CURRENT CONDITIONS /RELEASE ASSESSMENT
EAST HELENA FACILITY

Prepared for:

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GLOSSARY OF TERMS

Term	Definition
AMSL	Above mean sea level
ANOV	Analysis of Variance
APSD	Acid Plant Sediment Drying Area
ARAR	Applicable or relevant and appropriate requirements
BOD	Biological Oxygen Demand
CAMU	Corrective Action Management Unit
CC/RA	Current Conditions/Release Assessment
CD or Consent Decree	Agreement between EPA and Asarco for Remedial Design and Remediation
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
cfs	cubic feet per second
CLP	EPA Contract Laboratory Procedures
COD	Chemical Oxygen Demand
CSHB	Concentrate Storage and Handling Building
CWA	Clean Water Act
cy	cubic yards
Dross	A copper bearing material which is separated from the lead bullion during the smelting process.
EHLAB	Hydrometrics' laboratory in East Helena, Montana
EPA	U.S. Environmental Protection Agency
EPTOX	Extraction Procedure Toxicity Test

GFAA	Graphite Furnace-Atomic Absorption
gpm	gallons per minute
HDS	High Density Sludge
HDPE	High Density Polyethylene
ICP-MS	Inductively Coupled Plasma- Mass Spectrometry
In situ	In place
LAP	Laboratory Analytical Procedure
LSD	Least Significant Difference
MCL	Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
MPDES	Montana Pollution Discharge Elimination System
MWQB	Montana Water Quality Bureau
NPL	National Priorities List
ppm	parts per million
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision (November, 1989)

SEP	Supplemental Environmental Project
Speiss	A copper-rich material produced from dross in the reverbatory furnace containing up to 17% arsenic.
SPLP	Synthetic Precipitation Leaching Procedure
SVOA	Semi-Volatile Organic Analyses
TCLP	Toxic Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TRC	Total Recoverable
TSC-SLC	Asarco Technical Services Center, Salt Lake City, Utah
TSS	Total Suspended Solids
USGS	U.S. Geological Survey
XRF	X-ray Fluorescence Analysis

RESPONSE TO EPA COMMENTS DATED NOVEMBER 30, 1998 ON THE CC/RA REPORT DATED SEPTEMER 1998.

GENERAL COMMENTS

General Comment 1*. Overall, the report provides a good summary of site history, investigation and remediation activities, data gathered at the facility, and the quality of site data. The majority of data compiled for the facility were gathered under Superfund protocols and appear acceptable for use in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI).*

Response: Asarco appreciates EPA's prompt review of the September CC/RA and the complete set of final comments received by Asarco on December 2, 1998. Asarco is pleased with EPA's determination that the CC/RA is acceptable.

General Comment 2. *As presently structured, the report is limited in scope to areas of concern or operable units developed under the Superfund remedial investigation and feasibility study (RI/FS). Since the RFI will fill in the gaps in existing information for all contaminated areas at the facility (not just the RI/FS operable units), the CC/RA should include one or more sections to the parts of the facility that are not RI/FS operable units.*

One general medium type not included in the identified areas of concern is subsurface soil. Although subsurface soil was a component of some of the RI/FS operable units, it has not been adequately addressed in the report for most of the site. Subsurface soils are likely a primary source of contamination to groundwater at the facility. The report should provide a thorough discussion of existing subsurface soil sampling results, an analysis of the adequacy of this subsurface data for meeting the goals of the RCRA corrective action program, and Asarco's understanding of the nature and extent of subsurface soil contamination on the basis of the existing information. Specific discussion of subsurface soils in each chapter of the report would provide a much clearer description of potential vadose and saturated zone source areas or data gaps.

Response: All available data are presented for the site in the CC/RA. The CC/RA units do not directly correspond to the RI/FS Operable Units and this is shown in the CC/RA report on Figure 1-1-2.

As per EPA's request the CC/RA report has been reorganized to provide more specific discussion on subsurface soils (see Section 4.1.2 in the Revised CC/RA report).

General Comment 3. *Although data gathered during the RI/FS indicate that impacts to groundwater from slag appear to be smaller compared to other impacts at the site, the database to support this conclusion is limited. Therefore, the slag pile should be included in the RFI. No soil borings have been completed within the main slag pile area and no monitoring wells have been installed in this area. Therefore, the nature and extent of slag-*

related contamination has not been fully characterized. The lack of groundwater monitoring wells within the large area of the slag pile makes it difficult to define the boundaries of groundwater plumes in this area or the source of groundwater contamination downgradient of the slag pile. The extent of a perched water zone, under portions of the main plant site penetrated in wells DH-23 and DH-9, is not known. Water quality data collected from well DH-23, which is screened in a perched water zone within the slag, should not be used to define both arsenic and zinc plumes in the shallow water-bearing zone. The RFI should more fully characterize slag chemistry, hydrology of the groundwater systems in the slag area, and impacts to groundwater and surface water from the slag.

Responses

- The RI included a very extensive evaluation of the leachability of the slag. This evaluation has been incorporated into the revised CC/RA report.
- Although wells were not completed in the slag pile as part of the RI due to the difficulty of drilling in this media, wells were completed immediately upgradient and downgradient, test pits were installed in the slag and the quality of infiltration was measured directly in the slag test basins. The results of these investigations have been incorporated into the revised CC/RA report.
- All available data indicate that leachable concentrations of arsenic from the slag are low compared to observed concentrations in groundwater and that the estimated arsenic load from the slag accounts for a very small fraction of what is observed in groundwater on the site. Likewise there is little evidence of impacts to Prickly Pear Creek. Concentrations of arsenic and metals in creek water generally remain below water quality standards and freshwater aquatic criteria. (An exception is copper, which is elevated above freshwater aquatic criteria both upstream and downstream of the plant site. For this reason, EPA ROD limits for Lower Lake were based on Prickly Pear Creek background concentrations.)
- Asarco presently sees little benefit to be gained from additional detailed investigation of hydrologic conditions and water quality conditions beneath the slag pile given the absence of measureable impacts to downgradient receptors. In fact, the Consent Decree indicates the slag pile will not be a primary focus of remedial investigation or corrective actions. Although there is no present evidence of groundwater impacts from the slag pile, EPA has noted that additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves.

General Comment 4. *The report does not describe all historical releases of plant water, acid plant water, acid and other materials. Specifically, the January 28, 1998 300 gallon spill is not included. Provide a description of limitations in records regarding historic releases.*

Response:

All records of releases are provided in this report. For these releases, a description of the location, date, volume and what was released are indicated on Exhibit 5-1-1. The 300 gallon sulfuric acid release to soil adjacent to the acid plant sump on January 28, 1998 was described in Exhibit 5-1-1 under the column labeled Acid Plant. Asarco has updated Exhibit 5-1-1 to reflect all historic spills on record through 1998.

Asarco has historically retained all records of releases that require notification to the National Response Center. There are no records of historical releases before the October 1992 fire, which destroyed the Asarco Plant Environmental Department files. Between 1992 and 1997, all reportable releases, in accordance with National Response Center requirements, were recorded. During the 1992 to 1997 period, minor non-reportable releases were not tracked by plant operations personnel and, as a result, are not part of the Asarco Plant Environmental Department files. In 1997, Asarco initiated a more detailed record keeping effort that includes reportable releases, as well as minor releases that are not considered reportable per National Response Center requirements. Updated Exhibit 5-1-1 in the revised CC/RA report includes both reportable and non-reportable releases that have been recorded through 1998.

General Comment 5. *Portions of Section 3.0 were compared to the information in Appendices 3-1-1, 3-1-2, and 3-1-3. Approximately 10 percent of the data were cross checked. A number of discrepancies were noted (as outlined below) and should be corrected or clarified. A thorough review of Section 3.0 and the appendices should be conducted to identify and correct other possible discrepancies.*

- *Section 3.2.4.3, Appendix 3-1-1, Review of Wilson Ditch and Remedial Alternatives. The text states that the data were reviewed using standard procedures, while the appendix states that no data review was completed.*
- *Table 3-2-1, Appendix 3-1-2. The data for 15 sampling locations listed in Table 3-2-1 were compared to the data in Appendix 3-1-2. The following inconsistencies were noted:*

Site Code DH-1: Table 3-2-1 lists two samples for the comprehensive RI/FS, while Appendix 3-1-2 contains three sets of data.

Site Code DH-13: Table 3-2-1 lists two samples for the comprehensive RI/FS, while Appendix 3-1-2 contains three sets of data.

Site Code EH-60: Table 3-2-1 lists two samples for the comprehensive RI/FS, while Appendix 3-1-2 contains three sets of data. Also in Table 3-2-1, the site code is incorrectly listed as EH-6 instead of EH-60.

Site Code LHULST: Table 3-2-1 lists the date of sample collection as 7/27/88 for the comprehensive RI/FS sample, while Appendix 3-1-2 lists it as 12/6/88.

Site Code LOWER LAKE: Table 3-2-1 lists five samples for the phase 1 study while Appendix 3-1-2 contains four sets of data. Also, Table 3-2-1 does not list any samples for post-RI monitoring, while Appendix 3-1-2 contains 18 sets of data.

Site Code ST-2: Table 3-2-1 lists four samples for the comprehensive RI/FS, while Appendix 3-1-2 contains five sets of data.

Site Code ZP-1: Table 3-2-1 does not list any samples for the comprehensive RI/FS, while Appendix 3-1-2 contains four sets of data.

Site Code SITEA: Table 3-2-1 does not list any samples for the phase 1 study, while Appendix 3-1-2 contains one set of data.

- *Table 3-2-1, Appendix 3-1-3. The data for 24 sampling locations listed in Table 3-2-1 were compared to the data in Appendix 3-1-3. The following inconsistencies were noted:*

Site Code LH-34S: Table 3-2-1 lists three samples for post-RI monitoring, while Appendix 3-1-2 contains seven sets of data.

Site Codes APSD-1S through APSD-4S and APSD7S through APSD14S: The listed sampling locations are not in Table 3-2-1. Appendix 3-1-3 contains data for each of the listed sampling locations.

- *Table 3-2-3, Appendix 3-1-3: Table 3-2-3 states that 100 samples were collected from piles #3 through #119. Appendix 3-1-3 contains 101 sample results.*

Response:
A thorough review of Section 3.0 and associated appendices has been completed and all discrepancies have been corrected.

General Comment 6*. Overall, Section 4.0 of the report is well organized and structured to address most of the major sources of contamination and environmental media at the site with the exception of subsurface soils and the discussion of metals (other than arsenic) in groundwater at the plant site. For example, the report largely ignores dissolved cadmium, zinc, and lead results, identification of the cadmium plume, and discussion of fate and transport of cadmium, zinc and lead in groundwater at the site even though drinking water maximum contaminant levels (MCL) or action level for each are exceeded in groundwater.*

Response:

- As described in the response to Comment 2 above, the revised CC/RA report has been slightly reorganized to more specifically address subsurface soils (see Section 4.1.2).
- As indicated in the water quality discussion, metals are present at varying concentrations throughout the plant site, but typically do not exceed Montana Water Quality Standards off-site. As a consequence, the CC/RA report focuses on arsenic, which is the primary constituent of concern. However, in response to EPA's comment, a discussion of cadmium, lead, and zinc has been added to the water quality and transport sections and includes discussion of relevant water quality standards.

General Comment 7. *The quality of tables and figures in Volume I of the report could be improved. Sample and well locations on many of the maps and figures are difficult to read, and some maps are missing scales, legends, reference locations, or have mislabeled figure numbers. Tables are of mixed format and often lack definitions of acronyms and references. All tables and figures should be reviewed for errors and omissions and corrected and revised, where necessary, for clarity and legibility.*

Response: The EPA comment suggests many of the figures and tables have problems, but provide specific comments regarding errors on only 3 of the 47 figures in the report and 5 of 36 tables. As noted in the meeting between Asarco and EPA, it is possible some of the quality issues noted in the written comment occurred as a result of copy fading from reproductions during EPA's review. All of the tables and figures have been examined for errors in the revised CC/RA report. Where errors or quality issues have been noted, corrections have been made in the revised report.

SPECIFIC COMMENTS

Specific Comment 1. *Section 3.2.2. Page 3-11. Slag is included in the list of data available for plant site soils; however, Section 3.2.2.3 states that no data are available. If no data for slag are available, the bullet listing slag under Section 3.2.2. and Section 3.2.2.3 should be removed from the report.*

Response: No post-RI/FS data were collected on slag. The text will be modified accordingly.

Specific Comment 2. *Table 3-2-4, Page 3-14. The text in Section 3.2.3.1 states that one post treatment sediment sample was collected during the bench scale test and that three sludge samples were collected during the phase I pilot test. However, these samples are not included in Table 3-2-4. A new column should be added to the table that lists the solid matrix samples and the analytical parameters.*

Response: An additional column has been added to the table listing solid matrix samples and analytical parameters.

Specific Comment 3. *Section 3.2.3.5, Page 3-24. The text states that soil under the Speiss Granulating Pit was excavated in July 1995 but does not list a depth of excavation. The approximate depth of excavation should be added to the text.*

Response: The approximate depth of excavation under the Speiss Granulating Pit was 17 feet (originally described in a January 26, 1996 letter to Scott Brown, EPA). A subsurface soils section (4.1.2) has been added to the report which provides a more detailed discussion of soil excavation in the Speiss Pit area.

Specific Comment 4. *Section 3.2.4.1, Page 3-26 and Section 3.2.4.3, Page 3-29. The text in these sections states that the data were validated using standard procedures. However, the meaning of standard procedures is not defined until Section 3.3. A reference to Section 3.3 should be added to each of these sections.*

Response: A reference to Section 3.3 has been added to appropriate sub-sections in Section 3.0.

Specific Comment 5. *Table 3-3-1. Table 3-3-1 should be added to the table of contents.*

Response: Table 3-3-1 has been added to the table of contents.

Specific Comment 6. *Section 3.3.1.2, Page 3-34. The first bullet under field blanks states that field blank contamination occurred from fall 1986 through fall 1994 sampling events but does not state what the contaminants were. Field blank contaminants should be added to the bullet.*

Response: Field blank contaminants have been added to the field blank bullet.

Specific Comment 7. *Section 4.1.2, Page 4-11. The last sentence of the third paragraph on this page states that the ESD allowed the lower lake sediments to be stored on a pad under a tarp. This is not an accurate summary of why the sediments are stored in this manner. This paragraph should be revised appropriately.*

Response: Prior analyses of soil cores from Lower Lake indicate that these sediments would likely fail TCLP (see Appendix 3-1-1, "LLB series data"). Accordingly, the ROD required that the dewatered sediments be stored in the concentrate storage and handling building (CSHB) until they could be smelted. During remedial design, it was discovered that the volume of dried sediments would be too great to store in the CSHB. A Short-Term Storage Plan (Hydrometrics 1997d) was prepared and submitted to EPA. Following EPA review of the Short-Term Storage Plan, a temporary cover for the dewatered sediments was implemented. As a result, the sediments currently reside in a short-term storage facility located in the ore storage area. The sediments are being stored in a protected environment to prevent contamination of the adjacent area from dispersion of the sediments by wind and water. The sediments are located on a concrete pad to prevent contact with adjacent soils. A containment berm around the perimeter of the sediment pile diverts run-on. A geomembrane cover over the sediments prevents wind and water dispersion and eliminates subsequent generation of leachate. This discussion has been added to the revised CC/RA in Section 4.1.3.

Specific Comment 8. *Section 4.1.3, Page 4-12. The report discusses infiltration tests on fumed and unfumed slag piles. The report, however, does not present information on the potential water quality impacts posed by each type of slag material. Some discussion on variations in the chemical composition of the slag pile materials should be presented.*

Response: The report presents both extraction results and test basin results for fumed versus unfumed slag. Additional discussion of the slag investigation has been added to the revised CC/RA report (see Section 4.1.4).

Specific Comment 9. *Table 4-1-4, Page 4-13. The table indicates a measurement date of 9/11/98 for the unfumed slag pile. This date appears to be out of chronological order or in error and should be corrected to 9/11/87. Also, an explanation for the lack of observed change in the retention basins for the 9/11/87 measurement event should be provided in the notes section of the table.*

Response: The date referenced is a typographical error and should read 9/11/87. No water level measurements were taken in September '87. The error has been corrected in the revised CC/RA report.

Specific Comment 10. *Section 4.1.3, Page 4-14. The last paragraph discusses the difference between Extraction Procedure (EP) Toxicity data and toxicity characteristics leaching procedure (TCLP) analytical data apparently from analysis of slag material. However, no TCLP data were presented. A table that compares EP Toxicity and TCLP data from slag should be included so that a direct comparison can be easily made for contaminants of concern. In addition, a comparison of all leachability data including bottle roll tests and infiltration test basin data should be included.*

Response: The paragraph in question refers to the differences between EP toxicity data and bottle roll and slag test basin results. The reference in the text to TCLP data should read EP Toxicity. The text has been modified accordingly (see Sections 4.1.4.1) and Figures 4-1-11 through 4-1-14 have been added to show a comparison of the results of different tests for arsenic, cadmium, lead and zinc.

Specific Comment 11. *Section 4.1.3, Page 4-15. The report states that, "Based on observed recharge rates in the slag test basins and associated water quality data, the slag pile would account for less than 1% of the observed arsenic at monitoring wells DH-5 and DH-10." A more complete explanation of how this calculation was made should be presented.*

Response: A complete explanation of the loading calculation and associated assumptions has been added (see Figure 4-1-15).

Specific Comment 12. *Section 4.1.3, Page 4-15. The report states that, "The potential for runoff from the slag in the slag pile area is very low…" This statement assumes that all infiltration in the slag pile results in direct recharge to groundwater. Overall, the report does not present a model for infiltration and runoff from the slag piles. Internal stratigraphy within the slag pile and potential low-permeability sediment below the pile may prevent infiltration and cause perched zones within the slag pile and discharge of water at the base of the pile. Discharge of contaminated water from the slag pile may result in the observed* *arsenic loading in the creek during high flow (precipitation) events. These high flow events may also erode slag material into the creek and "flush" perched water within the slag pile. A more complete and detailed evaluation of water movement within the slag pile and the connection to both groundwater and surface water should be presented in the report or be conducted as part of the RFI.*

Response:

- Additional discussion has been added to the revised CC/RA report concerning infiltration and runoff in the slag pile area.
- There is no indication that perched zones result in discharge from the base of the slag pile. Fine-grained marsh deposits are not present in wells between the slag pile and Prickly Pear Creek downgradient of the site. Field observation shows no evidence of seepage from the slag pile face. While it appears evident that the fine-grained perched layer underlies some of the slag pile, down-gradient DH-6 and DH-10 show no evidence of the layer (see Figure 4-1-16 in the revised CC/RA report).
- The presumption that discharge of water from the slag may have significant repercussions on water quality is not borne out by slag test data and down-gradient groundwater quality data. Field and laboratory leaching tests indicate water quality produced from water percolating through the slag is generally better than ambient groundwater beneath the site. Likewise, no measurable water quality impacts have been noted in the reach of Prickly Pear Creek adjacent to the Slag Pile (see Sections 4.1.4.1 and 4.1.4.2 of the revised CC/RA report).
- The reviewer speculates that perched water within the slag may be a potential cause for the load increase noted in Prickly Pear Creek during a high flow event. However, leaching of slag would cause a dissolved metals increase. There has been no evidence of an increase in dissolved metal load associated with high flow events as postulated by the reviewer. In addition, as described in Section 4.1.4.2 in the revised CC/RA report, total metal concentration differences upgradient and downgradient of the slag pile are very small.

Specific Comment 13. *Section 4.1.3, Page 4-16.* *No flood statistics for Prickly Pear Creek or erosion mitigation measures are presented in this section. This information, along with the predicted stage level of the creek, should be presented to evaluate the potential for erosion of the slag pile during heavy runoff or flood events.*

Response: None of the water quality data indicate slag has measurable impacts on Prickly Pear Creek water quality. As described in Section 4.1.4.2 of the revised CC/RA report, arsenic and metal concentrations during the highest flow events were lower downstream of the slag pile than upstream. The metals loading described in the first version of the CC/RA report is attributed to unavoidable flow measurement error. While erosion of the slag pile undoubtedly occurs during flood conditions, correspondingly elevated concentrations of arsenic and metals downstream of the slag pile have not been observed.

Specific Comment 14. *Section 4.2.2.2, Page 4-22.* *The report discusses remediation conducted at the Speiss Pond and pit area conducted in 1988; however, there is no discussion of the volume or type of soils removed from the area or results of analytical sampling. This information should be presented in order to evaluate potential impacts to groundwater for this source area.*

Response: 2500 cubic yards of soil were removed from the Speiss Pond and surrounding area during the initial phase of remedial action in 1988. An additional 250 cubic yards of soil were removed in 1992 when the remaining portion of the original settling pond was removed. In 1995, the Speiss Pit area was excavated and an additional 275 cubic yards of soil were removed. A discussion of excavated soils and analytical results has been added to the revised CC/RA report as Section 4.1.2 – Subsurface Soils).

