow in a downstream direction, the steep downward vertical gradients adjacent to the creek, and the obvious groundwater mounding beneath the creek. The accuracy associated with streamflow measurements is well documented and accounted for in using the data. As referenced in the annual Corrective Action Monitoring Program (CAMP) sampling plans, all streamflow measurements collected under the CMS program followed protocol detailed in the USGS Techniques and Methods 3-A8 publication, Discharge Measurements at Gaging Stations (Turnipseed and Sauer, 2010). In accordance with the USGS manual, flow measurements are rated as excellent (+/-2%), good (+/-5%), fair (+/-8%) or poor (>8%) at the time of measurement based on channel, flow, substrate and weather conditions. The USGS manual notes that, as a general rule, most streamflow measurements fall within the +/-5% range. Based on the significant loss in streamflow documented downstream of the former smelter, any error associated with the synoptic streamflow measurements, or stream stage/groundwater level measurements, would not alter the monitoring results or the conclusion that leakage from the creek is a significant source of recharge to groundwater.

1.c. The monthly piezometer readings and corresponding stream stage measurements are believed to accurately document vertical hydraulic gradients and groundwater mounding beneath the creek. However, with the understanding that the primary purpose of the piezometers is to inform the evaluation of corrective measures performance through ongoing groundwater monitoring, LCWQPD is welcome to instrument select piezometers if desired.

2. *2.a.* The groundwater assessment relies upon natural sorption processes of arsenic to iron oxides at the

leading edge of the arsenic plume as the mechanism for controlling the size of the plume. While this is generically a reasonable statement, there is really on full understanding of what actual processes are happening. Understanding the actual processes allow for a determination of the long-term fate and transport of the arsenic that has migrated off-site. Unanswered questions reflect the processes – such as is there a finite capacity for these processes such that in the future, the arsenic plume will start to migrate further downgradient? Will a change in redox conditions onsite over time result in release of the arsenic in the future? *2.b.* Invoking natural attenuation as a remedial component is reasonable and consistent with the EPA Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action (2004), cited in the CMS as a guidance document. Chapter 11 is focused on monitored natural attenuation. While these processes are typically applied to organic chemicals, this is still essentially what has been applied to the site, but only at a generic level. Mining sites with arsenic issues provide an excellent example of how science is applied to understand the complex geochemistry associated with the long-term fate and transport of metals and metalloids (e.g. arsenic and selenium).

2.c. For this site, LCWQPD recommends that mineral speciation modeling is completed to identify minerals phases that are anticipated within the system based on the extensive groundwater chemistry dataset that exists for the site. This dataset includes major ions and trace elements, includes redox conditions, and can be used to characterize the geochemical system. The assessment can answer multiple questions, such as: Is arsenic incorporated into the amorphous iron oxide crystalline structure in precipitates or onto existing iron oxide surfaces? Does this reflect a redox boundary between mixing of stream water with ambient groundwater? Do the organics in the system play a part in controlling the chemistry?

2.d. Completion of this type of assessment showing an understanding of the processes would potentially help in remedial design alternatives to manage the plume. This type of work was done with the EPA assessment of the slurry wall containment system, but seems to have been overlooked with respect to understanding the plume(s) and fate and transport properties for contaminants migrating offsite. Again, the concern is the long-term disposition of the site- derived contaminants, and the needed assurance that natural changes in site geochemistry as a result of the excavation and capping interim measure may eventually change the chemistry such that the arsenic held in the soil profile may be released back into the groundwater system. A good example of how changes in local geochemistry result in arsenic contamination occurs across much of Bangladesh – with abundant research on this by both academia and the World Health Organization.

EPA Responses – The comment has been divided into 4 sections.

2.a. The processes controlling the behavior of the East Helena groundwater arsenic plume (and, more recently, the selenium plume) both on-site and off-site, including interactions with solid phases in aquifer materials and the redox state of the groundwater system, have been the focus of numerous investigations at the Facility, from the earliest RI/FS work, through the Phase I and II RFIs, and the 2014 and 2015 Source Area Investigations conducted to support the CMS. A wide range of testing has been conducted on soil samples collected from borings in the saturated and unsaturated zones, including measurement of total concentrations, leach tests with various solutions (SPLP-type, saturated paste, upgradient groundwater), sequential batch leach tests, batch adsorption tests, sequential extraction tests, and mineralogical analysis of selected samples at Montana Tech. The redox status of groundwater has been characterized through arsenic and selenium speciation analysis of groundwater samples, as well as measurement of dissolved oxygen and oxidation-reduction potential (ORP), observations of the presence of organics in certain areas of the plume, and correlations between redox indicators and contaminant mobility. As referenced in the CMS report, the results of this testing are presented and summarized in multiple reports, including the Phase I and Phase II RFI reports, and the 2014 and 2015 Source Area Investigation Reports. One of the primary considerations throughout the RFI and CMS process regarding groundwater remedy evaluations has been the contrasting geochemical behavior of arsenic and selenium (i.e., increased arsenic mobility under reducing conditions and increased selenium mobility under oxidizing conditions), and the potential impacts of this behavior on the feasibility of different remedial approaches.

The results of the investigations described above, as presented in the referenced documents, have yielded a good understanding of geochemical controls on arsenic and selenium plume behavior in the East Helena groundwater system. For example, arsenic speciation results show aqueous phase reduced arsenic (As(III)) in source areas, transitioning to As(V) prior to attenuation from the aqueous to the solid phase. Sequential extraction results have consistently shown that arsenic retained in aquifer material is distributed across a wide variety of solid phases by a variety of binding mechanisms, from more available (water soluble or ion exchangeable) to less available (incorporated in iron/manganese oxides or present in refractory phases), with the percentage of arsenic present in different phases varying by location. Mineralogical examination of saturated soil in the primary arsenic source area showed iron oxide phases present with associated arsenic up to 2% (20,000 ppm). Leach tests of arsenic-bearing saturated materials with different solutions have shown that saturated soils in source areas are capable of generating leachate concentrations similar to those observed in groundwater, although mass leaching rates (percent of arsenic leached from the solid phase) are typically low. Finally, adsorption tests on saturated soils within the arsenic plume downgradient of the former smelter indicate that these soils retain additional capacity for arsenic adsorption, although this capacity is diminished compared with adsorption test results at the arsenic plume front. Overall, groundwater geochemistry data, along with the leaching and adsorption test data from aquifer materials collected to date at the East Helena Facility have provided a significant basis for evaluating the processes controlling fate and transport at this geochemically complex site and for selecting appropriate corrective measures.

