1.9.7

INTERIM ACTION REPORT
FENCED AREA CLEANUP
EVERETT SMELTER SITE

Public Review Draft

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December 2002

USEPA SF
1192381

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1.0 PURPOSE AND GENERAL REQUIREMENTS

The Washington Department of Ecology (Ecology) has issued an enforcement order (#02TCPNR-4059) to ASARCO Incorporated (Asarco) to perform an interim action to address the area of the former Everett smelter designated as the fenced area (see Figures 1-1 and 1-2). Within the fenced area, Ecology is requiring Asarco to remove soil and former smelter debris with arsenic concentrations greater than 3,000 mg/kg arsenic. Removal is required to begin no later than April 30, 2003 and be completed by October 30, 2004. Ecology is not requiring Asarco to perform any other actions at the Everett smelter under this enforcement order.

Asarco and Ecology have discussed an approach that would allow Asarco to meet the conditions of the enforcement order under this schedule and that will allow the work to be performed with significant cost savings. Asarco's plan to perform this work at Everett utilizes the former Tacoma smelter, a Superfund site that is also being remediated under EPA oversight. At the Tacoma smelter, a much larger amount of the same type of material that is present at Everett (i.e., source area material) is being excavated and disposed of at the smelter in an On-site Containment Facility (OCF). The OCF has been constructed to exceed RCRA Subtitle C standards for hazardous waste landfills in order for the source area materials to be disposed there without further treatment. The capacity of the OCF is 260,000 cubic yards (CY) and the current estimate of the quantity of material from the Tacoma smelter that will be disposed of in the OCF is about 210,000 CY. The remaining capacity of the OCF at Tacoma is available to dispose of the same type of material from Everett within the fenced area. This volume has been estimated to be about 25,000 CY, less than 10% of the amount of material that will be disposed of from Tacoma and within the remaining capacity of the OCF.

The key elements of the approach Asarco is prepared to implement for removal of the fenced area material at Everett are:

- The material greater than 3,000 mg/kg arsenic within the fenced area will be removed and transported to the Tacoma smelter for disposal in the OCF without treatment.
- Material less than 3,000 mg/kg arsenic will also be removed from the fenced area, transported to Tacoma, and placed beneath the Tacoma Smelter site-wide cap along with other soils from the cleanup of residential yards in Ruston and north Tacoma.
- Asarco will backfill and grade the fenced area with clean material following remediation and proceed with redevelopment of its property. At the completion of remediation, Asarco will revegate and provide for storm water, erosion, and sediment control at the site.

There are three key conditions needed to perform the cleanup of the fenced area:

- ✓ Asarco will prepare an Interim Action Report (IAR – this document) consistent with MTCA requirements. Ecology will have to approve this IAR.

- ✓ EPA and Ecology will have to approve the transportation of material to the Tacoma smelter and the disposal of soil and debris with concentrations greater than 3,000 mg/kg arsenic in the OCF without treatment.

- ✓ Favorable support from the communities of Ruston and Tacoma will be necessary to dispose of material from Everett at the former Tacoma smelter.

Asarco may also remediate the residential properties immediately adjacent to the fenced area and within the boundary of property historically owned by Asarco (see Figure 1-2). If Asarco decides to proceed with this phase of cleanup, the work will be conducted per the provisions of the FCAP applicable to residential properties (see Section 3.5).

Interim actions are regulated under WAC 173-340-430 and are intended to partially address the cleanup of a site, although they may constitute the entire cleanup if they comply with applicable requirements (WAC 173-340-430 (1)). WAC 173-340-430 (2) describes the

general requirements of interim actions. WAC 173-340-430 (3) (a) goes on to require the interim action to be performed consistent with the ultimate cleanup action if it has been selected. WAC 173-340-430 (4), (5), and (6) establish the requirements for timing of the interim action, the administrative options which allow interim actions (i.e., enforcement order #02TCPNR-4059), and public participation, respectively. Submittal requirements for the IAR are stated in WAC 173-340-430 (7) and construction provisions are subject to WAC 173-340-430 (8).

1.1 CLEANUP STANDARDS

In accordance with WAC 173-340-430 (2), interim actions may (a) achieve cleanup standards for a portion of the site; or (b) provide a partial cleanup, that is, clean up hazardous substances from all or part of the site, but not achieve cleanup standards; or (c) provide a partial cleanup of hazardous substances and not achieve cleanup standards for a cleanup. WAC 173-340-430 (3)(a) requires the interim action to be performed consistent with the selected final cleanup action (i.e., the FCAP).

Cleanup standards for the Everett site have been established in the FCAP. The FCAP contains cleanup standards for soil, groundwater, surface water, and storm drain sediment in these areas of the site. Cleanup standards consist of both cleanup levels and points of compliance. This IAR has been prepared to comply with these requirements and is focused on remediation of the fenced area consistent with the enforcement order. Remediation of the residential properties adjacent to the fenced area will be conducted per the requirements and specifications of the FCAP if Asarco remediates these residential properties.

1.1.1 Soil

The FCAP established the following soil cleanup levels for residential land which are shown in Table 1-1:

TABLE 1-1. SOIL CLEANUP LEVELS

Chemical	Cleanup Level (mg/Kg)
Arsenic	20
Lead	353
Cadmium	80
Antimony	32
Mercury	24
Thallium	5.6

The point of compliance for soil will be the existing ground surface to a depth of 15 feet below the ground surface for direct contact with soil and throughout the site for protection of surface and ground water.

1.1.2 Groundwater

The established cleanup levels consist of acute and chronic levels for groundwater and are shown in Table 1-2. The FCAP states that the groundwater is not present in sufficient quantity to serve as a drinking water supply and that the City of Everett has no plans to use groundwater from the fenced area in the future.

TABLE 1-2. GROUNDWATER CLEANUP LEVELS

Chemical	Cleanup Level	
	Acute Level (ug/L)	Chronic Level (ug/L)
Arsenic	360 (c)	190 (d)
Lead (dd)	(q,c)	(r,d)
Cadmium (dd)	(i,c)	(j,d)
Mercury (s,ff)	2.4 (c)	0.012 (d)

(c): A 1-hour average concentration not to be exceeded more than once every three years on the average.

(d): A 4-day average concentration not to be exceeded more than once every three years on average.

(i): $\leq (0.865)(e^{(1.28[\ln(hardness)]-3.828)})$

(j): $\leq (0.865)(e^{(0.7852[\ln(hardness)]-3.49)})$

(q): $\leq (0.687)(e^{(1.273[\ln(hardness)]-1.46)})$

(r): $\leq (0.687)(e^{(1.273[\ln(hardness)]-4.705)})$

(s): If the 4-day average chronic concentration is exceeded more than once in a three-year period, the edible portion of the consumed species should be analyzed. Said edible tissue concentrations shall not be allowed to exceed 1.0 mg/Kg of methylmercury.

(dd): These ambient criteria are based on the dissolved fraction (for cyanide criteria using the weak and dissociable method) of the metal. The department shall apply the criteria as total recoverable values to calculate effluent limits unless data is made available to the department clearly demonstrating the seasonal portioning of the dissolved metal in the ambient water in relation to an effluent discharge. Metals criteria may be adjusted on a site-specific basis when data is made available to the department clearly demonstrating the effective use of the water effects ration approach established by USEPA *Water Quality Standards Handbook*, December 1998e, as supplemented or replaced. Information which is used to develop effluent limits based on applying metals portioning studies or the water effects ration approach shall be identified in the permit fact sheet developed pursuant to WAC 173-220-060 or 173-226-110, as appropriate, and shall be made available for the public comment period required pursuant to WAC 173-220-050 or 173-226-130(3), as appropriate.

(ff): These criteria are based on the total-recoverable fraction of the metal.

Antimony and thallium do not have standards listed. However, the FCAP states that these chemicals should not be above natural background levels in the state.

Because it is anticipated that some hazardous substances will remain on-site above the cleanup levels (i.e., soils > 150 mg/Kg arsenic under a minimum of 2 ft. of backfill), a conditional point of compliance is to be as close as practicable to the source of these substances. The point of compliance for groundwater shall be a conditional point of compliance located at any receiving surface water body in the Upland Area (such as ditches, springs, or other surface water flows) and at the Upland Area boundary, where groundwater flows into the Lowland Area.

1.1.3 Surface Water

Because it is believed that the surface water in the fenced areas reports to the City of Everett's combined sewer storm water system and subsequently to the wastewater treatment plant, the City of Everett's pretreatment criteria will be the cleanup levels. The applicable surface water cleanup levels are shown in Table 1-3.

TABLE 1-3. SURFACE WATER CLEANUP LEVELS

Chemical	Cleanup Level (ug/L)
Arsenic	500
Lead	1890
Antimony	No criteria
Cadmium	240
Mercury	100
Thallium	No criteria

The point of compliance for surface water is set such that identification of potential water quality problems anywhere in the area affected by the interim action may be evaluated by sampling the water at the location of concern and comparing the quality of the water with the

cleanup levels. However, surface water will be controlled during the interim action and specific points of compliance designated.

1.1.4 Storm Drain Sediment

The applicable cleanup levels for storm drain sediment are shown in Table 1-4.

TABLE 1-4. STORM DRAIN SEDIMENT CLEANUP LEVELS

Chemical	Cleanup Level (mg/Kg)
Arsenic	20
Lead	250
Cadmium	2
Antimony	32
Mercury	1
Thallium	5.6

The point of compliance for storm drain sediment will be each cleanout point and at any point where sediment discharges from the storm sewer system.

1.1.5 Indicator Hazardous Substances and Remediation Levels

The six chemicals of concern (arsenic, lead, cadmium, antimony, mercury, and thallium) that have been identified in the FCAP must be monitored for in groundwater, surface water, and storm drain sediment because data regarding the correlation are not sufficient to eliminate any of them from consideration. However, arsenic will be the only indicator chemical for soil because the cleanup of arsenic in soil is expected to result in the cleanup of the other five chemicals.

In addition, for soil, remediation levels have been established in the FCAP that vary from the cleanup levels. For soil removed from typical residential lands, the remediation levels are shown in Table 1-5.

TABLE 1-5. SOIL REMEDIATION LEVELS

Depth	Average Arsenic (mg/Kg)	Maximum Arsenic (mg/Kg)
0-1 feet	20	40
1-2 feet	60	150
2-15 feet	150	500

The average remediation levels will be compared with the composite sample results. The maximum remediation levels will be compared with the discrete sample results, if analysis of discrete samples is required.

Two other soil remediation levels have been established in the FCAP. The first is for gardens at residential properties. At gardens, the remediation levels are an average of 20 mg/Kg and a maximum of 40 mg/Kg for arsenic concentrations to a depth of 18 inches rather than 12 inches. Another remediation level is for maintenance areas not normally occupied (crawl spaces). At these areas, the remediation level is an average of 200 mg/Kg for arsenic concentrations from a composite surface sample.

Locations with soil containing arsenic below the applicable remediation level but above the cleanup level or containing contaminated soil beneath inaccessible areas such as driveways will be subject to institutional controls and confirmational monitoring.

The criteria in Table 1-5 are applicable to the fenced area under the cleanup plan described in this IAR. Specifically, Asarco plans to remove two categories of material from the fenced area: above 3,000 mg/Kg arsenic and above 150 mg/Kg but less than 3,000 mg/Kg arsenic. After removal of this material, the fenced area will be backfilled with at least two feet of clean material to meet the soil cleanup requirements of Table 1-5 above. As such, the result of the interim action will be that soils in the fenced area will satisfy the FCAP requirements for remediation of residential property.

1.2 RELATIONSHIP TO THE FINAL CLEANUP ACTION PLAN

WAC 173-340-430 (2)(b)(i) states that if the cleanup action is known, the interim action shall be consistent with the cleanup action. Therefore the basis of this interim action is the FCAP. The effect of these differences is that the proposed interim action will significantly exceed the applicable requirements of the FCAP. The differences are described in the following subsections.

1.2.1 Residential Properties Adjacent to the Fenced Area

If Asarco decides to proceed with remediation of the residential properties adjacent to the fenced area and within the boundary of property currently or historically owned by Asarco, the work will be conducted as per the FCAP; however, the performance monitoring program will be modified. The performance monitoring program contained in the FCAP was designed to evaluate whether soil arsenic concentrations meet the cleanup level, remediation levels, and other performance standards for each property before soil removal. While this program applies to these properties, existing data suggest that soil removal will be required to a depth of at least 1.5 to 2 feet. Because of the proximity of these properties to the fenced area, the remediation approach has been simplified to require at least two feet of soil removal from the residential properties before soil samples are collected. This strategy provides the following advantages:

- Ensuring that each of the selected properties will have at least two feet of clean backfill that meet the soil cleanup level of 20 mg/Kg for arsenic.
- Eliminating the need for one or two pre-removal sampling events with a drill rig. This strategy will be more cost effective and reduces the inconvenience to the homeowner. Samples will be collected with a hand auger after soil removal. Additionally, discrete samples will be collected at the same time as composite samples (see Appendix A).

1.2.2 Fenced Area

The FCAP selected the Consolidation Facility (accepting problem waste) alternative over the On-Site Containment Facility (accepting dangerous waste) alternative for the fenced area. Asarco's plan under this interim action will not provide a Consolidation Facility but will, following material removal and backfilling of the site, allow the fenced area to be re-developed consistent with the land use rules of the City of Everett.

The interim action should, upon completion, constitute the final cleanup for the fenced area. Asarco's preferred remediation approach for this site is source control: removal and on-site control of material that has the potential to be directly exposed to people and the environment or that can contribute arsenic and other metals to groundwater, surface water, and storm drain sediments. Removal of soil and smelter debris with concentrations over 150 mg/Kg arsenic, followed by capping/containment with at least two feet of clean material, will eliminate direct exposure and is expected to reduce concentrations in groundwater, surface water and storm drain sediments to levels below the cleanup levels listed in Section 1.1. Post remediation monitoring will document the extent of the reductions achieved in these media; should the cleanup levels be attained there is no reason why the interim action will not satisfy the WAC requirements for final cleanup of the fenced area.

The key differences for remediation of the fenced area from the provisions of the FCAP are discussed below.

<u>Soil Removal</u>

In accordance with the FCAP, material that is in excess of 3,000 mg/Kg arsenic will first be removed. However, it will not be sent off for disposal at a permitted commercial facility. Instead, it will be transported to the former Tacoma smelter. This material will subsequently be processed (i.e., reduced in size) if needed, and placed in the Tacoma OCF.

Soil with arsenic concentrations greater than 150 mg/Kg will also be removed and transported to the former Tacoma smelter rather than being placed in a Containment Facility constructed at Everett. This soil will be treated in the same manner as the Ruston/North Tacoma residential soils and will be subsequently used as subgrade backfill below the Tacoma smelter site-wide cap.

Soil Sampling

With the elimination of the Consolidation Facility, the FCAP's performance monitoring strategy has to be adjusted. Sampling will be similar to the residential property strategy. Grids or decision units will be established after the targeted soil is removed. Three sampling events, or phases, will be conducted. One phase will verify the removal of material containing an excess of 3,000 mg/Kg arsenic and the second will verify the removal of soil containing an excess of 150 mg/Kg arsenic. The third phase will provide data following site grading before clean import material is placed. The soil sample collection frequency will follow the FCAP guidelines (i.e., number of locations per square feet). The third phase was requested by Ecology specific to this IAR and these provisions are not mentioned in the FCAP. Specific revisions are presented in Appendix A.

Other

With the elimination of the Consolidation Facility, granite monuments called for in the FCAP will not be erected. In addition, the need for constructing a groundwater interception and diversion trench upgradient of the fenced area is eliminated as only material less than 150 mg/Kg arsenic will be left on-site. Deed restrictions will provide for an easement in which such a trench can be constructed, if needed. The easement will be in place until monitoring data have indicated the source removal is successful.

1.3 INTERIM ACTION TIMING

WAC 173-340-430 (4) specifies the requirements for timing of an interim action in context of the overall cleanup anticipated for a site. It also requires Ecology to set deadlines for the interim action commensurate with the activities to be performed. As stated in the enforcement order, removal of materials with arsenic concentrations above 3,000 mg/Kg is required to begin no later than April 30, 2003 and be completed by October 30, 2004. Deadlines for reports have been established by Ecology.

The timing of the work at Everett under this IAR needs to be closely coordinated with the remediation activities at the Tacoma smelter, particularly the excavation of the remaining source area materials and placement to this and other stockpiled source area materials in the OCF. This is explained in more detail in Section 3.1.2; the overall plan as presented in this IAR is intended to occur within the above-mentioned timeframes established by Ecology.

There are several actions that need to take place in order for the work at Everett to proceed on a schedule that can meet Ecology's timeline. These were included in Asarco's August 9, 2002 letter to Ecology regarding the actions anticipated per the enforcement order. Table 1-6 provides an updated timeline for the actions needed to meet Ecology's deadlines.

1.4 SUBMITTAL REQUIREMENTS FOR THE INTERIM ACTION REPORT

Submittal requirements for the interim action are specified in WAC-340-430 (7). This IAR addresses these requirements as shown in Table 1-7.

TABLE 1-6 REGULATORY AND STAKEHOLDER APPROVALS

Start Date(s)	Anticipated Completion Date	Task	Status
July25, 2002	August 9, 2002	Prepare IAR Outline.	Complete
August 10, 2002	August 23, 2002	Agency IAR Outline review & approval.	Complete
August 23, 2002	January 31, 2003	Work with EPA and Ecology to obtain all necessary approvals; consult with Stakeholders	In process
August 23, 2002	November 8, 2002	Prepare Draft IAR.	Submitted November 8, 2002
August 2002	Undetermined	EPA negotiations on 2003 work scope.	In process
November 12, 2002	December 16, 2003	Agency Draft IAR review and comment.	Completed.
November 12, 2002	December 20, 2002	Prepare Public Review Draft IAR	Completed
December 20, 2002	January 31, 2003	Prepare plans and specifications and Final IAR.	To be completed.
February 1, 2003	February 28, 2003	Ecology Review & Approval – Final IAR and plans and specifications.	To be completed
September 1, 2002	February 15, 2003	All Agency approvals obtained to dispose of soils at Tacoma.	To be completed
March 1, 2003	April 30, 2003	Let Bids and Procure Contractor.	To be completed

TABLE 1-7 EVERETT SMELTER IAR SUBMITTAL REQUIREMENTS

WAC Citation	Requirement	Where Addressed in IAR
173-340-430 (7)(a)	A description of the interim action and how it will meet the criteria in subsections of (1), (2), and (3).	Sections 1.0, 1.1, and 1.2 respectively.
173-340-430 (7)(b)	Information from the applicable subsections of the RI/FS, including at a minimum: (i) A description of all available data related to the interim action; and (ii) Alternative interim actions considered.	(i) Addressed in Sections 2.0 and, 2.1, Appendix E, and Exhibits 2-1 through 2-5. (ii) Addressed in Section 2.2.
173-340-430 (7)(c)	Information from the applicable subsections of the design and construction requirements of WAC 173-340-400.	Sections 3 and 4, Appendix D
173-340-430 (7)(d)	A compliance monitoring plan meeting the applicable requirements of WAC 173-340-410.	Appendix A
173-340-430 (7)(e)	A safety and health plan meeting the requirements of WAC 173-340-810.	Appendix B
173-340-430 (7)(f)	A sampling and analysis plan meeting the requirements of WAC 173-340-820.	Appendix C

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

The Everett smelter site is located in northeast Everett, Washington and includes the former operation area of the Everett Smelter and the surrounding area. The smelter operated from 1894 to 1912 and the structures were demolished by 1915. Remnants of foundations, footings, flue and demolition debris from the smelter were still present when portions of the smelter area were redeveloped for residential use in the 1930s and 1940s. During this redevelopment. smelter demolition debris appears to have been graded with some localized cut and fill for construction of roads, basements, and walkways. The floors and foundations of the former smelter structures are still present in many areas in near surface soils. Construction of the road interchange of East Marine View Drive and State Route 529 in the northern portion of the former smelter operational area occurred in 1956. In the road interchange area, soils (including any residual smelter demolition debris) were excavated and used for fill under the adjacent State Route 529 overpass and Weyerhaeuser access road (see Figure 1-1).

The site has been divided into two primary areas: (1) the upland area, which includes the residential area west of East Marine View Drive; and (2) the lowland area, which includes the industrial properties at the base of the bluff east of East Marine View Drive, extending across the Weyerhaeuser East Site to the Snohomish River. The upland area has been further divided into two primary sub-areas: (1) the smelter area, which includes footprints of the former smelter operations area and adjacent areas where residual smelter materials and debris are present; and (2) the surrounding peripheral area. A portion of the smelter area has been purchased by Asarco and fenced off. The residential structures in this portion (the fenced area) have been demolished and only foundations and ground-level structures remain.

2.1 EXISTING SITE CONDITIONS

This section describes the existing site conditions in the area that will be addressed by the interim action; the fenced area and potentially the residential properties near to it within the boundary of the property historically or currently owned by Asarco (see Figure 1-2).

Environmental conditions in the former smelter area have been investigated and an evaluation of remedial options has been performed as documented in the Remedial Investigation (RI) and Feasibility Study (FS) report (Asarco, 1995). The requirements for additional characterization were specified in Enforcement Order DE 97TC-N119 issued by Ecology. As a result of this order, Asarco prepared the Smelter Area Investigation Report in August 1998.

2.1.1 Smelter Area Characterization Summary

The area of former smelter operations has been thoroughly investigated. For example, during the smelter area investigation, soil samples were collected at 60 locations to depths up to 39 feet. These samples were analyzed for total arsenic and lead and selected samples were also tested for leachability and toxicity. Sampling locations were identified based on a variety of information sources, including: (1) historical maps of the smelter which showed locations of operations units; (2) documentary information on the nature of the different materials handled and processed by the smelter in each area; (3) documentary information on smelter demolition and subsequent development (including residential and right-of-way); (4) a series of aerial photographs beginning in 1941 showing development activities; and (5) data from previous soil, groundwater, and surface water investigations.

The smelter area investigation provided further characterization regarding the nature and extent of elevated concentrations of arsenic and lead associated with the residual materials from the smelter demolition and subsequent redevelopment of the property (see Smelter Area Investigation Report). From a practical perspective an overarching goal of the investigation was to characterize the location of smelter residuals with respect to the fenced area and immediately surrounding areas. Identification of the nature and extent of these residuals was important from the perspective of evaluating potential waste categories and also in the evaluation of sources of arsenic to groundwater and surface water. Information was gathered regarding the residual contamination associated with the historical smelter footprint. Additional data has also been collected to determine if residuals are present outside of the historical footprint due to redevelopment, which occurred after the smelter closed. Samples

were collected from within the currently fenced portion of the historical smelter footprint, portions of the historical smelter footprint outside of the fenced area, and from outside the perimeter of the historical smelter footprint. The investigation was implemented to gather as much pertinent information as possible; however, this section summarizes the information relevant to this IAR (i.e., the fenced area).

The information collected and data generated through the smelter area investigation was combined with all pertinent data from previous investigation to identify the nature and extent (volumes) of potential state extremely hazardous waste (EHW), federally designated hazardous waste, and state dangerous waste (DW). Based on the analysis in the Smelter Area Investigation Report, materials containing greater than 760,000 mg/Kg arsenic would be classified as EHW using the book designation procedure in the WAC, although it was noted that bioassay testing of materials with arsenic concentrations between 10,000 and 760,000 mg/Kg may result in a lower threshold value for EHW. No level was established for State DW, however, it would be greater than 10,000 mg/Kg arsenic, based on the results of the bioassay testing.

No additional TCLP testing was performed during the smelter area investigation. Previous evaluations estimated that total arsenic concentrations of 3,000 mg/Kg would exceed the TCLP standard of 5 mg/L at the upper 95% confidence limit. This level would represent federally designated hazardous waste.

Based on these evaluations in the Smelter Area Investigation Report, the aerial extent and depths of materials that, if excavated, would fall under the different waste categories was estimated. The finding were as follows:

- No EHW has been identified at the site.

- Materials that may be classified as State DW (greater than 10,000 mg/Kg arsenic) were contained within the fenced area, with the exception of a relatively small volume

of material just outside the fenced on the eastern boundary next to East Marine View Drive. No potential State DW was identified in any current residential property. The materials were primarily associated with residual flue dust and arsenic in smelter debris within and immediately adjacent to the footprints of former smelter flues, dust chambers and arsenic processing units. The materials are present over an approximate area of 1.4 acres (this is the area for materials with 10,000 mg/Kg or greater arsenic) at depths ranging from 1 to 10 feet. The aerial extent of this material is shown on Figure 2-1. The total volume of materials with arsenic concentrations greater than 10,000 mg/Kg was estimated to be approximately 10,000 to 15,000 cubic yards, with just 1,000 cubic yards present outside the fenced area in the East Marine View Drive right-of-way.

- The majority of materials which would be designated as federal hazardous waste if excavated were also contained in the fenced area with the exception of an area just outside the eastern fence along East Marine View Drive. The materials were associated with the same residuals discussed for State DW but with slightly greater areas of smelter debris and with soils underlying smelter materials in some areas. It was noted that occasional single values of arsenic concentrations have been measured above 3,000 mg/Kg at other areas at the site (Medora Way, for example). However, these appear to represent small pockets of materials which could not be excavated discretely and would therefore most likely not be classified as hazardous waste after excavation with the immediately adjacent material. Based on this analysis, the materials in the fenced area that are expected to have arsenic concentrations greater than 3,000 mg/Kg are present over an area of approximately 2.8 acres at depths ranging from 1 to 10 feet. The estimated aerial extent of these materials is shown on Figure 2-2. The total volume of materials with arsenic concentrations greater than 3,000 mg/Kg was estimated to be approximately 20,000 to 25,000 cubic yards, with just 600 cubic yards present outside the fenced area in the adjacent East Marine View Drive right-of-way.

The principle findings of the smelter area investigation with respect to smelter material residuals in the fenced area were:

- Test pits identified intact floors and foundations of former smelter structures at between one to four feet below current ground surface at several locations. In addition, an intact underground flue was identified in the northern portion of the fenced area. These observations corroborated within a few feet the location of the former smelter structures which was estimated based on historical smelter maps. Debris from smelter demolition is present above the intact floors within the footprints of former smelter structures and in immediately adjacent areas.

- The investigation confirmed that the smelter materials of primary interest are residual arsenic trioxide and flue dust. Arsenic trioxide was a product of the smelting process, containing approximately 760,000 mg/Kg arsenicFlue dust was a byproduct of smelting and roasting operations, containing approximately 25,000 mg/Kg arsenic.

- Residual arsenic trioxide and flue dust is present, usually mixed with demolition debris, within and adjacent to the footprints of structures where it was handled, processed or stored during smelter operation. The highest arsenic concentrations measured were in smelter material containing residual arsenic trioxide. Transport of arsenic from residual smelter materials to underlying soils has occurred at some locations indicating that these materials have potential to be sources of arsenic to groundwater. In most cases the arsenic concentrations attenuated rapidly with depth.