Specific Comment 15. *Figure 4-2-2, Page 4-22.* *The figure presents a general schematic for the process water circuits at the facility. However, the color coded circuits should be defined in the legend. In addition, another figure showing the general chemistry (such as pH and total dissolved solids [TDS] content) of the various process water circuits would also be useful for understanding water quality changes in relation to changes in plant water management.*

Response: Figure 4-2-2 has been revised to provide more information on water sources and general water circuit chemistry.

Specific Comment 16. *Figure 4-3-1, Page 4-34.* *It is difficult to identify the locations of the facility fenceline and boundaries on the figure; and the figure also lacks a legend. The figure should be corrected as noted.*

Response: A legend and the plant site boundary have been added to this figure.

Specific Comment 17. *Table 4-3-1, Page 4-42.* *The table presents average water quality data from four surface water monitoring stations on Prickly Pear Creek; however, the table lacks further statistical evaluation parameters that may indicate bias in the data sets. While this information is presented in an Appendix, at a minimum additional parameters such as standard deviation, minimum value and maximum value should also be included in the table.*

Response: Table 4-3-1 has been revised to include more complete statistical information for the four Prickly Pear Creek monitoring stations, including number of analyses for each listed parameter at each site (n), average concentration, minimum concentration, maximum concentration, and standard deviation. Revisions to Table 4-3-1 also included recalculation and checking of the reported statistics. As a result, some of the values shown in the table are slightly different from the previous version.

Specific Comment 18. *Section 4.3.1.2, Page 4-42.* *In summarizing the RI/FS report (1990), the report states that "Arsenic concentration increases were at a maximum during periods of* *low flow." It is unclear from this statement as to when or where arsenic concentration increases were observed. Additional information should be added to fully describe the location and extent of elevated arsenic concentrations during the low flow period.*

Response: Arsenic concentrations generally increase slightly at all stations under seasonal low flow conditions. Arsenic concentrations between PPC-3 and PPC-7 (upstream of the plant site to downstream of the plant site) were at a maximum during periods of low flow; increasing an average of 0.014 mg/L for the 1984-1986 data and 0.008 mg/L for the 1986-1988 data. Additional discussion/clarification has been added to the text in Section 4.3.1.2 (see number 3).

Specific Comment 19. *Section 4.3.1.2, Page 4-47. The report discusses total arsenic data and loading to Prickly Pear Creek; however, these data are not presented in graphical form. The report also refers to Figure 4-3-5 concerning an increase in arsenic loading during high runoff (May 1994), but this event is not labeled on the figure. Additional clarification and comparative figures for total versus dissolved arsenic for the critical stations discussed in the report should be included.*

Response: Graphs of total and dissolved arsenic load were presented in this section as Figures 4-3-6 and 4-3-7. The reference to Figure 4-3-5 was incorrect and should have read 4-3-6. These graphs have been updated and are presented as Figures 4-3-8 and 4-3-9 in the revised CC/RA report. Two additional figures (Figures 4-3-6 and 4-3-7) have been added to the report to show in-stream total and dissolved arsenic concentrations.

Specific Comment 20. *Section 4.3.1.3, P.4-52, First Item. In reference to the Upper Lake sediments, the report states:" These fine sediments have accumulated in the slow velocity conditions of Lower Lake." Lower Lake should be changed to Upper Lake.*

Response: The reference to Lower Lake has been changed to Upper Lake.

Specific Comment 21. *Section 4.3.3, Pages 4-57 to 4-58. The report discusses 5-year, 25-year and 100-year 14-hour storm events but does not indicate the amounts of precipitation that were calculated for these events to design the storm water system modifications. These data should be included in the report so that stormwater volume presented for these events can be calculated.*

Response: Precipitation amounts for the 5-year, 25-year, and 100-year 24-hour storm events were obtained from an atlas published in 1983 by the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS), the NOAA Atlas 2 – Precipitation-Frequency Atlas of the Western United States, Volume 1-Montana. Precipitation data were included as one input variable in a hydrologic runoff model used to calculate runoff volumes for the Asarco plant site. Detailed model calculations and assumptions are given in the Asarco East Helena Storm Water System Improvement Project Design Criteria & Conceptual Design Summary (Hydrometrics, 1996). References to the

NOAA data source and the conceptual design summary document have been added to the text of the CC/RA report in Section 4.3.3, along with the precipitation amounts used in modeling; however, it should be noted that calculation of runoff volumes requires more than rainfall amounts and drainage area measurements, including infiltration parameters, antecedent soil moisture conditions, etc. For a complete discussion of storm event modeling, see the conceptual design summary document cited above.

Specific Comment 22. <u>Section 4.4.1, P.4—66, First Bullet Item.</u> *The item identifies a perched groundwater system within slag and fill deposits overlying marsh deposits at the plant site. A lithofacies map identifying the location and estimated extent of all perched and shallow water-bearing deposits should be included as an exhibit within the report.*

Response: A map showing the approximate extent of all perched water-bearing strata has been added to Exhibits 4-4-1 and 4-4-2.

Specific Comment 23. <u>Section 4.4.2.2, Page 4-73 to 4-79.</u> *The report generally discusses the groundwater flow direction, presumably of the shallow water table aquifer at the site. The report does not, however, present information or discuss the potential for the vertical movement of groundwater. These factors should be presented in the discussion of groundwater movement at the site.*

Response: A discussion of vertical gradients and vertical flow has been added in Section 4.4.2.2.

Specific Comment 24. <u>Section 4.4.3.1, Page 4-89.</u> *The last sentence in the third paragraph should be corrected to "This indicates geochemical attenuation of arsenic…"*

Response: The text has been corrected in the Revised CC/RA report as noted.

Specific Comment 25. <u>Table 4-4-6, P.4-86 and Table 4-4-7, P.4-90.</u> *These tables present overall summary statistics for groundwater at the east and west plant sites. Additional information or tables are not presented that would allow comparison of these data to preliminary remediation goals such as MCLs, Montana water quality standards or freshwater aquatic toxicity criteria. This information and discussion of criteria that have been exceeded should be presented in the groundwater quality section of the report.*

Response: Applicable water quality standards have been added to the revised CC/RA report as Table 4-3-2 and, references and discussion have been added to the text in Section 4.4.3.1.

Specific Comment 26. <u>Section 4.4.3.1, Pages 4-81 to 4-110.</u> *Considerable portions of the inorganic constituent discussion for groundwater are presented for arsenic; however, cadmium and lead are also present at levels exceeding the MCL or action level in samples from several wells both in the east and west plant site areas but is not discussed in this* *section of the report. Data concerning cadmium and lead in groundwater should be presented and discussed.*

Response: Maps showing the distribution of cadmium, lead and zinc in groundwater have been added to the revised CC/RA report as Figures 4-4-12, 4-4-13 and 4-4-14. Appropriate discussion has been added to the text in Section 4.4.3.1 of the revised CC/RA report.

***Specific Comment 27**. <u>Table 4-4-10, Page 4-112.</u> The table does not report the sample dates for the results or detection limits for benzene, toluene, ethylbenzene and xylene (BTEX) analyses. These data, if available, should be included in the table.*

Response: The table contains averages based on sampling over the period of record. Detection limits and date ranges vary and are not readily synthesized into a summary format. General information on date ranges and detection limits have been added to the notes with reference to the database appendix (Appendix 3-1-3) for information on specific samples (see Table 4-4-11 in the revised CC/RA report).

***Specific Comment 28**. <u>Section 4.4.3.2, Pages 4-113.</u> The report states that "Analysis of volatile and semi-volatile organics were conducted during the RI. The results showed no detectable volatile organics …." It is unclear if the results are from the 1990 comprehensive RI/FS, post-RI monitoring, or from the May 1997 sampling event for organic constituents. The statement should be clarified and organic summary data tables revised to indicate sampling dates.*

Response: The text has been modified in Section 4.4.3.2 of the Revised CC/RA report to note the data referenced in the table is from both the Comprehensive RI/FS (pre-1990) period and the post-RI monitoring period.

***Specific Comment 29.** <u>Figure 4-5-2, P.4-120.</u> The figure presents an Eh-pH diagram for arsenic at 25°C. Field stability of various arsenic species is likely temperature dependent. If available, an Eh-pH diagram of arsenic species at or near groundwater temperature at the plant site should also be presented along with other redox species of concern such as iron and manganese.*

Response: The arsenic Eh-pH diagram referred to is a standard reference illustrating general arsenic equilibrium relationships and the stability of various species under differing redox and pH conditions. Free energy data and equilibrium chemical equations used to construct Eh-pH diagrams are typically tabulated for standard conditions (i.e. elements in their standard states, 25°C temperature, 1 atmosphere pressure). Equilibrium constants can be recalculated for different temperatures using the van't Hoff equation:

$$\log K_2 = \log K_1 - (\Delta H_r^\circ/2.303R \times [1/T_2 - 1/T_1])$$

where K_1 = equilibrium constant at temperature T_1;
K_2 = equilibrium constant at temperature T_2;
ΔH°_r = enthalpy of reaction (kcal/mole); and
R = 1.98 cal/ Kelvin degree K/mole
and temperatures are in degrees (K).

The Eh-pH diagram is useful only as a general guide to stable species under given Eh and pH conditions, and recalculation of equilibrium constants does not alter the features of the diagram in any meaningful way. For example, the stability boundary between the species $H_2AsO_4^-$ and $H_3AsO_3^{\circ}$ shown on Figure 4-5-2 was recalculated for a temperature of 10° C rather than 25° C. This transformation results in a shifting of the boundary less than 0.1 inches toward the top of the diagram at the scale shown in Figure 4-5-2. Other stability boundaries would be similarly affected by recalculating equilibrium relationships at a different temperature. Since the Eh-pH diagram is used only in a general way, and not quantitatively, a new diagram at 10° C (more representative of groundwater temperatures) would not be particularly useful. Text has been added to the CC/RA report to clarify that the diagram at 10° C would not look significantly different from Figure 4-5-2 (at 25° C).

Eh-pH diagrams for the redox-active elements iron and manganese have been added to the revised CC/RA report for reference (see Figures 4-5-3 and 4-5-4).

Specific Comment 30. <u>*Section 4.5, P.4-115.*</u> *The report states that "Visual evidence of petroleum hydrocarbons was also observed in plant site area groundwater…" It is unclear what visual evidence could have been present other than light nonaqueous phase liquid (LNAPL) or whether the reference should be to visible soil contamination.*

Response: The text has been revised to omit the word "visible" and add a reference to the hydrocarbon sheen or odor noted in some plant site wells.

Specific Comment 31. <u>*Section 4.5.3.1, Pages 4-128 to 4-129.*</u> *The report presents a flow path model for the changes in redox chemistry and arsenic concentrations downgradient of the Lower Lake area; however, no graphical presentation of these data is provided as was done for the Speiss Pond area. Flow path water quality graphs should be provided for the Lower Lake area to provide a summary of concentration data discussed in the text of the report.*

Response: Unlike the Speiss Pond area, monitoring wells are not present along a distinct flow path on the plant site downgradient of Lower Lake due to the presence of the slag pile and associated difficulties with well completion. Downgradient of the slag pile, monitoring wells are present along a flow path. Graphs summarizing Lower Lake and downgradient well water quality (Figures 4-5-7 and 4-5-8) have been added to the CC/RA report. However, it should be emphasized that, unlike Figures 4-5-5 and 4-5-6 for the Speiss Pond area flow path, these graphs do not represent a coherent flow path downgradient of Lower

Lake (for reasons cited above), but rather illustrate changes over time at wells adjacent to Lower Lake and downgradient of Lower Lake and the slag pile.

Specific Comment 32. *Section 4.5.3.2, Page 4-132. The report suggests that a potential cause of arsenic concentration increases at well EH-60 is due to the presence of organic constituents (dissolved petroleum compounds) in the groundwater. The report later concludes that the presence of organic constituents is probably not the cause of the observed concentration increases. The discussion of arsenic mobility and its relation to dissolved organic compounds should be consistent throughout the report. Redundant discussion should be omitted from this section.*

Response: The discussion of organics at well EH-60 in Section 4.5.3.2 is consistent with the earlier general discussion of groundwater organics in Section 4.4.3.2. Text has been added to the CC/RA report to clarify that, in examining the arsenic trend at a specific well (EH-60), organics in groundwater have been considered as a potential cause, but that significant influence on arsenic mobility by organics is unlikely due to the factors discussed. These factors include the generally low organics concentrations at EH-60, the lack of a trend in organics concentrations over time at well EH-60, and the lack of an overall statistical correlation between organics concentrations and arsenic speciation or concentration in west plant site and downgradient wells. It is appropriate to reexamine general conclusions regarding arsenic transport in groundwater when considering local water quality trends at a specific well site.

Specific Comment 33. *Section 4.5.3.2, P.4-134. The paragraph discussing the gradual advance of arsenic plume should be numerically labeled as the third potential cause of observed changes in samples from well EH-60.*

Response: The cited paragraph has been labeled as suggested.

Specific Comment 34. *Section 5.1, Table 5-1-1. Table 5.1.1, Release Assessment Summary, should include subsurface soil as a separate CC/RA area in order to clearly evaluate the adequacy of data for this medium.*

Response: A subsurface soil section has been added to Table 5-1-1 and to Table 5-2-1.

Specific Comment 35. *Section 5.1, Table 5-1-1, Slag Pile. The current data base of the slag area is not adequate to conclude that no further action is required. No soil borings have been completed within the main slag pile area and no monitoring wells have been installed in this area. Therefore the nature and extent of the slag have not been fully characterized. The lack of groundwater monitoring wells within the large area of the slag pile makes it difficult to define the boundaries of groundwater plumes in this area or the source of groundwater contamination downgradient of the slag pile. In addition, the extent of a perched water zone present under portions of the main plant site penetrated in wells DH-23 and DH-9 is not known. The RFI should more fully characterize slag chemistry, the* *hydrology of groundwater systems in the slag area, and impacts to groundwater and surface water from the slag.*

Response: As previously noted in response to General Comment 3 and to Specific Comments 8 and 12, the slag chemistry has been well documented relative to impacts on downgradient receiving waters. Additional text has been added (see Section 4.1.4) to the revised CC/RA report providing additional discussion of these issues. Asarco questions the benefits that would be gained from an expanded RFI investigation of this operable unit which would be very difficult to complete due to the difficulty of completing wells in the slag. Asarco has proposed continued monitoring and investigation of surface and groundwater in the vicinity of the slag pile. The need for additional detailed investigation of the slag has not been demonstrated based on any observed water quality results. EPA has noted that although there is no present evidence of groundwater impacts from the slag pile, additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves. One or more wells would indeed fill a data gap beneath the slag pile; however, as discussed in the November meeting between Asarco and EPA, the need for an expanded investigation of the slag pile is not presently evident based on existing data.

Specific Comment 36. <u>*Section 5.1, Table 5-1-1, Former Thornock Lake.*</u> *Although additional data specific to Thornock Lake are not required because the lake has been removed, the nature and extent of residual subsurface soil contamination in the vicinity of the lake should be clarified. There may be a need to investigate residual contamination under RFI (see Revised Table 5-1-1).*

Response: Post excavation soil sampling was conducted at nine sampling locations within the footprint area and demonstrated that the site met the remedial action goals of the ROD. Additional discussion of these results has been provided (see Section 4.1.2). No additional data needs have been identified at this time, but EPA has raised the possibility that additional investigation may be required under the RFI.

Specific Comment 37. <u>*Section 5.1, Table 5-1-1, Former Acid Plant Water Treatment Settling Facility.*</u> *Although soil underlying the acid plant water treatment settling pond has been removed, the nature and extent of residual subsurface soil contamination in the vicinity of the lake should be clarified. There may be a need to investigate residual soil contamination under the RFI.*

Response: The following statement has been added to the need for additional data, "EPA has indicated that there may be a need to investigate residual soil contamination under the RFI."

Specific Comment 38. <u>*Section 5.1, Table 5-1-1, Prickly Pear Creek.*</u> *There appears to be a need to collect additional data during the RFI to better characterize potential erosion of slag during floods and potential impacts of the slag to surface water and groundwater.*

Response: None of the water quality data indicate slag has measurable impacts on Prickly Pear Creek water quality. As described in Section 4.1.4.2 of the revised CC/RA report, arsenic and metal concentrations during the highest flow events were lower downstream of the slag pile than upstream. The metals loading described in the first version of the CC/RA report is attributed to unavoidable flow measurement error. While erosion of the slag pile undoubtedly occurs during flood conditions, correspondingly elevated concentrations of arsenic and metals downstream of the slag pile have not been observed.

Specific Comment 39. *Section 5.2, Table 5-2-1. Evaluation of Interim and Final Remedial Measures, should be modified to address concerns with subsurface soils, the slag pile, and Prickly Pear Creek as outlined in comments on Table 5-1-1 above.*

Response: Changes have been made as indicated in Comments 33, 35 and 38.

Specific Comment 40. *Section 6.2.2.1, Lower Lake, P.6-7. The water in Lower Lake has not yet met the remedial action goals even after the lake sediments were dredged. However, no explanation for this has been provided. Potential contaminant sources inhibiting the improvement of quality in Lower Lake should be identified and quantified. Investigation of surface and subsurface soil around Lower Lake should be added to the section titled Need for Additional Data and/or Remedial Action.*

Response: The report has been modified to provide additional discussion of remedial action goals in Lower Lake. Recent water results for Lower Lake indicate an arsenic concentration of 0.049 mg/L and water quality continues to improve due to the effects of dredging and HDS water treatment. It should be noted that Lower Lake remediation, in accordance with the Process Pond ROD, was to include excavation of sediments in the former drying area adjacent to Lower Lake and treatment of Lower Lake water. These steps have not yet been implemented. Based on recent improving Lower Lake water quality trends, direct treatment of Lower Lake may not be needed. In addition, as described in Table 5-2-1, other actions such as groundwater gradient controls and capping remain options for Lower Lake.

Detailed data exist on Lower Lake sediment and subsurface soils in the sediment drying pad area and in the area between Upper and Lower Lake. These data are in Appendix 3-1-3 of the CC/RA report. Additional subsurface soil concentration maps showing the subsurface data in the Lower Lake area have been added to the revised CC/RA report in Section 4.1.2. The need for remedial action in the Lower Lake area has already been identified and is described in associated sections of the report. The need for remedial action in these areas has been noted and a reference has been added to Table 5-2-1 and to Section 6.2.2.1.

Specific Comment 41. *Section 6.2.2.1, Former Thornock Lake, P.6-8. Evaluation of the arsenic plume map for 1997 (Figure 4-4-10) suggests that soils around former Thornock Lake are a potential source of arsenic in groundwater. The surface and subsurface soil near* *former Thornock Lake should be investigated to evaluate whether there is arsenic contaminated soil acting as a source for arsenic in groundwater.*

Response: It is apparent the basis for EPA's interpretation of water quality trends near former Thornock Lake was based on plume maps submitted in the original CC/RA report. As discussed in the meeting between Asarco and EPA in November 1998, the maps are being modified to more representatively show arsenic concentrations at the plant site. No significant change in water quality has been observed between upgradient and downgradient locations since remediation of Thornock Lake was completed. The concentration of arsenic in groundwater downgradient of former Thornock Lake (less than 1 mg/L at DH-9) is the lowest arsenic concentration observed in shallow groundwater on the main plant site, and is attributable to up-gradient sources.

Soils data and leachability tests already exist and are in the CC/RA report in Appendix 3-1-3. The leachability test data are consistent with the relatively low observed arsenic concentrations in this area. Additional subsurface soil concentration maps showing the subsurface soil data and excavation information in the Thornock Lake area have been added to the revised CC/RA report in Section 4.2. It is unclear what benefit would be derived from additional soils investigation in this immediate area.

As discussed in the meeting between Asarco and EPA in November, the discussions in the CC/RA report (see Section (see Tables 5-1-1, 5-2-1 and Sections 6.2.2.1) have been modified to note that EPA may require additional data in the Thornock Lake area.

Specific Comment 42. *Section 6.2.2.1, Speiss Settling Pond, P.6-9. Evaluation of the arsenic plume map for 1997 (Figure 4-4-10) suggests that soils in the Speiss Pond area are a source of arsenic in groundwater. The surface and subsurface soil near the Speiss Settling Pond should be investigated to evaluate whether there is arsenic-contaminated soil acting as a source for arsenic in groundwater.*

Response: The text in Section 6.2.2.1, Speiss Settling Pond, Need for Additional Action, has been modified to note that although remediation was completed in accordance with CERCLA requirements, EPA has noted additional data may be needed to evaluate residual concentrations of metals as part of an RFI.