The finite capacity of off-site soils to retain arsenic, and the potential for arsenic (and selenium) remobilization from soils under changing future redox conditions have been explicitly addressed as part of CMS remedy evaluations; these factors are a relevant concern at any site where contaminants remain in situ. The selected remedies for groundwater at the site are intended to (1) reduce contaminant loads entering groundwater and leaving the site through a combination of source removal, capping, and desaturation of contaminated soils through lowering of the water table; (2) eliminate pathways to receptors, and (3) provide for institutional controls and long-term monitoring. While the selected remedies are not expected to result in future remobilization of arsenic, the remedy performance evaluation monitoring program will include monitoring to verify this.

2.b. It should be noted that natural attenuation is not one of the selected remedies for the East Helena Facility. As described in the CMS, the proposed final corrective measures include (1) existing Interim Measures (ET Cover, South Plant Hydraulic Control, Speiss-Dross Slurry Wall, Source Removals and CAMUs), (2) slag pile cover, and (3) institutional controls. Long-term monitoring will be conducted to evaluate the performance of the final corrective measures in terms of decreasing contaminant concentrations in groundwater.

Given the extensive work completed at the Facility to assess the aqueous and solid phase geochemistry of the groundwater system and the effects on arsenic and selenium transport and mobility, as described above, characterizing this work as "at a generic level" does not seem correct. On the contrary, the majority of the investigations described in the CMS supporting documents included site-specific observations and empirical testing, supported as necessary by modeling efforts (e.g., remedy evaluations involving groundwater flow and fate and transport modeling).

2.c. The geochemical system has been well-characterized through the groundwater monitoring and other investigations conducted to date, and it is unclear how a modeling effort to ascertain anticipated mineral phases would add significantly to addressing the questions posed in the comment. As far as elucidating adsorbed arsenic vs. arsenic incorporated into iron oxide precipitates, the key questions of the attenuation capacity of off-site soils and the remobilization potential of attenuated arsenic has been investigated through empirical adsorption, leaching, and sequential extraction testing, as well as mineralogical analyses. Site-specific adsorption coefficients were also incorporated into the groundwater modeling conducted as part of remedy evaluations. Groundwater monitoring has shown that elevated arsenic concentrations in groundwater are directly correlated with reducing conditions typified by low dissolved oxygen concentrations, and that as downgradient groundwater becomes more oxic through mixing with Prickly Pear Creek water (from the east) and/or tertiary groundwater (from the west), arsenic concentrations decrease. The influence of organic aquifer contamination in the central plant site on the redox status of groundwater, and hence on the speciation and mobility of both arsenic and selenium is well-established, with reducing conditions corresponding with increased arsenic concentrations and mobility and decreased selenium concentrations and mobility, and vice versa for oxidizing conditions.

2.d. Remedial alternatives considered in the CMS were evaluated based on a conceptual site model that includes an understanding of site-specific contaminant geochemistry obtained from numerous historical investigations as described above. The potential response of the groundwater arsenic and selenium plumes to various remedial scenarios was evaluated (in part) using predictive groundwater modeling, which utilized the results of site-specific geochemical testing. It is assumed that the comment intends to reference the EPA permeable reactive barrier (PRB) work rather than the slurry wall. The PRB demonstration project was a research effort intended to test the applicability of the technology at the East Helena site, which included detailed sampling and evaluations including some geochemical modeling and an extensive set of advanced spectroscopic techniques for mineral identification.

The proposed remedies for the East Helena Facility presented in the CMS are based on reducing contaminant loading and concentrations through source removal and isolation, along with institutional controls to prevent exposure to groundwater contaminants. The long-term monitoring component of the remedy will address both the effectiveness of the proposed remedies and potential need for additional remedies in the future, along with monitoring the "long-term disposition" of site-related contaminants (i.e., potential remobilization) as the groundwater system moves toward a post-remediation geochemical and hydrologic steady-state.

3. With respect to understanding the relationship between Prickly Pear Creek and recharge to the local aquifer downgradient from the facility, *3.a*: the groundwater flow model does not appear to be constructed in a way that can model the conditions related to aquifer depletion in the Southeast Helena valley. After reviewing the model and how it was constructed, there are some components that do not seem consistent with observed field conditions in the area.

- The hydraulic conductivities assigned to the different units in the model are not consistent with the results reported in previous project reports. Specifically, tables of aquifer tests results (e.g. Appendix A from Oct 2012 Groundwater Modeling Memo) indicate determined hydraulic conductivities reports values generally up to 200 ft/day, with some values higher. The aquifer tests determine the transmissivity for the well; however, these wells are all partially penetrating wells in the aquifer, and the hydraulic conductivities are determined by dividing the determined transmissivity by the aquifer thickness. The reported values reflect generally the screened interval in the well, or in some cases the thickness of the sand pack around the screen, which do not account for aquifer flow from above and below the screened intervals. As a result, these tests, especially when wells are only partially penetrating, results in hydraulic conductivity estimates that are biased high above actual values. *3.b*: Figure 4.32 of the groundwater modeling memo in CMS Appendix A by Newfields shows values exceeding 1000 ft/day from some areas. There does not appear to be data supporting permeability values this high for the local geologic conditions.

- *3.c*: An effective porosity figure of the model domain, included in previous groundwater modeling memos, was not included with the CMS document. The lack of this information makes reviewing the representativeness of the model to local conditions difficult, especially when compared to the permeability issues discussed above.
- *3.d*: The interpretation of the paleo channel downgradient from the site reflects the interpretation of incision into the bentonitic clay unit (Figure 2.5, "Weathered Tuffaceous Sediment Surface," CMS Appendix A by Newfields). While there may be some type of paleochannel directing groundwater flow, the arsenic and selenium plumes are not consistent with the location of this defined paleochannel. Further, since there is a dramatic change in the lithology of the bentonite clay unit in this area, the disposition of a specific, coarse grained channel would likely change at this location as well.