- Soil borings drilled around the southern boundary of the fenced area did not find smelter residuals outside the fence between Hawthorne Street and East Marine View Drive.

- Soil borings drilled inside and outside the fence along the western boundary of the fenced area indicate that smelter residuals are not present outside the fence along Hawthorne Street.

Synthetic Precipitation Leachate Procedure (SPLP) testing demonstrated that smelter materials containing residual arsenic trioxide or flue dust can act as sources of arsenic under ambient leaching conditions. These smelter materials are identified as the principal potential sources of arsenic to groundwater in the smelter area, although other localized factors are likely to be important such as materials volume and infiltration rates. The estimated aerial extent of smelter residuals containing arsenic trioxide or flue dust is shown on Figure 2-3.

Limited testing of surface soils was performed to evaluate potential sources of arsenic to surface water. Sources appear to be associated with smelter residual materials in the fenced area. The findings on the nature and extent of materials that may be acting as sources of arsenic to storm water are presented in the Storm Water and Storm Drain Sediment Characterization Controls Work Plan (Asarco, 1998).

In summary, the smelter area investigation filled data gaps from previous investigations to further refine the nature and extent (volume) of smelter residuals within and adjacent to the former smelter footprint. The data were used to evaluate the nature and extent of materials, which if excavated, may be classified as extremely hazardous waste, federally designated hazardous waste and state dangerous waste. The smelter residuals are also the principal potential sources of arsenic to groundwater and surface water.

2.1.2 Site Conditions Related to Interim Action Plans

The existing site conditions as they relate to the tasks planned under this interim action are graphically described in Exhibits 2-1 through 2-5. The CD provided to Ecology contains photographs taken from various locations in the fenced area and generally illustrates the current surface condition, including vegetation, which is more difficult to convey in the exhibits. Exhibits 2-1, 2-2, and 2-3 depict the existing surface topography, underground

utilities, and overhead utility network, respectively, in and around the fenced area. Exhibits 2-4 and 2-5 present subsurface cross-sections across the fenced area and include related boring/soil sample results (see also Appendix E for the complete list of soil sample results and the associated geologic logs).

The interim action is primarily a removal action; soil and smelter debris with arsenic concentrations greater than 3,000 mg/Kg will be removed first followed by removal of underlying or adjacent soil with arsenic concentrations greater than 150 mg/Kg. The data collected to date provides sufficient information to plan the excavation and removal of this material and no further pre-removal sampling is planned. The basis for this design approach, including performance sampling after excavation, is discussed in Section 3. The site conditions that support this design approach are summarized below (see Exhibits 2-4 and 2-5):

(a) The previous smelter area investigation documented these conditions related to material greater than 3,000 mg/Kg arsenic:

- They are primarily associated with debris and residual flue dust in smelter debris within and immediately adjacent to the footprints of former smelter flues, dust chambers and arsenic processing units.
- These materials are present over a well-defined area of approximately 2.8 acres and at depths ranging from 1 to 10 feet.
- Observations of former smelter structures were confirmed to within a few feet of the expected location based on historical smelter maps.
- Debris from smelter demolition is present above the intact floors within the footprints of former smelter structures and in immediately adjacent areas.

(b) Previous soil samples, from borings, wells, and test pits, show that arsenic concentrations decrease significantly with depth, particularly with depth into the glacial till. While there is some variability with depth closer to the existing ground surface, this can be addressed by increasing the excavation depth to levels shown to be, or highly likely to be, less than 150 mg/Kg arsenic.

(c) The stratigraphy of the fenced area is consistent, which minimizes the potential for vertical or lateral migration of arsenic into the glacial till beyond the estimated limit of 3,000 mg/Kg arsenic. In addition, once concentrations in the glacial till are less than 150 mg/Kg arsenic, there is little likelihood that material at greater depth will exceed this value.

(d) The physical nature of smelter debris and residuals is visually distinct, which will allow excavation to "chase" this type of material if it is encountered beyond the estimated 3,000 mg/Kg arsenic boundary.

The other primary consideration regarding site conditions is the need to excavate and transport off-site upwards of 60,000 cubic yards of material and import about 15,000 – 20,000 cubic yards of clean backfill. The site is relatively small and the only method available to move material on and off-site is by truck. Truck access is limited to East Marine View Drive, Hawthorne St.., Pilchuck Path via Butler St., and 5th St.

2.2 ALTERNATIVE INTERIM ACTIONS CONSIDERED

The proposed approach to conduct the interim action is very specific and requires the work at the Everett smelter to be closely coordinated with the remediation underway at the former Tacoma smelter. Consistent with Ecology's direction, no other alternatives have been considered to conduct the interim action.

In a September 23, 2002 letter to Ecology, Asarco stated its position regarding the need for a contingency plan for off-site disposal in the event that approval to accept Everett material at the former Tacoma smelter cannot be obtained in a timely manner. If this occurs, Ecology has stated that it expects the Everett material to be shipped to a commercial disposal facility permitted to accept the material from Everett. In this letter, Asarco stated, in part, that the company has not committed in any way to ship the Everett smelter material to a commercial facility in the event that timely approval to accept this material at the Tacoma smelter is not obtained.

With the respective positions of Ecology and Asarco clearly understood, the company stated that a contingency plan would be presented in this IAR addressing disposal of Everett material at another facility if the Tacoma smelter is unavailable. The plans for this are described below.

2.2.1 Contingency Plan for Material Above 3,000 mg/Kg Arsenic

There are two potential actions that may be implemented if the material with arsenic concentrations greater than 3,000 mg/Kg are not accepted for disposal in the Tacoma smelter OCF:

(a) If at all possible under the permits for the commercial disposal facility (Subtitle C), the material will be transported for landfill disposal without further treatment upon receipt (direct placement). Treatment costs may range between $50 - $80/ton; however, treatment does not provide any meaningful improvement in the characteristic of this material (see Tacoma Smelter ROD). Ecology would be requested to support direct placement at the receiving facility. If Asarco requests such support, the request will include the basis on which Asarco believes Ecology could base such support. Ecology has agreed to consider supporting placement without treatment, but has not committed to do so.

(b) If treatment is required, the option for treating the material on-site before transportation to the disposal facility will be evaluated and, if more cost effective, implemented. It is expected that treatment will consist of the addition of pozzolanic agents (e.g., cement, kiln dust, fly ash) with limited amounts of water to stabilize the soil and smelter debris. The material handling and unit operations for on-site work would need to be adjusted accordingly. Ecology would be requested to support this approach if it will meet the receiving facility's requirements more cost effectively. If Asarco requests such support, the request will include the basis on which Asarco believes Ecology could base such support. Ecology has agreed to consider on-site treatment, but has not committed to do so. Ecology will pay particular attention to public concerns associated with such a request.

(c) Removal of source material is planned to take place over two years to comply with Ecology's requirement that work begin by April 30, 2003. However, EPA has stated that it's conditions for allowing source material to be transported to or disposed of in the Tacoma OCF, in part, requires completion of the excavation of source materials at Tacoma and placement in the OCF before Everett material is received. This will not be completed until mid-2004. If this condition remains, the source material removal from Everett would need to be deferred until 2004, at which time source material would be excavated from both the Upper and Lower areas and shipped to Tacoma for placement in the OCF. This activity would be completed by the end of October 2004 as the Enforcement Order requires. Residential material removal in this scenario is discussed in 2.2.2 (c) below.

Delay of removal of Everett source material to 2004 will not meet the required date for beginning removal of this material in Enforcement Order #02TCPNR-4059, and hence would be a violation of the Order. In the event Asarco and EPA have reached agreement for acceptance of this material beginning in 2004, the Order could be amended to provide for beginning removal in 2004 rather than 2003. Ecology has advised Asarco that they will consider such amendment, but only after careful consideration of Asarco's agreement with EPA, the degree of surety removal will start in 2004, and public comment on any proposed amendment.

If EPA determines that some Everett source material can be received at Tacoma during 2003, the Upper area would be excavated as described in this IAR and transported to Tacoma where it would be stored in the Fine Ore Bins building until placement in the OCF in 2004. The remainder of the source material would be removed in 2004 as currently scheduled. If this occurs, the source area excavations in the Upper area would be handled in one of two ways:

- The residential material below the source material would be excavated and transported to Tacoma where it would be stockpiled with other residential soils

from Tacoma and Ruston. This material will eventually be graded and placed below the site-wide cap as planned. The excavation limits would be marked with filter fabric, the excavation backfilled with clean import material to approximately the original grade, and the disturbed areas hydroseeded for temporary erosion control.

- The second option is similar to the first except that removal of residential material from the Upper source areas would be deferred for a year. The source area excavation would be minimally re-graded to accept a temporary PVC liner that would be installed to prevent surface water contact with the disturbed area during the winter shutdown period. Surface water berms/ditches would be constructed to divert runon from surrounding areas reporting to the lined excavation. The excavated area would collect water that results from direct precipitation only; the liner will prevent any contact with disturbed soils so this collected water should be able to be pumped periodically to the City of Everett storm water system. If, for any reason, Asarco does not proceed with excavation of residential material in the construction season following placement of the PVC liner, Asarco will remove the liner and recontour and revegetate the area in a manner acceptable to Ecology and the City of Everett.

(d) Removal of material with arsenic concentrations above 3,000 mg/Kg may still use the former Tacoma smelter for intermediate storage before ultimate transport to disposal. EPA would have to approve this intermediate storage contingency. This option would be most appropriate for the material removed during Stage 1, which is estimated to be about 4,700 cubic yards (see Section 3.1). Material would be transported to the former Tacoma smelter and stored in the Fine Ore Bins until it is shipped to the final disposal facility. This approach would allow Asarco to defer the significant disposal cost for about a year while still proceeding with the removal action at Everett during the first year. Again, Ecology would be requested to support this action, which would also require approval by EPA. If Asarco requests such support, the request will include the basis on which Asarco believes Ecology could

base such support. Ecology has agreed to consider such intermediate storage at the Tacoma Smelter, but has not committed to do so.

2.2.2 Contingency Plan for Material Less Than 3,000 mg/Kg Arsenic

If the former Tacoma smelter cannot accept material with arsenic concentrations between 150–3,000 mg/Kg, there are two potential contingency actions:

(a) Excavation and disposal at a Subtitle D facility. This is the approach Ecology is using to dispose of soil from residential cleanups that it conducts.

(b) Suspend removal and disposal of this material until funding associated with site redevelopment becomes available. The current enforcement order addresses only material greater than 3,000 mg/Kg arsenic. If the former Tacoma smelter is not able to accept material below this limit, the soil would be left in place after grading for drainage, minimal backfill/cover, and hydroseeding. If and when Asarco is able to secure financing via a developer or some other entity for redevelopment of the site, the remaining material would be removed and disposed of off-site per (a) above. This is the preferred option if the former Tacoma smelter cannot accept this type of material.

(c) Residential soil removal alternatives associated with the source removal contingencies in 2.2.1 (c) above are described in this paragraph. If EPA determines that some Everett source material can be received at Tacoma during 2003, the Upper area would be excavated as described in this IAR and transported to Tacoma where it would be stored in the Fine Ore Bins building until placement in the OCF in 2004. If this occurs, the residential soil underlying the source area excavations in the Upper area would be handled in one of two ways:

- The residential material below the source material would be excavated and transported to Tacoma where it would be stockpiled with other residential soils from Tacoma and Ruston. This material will eventually be graded and placed below the site-wide cap as planned. The amount of residential material removed

is estimated at about 5,600 CY in the Upper source areas. The excavation limits would be marked with filter fabric, the excavation backfilled with clean import material to approximately the original grade, and the disturbed areas hydroseeded for temporary erosion control. Removal of the remaining residential material from the Upper area would follow in the subsequent year.

- The second option is similar to the first except that removal of residential material from the Upper source areas would be deferred for a year. Residential material in the source area excavations will be isolated from surface water by minimal re-grading to accept a temporary PVC liner installed to prevent surface water contact with the disturbed area during the winter shutdown period. Surface water berms/ditches would be constructed to divert runon from surrounding areas reporting to the lined excavation. The excavated area would collect water that results from direct precipitation only; the liner will prevent any contact with disturbed soils so this collected water should be able to be pumped periodically to the City of Everett storm water system. If, for any reason, Asarco does not proceed with excavation of residential material in the construction season following placement of the PVC liner, Asarco will remove the liner and recontour and revegetate the area in a manner acceptable to Ecology and the City of Everett.

3.0 SITE CLEANUP DESIGN REQUIREMENTS

This section consists primarily of the requirements of WAC 173-340-400 (4) applicable to the fenced area, namely these subsections:

(a) The Engineering Design Report (Sections 3.1 through 3.4 below);

(b) List of Construction Plans and Specifications (Appendix D); construction documents will be prepared as a separate deliverable following Ecology's approval of this IAR; and

(c) Operations and Maintenance Plan (to be included as part of Appendix D).

The other provisions of WAC 173-340-400, subsections (5) through (9), applicable to the fenced area are addressed in Section 4 of this IAR. The option of remediating the residential properties within the former smelter footprint immediately adjacent to the fenced area is included per the provisions of the Everett FCAP (see Section 3.5). Should this option be implemented, plans and specifications for individual properties will be substantively similar to the bid documents Ecology prepared for residential cleanups at Everett.

3.1 SOIL AND DEBRIS EXCAVATION, REMOVAL, AND REPLACEMENT

This section describes the conceptual design soil removal and replacement within the fenced area. General plans illustrating the sequence and methodology for this activity are included in addition to the rationale for conducting the work as described. The conceptual design also includes options that may be implemented during different stages of soil and debris excavation and removal.

The following subsections of WAC 173-340-400 (4)(a) are addressed in this subsection:

(i) Goals of the cleanup action

(ii) General facility information – see also Section 2.1 above

(iii) Identification of who will own, operate, and maintain the cleanup

(iv) Facility Maps showing how the cleanup will be conducted

(v) Characteristics, quantities, and location of materials to be managed, including groundwater

(vi) Schedule and options for final design and construction

(vii) Description and conceptual plans of the excavation, removal, and replacement tasks

3.1.1 Cleanup Goals and Summary of Cleanup Responsibilities

There are two cleanup goals for the cleanup of the fenced area:

- Remove the soil and debris greater than 3,000 mg/kg As with ultimate disposal of this material in the OCF at the former Tacoma smelter.

- Remove the remaining soil greater than 150 mg/kg As and dispose of it at the former Tacoma smelter, where it will be used as subgrade backfill and placed underneath the site-wide cap. Following removal of this material, a marker barrier similar to that used in the residential areas will be placed and the fenced area will be backfilled with at least two feet of soil with arsenic concentrations less than 20 mg/kg.

At the completion of the remediation, the requirements of the FCAP for cleanup to residential standards will be satisfied in the fenced area (e.g., no material greater than 150 mg/kg arsenic will be within two feet of the final revegetated surface). This will allow subsequent redevelopment of the property by Asarco or others within the range of land uses allowed by the City of Everett, including residential development.

Asarco expects that it will be the entity that conducts the cleanup of the fenced area, probably through use of it's own personnel and independent contractors, both at Everett and at Tacoma. Asarco has not selected a construction contractor for Everett at this time; however, engineering design and oversight will be performed by Asarco Consulting, Inc. Most of the laboratory analyses will be performed on-site, at Asarco Consulting's XRF lab in Tacoma, or samples will be sent to Asarco's TSC Laboratory in Salt Lake City. Some analyses such as

soil fertility and soil organic content tests will be performed by local commercial laboratories.

Asarco owns the non-public property in the fenced area, several individual properties surrounding the fenced area (see Figure 1-2), as well as the former Tacoma smelter property. Streets and an alley are the only other public property in the fenced area and are owned by the City of Everett. Access to and removal of the streets, overhead electrical distribution lines, and other underground utilities will be needed to complete remediation of the fenced area. Depending on the method of transportation, Asarco may also use barge loading facilities in Everett owned by others. Access and related provisions for other privately owned facilities and public areas needed to conduct the cleanup are discussed further in Section 3.4.

3.1.2 Fenced Area Layout and Designations for Cleanup

The fenced area and surrounding area has been previously described in this document and in other investigations (see Section 2.1). For design and construction purposes, the fenced area has been designated at a finer level of detail based on the anticipated excavation methodology:

- The fenced area is subdivided into two sub-areas: an Upper (U) area and Lower (L) area (see Figures 3-1 a - c and 3-2 a - f; note these figures also include Tables 3-1 and 3-2). The Upper area is bounded on the east by Pilchuck Path and the west by Hawthorne Dr. The Lower area extends from Pilchuck Path east to East Marine View Dr. and includes 5th St. and the alley east of Pilchuck Path.

- Sub-areas are further designated by the primary type of material that will be removed from it: Source (S) material designates areas likely to have concentrations > 3,000 mg/kg As, and Residential (R) soils that will probably have concentrations <3,000 but > 150 mg/kg As. The Source and Residential designations are the same used to

describe similar material at the former Tacoma smelter and will facilitate the correct handling of the material upon receipt there.

- Sub-areas are numbered sequentially based on the previous two designations. In the Upper area, sub-areas are designated US-1 through US-12 and UR-1 through UR-24. The Lower area designations are LS-1 through LS-84 and LR-1 through LR-11.

In general, the Upper area consists mainly of R material with well defined areas of S material near the southern portion of the Upper area and west of the north end of Pilchuck Path. In contrast, the Lower area consists primarily of S materials that are underlain by R materials. The estimated quantities for the sub-areas are shown in Table 3-3. No allowance for shrink/swell are reflected in these quantities.

TABLE 3-3. SUMMARY OF ESTIMATED QUANTITIES

Area and Type of Material	*Estimated Quantity (CY)*
Upper Source	4,660
Upper Residential	11,900
Subtotal Upper	16,560
Lower Source	19,800
Lower Residential	24,560
Subtotal Lower	44,360
Subtotal Source	24,460
Subtotal Residential	36,460
Total Source and Residential	60,920

3.1.3 General Plan of Material Excavation and Replacement

This difference in the distribution of the S and R materials between the U and L areas necessitates two separate excavation and removal approaches. The Upper area will be excavated the first year (i.e., Stage 1) and the Lower area will be remediated in the second year (Stage 2). In both stages, removal of S material occurs before R soils. Remediation of the Upper area will resemble the cleanups of residential properties near the fenced area. Excavation depths to remove R materials will be relatively shallow except in the smaller US areas, where removal of S materials will precede excavation of R materials. In the Lower area, the amount of S material is substantially more than in the Upper area. In addition, the cross-contamination potential between S and R areas is much higher due to the greater aerial extent of S material, the deeper excavation depths required, and the surface water drainage paths across the Lower area. As such, smaller sub-areas that can be more easily controlled as they are excavated are needed.

The other key aspects in the approaches for the Upper and Lower areas are described below:

- Stage 1 is planned for late April to mid-October the first year. Material removal would occur in the drier months of July, August, and September followed by re-grading, backfilling, re-grading, and revegetation. Stage 2 would start in early April of the second year and would be completed later that year (currently scheduled for October 31, 2004), again including re-grading, backfilling, re-grading and revegetation. Removal of S material in Stage 2 is planned for May and June with R material following in July and August. Construction of replacement roads and utilities through the fenced area are not planned as part of remediation but would be completed as part of future redevelopment.

- Roads are left intact during Stage 1 and are removed during Stage 2 (Pilchuck Path, 5th St., and the alley east of Pilchuck Path).

- Only those utilities extending into US and UR subareas need to be disconnected and abandoned during Stage 1, although some rerouting of overhead electrical service along Pilchuck Path may be needed during this stage. During Stage 2, all utility services will need to be abandoned and removed to complete the cleanup. The degree to which they will be re-established will be determined in conjunction with the utility providers and the City of Everett.

- Use of existing material < 150 mg/kg on-site for backfill more than 2 feet below final grade is likely and will minimize the amount of backfill that needs to be imported. Clean material will need to be imported to achieve final grades; however, final grades will be lower following remediation. Should development occur after remediation, additional clean material can be imported by the developer to achieve the grades needed for development.

- Clearing, grubbing, and removal of foundations will occur in both stages. Surface soils with lawn or plant roots will be segregated for off-site disposal; material from R areas can go to Tacoma, material from S areas will need to go to another permitted Subtitle C landfill because this high-organic material cannot be placed in the Tacoma OCF. Trees and large shrubs will be taken to a permitted landfill for disposal (not recycling). Concrete can be taken to Tacoma where it will be crushed and placed according to the area it originates (i.e., from R areas can go below the site-wide cap, from S areas should go to the OCF). Alternatively, concrete and asphalt could go to approved recyclers with Ecology's authorization.

- Surface water controls will be needed during active construction in both stages; however, the type and extent of controls needed for the Upper area are significantly less than for the Lower area (see Section 3.2). Groundwater is not expected to be encountered in any substantial quantities and will be incorporated with the surface water controls as necessary.

- Material will be stockpiled and loaded to over-the-road trucks (nominal 30 tons capacity) and/or smaller 10 CY trucks for transfer to barge for transportation to the Tacoma smelter. The option of use of containers to load and ship contaminated soil may also be viable depending on costs and other logistical factors (e.g., equipment needed to load/unload barges).

These two approaches for excavation/stockpile/backfill tasks are sequentially described in Tables 3-1a through 3-1c and 3-2a through 3-2h for the Upper and Lower areas, respectively. Figures 3-1a through 3-1c and 3-2a through 3-2h illustrate the excavation sequence. Figure 3-3 shows the removal depths targeted for each area. Exhibits 3-1 and 3-2 show the surface contours anticipated after removal of the S and R material and the final grade following remediation for the Upper and Lower areas, respectively. Exhibit 3-3 presents cross sections showing the estimated depths to glacial till, the anticipated excavation depths after removal of the R material, and the final surface elevation after remediation. Material handling and transportation options are described in Section 3.3.

3.2 ENGINEERING DESIGN CRITERIA AND FEATURES

This section describes the engineering design criteria and parameters upon which the overall cleanup is based. The following subsections of WAC 173-340-400 (4)(a) are addressed in this section:

(viii) Engineering justification for the design and operations parameters, including:

(A) Design criteria, assumptions, and calculations for components of the cleanup that have not already been designed.

(B) Containment effectiveness – (see also Record of Decision for the Tacoma Smelter, EPA, March 1995).

(C) Demonstration that cleanup will achieve compliance with cleanup criteria of FCAP.

(ix) Design for control of spills or accidental releases.

(x) Design features to assure long-term safety of workers and local residences.

3.2.1 ENGINEERING DESIGN EVALUATION

The plan described in this IAR is based on combining the removal actions in the fenced area at Everett with the ultimate disposal facilities Asarco has constructed at the former Tacoma smelter, which is being remediated under EPA oversight. At the Tacoma smelter, a much larger amount of the same type of material present at Everett (i.e., Source material) is being excavated and disposed of at the smelter in an OCF. The capacity of the OCF is 260,000 CY and the current estimate of the quantity of material from the Tacoma smelter that will be disposed of in the OCF is about 210,000 CY. Under the terms of the ROD for the Tacoma smelter, EPA determined that the OCF must be constructed to exceed RCRA Subtitle C standards for hazardous waste landfills in order for the source area materials to be disposed there without further treatment.

The remaining capacity of the OCF at Tacoma is available to dispose of the same type of material from Everett within the fenced area. This volume has been estimated to be about 25,000 CY, less than 10% of the amount of material that will be disposed of from Tacoma and well within the remaining capacity of the OCF.

The key elements of the approach Asarco is prepared to implement for removal of the fenced area material at Everett are:

- The Source material greater than 3,000 mg/kg arsenic within the fenced area will be removed and transported to the Tacoma smelter for disposal in the OCF without treatment.

- Residential material greater than 150 mg/kg arsenic will also be removed from the fenced area, transported to Tacoma, and placed beneath the smelter site-wide cap along with other soils from the cleanup of residential yards in Ruston and north Tacoma.

- After removal of the material from the fenced area, this area will be remediated consistent with the soil cleanup requirements of FCAP. The site will be backfilled and graded with clean material following remediation. At that point, the property will be in a condition to support further redevelopment.

This overall concept greatly simplifies the type and extent of engineering design needed to perform the cleanup. The WAC requirements regarding ultimate disposal, particularly containment effectiveness, are met and documented in EPA's ROD for the Tacoma smelter and the associated design documents submitted to EPA and Ecology during the design process at that site. The Source and Residential material from Everett will be handled in the same fashion as the comparable material at Tacoma. Consequently, no further documentation or analysis in this IAR is needed regarding the ultimate disposal of this material at the former Tacoma smelter.

Similarly, the FCAP for the Everett site addressed the issues regarding the cleanup and containment effectiveness for material up to 150 mg/kg As at a depth of 2 feet or more. As this will be the site condition following completion of the remediation of the fenced area, it does not need to be further evaluated. Finally, the FCAP specifies removal of material greater than 3,000 mg/kg from the fenced area, which is provided for in this IAR.

The remaining engineering design evaluations needed for this IAR are:

- Assessment of the removal methodology's ability to achieve cleanup goals;
- Evaluation of surface and groundwater control measures needed during and after the cleanup;
- Materials management issues; and
- Performance sampling to assure compliance with the cleanup standards.

The first two bulleted items are covered in Sections 3.2.2 and 3.2.3 below. The other two items are addressed in Sections 3.3 and 3.4, respectively.

3.2.2 Assessment of the Removal Methodology

The approach and methodology selected for the fenced area have been developed based on Asarco's experience at many other sites with a wide range of soil-metals concentrations. The Everett site, particularly the fenced area, has a few key features that provide a high degree of confidence that the removal methodology will achieve cleanup goals:

- ✓ The relatively shallow depth of surface soils/fill which are underlain by glacial till of significantly lower permeability. Previous sampling data shows that metals concentrations decrease rapidly with depth into undisturbed glacial till, limiting excavation depth needed to achieve the 150 mg/kg As cleanup goal (see Appendix E). This information is sufficient to prepare excavation and removal plans without further field investigation.

- ✓ Groundwater flux across the fenced area is low (less than 1gpm per 1,000 lineal feet – see Everett Smelter RI) and is mainly confined to the shallow surface fill strata. While some groundwater will be present, quantities are expected to be small and can be managed as part of the surface water control system. Significant groundwater dewatering is not anticipated.

- ✓ The highest concentrations identified in the fenced area are closely tied to smelter debris and residual by-products. These areas have been thoroughly mapped previously (see Everett Smelter Site Remedial Investigation, Hydrometrics, Inc. September 1995) and this information provides a clear guide to excavating the Source material. In addition, the debris and by-products are visually distinct from the native material, making it much easier and more reliable to excavate based on a visual as well as a chemical basis.