Specific Comment 43. *Section 6.2.2.1, Speiss Granulating Pit, P.6-11. Evaluation of the arsenic plume map for 1997 (Figure 4-4-10) suggests that soils in the Speiss Granulating Pit area are a source of arsenic in groundwater. The surface and subsurface soil near the Speiss Granulating Pit should be investigated to evaluate whether there is arsenic-contaminated soil acting as a source for arsenic in groundwater.*

Response: The discussion of the Speiss Granulating pit has been modified to show that additional data to be collected includes data on surface soil, subsurface soil and groundwater.

Specific Comment 44. *Section 6.2.2.1, Acid Plant Water Treatment Facility and Acid Plant Water Circuit, P.6-14.* *Evaluation of the arsenic plume map for 1997 (Figure 4-4-10) suggests that soils in the acid plant pond, former settling pond, and former sediment drying areas are a source of arsenic in groundwater. The surface and subsurface soil near these potential source areas should be investigated to evaluate whether there is arsenic-contaminated soil acting as a source for arsenic in groundwater.*

Response: The discussion of the Acid Plant Water Treatment Facility and Acid Plant Water Circuit has been modified to show that additional data to be collected includes data on surface soil, subsurface soil and groundwater.

Specific Comment 45. *Section 6.2.4, P.6-20.* *The data adequacy section state that the data are adequate to identify the nature and extent of contamination. There is a large data gap under the slag pile where the distribution of arsenic in unknown. Figure 4-4-10 shows that the Lower Lake arsenic plume is not connected to the plume north of the slag pile. However, there are no wells located in the slag pile that would assist in assessing whether the plumes are connected. The lack of monitoring wells in the slag pile should be listed as a data gap.*

Response: EPA appears to rely heavily on the plume map in Figure 4-4-10 in their interpretation of groundwater geochemistry. The fact that Figure 4-4-10 showed the plumes upgradient and downgradient of the slag pile as separate is due to limitations of the contouring program, resulting in interpretation of the absence of data beneath the slag pile as an absence of a plume beneath the slag pile. In fact, a broader examination of the geochemical quality of the water indicates that Lower Lake is clearly a source for downgradient water. This relationship was discussed at some length in the RI and is also examined in the transport section of the CC/RA report.

As discussed in the meeting between Asarco and EPA in November, the plume maps have been revised to more representatively reflect groundwater conditions on the plant site. As a result, the "gap" noted by EPA has been removed and shows a continuation of groundwater arsenic under the slag pile. Asarco and EPA concur this situation is the actual groundwater condition beneath the slag pile on the site.

Although there is no present evidence of groundwater impacts from the slag pile, EPA has noted additional monitoring wells in the slag may be required in the future; particularly when upgradient sources to groundwater have been eliminated and groundwater quality improves. One or more wells would indeed fill a data gap beneath the slag pile; however, as discussed in the November meeting between Asarco and EPA, the need for an expanded investigation of the slag pile is not presently evident based on existing data.

CURRENT CONDITIONS / RELEASE ASSESSMENT
EAST HELENA FACILITY

1. INTRODUCTION

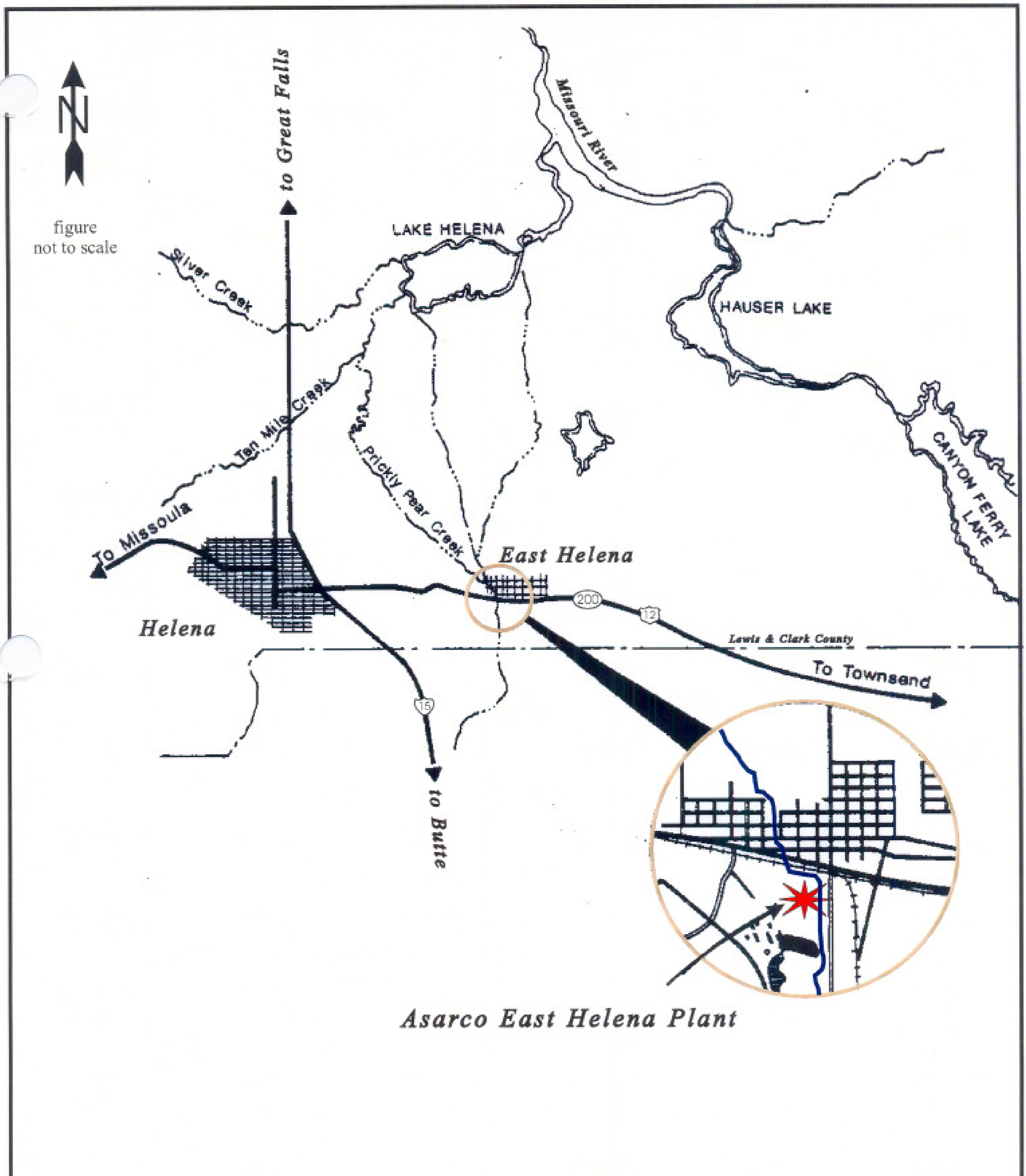
The Asarco East Helena Plant ("The Plant" or "The Facility") was constructed in 1888 by the Helena and Livingston Smelting and Reduction Company for the purpose of processing ores from local mines. The Plant represents one of the original units organized in 1899 to form the American Smelting and Refining Company, today's Asarco Incorporated.

The Plant is a custom smelter, which means that the facility processes ores and concentrates produced by individuals and companies other than Asarco. Currently, the East Helena smelter receives ores and concentrates from several foreign countries and numerous states throughout the United States. The East Helena smelter produces lead bullion from a variety of both domestic and foreign concentrates, ores, fluxes, byproducts, and other non-ferrous metal bearing materials. In addition to the production of lead bullion, the Asarco East Helena smelter also produces food-grade sulfuric acid and copper bearing speiss/matte.

The East Helena Plant is located in the City of East Helena, three miles east of the City of Helena (Figure 1-1-1). The City of East Helena has a population of approximately 1650 and lies adjacent to several residential subdivisions which have an additional estimated population of 2500.

In September 1984, the U.S. Environmental Protection Agency ("the EPA") listed the East Helena Site[1] on the National Priorities List (NPL) pursuant to Section 105 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

[1]The East Helena Site consists of the East Helena community and areas immediately adjacent in the Helena Valley, and the Asarco Plant, which is just south of the community of East Helena.



CC/RA REPORT ASARCO EAST HELENA FACILITY	SITE LOCATION MAP	FIGURE 1-1-1

The major investigations, related documents and their respective completion dates are:

- Process Ponds Remedial Investigation/Feasibility Study (RI/FS) - September 1989 (Hydrometrics, 1989);
- Record of Decision (ROD) on Process Ponds RI - November 1989 (US EPA, 1989);
- Comprehensive RI/FS (for all media) - March 1990 (Hydrometrics, 1990a);
- Consent Decree for Process Ponds Operable Unit – December 1990;
- Explanation of Significant Difference amending 1989 ROD – June 1993;
- Remedial Design and Remedial Action (RD/RA) for Process Ponds - July 1990 (Hydrometrics, 1990c);
- RI/FS for Residential Soils, Wilson Ditch Sediments and Vegetation (a subset of the Comprehensive RI/FS), that focused primarily on Residential Soils - March 1991 (Hydrometrics, 1991);
- Administrative Orders on Consent for Off-Site Soils – July 1991;
- Post RI/FS Well and Surface Water Monitoring Report – September 1995 (Hydrometrics, 1995); and
- February 1998 Plant Water Investigation Report (Draft) – July 1998.

An RI/FS Study Plan (Hydrometrics, 1987) for the East Helena site was approved by EPA on November 30, 1987. This plan addressed the entire East Helena Site on an operable unit basis. The Operable Units for the East Helena Site consist of:

1) Process Fluids - consisting of two subunits; the Process Ponds, and the Process Fluid Circuits (Process Circuits);

   The Process Ponds Subunit was further subdivided into four components:

   - Lower Lake
   - Speiss Settling Pond and Speiss Granulating Pit
   - Acid Plant Water Treatment Facility

- Former Thornock Lake

2) Groundwater;
3) Surface Water/Surface Soils - consisting of six subunits:
   - Plant Site Surface Soils
   - Off-Plant Soils
   - Surface Water
   - Vegetation
   - Cattle
   - Fish and Waterfowl
4) Slag Pile; and
5) Ore Storage Area.

From 1984 through 1997, Remedial Actions conducted on the plant-site consisted of either voluntary actions initiated by Asarco or actions implemented as part of the CERCLA activities at the site. These included modifications to the plant process water handling systems, the addition of water treatment facilities, excavation of impacted soils underlying facilities demolished and removed to facilitate new construction, and dredging of Lower Lake sediments. As part of the Post-RI/FS studies, monitoring of groundwater and surface water continues on a semi-annual basis at the East Helena Site.

Remedial actions outside of the Plant began in 1990 and included soil removal from over 580 residences, 30 business, two city parks, two schools, as well as road aprons and alleys in the community of East Helena.

In 1997, EPA determined to transfer responsibility for on-going remedial activities at East Helena Facility from its CERCLA program to its "corrective action" program under the Resource Conservation and Recovery Act (RCRA). EPA determined that the latter is better suited for application to operating industrial facilities than is the CERCLA program, since the RCRA program allows framing of remedial investigation of corrective measures in a manner tailored to circumstances at an operating facility.

In a consent decree effective May 5, 1998, EPA recited its intent to take "full account" of the remedial investigation/feasibility studies and remedial measures already undertaken at the East Helena Facility pursuant to CERCLA. Recognizing that ASARCO had already implemented substantial remedial measures with respect to its process ponds and had completed an RI/FS for the East Helena slag pile, the consent decree recites that the primary focus of further remedial investigation would be on contamination in groundwater, surface water and soils, and in the former ore storage areas. The consent decree also noted that EPA plans to use RCRA corrective action as a mechanism for expeditious review of a proposal by ASARCO to build a new onsite corrective action management unit (CAMU) for disposal of contaminated soils and sediment presently at the East Helena Facility.

1.1 PURPOSE AND SCOPE

The purpose of the CC/RA Report is to assess the completeness and quality of the existing data to be used to define, in whole or in part, the nature and extent of any hazardous waste and hazardous constituent releases, if any, at, or migrating from, the Facility (EPA, 1998).

This CC/RA has been conducted in accordance with the Consent Decree and addresses the following objectives which are described in the Consent Decree beginning on page 25:

1. Lists any and all sources of existing data which might be used to define, in whole or in part, the nature and extent of any hazardous waste or hazardous constituent releases, at, or migrating from the Facility, including whether a data quality analysis exists for such data (from section a. of paragraph 24 of the Consent Decree).
2. Explains whether EPA has a copy of each such sources of data (from section b. of paragraph 24 of the Consent Decree).
3. For each source of data which Asarco does not believe EPA already has a copy of, identifies (section c. of paragraph 24 of the Consent Decree):

a) Its present location;
b) The intended retention time by Asarco;
c) Any privilege or confidentiality claims which may attach, or would be asserted by Asarco if EPA were to request a copy of such source; and
d) Any other relevant information.

4. Addresses the existing data quality issues, including (from paragraph 25 of the Consent Decree):

a) A summary of the quality of existing data;
b) Identification of data Asarco proposes not be used in assessing site conditions based on data quality concerns;
c) Identification of the areas of the Facility for which existing data are adequate to define releases and supply information for identification and evaluation of interim and corrective measures;
d) Identification of areas of the Facility for which existing data are adequate to demonstrate that there are, or have been, no releases of hazardous waste and/or hazardous constituents from any source and that no additional consideration is needed;
e) Identification of areas of the Facility for which existing data are adequate to demonstrate that remedial work is underway, or has been completed, which, when completed, will remediate that area in a manner, and to the degree, equivalent to the remedial goals of the RCRA corrective action program;
f) Identification of areas of the Facility for which existing data are not adequate for such determinations;
g) Identification of additional Facility data needs, including a discussion of whether such data should be gathered as an interim measure, or through the RFI.

5. Details the nature and extent of each known or legitimately suspected release of hazardous waste and/or hazardous constituent, whether the source is a solid and/or hazardous waste management unit, or other source (such as a one-time release), and migration pathways of releases, at or from the Facility. Discusses any significant impacts quality assurance/quality control issues might have on such releases (from paragraph 26 of the Consent Decree).

6. Describes information regarding any existing interim measures as follows (from paragraph 27 of the Consent Decree:

   a) The objectives, design, construction, operation and maintenance requirements of any measures which are, or may be used as, interim measures;
   b) Whether each is consistent with and may be integrated into any long-term corrective measures;
   c) Any changes/additions which would increase their effectiveness; and
   d) All additions or alternative interim measures which might better stabilize the releases of hazardous waste and hazardous constituents, at or migrating from the Facility.

7. Describes information regarding any final remedial actions as follows (from paragraph 28 of the Consent Decree):

   a) The objectives, design, construction, operation and maintenance requirements of any final remedial measures;
   b) Whether each such measure is consistent with and may be integrated into any long-term corrective measures; and
   c) Any changes/additions which would increase their effectiveness either as interim measures or corrective measures.

Figure 1-1-2 shows the relationship between the operable units and subunits evaluated during the Comprehensive RI/FS (Hydrometrics, 1990) and the areas evaluated in this CC/RA report.

This CC/RA evaluates on-site releases to groundwater, surface water and soils. The geographic area for the CC/RA study includes the Asarco East Helena Facility and any off-site areas to which hazardous wastes or hazardous constituents may have migrated. The CC/RA plant site study boundary is shown in Figure 1-1-3, and study areas associated with groundwater and surface water pathways are shown in Figures 1-1-3 and 1-1-4, respectively. The CC/RA study does not address air emission releases or associated off-site air impacts. Operable subunits pertaining to off-site air emissions include off-plant soils, vegetation and cattle (see page 1-3 for list of Operable Units and Subunits) operable units. These units are being addressed under the CERCLA residential soils consent decree. In addition, the Fish and Waterfowl Operable subunit was not carried forward into the CC/RA analysis, since this subunit was previously evaluated in the comprehensive RI/FS and was not found to be impacted. For further information on the analysis of Fish and Waterfowl refer to Sections 5.5 and 5.6 of the Comprehensive RI/FS (Hydrometrics, 1990a).

The CC/RA report is organized into the following sections:

Section 1 A brief discussion of CERCLA activities and remedial actions conducted at the East Helena Plant, description of Plant operable units, and a discussion of the purpose and scope of the CC/RA report.

Section 2 A description of Plant facilities, smelter operations, and smelter-related materials present at the Plant. A brief discussion of the Plant setting including climate, water resources, hydrogeology, and soils.