3.e: Based on this information, the model is not considered representative of the actual hydrogeologic conditions related to the downgradient migration of the plume off-site from the facility. In addition, while part of the model domain, the model is not constructed in such a manner that will allow an assessment of the risk to downgradient water users in the southeast part of the Helena Valley, directly downgradient from the site. ***LCWQPD requests a copy of the groundwater model files so that we can evaluate, in detail, the potential use of the model to characterize regional conditions.***

EPA Responses – The comment has been divided into five sections.

3.a. The model construction would in no way preclude simulation of the reported groundwater depletion area, if desired. However, as noted in Appendix A of the CMS report and in other modeling documents referenced in the report, calibration of water levels to individual transient pumping conditions a mile or more east of the former smelter was not an objective of the groundwater model. As shown in Figures 4-8, 4-9 and 4-10 of the CMS Report Appendix A, there are no groundwater level calibration targets within the area in question. Secondly, the area of reported aquifer depletion is apparently not affecting groundwater conditions in the project area since the depletion area is located to the east and groundwater flow and the Facility plumes have shown a significant shift to the west since 2012. Therefore, the presence of the reported groundwater depletion zone does not appear to have any detrimental effects on the completed model calibration or predictive simulations.

3.b. One purpose of groundwater modeling is to estimate aquifer parameters and conditions in areas of limited data based on calibration to known conditions. The higher hydraulic conductivity zone is included in the model based on calibration to the three-dimensional selenium plume geometry, vertical hydraulic gradients in the area, and an area of very high well yields and coarse gravel/cobbles noted in deeper wells such as EH-144d. Based on numerous model runs and sensitivity analyses, this scenario best simulates observed groundwater flow and contaminant transport patterns, and as such provides the best means for simulating future plume migration trends.

3.c. The simulated effective porosity is included in Figure 5.15 of Appendix A to the CMS Report.

3.d. Comment noted. The important point is that the simulated plume coincides closely with the location of the monitoring delineated plume.

3.e. The project technical team disagrees with the reviewer's conclusion. Based on the detailed evaluations and analyses, the groundwater flow model meets its stated objectives and represents a valuable tool for assessing future groundwater quality trends and, in conjunction with the controlled groundwater area and completed interim measures, is an important tool in evaluating and assessing risk to downgradient water users within the project area.

As with all numerical and conceptual hydrologic models, models should be updated as new information becomes available and the need arises. Currently, the depressed groundwater levels do not appear to have any detrimental effect on groundwater flow and plume migration from the former smelter since current trends show a westward shift in flow away from the depletion area.

The model was not constructed to characterize regional conditions, but to evaluate the effectiveness of the proposed and implemented interim measures. Therefore, the project team does not agree that the groundwater model files would be an appropriate tool to characterize regional conditions and the model files will not be provided.

4. While not addressed in the CMS, the impact of removal of recharge to an irrigation canal from smelter dam to the northeast, in to the southeast part of the Helena Valley, east of east Helena, has not been evaluated. This issue was discussed in the recent public meeting for the CMS. A question that could be addressed by a proper model would be the impact of losing recharge to the groundwater system from the irrigation canal, and determining how this may relate to the aquifer depletion observed in the area (see Figure 1).

EPA Response – A review of the use of the Eastgate ditch indicated that the last time water flowed in the ditch was for a brief period in 1999. Accordingly, the ditch is not a significant source of recharge in the southeast part of the Helena Valley.

5. While not part of the determined contaminants of concern for the former Asarco site, uranium in groundwater represents a concern and has been detected in ground water at concentrations exceeding the drinking water standard in wells installed into Tertiary strata in the area (Figure 3). The USGS released a regional study of uranium and radionuclides in ground water near and proximal to the Boulder Batholith located south and southwest of the East Helena site, noting the occurrence of uranium in local ground waters (Caldwell, Nimick and DeVaney, 2014). With respect to the former Asarco site, uranium has been identified as present in the lower part of Tertiary beds in the region, from a USGS study identifying areas for potential mining of uranium (Becraft, 1958). The study is important since the East Helena site is located on the Tertiary unit as bedrock, and site studies indicate one or more organic rich lenses in the system which are related to elevated levels in groundwater. ***Due to the potential health concerns from public exposure, LCWQPD requests permission to obtain split samples from project groundwater sampling locations for analysis for uranium, to characterize the risk to groundwater users in the area***. In addition to monitoring wells, this applies to residential wells in the Seaver Park area and area downgradient from the Controlled Ground Water Area. If sampling is not planned, LCWQPD can also work with Energy Laboratories to get estimated values for uranium concentrations from the electronic data maintained from previous sample analyses.

EPA Response – Uranium and radionuclides are not contaminants of concern for the former smelter site, and the groundwater monitoring program was not developed to address naturally occurring contaminants. EPA supports the work that the LCWQPD is doing with residential well owners to delineate areas of potential health concerns from naturally occurring uranium and radionuclides. To avoid any perceived contribution from the site, EPA will not allow for split samples from the existing groundwater monitoring network. Additionally, there are no plans to conduct groundwater sampling in any residential wells in Seaver Park or north of the Controlled Groundwater Area.

References:

Becraft, G.E., 1958. Uranium in Carbonaceous Rocks in the Townsend and Helena Valleys, Montana. US Geological Survey Bulletin 1046-G.

Caldwell, R.R., Nimick, D.A., and R.M. DeVaney, 2014. Occurrence and Hydrogeochemistry of Radiochemical Constituents in Groundwater of Jefferson County and Surrounding Areas, Southwestern Montana, 2007 through 2010. USGS Scientific Investigations Report 2013-5245.