- ✓ The residential superstructures in the fenced area have been previously demolished and removed. All remaining foundations and soil below them will be removed as part of the cleanup. Also, the portions public roads that bisect the fenced area (Pilchuck

Path, 5th St., and the alley east of Pilchuck Path), as well as underground utilities in these roadways and in the fenced area proper, will be removed to be able excavate Source and Residential soils in these areas. As such, the removal action will be total in this area; all remaining material will meet the concentration and depth requirements of the FCAP.

The excavation sequence and associated compliance sampling plans (see Appendices A and C) have been prepared to take advantage of these site characteristics. The key design elements incorporated into the excavation and removal plan discussed in Section 3.1 are summarized in Table 3-4.

3.2.3 Evaluation of Surface Water and Groundwater Controls

Surface water and groundwater controls will be implemented during the interim action. As previously discussed, groundwater flux across the fenced area is low and is mainly confined to the shallow surface fill. While some groundwater will be present, only small quantities are expected and will be managed as part of the surface water control system. Significant groundwater dewatering is not anticipated.

Surface water controls for remediation of the residential properties adjacent to the fenced area are specified in the FCAP and will be implemented when remediation of these properties occur. For the remediation of the fenced area, surface water controls will be implemented based on the City of Everett Stormwater Management Manual (*Stormwater Management Manual – City of Everett Public Works Department*, Rev. 4/00). For this site, the primary surface water issues are:

- ✓ Minimizing, to the extent practical, the contact of direct precipitation, run-off within the fenced area, and run-on from outside the fenced area from contacting disturbed or stockpiled soils; and

- ✓ Collecting surface water that has come in contact with disturbed soils and removing suspended sediment before discharge to the City of Everett stormwater system.

The surface water control measures are included in the Tables 3-1and 3-2, and Figures 3-1 a - c and 3-2 a - f. The Everett Stormwater Management Manual provisions will be incorporated as part of the final design specifications along with specific provisions to be implemented (see also *City of Everett Design and Construction Standards and Specifications for Development.* Rev. 4/02). The surface water management design is consistent with the Stormwater Management Manual and incorporates both Best Management Practices (BMPs) and Erosion and Sediment Control (ESC) practices.

The excavation planned for Stage 1 (the Upper area) will be performed during July through September, which is the driest time of the year in Everett. While some rainfall can be expected, the storms are generally of short duration and low to medium intensity. The excavation sequence will allow any surface water that needs to be collected to be routed to the deepest areas excavated (e.g., US-1 through US-9) and contained prior to sediment removal and discharge.

Stage 2 (the Lower area) excavation will start earlier in the second year (May) and more intense storms of longer duration can be expected. As such, runoff collection, detention, and sediment removal will be needed before discharge. This will be accomplished by constructing a network of diversion dikes to route surface water to a detention pond or trap in LS-39 and LS-43. Assuming a worse case for the design storm, in which the entire Lower area runoff from a 10 year-24 hour event would need to be contained, results in required retention capacity of 0.375 acre-feet. This estimate also assumes no other BMPs within the Lower area. Providing that other BMPs will be installed, a sediment pond or trap 50 ft. x 50 ft. x 6 ft. would probably have sufficient capacity (about 0.35 acre-feet) to deal with the design storm. It is feasible to build a facility with sufficient capacity in this area; the actual configuration and design parameters will be included as part of the final design plans and

specifications. These will be constructed at the outset of Stage 2 and will remain in service until this phase of the work is completed.

The other key aspects regarding surface water control for the fenced area are summarized below:

- ✓ General BMPs include, but are not limited to sediment detention ponds or traps, filter fabric fences, straw bale barriers, diversion dikes, inlet controls at catch basins, pipe slope drains, terracing, construction entrance rock pads, and hydroseeding.
- ✓ Intercepted groundwater (i.e., groundwater that "daylights") will be routed to the surface water system and handled as surface water from the point of collection on.
- ✓ Excavation, fill, and backfill work areas shall be continually and effectively drained. In particular, water will not be permitted to accumulate in excavations that are receiving material that will be compacted.
- ✓ The contractor shall be required to construct suitable dikes, drainage ways, or provide portable pumping equipment to divert water flows away from work areas.
- ✓ Off-site water shall be routed around the site if possible; if it must flow across the site it will be prevented from contacting disturbed soils.
- ✓ Surface water originating from R areas will be prevented from contacting S soils insofar as is practical.
- ✓ Existing vegetative cover will remain in each sub-area until active excavation of that area begins.
- ✓ Stockpiles will be covered and BMPs implemented to divert surface water around the stockpile as well as to prevent migration of stockpiled material beyond the stockpile boundary.
- ✓ Periodic testing of surface water discharges will document the metals concentrations of surface water discharged from the fenced area during the interim action.

3.3 MATERIALS MANAGEMENT AND DISPOSAL

This section describes how material will be excavated, stockpiled, transported, and disposed of at the Tacoma smelter and how clean backfill will be placed and graded following remediation. The following subsections of WAC 173-340-400 (4)(a) are addressed in this section:

(xi) Methods for management and disposal of any materials excavated and disposed of at the Tacoma smelter

(xii) Facility specific characteristics that affect the movement and placement of materials at Everett and Tacoma, including;

(A)Relationship of the cleanup to the surrounding area

(B)Probability of flooding, seismic, and other local planning and/or development issues that could affect the cleanup

(C)Soil characteristics and groundwater system interactions with the cleanup

3.3.1 Unit Operations for Excavation, Removal, and Backfill

Section 3.1 describes the excavation, stockpile, and backfill sequence for the fenced area. This section describes the individual unit operations associated with these activities. Unit operations are the distinct steps associated with the excavation, stockpiling, transportation and disposal of material from the fenced area.

Figure 3-4 illustrates these unit operations for Source and Residential materials. Table 3-5 summarizes the key elements of each unit operation for both types of materials.

The on-site requirements for material management have previously been discussed. Off-site requirements will be governed by state and federal regulations covering hazardous materials. These requirements are well established for over-the-road transportation of S and R materials to the Tacoma smelter. There are several licensed transporters that can move the material to the Tacoma smelter and comply with all the applicable containment, spill response, and decontamination requirements. While feasible, over-the-road transport may pose

disadvantages in terms of higher cost, truck availability to support site work schedules, and traffic disruption, both at Everett and Tacoma.

The option of transporting fenced area soils to Tacoma via barge has been explored at a preliminary level. There are two potentially available barge loadout facilities in Everett close enough to be practical. Barging may be the most cost effective means to move material from Everett to the Tacoma smelter and could significantly reduce or eliminate traffic delays and impacts, both to the public and project-related at Everett. Tacoma has received material by barge, most recently the import of several hundred thousand tons of material needed to build the OCF berm. This option appears very feasible and should be further explored during final design.

There are also potential drawbacks to barging material, mainly the multiple transfer steps needed to eventually deliver the material to Tacoma. Control of any spillage, decontamination measures, and other steps needed to keep S and R material contained and secure from loading in Everett to its receipt at the Tacoma smelter will have to be developed. The use of shipping containers to move the material rather than in bulk may provide a practical means to address many of these issues. The provisions needed to employ barge transport are probably specific to each barge loadout facility and can be prepared as part of final design should this option continue to be viable.

3.3.2 Other Facility-Specific Characteristics

The FCAP and documents previously submitted to Ecology by Asarco (e.g., the Everett RI/FS) characterize the Everett site in detail and this information is not repeated in this IAR. The FCAP also addresses removal of S material from the fenced area. While the ultimate disposal site is different than the FCAP (i.e., the Tacoma smelter), the removal action is similar to that described in the FCAP. The FCAP did not contain provisions for removal of all the R material from the fenced area. Construction of a containment facility per the FCAP would mean that the R material would be excavated and stockpiled while the containment facility is built, followed by placement in the containment cell with other R material from the

surrounding areas. Excavation and off-site disposal of this material will be less of an impact than the plans envisioned by the FCAP.

The other facility specific characteristics that affect the movement and placement of materials at Everett and Tacoma are summarized below:

Relationship of the Cleanup to the Surrounding Area

The area surrounding the fenced area is primarily residential to the west and south with arterial streets bounding the site to the north and east. Access to the fenced area is limited to Hawthorne St., Pilchuck Path, 5th St., and East Marine View Dr. The sequence of remediation activities described in Section 3.1 takes this constraint into account. The main transportation routes during Stage 1 are via Hawthorne St., Pilchuck Path, and 5th St. The last two streets would be closed to the public during Stage 1 but reopened after the Upper area is complete. Pilchuck Path, the alley immediately to the east, and 5th St. will all be removed during Stage 2; primary site access will be via East Marine View Dr.

The most noticeable aspect of the remediation with the surrounding area is likely to be the amount of truck traffic to and from the site. Unfortunately, there is no other alternative to remove and deliver material at the site except to use trucks. A similar situation exists at the Tacoma smelter; the primary route for truck traffic between Everett and Tacoma is via Ruston Way. This two-lane arterial can pose significant delays on truck cycle times, especially during commuting hours or on fair weather days in the spring and summer. Barging the material to the Tacoma smelter would avoid this problem and could substantially minimize the impacts in Everett. A traffic management plan will be prepared to deal with the anticipated affects based on the transportation methods(s) selected as part of final design.

The provisions for public health and safety are addressed in the Health and Safety Plan in Appendix B.

Flooding, Seismic, and Other Local Planning and/or Development Issues

The potential for flooding and seismic issues affecting the cleanup at this site are minimal. The site is geologically stable, on relatively shallow slopes, and at the top of a hill that receives incidental run-on from surrounding areas. The surface water control plan is based on a 10 year-24 hour design storm as required by the City of Everett. Excavation and re-grading will occur during the drier months of the year, avoiding the major potential for storm events and run-off volumes in excess of the stormwater control capacity.

Redevelopment of the site is probable and desirable; however, the remediation design does not incorporate redevelopment features, particularly roads and utility services at this time. Should Asarco and a developer pursue redevelopment of the site, these features could be integrated into the final grading, a move that could be cost effective. Any redevelopment would follow the normal process for such activities governed by the City of Everett.

Soil Characteristics and Groundwater System Interactions with the Cleanup

As previously described in Section 3.2, there are no inherent soil characteristics or groundwater conditions that will materially interfere or hinder the cleanup. Excavation to depths of 15 ft. $\pm$ into glacial till is expected to be difficult but surmountable with conventional equipment. Smelter debris will probably give rise to some surprises during the excavation; the design acknowledges this potential by keeping production rates reasonable and disturbed areas to a minimum.

3.4 REGULATORY COMPLIANCE

This section completes the requirements of the Engineering Design Report and addresses the following subsections of WAC 173-340-400 (4)(a)

(xiii) General Description of construction quality control and testing to be performed

(xiv) General Description of compliance monitoring to meet the requirements of WAC 173-340-410

(xv) General Description of construction procedures to assure the safety and health requirements of WAC 173-340-810 are met

(xvi) Not needed

(xvii) Permitting requirements and access issues

(xviii) Not needed

(xix) Institutional controls per the FCAP (residential properties) and otherwise needed for the fenced area

3.4.1 Compliance Monitoring

The FCAP describes the procedures and protocols for these items in the residential areas adjacent to the fenced area. These procedures will be followed in large part when these properties are remediated; however, some differences are proposed and are described in Appendix A. The FCAP did not address removal R material from the fenced area. The compliance monitoring requirements for the fenced area are also addressed in Appendix A and are based on protocols in the FCAP to the extent practical (e.g. sample frequency).

Quality control (QC) provisions are included in the Compliance Monitoring Plan (Appendix A) and the Sampling and Analysis Plan (Appendix C). The Compliance Monitoring Plan is primarily aimed at chemical data obtained by sampling the excavated surface following removal. It also addresses chemical requirements and basic physical properties of imported material used as backfill as specified in the FCAP. The final design will include additional specifications for backfill material as well as the physical testing to be accomplished during backfilling and final grading. The specifications, including quality control requirements, will be based on the *City of Everett Design and Construction Standards and Specifications for Development*, Rev. 4/02. Additional quality control requirements applicable to backfill and grading activities may be included from ASTM or WSDOT protocols as needed.

The Health and Safety Plan (Appendix B) addresses monitoring for field personnel and for the general public. The primary exposure path for both workers and the general public will be via airborne emissions. As such, rigorous dust control provisions will be instituted to control emissions to levels below applicable standards. A general "no visible dust" standard will be imposed to assure that no visible dust is present at the fence line. Air sampling will

be conducted for both field personnel (personal samples) and at the fence line to measure ambient concentrations.

3.4.2 Permitting Requirements

MTCA provides an exemption from the procedural requirements of the following state laws, though their substantive requirements must be met:

- RCW 70.94, Washington Clean Air Act
- RCW 70.95, Solid Waste Management Reduction and Recycling
- 70.105, Hazardous Waste management
- RCW 75.20, Construction Projects in State Waters
- RCW 90.48, Water Pollution Control, and
- RC 90.58, Shoreline Management Act of 1971

Ecology's FCAP incorporates the substantive requirements of applicable or relevant and appropriate requirements of the state laws listed above. (FCAP, Section 3.3). Because the proposed interim cleanup action is consistent with and meets or exceeds the requirements of the FCAP, the proposed interim action also complies with the substantive requirements of these laws and regulations.

Regarding local permits for construction activities entailed in the interim cleanup action, MTCA also provides an exemption from the procedural requirements of laws authorizing local government permits or approval for remedial actions. Again, the substantive requirements of local ordinances affecting land use, development and construction must be met.

The City of Everett has advised Ecology that substantive requirements for grading, storm water control, work in City rights-of-way, and other construction-related requirements will apply to the final cleanup and, by extension, to this interim cleanup action. In Everett, the

applicable requirements are implemented through the City's Public Works permit process. Section 4.2 (Applicable Permits) addresses how the substantive requirements will be met in the design implementation of the interim cleanup action.

Asarco will require access to property that it does not own to complete the interim action. In the vicinity of the fenced area, access to roadways and other public areas will need to be obtained from the City of Everett. Utility providers will also need to provide access to their systems or equipment during the cleanup. Individual property owners will be asked to provide Asarco access to conduct residential remediation outside of the fenced area should this be implemented; this process is described in Appendix A.

3.4.3 Institutional Controls

The FCAP describes the Institutional Controls required for the residential properties adjacent to the fenced area. These will be implemented upon completion of the remediation of these properties, whenever that occurs. The institutional controls for the fenced area will be different than those specified in the FCAP. Because the fenced area is being remediated to the same standard as other residential properties, the Institutional Controls should also be the same as for other residential properties under the FCAP, with the exception that Asarco-owned property must have deed covenants to address future handling of any contaminated soil remaining on the property. These will be implemented after the cleanup of the fenced area is finished.

TABLE 3-4. EXCAVATION AND REMOVAL DESIGN ELEMENTS

Design Element	Issue to Address	How Issue is Addressed in Design
Area and depth of excavation	How large an area to excavate and to what depth?	Source and Residential areas divided into discrete excavation units. Size of areas based on production of 750 to 1,000 CY/day using conventional excavating equipment capable of over-the-road delivery and use. Layout and target depths will allow excavation to proceed in controlled manner while still allowing for unplanned excavation of Source material if is encountered outside of expected areas. Active excavation areas will be minimized, making dust control and ESC provisions more manageable.
Area and depth of excavation	How will debris be handled if encountered outside of S areas?	Debris will be considered S material. Three foundations on the west side of Pilchuck Path in the Upper area will be designated for debris stockpiling if debris is encountered in R areas. In the Lower area, almost all of the areas with R material will be excavated to remove S material first. As such, the likelihood of significant amounts of debris from R sites is low. However, a separate stockpile for debris will be established in the Lower area if needed.
Slope Stability	What are the provisions for cut slopes to assure safe excavation?	Previous investigations and Ecology's work in this area show that material can be excavated without excessive slope-back for stability. Shallow cuts (up to 4 ft.) may extend vertically while deeper excavations will need to be sloped back about 1:1. Trenches will be avoided and the contractor will be allowed to cut back or otherwise reduce side slopes as needed based on conditions encountered. Protection from direct rainfall and runoff on cut slopes will be implemented via temporary sheeting or surface water diversions.
Slope Stability	Final site grading.	The existing fenced area topography has several terraced areas running north/south and has a general slope of about 1V:10H across the site from west to east and north to south. The post-cleanup topography will match existing elevations along Hawthorne St., East Marine View Dr., and at the southern limit of the fenced area. Final elevations will generally be lower across the site and the north/south slope will be decreased toward the northern end of the fenced area. The overall site will have a general slope about 1V:10H from west to east after remediation and will be graded so steeper transitions will be nominally 1V:3H.

TABLE 3-4. EXCAVATION AND REMOVAL DESIGN ELEMENTS (continued)

Design Element	Issue to Address	How Issue is Addressed in Design
Cross-contamination	How will S and R material be kept from contaminating other areas, particularly those already remediated?	The excavation sequence is based on a "top down" approach across the site with removal of S material occurring before R material. Source area boundaries extend beyond the neat-line limit established during the smelter area investigation to allow for variations in the distribution of S debris and material. Separate stockpiles for S and R materials will be established. Segregation of the site into clean, R, and S areas with traffic control and decontamination stations between areas will limit potential cross-contamination. Surface water controls will be established to route runoff away from disturbed areas and to avoid runoff from S areas flowing across R or clean areas.
Surface Features	How will surface features be addressed?	Surface features include: vegetation and sod layer; concrete foundations; roads/road base; underground and overhead utilities. They will be addressed as shown in Table 3-5.
Confirmation at excavation depth	How will confirmation of cleanup levels be achieved? What if further excavation is needed?	Confirmation sampling is planned as described in Appendices A and C of this IAR. The general approach for material that fails confirmation testing is to excavate another discrete interval (e.g., 4 – 6 inches) across the sub-area rather than implement a complex and time consuming sampling plan to chase "hot spots". Simply removing another depth interval and retesting provides the best assurance that any material remaining above the cleanup level is removed. This approach may be modified if it is clear that a smaller area is probably the source of higher concentrations (i.e., debris or residual by products) is visually evident and can be excavated and retested without the need for excavating the entire sub-area.
Decontamination	How will contamination be controlled beyond the fenced area?	Separate clean and contamination zones will be established at the site and people/equipment subject to decontamination before they exit the contaminated zone. Trucks or other equipment that moves off-site will be subject to tire washing before they leave the site. Trucks and containers containing S or R material will be covered when they leave the site and during transportation. Decontamination of this equipment will occur before it is released for other tasks. Decontamination procedures will be part of the specifications; for S and R materials it will generally include water wash to remove residual soil and/or physical removal (e.g., brooming, high pressure/low volume washing) to assure appropriate decontamination.

TABLE 3-4. EXCAVATION AND REMOVAL DESIGN ELEMENTS (continued)

Design Element	Issue to Address	How Issue is Addressed in Design
Stockpiling	Where and how will material be stockpiled on-site?	Stockpiling of materials will be needed prior to loadout and transport to Tacoma. Three different types of stockpiles may be used: ✓ Day piles – either S or R materials will be temporarily stockpiled in areas of the same type of material (i.e., no S material in an R sub-area) before loading to truck or container for transport later in the day. These piles should be less than 500 CY capacity. ✓ Accumulation piles – these are larger stockpiles (up to 2,500 CY) that may be used to aggregate sufficient volume to allow the S or R material to be transported and loaded to a barge in one 12 – 14 hour period. ✓ Debris piles – these areas will use existing foundations on the west side of Pilchuck Path for the Upper area and other foundations not yet excavated in the Lower area to collect smelter debris and residuals encountered in the excavation of R areas. They should be about 50 CY capacity. The existing shed at the north end of Pilchuck Path may also be used for this purpose if needed. All stockpiles will have appropriate surface water diversion and ESC measures (i.e., City of Everett requirements) as part of their construction and operation and will be covered at the end of each work day. Specifications for these stockpiles will be included as part of the final design package.

TABLE 3-5. UNIT OPERATIONS SUMMARY– EVERETT SMELTER

Unit Operation	Description of Operation and Alternatives
Clearing & Grubbing	Vegetation and sod layer: trees and shrubs within the fenced area will be removed and sent for off-site disposal at a permitted Subtitle D facility. The surface sod layer in R areas will be included with R soils for disposal at the Tacoma smelter. Surface sod in S areas will be stockpiled separately from other S material and sent for disposal at a Subtitle C facility.
Foundation/Road/Utilities Demolition	Concrete foundations: these will be removed from S and R areas and handled in the same manner as the soils from the areas in which they are currently located. Crushing and other size reduction, if needed, will occur at the Tacoma smelter. The potential for decontaminating foundations in S areas so this material can be treated as R soils is not ruled out; a separate decontamination plan will be prepared if this becomes necessary due to space constraints in the Tacoma OCF. Roads and road base: asphalt will be removed and recycled as it should not have any metals content of concern. Road base material will be will be removed from S and R areas and handled in the same manner as the soils from the areas in which they are currently located. Underground and overhead utilities: material will be removed and, if requested by the utility owner, decontaminated (if possible), and returned to them. Otherwise, these systems will be treated handled in the same manner as the soils from the areas in which they are currently located. Disposal will be at a Subtitle D facility for R material and a Subtitle C facility for S material.
Excavate & Load to Stockpile	Excavation is anticipated to use conventional equipment (e.g., CAT 300 series excavator nominal). More than one excavator may be used if space allows, particularly in deeper excavations. Production is anticipated to be about 750 – 1,000 TPD. The excavator(s) will load to 10 CY nominal dump trucks for transfer to stockpiles unless they are proximate enough to load to stockpile directly. Alternatively, excavators may load containers that will subsequently be transported to the Tacoma smelter.

TABLE 3-5. UNIT OPERATIONS SUMMARY– EVERETT SMELTER (continued)

Unit Operation	Description of Operation and Alternatives
Stockpile	Three options are available: ✓ Day piles – either S or R materials will be temporarily stockpiled in areas of the same type of material (i.e., no S material in an R sub-area) before loading to truck or container for transport later in the day. These piles should be less than 500 CY capacity. ✓ Accumulation piles – these are larger stockpiles (up to 2,500 CY) that may be used to aggregate sufficient volume to allow the S or R material to be transported and loaded to a barge in one 12 – 14 hour period. ✓ Containers – the option of using shipping containers capable of containing and transporting soil may be available; these are typically the size of standard shipping containers and can handle up to 20 tons ±. These can either be loaded from a day pile or directly from the point of excavation. Stockpiles need to be worked and shaped by a loader and will be covered at the end of each workday.
Loadout & Transportation to Tacoma	Loadout and transportation to Tacoma may occur via any or all of the following methods: ✓ Load from either day or accumulation piles via front end loader to 10 CY end dump trucks and transfer to bulk barge for transportation to Tacoma. The 10 CY trucks would dump onto the barge and another loader would shape the material for shipment. Appropriate decontamination, containment, and spill control measures would be in place throughout barge loading. Covered barges containing 2,500 – 3,000 tons of material would be towed to the Tacoma smelter. ✓ Loadout of containers to barge is similar to the previous method except that a crane would probably be required to place the container on a truck for short-haul to the barge loading area, where another crane would place the container on the barge. ✓ Loadout from stockpiles to 30 ton (nominal) "truck and pup" over-the-road trucks and transport to the Tacoma smelter via road. A front end loader would load the truck.

TABLE 3-5. UNIT OPERATIONS SUMMARY– EVERETT SMELTER (continued)

Unit Operation	Description of Operation and Alternatives
Unload & Stockpile at Tacoma, Decon	Unloading at the Tacoma smelter is essentially the reverse of the previous unit operation: ✓ Bulk barge unloading would require a front end loader to fill 10 CY trucks on the barge which would then transport the material to the next operation. The large amount of debris expected with S material makes unloading using a hopper and conveyor impractical. Appropriate precautions during loading and transfer would need to be in place. ✓ Container unloading would require a crane, transfer truck, and tipping bed to unload the soil from the container. The truck would then transport the container back to the barge to be reloaded by the crane. ✓ Unloading 30 ton over-the-road trucks is readily accomplished by the truck lift-bed and no further assistance is needed. If possible, unloaded material will be immediately processed to achieve the appropriate size followed by direct placement. If material will be stockpiled, it will either be in the Fine Ore Bins (FOB) for S material or with other residential soil stockpiles for R material. Decontamination following delivery of the final shipment for each container will be accomplished at the Tacoma smelter.
Size S or M material	Source material must be less than 6 inches to be placed in the Tacoma OCF; R material must be less than 3 inches for placement below the site-wide cap. Material that needs to be sized will be screened and/or crushed at Tacoma after delivery. If material meets the size requirements upon delivery then it may be able to be placed directly.
Place S or M material	Source material that is appropriately sized can be placed in the OCF provided it passes the "paint filter test". As this material is being received essentially dry, this requirement should easily be satisfied. Residential material that is the appropriate size and meets the other requirements for sub-grade backfill can be placed below the sitewide cap.

4.0 CONSTRUCTION ACTIVITIES

4.1 CONSTRUCTION MANAGEMENT

This section describes the construction management organization and structure and defines key positions and related responsibilities for the Everett site interim action. A table of functional descriptions for key positions, qualifications for key personnel, descriptions of duties, and lines of authority is included (see Table 4-1). The interrelationships between Asarco, Ecology, and the City of Everett are also described.

Project objectives for design and implementation of the interim action are listed below.

1. Conduct all design and interim action construction activities in the most cost efficient manner practical while fully complying with applicable regulatory requirements.
2. Regularly communicate the status of the project to the public, Stakeholders, agencies, and to others upon request.
3. Complete the project on-time and within budget.
4. Minimize, to the extent practical, disruptions or inconveniences that may be necessary to accomplish the site interim action by consulting and coordinating field activities with the neighboring public, local governments, and state/federal agencies.
5. Institute appropriate work practices and policies to produce high quality work products that meet the task requirements.
6. Coordinate related off-site work including transport to and stockpiling/disposal at the former Tacoma smelter site to achieve cost effective and environmentally satisfactory results for both sites.
7. Complete protection monitoring and performance monitoring in accordance with WAC 173-340-410.

8. Institute the necessary health and safety measures to assure acceptable public and worker protection during all interim action activities in accordance with WAC-173-340-810.

9. Establish project management systems, including policies, procedures, organizational descriptions, and cost control practices, that allow Asarco to achieve project objectives.

10. Develop workable, efficient practices for document review and revision by all parties that will participate in this project, including applicable state requirements for professional engineering approval of plans and specifications.

The work tasks to be performed during interim action are divided into four functional areas. Each functional area is comprised of one or more entities that are responsible for the assigned tasks:

1. Project Direction and Regulatory Oversight: Asarco and its legal counsel (Heller, Ehrman, White, & McAuliffe), Ecology, and City of Everett.
2. Project Management, Construction Management, Administration, and Control: Project Manager - Asarco Consulting, Inc.
3. Design and Field Engineering: The remedial design team and additional engineering expertise and inspectors as needed to support implementation of the interim action. The field engineering team includes the monitoring team responsible for protection monitoring and performance monitoring as described in WAC 173-340-410.
4. Construction: The Contractors and other subcontractors as needed to implement the cleanup as designed.