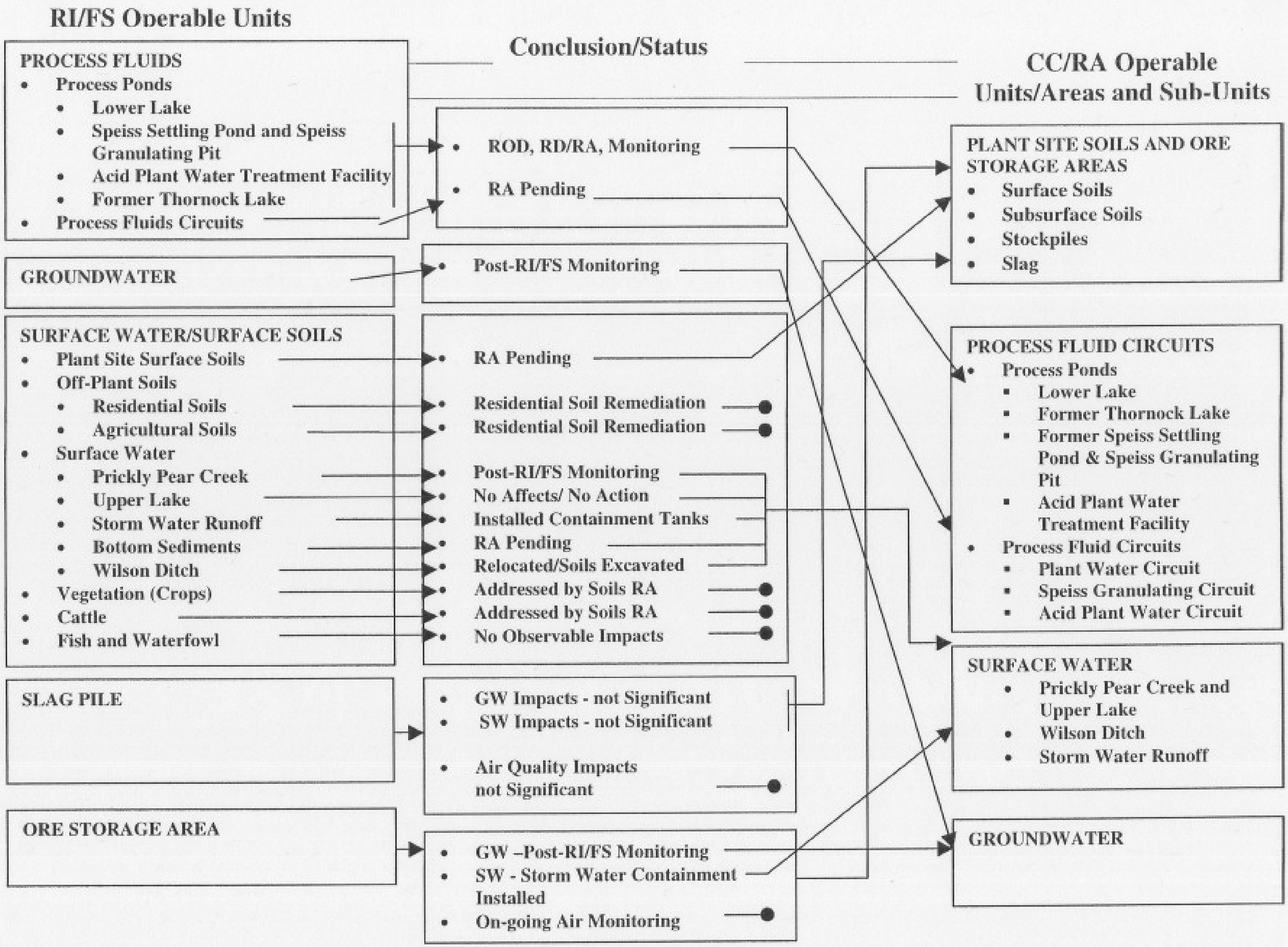


FIGURE 1-1-2 CC/RA REPORT ORGANIZATION

CC/RA REPORT
ASARCO EAST HELENA FACILITY

CC/RA PLANT SITE AND GROUNDWATER STUDY AREAS

FIGURE 1-1-3

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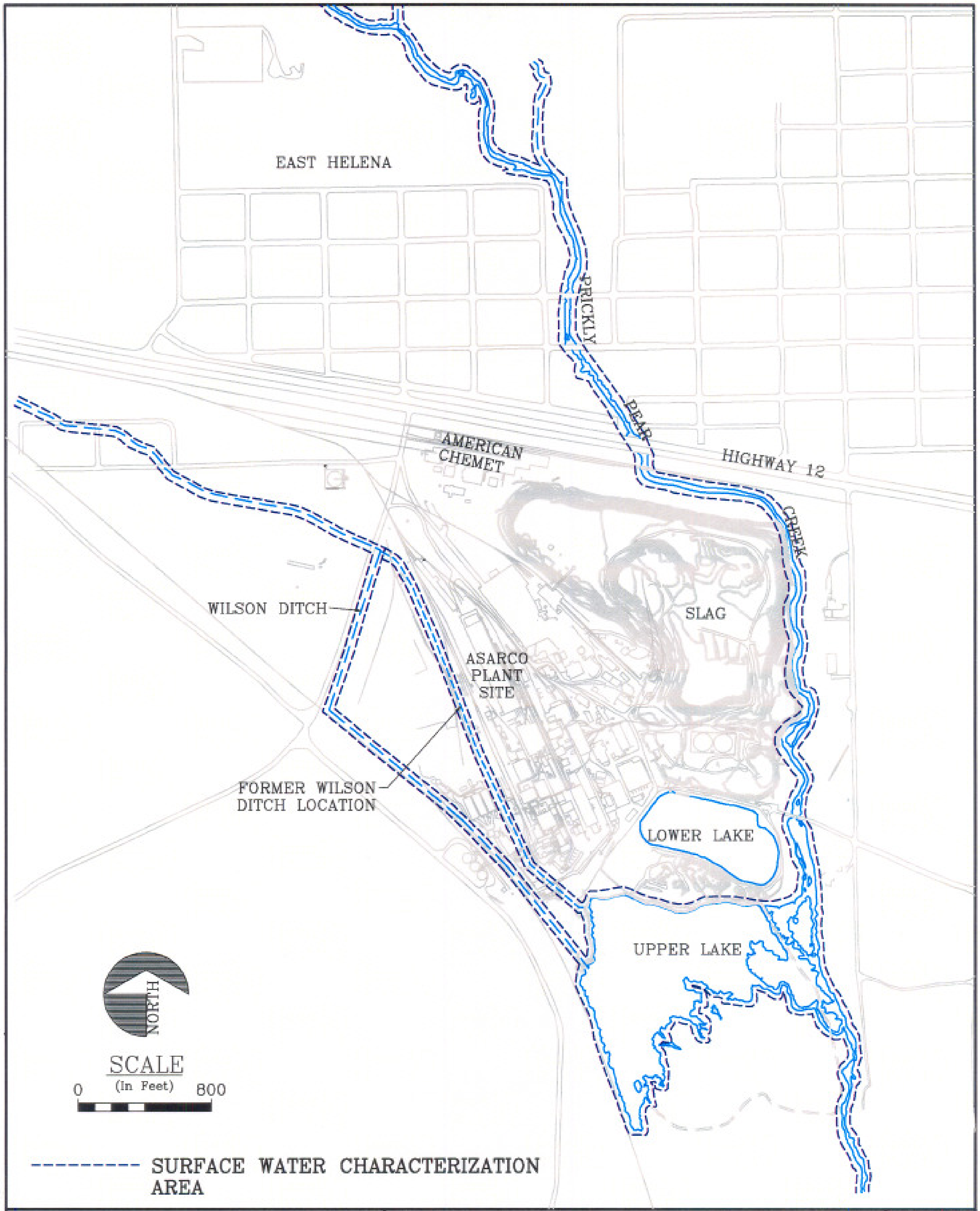
Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



CC/RA REPORT
ASARCO EAST HELENA FACILITY

CC/RA SURFACE WATER STUDY AREA

FIGURE 1-1-4

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Section 3 A summary and description of all existing data at the site and an evaluation of its quality.

Section 4 An evaluation of current conditions for specific Plant Operable Units or media areas including:

1. Plant Site ~~Surface~~ Soils and Ore Storage Area
   - Surface Soils
   - Subsurface Soils
   - Stockpiles
   - Slag
2. Process Fluids

   Process Pond
   - Lower Lake
   - Former Thornock Lake
   - The Former Speiss Settling Pond and Speiss Granulating Pit
   - Acid Plant Water Treatment Facility

   Process Circuits
   - Plant Water Circuit
   - Speiss Granulating Circuit
   - Acid Plant and Sinter Plant Circuit
3. Surface Water~~, and~~
   - Prickly Pear Creek
   - Upper Lake
   - Wilson Ditch
   - Storm Water
4. Groundwater

The evaluation of current conditions includes a discussion of contaminant fate and transport including potential routes of migration, geochemistry, and groundwater transport of arsenic and metals.

Section 5 A discussion of site contaminant releases, and a description of interim and final-proposed and implemented remedial actions. A comparison of observed water quality trends and known Plant activities is described regarding the effectiveness of proposed and implemented remedial actions.

Section 6 A general summary of finding for the data review and an evaluation summary for each of the CC/RA operable units.

Section 7 References

Table 1-1-1 indicates where information pertinent to specific requirements of the consent decree can be found within the report.

TABLE 1-1-1. CROSS-REFERENCE LIST FOR CONSENT DECREE REQUIREMENTS

Consent Decree Requirement	Corresponding CC/RA Section or Table
¶24 The CC/RA Report shall: ¶24(a) List any and all sources of existing data which might be used to define, in whole or in part, the nature and extent of any hazardous waste or hazardous constituent releases, if any, at, or migrating from, the Facility, including whether a data quality analysis exists for such data;	Data Sources Inventory (Appendix 3-1-1) and Section 3.1
¶24(b) Explain whether ASARCO believes that EPA has a copy of each such source of data; and	Data Sources Inventory (Appendix 3-1-1)
¶24(c) For each source of data which ASARCO does not believe EPA already has a copy of, identify: (1) Its then present location;	Data Sources Inventory (Appendix 3-1-1)
(2) The intended retention time by ASARCO;	Data Sources Inventory (Appendix 3-1-1)
(3) Any privilege or confidentiality claims which may attach, or would be asserted by ASARCO if EPA were to request a copy of such source; and	Data Sources Inventory (Appendix 3-1-1)
(4) Any other relevant information.	Data Sources Inventory (Appendix 3-1-1)
¶25 The CC/RA Report shall address existing data quality issues, including: ∂25(a) Summary of the quality of the existing data;	Section 3.3
¶25(b) Identification of data ASARCO proposes not be used in assessing site conditions based on data quality concerns:	Section 3.3 and Table 3-3-1
¶25(c) Identification of the areas of the Facility for which existing data are adequate to define releases and supply information for identification and evaluation of interim and corrective measures;	Section 5.1 and Table 5-1-1

TABLE 1-1-1. CROSS-REFERENCE LIST FOR CONSENT DECREE REQUIREMENTS (continued)

Consent Decree Requirement	Corresponding CC/RA Section or Table
¶25(d) Identification of the areas of the Facility for which existing data are adequate to demonstrate that there are, or have been, no releases of hazardous waste and/or hazardous constituents from any source and that no additional consideration is needed;	Section 5.1 and Table 5-1-1
¶25(e) Identification of the areas of the Facility for which existing data are adequate to demonstrate that remedial work is underway, or has been completed, which, when completed, will remediate that area in a manner, and to the degree, equivalent to the remedial goals of the RCRA corrective action program;	Section 5.1 and Table 5-1-1
¶25(f) Identification of the areas of the Facility for which existing data are not adequate for such determinations; and	Section 5.1 and Table 5-1-1
¶25(g) Identification of additional Facility data needs, including a discussion of whether such data should be gathered as an interim measure, or through the RFI.	Section 5.1 and Table 5-1-1
¶26 The CC/RA Report shall detail the nature and extent of each known or legitimately suspected release of hazardous waste and/or hazardous constituent, whether the source is a solid and/or hazardous waste management unit, or other source (such as a one time release), and migration pathways of releases, at or from the Facility. A discussion of any significant impacts quality assurance/quality control issues might have on such releases should also be provided.	Releases are summarized in Section 5.1 and Table 5-1-1. Water and soil quality data and data trends are described in Section 4 (Evaluation of Current Conditions)
¶27 In the CC/RA Report, ASARCO shall describe information regarding any existing interim measures as follows:	

TABLE 1-1-1. CROSS-REFERENCE LIST FOR CONSENT DECREE REQUIREMENTS (continued)

Consent Decree Requirement	Corresponding CC/RA Section or Table
¶27(a) The objectives, design, construction, operation and maintenance requirements of any measures which are, or may be used as, interim measures:	Section 5.2 and Table 5-2-1
¶27(b) Whether each is consistent with and may be integrated into any long term corrective measures;	Section 5.2 and Table 5-2-1
¶27(c) Any changes/additions which would increase their effectiveness; and	Section 5.2 and Table 5-2-1
¶27(d) All additional or alternative interim measures which might better stabilize the releases of hazardous waste and hazardous constituents, at or migrating from the Facility.	Section 5.2 and Table 5-2-1
¶28 In the CC/RA Report, ASARCO shall describe information regarding any final remedial actions as follows: ¶28(a) The objectives, design, construction, operation and maintenance requirements of any final remedial measures;	Section 5.3
¶28(b) Whether each such measure is consistent with and may be integrated into any long term corrective measures; and	Section 5.3
¶28(c) Any changes/additions which would increase their effectiveness either as interim measures or corrective measures.	Section 5.3

2. DESCRIPTION OF SMELTER OPERATIONS AND SMELTER SITE SETTING

The East Helena facility produces lead bullion from smelting a variety of foreign and domestic concentrates, ores, fluxes, and other non-ferrous, metal-bearing materials. In addition to the production of lead bullion, the Plant produces copper byproducts and sulfuric acid.

1.12.1 SITE FEATURES

The major features at the Plant include buildings, stacks and other plant operation structures, the slag pile, outside ore storage areas, and former water storage ponds and existing water storage tanks (Exhibit 2-1-1). Major features of the Asarco East Helena Plant are:

1. Administrating Buildings and Infrastructure
   a. Administrative Office Building
   b. Analytical Laboratory
   c. Employee Changehouse
   d. Medical Office
   e. Maintenance Building
   f. Warehouse
   g. Powerhouse

2. Material Handling
   a. Outside Ore Storage Area
   b. Sampling Department
   c. Concentrate Storage and Handling Building (CSHB)
   d. Direct Smelt Building
   e. Thawhouse

3. Material Processing
   a. Sinter Plant

b. Blast Furnace
c. Dross Plant
d. Reverberatory Furnace
e Slag Handling Facility
f. Slag Pile

4. Acid Plant
   a. Acid Plant Converter
   b. Decolorization Facility
   c. Sulfuric Acid Storage Tank
   d. Hydrogen Peroxide Storage Tanks
   e. Acid Plant Tall Gas Stack

5. Process and Ventilation Gas Control
   a. Electrostatic Precipitator (Cottrell)
   b. Open and Packed Scrubbers
   c. Mist Precipitator
   d. Sinter Plant Baghouse and Stack
   e. Blast Furnace Baghouse and Stack
   f. Dross Plant Baghouse and Stack
   g. Numerous other Baghouses

6. Surface Water Features
   a. Prickly Pear Creek
   b. Upper Lake
   c. Lower Lake
   d. Wilson Irrigation Ditch

7. Existing Process Water Features

   a. Thornock Tank

   b. Million Gallon Storage Tanks

   c. Speiss Granulating Tank

   d. Storm Water Containment Facility

   e. Acid Plant Scrubber Water Neutralization Treatment Plant

   f. High Density Sludge (HDS) Water Treatment Facility

   g. Sanitary Sewer Treatment Facility

8. Abandoned Process Water Features

   a. Former Thornock Lake

   b. Former Speiss Pond and Pit

   c. Former Acid Plant Settling Pond

Excluding these features, approximately 63 percent of the area located within the East Helena smelter facility is covered by asphalt pavement or concrete. All site features are shown on Exhibit 2-1-1.

~~1.2~~2.2 GENERAL DESCRIPTION OF SMELTER OPERATIONS

The East Helena Plant is a custom lead smelter that recovers lead and other metals from ore, ore concentrates and secondary materials using pyrometallurgical processes. The Plant is a primary lead smelter that has also recovered zinc in the recent past. Zinc recovery operations were discontinued at the site in October 1982.

The smelter operations consist of: 1) receiving feed stocks via railcar or truck, 2) various stages of mixing, blending and proportioning, 3) making a roast (sinter), 4) smelting, and 5) final shipment of product to off-site locations. As part of the process of smelting lead ores at the East Helena smelter facility, several commercial byproducts of lead production are produced including sulfuric acid and, matte and copper enriched speiss. Slag is produced as a waste product of the smelting process. Process and fugitive air emissions are captured by state-of-the-art air control devices including baghouses, electrostatic precipitators, and dust enclosures.

A flow diagram of Plant operations is shown in Figure 2-2-1. A detailed discussion of East Helena smelter operations is included in Appendix 2-2-1.

~~1.3~~2.3 SITE SETTING

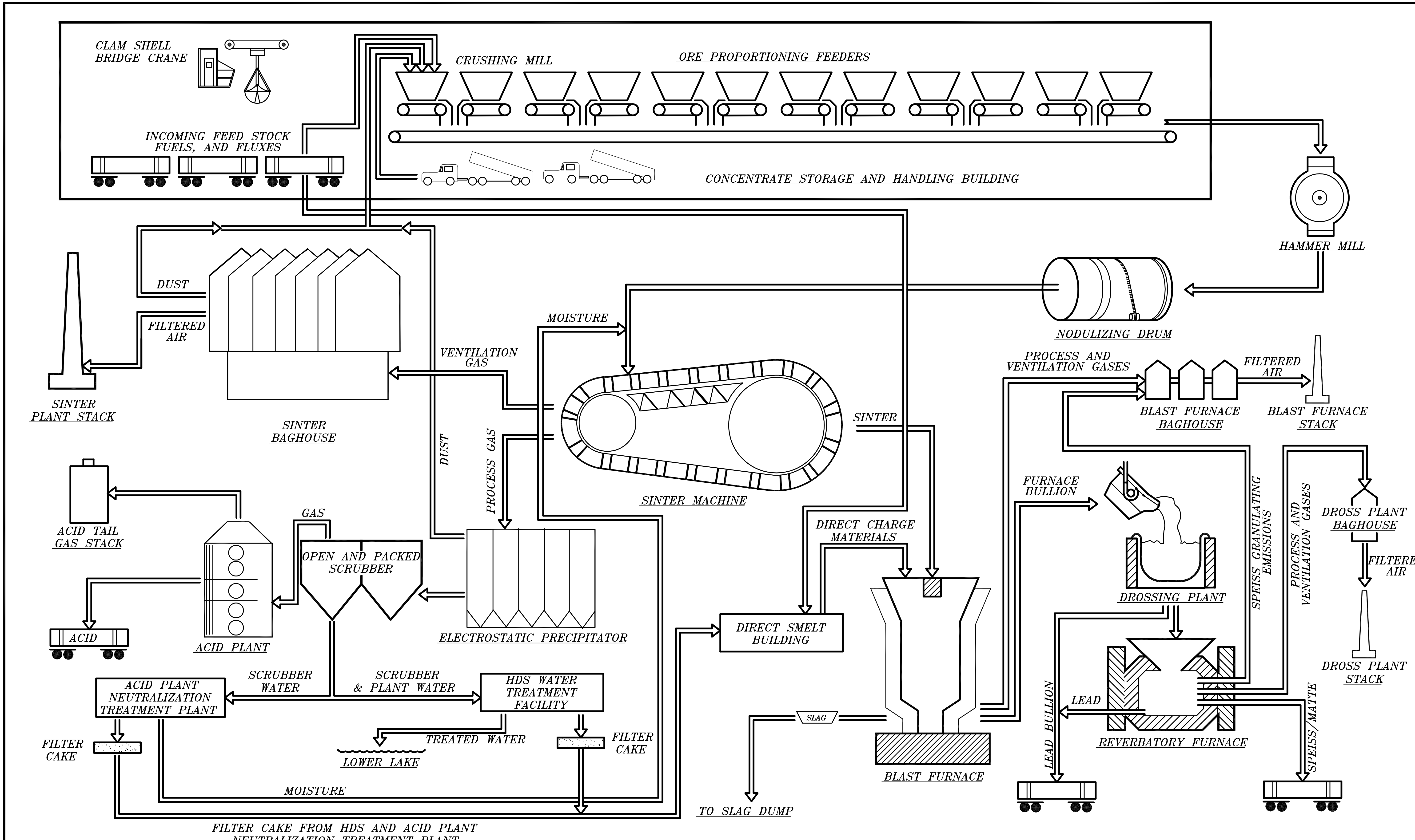
The smelter is located in Lewis & Clark County, Montana (T10N, R3W, NE 1/4 of Sec 36) and is situated on approximately 142 acres. It is bounded to the south by Lower and Upper Lake, to the east and northeast by Prickly Pear Creek, to the north by the City of East Helena and to the west by agricultural land owned mostly by Asarco.

~~1.1.1~~2.3.1 Climate

The climate of the Helena Valley, including the East Helena Plant is described as modified continental. Seasons typically consist of cold winters, wet springs and warm summers with moderate thunderstorm activity. Weather temperature extremes are modified by periodic invasion of Pacific Ocean air masses, as well as drainage of air into the valley from the surrounding mountains. Maximum and minimum mean monthly temperatures during the period from 1951 to 1980 were 67.9 degrees Fahrenheit in July and 18.1 degrees Fahrenheit in January (Hydrometrics, 1990a).

Total precipitation varies widely throughout the Helena Valley area, from a semi-arid total of less than 10 inches in the northern and eastern portions of the valley, to a sub-humid 30 inches or more along the Continental Divide to the west. Average precipitation is about 11 inches annually in the Helena area with the greatest amounts occurring in May and June.

Precipitation occurs primarily as snow from November through March and generally as rain the remainder of the year. By contrast, mean annual evaporation is about 36 to 38 inches (Hydrometrics, 1990a). Table 2-3-1 shows the mean monthly precipitation at the Helena airport for the period between 1983 and 1997.



CC/RA REPORT
ASARCO EAST HELENA FACILITY

FLOW DIAGRAM OF PLANT OPERATIONS

FIGURE
2-2-1

UPDATE TIME: 10:44AM
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Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors

TABLE 2-3-1. MEAN MONTHLY PRECIPITATION AT HELENA, MONTANA 1983-1997

MONTH	1983-1997 Average	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
		(precipitation in inches)														
January	0.38	0.24	0.17	0.16	0.32	0.00	0.27	1.42	0.47	0.27	0.29	0.80	0.20	0.20	0.55	0.34
February	0.34	0.07	0.15	0.38	1.20	0.03	0.50	0.82	0.14	0.02	0.10	1.03	0.40	0.08	0.11	0.08
March	0.62	0.36	0.49	0.32	0.49	1.18	0.45	1.35	0.91	0.90	0.60	0.56	0.32	0.49	0.58	0.28
April	0.87	0.29	1.45	0.46	1.08	0.76	1.32	0.72	0.43	0.75	0.55	1.63	1.45	1.15	0.70	0.3
May	1.58	1.79	1.03	0.75	0.83	1.90	1.82	1.00	1.54	1.71	0.64	1.71	1.23	3.09	2.40	2.22
June	1.89	2.20	2.14	0.08	1.56	1.50	1.50	1.79	0.92	3.27	2.36	3.14	0.84	2.93	1.20	2.93
July	1.52	3.48	0.11	0.10	1.37	2.88	0.36	1.55	0.40	0.72	1.06	4.70	0.71	1.51	1.27	2.58
August	1.42	2.67	1.11	2.64	1.84	0.38	0.02	1.61	2.57	0.70	1.01	2.79	0.47	0.33	0.89	2.27
September	1.11	1.56	0.73	2.11	2.45	0.80	2.09	1.31	0.11	1.26	0.09	1.25	0.09	1.59	0.51	0.66
October	0.66	0.35	0.74	0.76	0.03	0.05	0.69	0.54	0.11	0.65	1.87	0.71	1.14	0.10	0.01	2.12
November	0.49	0.26	0.47	0.84	0.54	0.12	0.69	0.26	0.36	0.88	0.19	0.36	0.55	0.62	1.03	0.16
December	0.44	0.76	0.41	0.35	0.38	0.42	0.32	0.48	0.47	0.79	0.57	0.13	0.07	0.32	0.66	Trace
Annual	11.31	14.03	9.00	8.95	12.09	10.02	10.03	12.85	8.43	11.92	9.04	18.01	7.27	12.21	9.36	13.52

Precipitation data from Helena Regional Airport

2.3.2 Surface Water

The Helena Valley is part of the Missouri River basin. Several major reservoirs, including Canyon Ferry Lake, Hauser Lake, Holter Lake and Lake Helena are located near the northern extent of the Helena Valley and are part of the Missouri River system (Figure 1-1-1).