Thamke, J.N. and M.W. Reynolds, 2000. Hydrology of Helena Area Bedrock, West-Central Montana. USGS Water Resources Investigations Report 00-4212,

Specific Comments

p. 3-21, Section 3.3.6. This section utilizes results of the 2016 Corrective Action Monitoring Program, but does not provide a reference where any of the data results may be reviewed, nor does the CMS include any of the data results.

EPA Response – EPA agrees with this comment. The 2016 CAMP report has been added to the METG website and can be accessed at https://www.mtenvironmentaltrust.org/east-helena/documents/.

p. 3-28, Section 3.4.4. The characterization of Prickly Pear Creek not interacting with groundwater near the site is inconsistent with the groundwater surface map in Figure 3-31, which shows contours downgradient and parallel to the stream along Highway 12. It is unknown, based on information provided, whether the stream is linked to groundwater here, or perched above groundwater as occurs downgradient. If it is connected to groundwater, the stream may provide recharge to groundwater as a "flow-through" system, where groundwater recharges the stream in the upgradient streambank while at the same time losing water to groundwater into the downgradient bank. Again, this issue is important to determine where recharge occurs to the groundwater system in the southeast part of the Helena Valley.

EPA Response - EPA agrees with this comment. The text will be revised to say that streamflow rates remain relatively constant along the eastern margin of the facility, with flows decreasing due to leakage to groundwater north of the slag pile and upstream of Highway 12.

Figure 3-24, Conceptual Model of Post-Operational Smelter, and Figure 3-32, Conceptual Model of Operation Smelter. The conceptual site model figures showing groundwater recharge from the lake indicate recharge from the base of Upper Lake to the system. Recharge and discharge from open lakes generally occur laterally along the shoreline(s), since the water table surface under a lake connected to groundwater is essentially the lake, and flow is only driven with a difference in heads, or gradient. For Upper Lake, the water table should mound up to the lake surface with flow laterally to the north from this position. These models also show Lower Lake as perched above the water table, which does not seem likely given the shallow groundwater in the area.

EPA Response - Figures 3-24 and 3-26 (the reference to Figure 3-32 in the comment is incorrect) are illustrations that are intended to be generalized depictions of site conditions representing post-operating and during operations conditions relative to migration of contaminants of concern. They are simplified to illustrate general conditions and do not take the place of detailed analyses presented in report attachments and reference documents. These figures will be updated for Upper Lake and Lower Lake to show similar connection of a saturated zone to the groundwater table and associated flow arrow as shown for Upper Lake.

Figure 3-25, Conceptual Model of Current Conditions. The conceptual model appears to show that

Prickly Pear Creek is perched above the water table upgradient from the site. This seems inconsistent with the goal of lowering the creek to lower the water table elevation from that area. Additionally, it would be useful to include the general range of pre and post SPHC water levels since there can be significant fluctuations and it's unclear what an "approximate" water level means. The magnitude of the lowering of the water table downgradient from the site is not consistent with the data depicted in Figure 3-32, Relative Changes in Water Levels.

EPA Response - Figures 3-25 is an illustration that is intended to be a generalized depiction of current (during IM implementation) site conditions relative to migration of contaminants of concern. It is simplified to illustrate general conditions and is not intended to take the place of detailed analyses presented in report attachments and reference documents. Pre- and post-SPHC levels are currently shown on the figure as the commenter suggests, and these levels will be updated to more accurately depict these groundwater levels relative to the creek and elsewhere. The commenter is referred to the 2015/2016 Water Resources Monitoring Report-East Helena Facility, and the groundwater level data packets previously distributed to the East Helena Groundwater Working Group for more details on pre- and post-SPHC groundwater level fluctuations.

Closing

Thank you for the opportunity to comment on the CMS and the work completed at the former Asarco smelter site in East Helena. I also look forward to hearing from you with responses to requests included within these comments. Regarding the requests please contact me if you would like to discuss any of the issues, or set up a meeting with the benefactors to discuss them.

Sincerely,

James Swierc, PG LCWQPD
Hydrogeologist

Burns, Betsy

From: Robert Rasmussen <robertrasmussen@yahoo.com>
Sent: Wednesday, April 11, 2018 2:52 PM
To: Burns, Betsy
Subject: East Helena CMS

I have skimmed the CMS for East Helena site and reviewed the video on the reroute of Prickly Pear Creek. Although the charge and emphasis is on groundwater contamination and remediation, I saw no mention of the Prickly Pear Creek Greenway study commissioned by PPLT (and funded by NRDP), which involves the METG property. I would think that the trail should be addressed, but I may have missed the reference in my brief review I think that Mary Hollow has discussed the issue with you and I believe that Andrea Silverman has been the point person at PPLT. I will not get out to East Helena this evening.
Thanks,
Robert Rasmussen

EPA Response to Robert Rasmussen - EPA appreciates your comments and support of the Prickly Pear Creek Greenway project. On November 4, 2019, Governor Steve Bullock approved the East Helena ASARCO Smelter Final Restoration Plan and Environmental Assessment Checklist. The plan funds $3,200,000 for the Greenway Trail system along the restored Prickly Pear Creek. The Greenway Trail system will serve to protect the South Plant Hydraulic Control remedy in perpetuity.

PUBLIC MEETING ON

THE DRAFT CORRECTIVE MEASURES STUDY REPORT

FOR THE EAST HELENA SMELTER SITE

TRANSCRIPT OF PUBLIC COMMENT PERIOD OF THE MEETING

Offices of the Montana Environmental Trust Group
325 Manlove Avenue
East Helena, Montana

April 11, 2018
6:30 p.m. - 8:48 p.m.

REPORTED BY: CHERYL ROMSA
CHERYL ROMSA COURT REPORTING
ONE NORTH LAST CHANCE GULCH, SUITE 1
P. O. BOX 1278
HELENA, MONTANA 59624
(406) 449-6380

I N D E X

WHEREUPON, the following proceedings were had:

(The meeting was opened by Betsy Burns. Presentations were given by Bob Anderson, Mark Rhodes, Joel Gerhart, and Lauri Gorton, followed by a question-and-answer session.)