As the name implies, the Project Direction and Regulatory Oversight group is responsible for the overall project direction and regulatory compliance. The other functional groups are responsible for project management and execution consistent with the direction provided by Asarco, Ecology, and the City of Everett. The general tasks assigned to these functional groups are summarized below.

Project Management, Construction Management, Administration, and Control is the responsibility of the Project Manager. Functional tasks assigned to the Project Manager are:

a) Procurement;
b) Construction Management and Oversight;
c) Implementation of Decision Making Processes and Procedures for the interim action;
d) Contract Administration;
e) Contractor/Employee logistics and administration facilities;
f) Cost and Scheduling;
g) Evaluation of on-going work, value engineering proposals, design revisions, and "realtime" interpretation of results from field activities.

Design and Field Engineering responsibilities are delegated between three groups: the Remedial Design team, the Results team, and the Field Engineering team. The functional tasks for these groups are:

Remedial Design Team:

a) Completion of the Remedial Designs and design support to the Field Engineering Team;
b) Revisions to approved Remedial Designs as needed during the interim action;
c) Preparation of construction plans and specifications in accordance with WAC 173-340-400; and
d) Incorporation of the value engineering process into design.

Results Team:

a) Field sampling and monitoring in coordination with the Field Engineering Team to complete performance monitoring as outlined in Appendix A, Compliance Monitoring Plan;
b) Internal and external laboratory coordination;
c) Data review and/or validation; and
d) Data reporting in accordance with Appendix C, Sampling and Analysis Plan.

Field Engineering Team:

a) Protection Monitoring - Environmental, Safety and Health (ES&H) monitoring and programs to meet the requirements of WAC 173-340-810. Protection monitoring is described in Appendix B, Health and Safety Plan;
b) Performance Monitoring (WAC 1173-340-410) – Engineering inspections, construction monitoring and testing, and construction quality control to confirm the interim action has attained cleanup standards and met interim action goals. Performance monitoring is described in Appendix A, Compliance Monitoring Plan and will be further defined in the final design specifications;
c) Engineering support to Construction Contractor;
d) Preparation of as-built drawings;
e) Field change recommendations to Remedial Design Team; and
f) Field surveying/mapping.

Construction Contractor:

a) Implementation of the interim action in accordance with project plans and specifications and WAC 173-340-400.
b) Operation and maintenance of roads and utilities;
c) Off-site traffic management/coordination;
d) Surface water controls;
e) Materials management:
   - On-site transportation and stockpiling of Everett S and R material and import material; and
   - Coordination of material logistics, storage, preparation, stockpiling, and final disposal for imported and exported materials.
f) Personnel monitoring per the Health and Safety Plan (Appendix B).

Figure 4-1 shows the project organization for accomplishing the interim action. The functional positions, reporting authority, and personnel assigned for the interim action are described in Table 4-1. Additional personnel will be assigned to perform specific tasks under the

supervision of the key positions shown. The Remedial Design team is not addressed in detail here.

Changes to scope, schedule or cost will require coordination with the Project Coordinator, Project Manager, and interim action Contractor and may also require coordination with the Remedial Design team if significant design changes are needed. An open line of communication between all functional groups will be established during the interim action to facilitate efficient change management during construction.

Design changes that are material to the Final Design will be documented with changes to Plans and Specifications which will be submitted to Ecology for review and approval.

TABLE 4-1 FUNCTIONAL ORGANIZATIONAL DESCRIPTION

Key Functional Positions	Project Reporting Relationships	Primary Duties and Responsibilities	Personnel Assigned
Asarco Project Coordinator The Project Coordinator is responsible for overall project direction and control. The Project Coordinator establishes the performance criteria for project deliverables (scope, schedule, cost, quality and compliance) which in turn are delegated to the Project Manager for implementation. The Project Coordinator is responsible for strategic and legal direction involving project execution and is the formal point of contact for regulatory agencies and the Community Stakeholders.			
Asarco Project Coordinator	Reports directly to the Asarco manager responsible for these projects within the corporation.	Direction and control of project to fully satisfy regulatory requirements while controlling project costs and schedule.	Donald A. Robbins, ASARCO Incorporated
Legal Direction	Reports to Asarco Project Coordinator and Asarco Executive Management.	Responsible for legal aspects of project, providing routine direction, review, and support to Project Coordinator and Supervising Contractor.	Michael R. Thorp Marcia Newlands Heller, Ehrman, White & McAuliffe (HEWM)
Contracts Manager	Reports to Asarco Project Coordinator and Asarco Executive Management	Responsible for contract review and approval, provides direction relative to contract terms, review and approval of contract changes, provides support to the Project Manager relative to contract issues.	Robert Litle ASARCO Incorporated
Asarco On-site Representative	Reports directly to the Asarco Project Coordinator and indirectly to the Project Manager	Responsible for on-site coordination of daily construction activities and public interaction.	*Clint Stanovsky* Consultant for ASARCO Incorporated

TABLE 4-1 1 FUNCTIONAL ORGANIZATIONAL DESCRIPTION (continued)

Project Manager The Project Manager is responsible for overall project management and execution, and is accountable for all project deliverables regarding scope, schedule, cost, quality and compliance. This position is responsible for construction management and implementation of all interim action activities including protection monitoring, performance monitoring, materials management, operations & maintenance, contractor management, field engineering, and construction quality control. Cost management, scheduling and coordination with regulatory agencies and community groups are also the responsibility of the Project Manager.			
Project Manager	Reports directly to Asarco Project Coordinator.	The Project Manager is responsible for management and execution of the project consistent with authority delegated by the Asarco Project Coordinator. This position is accountable for all project deliverables and project team performance regarding scope, schedule, cost, quality and compliance. The Project Manager supports other team positions to ensure that resource issues are met, decisions are made, and project needs are met. The Project Manager is the primary technical liaison between regulatory agencies, community groups, and the project team. The Project Manager will be a registered Professional Engineer in the State of Washington in accordance with WAC-173-340-400(6)(b)(i).	David K. Nation, P.E. Asarco Consulting, Inc.
Construction Contractor Responsible for construction and implementation of the interim action consistent with the project plans, specifications, and control documents in accordance with WAC 173-340-400.			
Construction Contractor	Reports directly to Asarco Project Coordinator.	The Construction Contractor is responsible for implementation of the interim action in accordance with project plans and specifications. The Construction Contractor will follow all protection monitoring requirements of the project as defined in the Health & Safety Plan, Appendix B. Construction management will include on- and off-site traffic management, site roads and utilities, dust control, and materials management.	TBA

TABLE 4-1 FUNCTIONAL ORGANIZATIONAL DESCRIPTION (continued)

Field Engineering/Construction Oversight This group is responsible for Protection Monitoring (Environmental Safety and Health), Performance Monitoring, field quality control, engineering inspections, surveying, monitoring/testing, and construction oversight/support. The Field Engineering/Construction Oversight Team includes the functions of regulatory mandated quality control of construction activities and project deliverables, field sampling and analysis oversight, monitoring oversight, data validation and management, environmental safety and health (ES&H) compliance, field construction changes, as-builts, and surveying.			
Field Engineering Manager	Project Manager	The Field Engineering Manager is responsible for oversight of engineering activities and coordination with the Project Manager, On-site Representative, and Contractors during the interim action. This position will provide technical direction, guidance and support to all project groups, particularly the Field Engineering Team. This position will ensure that field results are evaluated in a timely manner to determine if project specifications and construction quality control criteria are being met. This position will provide real-time "in-the-field" guidance and direction to the Field Engineering Team to determine a course of action when requirements are not met. The Field Engineering Manager will coordinate with the Lead Design Engineer to obtain design support as needed to address field conditions, design changes, etc.	TBA
Engineering Inspector(s)	Field Engineering Manager	The Engineering Inspector(s) will work with the Contractor in coordinating construction tasks to meet project requirements as designated in the project Plans and Specifications, Compliance Monitoring Plan, Sampling and Analysis Plan, and Health and Safety Plan. The Engineering Inspector(s) will also direct field engineering changes, develop as-built drawings, complete surveying, and provide general engineering support.	TBA
ES&H Compliance Officer	Field Engineering Manager	This position will direct the Environmental Safety & Health (ES&H) program in accordance with the requirements of WAC-173-340-810, Protection Monitoring. The ES&H Compliance Officer will develop and implement all ES&H programs required for the site, review Contractor safety plans, and provide oversight of contractor compliance with applicable programs. The ES&H Compliance Officer may observe any operation on-site report directly to the Project Manager as needed.	TBA

TABLE 4-1 FUNCTIONAL ORGANIZATIONAL DESCRIPTION (continued)

Results Team Responsible for coordination and tracking of project data, oversight of field sampling teams, laboratories coordination, validation of data as appropriate, and data results reporting to all project groups.			
Results Manager	Project Manager	Development, implementation, and tracking of all field sampling, analysis, and reporting activities including tasks performed by Asarco, field subcontractors, onsite XRF laboratory and Asarco TSC laboratory. This position will direct sampling teams and will coordinate and direct laboratories and testing subcontractors. The Results Manager will review laboratory and testing results and coordinate additional technical review with appropriate members of the Field Engineering/Construction Oversight team. The Results Manager reports and distributes results to all project groups in a timely fashion and identifies areas that are not in compliance with the Project Specifications, Compliance Monitoring Plan, or Sampling and Analysis Plan.	TBA
Sampling Teams	Results Manager and/or Lead Field Engineer	Sampling teams may be comprised of Engineering Inspectors, laboratory personnel, and construction/field personnel. The sampling team will be responsible for sample collection as defined in the Project Specifications, Sampling and Analysis Plan, and Compliance Monitoring Plan. The sampling team will complete Chain-of-Custody forms and other sample documentation as required.	TBA
Laboratory Supervisors	Results Manager	Responsibility for supervision of laboratory analyses performed during the interim action, consistent with the Project Specifications, Sampling and Analysis Plan and Compliance Monitoring Plan.	- Onsite XRF Laboratory - Asarco TSC - Salt Lake City, UT
Data Validation and Management	Results Manager	Data validation and management of information per the Sampling and Analysis Plan.	TBA

4.2 APPLICABLE PERMITS

This section describes the applicable permit requirements for the interim action and presents the plan for addressing the substantive conditions as provided for under MTCA.

4.2.1 REQUIREMENTS AND EXEMPTIONS

As discussed in Section 3.4.2, MTCA provides exemptions from the procedural requirements of several state laws applicable to the design and implementation of cleanup actions, though the substantive requirements of these laws must be met. Ecology's FCAP for the Upland Area of the Everett Smelter Site incorporates the substantive requirements of those state laws applicable to the cleanup action selected in the FCAP. Because the proposed interim cleanup action is consistent with and meets or exceeds the requirements of the cleanup action selected in the FCAP, the proposed interim action also complies with the substantive requirements of the applicable state laws.

Regarding applicable local laws regulating construction activities in the City of Everett, the FCAP notes that the City has substantive requirements for grading, erosion control, and work in City rights-of-way. The FCAP directs the Engineering Design Report (in this case, the IAR) for the selected cleanup action to specify the means of compliance with these substantive local requirements.

Further, MTCA 173-340-400(5) requires that:

> Permits and approvals and any substantive requirements for exempted permits, if required for construction or to otherwise implement the cleanup action, shall be identified and where possible, resolved before, or during, the design phase to avoid delays during construction and implementation of the cleanup action.

4.2.2 LOCAL PERMITS AND APPROVALS

The City of Everett regulates site development and construction activities through two permit processes: the Public Works Permit, and the Industrial Waste Discharge Permit.

The Public Works Permit addresses grading, storm water control, landscaping and erosion control, work in public rights-of-way, emergency access and other aspects of improvements undertaken within the City of Everett. Once a permit application is initiated (through the Building Permits desk of the Department of Public Works), Public Works staff conduct an internal review of proposed construction plans, and route them for review by the Fire Department and the Utilities Division (the local water and sewer utility). According to Public Works staff, review times for projects similar to the proposed interim action are typically four to five weeks.

The Industrial Waste Discharge Permit sets standards and, when appropriate, pretreatment requirements for water discharged into the City's wastewater treatment system. Asarco has previously obtained this permit for water reporting to the City's system. Staff of the Everett Utilities Industrial Pretreatment Program review quantities and characteristics of water to be discharged from the construction site into the City's combined storm and sanitary sewer system. Staff may recommend specific testing, monitoring and pretreatment programs to assure the acceptability of discharges from the site. According to City staff, typical review times range from 1 week to 60 days (in cases where public notice is required).

Asarco anticipates that the existing local permit review processes can be employed to assure compliance with substantive requirements within the schedule necessary to begin work onsite in April 2003. This IAR will provide much of the information necessary for the City's permit review processes. Upon completion and acceptance of this report, Asarco will develop and submit its applications for both local permits. Requirements or conditions that may arise from these permits will be incorporated into the final plans and specifications.

4.2.3 Transportation Facilities

Asarco or its contractor(s) will need to comply with the federal, state and local permits governing the operation of any off-site intermodal facilities used in interim action, including barge loading facilities and, possibly, rail/container facilities. These permits will include City of Everett operating permits and NPDES permits.

Two barge-loading facilities in Everett could potentially be used in the shipment of contaminated soil to Tacoma, and to import clean fill to the site. Both facilities operate under Sand and Gravel Facility General (NPDES) Permits, which require a Stormwater Pollution Prevention Plan and a Spill Plan. These and other relevant requirements of the general permits will be reviewed, and may need to be modified to assure their adequacy for the handling of state dangerous and hazardous wastes.

Asarco or its contractor(s) will collaborate with transportation facility operators as necessary to develop suitable operations plans for the interim action.

4.3 QUALITY CONTROL AND DOCUMENTATION

Construction quality control and documentation requirements are specified in WAC 173-340-400 (4) and (6). Quality control requirements applicable to this IAR can be divided into two groups:

- Chemical-related parameters, which are addressed in the Compliance Monitoring and Sampling and Analysis Plans (Appendices A and C), and the Health and Safety Plan (Appendix B); and
- Physical parameters, such as percent compaction, which are addressed in the applicable ASTM test method that will be cited in the specifications.

These requirements are or will be incorporated into the construction management plan (Section 4.1) and the construction plans and specifications that will be prepared as part of the final design. As remediation of the fenced area progresses, documentation regarding the

execution of the interim action and variations from the remedial design will be prepared. Data management and reporting is addressed in Appendix C, Sampling and Analysis Plan.

This interim action is straightforward, so the type of information to be documented will primarily consist of the following items:

- Excavation limits, depths, and beginning and ending elevations;
- Volumes and quantities (tons) of material excavated and classification by type (S or R);
- Sample results from performance monitoring activities;
- Air quality monitoring information, both personal and ambient;
- Number of trucks loaded and daily quantities shipped off-site;
- Field and laboratory data for physical tests (e.g., compaction, grain size analysis); and
- Water quality information related to surface water that will be discharged.

This information will be compiled and reported to Ecology periodically throughout the interim action. It will be available for inspection during normal business hours. At the completion of both Stage 1 and Stage 2, as-built drawings will be prepared documenting these conditions:

- The excavated surfaces after removal of the S and R material before backfilling;
- The surface topography after cut and fill operations have been completed but before import of clean material;
- The final surface topography after clean material import and final grading; and
- The details of subsurface and overhead utility abandonments, relocations, or new services.

At the end of the interim action, this information for the fenced area will be compiled, organized, and submitted to Ecology and the City of Everett in a report. This report will be prepared under the direction of a professional engineer registered in Washington. This report may be used to update other public records and will provide the basis for the institutional controls program in the fenced area called out in the FCAP.

Procedures for collecting information and documenting the remediation of any residential properties outside the fenced area are contained in Appendix A.

4.4 OPERATION AND MAINTENANCE

The requirements of the Operations and Maintenance Plan in WAC 173-340-400 (4) (c) are intended for remediation activities that have some ongoing treatment or waste management activities. The actions planned under this interim action are primarily construction oriented. While there will be operational aspects associated with the cleanup of the fenced area, they will be ancillary to the overall construction activities that will be undertaken. The O&M provisions needed during the interim action will be included with the construction plans and specifications prepared as part of final design.

Because the interim action will remove material from the fenced area to residential standards established in the FCAP, no further O&M provisions beyond those required by the FCAP are anticipated after completion of the interim actions

5.0 REFERENCES

Record of Decision, Commencement Bay Nearshore/Tideflats Superfund Site Operable Unit 02, Asarco Tacoma Smelter Facility, Ruston and Tacoma, Washington, U.S. Environmental Protection Agency Region 10, March 1995

Everett Smelter Site Remedial Investigation, Everett, Washington, Hydrometrics, Inc. and Kleinfelder, Inc., September 1995

Everett Smelter Site Feasibility Study, Everett, Washington, Hydrometrics, Inc., September 1995

Smelter Area Investigation Report, Everett Smelter Site, Everett, Washington, ASARCO Incorporated, August 13, 1998

Storm Water and Storm Drain Sediment Characterization and Controls Work Plan, ASARCO Incorporated, April 1998

Everett Smelter Site Final Cleanup Action Plan (FCAP) and Final Environmental Impact Statement for the Upland Area, Everett, Washington, Washington State Department of Ecology, November 19, 1999

Stormwater Management Manual, City of Everett, Revised 4/00

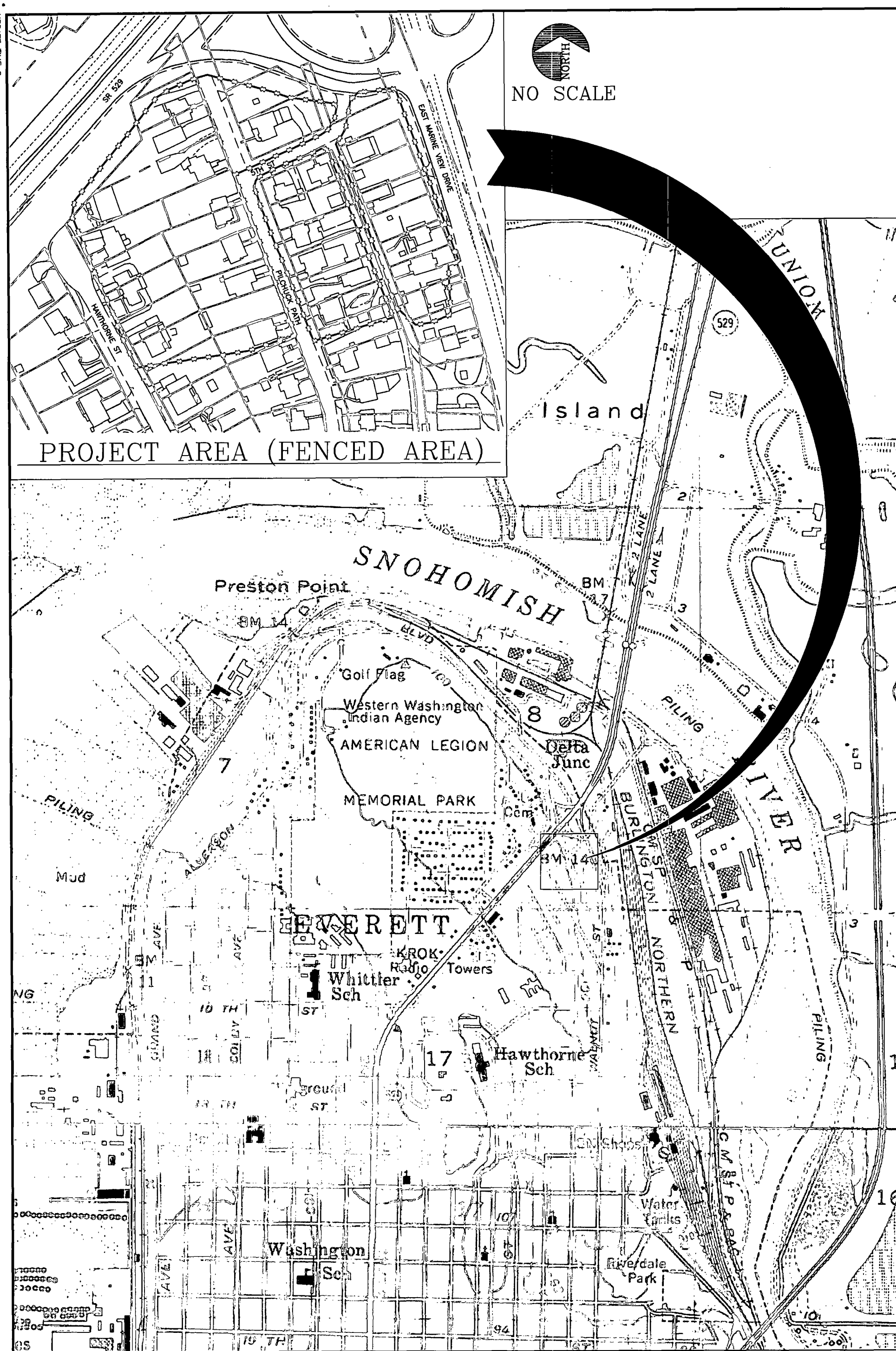
Interim Actions, WAC 173-340-430 et al, Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC, Washington State Department of Ecology Toxics Cleanup Program, Publication 94-06, Amended February 12, 2001

Design and Construction Standards and Specifications for Development, City of Everett, Revision 4/02

Standard Specifications for Road, Bridge, and Municipal Construction-2002, Washington State Department of Transportation

FIGURES

UPDATE TIME: 8am
PG \TAC\112502\ Everett-091902-T036



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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE - EVERETT, WASHINGTON -

PROJECT GENERAL LOCATION MAP

FIGURE 1-1

UPDATE TIME: 8pm
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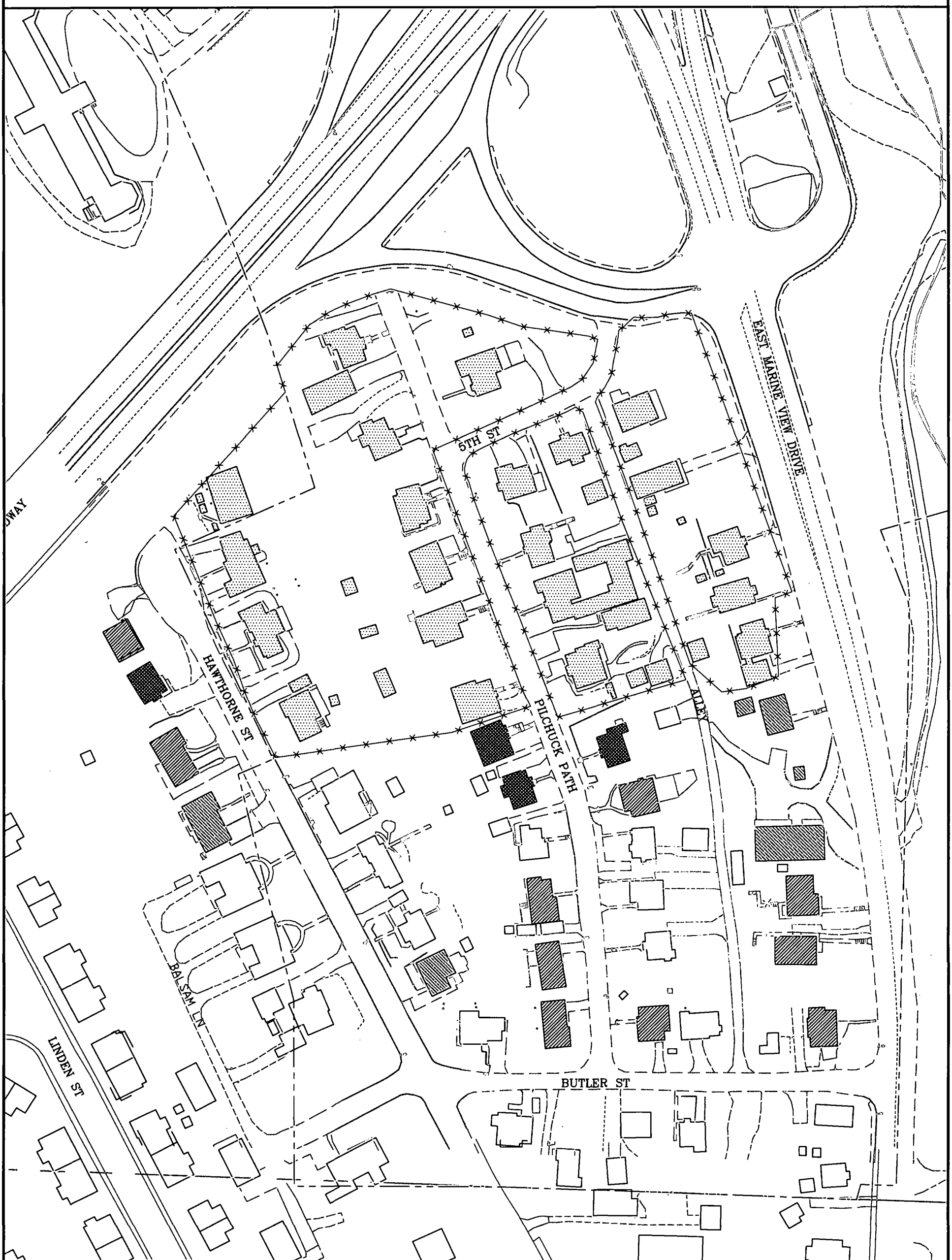
Everett-091902-T032

LEGEND

- ASARCO OWNED - DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- ASARCO OWNED - RENTAL PROPERTIES
- ASARCO OWNED - VACANT PROPERTIES
- PROPERTIES REMEDIATED BY ECOLOGY
- ASARCO INFORMATION CENTER
- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE

NORTH

SCALE (In Feet) 0 100



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RESIDENTIAL PROPERTIES ADJACENT TO THE FENCED AREA

FIGURE 1-2

UPDATE TIME: 8am
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LEGEND

APPROXIMATE LOCATION OF HISTORICAL SMELTER FOOTPRINT

SECURITY FENCE

ESTIMATED EXTENT OF MATERIAL WITH ARSENIC CONCENTRATIONS GREATER THAN 10000 mg/kg

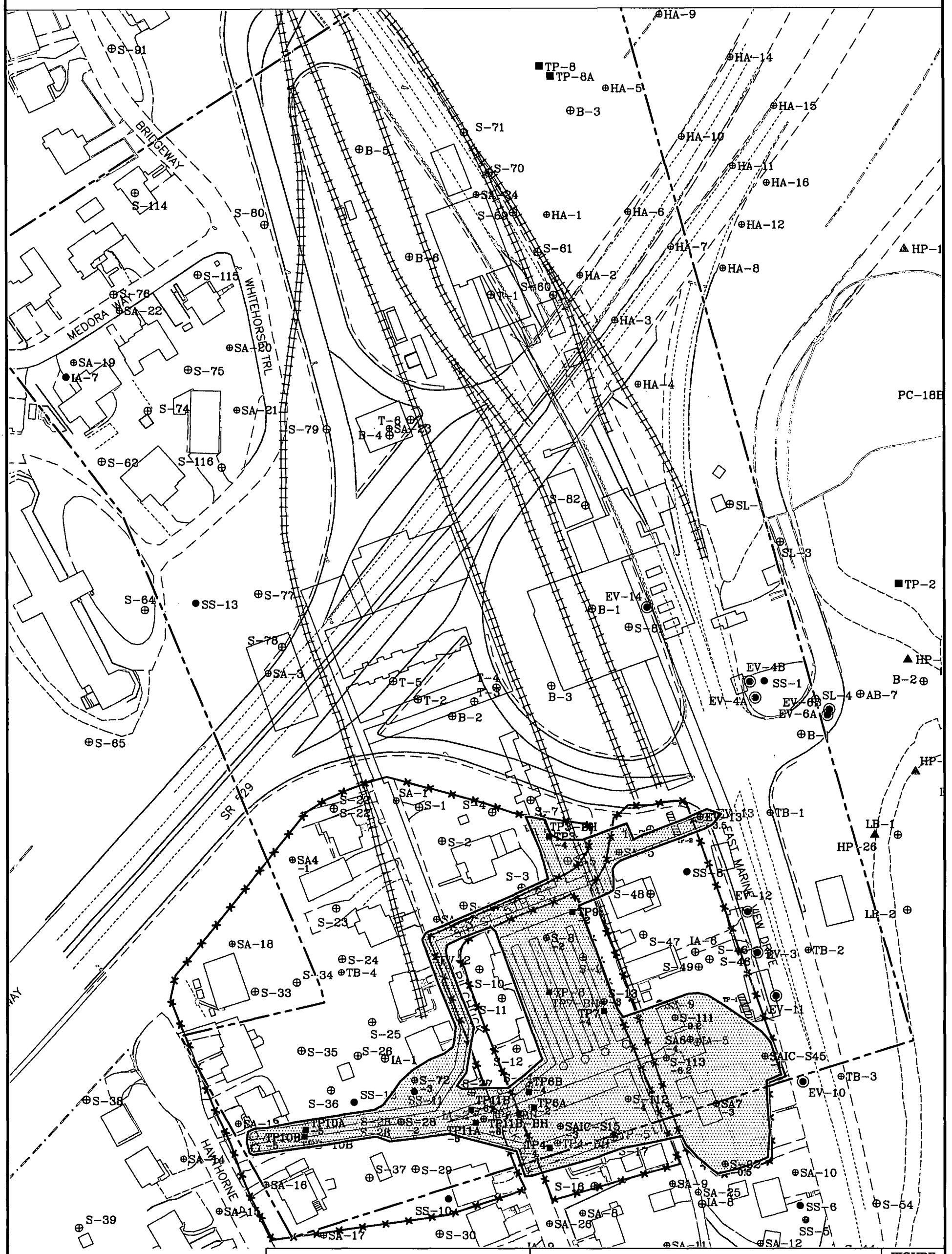
EV-12 SAMPLE LOCATION
TB-4 SAMPLE LOCATION
TP7-4 SAMPLE LOCATION
SS-12 SAMPLE LOCATION

NORTH

SCALE (In Feet) 0 100

NOTES

SOURCE- EVERETT SMELTER AREA INVESTIGATION REPORT



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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE - EVERETT, WASHINGTON -

ESTIMATED EXTENT OF MATERIAL WITH ARSENIC CONCENTRATIONS GREATER THAN 10000 mg/kg

FIGURE 2-1

UPDATE TIME: 8am
PG \TAC\112502\ Everett-091902-T033

LEGEND

APPROXIMATE LOCATION OF HISTORICAL SMELTER FOOTPRINT

SECURITY FENCE

ESTIMATED EXTENT OF MATERIAL WITH ARSENIC CONCENTRATIONS GREATER THAN 10000 mg/kg

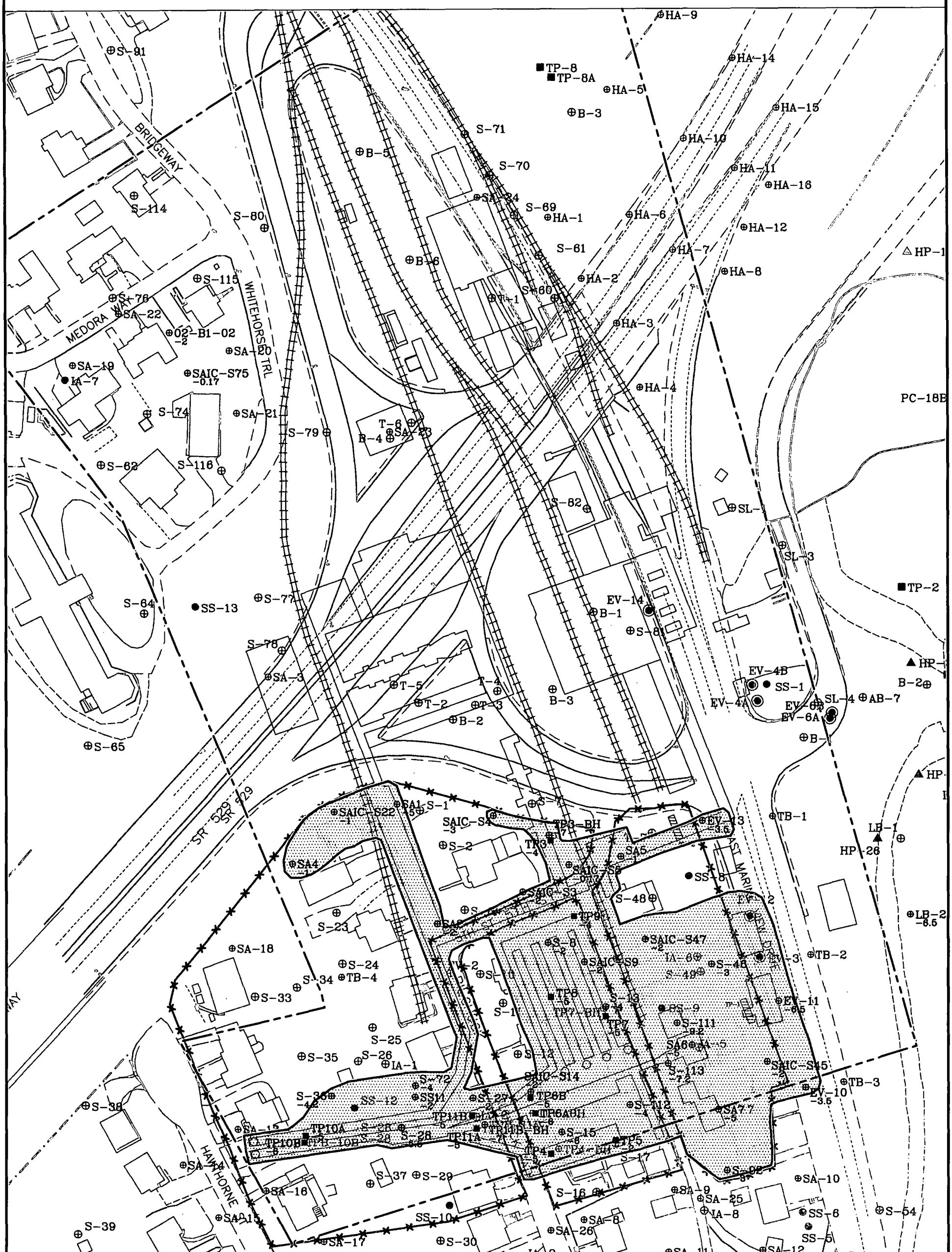
EV-12 SAMPLE LOCATION
TB-4 SAMPLE LOCATION
TP11B-5 SAMPLE LOCATION
SS-12 SAMPLE LOCATION

NORTH

SCALE (In Feet) 0 100

NOTES

SOURCE- EVERETT SMELTER AREA INVESTIGATION REPORT



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ESTIMATED EXTENT OF MATERIAL WITH ARSENIC CONCENTRATIONS GREATER THAN 3000 mg/kg

FIGURE 2-2

UPDATE TIME: 8am
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LEGEND

APPROXIMATE LOCATION OF HISTORICAL SMELTER FOOTPRINT

SECURITY FENCE

ESTIMATED EXTENT OF SMELTER RESIDUAL CONTAINING ARSENIC TRIOXIDE OR FLUE DUST

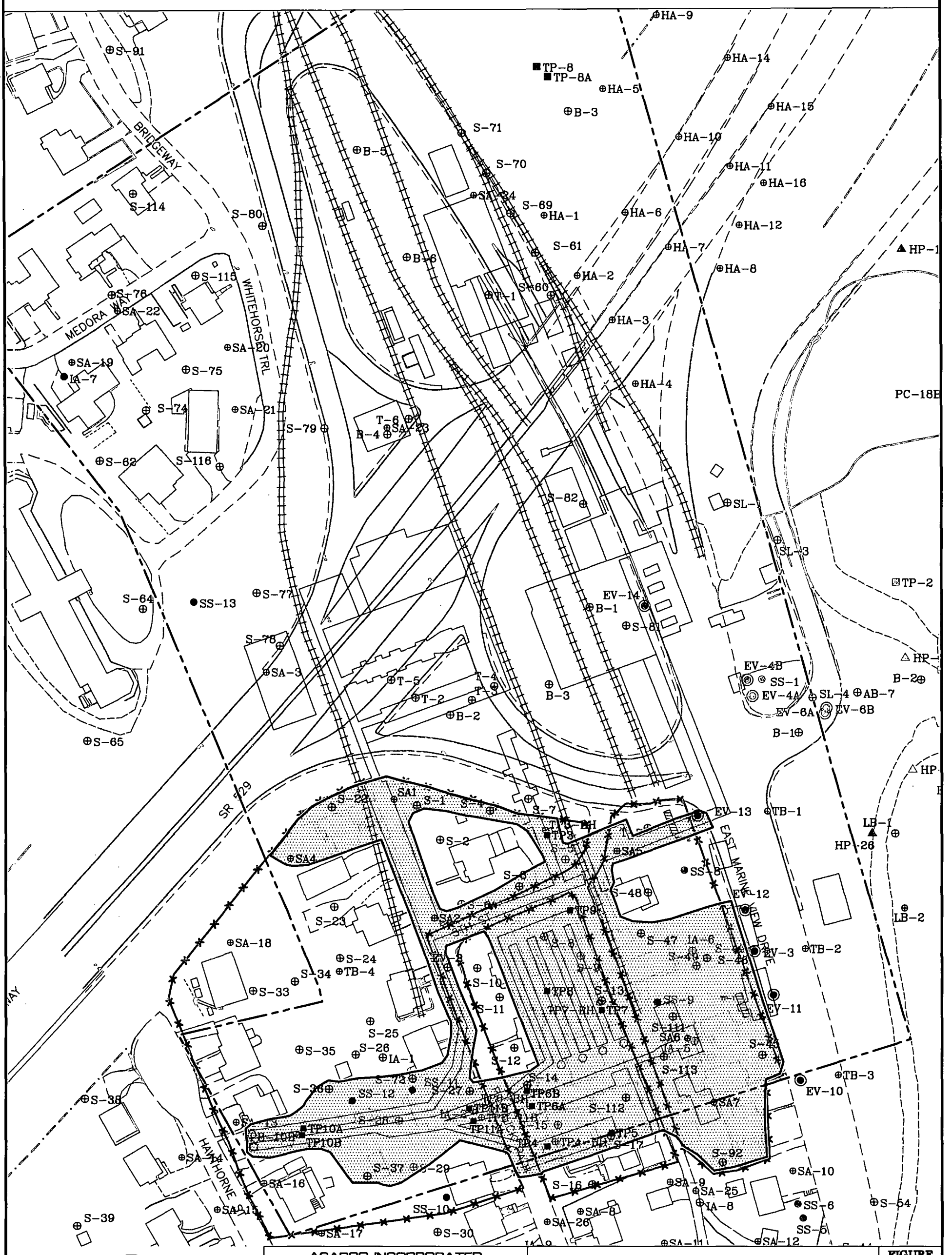
EV-12 SAMPLE LOCATION
TB-4 SAMPLE LOCATION
TP10A SAMPLE LOCATION
SS-12 SAMPLE LOCATION

NORTH

SCALE
0 (In Feet) 100

NOTES

SOURCE- EVERETT SMELTER AREA INVESTIGATION REPORT



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ESTIMATED EXTENT OF SMELTER RESIDUAL CONTAINING ARSENIC TRIOXIDE OR FLUE DUST

FIGURE 2-3

NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
▨	STOCKPILE AREA

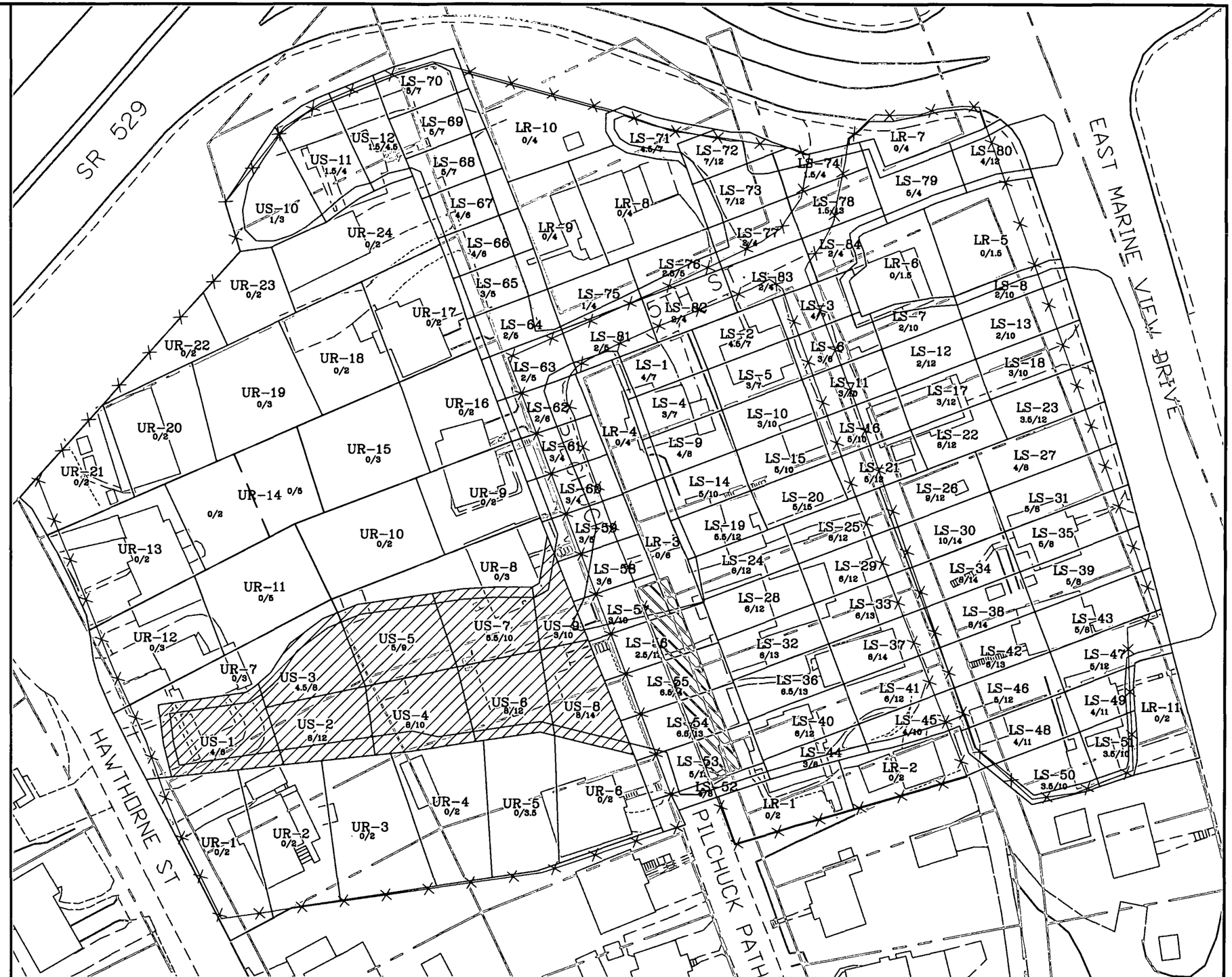
NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-1a

Stage 1 – Excavation, Stockpile & Backfill Sequence – Upper Area

Step	Description
1.	Construct decontamination wash station at the corner of Pilchuck Path & 5th St.; close these streets to public access.
2.	Construct construction access to US (Upper Source) areas from Pilchuck Path; construct stockpile for S and R materials on east side of Pilchuck Path parallel to road (120' X 20') in sub-areas LS-53 through LS-56. Install surface water ESC measures and institute BMPs. Remove/reroute overhead electrical distribution service on the east side of Pilchuck Path as needed.
3.	Clear and grub US-1, US-2, and US-3; dispose of material off-site as Subtitle C waste.
4.	Excavate/stockpile US-1, US-2, and US-3 for S material (>3000 mg/Kg As) and sample; re-dig as needed. Demo foundations/non-organic debris and stockpile for transport to Tacoma.
5.	Repeat (3) for US-4 and US-5. Excavate/stockpile US-4 and US-5 S material and sample as per (4), re-dig as needed.
6.	Repeat (5) for US-6 and US-7.
7.	Repeat (5) for US-8 and US-9; surface limit of eastward excavation @ elevation 94±.



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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE - EVERETT, WASHINGTON -

FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-1-A

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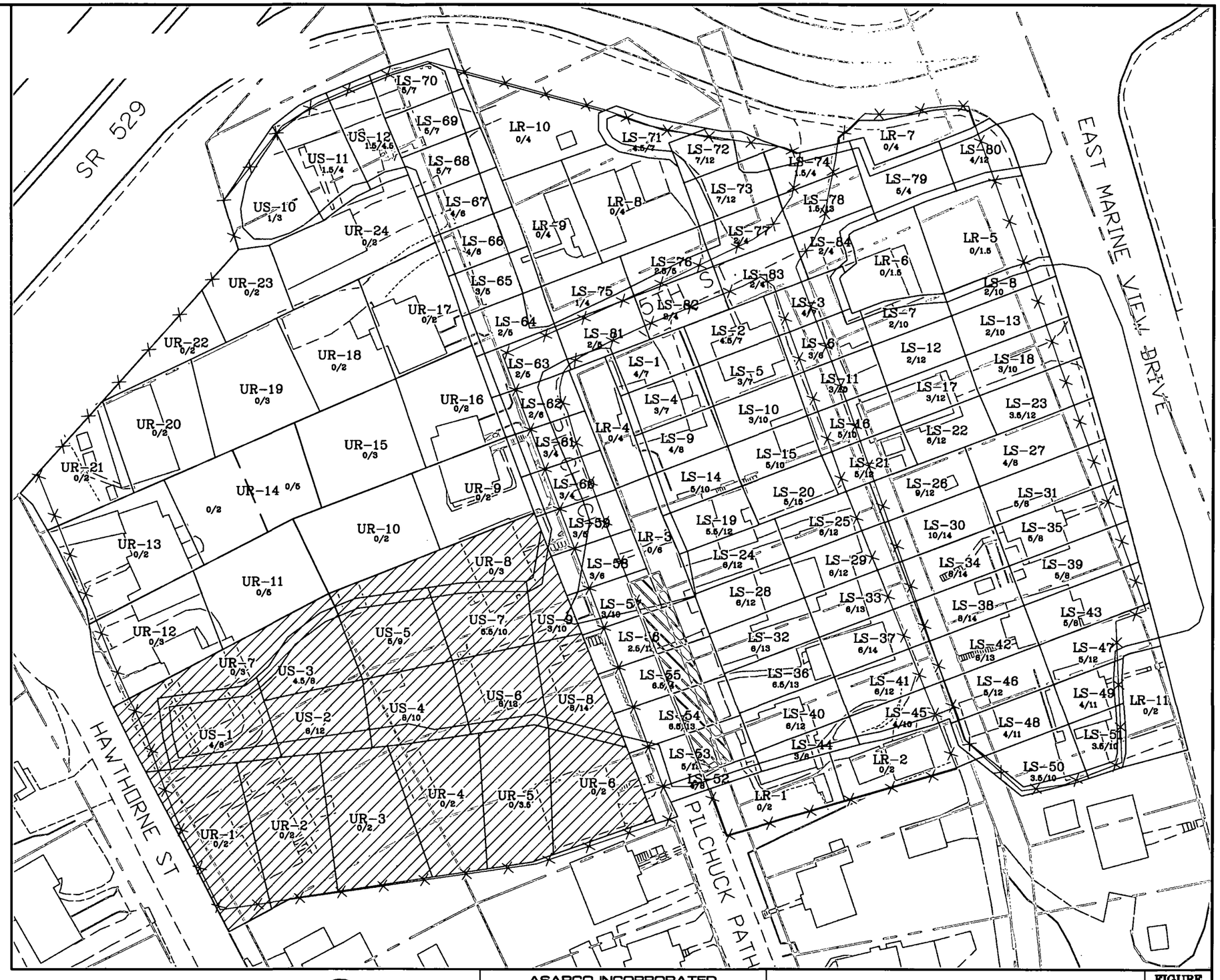

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
▨	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-1b

Stage 1 – Excavation, Stockpile & Backfill Sequence – Upper Area

Step	Description
8.	Clear and grub UR-1; dispose of material off-site as Subtitle D waste. Excavate R material (<3,000 and >150 mg/Kg As) to either Hawthorne or Pilchuck Path from UR-1, and US-1; segregate debris encountered to stockpiles on west side of Pilchuck Path. Demo foundations/non-organic debris and stockpile for transport to Tacoma. Minimum excavation depth is 2' to 150 mg/Kg As or less, or lesser depth to <20 mg/Kg As, whichever is reached first.
9.	Clear and grub UR-2; repeat (8) for US-2, US-3, and UR-2 and load via Pilchuck Path.
10.	Clear and grub UR-3 and west ½ of UR-7; repeat (8) for US-4, US-5, UR-3, west ½ of UR-7.
11	Clear and grub UR-4; repeat (8) for UR-4, US-6, US-7, east ½ of UR-7.
12.	Clear and grub UR-5 and west ½ of UR-8, repeat (8) for UR-5, US-8, US-9, and west ½ of UR-8.
13.	Clear and grub UR-6 east ½ of UR-8 and repeat (8) for UR-6 and east ½ of UR-8. Confirm southern UR sites (UR-1 through UR-6) sites >2' below final grade, grade accordingly and install barrier. Backfill with clean access from Hawthorne or Pilchuck Path as needed for UR-1 thru UR-6, grade and hydroseed.
14.	Grade UR-7 and UR-8 to assure >2' below final grade; material <150 mg/Kg can be used as fill in US sites with compaction (± 90%) standard proctor; re-establish ESC around remaining US excavation for surface water controls.

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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-1-B

UPDATE TIME: 8am
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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
▨	STOCKPILE AREA

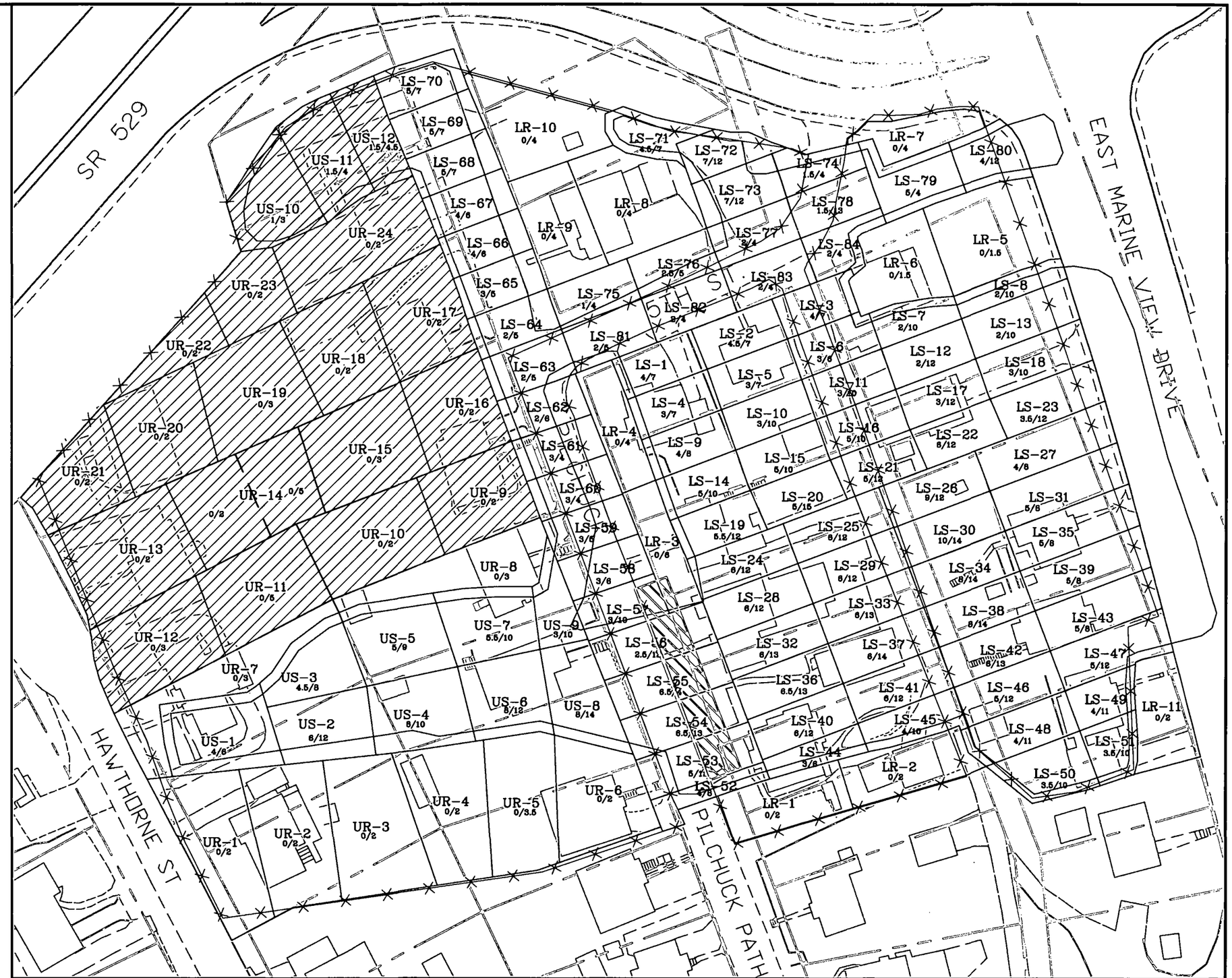
NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-1c

Stage 1 – Excavation, Stockpile & Backfill Sequence – Upper Area

Step	Description
15.	Complete excavation of UR-9 thru UR-22 per the following order and follow process of (8), (13), and (14) above; material <150 mg/Kg can be used as fill in US sites with compaction up to 2' below final grade: Site — Excavation Sequence UR-21 — 1 UR-13 — 2 UR-20 — 3 UR-22 — 4 UR-12 — 5 UR-19 — 6 UR-14 — 7 UR-11 — 8 UR-18 — 9 UR-15 — 10 UR-10 — 11 UR-17 — 12 UR-16 — 13 UR-9 — 14 Establish barrier and surface water diversion along the east side of UR-17, UR-16, UR-9, and UR-8 at elevation 94'-100'± and route to storm drain on Pilchuck Path.
16.	Repeat steps (3), (4), (8), and (13) for US-10, US-11, and US-12. Load all material via Pilchuck Path.
17.	Repeat (8) and (13) for UR-23 and UR-24; keep shed. Re-establish BMPs and surface water controls along the east side of UR-24 and US-12 at elevation 102' ±
18.	Finish backfilling all remaining UR and US areas to grade with clean material (<20); no material > 150 mg/Kg As < 2' from surface elevation. Hydroseed..
19.	Secure site for winter shutdown; re-fence Upper and Lower areas as needed; maintain ESC measures over winter. Re-open Pilchuck Path and 5th St. to public access.