Prickly Pear Creek flows along the east and northeast boundaries of the East Helena Plant. This perennial stream has its headwaters in the Elkhorn and Boulder Mountains about 30 miles south and west of the site. The U.S. Geological Survey maintains a gaging station (No. 06061500) on Prickly Pear Creek below Clancy, approximately 5 miles upstream of the site. Average monthly discharge at the gaging station ranges from 133 cfs in June to 21 cfs in January for a discontinuous period of record from 1908 to 1996 (USGS, 1997). The mean annual flow is 48 cfs. Prickly Pear Creek drains into Lake Helena located approximately seven miles north of the site.

Prickly Pear Creek has been impacted by historical mining activities upstream of the Asarco East Helena site resulting in elevated arsenic and metals in stream sediments. Mining-related impacts to Prickly Pear Creek have been evaluated by Traynor (1969), Pedersen (1977), the Montana Water Quality Bureau (MWQB, 1981) and Baker and Baldigo (1984 and 1985).

Upper Lake receives flow from a diversion on Prickly Pear Creek about one-half mile south of the Plant. Upper Lake provides Plant make-up water and supplies irrigation water to Wilson Ditch with flow controlled by a headgate in Upper Lake.

Lower Lake receives flow from precipitation, groundwater and treated effluent from the HDS Water Treatment Facility (authorized under MPDES Permit No. MT-0030147). The Plant has periodically used Lower Lake water to recharge one of the two one-million gallon plant water storage tanks (the second tank is held in reserve to provide storage during storm events). Outflow from Lower Lake is primarily through infiltration and evaporation.

Infiltration from Lower Lake flows to groundwater and to Prickly Pear Creek in the reach adjacent to the lake.

2.3.3 Groundwater

The Helena Valley is a 100-square mile intermountain basin filled with sediments of Tertiary and Quaternary geological age. Prickly Pear Creek has deposited a large, north sloping, alluvial fan from its entry point on the south side of the valley. Surface water and groundwater in the East Helena area generally flow from south to north, discharging to Lake Helena in the northeastern corner of the Helena Valley (Hydrometrics, 1986).

The Tertiary age deposits in the Helena valley are often described as “lake beds” and consist of gray and tan clays and silts interlayered with occasional sand and gravel layers (Lorenz and Swenson, 1951). Schmidt (1986) describes these Tertiary deposits as older stream and lake deposits consisting of gravel, sand, silt, clay, bentonite and volcanic ash and states they may be more than 500 meters (approximately 1,600 feet) thick in the central part of the Helena Valley. In the central Helena Valley, these deposits commonly are overlain by up to 200 feet of unconsolidated, stream-deposited Quaternary alluvium consisting of layers and mixtures of silt, sand and gravel from tributary drainages including Ten Mile Creek, Last Chance Gulch and Prickly Pear Creek.

The Plant and the East Helena community are underlain by unconsolidated alluvium deposited by ancestral Prickly Pear Creek. The composition of the alluvial deposits is highly variable resulting in a wide range of aquifer permeabilities. The hydraulic conductivity of the alluvium generally ranges from less than 1 ft/day to greater than 200 ft/day reflecting the variable composition of cobbles, gravel, sand, silt and clay within this unit. Depth to water ranges from 10 feet to 60 feet. Underlying the alluvium, and present in exposures west and north of the Plant and the East Helena community, are fine-grained Tertiary volcanic ash tuff deposits. These tuff deposits have low permeabilities and have weathered to a fine clay in some locations.

For the purposes of this investigation, six hydrostratigraphic units have been defined in the Plant site area. These include:

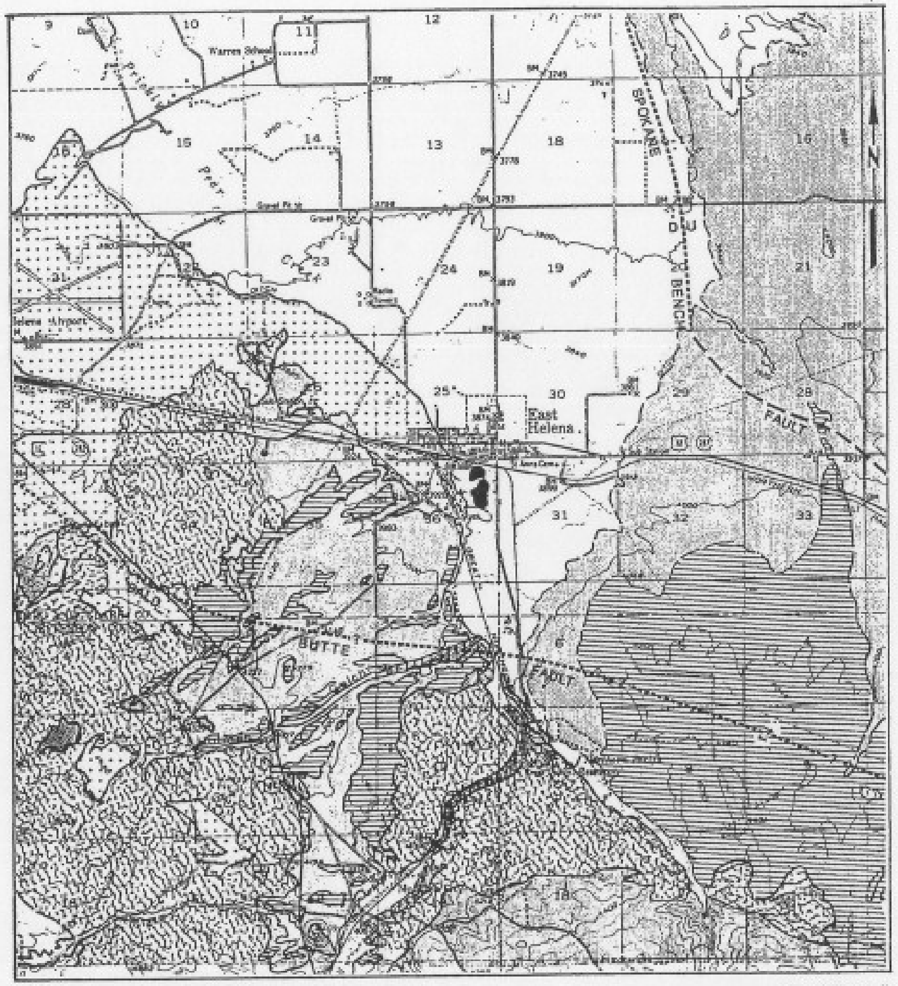
- A shallow, perched groundwater system,
- A shallow groundwater system within the alluvium,
- An intermediate groundwater system within the alluvium,
- A Tertiary volcanic ash/tuff confining unit,
- A deep alluvial groundwater system beneath the fine-grained Tertiary volcanic ash/tuff deposits, and
- Precambrian bedrock at depth.

A detailed discussion of the hydrologic characteristics of these units is presented in Section 4.3.4. Surficial geology of the East Helena area is shown in Figure 2-3-1.

Groundwater in the Helena Valley generally moves north toward Lake Helena, which is a discharge point for the valley groundwater system (Wilke and Coffin, 1973). Groundwater recharge in the Helena Valley comes from precipitation on the valley floor and surrounding mountains and from streams and irrigation canals that cross the valley floor. These streams and canals generally lose water into the underlying groundwater system. In the vicinity of the East Helena Plant, groundwater in the unconsolidated Quaternary deposits generally flows to the north and northwest and receives recharge from Upper Lake and Lower Lake in the Plant area, and from Prickly Pear Creek as the stream enters the valley near East Helena. Groundwater-surface water interactions in the Plant site area are described in detail in Section 4.3.3.

2.3.4 Soils

Soils in the East Helena area are described in the EPA's draft RI Report for Soils, Vegetation and Livestock (EPA, 1986). Soils in the Helena Valley developed on valley fill are derived



Source: Schmidt, 1977. USGS Open File Report 77-129

scale: 1 inch = 1 mile

ARTIFICIAL FILL—Refuse fill in old city trash dump northwest of Helena Airport and piles of smelter slag at East Helena. Refuse fill unsorted and unstratified, loosely compacted, uncemented, and as much as 3 m thick; smelter slag unsorted and unstratified, moderately well compacted, uncemented, and as much as 15 m thick

PLACER TAILINGS—Piles of coarse, washed gravel, commonly arranged in rows, constituting waste rock from placer-mining operations; unsorted and unstratified; loosely compacted and uncemented; maximum thickness about 6 m

STREAM DEPOSITS—Gravel, sand, silt, and clay in stream beds, on flood plains, and in alluvial fans; mostly well sorted sandy gravel; loosely to firmly compacted; uncemented to weakly cemented; maximum thickness unknown but probably as much as 30 m

SLOPE WASH—Gravel, sand, silt, and clay on steep to gentle slopes; mostly poorly sorted clayey gravel; loosely to firmly compacted; uncemented to weakly cemented; maximum thickness unknown but probably as much as 6 m

OLDER GRAVEL—Gravel, sand, silt, and clay on terrace surfaces above major streams, in ancient alluvial fans, and on remnants of old erosion surfaces; mostly poorly to moderately well sorted gravel; loosely to firmly compacted and weakly cemented; maximum thickness about 20 m

OLDER STREAM AND LAKE DEPOSITS—Gravel, sand, silt, clay, bentonite, lignite, and volcanic ash, well-sorted and evenly stratified, firmly compacted, weakly to moderately well cemented; bentonite swells and becomes plastic when wetted; maximum thickness unknown but probably more than 500 m thick in central part of Helena Valley

BEDROCK

SEDIMENTARY BEDROCK—Limestone, dolomite, shale, and sandstone: hard, firm, and dense; permanently and strongly cohesive

PLUTONIC BEDROCK—Mostly coarse grained crystalline granitic rock: hard, firm, and dense; permanently and strongly cohesive; locally weathered to loose granular soil

NORMAL FAULT—Dashed where inferred; dotted where concealed; U, upthrown side; D, downthrown side; queried where location uncertain

STRIKE-SLIP FAULT—Arrows show inferred relative direction of horizontal movement. Dashed where inferred; dotted where concealed; queried where location uncertain

CC/RA REPORT ASARCO EAST HELENA FACILITY	SURFICIAL GEOLOGY MAP OF THE EAST HELENA AREA	FIGURE 2-3-1

007\0867\065\009\6\1/18/99 K:\DATA\PROJECT\0867\F2-3-2.CDR from surrounding mountain ranges, and on lake sediments of Tertiary age. The silt and clay soils are moderately calcareous and have little organic matter. Soil profiles are only poorly to moderately developed. Soils in the Canyon Ferry Lake area, to the east of Helena, are rich in tuffaceous materials of volcanic origin. The grassland soils are alluvial mollisols, inceptisols, and entisols. The forest soils can generally be defined as alfisols.

2.4 PREVIOUS INVESTIGATIONS

Sources of additional background information and technical data pertaining to the Plant site and the East Helena area are described below:

The geology and hydrology of the Helena Valley area have been described in a number of previous reports. Descriptions of the Helena area geology are detailed in Pardee and Schrader (1933), Lorenz and Swenson (1951), Knopf (1963) and Schmidt (1977). Groundwater resources in the valley, including water quality, are discussed by Lorenz and Swenson (1951), Wilke and Coffin (1973), Moreland and others (1979), and Moreland and Leonard (1980).

Assessments of groundwater availability for municipal use have been made by Botz (1971) and Hydrometrics (1983 and 1984). Unconsolidated valley fill deposits in the Helena Valley have been the primary focus of previous groundwater studies.

Prickly Pear Creek is adjacent to the East Helena Plant and has been the subject of numerous studies. Traynor (1969), Pedersen (1977), the Montana Water Quality Bureau (MWQB, 1981) and Baker and Baldigo (1984 and 1985) have assessed water quality in Prickly Pear Creek. Additional groundwater and surface water quality data are on file with the Montana Water Quality Bureau (WQB) and U.S. Geological Survey (USGS).

Numerous documents have been prepared for investigations and remedial actions conducted at the East Helena Plant site and for residential remediation activities in the town of East

Helena. A complete listing of all sources of existing data which might be used to define, in while or in part, the nature and extent of any hazardous waste or hazardous waste constituent release (as specified in paragraph 24 of the RCRA Consent Decree) is in Appendix 2-2-2. Data sources are discussed in detail in Section 3.0.

3. EXISTING DATA SUMMARY

This section describes the types of data which are available, areas of the Plant to which the data apply, the purpose for which the data were collected, quality assurance/quality control standards under which the data were collected, and whether the gathering and analysis of these data met applicable quality assurance and quality control and other applicable gathering and analysis procedures.

3.1 DATA SOURCES

The data sources inventory in Appendix 3-1-1 lists the sources of existing data and includes related documents which might be used to define, in whole or in part, the nature and extent of any hazardous waste or hazardous constituent releases, if any, at, or migrating from, the Plant. This Appendix also describes the available data, publication dates, data location, level of data validation (see Section 3.3 for data validation level descriptions), document retention time and confidentiality status. For completeness, the data sources inventory also contains a listing of all available reports and documents relating to the collection and interpretation of the data such as work plans, quality assurance plans, sampling plans, validation reports, construction reports, construction documents (plans and specifications), project reports and EPA responses. A complete database of water sample results is in Appendix 3-1-2. Soil sample results are in Appendix 3-1-3. Exhibit 3-2-1 shows the location of historical monitoring sites within the study area.

3.2 DATA DESCRIPTION

Because large portions of the data were collected in specific regard to work plans and sampling plans (which often included more than one operable unit or subunit), the discussion in this section is necessarily work plan/sampling plan specific instead of operable unit or subunit specific. For example, the Phase I Hydrogeologic Investigation of the Asarco East Helena Facility Water Resources Monitoring Plan (Asarco and Hydrometrics, 1984) resulted in the sampling of groundwater (an operable unit), Lower Lake (a component of the Process

Ponds Subunit), Surface Water (part of the Surface Water/Surface Soils Operable Unit) and subsurface soils. Specific segments of a specific study, for example, Lower Lake sampling in the Phase I hydrogeologic study, can be referenced to a specified subunit by referring to Figure 1-1-2. The discussion in this section is also chronological.

The following are the major categories of data addressed in subsequent sub-sections.

- RI/FS and Post RI/FS Biannual (twice yearly) Sampling Data (Section 3.2.1)
- Post RI/FS Plant Site Soils and Ore Storage Area Data (Section 3.2.2)
- Post RI/FS Process Fluid Circuit Data (Section 3.2.3)
- Post RI/FS Surface Water and Associated Soils Data (Section 3.2.4)
- Post RI/FS Groundwater Well Construction Data (Section 3.2.5)
- General Storm Water Discharge Data (Section 3.2.6)

3.2.1 RI/FS Data and Post RI/FS Biannual Sampling Data

The RI/FS and Post RI/FS Biannual Sampling data were collected and analyzed according to the following plans:

1. Phase I (1984 through 1985) - Hydrogeological Investigation of the Asarco East Helena Facility Water Resources Monitoring Plan (Asarco and Hydrometrics, 1984). This phase consisted of sampling of the following:

    - Soils samples collected during the drilling of monitoring wells
    - Plant process fluids (Lower Lake)
    - Surface Water (Prickly Pear Creek, Wilson Ditch and Upper Lake)
    - Groundwater (Plant site and private wells)

2. Phase II (fall 1986-spring of 1987) - Water Resources Investigation, Asarco East Helena Plant, Phase II Remedial Investigation Work Plan (Hydrometrics, 1986). Phase II expanded on the Phase I work plan by adding the following:

- Sampling of East Helena municipal wells
- Synoptic run sampling of Prickly Pear Creek
- Investigation of precipitation water movement through the slag pile
- Determination of arsenic (III) and arsenic (V) concentrations in groundwater and surface water
- Determination of iron (II) and iron (III) concentrations in groundwater and surface water

3. Comprehensive Remedial Investigation/Feasibility Study Plan (Hydrometrics, 1987); Comprehensive RI/FS (fall 1987 through fall 1989). For the Comprehensive RI/FS, the Phase II sampling plan was expanded to include:

   - Air sampling (not addressed in this report)
   - Ore storage area sampling
   - Organic contamination evaluation of plant surface soils and certain plant site and municipal wells
   - East Helena soil core drill holes
   - Wilson Ditch sediment core sampling
   - Process ponds sediment sampling
   - Storm water runoff sampling

4. The Post Comprehensive RI/FS biannual sampling (spring 1989 to present) continued the monitoring of the following:

   - Plant site wells
   - East Helena municipal wells
   - Designated private wells
   - Plant Process Fluids
   - Prickly Pear Creek

Table 3-2-1 is a historical summary of the water, soil and slag samples collected during major facility investigations. Table 3-2-2 is a listing of the corresponding parameter schedules.

These schedules are general lists of parameters that were analyzed for each site; however, some sampling events may exclude parameters that are listed or include non-listed parameters. The quality of these data is discussed in Section 3.3.

3.2.2 Post RI/FS Plant Site Soils and Ore Storage Area Data

Post RI/FS collection of soils data was conducted primarily in association with construction activities or source area remediation. Data collection associated with these remedial activities is described in Section 3.2.3. Any additional post RI/FS site characterization sampling of surface soils, stockpiles, slag and subsurface soils is described below.

~~Plant Site surface soils and ores storage areas include the following data:~~

- ~~Surface Soils~~
- ~~Stockpiles~~
- ~~Slag~~

3.2.2.1 Surface Soils (1990 to Present)

Post RI/FS soils data were collected in the Acid Plant Sediment Drying Area and in the area between Upper and Lower Lakes as part of continued investigations in these areas. Surface and subsurface soil sampling was conducted at test pit, soil boring and monitoring well locations. These soils data are described with subsurface soils in Section 3.2.2.2.

[Note: Following discussion of soils data moved to subsurface soils section.]