MS. BURNS: This is the moment that you've all been waiting for. This is an opportunity to provide formal public comment. We have a court reporter here tonight. Cheryl will take your comments. If you do have comments that you'd like to present, I'd like you to just state your name clearly and then provide the comment. We won't be providing responses tonight. We will provide a formal comment response in the Statement of Basis when EPA approves the final remedy that was proposed in the Corrective Measures Study.

You also have the opportunity to write -- send me a either a letter in the mail or send me an e-mail if you have formal comments that you would like to have a response provided in the Statement of Basis, and we'll be happy to incorporate it in there.

So anyone want to do a formal?

MS. RILEY: I'll do that formal comment. My name is Jean Riley. I'm the president of the Water & Sewer Association for the Eastgate Water & Sewer Association.

And my question, again, I'm going to state. I realize that the ASARCO cleanup has contaminated soils. There's contaminated soils that right now are not revegetated, are not capped, and do not have stormwater controls. I feel that that needs to be addressed and needs to be addressed quickly. That contaminated soil did go into the subdivisions.

My question is, is the ASARCO or EPA willing to test the soils that went through the subdivisions and whether they're now deposited in my -- in our irrigation field for where we do our deposits of our effluent from our treatment plants?

MS. BURNS: Thanks, Jean.

Anyone else willing to provide or interested in giving an oral public comment tonight?

Yes.

COUNCIL MEMBER MISOWIC: Mike Misowic. I'm on the City Council for the City of East Helena, a resident of East Helena.

Please, don't forget the citizens of East Helena through all of this. We are the ones that have taken the hardest hit with the loss of the smelter. We have to take care of our infrastructure, and we need the help of the Trust Group.

Thank you.

MS. BURNS: Thanks, Mike.

MS. RILEY: Jean Riley again, president of the Eastgate Water & Sewer Association. I wanted to ask one question, and I want to make a comment.

I do not understand why the Trust can go against state law. I'm referring to 70-17-112. It is concerning the irrigation ditches that were damaged and the diversion structure that was removed when they did the creek realignment. The statute actually says, "A person may not encroach upon or otherwise impair any easement for" which "a canal or ditch used for irrigation or any other lawful domestic or commercial purpose, including carrying return water." You cannot do that without written permission. Written permission was never received. It was damaged multiple times.

Again, that needs to be addressed, and it needs to be addressed with this final.

MS. BURNS: Thanks, Jean.

MS. COHENOUR: I'd like to just add to that. I'm Jill Cohenour. I'm also a member of the Eastgate Water & Sewer Board.

I'm a bit concerned about the lack of response from the Trust Group to the letters that have come from the Eastgate Water & Sewer Board. We, we need some kind of a response to the concerns that we've put forward to the

Trust Group on that particular issue. There has not been a response, and I think it would be necessary that some kind of formal response is received to our group so that we can move forward on the things that we're trying to do on behalf of our folks as well.

You know, we have property rights, essentially, and water rights that are necessary to be able to be exercised on behalf of our folks, and this situation has kind of damaged our ability to do that. So I would ask that some kind of formal response be given to our group as soon as possible.

MS. BURNS: Thank you.

REPRESENTATIVE DUNWELL: Hi. I'm Mary Ann Dunwell. I am a Montana representative. I represent House District 84, which includes East Helena.

I think my takeaway is we only have a finite amount of cleanup money. It's interesting to me that ASARCO was given $4 million for cleaning up something that they caused and it detracted from the 100 million that was estimated, so we get only 96 million. That sounds like a chunk of change, but it's not. We heard tonight that these protections will be required in perpetuity, these measures will be required in perpetuity, and not a hundred percent protected. We're going to have to let some soils go contaminated, some plumes out there. And institutional controls that we heard tonight are really subject to the whims of the leadership of the time.

I just would encourage us as, as communities and a society to think twice as we move forward when we allow permits of construction industries that will most likely require remediation in perpetuity. And frankly, the local communities, like our good council member mentioned, are left holding the bag.

So that's my public comment.

MS. BURNS: Thank you.

Any other public comments tonight?

Luke.

MR. SERATI: My name is Luke Serati. I'm from East Helena.

Back to the runoff out of the east fields, they have that huge pit out there. Why are you not using that for a retaining pond? It just seems, you know, kind of remiss, I guess.

MS. BURNS: Thanks, Luke.

MR. HERRIN: I'm John Herrin, a local valley resident.

Unfortunately, I didn't get here to get the early gist of a lot of the technical part of it, but what I hear is roughly a $50 million budget as we sit now and going forward. And has there been some assessment of what the cost needs are for doing the remediation?

And then is there anything that could be done to look like what, what happened down in Anaconda when they did the golf course repurposing or something that would help the community as far as economic development going forward? I don't know exactly what that would be, but something that would allow the lands that ASARCO has to be used in some capacity that generates jobs and income.

Like the gentleman was saying, and I guess the whole community feels, the loss of ASARCO is a pretty heavy hit to take. And if there's something -- I know a lot of the people here are probably structured on the environmental side of things, but there is a whole socioeconomic side of this thing that seems like it should be part of this whole plan too. Maybe you should look at bringing in some predevelopment folks that could help give you an idea of what, what might be done with these lands and associated lands that would make something that would boost the community and maybe make a difference for the next generation.

MS BURNS: Thank you very much. Again, there's a public meeting tomorrow on redevelopment at City Hall.

Luke.

MR. SERATI: Yeah, one more. It's about cleanup.

All the water that washed out of the -- behind the

Smelter Dam and down through East Helena, I'm just wondering if there's any plans to clean up the creek through East Helena yet and why not.

MS. BURNS: Thanks.

Going once. Going twice.

We're done, guys. Thank you so much for your patience. Please look online at the Corrective Measures Study. The public comment period stays open until May 29th.

So thank you for your interest in this project.

(The public hearing concluded at 8:48 p.m.)

* * * * * * *

COURT REPORTER'S CERTIFICATE

STATE OF MONTANA)
ss.
COUNTY OF LEWIS AND CLARK)

I, CHERYL ROMSA, Court Reporter, residing in Helena, Montana, do hereby certify:

That the foregoing proceedings were reported by me in shorthand and later transcribed into typewriting; and that the foregoing -9- pages constitute a true and accurate transcription of my stenotype notes of the proceedings.