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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-1-C

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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2a

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
1.	Construct surface water SEC elements and implement surface water BMPs; construct decontamination/wash station and stockpile in the vicinity of LR-5 and LR-6. Close public access to Pilchuck Path & 5th St.
2.	Clear and grub eastern 20' of LS-13, LS-18, LS-23, LS-27, LS-31, and LS-35 (from curb westward 20'±); dispose of material as Subtitle C waste. Temporarily abandon and/or disconnect subsurface utilities. Remove all S material (>3,000 mg/Kg As) first, followed by removal of R material (>150 mg/Kg As) and stockpile. Install membrane barrier on west side of excavation and construct temporary truck loadout road in excavated area parallel to East Marine View Drive.
3.	Clear and grub LS-39 and LS-43 and dispose of material as Subtitle C waste. Remove all S material first, followed by removal of material and stockpile. Install membrane barrier on south and west sides of excavation and construct sediment detention pond per City of Everett requirements.
4.	Construct diversion dike immediately west of temporary loadout road and route to pond. Construct temporary diversion dike on the west side of the alley in LS-3 and LS-6, draining to the south. Construct diversion ditch along the perimeter of LS-50, LS-51, and LS-49 and route to pond.

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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-A

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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

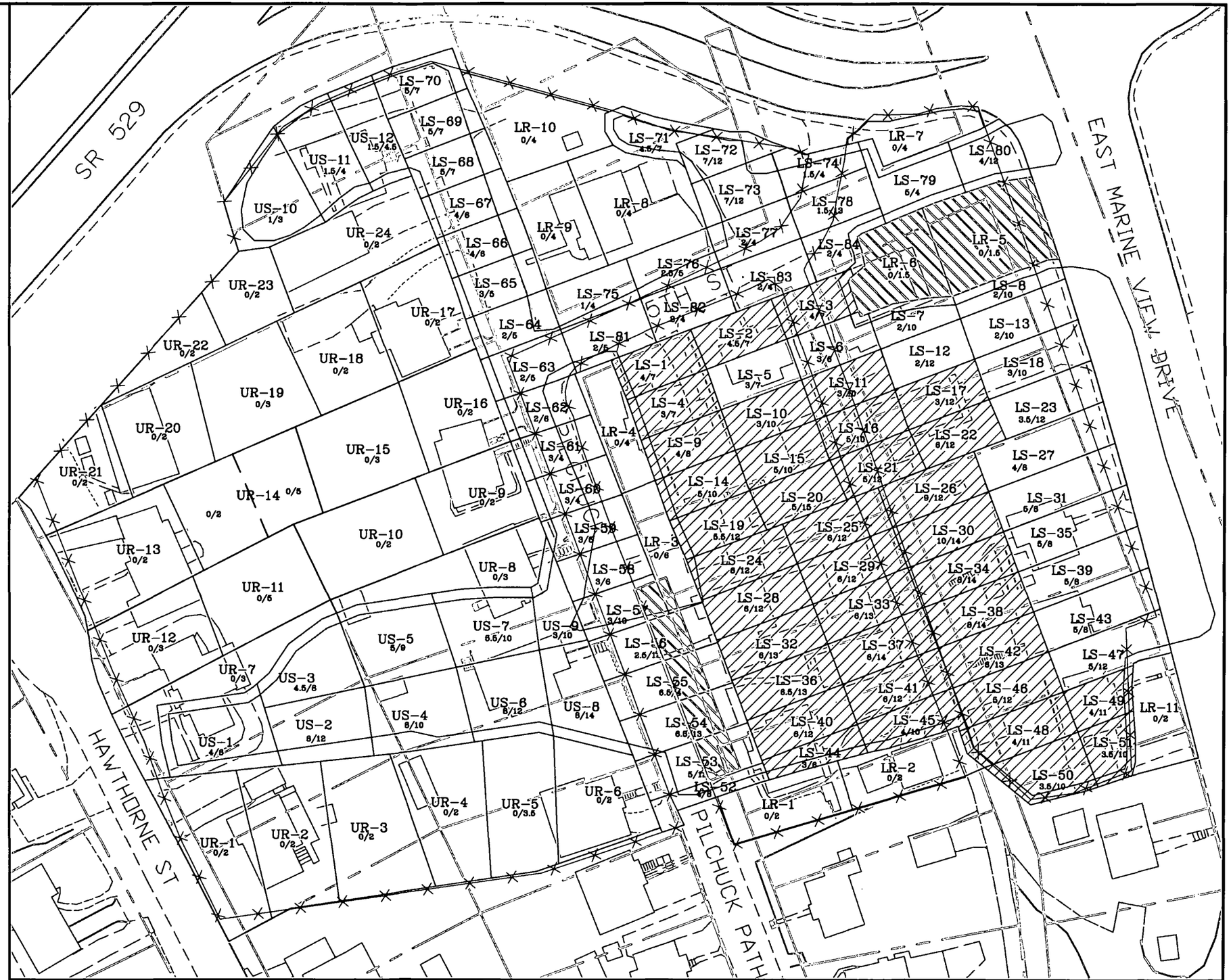
Table 3-2b

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
5.	Excavate S material in LS-1, LS-2, LS-4, and LS-5 (clear and grub and utility abandonment per (2) above); confirmation testing and re-dig as needed, and stockpile. Construct diversion ditch on north side of LS-1 and LS-2 and tie into diversion berm in LS-3 and LS-6. Install temporary plastic sheeting to cover exposed S material on north perimeter of LS-1 and LS-2.
6.	Continue clearing and grubbing, utility abandonments, and excavation of S material, followed by confirmation testing, re-dig as needed, and stockpile in the following sequence:

Site	Excavation Sequence	Site	Excavation Sequence
LS-9	1	LS-22	17
LS-14	2	LS-36	18
LS-10	3	LS-33	19
LS-19	4	LS-30	20
LS-15	5	LS-40	21
LS-11	6	LS-37	22
LS-24	7	LS-34	23
LS-20	8	LS-44	24
LS-16	9	LS-41	25
LS-28	10	LS-38	26
LS-25	11	LS-45	27
LS-21	12	LS-42	28
LS-17	13	LS-46	29
LS-32	14	LS-48	30
LS-29	15	LS-50	31
LS-26	16	LS-51	32
		LS-49	33

As excavation progresses, install plastic sheeting and diversion ditch along cut slope on east side of Pilchuck Path; diversion ditch and ESC elements drain north and then flow reverses to south to detention pond.



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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-B

UPDATE TIME: 8am
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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2c

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
7.	Clear and grub, excavate and stockpile S material per (5) from LS-70 and progress to the south in sequence: LS-69, LS-68, LS-67, LS-66, LS-65, and LS-64. Use paved road on Pilchuck Path and 5th St. to haul to stockpile. Install ESC elements and slope to drain excavated areas to LR-9 and LR-10.
8.	Continue clearing and grubbing, road demolition, utility abandonments, and excavation of S material, followed by confirmation testing, re-dig as needed, and stockpile in the following sequence: Site — Excavation Sequence LS-52 — 1 LS-53 — 2 LS-54 — 3 LS-55 — 4 LS-56 — 5 LS-57 — 6 LS-58 — 7 LS-59 — 8 LS-60 — 9 LS-61 — 10 LS-62 — 11 LS-63 — 12 Use paved road on Pilchuck Path and 5th St. to haul to stockpile. Install ESC elements and slope to drain excavated areas to the east of Pilchuck Path.

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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-C

UPDATE TIME: 8am
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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2d

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
9.	Continue clearing and grubbing, road demolition, utility abandonments, and excavation of S material, followed by confirmation testing, re-dig as needed, and stockpile in the following sequence: Site — Excavation Sequence LS-75 — 1 LS-81 — 2 LS-76 — 3 LS-82 — 4 LS-71 — 5 LS-72 — 6 LS-73 — 7 LS-77 — 8 LS-83 — 9 LS-84 — 10 LS-78 — 11 LS-74 — 12 LS-79 — 13 LS-80 — 14 Use paved road on Pilchuck Path and 5th St. to haul to stockpile. Install ESC elements and slope to drain excavated areas to the east of Pilchuck Path.
10.	Continue clearing and grubbing, road demolition, utility abandonments, and excavation of S, followed by confirmation testing, re-dig as needed, and stockpile in the following sequence: Site — Excavation Sequence LS-3 — 1 LS-6 — 2 LS-7 — 3 LS-8 — 4 LS-12 — 5 LS-13 — 6 LS-18 — 7 LS-23 — 8 LS-27 — 9 LS-31 — 10 LS-35 — 11 Re-establish surface water ESCs and diversion berms to route to pond following excavation of these areas.

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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-D

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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

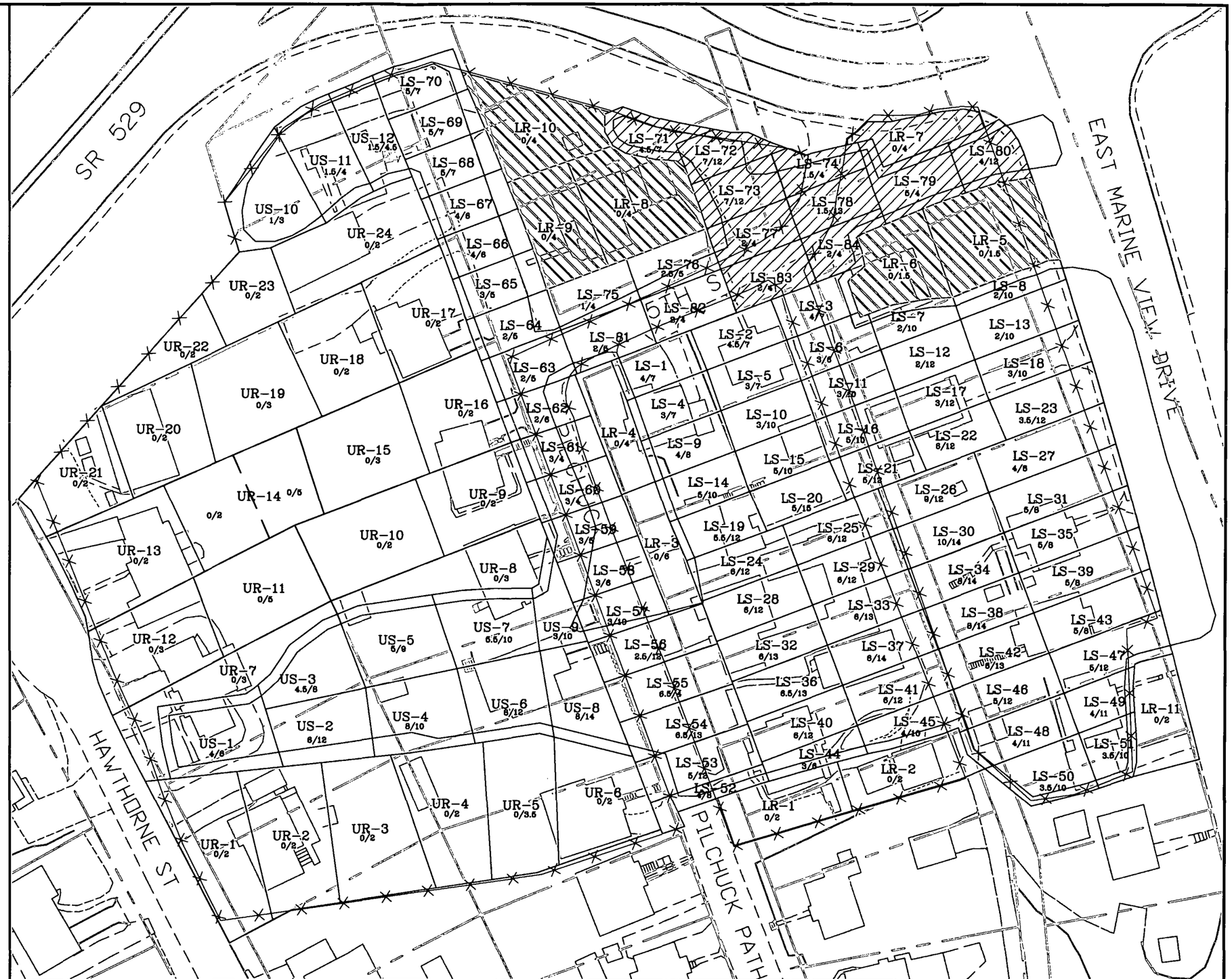
NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2e

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
11.	Concurrently with (10), proceed with removal of R material (>150 mg/Kg As) from the following areas in sequence, stockpiling material in general vicinity of LR-8, LR-9, and LR-10 for loadout: Site — Excavation Sequence LS-71 — 1 LS-72 — 2 LS-73 — 3 LS-77 — 4 LS-83 — 5 LS-84 — 6 LS-78 — 7 LS-74 — 8 LR-7 — 9 LS-79 — 10 LS-80 — 11 Minimum excavation depth is 2' below existing ground surface to 150 mg/Kg As or less, or lesser depth to <20 mg/Kg As, whichever is reached first. Place marker barrier and backfill via import to grade. Re-establish ESC measures to keep runoff from surrounding areas from these sites.
12.	Following completion of (10) and removal of all S material, re-establish primary stockpile in the vicinity of LR-5 and LR-6 for R material (>150 mg/Kg As), including appropriate ESC measures.



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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-E

UPDATE TIME: 8am
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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2f

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
13.	Commence removal of R material from the following sites in sequence, confirmation sample and re-dig as needed, and stockpile. Re-establish ESC measures as needed.

Site	Excavation Sequence	Site	Excavation Sequence
LS-70	1	LR-8	9
LS-69	2	LS-64	10
LS-68	3	LS-63	11
LS-67	4	LS-75	12
LR-10	5	LR-81	13
LS-66	6	LR-76	14
LS-65	7	LS-82	15
LR-9	8		

Step	Description
14.	Continue progression of excavating R material from following areas, generally from north to south and west to east in sequence below:

Site	Excavation Sequence	Site	Excavation Sequence
LS-62	1	LS-2	11
LS-61	2	LS-5	12
LS-60	3	LS-14	13
LR-4	4	LS-10	14
LS-59	5	LS-19	15
LS-58	6	LS-11	16
LS-57	7	LS-24	17
LR-3	8	LS-20	18
LS-1	9	LS-46	19
LS-4	10		

Backfill after confirmation at excavation depth, either by cut/fill from areas remediated in (13) or via import; on-site material <150 mg/Kg can be used as fill in US sites with compaction up to 2' below final grade (± 90% standard proctor). Place barrier at 150 mg/Kg As limit or 2 ft. below final ground surface, whichever is deeper.

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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE 3-2-F

UPDATE TIME: 0:00
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NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)
	STOCKPILE AREA

NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2g

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
15.	Continue progression of excavating R material from following areas, in sequence below:

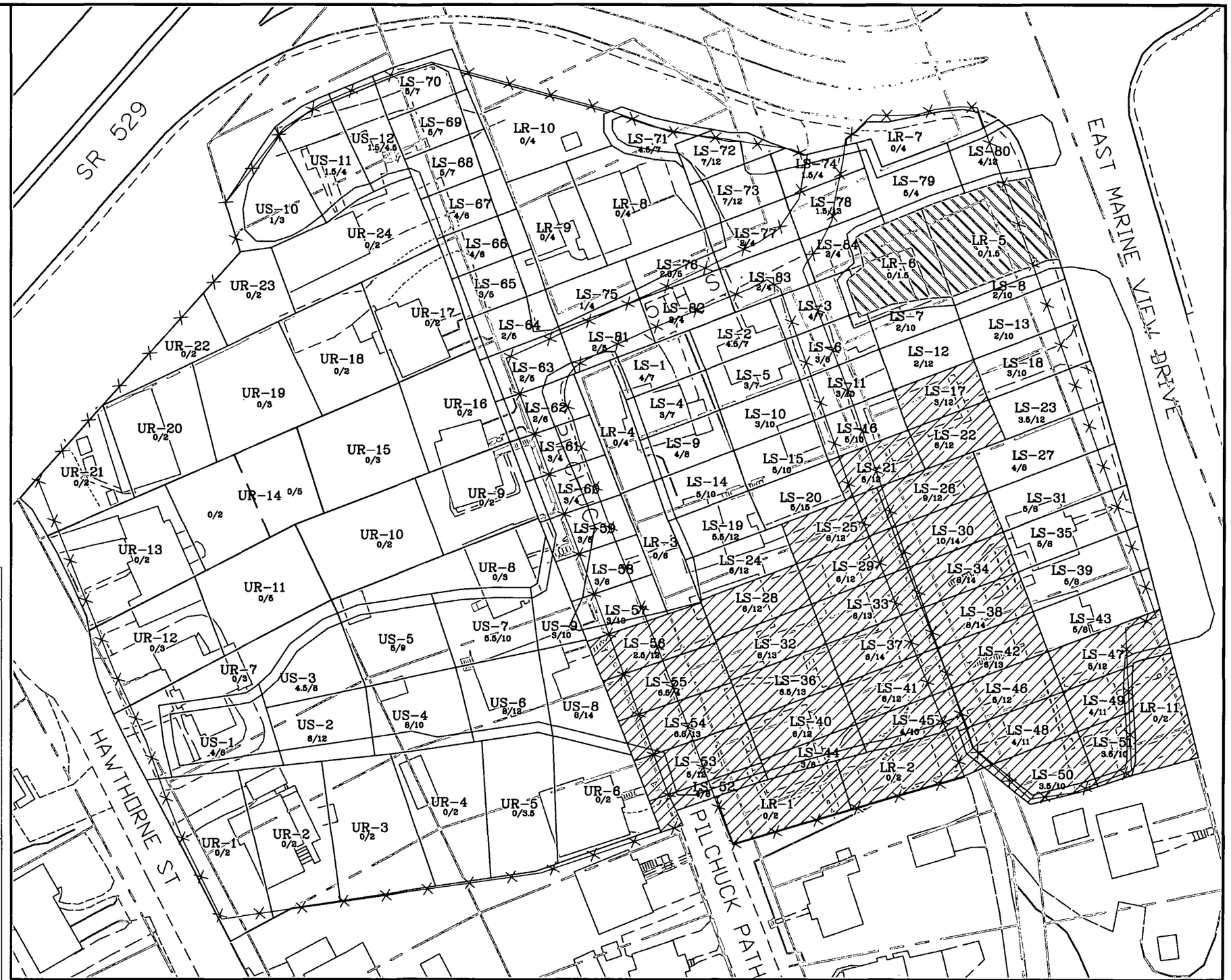
Site	Excavation Sequence	Site	Excavation Sequence
LS-56	1	LS-22	11
LS-55	2	LS-53	12
LS-28	3	LS-36	13
LR-25	4	LS-33	14
LS-21	5	LS-30	15
LS-17	6	LS-52	16
LS-54	7	LS-40	17
LS-32	8	LS-37	18
LS-29	9	LS-34	19
LS-26	10		

Backfill after confirmation at excavation depth, either by cut/fill from areas remediated in (13) or via import; on-site material <150 mg/Kg can be used as fill in US sites with compaction up to 2' below final grade (± 90% standard proctor). Place barrier at 150 mg/Kg As limit or 2 ft. below final ground surface, whichever is deeper.

Step	Description
16.	Continue progression of excavating R material from following areas, in sequence below:

Site	Excavation Sequence	Site	Excavation Sequence
LR-1	1	LS-48	8
LS-44	2	LS-49	9
LR-2	3	LR-11	10
LR-45	4	LS-46	11
LS-41	5	LS-47	12
LS-50	6	LS-42	13
LS-51	7	LS-38	14

Backfill after confirmation at excavation depth, either by cut/fill from areas remediated in (13) or via import; on-site material <150 mg/Kg can be used as fill in US sites with compaction up to 2' below final grade (± 90% standard proctor). Place barrier at 150 mg/Kg As limit or 2 ft. below final ground surface, whichever is deeper.



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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE 3-2-G

NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—x—x—x	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)

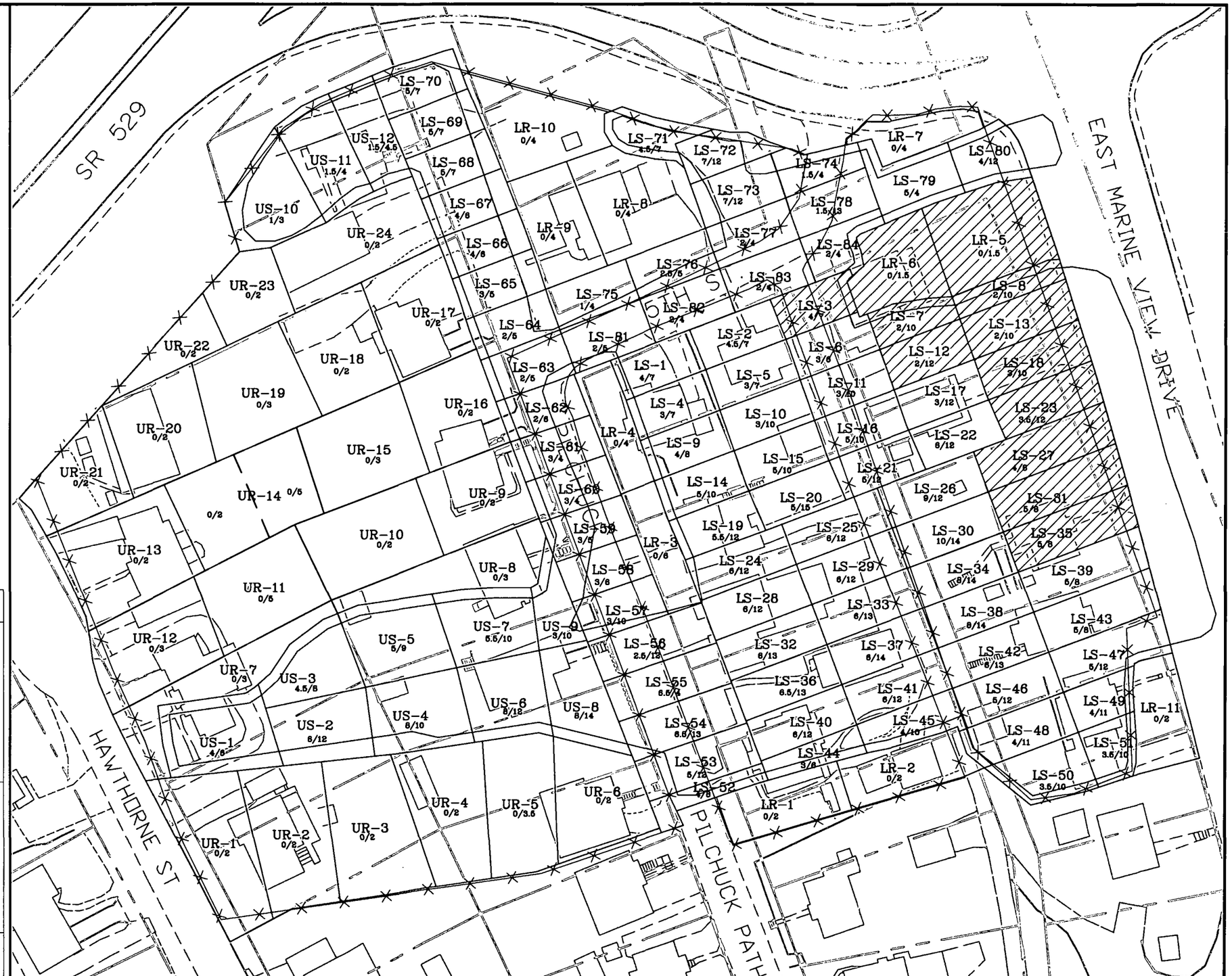
NOTES

1. TABLE REFERS TO HATCHED UNITS

Table 3-2h

Stage 2 – Excavation, Stockpile & Backfill Sequence – Lower Area

Step	Description
17.	Continue excavation of R material from following areas, in sequence below: Site — Excavation Sequence LS-35 — 1 LS-31 — 2 LS-27 — 3 LS-23 — 4 LS-18 — 5 Backfill after confirmation at excavation depth using import material and compact. Place barrier at 150 mg/Kg As limit or 2 ft. below final ground surface, whichever is deeper.
18.	Remove stockpile and excavate R material from the following sites in order, followed by backfill with import per (17) above. Site — Excavation Sequence LR-6 — 1 LR-5 — 2 LS-3 — 3 LS-7 — 4 LS-12 — 5 LS-8 — 6 LS-13 — 7
19.	Demolish shed/foundations in UR 24 and remove R material, confirm excavation depths, place barrier and backfill. Remove detention pond in LS-39 and LS-43 and backfill with clean import. Re-establish necessary utilities and hydroseed; install necessary traffic signage/turnarounds and curb/gutters disrupted by remediation. Secure site and demob.