~~In November of 1990, soil samples were taken at eight test pit sites (LLB-1 through LLB-8) in the area between Upper and Lower Lake in order to characterize the soils. Each site was sampled at the following intervals: 0-1 ft., 2-3 ft., 3-5 ft., and 9-10 ft. Samples were analyzed for Toxic Characteristic Leaching Procedure (TCLP) and total arsenic metals. These data~~

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

		Phase I			Phase II			Comp RI/FS			Post RI Monitoring		
		1984 to 1985			Fall 1986 - Spring/Summer 1987			Fall 1987 to Fall/Winter 1988			Spring 1989 to Fall/Winter 1997		
Site Code	Site Description	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)
Plant Site Monitoring Wells													
APSD-1	Shallow - Plant Site										SA 1991-97; P 1994-96	29	F
APSD-2	Shallow - Plant Site										SA 1991-97; P 1994-96	29	F
APSD-3	Shallow - Plant Site										SA 1991-97; P 1994-96	29	F
APSD-4	Shallow - Plant Site										SA 1991-97; P 1994-96	29	F
APSD-7	Shallow - Plant Site										SA 1993-97 ; P 1994-96	52	F
APSD-8	Shallow - Plant Site										SA 1993-97 ; P 1994-96	55	F
APSD-9	Shallow - Plant Site										SA 1993-97 ; P 1994-96	24	F
APSD-10	Shallow - Plant Site										SA 1993-97 ; P 1994-96	24	F
APSD-11	Shallow - Plant Site										SA 1993-97 ; P 1994-96	24	F
APSD-12	Shallow - Plant Site										SA 1993-97 ; P 1994-96	24	F
APSD-13	Shallow - Plant Site										SA 1993-97 ; P 1994-96	24	F
APSD-14	Shallow - Plant Site										SA 1993-94; P 1994	5	F
DH-1	Shallow - Upgradient	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-2	Shallow - Upgradient	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-3	Shallow - Upgradient	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	19	F
DH-4	Shallow - Upgradient	S 1985	4	A & C	SA	2	D & E	SA	3	E	SA 1989-97; P 1994-96	55	F
DH-5	Shallow - Plant Site	S 1985	4	B & C	SA	2	D & E	SA	3	E	SA 1989-97; P 1994-96	43	F
DH-6	Shallow - Plant Site	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-7	Shallow - Plant Site	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-8	Shallow - Plant Site	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-9	Shallow - Plant Site	S 1985	4	B & C	SA	2	D & E	SA	2	E	SA	12	F
DH-10	Shallow - Plant Site	S 1985	4	A, B & C	SA	2	D & E	SA	3	E	SA	14	F
DH-10A	Shallow - Plant Site										11/95	1	F
DH-11	Shallow - Plant Site	S 1985	5	A, B & C	SA	2	D & E	SA	3	E	SA	18	F
DH-12	Shallow - Plant Site				S	4	E	11/87	2	E	SA	13	F
DH-13	Shallow - Plant Site				S	4	E	SA	3	E	SA	18	F
DH-14	Inter. - Plant Site				S	4	E	SA	2	E	SA 1989-97; P 1994-96	41	F
DH-15	Inter. - Plant Site				S	6	E	SA	2	E	SA	0	F
DH-16	Shallow Upgradient				S dry	0	E	SA dry	0	E	SA often dry	3	F
DH-17	Shallow Upgradient				S	4	E	SA 1988	2	E	SA	16	F
DH-18	Deep - Plant Site				S	4	E	SA 1988	3	E	SA	18	F
DH-19	Shallow - Plant Site				S 1987	2	E	SA	3	E	SA	18	F
DH-20	Shallow - Plant Site				S 1987	3	E	SA	4	E	SA 1989-97; P 1994-96	33	F
DH-21	Shallow - Plant Site				S 1987	3	E	SA	3	E	SA	18	F
DH-22	Shallow - Plant Site				S 1987	2	E	SA	3	E	SA	18	F
DH-23	Shallow - Plant Site				S 1987	2	E	SA	3	E	SA	18	F
DH-24	Shallow - Plant Site				S 1987	2	E	SA	3	E	SA	18	F
DH-26	Shallow - Plant Site				S 1987	2	E	SA	3	E	4/89	1	F
DH-27	Shallow - Plant Site				S 1987	2	E	SA	3	E	SA	20	F
DH-28	Shallow - Plant Site							SA	3	E	SA	20	F
DH-29	Shallow - Plant Site							SA	3	E	SA 1989-97; P 1994-96	33	F
East Helena Groundwater Monitoring Wells													
EH-50	Shallow - Downgradient				S	5	E	SA	3	E	SA	18	F
EH-51	Shallow - Downgradient				S	4	E	SA	4	E	SA	18	F
EH-52	Shallow - Downgradient				S	5	E	SA	4	E	SA	18	F
EH-53	Shallow - Downgradient				S	4	E	SA	3	E	SA	18	F
EH-54	Shallow - Downgradient				S	4	E	SA	4	E	SA	18	F
EH-57A	Shallow - Downgradient							SA	3	E	SA	18	F
EH-58	Shallow - Downgradient				S	4	E	SA	3	E	SA	18	F
EH-59	Shallow - Downgradient				S	3	E	SA	2	E	SA	15	F
EH-60	Shallow - Downgradient							SA	3	E	SA	18	F

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

		Phase I			Phase II			Comp RI/FS			Post RI Monitoring		
		1984 to 1985			Fall 1986 - Spring/Summer 1987			Fall 1987 to Fall/Winter 1988			Spring 1989 to Fall/Winter 1997		
Site Code	Site Description	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)
East Helena Groundwater Monitoring Wells (Cont.)													
EH-61	Shallow - Downgradient							SA	3	E	SA	18	F
EH-62	Shallow - Downgradient							SA	3	E	SA	18	F
EH-100	Deep - Downgradient				S	4	E	SA	2	E			
EH-101	Inter. - Downgradient				S	6	E	SA	2	E			
EH-102	Inter. - Downgradient				S	5	E	SA	3	E	SA	18	F
Private Groundwater Monitoring Wells													
AMCHEM1	Deep - Downgradient							SA	2	E			
AMCHEM2	Deep - Downgradient	SA	3	A & B	SA	2	D & E	SA	2	E	SA	18	F
AMCHEM3	Deep - Downgradient	SA	2	A & B				4/88	1	E			
AMCHEM4	Deep - Downgradient				SA	2	D & E	12/88	1	E	SA	18	F
ASRWELL	Deep - Plant site				S 1987	3	D						
BERRY	Inter. - Downgradient	5/85	1	A	SA	2	D	4/88	1	E			
BRNHAM1	Inter. - Downgradient	SA	3	B & C									
CASEY	Inter. - Downgradient										5/89	1	F
COX	Well Info. Not Available							4/88	1	E			
DHULST	Inter. - Downgradient	SA	3	B & C	S	4	E	SA	2	E	SA	18	F
DUEL	Inter. - Downgradient	SA	3	A & B	SA	2	D	SA	2	E	SA	16	F
EHC1	Deep - Downgradient				S	4	D & E	4/88	1	E			
EHC2	Deep - Downgradient				S	3	D & E	4/88	1	E			
ERNST	Inter. - Downgradient	5/85	1	A	SA	2	D	SA	2	E			
FLAGE	Inter. - Downgradient	5/85	1	A				4/88	1	E			
HELFERT	Inter. - Downgradient	SA	3	A & B	SA	2	D & E	SA	2	E			
HOFF	Inter. - Downgradient	3/83, 10/83, 5/85	3	A	SA	2	D & E						
JENSEN A1	Inter. - Downgradient	10/83	1	A									
JENSEN A2	Inter. - Downgradient	5/85	1	C	SA	2	D & E	SA	2	E			
KAMRMN	Inter. - Downgradient				2/87	1	D & E						
KHULST	Inter. - Downgradient				S	2	E	7/88	1	E			
LAMPC	Inter. - Downgradient	SA	4	B & C									
LAMPF1	Inter. - Downgradient	SA	2	A & B									
LAMPR	Inter. - Downgradient	SA 1985	2	A	SA	2	D	4/88	1	E			
LHULST	Inter. - Downgradient				S	2	E	SA	2	E	SA	18	F
MANION	Inter. - Downgradient	SA	5	A & C	SA	2	D						
MCD1	Inter. - Downgradient	SA	3	A & B									
NORDSTR	Inter. - Downgradient	5/85	1	A	SA	2	D						
ROMASKO	Inter. - Downgradient	5/85	1	A	SA	2	D	SA	2	E			
SIMAC	Inter. - Downgradient				SA 1987	2	E	SA	2	E			
STCLAIR	Shallow - Downgradient				4/87	1	D	SA	2	E	SA often dry	9	F
VETSCH	Inter. - Downgradient	5/85	1	A	SA	2	D & E	SA	2	E			
WALTER	Inter. - Downgradient				2/87	1	E	SA	3	E	SA 1989-90	3	F
WESTON	Inter. - Downgradient	5/85	1	A	SA	2	D	SA	2	E			
WOJCIK	Inter. - Downgradient	5/85	1	A	SA	2	D	SA	2	E			
Plant Process Fluids													
AP-1	Acid Plant Treatment Facility							P	6	E			
AP-2	Acid Plant Treatment Facility				P 1987	2	D	P	4	E			
AP-3	Acid Plant Treatment Facility							P	4	E			
APTF	Acid Plant Treatment Facility										P 4/93	1	F
AS\W\SUMP1	Acid Plant Demolition										5/98	1	See Table 3-2-8
AS\W\SUMP2	Acid Plant Demolition										5/98	2	See Table 3-2-8
AS\W\SUMP3	Acid Plant Demolition										5/98	3	See Table 3-2-8
EHSE	Sewage Out							8/88		E			
EHSI	Sewage In							8/88		E			
LH-13	Lower Lake										4/92	1	See Table 3-2-5
LH-18	Lower Lake										4/92	1	See Table 3-2-5
LH-42	Lower Lake										4/92	1	See Table 3-2-5
LH-52	Lower Lake										4/92	1	See Table 3-2-5

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

		Phase I			Phase II			Comp RI/FS			Post RI Monitoring		
		1984 to 1985			Fall 1986 - Spring/Summer 1987			Fall 1987 to Fall/Winter 1988			Spring 1989 to Fall/Winter 1997		
Site Code	Site Description	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)
Plant Process Fluids (Cont.)													
LH-48	Lower Lake										4/92	1	See Table 3-2-5
LL-1	Composite of Lower Lake - 1a, 1b & 1c				P 5/87	1	E	FALL 1987	4	E			
LL-2	Lower Lake - 2				P 5/87	2	E	FALL 1987	4	E			
LL-1D	Lower Lake Deep										P 1994-96	27	F
LL-1S	Lower Lake Surface										P 1994-96	40	F
LOWER LAKE	Lower Lake	P 1984-85	4	A	S	3	D & E				SA 1994-97	18	F
S-1	Sump (Ore Storage Area)				P	2	E	P	5	E			
S-2	Sump (South Plant Drain)				P	2	E	P	5	E			
S-3	Sump (Ore Storage Area)							P	5	E			
SHOWER	SHOWER							P 8/88	1	E			
SP-1	Speiss Pond				P	2	E	P	4	E			
SP-2	Speiss Pond				5/87	1	E						
SP-3	Speiss Pond										SA 1991-97	0/Dry	
SP-4	Speiss Pond										SA 1991-97	0/Dry	
SP-5	Speiss Pond										SA 1991-97	0/Dry	
ST-1	Sinter Plant				5/87	1	E	P	5	E			
ST-2	Sinter Plant							P	5	E			
TRWASH	Truch Wash Drain				P 5/87	1	E						
TT-1	Thornock Lake	P 1984-85	4	A	P 7/87	1	E	P	5	E			
WASHER	Washing Machine Drain							P 8/88	1	E			
ZP-1	Zinc Plant Drain							FALL 1987	4	E			
Surface Water													
PPC-3	Prickly Pear Creek	P 1984-85	8	A & B	S	5	D				SA 1989-97; P 1994-96	69	F
PPC-3A	Prickly Pear Creek (Sample Site Change)										SA 1996-97	5	F
PPC-4	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D				P 1995-96	38	F
PPC-5	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D				SA 1989-97; P 1994-96	62	F
PPC-6	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D				P 1995	26	
PPC-7	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D				SA 1989-97; P 1995	47	F
PPC-8	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D				SA	18	F
PPC-9	Prickly Pear Creek	P 1984-85	8	A & B	S	3	D						
PPC-29A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-30A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-31A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-32A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-33A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-34A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-35A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-36A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-37A	Prickly Pear Creek Synoptic Run				S	2	D						
PPC-38A	Prickly Pear Creek Synoptic Run				S	3	D						
PPC-40A	Prickly Pear Creek Synoptic Run				S	2	D						
PPC-101	Prickly Pear Creek										P 1994-97	27	F
PPC-102	Prickly Pear Creek										P 1994-97	27	F
PPC-103	Prickly Pear Creek										P 1994-97	27	F
SITEA	Storm Water Runoff - Off Plant	5/85	1	C	P 7/87	1	E						
SITEE	Storm Water Runoff - Off Plant				P 7/87	1	E						
SITEF	Storm Water Runoff - Off Plant				P 7/87	1	E						
SITEG	Storm Water Runoff - Off Plant				P 7/87	1	E						
SITEH	Storm Water Runoff - Off Plant				P 7/87	1	E						
UPPER LAKE	Upper Lake	P 1984-85	4	A									

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

		Phase I			Phase II			Comp RI/FS			Post RI Monitoring		
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Site Code	Site Description	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)	Sampling Intervals (1)	Tot. No. of Samp.	Parameter Schedule (2)
Surface Water (Cont.)													
WD-1	Wilson Ditch	5/85	1	B									
WD-2	Wilson Ditch	P 1984-85	22	B							P 5/93	2	E
WD-3	Wilson Ditch	5/83	1	B							P 5/93	1	E
WD-4	Wilson Ditch										P 5/93	1	E
Plant Site Monitoring Well Drill Hole Soils													
APSD-1	Well Site Drill Hole										8/91	8	See Table 3-2-9
APSD-2	Well Site Drill Hole										8/91	10	See Table 3-2-9
APSD-3	Well Site Drill Hole										8/91	5	See Table 3-2-9
APSD-4	Well Site Drill Hole										8/91	7	See Table 3-2-9
APSD-7	Well Site Drill Hole										10/93	5	arsenic, lead, cadmium, zinc
APSD-8	Well Site Drill Hole										10/93	6	arsenic, lead, cadmium, zinc
APSD-9	Well Site Drill Hole										10/93	8	arsenic, lead, cadmium, zinc
APSD-10	Well Site Drill Hole										10/93	8	arsenic, lead, cadmium, zinc
APSD-11	Well Site Drill Hole										10/93	7	arsenic, lead, cadmium, zinc
APSD-12	Well Site Drill Hole										10/93	6	arsenic, lead, cadmium, zinc
APSD-13	Well Site Drill Hole										10/93	12	arsenic, lead, cadmium, zinc
APSD-14	Well Site Drill Hole										10/93	6	arsenic, lead, cadmium, zinc
DH-1	Well Site Drill Hole	11/84-12/84	6	G				12/87	6	H			
DH-2	Well Site Drill Hole	11/84-12/84	6	G				12/87	7	H			
DH-3	Well Site Drill Hole	11/84-12/84	4	G				12/87	6	H			
DH-4	Well Site Drill Hole	11/84	2	G									
DH-5	Well Site Drill Hole	11/84	2	G									
DH-6	Well Site Drill Hole	11/84	2	G				12/87	6	H			
DH-7	Well Site Drill Hole	12/84	2	G				12/87	6	H			
DH-8	Well Site Drill Hole	12/84-1/85	6	G									
DH-9	Well Site Drill Hole	11/84	2	G									
DH-10	Well Site Drill Hole	11/84	1	G				12/87	6	H			
DH-11	Well Site Drill Hole	1/85	1	G				12/87	6	H			
DH-13	Well Site Drill Hole				11/86	8	Sequential Extraction & Totals - H	12/87	6	H			
DH-14	Well Site Drill Hole				10/86	5	Sequential Extraction & Totals - H	12/87	5	H			
DH-15	Well Site Drill Hole				10/86	5	Sequential Extraction & Totals - H						
DH-16	Well Site Drill Hole				11/86	5	Sequential Extraction & Totals - H						
DH-17	Well Site Drill Hole				11/86	3	Sequential Extraction & Totals - H						
DH-18	Well Site Drill Hole				12/86	4	H						
DH-19	Well Site Drill Hole				4/87	9	H						
DH-20	Well Site Drill Hole				4/87	9	H						
DH-21	Well Site Drill Hole				4/87	9	SVOA(3) & H						
DH-22	Well Site Drill Hole				4/87	10	H						
DH-23	Well Site Drill Hole				4/87	6	H						
DH-24	Well Site Drill Hole				4/87	10	H						
DH-25	Well Site Drill Hole				4/87	8	SVOA(3) & H						
DH-26	Well Site Drill Hole				5/87	8	SVOA(3) & H						
DH-27	Well Site Drill Hole							12/87	9	H			
DH-28	Well Site Drill Hole							12/87	8	H			
DH-29	Well Site Drill Hole							12/87	7	H			

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

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East Helena Groundwater Monitoring Well Drill Hole Soils													
EH-57	Well Site Drill Hole				5/87	10	H						
EH-59	Well Site Drill Hole				5/87	7	H						
EH-60	Well Site Drill Hole							12/87	2	H			
EH-61	Well Site Drill Hole							11/87	7	H			
EH-100	Well Site Drill Hole				11/86	10	Sequential Extraction & Totals - H						
EH-101	Well Site Drill Hole				10/86	4	Sequential Extraction & Totals - H						
EH-102	Well Site Drill Hole				11/86	4	Sequential Extraction & Totals - H						
Plant Site Soil Samples Not Associated With Well Sites													
ASEX-SW-1	Acid Plant Demolition Surface Samples										4/93	1	See Table 3-2-8
ASEX-HDS-1	Acid Plant Demolition Surface Samples										4/93	1	See Table 3-2-8
ASEX-HDS-2	Acid Plant Demolition Surface Samples										4/93	1	See Table 3-2-8
APSD-5	Core Sample										8/91	8	See Table 3-2-3
APSD-6	Core Sample										8/91	7	See Table 3-2-3
AS\S\1EXC	Acid Plant Post Excavation Samples										5/93	1	See Table 3-2-8
C-56 thru C-106	Lower Lake Core Samp.										4/95	121	See Table 3-2-5
LH-1	Lower Lake Core Samp.							10/87	6	H			
LH-2	Lower Lake Core Samp.							10/87	8	H			
LH-3	Lower Lake Core Samp.							11/87	8	H			
LH-4	Lower Lake Core Samp.							11/87	9	H			
LH-5	Lower Lake Core Samp.							11/87	8	H			
LH-6	Lower Lake Core Samp.							11/87	7	H			
LH-8	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-11	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-13	Lower Lake Core Samp.										10/91, 4/92	2	See Table 3-2-5
LH-18	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-20	Lower Lake Core Samp.										10/91, 4/92	2	See Table 3-2-5
LH-26	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-28	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-31	Lower Lake Core Samp.										10/91	1	See Table 3-2-5
LH-34	Lower Lake Core Samp.										5/92, 8/92, 10/92	7	See Table 3-2-5
LH-37	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LH-38	Lower Lake Core Samp.										5/92	1	See Table 3-2-5
LH-41	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LH-42	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LH-46	Lower Lake Core Samp.										5/92	1	See Table 3-2-5
LH-47	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LH-49	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LH-52	Lower Lake Core Samp.										4/87	1	See Table 3-2-5
LH-54	Lower Lake Core Samp.										5/92, 8/92	2	See Table 3-2-5
LLB-1	Lower L. Boundry Core										11/90	4	See Table 3-2-3
LLB-2	Lower L. Boundry Core										11/90	4	See Table 3-2-3
LLB-3	Lower L. Boundry Core										11/90	3	See Table 3-2-3
LLB-4	Lower L. Boundry Core										11/90	4	See Table 3-2-3
LLB-5	Lower L. Boundry Core										11/90	2	See Table 3-2-3
LLB-6	Lower L. Boundry Core										11/90	3	See Table 3-2-3
LLB-7	Lower L. Boundry Core										11/90	2	See Table 3-2-3
LLB-8	Lower L. Boundry Core										11/90	2	See Table 3-2-3
LOWERLKSED	Lower Lake Sediment	11/84	1	G									
APSD-P1 thru APSD-P9	Acid Plant Sediment Drying Area Pit Samples										8/96-9/96	7	See Table 3-2-9
Pile #3 thru Pile #119	Lower Ore Storage Area Pit Samples										10/94	100	See Table 3-2-3
S-3SED	Sump Lower Ore Storage Area Sediment							10/87	1	H			

TABLE 3-2-1. HISTORICAL SUMMARY OF THE WATER, SOIL AND SLAG SAMPLING PROGRAM

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Plant Site Soil Samples Not Associated With Well Sites (Cont.)													
SC-1	Soil Core Samples from Various Sites							11/87	2	H			
SC-2	Soil Core Samples from Various Sites							11/87	3	H			
SC-3	Soil Core Samples from Various Sites							12/87	10	H			
SC-4	Soil Core Samples from Various Sites							12/87	9	H			
SC-5	Soil Core Samples from Various Sites							12/87	7	H			
SP-1SED	Speiss Pond Sediment							11/87	1	H			
SPIT-1	Speiss Pit Post Excavation Samples										7/95	1	arsenic, cadmium, copper, lead, zinc
SPIT-2	Speiss Pit Post Excavation Samples										7/95	1	arsenic, cadmium, copper, lead, zinc
SP-SS-1 thru SP-SS-9	Speiss Pond Core Samples										7/89	87	arsenic, cadmium, copper & lead (EPTOX only)
SS-1 thru SS-31 (4)	Plant Site Surface Soil Samples							1987	26	See Table 4-1-1			
ST-2SED	Sinter Plant Sediment							10/87	1	H			
TH-1	Thornock L. Core Samp.							12/87	4	H			
TH-2	Thornock L. Core Samp.							12/87	8	H			
TL-001 thru TL-009	Thornock Lake Surficial										12/91	9	See Table 3-2-7
TL-3	Thornock L. Sediment										6/91	6	See Table 3-2-7
TL-4	Thornock L. Sediment										6/91	6	See Table 3-2-7
TREATSLUDG	Lower Lake Sludge										6/92	1	See Table 3-2-5
TT-1SED	Thornock Lake Sediment	11/84	1	G				10/87	1	H			
Soils Samples Associated With Surface Water Sites													
PPC-3SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-4SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-5SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-6SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-7SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-8SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
PPC-9SED	Prickly Pear Cr. Sediment	11/84,5/85	2	G									
UPPERLKSED	Upper Lake Sediment	11/84	1	G									
WD-2SED	Wilson Ditch Sediment	11/84	1	G									
WD-3SED	Wilson Ditch Sediment	11/84	1	G									
WD-2	Wilson Ditch Pit Samples							12/87	4	H			
WD-3	Wilson Ditch Pit Samples							12/87	4	H			
WD-4	Wilson Ditch Pit Samples							12/87	4	H			
WD-5	Wilson Ditch Pit Samples							12/87	4	H			
WD-A (PRE)	Wilson Ditch Proper Pit Samples										2/93, 4/93	94	arsenic, lead, cadmium
WD-A (PST)	Wilson Ditch Sediment										4/93-4/94	146	arsenic, lead, cadmium
WD-B (PST)	Wilson Ditch Spur Sediments										4/93	13	arsenic, lead, cadmium
WD-C (PST)	New Wilson Ditch Soil										4/93-5/93	19	arsenic, lead, cadmium
Slag													
FSLAG	Slag Pile Leachate				P 1986-87	6	H						
USLAG	Slag Pile Leachate				P 1986-87	5	H						

Notes: 1) A = Annual Sampling; SA = Semi-Annual Sampling; S = Seasonal; and P = Periodic Sampling.