DATED this 17th day of April 2018.

/s/Cheryl A. Romsa
CHERYL A. ROMSA

EPA responses to oral comments provided by at Public Meeting on April 11, 2018 as transcribed in above transcript:

1. Jean Riley
2. Council Member Mike Misowic
3. Jean Riley
4. Jill Cohenour
5. Representative Mary Ann Dunwell
6. Luke Serati
7. John Herrin
8. Luke Serati

EPA Response to Jean Riley – EPA formally responded to Jean Riley, President of Eastgate Village Water & Sewer Association, on November 16, 2018 regarding her comment as transcribed during the oral formal public provided on April 11, 2018. The arsenic and lead levels in the analytical results submitted on October 31, 2018 fall well below the cleanup thresholds and are representative of lead and arsenic values in soil samples relatively the same distance from the smelter. See attached November 16, 2018 letter, below.

EPA Response to Mike Misowic – EPA appreciates the comment on infrastructure improvements for the City of East Helena. The Custodial Trust has proposed and EPA has approved several environmental actions to be implemented for the City. The Trust is currently drilling a new water supply well for the City and participated in the cost of installation of the new waterline to connect the new water supply well to the City water main lines.

EPA Response to Jean Riley - EPA and the Counsel for the Custodial Trust have previously formally responded to Jean Riley, President of Eastgate Village Water & Sewer Association, regarding her comments on the Company Ditch as transcribed during the oral formal public provided on April 11, 2018.

On June 5, 2014, the Montana Department of Natural Resources and Conservation issued a Change Authorization. Paragraph 20 of the Change Authorization states, " Applicant's share of the three water rights will be left instream at the historic point of diversion to mitigate 134.5 AF of the net depletion to Prickly Pear Creek caused by a groundwater well permitted by the Department on July 21, 2009".

EPA is relying on the statement in the Change Authorization and a paragraph in the below referenced letter from the Custodial Trust Counsel to Betsy Burns – "Several years ago, Eastgate applied to the DNRC for a permit to install a new well. On July 21, 2009, DNRC granted the application and issued Beneficial Water Use Permit No. 41I 30026328. This permit was granted with the condition that Eastgate obtain approval to use three Prickly Pear water rights as mitigation in an amount of not less than 185 acre feet. Obtaining approval for mitigation required a separate application. The mitigation application was approved in an authorization (Authorization No. 41I-30050020) dated June 5, 2014. The authorization states that portions of acres formerly authorized for irrigation "will be retired". The DNRC order granting the change authorization indicates that the water historically diverted from the Company Ditch Headgate on Prickly Pear Creek now will be left in the creek and not diverted".

As stated previously, the Company ditch was not damaged during construction. Before the June 5, 2014 DNRC authorization, the Custodial Trust had offered numerous times to deliver water to the ditch. It appears that all of the water rights owned by Eastgate to divert Prickly Pear Creek water to the Company ditch were used as mitigation for the new well.

See EPA formal response to Eastgate Village Water & Sewer Association on the same comments received on the Former ASARCO Facility Interim Measures Work Plan - 2016 and 2016 at https://www.mtenvironmentaltrust.org/final-interim-measures-work-plan-2015-and-2016-may-29-2015/ and attached March 20, 2015 letter below from Stephen Brown to Betsy Burns that was provided in the EPA response to comments on the Final Former ASARCO Facility Interim Measures Work Plan - 2016 and 2016.

EPA Response to Jill Cohenour – See responses to Jean Riley above. Additionally, EPA has provided the March 20, 2015 letter to Jill Cohenour via e-mail on February 16, 2016.

EPA Response to Representative Mary Ann Dunwell – EPA appreciates your comments and is committed to a Corrective Action remedy in East Helena that is protective of human health and the environment. EPA is approving long term (perpetual) performance monitoring and evaluation as a final corrective measure at the East Helena site.

EPA Response to Luke Serati – EPA appreciates your comments on runoff from the East Fields. See the first response to Jean Riley above. The arsenic and lead levels in the analytical results submitted by Ms. Riley on October 31, 2018 fall well below the cleanup thresholds and are representative of lead and arsenic values in soil samples relatively the same distance from the smelter.

EPA Response to John Herrin – EPA appreciates your comments on the economic impacts on the closure of the smelter. EPA and the Custodial Trust are committed to remediating and seeking redevelopment opportunities for the former ASARCO properties. As of the end of 2018, all the former ASARCO property north of Highway 12 has been sold for redevelopment or transferred to the community for public use – East Helena School District and Lewis & Clark County Search and Rescue. During the bankruptcy proceedings, the United States and State of Montana filed claims for the estimated costs of remediation. The bankruptcy court awarded approximately $95 million for the East Helena cleanup, which was a portion of the original claim. METG has approached the remediation in a unique and innovative manner, expending approximately $50 million. The remaining assets will be used for the slag pile remediation, perpetual groundwater monitoring of the arsenic and selenium plumes and the long-term operation and maintenance of the cap on the former smelter site and slag pile, the engineered landfills and the reconstructed Prickly Pear Creek corridor.

EPA Response to Luke Serati - The Custodial Trust completed human health and ecological risk assessments on soil and sediment from Prickly Pear Creek as detailed in Section 4 of the CMS Report. The results indicated that the human health and ecological risks for the soil and sediment do not represent unacceptable human health or ecological risk.

Burns, Betsy

From: Riley, Jean <jriley@mt.gov>
Sent: Wednesday, October 31, 2018 10:57 AM
To: Burns, Betsy; cb.g-etg.com
Cc: Harris, Harley; Kathy Moore; Jan Williams; 'cness@lccountymt.gov'; 'egws@eastgatevillage.org'
Subject: Lead contamination migration
Attachments: Eastgate soil report2018t.pdf

Cindy/Betsy,

At the last public meeting I asked why the soil repositories did not have stormwater containment. I explained that the ditches that run through the Eastgate area were receiving water from the area of the repositories and we were concerned with the potential for contamination. I was told that there the repositories were capped and would not impact the Eastgate area and there was no need for stormwater containment.