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FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-2-H

UPDATE TIME: 8am
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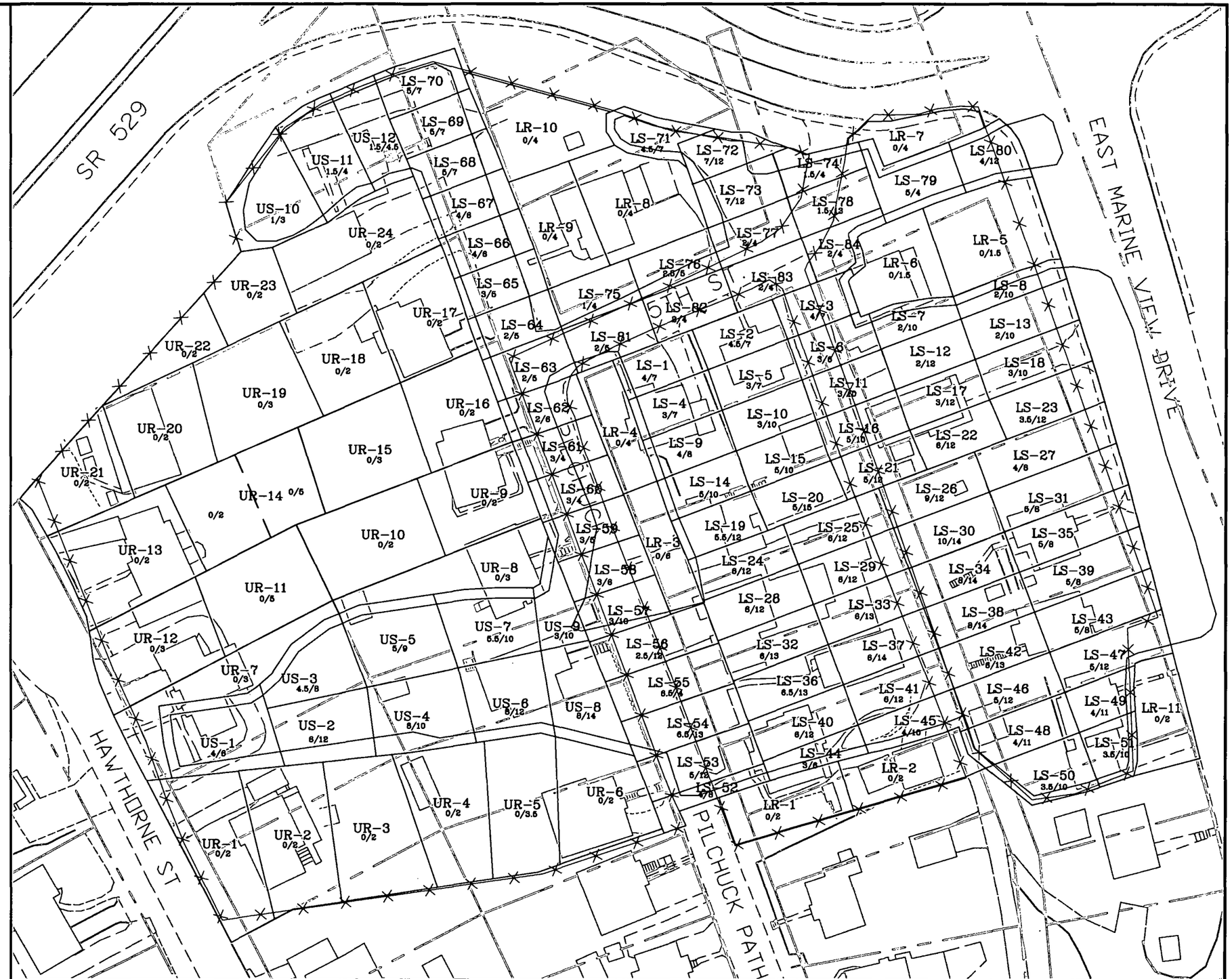
NORTH

SCALE
(In Feet)
0 60

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED SOURCE AREA BOUNDRY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
———	RESIDENTIAL/SOURCE AREA UNIT BOUNDARY
— —	SEGREGATES DIFFERENT CUT DEPTHS WITHIN A UNIT
—×—×—	SECURITY FENCE
0/2	AREA CUT (DEPTH OF 3000+ REMOVAL IN FEET / DEPTH OF 150+ REMOVAL IN FEET)



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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE - EVERETT, WASHINGTON -

FENCED AREA SOURCE AND RESIDENTIAL REMOVAL SITE DESIGNATION

FIGURE
3-3

UPDATE TIME: 8am
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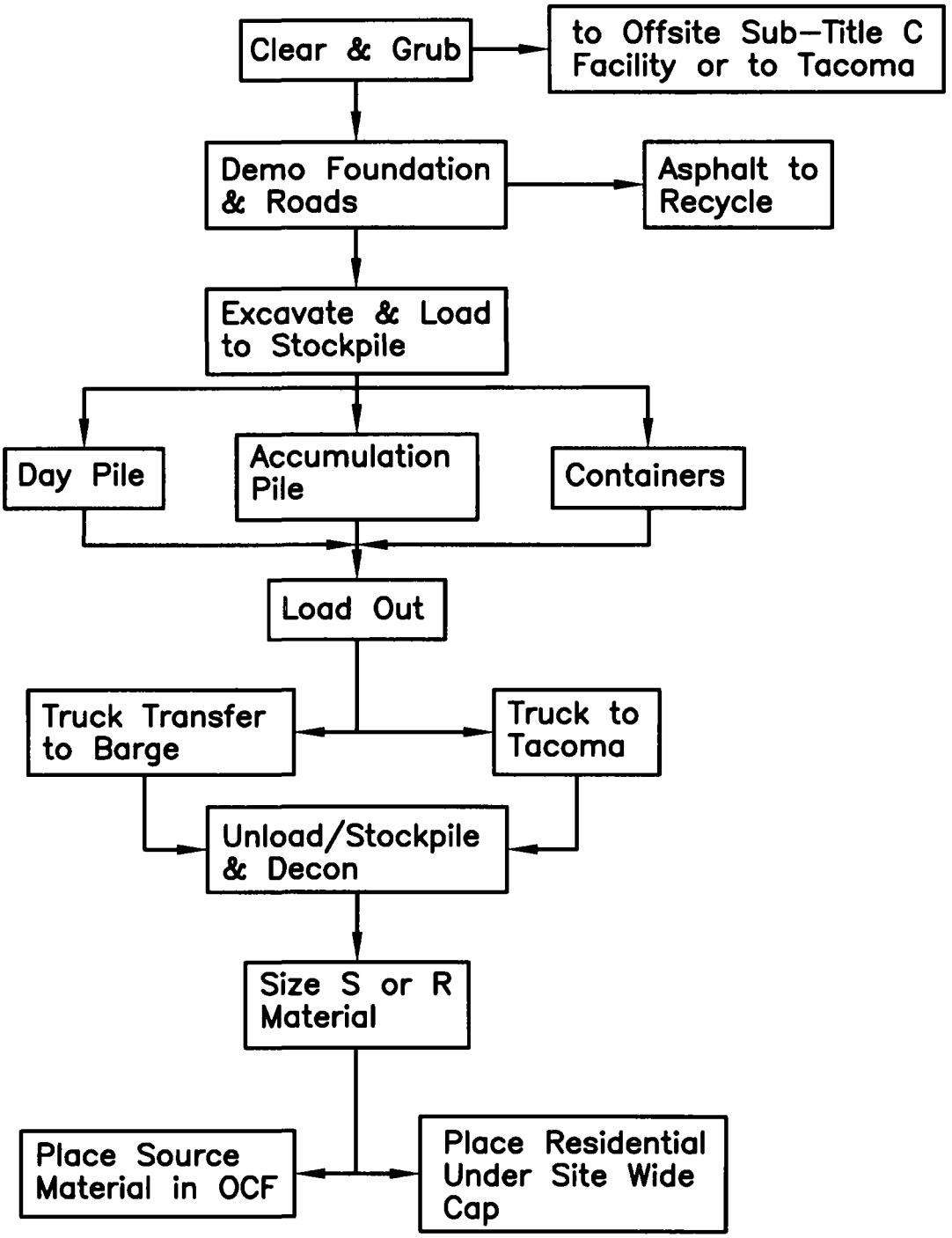
Unit Operation Diagram



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ASARCO INCORPORATED INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE – EVERETT, WASHINGTON –	UNIT OPERATIONS FOR FENCED AREA EVERETT SMELTER	FIGURE 3-4

UPDATE TIME: 8pm
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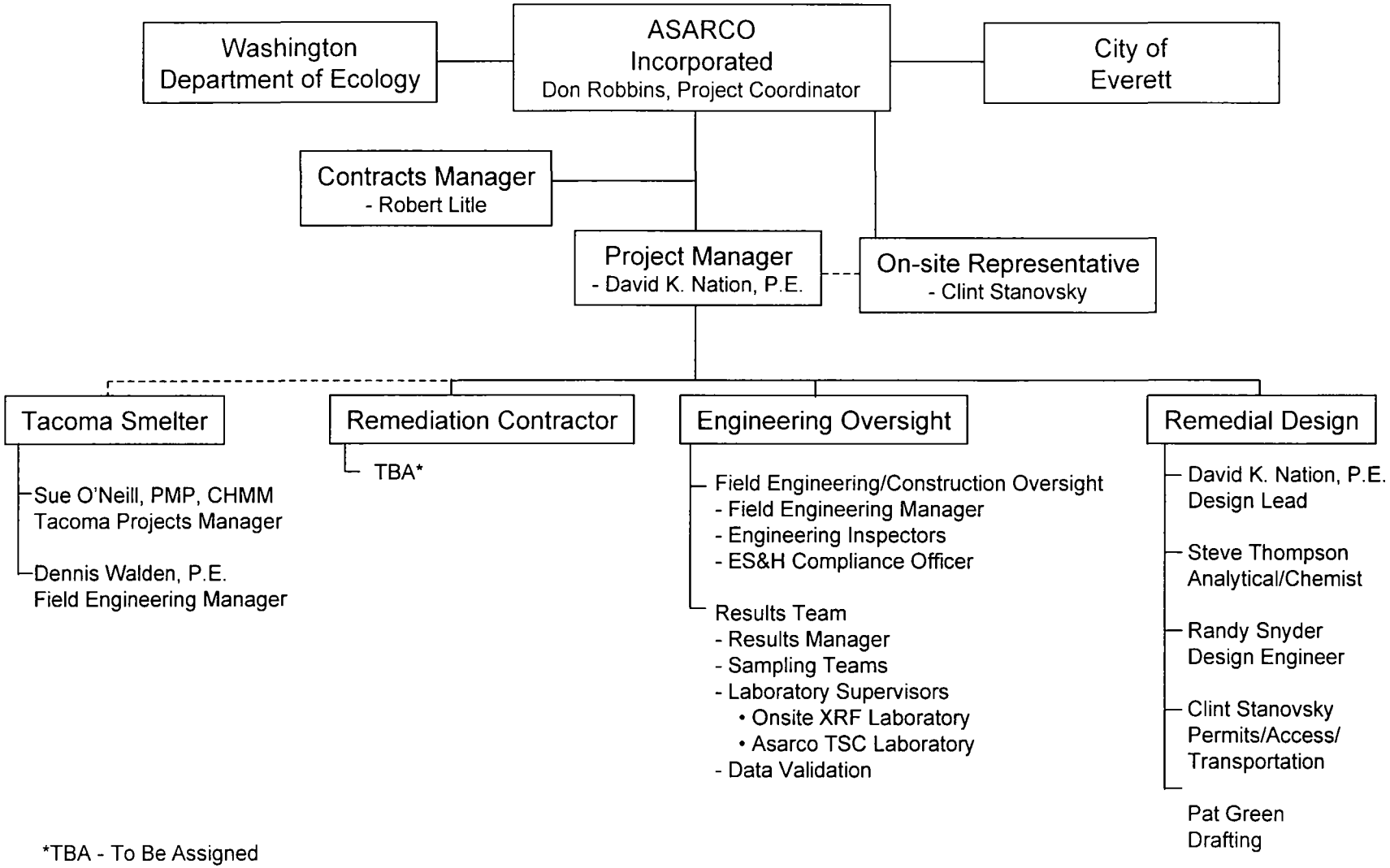
Figure 4-1 Construction Management Organization



*TBA - To Be Assigned

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Appendix A

APPENDIX A

COMPLIANCE MONITORING PLAN

COMPLIANCE MONITORING PLAN

Prepared for:

ASARCO Incorporated

Prepared by:

Asarco Consulting, Inc.
5219 N Shirley St
Suite100
Tacoma, WA 98407

December 2002

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COMPLIANCE MONITORING PLAN

In accordance with WAC 173-340-410, this plan addresses the compliance monitoring requirements. Compliance monitoring is comprised of three types of monitoring:

1. Protection Monitoring
2. Performance Monitoring
3. Confirmational Monitoring

In addition, the FCAP requires the development of a Contingency Plan to address actions to be taken if protection, performance, or confirmational monitoring identifies environmental conditions which are out of compliance.

I. PROTECTION MONITORING

Protection monitoring is conducted to confirm that human health and the environment are adequately protected during implementation of interim actions. As stated in WAC 173-340-410(3) and the FCAP, protection monitoring requirements may be addressed in the Health and Safety Plan. The Health and Safety Plan is included as Appendix B.

II. PERFORMANCE MONITORING

Performance monitoring is conducted to confirm that the interim actions have attained the identified standards including cleanup and remediation levels. As stated in WAC 173-340-410(3), performance monitoring requirements may be addressed in separate plans. The requirements of WAC 173-340-820 and WAC 173-340-830 as referenced in WAC 173-340-410(3) will be addressed in the Sampling and Analysis Plan which generally includes sample collection, processing, and analysis procedures as well as quality assurance and quality control measures. The Sampling and Analysis Plan is included as Appendix C.

Performance monitoring will be conducted for soil in excavation areas and import material at selected residential properties in the peripheral area and the Former Arsenic Trioxide

Processing Area (fenced area). In addition performance monitoring will be conducted for surface water, groundwater, and storm drain sediment near the areas of remediation. The following describes the performance monitoring requirements.

1.0 SOIL

Performance monitoring for soil will consist of comparing the laboratory results to the selected remediation levels identified in the FCAP. The remediation levels are as follows based on the total arsenic concentration:

Depth	Average (mg/Kg)	Maximum (mg/Kg)
0-1 feet	20	40
1-2 feet	60	150
2-15 feet	150	500

The average remediation levels will be compared with the composite sample results. The maximum remediation levels will be compared with the discrete sample results, if analysis of discrete samples is conducted.

Two exceptions have been identified by Ecology in the FCAP. The first is for gardens at residential properties identified by the owners. At these gardens, the remediation levels are an average of 20 mg/Kg and a maximum of 40 mg/Kg for arsenic concentrations to a depth of 18 inches rather than 12 inches. The second exception is for maintenance areas not normally occupied. At these areas, the remediation level is an average of 200 mg/Kg for arsenic concentrations.

1.1 PERIPHERAL AREA

1.1.1 Sample Collection Strategy

Selected residential properties within the historically owned Asarco property boundary may be remediated in this interim action (see Figure A-1-1). Note that the individual property boundaries depicted on Figure A-1-1 are estimated. Prior to work commencing, Asarco will

confirm actual boundaries by working with the County Assessor's Office regarding property ownership.

Should the properties adjacent to the fenced area be remediated, the cleanup will be performed per the requirements of the FCAP. In accordance with the FCAP, sampling criteria will follow the requirements listed for Zone B. The FCAP specifies five sampling locations (bore holes) per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional borings are advanced. To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. The sampling frequency for Zone B properties are shown below in Table A-1-1:

TABLE A-1-1 SAMPLE FREQUENCY FOR ZONE B

Decision Unit Size (ft^2)	No. of Bore Holes per Decision Unit
<1,125	5
1,125-1,800	Add 1 per 225 ft^2
1,800-4,000	8
4,000-6,000	Add 1 per 500 ft^2

Sample locations will be distributed evenly to the extent practicable. Samples will be collected at 6-inch intervals. The discrete samples collected from each decision unit will have a portion composited by depth interval. Rather than collecting and analyzing samples from the top 24 inches (4 depth intervals), at least two feet of soil will be removed at all the selected properties prior to sample collection and analyses. Therefore, once soil is removed to a depth of 2 feet, two depth intervals (24-30 and 30-36 inch) will be collected and analyzed for each decision unit to determine if additional excavation is required. The samples will be analyzed within 24 hours during the work week (Monday through Friday). Based on the results, additional sampling will be performed if soil removal is required to a depth of 36 inches or more. This sampling approach will not cause the excavation area to remain open

any longer than if all sampling was conducted prior to soil removal. Typically, remediation at a residential yard can be expected to take about two weeks. Table A-1-2 summarizes the estimated sample collection information for the selected residential properties.

Each discrete sample will be archived for possible analysis in case laboratory results for composite samples indicate an arsenic concentration greater than the equation provided in the FCAP. The equation is:

$$As_{comp} > \frac{[RL_{max} + (7\ mg/Kg)(n-1)]}{n}$$

As_{comp} is the arsenic concentration in the composite sample; n is the number of discrete samples which originally were collected and composited for the decision unit; RL_{max} is the maximum arsenic concentration remediation level for the given depth interval; and 7 mg/Kg is an assumed arsenic concentration for n-1 out of the n samples collected.

Gardens identified by the owner will be segregated from the yard and considered unique decision units. Generally, gardens will have two sample locations. In addition, flower beds or landscape areas will be sampled separately in an attempt to avoid soil removal if requested by the owner.

Maintenance areas not normally occupied will be sampled in a different manner. At these areas, four discrete surface samples will be collected from 0-2 inches and composited. Only the composite sample will be compared to the average remediation level to determine if remedial actions are required.

1.1.2 Sample Numbering System.

The sample designation for discrete samples will contain the assigned property number (see Figure A-1-1), decision unit number, type of sample (DRT for discrete), bore hole number, and depth interval (A=0-6", B=6-12", C=12-18", D=18-24", E=24-30", and F=30-36"). For example, a sample collected from the front yard decision unit (No.1) from the second bore

hole from the depth interval 24-30 inches will be "IA01-DU1-DRT-B2-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. It is noted that a sufficient amount of sample may not exist from discrete samples for field duplicates or splits once a portion has been removed for the composite sample. If a garden or landscape area is sampled, a "G" or "LS" respectively will be used instead of the decision unit number.

The sample designation for composite samples will contain the assigned property number, decision unit number, type of sample (CMP for composite), and depth interval. For example, a sample composited from the 24-30 inch interval in the back yard decision unit (No.2) will be "IA01-DU2-CMP-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. If a garden, landscape area, or maintenance area not normally occupied is sampled, a "G", "LS", or "MA" respectively will be used instead of the decision unit number.

1.1.3 Property Access and Sample Data Sharing

Property access will be required for residential properties not currently owned by Asarco. Property owners will be identified and asked to sign an access agreement with Asarco. In the event Asarco is unable to obtain access under reasonable terms and conditions, Ecology will be asked to assist in obtaining access.

Once access is granted, an "Existing Configuration" figure for the property will be prepared that includes proposed decision units with their area size in square feet. An Asarco representative will then visit with the owner to prepare a "Proposed Configuration" figure for the property. Asarco will make every attempt to accommodate reasonable changes requested by the owner. At that time, the owner will authorize a "Sign Up" form to begin the work. A copy of the "Existing Configuration" figure, the "Proposed Configuration" figure, and the "Sign Up" authorization will be given to the owner, Ecology, and the contractor prior to initiating soil removal and replacement.

Upon receipt of passing laboratory results, a "Performance Monitoring" figure (see Figure A-1-2) will be prepared to depict the sample locations and data for each decision unit within a property. Upon completion of backfilling activities including sodding, etc., an Asarco representative will again meet with the owner have them sign off on the authorization form stating that the work has been completed as proposed.

At the end of the project, Asarco will submit a copy of the "Existing Configuration" figure, the "Proposed Configuration" figure, the performance monitoring data summary table, the "Performance Monitoring" figure, and the "Sign Up/Sign Off" authorization to each owner and Ecology.

1.2 FENCED AREA

Performance monitoring at the fenced area may not be conducted as specified in the FCAP due to the potential full scope of the interim action. The full scope of the interim action would allow the area to be redeveloped into residential lots by removing all soil containing arsenic concentrations exceeding 150 mg/Kg rather than constructing a consolidation facility. Therefore, a different sampling strategy is required to address all the remediation levels to a depth of 15 feet. A contingency plan is discussed in Section IV should the full potential scope of the interim action not be pursued which includes sample collection as detailed in the FCAP following the removal of material containing arsenic concentrations exceeding 3,000 mg/Kg.

If the full potential scope of the interim action is pursued, three phases of performance monitoring will be conducted. The first phase will consist of sample collection after the soil containing arsenic concentrations above 3,000 mg/Kg have been removed. The second phase will be conducted after the soil containing arsenic concentrations above 150 mg/Kg have been removed. The third phase will be conducted after the final "cut and fill" is completed but before clean import material is placed.

1.2.1 Phase 1 Sample Collection Strategy

Soil samples will be collected from the floor (0-6 inch interval) and the outer perimeter of the excavation grids (i.e., decision units) as shown on Figure A-1-3. These units are the same as the excavation sub-areas described in Section 3 of the Interim Action Report.

Floor samples will be collected from each identified decision unit in accordance with the sample frequency identified in the FCAP. The FCAP specifies five sampling locations per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional borings are advanced.

To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. Floor sample locations will be distributed evenly to the extent practicable. In accordance with the FCAP, sampling criteria for floor samples will follow the requirements listed for Zone A. The sampling approach for Zone A properties are shown below in Table A-1-3:

TABLE A-1-3 SAMPLE FREQUENCY FOR ZONE A

Decision Unit Size (ft^2)	No. of Sampling Locations per Decision Unit
<1,125	5
1,125-2,250	Add 1 per 225 ft^2
2,250-4,000	10
4,000-6,000	Add 1 per 400 ft^2

Perimeter samples were not addressed in the FCAP. However, Asarco will collect perimeter samples from decision units that represent the outer side slope of the excavation (see Figure A-1-3). These samples will be collected at two foot depth intervals beginning with the surface to the excavation base at four locations along the decision unit's boundary that forms

the perimeter of the excavation, which will usually be a continuation of the excavation boundary with adjacent units. Samples will be collected directly from the excavation cut. Only composite samples will be collected and analyzed during Phase 1 sampling. For perimeter samples, samples will be composited by depth interval. Discrete samples will not be collected during this phase of soil sampling because a maximum remediation level has not been defined. Therefore, if a composite sample indicates an arsenic concentration greater than 3,000 mg/Kg, the decision unit will be re-excavated as determined by the Field Engineer (see Section 3 of the Interim Action Report). Table A-1-4 summarizes the estimated sample collection for Phase 1 sampling. The perimeter sample counts in the table are based on an estimated average excavation depth. It is noted that depths sampled will be dependent on the actual depth of the excavation.

1.2.2 Phase 1 Sample Numbering System

To remain consistent with the engineering design, the fenced area is divided into two source area excavation zones developed for soil removal. The two source zones will represent the upper and lower areas. The upper area decision units will be designated as "US" (Upper Source) while the lower area will be "LS" (Lower Source).

The sample designation for floor samples will contain the project location (IAFA for interim action in the fenced area), sampling phase, sample area (F for floor), decision unit, and round of soil removal. The round of soil removal will assist in identifying re-excavations. For example, the first floor sample collected from decision unit US1 will be "IAFA-P1-F-US1-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

The sample designation for perimeter samples will contain the project location (IAFA for interim action in the fenced area), sampling phase, sample area (P for perimeter), decision unit, depth (A=surface, B=2', C=4', etc.), and round of soil removal. For example, the perimeter surface sample collected from decision unit US1 will be "IAFA-P1-P-US1-A-1".

Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

1.2.3 Phase 2 Sample Collection Strategy

Soil samples will be collected from the decision unit's floor (0-6 inch interval) as shown on Figure A-1-4. In addition, where appropriate, samples will be collected from the outer perimeter of the side slope directly from the excavation cut.

Floor samples will be collected from each identified decision unit in accordance with the sample frequency identified in the FCAP. The FCAP specifies five sampling locations per 1,125 square foot decision unit. However, the FCAP also allows a decision unit to be larger in size provided additional sample locations are collected.

To remain consistent with Ecology's original field sampling plan, no decision unit may exceed 6,000 square feet. Floor sample locations will be distributed evenly to the extent practicable. In accordance with the FCAP, sampling criteria for floor samples will follow the requirements listed for Zone A (see Table A-1-3).

Perimeter samples were not addressed in the FCAP. However, Asarco will collect perimeter samples from decision units that represent the outer side slope of the excavation cut (see Figure A-1-4). Samples will be collected at two foot depth intervals beginning with the surface to the excavation base at four locations along the decision unit's boundary that is in common with an adjacent unit.

Discrete samples that are collected from each decision unit will have a portion composited. For perimeter samples, samples will be composited by depth interval. Each discrete sample will be archived for possible laboratory analysis in case laboratory results for composite samples indicate an arsenic concentration greater than the equation provided in the FCAP (see Section 1.1.1 above). Table A-1-5 summarizes the estimated sample collection. .The

perimeter sample counts in the table are based on an estimated average excavation depth. It is noted that depths sampled will be dependent on the actual depth of the excavation.

1.2.4 Phase 2 Sample Numbering System

To remain consistent with the engineering design, the fenced area is divided into two source and two residential area excavation zones developed for soil removal. The four zones will represent the type of material in the upper and lower areas. The upper area decision units will be designated as "US" (Upper Source) and "UR" (Upper Residential) while the lower area will be "LS" (Lower Source) and "LR (Lower Residential).

The sample designation for floor samples will contain the project location (IAFA for interim action in the fenced area), sampling phase, sample area (F for floor), decision unit, sample type (DRT for discrete and CMP for composite), and round of soil removal. For example, the first floor composite sample collected from decision unit US1 will be "IAFA-P2-F-US1-CMP-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. Discrete samples will also have the sample location identified after the sample type. For example, the same sample collected from the first location will be "IAFA-P2-F-US1-DRT-L1-1".

The sample designation for perimeter samples will contain the project location (IAFA for interim action in the fenced area), sampling phase, sample area (P for perimeter), decision unit, sample type (DRT for discrete and CMP for composite), depth (A=surface, B=2', C=4', etc.), and round of soil removal. For example, the perimeter surface composite sample collected at decision unit US1 will be "IAFA-P2-P-US1-CMP-A-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification. Discrete samples will also have the sample location identified after the sample type. For example, the same sample collected from the first location will be "IAFA-P2-F-US1-DRT-L1-1".

1.2.5 Phase 3 Sample Collection Strategy

A final round of sampling, Phase 3, will be performed at the upper and lower areas once the final "cut and fill" has been completed. This sampling will however, be performed prior to backfilling clean import material. Although this sampling approach is not specified in the FCAP, Asarco and Ecology agreed to a sampling strategy that would provide data on arsenic concentrations up to a depth of four feet below the final grade. This information will be used in the preparation of deed restrictions. Because at least two feet of clean material will be placed after the final "cut and fill", the Phase 3 sampling will require sample collection to a depth of two feet (two feet of clean material and two feet of existing soil equals a minimum of four feet below the final grade).

A grid system will be used that establishes approximately 2,500 square foot decision units (see Figure A-1-5). A single bore hole will be advanced in each decision unit. A discrete sample will be collected at six inch depth intervals to a depth of two feet. Because two feet of clean material will be brought in, these samples will represent the soil that will be two feet to four feet below the final grade. Therefore, the four depth intervals will be identified as 24-30, 30-36, 36-42, and 42-48 inches. Table A-1-6 summarizes the estimated sample collection for Phase 3.