2) Refer to Table 3-2-2. Sampling Parameter Schedule

3) SVOA = Semi-Volatile Organic Analysis

4) Refer to Table 4-1-1 for data. Hydrometrics did not collect these samples, therefore, data is not in Appendix 3-1-3.

TABLE 3-2-2. SAMPLE PARAMETER SCHEDULE

	Schedules								
	A	B	C	D	E	F	G	H	I
Parameter	Complete [1]	Partial [1]	Special A [1]	Standard[2]	Special B [2]	Special C [3]	Phase I Soils [1]	Post Phase I Soils [2]	Slag [2]
Physical Parameters									
Specific Conductivity (field & lab)	X	X	X	X	X	X			
pH (fld & lab)	X	X	X	X	X	X			
Depth to Water Level or Flow	X [4]	X [4]	X [4]	X	X	X			
Total Dissolved Solids	X	X	X	X	X	X			
Total Suspended Solids (Surface Water Only)	X	X	X	X	X	X			
Dissolved Oxygen	X [4]	X [4]	X [4]	X	X	X			
Temperature	X [4]	X [4]	X [4]	X [4]	X [4]	X			
Ions and Cations									
Sulfate	X		X	X	X	X			
Chloride	X		X		X	X			
Total Alkalinity as $CaCO_3$	X		X		X	X [5]			
Bicarbonate	X		X	X	X	X [5]			
Calcium	X		X		X	X [5]			
Magnesium	X		X		X	X [5]			
Sodium	X		X		X	X [5]			
Potassium	X		X		X	X [5]			
Arsenic and Metals (total and dissolved for surface water; dissolved for ground water)									
Aluminum			X						
Antimony			X				X		
Arsenic	X	X	X	X	X	X	X	X	X
Arsenic III					X[6]	X			
Arsenic V					X[6]	X			
Barium			X				X		X
Beryllium			X						
Cadmium	X	X	X	X	X	X	X	X	X
Chromium			X				X		X
Cobalt			X				X		
Copper	X		X		X	X	X	X	X
Iron	X		X	X	X		X	X	X
Iron II					X[6]				
Iron III					X [7]				
Lead	X	X	X	X	X		X	X	X
Manganese	X		X		X	X	X		X
Mercury			X				X		X
Nickel			X					X	
Selenium			X						X
Silver			X				X		X
Thallium			X						
Tin			X						
Vanadium			X				X		
Zinc	X	X	X	X	X	X	X	X	X
Organics									
Volatile Organics [8]					X	X	X		
Semi-Volatile Organics[9]					X	X	X		
Fuel Hydrocarbons (Gas & Diesel)[10]					X	X			

Notes: 1) ASARCO and Hydrometrics, 1984. Hydrogeological Investigation of the Asarco East Helena Plant, Water Resources Monitoring Plan, June 29,1984.

2) Hydrometrics, 1986. Water Resources Investigation ASARCO East Helena Plant - Phase II, Remedial Investigation Work Plan, August, 1986; and
Hydrometrics and MDI, 1987. Comprehensive Remedial Investigation/Feasibility Study Plan, ASARCO, East Helena, Montana.

3) Variation of Special B analyte list used for the Post RI/FS Sampling.

4) Required by Work Plan but was not consistantly recorded.

5) Analyzed in the Spring only for Plant Process Plant Fluids, Ground Water and Private Well samples.

6) Not analyzed in Plant Process Fluids.

7) Required by Work Plan but was not analyzed.

8) EPA Method 624, Target Compound List - Only analyzed for sites DH-13, EH-60 and EH-61.

9) EPA Method 625, Target Compund List, Only analyzed for sites DH-13, DH-17(1 sample event), DH-24(1 sample event), EH-60 and EH-61.

10) Only analyzed for sites, DH-13, DH-24, EH-60 and EH-61, EH-62. Carbon analyses for Site DH-27 & DH-28, starting Fall 1996.

11) Hydrometrics, 1986. Water Resources Investigation Asarco East Helena Plant - Phase II, Remedial Investigation Work Plan, August 1986. Sampled during construction phase only.

were collected by Asarco for information purposes and were not part of an established work plan.

Borehole samples were taken at sites APSD-5 and APSD-6 in August of 1991. These samples were sent to Asarco's Technical Services Center in Salt Lake City (TSC-SLC) for Extraction Procedure Toxicity (EPTOX) tests and the leachate was tested for arsenic and metals.

Soil and leachate samples were analyzed according to each laboratories' analytical plan (LAP) and quality assurance plan (QAP). The results for these samples were not validated.

Table 3-2-3 summarizes sampling conducted in the areas between Upper Lake, Lower Lake and Prickly Pear Creek.

3.2.2.2 Subsurface Soils

Post RI/FS sampling of subsurface soils was conducted in conjunction with the implementation of remedial measures for Lower Lake, the former Thornock Lake area, the Speiss Pond area, and the acid plant water treatment facility. The data collection associated with remedial activities in each of these areas is described in Section 3.2.3. Additional subsurface soils characterization was also conducted in the Acid Plant sediment drying area and in the area between Upper and Lower Lakes. This included soils data from test pits, soil borings and installation of monitoring wells.

In November of 1990, soil samples were taken at eight test pit sites (LLB-1 through LLB-8) in the area between Upper and Lower Lake in order to characterize the soils. Each site was sampled at the following intervals: 0-1 ft., 2-3 ft., 3-5 ft., and 9-10 ft. Samples were analyzed for Toxic Characteristic Leaching Procedure (TCLP) and total arsenic and metals. These data were collected by Asarco for information purposes and were not part of an established work plan.

Borehole samples were taken at sites APSD-5 and APSD-6 in August of 1991. These samples were sent to Asarco's Technical Services Center in Salt Lake City (TSC-SLC) for Extraction Procedure Toxicity (EPTOX) tests and the leachate was tested for arsenic and metals.

Soil and leachate samples were analyzed according to each laboratories' analytical plan (LAP) and quality assurance plan (QAP). The results for these samples were not validated.

Table 3-2-3 summarizes sampling conducted in the areas between Upper Lake, Lower Lake and Prickly Pear Creek.

TABLE 3-2-3. AREAS BETWEEN UPPER LAKE AND LOWER LAKE, LOWER LAKE AND PRICKLY PEAR CREEK, AND LOWER ORE STORAGE AREA SAMPLING SUMMARY

	LLB-1 thru LLB-8 Pit Soil 24 Samples		APSD-5 and 6 Drill Hole Soils 15 Samples	Pile#3-Pile #119 (Stockpiles) 100 Samples
Parameter	**TCLP**	**Total**	**EPTOX**	**XRF**
Arsenic	X	X	X	X
Barium	X		X	
Cadmium	X	X	X	
Chromium	X		X	
Iron		X		
Lead	X	X	X	X
Manganese		X		
Mercury	X		X	
Selenium	X		X	
Silver	X		X	
Zinc		X		

3.2.2.3 **Stockpiles**

Stockpile characterization sampling was conducted in October 1994. One-hundred test pit samples* were collected from stockpiles in the Lower Ore Storage Area and in the area between Upper and Lower Lakes. These samples were analyzed by Hydrometrics' East Helena Laboratory (EHLAB) for total lead and arsenic using x-ray fluorescence (XRF) according to the laboratory's LAP and QAP procedures. The results for these samples were not validated. ~~Table 3-2-3 summarizes this sampling event.~~

3.2.2.4 **Slag**

Post RI/FS sampling of the slag pile was not conducted. Refer to Table 3-2-1 and 3-2-2 for Phase II sampling information.

3.2.3 Post RI/FS Process Fluid Circuits Data

Data has been collected as part of the following:

- Process Ponds:
    - Lower Lake Testing and Remedial Action
    - Former Thornock Lake Remedial Action
    - Acid Plant Water Treatment Facility (Settling Ponds and Sediment Drying Area)
    - Remedial Action
    - Speiss Granulating Pond and Pit Remedial Action
- Process Fluid Circuits
    - Plant Water Operational Monitoring
    - HDS MPDES Monitoring

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* Test pit samples were composites of individual samples collected throughout the vertical profile of the pit.

Samples associated with the Process Ponds data (1990 to present) were collected according to

the Comprehensive Work Plan for Remedial Design and Remedial Action Sampling and Analyses Plan (Hydrometrics, 1990b). This plan was developed as an action response to the Record of Decision (ROD) for the Process Ponds Operable Unit.

3.2.3.1 <u>Lower Lake In Situ Treatment and Dredging Phase (1990-1996)</u>

The ROD prescribed treatment of Lower Lake water and the dredging of Lower Lake sludges and marsh deposits (collectively referred to as sediments) since both the water and sediments were shown to contain elevated concentrations of arsenic and selected metals (Process Ponds RI/FS, 1989).

Treatment of Lower Lake Water

The feasibility of in-situ treatment of Lower Lake water to remove arsenic and metals to concentrations at or below those prescribed in the ROD was first examined by bench scale testing in fall 1989 (Hydrometrics, 1990a). Bench scale testing consisted of three individual precipitation and settling tests using various reagents. Seven untreated and treated water samples, and one post treatment sediments sample were collected in January 1990. These samples were sent to TSC-SLC for total and dissolved arsenic and metal analyses (see Table 3-2-4).

The in-situ pilot scale testing program was conducted from January 1990 to September 1990 and was based on bench scale test results. The purpose of the testing program was to test and develop a potentially feasible in-place method for removing arsenic and selected metals from Lower Lake water. The testing was divided into two phases. Phase I pilot testing was conducted in a 3000-gallon fiberglass tank using Lower Lake water. The Phase I pilot consisted of six tests in which a total of 23 treated and untreated water samples, and three sludge samples were collected. These samples were analyzed by TSC-SLC for the same parameters as the bench scale tests.

TABLE 3-2-4. LOWER LAKE IN-SITU TREATMENT WATER AND SEDIMENT SAMPLING SUMMARY

Parameter	Bench & Phase I Pilot			Phase II Lower Lake Pilot
	30 Samples	1 Post Treatment Sed	3 Sludge	32 Samples
Arsenic (dis & tot)	X		X	X
Cadmium (dis & tot)	X		X	X
Copper (dis & tot)	X		X	X
Iron (dis & tot)	X		X	X
Magnesium (tot)		X		
Manganese (dis & tot)	X		X	X
Lead (dis & tot)	X		X	X
Zinc (dis & tot)	X		X	X
Carbonate	X			
Chloride	X	X	X	
Specific Conductivity	X			
Bicarbonate	X			
Potassium	X			
Magnesium	X			
Sodium	X			
Sulfate	X			
pH	X			
Total Dissolved Solids	X			
% Moisture		X	X	
% Solids		X	X	

Phase II testing took place in two partitioned areas of Lower Lake and was intended to demonstrate a possible methodology for full scale treatment. A total of 32 treated and untreated water samples were taken. As with the Phase I testing, samples were sent to TSC-SLC for analyses. All analyses for both Phase I and Phase II testing were conducted and validated using CLP procedures. The quality of these data is discussed in Section 3.3.4. Table 3-2-4, above, summarizes samples associated with the in-situ treatment testing (1990).

Dredging of Lower Lake Sediments

To determine the chemical and physical characteristics of Lower Lake sediments, core samples (see Table 3-2-5) were collected from Lower Lake:

- In October 1991, core samples were collected at eight sites. These samples were sent to TSC-SLC. The leachate from EPA Method 1312 and EPTOX tests were analyzed for total arsenic and metals.

  Additional core samples were gathered in April and May 1992 from nine sites. EPTOX and TCLP tests were conducted on these core samples and the leachate was analyzed for total arsenic and metals. During the April and May 1992 sampling period, three additional core samples of Lower Lake bottom sediments were collected; one from a previously unsampled site and two from sites originally sampled in October, 1991. These three samples were also analyzed for total arsenic and metals.
- Five water samples were collected from various sites (see Table 3-2-5) at the same time as the Lower Lake bottom sediment samples (April and May 1992 sampling event). These were analyzed for dissolved arsenic and metals.
- In August of 1992, seven sites from the April and May 1992 sampling event were re-sampled and the leachate from EPA Method 1312 and EPTOX were analyzed for total arsenic and metals.
- In June 1992, one treatment sludge sample[*] was collected from the in-situ pilot scale treatment area. This sample was analyzed for total arsenic and metals.
- In October 1992, five core samples were taken at six inch intervals (from 8.5 ft. to 11.0 ft. below the water surface) from site LH-34 which had been previously sampled in August 1992. These samples were analyzed for total arsenic and metals.

[*] Field notes for this sample could not be found. Therefore, the location where this sample was collected is not known. In addition, although the database indicates the sample is "treatment sludge", the actual sample is thought to consist of a mixture of treatment sludge (from the in-situ pilot scale testing) and Lower Lake sediments.

TABLE 3-2-5. LOWER LAKE SEDIMENT SAMPLING SUMMARY

Site	# of Samp	Method 1312 (1)	EPTOX (2)	TCLP (3)	Total (Soils) (4)	Dissolved (Water) (5)
LH-8	1	10/22/91	10/22/91			
LH-11	1	10/23/91	10/23/91			
LH-13	2	10/23/91	10/23/91		04/23/92	04/23/92
LH-18	1	10/23/91	10/23/91			
LH-20	2	10/23/91	10/23/91		04/23/92	04/23/92
LH-26	1	10/24/91	10/24/91			
LH-28	1	10/23/91	10/23/91			
LH-31	1	10/24/91	10/24/91			
LH-34	3	08/20/92	05/01/92 08/20/92	05/01/92	10/02/92	
LH-37	2	08/20/92	05/01/92 08/20/92	05/01/92		
LH-38	1		05/01/92	05/01/92		
LH-41	2	08/20/92	05/01/92 08/20/92	05/01/92		
LH-42	2	08/20/92	05/01/92	05/01/92		04/23/92
LH-46	1		05/01/92	05/01/92		
LH-47	2	08/27/92	05/01/92 08/27/92	05/01/92		
LH-48	1					04/23/92
LH-49	2	08/27/92	05/01/92 08/27/92	05/01/92		
LH-52	1				04/23/92	04/23/92
LH-54	2	08/27/92	05/01/92 08/27/92	05/01/92		
Treatment Sludge	1				06/29/92	
C-56 thru C-106	122				04/07/95- 08/28/95	

Notes:
1) Total arsenic, cadmium, chromium, copper, mercury, selenium, silver and zinc.
2) Total arsenic, barium, cadmium, lead, mercury, selenium, and silver.
3) Total arsenic, barium, cadmium, copper and zinc.
4) Total arsenic, cadmium, copper, lead and zinc.
5) Dissolved arsenic, cadmium, copper, lead and zinc.

- In April and June of 1995, 53~~122~~ sediment cores ~~samples~~ were collected from Lower Lake for characterization purposes. Representative samples were taken from each core based on stratigraphic intervals. ~~These samples~~Subsamples from 42 cores (132 total) were analyzed for arsenic, cadmium, copper, lead and zinc by XRF at EHLAB. Ten split samples were analyzed at TSC-SLC laboratories for the same parameters.

Lower Lake sediments samples sent to EHLAB were analyzed using the laboratory's LAP and QAP. These samples were validated using the Standard method (described in Section 3.3). All other core soil samples and the associated water samples were sent to TSC-SLC for analyses by CLP procedures. These samples were analyzed and validated using CLP procedures. The quality of the data was deemed acceptable for purposes of the Lower Lake remediation project. Table 3-2-5 summarizes Lower Lake core sampling information (1991-1995).

On April 11, 1994 collection of baseline water samples (ground water, Lower Lake water and Prickly Pear Creek water) associated with the construction phase (dredging) of Lower Lake began. These samples were gathered according to the Sampling and Analyses Plan for Lower Lake Remediation (Hydrometrics, 1994a). Actual dredging of Lower Lake began on May 17, 1994 and twice weekly sampling of Lower Lake took place for the first five weeks. The purpose of this sampling was to determine if dredging was impacting the quality of Lower Lake water. When no significant impacts were apparent, sampling was reduced to once per month during the construction season with the exception of designated sites which were sampled weekly during the period of August 8 to November 3, 1994. After dredging was completed in June 1996, samples were collected in September and November 1996 (quarterly sampling). Starting spring 1997, biannual sampling resumed. Samples associated with Lower Lake's construction phase were sent to TSC-SLC for analysis following the laboratory's specified LAP and QAP. These samples were validated using Standard procedures. Splits of 133 samples collected in April through July 1995 were analyzed by EHLAB (XRF) for quick-turn-around results. The results were used for informational purposes only and were not validated. Post-construction biannual samples were analyzed by TSC-SLC and validated using CLP procedures. Table 3-2-6 summarizes Lower Lake sampling information during and after the construction phase.

TABLE 3-2-6. LOWER LAKE CONSTRUCTION AND POST-CONSTRUCTION WATER SAMPLING SUMMARY

Sample Period	Date(s)	# of Samples per Site	Downgradient Wells (1)	Lower Lake Water (2)	Prickly Pear Cr. (3)	Upgradient Wells (4)
4 Weeks (Wks) before construction	4/11/94	1	X	X(5)	X(6)	X
1-1/2 Wks before construction	5/6/94	1	X	X(5)	X(6)	
Tues/Thurs of 1st wk of construction	5/17/94; 5/19/94	2	X	X(5)	X(6)	
Tues/Thurs of 2nd wk of construction	5/24/94; 5/26/94	2	X	X(5)	X(6)	
Tues/Thurs of 3rd wk of construction	5/31/94; 6/2/94	2	X	X(5)	X(6)	
Weekly of 4th wk of construction	6/6/94	1	X	X(5)	X(6)	
Weekly of 5th wk of construction	6/13/94	1	X	X(5)	X(6)	
Monthly during active construction	Jul.-Oct. 1994; Mar.-Nov. 1995; May-Jun. 1996	4 9 2	X(8)	X	X(7)	X
Special Weekly	8/10/94 to 11/03/94	13	X(8)	X	X(7)	
Quarterly (1st year post-construction)	Sept. 1996 & Nov. 1996	2	X(8)	X	X(7)	X
Bi-annual (2nd- 5th year post-construction)	Spring & Fall 1997	2	X(8)	X	X(7)	X

Notes:
1) Sites DH-4; DH-5, DH-14; APSD-7; APSD-8
2) Sites LL-1S (shallow); LL-1D (deep)
3) Sites PPC-3 (3A); PPC-5; PPC-101 thru PPC-103
4) Sites APSD-1 thru APSD-4; APSD-9 thru APSD-14; DH-20; DH-29
5) Site LL-1S only.
6) Sites PPC-3 (3A) and PPC-5 only.
7) Sites PPC-101 thru PPC-103 only.
8) Sites APDS-7 and APSD-8 only.

3.2.3.2 Former Thornock Lake Remedial Action Phase (1991)

Construction to replace Thornock Lake (a former plant water and storm water runoff flow equalization pond) with a steel tank installed within a concrete vault occurred in 1986 and 1987. The new installation (Thornock Tank) provides secondary containment. During the installation, most of the sediments adjacent to the tank were removed from the bottom of the lake, to a depth of five feet. At this depth, test results from the underlying coarse sediments showed that arsenic and metal concentrations were near background level (refer to Table 3-2-1, sites TH-1 and TH-2). Therefore, further excavation was halted and the area backfilled with clean fill to facilitate placement of the new tank and vault.