Eastgate Village Water Sewer Association completed some sampling of our field that receives water from the ditch culvert were it crosses under Lake Helena Drive and a background sample in the pivot field were ditch flow is not received .

The background sample has Arsenic at 2.55 ug/g and Lead at 11.6 u/g. The sample at the culvert was Arsenic at 8.75 ug/g and Lead at 131 ug/g. This shows that the ditches are moving sediment from the repositories into the subdivisions.

As a resident of the area, why is EPA and the Trust allowing the contamination to move and contaminate previously uncontaminated areas. What is the plan to not clean the ditches, and to prevent further migration of contaminated soils?

I have attached the sampling results to this email for you information. .

Jean Riley
President
Eastgate Village Water Sewer Association

State of Montana
Department of Health and Human Services
Environmental Laboratory
1400 Broadway, Room B 206 Helena, MT 59620
phone: 406-444-2642 fax: 406-444-5527

RESULTS OF CHEMICAL ANALYSIS

Billing ID: G0008640

Eastgate Village
2630 Winchester Dr.
East Helena, MT 59635

Lab #: 1808155-02
Sample ID: Culvert sample

Account ID #:	01784001
PWSID #:	MT0001784
Collected:	08/08/2018
Time:	9:15
By:	Brian Palkovich
Received Date:	08/08/2018
Sample Type:	
Matrix:	Sediment
Report Date:	09/27/2018
Print Date:	09/27/2018

TEST	FLAG	RESULT	UNITS	**EPA Drinking Water Limit	ANALYSIS DATE	METHOD
Metals by EPA 200.7						
Arsenic	x	8.75	ug/g		09/13/2018	200.7
Metals by EPA 200.8						
Lead		131	ug/g		09/13/2018	200.8
Selenium	<	0.50	ug/g		09/13/2018	200.8

Reviewed By: [signature]

Flags: < = less than
> = greater than
H = above EPA limit for drinking water
* = holding time exceeded
** Not all parameters have EPA Drinking Water Limits

Comments: Sieved sample > 2 mesh not analyzed. Three fractions analyzed. Average reported. Results for fraction -2 +35 mesh were 5.1 for As, 55.6 for Pb. Fraction -35 +100 Mesh was 9.14 for As, 127 for Pb. Fraction -100 Mesh was 12 for As, 211 for Pb. (ug/g)

Qualifiers: x All three metal results represent an average of fractions below 2 mesh (GAL).

State of Montana
Department of Health and Human Services
Environmental Laboratory
1400 Broadway, Room B 206 Helena, MT 59620
phone: 406-444-2642 fax: 406-444-5527

RESULTS OF CHEMICAL ANALYSIS

Billing ID: G0008640

Eastgate Village
2630 Winchester Dr.
East Helena, MT 59635

Lab #: 1808155-01
Sample ID: Control Pivot Field

Account ID #:	01784001
PWSID #:	MT0001784
Collected:	08/08/2018
Time:	9:15
By:	Brian Palkovich
Received Date:	08/08/2018
Sample Type:	
Matrix:	Sediment
Report Date:	09/27/2018
Print Date:	09/27/2018

TEST	FLAG	RESULT	UNITS	**EPA Drinking Water Limit	ANALYSIS DATE	METHOD
Metals by EPA 200.7						
Arsenic		2.55	ug/g		09/13/2018	200.7
Metals by EPA 200.8						
Lead		11.6	ug/g		09/13/2018	200.8
Selenium	<	0.50	ug/g		09/13/2018	200.8

Reviewed By: ____________

Comments:

Flags: < = less than
> = greater than
H = above EPA limit for drinking water
* = holding time exceeded
** Not all parameters have EPA Drinking Water Limits

Qualifiers: No Qualifiers were applied to the sample results.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 10 West 15TH Street, Suite 3200
Helena, MT 59626-0096
Phone 866-457-2690
www.epa.gov/region8

SENT VIA E-MAIL

Ref: 8EPR-D

November 16, 2018

Jean Riley, President
Eastgate Village Water & Sewer Association, Inc.
P. O. Box 1220
East Helena, MT 59635

Dear Jean,

Thank you for your e-mail dated October 31, 2018, and for the attached analytical results. The analytical results from the samples collected by Eastgate Village indicate that the levels of lead and arsenic fall below the threshold for cleanup in the *East Helena Superfund Site Operable Unit No. 2, Residential Soils and Undeveloped Land Final Record of Decision, September 2009*. The remedial goal for human receptors in residential areas is to prevent direct contact/ingestion with soil having concentrations in excess of the cleanup level of 1,000/500 ppm lead – once cleanup is triggered by a section of the yard exceeding 1,000 ppm, all sections of the yard with concentration of lead exceeding 500 ppm will be cleaned up.

The arsenic and lead levels submitted on October 31, 2018 fall well below the cleanup threshold and are representative of lead and arsenic values in soil samples relatively the same distance from the smelter. We have seen in surrounding agricultural land, that has been tilled, similar lead and arsenic values to your reported background sample.

I appreciate your commitment to the community of East Helena and to the work being conducted by EPA. Please feel free to contact me at 406-457-5013 if you have any further questions or concerns.

Sincerely,

Betsy Burns
Project Manager

Cc: Cindy Brooks, METG
Harley Harris, Montana NRD
Kathy Moore, Lewis & Clark County
Jan Williams, Lewis & Clark County
Crystal Ness, Lewis & Clark County
Daryl Reed, Montana DEQ
Tom Stoops, Montana DEQ

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(406) 523-2500
Fax (406) 523-2595
www.garlington.com

March 20, 2015

Betsy Burns
U.S. Environmental Protection Agency
Region 8
10 West 15th Street, Suite 3200
Helena, MT 59626

RE: Draft 2015-16 Interim Measures Work Plan Comments Regarding Company Ditch

Dear Betsy:

This letter is in reference to two comments that were sent to the Environmental Protection Agency ("EPA") in response to the Draft 2015-16 Interim Measures Work Plan that recently was released for public comment. The first letter is dated March 2, 2015, and is from Paul Johnson on behalf of the Eastgate Village Water & Sewer Association, Inc. ("Eastgate"). The second letter is dated March 6, 2015, and is from Jerry Hamlin, Trustee for the Hamlin Family Revocable Trust ("Hamlin Trust"). Both letters raise issues as to the effect the Prickly Pear Creek temporary bypass channel interim measure ("IM") has on the diversions to the irrigation ditch known as the "Company Ditch."

On behalf of the Custodial Trust we provide the following background, and responses to each letter.

A. BACKGROUND

Eastgate and the Hamlin Trust jointly own three water rights that list Prickly Pear Creek as the source of supply. The point of diversion for each of the three water rights is in Section 36, Township 10 North, Range 3 West in Lewis & Clark County. The Company Ditch is the name for an irrigation ditch that is shown on some maps as having a point of diversion on Prickly Pear Creek at a point near Smelter Dam. The Custodial Trust owns the property where the point of diversion is depicted on the maps.

According to records maintained in the Montana Department of Natural Resources and Conservation ("DNRC") online database, Eastgate and the Hamlin Trust jointly own the following three water rights:

Water Right No.	Priority	Flow Rate	Acres[1]
41I 89277-00	11/24/1866	1.25 CFS	63.00
41I 89278-00	2/10/1869	1.69 CFS	63.00
41I 89279-00	10/15/1866	421.87 GPM	63.00

When the predecessors of the current owners filed their water right claims with the DNRC in 1981, they described the point of diversion as a headgate located on the east bank of "Smelter Pond" on Prickly Pear Creek. The water right claim files do not indicate how long the diversion point had been at that particular location. At the time the water right claims were filed, water evidently flowed 400 feet through an 18 inch diameter pipeline, then into an open ditch that conveyed water northeast across what is now Custodial Trust property. The records indicate that ditch then passed under U.S. Highway 12 through a 36 inch pipeline, and then further north and east to reach its ultimate place of use on property now owned by either Eastgate, the Hamlin Trust or others.

Several years ago, Eastgate applied to the DNRC for a permit to install a new well. On July 21, 2009, DNRC granted the application and issued Beneficial Water Use Permit No. 41I 30026328. This permit was granted with the condition that Eastgate obtain approval to use three Prickly Pear water rights as mitigation in an amount of not less than 185 acre feet. Obtaining approval for mitigation required a separate application. The mitigation application was approved in an authorization (Authorization No. 41I-30050020) dated June 5, 2014. The authorization states that portions of acres formerly authorized for irrigation "will be retired." The DNRC order granting the change authorization indicates that the water historically diverted from the Company Ditch headgate on Prickly Pear Creek now will be left in the creek and not diverted.

B. RESPONSE TO LETTERS

1. Eastgate Water and Sewer

When the IMs were proposed last year, Eastgate submitted comments objecting to the effect of the bypass channel on its Company Ditch diversion. The Custodial Trust held several conference calls with Eastgate to discuss its concerns, but understood that Eastgate's change application would make Eastgate's concerns moot because the mitigation requirements would require it to leave water in Prickly Pear Creek and would prohibit any diversions. Until receiving Eastgate's March 2, 2015 letter, the Custodial Trust had assumed that Eastgate's issues were resolved because there no longer were any diversions, nor had there been for many years. The June 5, 2014 approval order approved the condition that Eastgate no longer divert water from Prickly Pear Creek, but instead leave it instream.

The Custodial Trust remains willing to listen to any remaining concerns that Eastgate might have. However, in light of the mitigation conditions on its water rights that appear to prohibit diversions,

[1] Note that these acreage figures are overlapping, not cumulative, which means a total of up to 63 acres can be irrigated with all three water rights.

Eastgate's letter does not provide sufficient information for a response. It does not appear to be consistent with Eastgate's current water rights to provide and maintain a diversion point that Eastgate cannot use without violating the mitigation conditions under which it now must operate. The Custodial Trust is, however, willing to work directly with Eastgate to reconcile these positions.

2. Hamlin Trust

The Hamlin Trust does not appear to be part of the Eastgate water rights change authorization mitigation conditions. Mr. Hamlin's March 10 letter makes several assumptions that do not appear to be accurate. First, the letter states that the Custodial Trust has caused a loss of the Hamlin Trust water right. That statement is not accurate. Under Montana law, a water right and a ditch right are separate property rights. The Custodial Trust has not taken any public position, filed any objections, nor made any public statements concerning the validity of the Hamlin Trust water rights. The validity of those rights is a matter between the Hamlin Trust, DNRC and the Montana Water Court.

As to the Hamlin Trust rights to the Company Ditch, the Custodial Trust does not believe that any improper interference has occurred. As part of the process for implementing the Prickly Pear Creek temporary bypass, the Custodial Trust interviewed the Water Commissioner to ensure that the work would not interfere with any active water use. The Water Commissioner assured us that no diversion has occurred since 1999. The records submitted in the Eastgate change authorization proceeding appear to support this statement. We also collected the filings that the Water Commissioner makes with the state district court. Our review of those filings confirmed the Water Commissioner's reports.

The Custodial Trust remains open to meeting with Mr. Hamlin to better understand his plans for continued use of the Company Ditch now that the Eastgate water rights have been carved out of the joint Eastgate-Hamlin Trust water right. Until receiving this letter, however, the Custodial Trust was not aware that the Hamlin Trust had concerns distinct from Eastgate. Because the vast majority of the Company Ditch on the Custodial Trust property remains intact, addressing whatever legitimate concerns Mr. Hamlin can discuss should not be difficult. However, based upon the review that has been done, the Custodial Trust does not agree that any unreasonable interference with the Hamlin Trust diversion and ditch rights has occurred. The Custodial Trust will reach out to Mr. Hamlin and offer to work with him and the Hamlin Trust to determine any necessary steps to restore a diversion structure on the Prickly Pear Creek, similar to what was in place prior to the implementation of the bypass project.

Please let us know if you have any questions about this letter.

Very truly yours,

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