In 1989, the ROD required that remaining sediments be removed from the former Thornock Lake site. The depth of excavation was determined by EPTOX tests of the sediments. ~~Specifically, excavation of sediments was halted when the concentration of arsenic and selected metals in the leachate from the EPTOX tests did not exceed 100 times the Federal Primary Drinking Water Standards.~~ Prior to excavation, twelve samples were collected from two pits (one at each end of the former pond area). The samples were collected at one-foot intervals (0 to 4 inches and 4 inches to 12 inches in the first foot) to a total depth of 4.5 feet at one site and to 5 feet at the other site. ~~Laboratory analyses of these samples showed elevated metals and arsenic remained in some of the fine-grained sediments. Due to these sample results, slag, remaining fine-grained sediments and 3.5 to 4 feet of the underlying coarse-grained sediments were removed from the former pond area.~~

After excavation, four surficial samples were collected from individual locations in the bottom of the excavated area. In addition, five samples were collected in one-foot intervals vertically at a single location along the north wall of the excavation. These soil samples were submitted for determination of concentrations of total arsenic and selected metals, and for EPTOX characteristic arsenic and selected metals (see Table 3-2-7). ~~Laboratory results showed EPTOX test results for arsenic and lead concentrations for all post-excavation samples were less than 100 times the Federal Primary Drinking Water Standard. These tests were conducted for informational purposes only, since the remediation objective was based on excavation to a required depth only, and not on post-construction EPTOX test results.~~

Samples associated with the Thornock Lake excavation phase were analyzed by Asarco's TSC-SLC and validated using EPA Contract Laboratory Procedures (CLP). The conclusion of the validation was all results were deemed acceptable for project use. Sampling information associated with the Thornock Lake Remedial Action phase are summarized in Table 3-2-7.

TABLE 3-2-7. FORMER THORNOCK LAKE SEDIMENT AND SOIL SAMPLING SUMMARY

	Pre-Excavation TL-3 and TL-4 Site Codes 12 Samples		**Post-Excavation TL Site Code 9 Samples**	
Parameter	Total Metals	EPTOX	Total Metals	EPTOX
Arsenic	X	X	X	X
Barium		X		X
Cadmium	X	X	X	X
Chromium		X		X
Copper	X		X	X
Iron	X			
Lead	X	X	X	X
Manganese	X			
Mercury		X		X
Selenium		X		X
Silver		X		X
Zinc	X		X	X

3.2.3.3 <u>Acid Plant Water Treatment Facility Settling Pond (Acid Plant Settling Pond) Demolition Phase Data (1991-1993)</u>

Demolition of the Acid Plant Water Treatment Facility Settling Pond* area started in February 1993. Following removal of the Pond's concrete walls and floor, and before excavation of underlying soils began, one soil sample was taken on April 1, 1993. This sample was sent to EHLAB for XRF analyses. On April 8, two additional soil samples were collected from the site, one at the northwest of the old acid plant building site and the second at the northeast corner of building site. Both samples were sent to the EHLAB for XRF

* The "Pond" was actually an open-top, below-grade concrete tank.

analyses. These samples were collected for informational purposes only and were not part of a stipulated work plan.

Excavation of soils underlying the former Pond was completed on April 28, 1993. The maximum excavated depth was 20 feet below the adjacent plant area ground surface. Depending upon location, this depth was from 8 to 11 feet below the measured water table.

On May 17, 1993, one soil sample was taken from the excavated Pond soil pile, and on May 19, three water samples were taken of standing water in the excavation. These samples were sent to TSC-SLC laboratory. The water samples were analyzed for total arsenic, arsenic speciation and total metals. The soil sample was analyzed for total arsenic and selected metals, and ~~EPTOX~~ TCLP leachate arsenic and selected metals. These results were used for informational purposes only since the remediation objective was based on excavation to the water table.

The laboratories used their own LAP and QAP for the analyses. Results for these samples were not validated. Sample information associated with the Acid Plant Settling Water Treatment Facility Pond demolition phase are summarized in Table 3-2-8.

TABLE 3-2-8. ACID PLANT WATER TREATMENT FACILITY SETTLING POND DEMOLITION PHASE WATER AND SOIL SAMPLING SUMMARY

	Pre-Demolition	**Post –Demolition**		
	AP Site Code 3 Samples	**AS\S\1EXC Site Code 1 Sample**		**AS\W\SUMP1-3 Site Code 3 Samples**
Parameter	Soil-Total	Soil-Total	Soil-TCLP	Water-Total
Arsenic	X	X	X	X
Arsenic III				X
Arsenic V				X
Barium			X	
Cadmium	X	X	X	X
Chromium			X	
Copper		X		X
Lead	X	X	X	X
Mercury			X	
Selenium			X	
Silver			X	
Zinc		X		X

3.2.3.4 Acid Plant Water Treatment Facility Sediment Drying Pad Area - Removal of Sediment (1991-1996)

From 1977 through 1991, sludge from the Acid Plant Water Treatment Facility was stored on the Acid Plant Sediment Drying (APSD) Pad north of Upper Lake. In December 1987, a monitoring well (DH-29) was drilled on the northwest side of the pad. Since installation, this well has been sampled biannually. In July of 1991, the Acid Plant sludge was permanently removed from the APSD Pad to the Lower Ore Storage Area.

In August of 1991, four monitoring wells were installed at sites APSD-1 through APSD-4. Drill hole soil samples were taken at two-foot intervals. These samples were sent to TSC-SLC for EPTOX tests and the leachate was tested for arsenic and metals. Groundwater samples from the newly constructed monitoring wells were taken in September of 1991. These samples were sent to TSC-SLC for dissolved arsenic and metals analyses. Biannual water sampling of sites APSD-1 through APSD-4 began in November of 1991.

In response to an EPA informational request (See Appendix 1-1-1), additional borehole samples (1-7 ft. composites) were taken at nine (9) sites in the sediment drying pad area (APSD-P1 through P-4, P-6, P-8 and P-9) in August and September of 1996. These samples were analyzed for total arsenic and metals, and arsenic and metals for TCLP leachate and synthetic precipitation leaching procedure (SPLP) leachate. These samples were sent to TSC-SLC for analyses.

Soil and leachate samples were analyzed according to each laboratories' LAPs and QAPs. The results for these samples were not validated. However, all water samples taken from the new wells were analyzed and validated according to CLP specifications. The quality of these data is addressed with the Post RI/FS water samples (Section 3.2.1). Table 3-2-9 summarizes the APSD Pad sampling:

TABLE 3-2-9. APSD PAD AREA WATER AND SOIL SAMPLING SUMMARY

	During APSD Pad Use	Post APSD Pad Use			
	DH-29 Water Monitoring	APSD-1 thru 4 Water Monitoring	APSD-1 thru 4 Drill Hole Soils 4 Samples	P-1 thru 4; P-6 thru 10 Pit Soils 9 Samples	
Parameter	**See Note**	**See Note**	**EPTOX**	**Total / SPLP**	**TCLP**
Arsenic			X	X	X
Barium			X	X	
Cadmium			X	X	
Chromium			X	X	
Iron					
Lead			X	X	
Manganese					
Mercury			X	X	X
Selenium			X	X	X
Silver			X	X	
Zinc					

Note: Refer to Table 3-2-1 and Table 3-2-2.

3.2.3.5 Speiss Fluid Settling Pond and Speiss Granulating Pit Demolition (1992-1993 and 1995, respectively)

Demolition of the Speiss Fluid Settling Pond started in September 1992 when the concrete lining was broken and removed. Excavation of underlying Speiss Granulating Pond soils followed. Excavation of these soils was completed in November 1992. The maximum excavation depth was 20 feet. Backfilling of the excavated Speiss Fluid Settling Pond area was completed in July 1993, and a concrete pad was poured over the backfill in August 1993. No soil sample results were recorded for the Speiss Fluid Pond demolition phase since remediation objectives were depth-based.

The concrete structure of the Speiss Granulating Pit was removed and underlying soils were excavated to a depth of 17 feet in July 1995. The site was backfilled with clean soils and a concrete cap placed over the backfill in August 1995. ~~No~~ On July 24, 1995, two soil samples were collected from the base of the Speiss Pit excavation (SPIT-01 and SPIT-02).

3.2.3.6 Plant Operation Data (Plant Water Circuit)

Plant water is sampled daily (Monday through Friday) by Asarco employees. This sampling is not mandated by a regulatory agency, but is used by Plant managers to determine if the plant water system is working properly. Sampling occurs at the pumphouse, before plant water is re-circulated. These samples are analyzed for arsenic and pH by Asarco's East Helena laboratory. Analyses are conducted according to the laboratory's analytical procedure plan (LAP) and quality assurance plan (QAP). Field quality control samples are not used.

3.2.3.7 HDS™ Water Treatment Plant Data

Excess plant water is treated by the HDS ™ Water Treatment Plant for removal of arsenic and metals, and is discharged to Lower Lake under the conditions of Montana Pollution Discharge Elimination System (MPDES) Permit No. MT0030147. Seepage from Lower Lake enters the shallow local groundwater system, which discharges to adjacent Prickly Pear Creek. MPDES permit compliance samples are sent to the TSC-SLC laboratory where they are analyzed according to the laboratory's LAP and QAP. Field quality control samples are not used. The data are visually reviewed by TSC-SLC and plant personnel. Monitoring results are sent to the State of Montana and the EPA. These data are not listed in Appendix 3-1-2. Table 3-2-10 lists the sampling sites, sampling intervals and parameters analyzed.

TABLE 3-2-10. MPDES PERMIT SAMPLING SUMMARY FOR HDS EFFLUENT

Sample Site	Sampling Interval	Parameters
HDS Effluent	Daily	Flow, pH, Oil and Grease (visual)
	Weekly	~~Antimony,~~ Arsenic, Cadmium, Copper, Iron, Lead, ~~Manganese,~~ Mercury, ~~Silver,~~ Selenium, Thallium, Zinc, Total Suspended Solids (TSS)
	Monthly	Weekly parameters+Antimony, Manganese
	Quarterly	Phosphorus, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Aluminum, Ammonia, Phosphorus, Silver
PPC-4 (1)	Monthly	Aluminum, Antimony*
PPC-5 (1) at Dam	Weekly	Flow only From July 1 to September 15 only
PPC-6 (1)	Weekly	Ammonia, Temperature, pH for August only
APSD-7 (2)	Monthly	BOD, COD*, Ammonia*, Fecal Coliform* (April – October only)

Notes:

1. Prickly Pear Creek surface water monitoring sites.
2. Groundwater monitoring well installed in the embankment separating Lower Lake from Prickly Pear Creek.

* Discontinued as of November 1, 1998

3.2.4 Post RI/FS Surface Water and Associated Soils Data

The Surface Water and associated bottom sediments data consists of:

- Prickly Pear Creek and Upper Lake
- Wilson Ditch
- Storm Water Runoff.

3.2.4.1 **Prickly Pear Creek Surface Water (1994 to Present)**

Prickly Pear Creek surface water sampling has been conducted biannually since 1989. More frequent sampling occurred during the dredging of the Lower Lake construction phase. The sampling summary for Prickly Pear Creek surface water is addressed in Section 3.2.1 (Biannual Sampling) and in Section 3.2.3.1 (Lower Lake Construction Phase).

In addition, in 1995, pursuant to Section 309(a) (3) of the Clean Water Act, the EPA ordered (Administrative Order for Compliance, CWA-VIII-95-08-C) additional sampling of Prickly Pear Creek and wells between Prickly Pear Creek and Lower Lake. These samples were sent to TSC-SLC and analyzed for arsenic and metals using CLP procedures and validated using Standard procedures (see Section 3.3). The results were deemed acceptable for the purpose of the project. Table 3-2-11 summarizes the sampling for EPA Administrative Orders CWA-VIII-95-08-C.

3.2.4.2 **Upper Lake Data (Post RI/FS)**

Post RI/FS sampling of Upper Lake was not conducted. Refer to Table 3-2-1 and 3-2-2 for Phase I sampling information.

3.2.4.3 **Wilson Ditch Construction Phase (1993-1994)**

The excavation of Wilson Ditch to remove soils with elevated arsenic and metals concentrations started in April of 1993 and (with the exception of a small section) was completed in October 1993. The uncompleted section of Wilson Ditch was excavated in April 1994. Ninety-four pre-construction pit samples (soil) were collected in February and April 1993, at 100-foot sections along Wilson Ditch. During the construction phase, five composite post-excavation soil samples were taken for each 100-foot section, for a total of 178 samples. Each composite sample was gathered from the ditch bottom, each side and each bank. These samples were analyzed for arsenic, cadmium and lead by XRF at EHLAB. Samples were analyzed according to the laboratory's LAP and QAP and validated using a Standard level of validation (described in Section 3.3). Analytical results were deemed acceptable for the purpose of the project. Table 3-2-12 is a summary of sampling associated with the Wilson Ditch construction phase.

TABLE 3-2-11. ADMINISTRATIVE ORDER CWA-VIII-95-08-C SAMPLING SUMMARY

	Weekly (1/6/95 thru 6/29/95)				Monthly (October 1995 thru September 1996)					
Parameter	**PPC-3**	**PPC-4**	**PPC-6**	**PPC-7**	**APSD-7**	**APSD-8**	**DH-4**	**DH-14**	**PPC-4**	**PPC-5**
# of Samples per Site	26	26	26	26	12	12	12	12	12	12
Physical Parameters										
Specific Conductivity (field)	X	X	X	X						
pH (field)	X	X	X	X	X	X	X	X	X	X
Depth to Water Level (ft) or Flow (cfs)	X	X	X	X	X	X	X	X	X	X
Dissolved Oxygen (field)	X	X	X	X						
Temperature (field)	X	X	X	X	X	X	X	X	X	X
Anions and Cations										
Sulfate	X	X	X	X	X	X	X	X	X	X
Chloride (2)										X
Total Alkalinity as $CaCO_3$ (2)										X
Bicarbonate (2)										X
Total Hardness as $CaCO_3$ (1)	X	X	X	X	X	X	X	X	X	X
Calcium (1)	X	X	X	X	X	X	X	X	X	X
Magnesium (1)	X	X	X	X	X	X	X	X	X	X
Sodium (2)										X
Potassium (2)										X
Nutrients										
Total Ammonia	X	X	X	X	X	X	X	X	X	X
Nitrate + Nitrite **as** N	X	X	X	X	X	X	X	X	X	X
Arsenic and Metals										
Aluminum (TRC)	X	X	X	X	X	X	X	X	X	X
Antimony (TRC)					X	X	X	X	X	X
Arsenic (TRC)	X	X	X	X						
Arsenic (dis)					X	X	X	X	X	X
Arsenic (tot)					X	X	X	X	X	X
Beryllium (TRC)	X	X	X	X	X	X	X	X	X	X
Cadmium (TRC)	X	X	X	X						
Cadmium (dis)					X	X	X	X	X	X
Cadmium (tot)					X	X	X	X	X	X
Chromium (TRC)	X	X	X	X						
Copper (TRC)	X	X	X	X						
Copper (dis)					X	X	X	X	X	X

TABLE 3-2-11. ADMINISTRATIVE ORDER CWA-VIII-95-08-C SAMPLING SUMMARY (continued)

	Weekly (1/6/95 thru 6/29/95)				Monthly (October 1995 thru September 1996)					
Parameter	**PPC-3**	**PPC-4**	**PPC-6**	**PPC-7**	**APSD-7**	**APSD-8**	**DH-4**	**DH-14**	**PPC-4**	**PPC-5**
Copper (tot)					X	X	X	X	X	X
Iron (TRC)	X	X	X	X	X	X	X	X	X	X
Lead (TRC)	X	X	X	X						
Lead (dis)					X	X	X	X	X	X
Lead (tot)					X	X	X	X	X	X
Manganese (TRC)	X	X	X	X	X	X	X	X	X	X
Mercury (tot)					X	X	X	X	X	X
Mercury (TRC)	X	X	X	X						
Nickel (TRC)	X	X	X	X						
Selenium (TRC)	X	X	X	X	X	X	X	X	X	X
Silver (TRC)	X	X	X	X	X	X	X	X	X	X
Thallium (TRC)	X	X	X	X	X	X	X	X	X	X
Zinc (TRC)	X	X	X	X						
Zinc (dis)					X	X	X	X	X	X
Zinc (tot)					X	X	X	X	X	X

Notes:

1) Parameter not analyzed after 10/4/95, except for Site PPC-5.

2) Started analyzing parameter 12/12/95.

TABLE 3-2-12. WILSON DITCH SOIL SAMPLING SUMMARY

Site Code	Pre-Construction 94 Samples	Post-Construction 178 Samples
WD-A (Wilson Ditch Proper)	2/93 & 4/93	4/93 thru 10/93, 4/94
WD-B (Wilson Ditch Spur)		4/93
WD-C (New Wilson Ditch)		4/93 thru 5/93

In November 1993, 25 samples of Wilson Ditch excavated soils were collected from the Wilson Ditch excavated soils disposal pile. Samples were collected at two-foot depth intervals at five sites (on the disposal pile) for a total of five samples per site. The samples were sent to the EHLAB for XRF analyses of total arsenic, cadmium, lead and zinc. Splits of these samples were sent to TSC-SLC for TCLP and SPLP testing. Leachate from these tests was analyzed for total arsenic, cadmium, and lead. XRF analyses were conducted by EHLAB's LAP and QAP and validated using a Standard level of validation (see Section 3.3). Samples sent to TSC-SLC were analyzed using CLP procedures. These samples were not validated.

3.2.5 Post RI/FS Groundwater Well Construction Data (1993)

In October of 1993, monitoring wells APSD-7 and APSD-8 were constructed between Lower Lake and Prickly Pear Creek; and monitoring wells APSD–9 through APSD-14 were constructed between Upper and Lower Lake. Soil samples were collected at two-foot intervals from the drill holes for a total of 58 samples. These samples were analyzed for total arsenic, cadmium, lead and zinc at EHLAB (XRF). The results for these samples were not validated. Biannual water sampling for these wells began in November, 1993.

3.2.6 General Storm Water Discharge Data

Under the Montana General Storm Water Discharge Permit for Industrial Facilities (Permit Number MTR000072), the site was granted authorization to discharge storm water in June 1993. The Permit was reissued in March 1995. Under the conditions of the General Permit, semi-annual sampling of storm water from the site was conducted. Sampling and flow measurements were conducted by Hydrometrics and samples were analyzed by TSC-SLC according to the laboratory's LAP and QAP. Analyses included pH, total suspended solids (TSS), total kjeldahl nitrogen (TKN), phosphorus, chemical oxygen demand (COD), and total and dissolved arsenic and metals. Oil and grease, and biological oxygen demand (BOD) were analyzed by Alpine Analytical Laboratory located in Helena, Montana beginning in 1996. Field quality control samples were not submitted for analysis. Data quality was reviewed by the laboratories and Hydrometrics. All data were sent to the State of Montana as required by the General Permit.

In December 1997, the Plant completed installation of a storm water containment system designed to contain runoff resulting from storm events up to and including the 100-year, 24-hour storm. With the exception of an 5.8 acre area used as a rail car cover laydown area, all storm water exiting the plant is contained in the containment facility. Storm water runoff from the 5.8 acre laydown area and overflow from the containment facility, for storms larger then the 25-year event, is directed towards the northern end of the Manlove Subdivision in East Helena and impounded in a depressed area along the Montana Rail Link railroad tracks. Storm runoff will be impounded in this area for storms up to and including the 100-year event. For storms larger than the 100-year event, water will exit the impoundment area through a riser/culvert and will flow to the agricultural fields to the northwest and potentially to Prickly Pear Creek.

Storm water contained in the containment facility is routed back to the smelter's plant water circuit via Thornock Tank. This water is reused within the plant water system with eventual treatment by the HDS plant. Currently, the General Storm Water Discharge Permit has been retained by Asarco in the unlikely event that Facility generated storm water runoff has the potential to reach Prickly Pear Creek.

3.3 SAMPLE DATA QUALITY

The quality of sample data is examined using three basic validation levels (refer to Appendix 3-1-1). The first level (as stated below) involves visual verification of sample data. The remaining two levels involve a more detailed examination of the data to quantify the data's precision, accuracy and completeness. Regardless of validation level, all results of samples analyzed at the TSC-SLC laboratory were internally reviewed by the laboratory before they were released. Following is a list of the methods used by Hydrometrics' QA/QC Department, and their descriptions:

- Visual validation - Sample results are visually inspected for obvious errors and entered into a database system where the results are again checked for data entry errors.
- Standard validation procedures - Visual validation plus field QC and laboratory QC forms (provided in a standard analyses laboratory package) are examined. Data may or may not be qualified depending on specific project and method requirements. Laboratory raw data and calculations are not reviewed.
- EPA Contract Laboratory Procedures (CLP) - This validation method uses specific EPA procedures for quantitatively examining and qualifying laboratory and field data using statistical methods. CLP validation is an in-depth examination of all field and laboratory quality control (QC) samples, laboratory procedures, laboratory raw data, instrument printouts, laboratory logs and calculations. Field and laboratory data are validated and flagged for violations according to "EPA CLP National Functional Guidelines for Inorganic/Organic Data Review."

Validation reports were written and delivered to the EPA for all CLP validated data (refer to Appendix 3-1-1).