1.2.6 Phase 3 Sample Numbering System

The sample designation will contain the project location (IAFA for interim action in the fenced area), sampling phase, decision unit, and depth (E=24-30", F=30-36", G=36-42", and H=42-48"). For example, the first sample collected from decision unit A1 will be "IAFA-P3-A1-E". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

2.0 IMPORT MATERIAL

2.1 BACKFILL (SUBSOIL)

The FCAP specifies that imported backfill (subsoil) must be sampled for priority pollutant metals including: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury,

nickel, selenium, silver, thallium, and zinc. In addition to the chemical analyses, two samples of backfill will be tested for pH and particle size. One sample will be tested prior to work commencing and the second sample will be tested when the project is about 50 percent complete for the construction season. The backfill must be sandy, freely draining material that meets the engineering specifications identified in the Interim Action Report. The pH must be in the range of 5.5 and less than 7.5.

2.1.1 Sample Collection Strategy

In accordance with the FCAP, samples for chemical analyses will be collected and analyzed at the rate of one sample per 1,000 cubic yards. Each sample will be a "4 X 1" composite of a stockpile at the supplier's location. Table A-2-1 summarizes the sample collection for import material.

2.1.2 Sample Numbering System

The sample designation for backfill samples will contain the project identification and soil type (IA for interim action and BF or backfill) and numerical order of sample collection. For example, the first sample collected will be "IABF-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

2.2 TOPSOIL

The FCAP specifies that imported topsoil must be sampled for priority pollutant metals including: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. In addition, topsoil must be analyzed for PCBs, organochlorine pesticides, semivolatile organic compounds, volatile organic compounds, and cyanide.

Two samples of topsoil will also be tested for pH, particle size, and fertility. One sample will be tested prior to work commencing and the second sample will be tested when the project is about 50 percent complete for the construction season.

The topsoil must be designated as a sandy loam based on the USDA standards. It should also comply with the criteria shown in Table A-2-2. This criteria is Asarco's preferred specifications and Asarco reserves the right to accept or refuse any topsoil not meeting these criteria. Asarco may allow amending the soil at the supplier's location per the direction and advise of a soil specialist based on the test results.

2.2.1 Sample Collection Strategy

In accordance with the FCAP, samples for chemical analyses will be collected and analyzed at the rate of one sample per 1,000 cubic yards. Each sample will be a "4 X 1" composite of a stockpile at the supplier's location. Table A-2-1 summarizes the sample collection for import material.

2.2.2 Sample Numbering System

The sample designation for topsoil samples will contain the project identification and soil type (IA for interim action and TP or backfill) and numerical order of sample collection. For example, the first sample collected will be "IATS-1". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

3.0 SURFACE WATER

The FCAP requires surface water flowing to the wet locations in the lowland (i.e., east of East Marine View Drive) and to the City of Everett's storm water system be sampled at appropriate locations. Samples from locations within and adjacent to the fenced area will not actually be surface water because there are no surface water features in the interim action area other than seeps during prolonged precipitation events in the winter. Therefore, samples will be storm water runoff (samples collected in catch basins) and storm water runoff combined with the sanitary sewer base flow (samples collected in manholes). Samples will be collected from the manholes because previous investigations concluded that these samples contained the highest concentrations of arsenic due to infiltration.

3.1 SAMPLE COLLECTION STRATEGY

Previous investigations concluded that there is no direct storm water runoff from the upland to the lowland. The storm water leaving the interim action area enters a series of catch basins that are connected to the City of Everett's combined sewer/storm water system. It is noted however, that several catch basins on the SR-529 interchange and the portion of East Marine View Drive north of the overpass discharge to the lowland through an outfall. Based on the vicinity of the interim action area, only locations associated with the City's system will be monitored. Selected sample locations are depicted in Figure A-3-1. Table A-3-1 summarizes the sample collection.

The selected locations accommodate the storm water runoff patterns as well as the base flow of the sanitary sewer which is to the east and eventually to the south in East Marine View

Drive to the City's wastewater treatment facility. A grab sample will be collected from each location during a significant precipitation event semi-annually (twice per year) for the first five years. At the end of five years, Asarco and Ecology will review the data to determine future sampling frequency requirements, if any.

Samples will be analyzed for arsenic, lead, cadmium, antimony, mercury, and thallium. The following are the applicable surface water cleanup levels identified in the FCAP for surface water which enters the City of Everett's storm water sewer system:

- Arsenic: 500 ug/L
- Lead: 1890 ug/L
- Cadmium: 240 ug/L
- Antimony: no level
- Mercury: 100 ug/L
- Thallium: no level

3.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and SW for surface water), the sample location, and date (month and year). For example, a storm water sample collected on December 18, 2003 from catch basin number 1 will be "IASW-CB1-1203". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

4.0 GROUNDWATER

The FCAP states that the groundwater is not present in sufficient quantity to serve as a drinking water supply and that the City of Everett has no plans to use groundwater at the interim action area in the future. The FCAP also established cleanup levels which consist of

acute and chronic levels largely based on 1 hour and 4 day averages respectively. It is noted that laboratory results for the groundwater samples will not be averages.

Previous investigations have confirmed that the groundwater has been impacted. It is believed that this interim action will remove the source of contamination in the area being remediated, particularly from the fenced area. However, the improvement to groundwater quality may take several years to establish trends that confirm decreasing arsenic concentrations. Therefore, groundwater data exceeding cleanup levels will not trigger additional remedial actions in these areas until sufficient data have been collected to assess the effectiveness of the interim action.

4.1 SAMPLE COLLECTION STRATEGY

The FCAP specified monitoring well locations near the fenced area based on the area housing a consolidation facility. Because a consolidation facility will not be constructed, available monitoring wells located in the previously identified arsenic plumes will be monitored. Groundwater samples will be collected from the monitoring wells shown on Figure A-4-1. These locations represent the downgradient flow and the historically highest detected arsenic concentrations for the shallow and deep groundwater systems. It is noted that some or all of the wells located on the west side of East Marine View Drive may have to be abandoned during soil removal. Abandoned wells, if any, may be replaced after consultation with and/or as directed by Ecology in order to establish an effective monitoring well network.

The monitoring wells will be sampled semi-annually (twice per year) in March and September for the first five years. At the end of five years, Asarco and Ecology will review the data to determine future sampling frequency requirements, if any.

Groundwater samples will be analyzed for total and dissolved arsenic, lead, cadmium, antimony, mercury, and thallium. Table A-4-1 summarizes the anticipated samples to be collected.

4.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and GW for groundwater), the monitoring well identification, filtered (F) or unfiltered (UF) sample, and date (month and year). For example, a groundwater sample collected on December 18, 2003 from monitoring well EV13 for dissolved metals will be "IAGW-EV13-F-1203". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

5.0 STORM DRAIN SEDIMENT

The FCAP specifies the cleanup levels for storm drain sediment as follows:

- Arsenic: 20 mg/Kg
- Lead: 250 mg/Kg
- Cadmium: 2 mg/Kg
- Antimony: 32 mg/Kg
- Mercury: 1 mg/Kg
- Thallium: 5.6 mg/Kg

Currently, Asarco inspects numerous catch basins near the interim action area for sediment accumulation. If needed, Asarco removes the sediment and manages it as problem waste through the Community Protection Measures program. It is noted that Asarco's current agreement to inspect and clean out catch basins will end once the performance monitoring has demonstrated catch basin sediment does not contain the above constituents in excess of the give cleanup levels.

5.1 SAMPLE COLLECTION STRATEGY

Storm drain sediment will be sampled from all catch basins within and directly adjacent to the interim action area (see Figure A-5-1) following completion of the final construction season. This includes Stage 2 of the fenced area and the adjacent residential properties. Table A-5-1 summarizes the sample collection.

The streets will be swept prior to sample collection. If laboratory results indicate an exceedance of a cleanup level, Asarco will request that the City of Everett vacuum the catch basins and lines and deposit the material at an area to be selected. Asarco will subsequently transport this material to the Tacoma Smelter Site or to another facility for appropriate disposal.

5.2 SAMPLE NUMBERING SYSTEM

The sample designation will contain the project identification and task (IA for interim action and SD for sediment), the sample location, and date (month and year). For example, a storm drain sediment sample collected on December 18, 2003 from catch basin number 1 will be "IASD-CB1-1203". Field duplicates will have a "D" added to the end of the sample identification and splits, if any, will have an "S" added to the end of the sample identification.

III. CONFIRMATIONAL MONITORING

Confirmational monitoring is performed to confirm the long-term effectiveness of the interim actions once cleanup and/or remediation levels have been attained for soil, groundwater, surface water, and storm drain sediment. The FCAP referred to WAC 173-340-420 for specific requirements. WAC 173-340-420 requires Ecology to review the cleanup action no less frequently than every five years at sites with hazardous substances remaining above cleanup levels. Two arsenic remediation levels greater than the cleanup level of 20 mg/Kg (60 and 150 mg/Kg) have been selected for soils at depth. Because these remediation levels exceed the cleanup level, confirmation monitoring will be required.

1.0 SOIL

1.1 PERIPHERAL AREA

If performance monitoring indicates that any of the selected residential properties will have arsenic concentrations above 20 mg/Kg remaining at depths below two feet, three residential properties will be selected for sampling and analysis only of soils in the 0-6 and 6-12 inch

depth intervals, not to 36 inches described in the FCAP. These properties will be sampled again in five years following the completion of all soil removal and replacement activities. The properties to be selected will be approved by Ecology and must be given access by owners. The same number of sample locations will be selected as during the performance monitoring. The same designation will however change slightly. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify that it is the first confirmation monitoring sample.

Soil samples will be obtained through the advancement of bore holes with a drill rig. Samples will be collected at 6 inch intervals to a depth of 36 inches or to the maximum depth soil was removed. Laboratory analyses will be conducted in the same manner as with performance monitoring. The bore holes will be abandoned by filling with bentonite pellets or chips to a depth of 1 foot. The top foot will be filled with purchased potting or topsoil and have the root grass turf cap replaced that was removed prior to advancing the bore hole.

1.2 FENCED AREA

It is believed that most of the established decision units will have concentrations above 20 mg/Kg remaining at depths below two feet. However, this area will subsequently be redeveloped and therefore, future sampling points cannot be selected at this time. It is unknown where buildings, streets, etc. will be constructed.

Sampling points will be determined once the redevelopment has been completed (no sooner than five years from the completion of soil removal and replacement). An attempt to re-establish and sample one of the decision units will be made. Soil samples will be obtained through the advancement of bore holes with a drill rig. Samples will be collected at 6 inch intervals to the maximum depth soil was removed. The same designation will however change slightly. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify it's the first confirmation monitoring sample.

Laboratory analyses will be conducted in the same manner as with performance monitoring. The bore holes will be abandoned by filling with bentonite pellets or chips to a depth of 1

foot. The top foot will be filled with purchased potting or topsoil and have the root grass turf cap replaced that was removed prior to advancing the bore hole.

2.0 GROUNDWATER

Groundwater quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, no additional actions will be conducted for confirmational monitoring.

3.0 SURFACE WATER

Surface water quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, no additional actions will be conducted for confirmational monitoring.

4.0 STORM DRAIN SEDIMENT

The same locations as identified in performance monitoring will be sampled five years from the completion of soil removal and replacement provided that they still exist. Laboratory analyses will be conducted in the same manner as with performance monitoring as well. Rather than "IA" for interim action at the beginning, "CM1" will be inserted to identify it's the first confirmation monitoring sample.

IV. CONTINGENCY PLAN

1.0 PROTECTION MONITORING

Contingency actions for protection monitoring are identified in the Health and Safety Plan (see Appendix B).

2.0 PERFORMANCE MONITORING

2.1 SOIL

2.1.1 Peripheral Area

Samples will be collected at six-inch intervals below the initial 24 inch excavation depth (i.e., 24 - 30 inches and 30 - 36 inches). If the evaluation of laboratory results (composite and/or discrete, if applicable) indicate an exceedance of the remediation level at either of these depth intervals, an additional 6 or 12 inches of soil will be removed as needed for the respective decision unit. If the evaluation of laboratory results (composite and discrete, if applicable) indicates an exceedance of the remediation level at the next depth interval (36 to 42 inches), an additional 12 inches of soil will be removed for the respective decision unit. Upon removal of this soil, samples from the next depth interval (48 – 54 inches) at the same locations will be collected and analyzed. This strategy will be followed until results indicate average arsenic concentrations are less than 150 mg/Kg and maximum arsenic concentrations, if analyzed, are less than 500 mg/Kg.

2.1.2 Fenced Area

If the evaluation of Phase 1 laboratory results for floor or perimeter samples indicate an exceedance of 3,000 mg/Kg, additional soil will be removed. The lateral and vertical extent of the re-excavation will be determined by the Field Engineer based on site conditions (see Section 3 of the Interim Action Report). Upon removal of the soil, samples will be collected following the same procedures outlined in performance monitoring. This strategy will be followed until results indicate arsenic concentrations are less than 3,000 mg/Kg. It is noted that a physical feature such as a street may prevent a lateral re-excavation.

If the evaluation of Phase 2 laboratory results (composite and/or discrete, if applicable) for floor or perimeter samples indicate an exceedance of the remediation level, additional soil will be removed. The lateral and vertical extent of the re-excavation will be determined by the Field Engineer based on site conditions. Upon removal of the soil, samples will be collected following the same procedures outlined in performance monitoring. This strategy will be followed until results indicate average arsenic concentrations are less than 150 mg/Kg and maximum arsenic concentrations, if analyzed, are less than 500 mg/Kg up to a depth of 15 feet below final grade. It is noted that a physical feature such as a street may prevent a lateral re-excavation.

If the evaluation of Phase 3 laboratory results indicate an exceedance of the remediation level, additional soil will be removed before clean import material is brought in and backfilled. Re-excavation will be performed to the depth identified by the laboratory results. Upon removal of the soil, samples will be collected again following the same procedures outlined in performance monitoring to confirm remediation levels have been met.

An additional contingency will be administered if only the material with arsenic concentrations greater than 3,000 mg/Kg is removed and the soil with arsenic concentrations between 150 and 3,000 mg/Kg remain. As specified in the FCAP, borings will be advanced to a depth of three feet beneath the limit of excavation at a frequency of one per 400 square feet once the material believed to contain 3,000 mg/Kg is removed. Samples will be collected in six-inch intervals. No single sample may exceed 3,000 mg/Kg arsenic. In case of an exceedance, the excavation will be deepened within the area outlined by a line connecting surrounding locations for which all samples are less than 3,000 mg/Kg arsenic. After excavation, six additional borings will be advanced to a depth of three feet beneath the new limit of excavation, re-sampled, and re-analyzed. In addition, the upper 95% confidence limit will be calculated for each group of six adjacent borings. If the upper 95% confidence limit exceeds 3,000 mg/Kg, the entire area outlined by adjacent clean locations will be excavated. After excavation, six additional borings will be advanced to a depth of three feet beneath the new limit of excavation, re-sampled, and re-analyzed.

2.2 IMPORT MATERIAL

If laboratory results indicate that backfill or topsoil contain chemical concentrations that exceed the criteria, the stockpile will be rejected and the supplier will be asked to investigate the potential source. Once a new stockpile of at least 1,000 cubic yards is available, it will be sampled following the strategy outlined in performance monitoring.

It will be at Asarco's discretion whether to accept or reject material that does not meet the other criteria such as fertility, grain size, etc.

2.3 SURFACE WATER

Surface water quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, a contingency plan has not been developed. However, following the five-year periodic review, additional actions may be taken if warranted. If only the material exceeding 3,000 mg/Kg arsenic is removed, additional actions may be required sooner than the five-year review period if groundwater monitoring data indicates such action is necessary.

2.4 GROUNDWATER

Groundwater quality will be evaluated on a long-term basis (semi-annually for five years) as described in performance monitoring. Therefore, a contingency plan has not been developed. However, following the five-year periodic review, additional actions may be taken if warranted. If only the material exceeding 3,000 mg/Kg arsenic is removed, additional actions may be required sooner than the five-year review period if groundwater monitoring data indicates such action is necessary.

2.5 STORM DRAIN SEDIMENT

If laboratory results indicate that storm drain sediment exceeds the identified levels, the material will be managed as described in performance monitoring. In addition, samples will be collected several months later following the same procedures outlined in performance monitoring. If these results exceed the identified criteria, an investigation will be performed to determine the potential source(s). The investigation may include but not limited to the identification of upgradient sources not associated with the interim action and the sanding material, if any, used by the City of Everett during the winter months. Based on the findings, appropriate action such as testing the sanding material may be taken. If additional action is taken, the material will be removed and disposed of properly and another round of sample collection will be performed during a significant precipitation event the following fall. These samples will be collected following the same procedures outlined in performance monitoring.

3.0 CONFIRMATIONAL MONITORING

A contingency plan has not been developed for confirmational monitoring at this time. A plan will be developed before confirmational monitoring is performed (five years after the soil removal and replacement in the interim action area is complete).

TABLES

TABLE A-1-2. RESIDENTIAL PROPERTY SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Bore Holes	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Yard	68	544	24-30" 30-36"	68 68	544 544	61	25
Garden	34	68	24-30" 30-36"	34 34	68 68	10	4
Landscape Area	34	68	24-30" 30-36"	34 34	68 68	10	4
Maintenance Areas	17	-	surface	17	-	1	1
				Total: 289	Total: 1360	Total: 82	Total: 34

TABLE A-1-4. FENCED AREA - PHASE 1 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Sample Locations	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Floor	96	960	surface of excavation	96	-	5	2
Perimeter	67 (93 sides)	372	average across site: surface 2' 4' 6' 8'	 93 93 93 93 93	-	24	10
				Total: 561	Total: 0	Total: 29	Total: 12

TABLE A-1-5. FENCED AREA - PHASE 2 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Estimated No. Sample Locations	Depth Interval	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Floor	131	1310	surface of excavation	131	1310	72	29
Perimeter	39	156	average across site:			59	24
			surface	39	156		
			2'	39	156		
			4'	39	156		
			6'	39	156		
			8'	39	156		
			10'	39	156		
				Total: 365	Total: 2246	Total: 131	Total: 53

TABLE A-1-6. FENCED AREA - PHASE 3 SOIL COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Estimated No. Decision Units	Depth Interval (from final grade)	Estimated No. Composite Samples for As	Estimated No. Discrete Samples for As	Estimated No. Field Duplicates (1 in 20)	Estimated No. Confirmation Samples (1 in 50)
Center of Grid	114	24-30"	-	114	23	10
		30-36"	-	114		
		36-42"	-	114		
		42-48"	-	114		
			Total: 0	Total: 456	Total: 23	Total: 10

TABLE A-2-1. IMPORT MATERIAL COLLECTION SUMMARY - EVERETT SMELTER SITE

Import Material Type	Estimated Minimum Volume Required (CY)	Sample Analyzed for Priority Pollutant Metals (1 per 1,000 CY)	Sample Analyzed for pH and Particle Size per Season	Sample Analyzed for Fertility per Season	Sample Analyzed for PCBs, Organochlorine Pesticides, SVOCs and VOCs (1 per 1,000 CY)
Backfill - Fenced Area Backfill - Residential Yards	14,000 13,000	27	2	-	-
Topsoil - Fenced Area Topsoil - Residential Yards	4,500 4,000	9	2	2	9
		Total: 36	Total: 4	Total: 2	Total: 9

TABLE A-2-2. PREFERRED USDA STANDARDS

Test	Criteria	Specification
Fraction Passing 2 mm Sieve	Coarse Sand (0.5-2 mm)	Max=15%; Min=0%
	All Sand (0.5-2 mm)	Max=85%; Min=65%
	Silt (0.002-0.5 mm)	Max=15%; Min=5%
	Clay (<0.002 mm)	Max=8%; Min=0%
Other Particle Classes	Gravel (2-12 mm)	Max=5%; Min=0%
	Rock (1/2 - 1 inch)	5% by volume with none>1 inch
	Organic (dry wt.<2 mm)	Max=10%; Min=3%
Reaction	PH	5.5-7.5
Infiltration Rate	Water Holding Capacity	*
Fertility	N, P, K, Ca, Mg, Cu, Zn, Mn, Fe, B, and SO4	*

Note: * indicates soil specialist will interpret the results to determine if material can support normal plant growth.

TABLE A-3-1. SURFACE WATER COLLECTION SUMMARY - EVERETT SMELTER SITE
(Per Sampling Event)

Sample Location	Sample For Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 20)
CATCH BASINS:		
CB-3	1	1
CB-6	1	
CB-7	1	
CB-8	1	
CB-11	1	
CB-17	1	
CB-18	1	
CB-19	1	
CB-20	1	
MANHOLES:		
MH-1	1	1
MH-2	1	
MH-3	1	
MH-4	1	
MH-5	1	
MH-6	1	
MH-7	1	
MH-8	1	
MH-9	1	
	Total: 18	Total: 2

TABLE A-4-1. GROUNDWATER COLLECTION SUMMARY - EVERETT SMELTER SITE
(Per Sampling Event)

Sample Location	Sample Analyzed For Total Antimony, Arsenic, Cadmium, Hardness, Lead, Mercury, and Thallium	Sample Analyzed For Dissolved Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 10)
SHALLOW:			
EV-6A	1	1	4
EV-7A	1	1	
EV-8A	1	1	
EV-9A	1	1	
EV-10	1	1	
EV-11	1	1	
EV-12	1	1	
EV-13	1	1	
EV-15A	1	1	
EV-16	1	1	
EV-17A	1	1	
EV-24A	1	1	
DEEP:			
EV-3	1	1	2
EV-6B	1	1	
EV-7B	1	1	
EV-8B	1	1	
EV-9B	1	1	
EV-15B	1	1	
EV-17B	1	1	
EV-18B	1	1	
EV-19B	1	1	
EV-20B	1	1	
EV-24B	1	1	
	Total: 23	Total: 23	Total: 6

TABLE A-5-1. STORM DRAIN SEDIMENT COLLECTION SUMMARY - EVERETT SMELTER SITE

Sample Location	Sample For Antimony, Arsenic, Cadmium, Lead, Mercury, and Thallium	Estimated No. Field Duplicates (1 in 20)
CB-1	1	1
CB-2	1	
CB-3	1	
CB-4	1	
CB-5	1	
CB-6	1	
CB-7	1	
CB-8	1	
CB-9	1	
CB-10	1	
CB-11	1	
CB-12	1	
CB-13	1	
CB-14	1	
CB-15	1	
CB-16	1	
CB-17	1	
CB-18	1	
CB-19	1	
CB-20	1	
	Total: 20	Total: 1

FIGURES

UPDATE TIME: 8pm
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T010

LEGEND

ASARCO OWNED – DEMOLISHED SUPERSTRUCTURE IN FENCED AREA

PROPERTIES TO REMEDIATE

PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY

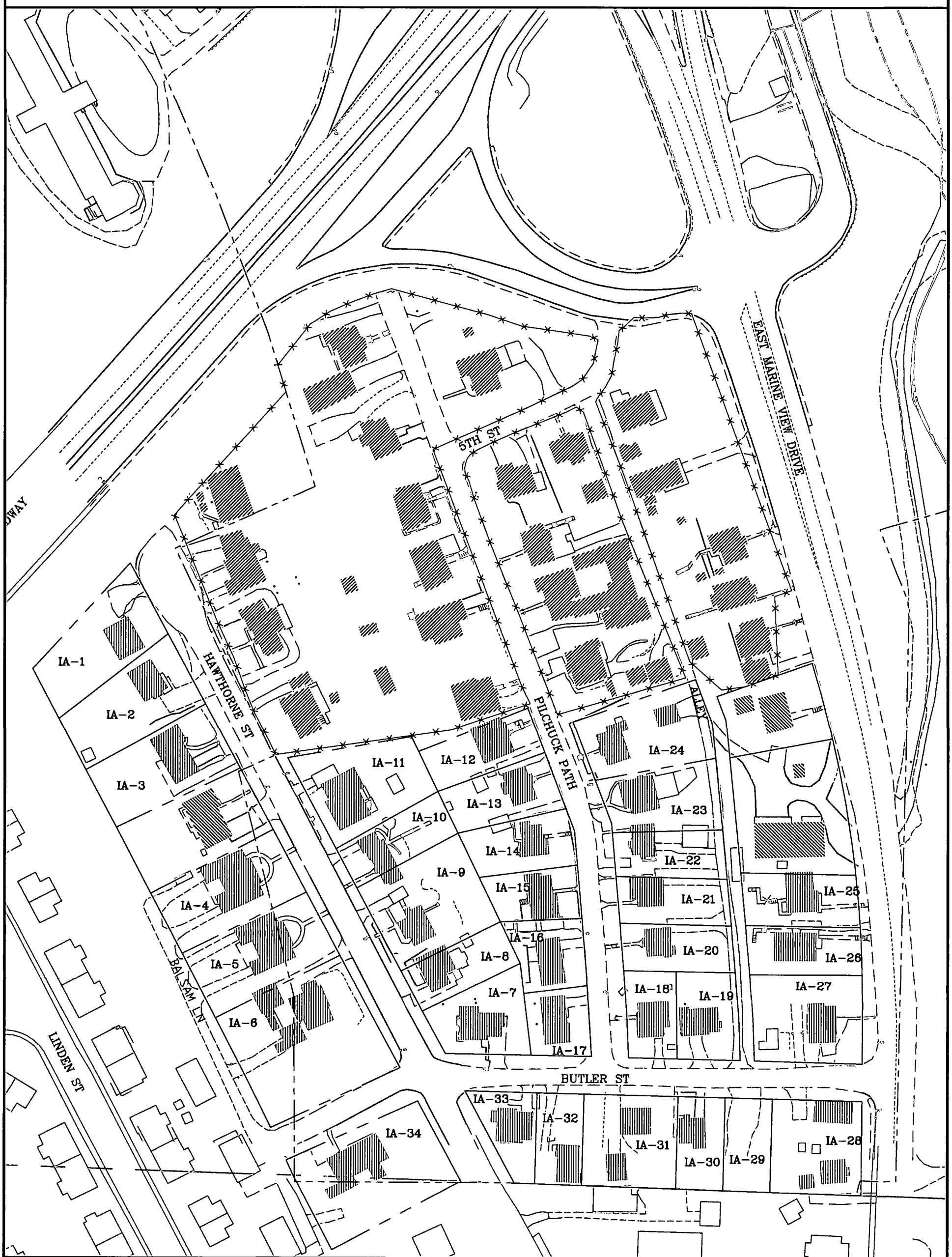
APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY

SECURITY FENCE

IA–1 INTERIM ACTION PROPERTY DESIGNATOR

NORTH

SCALE (In Feet) 0 100



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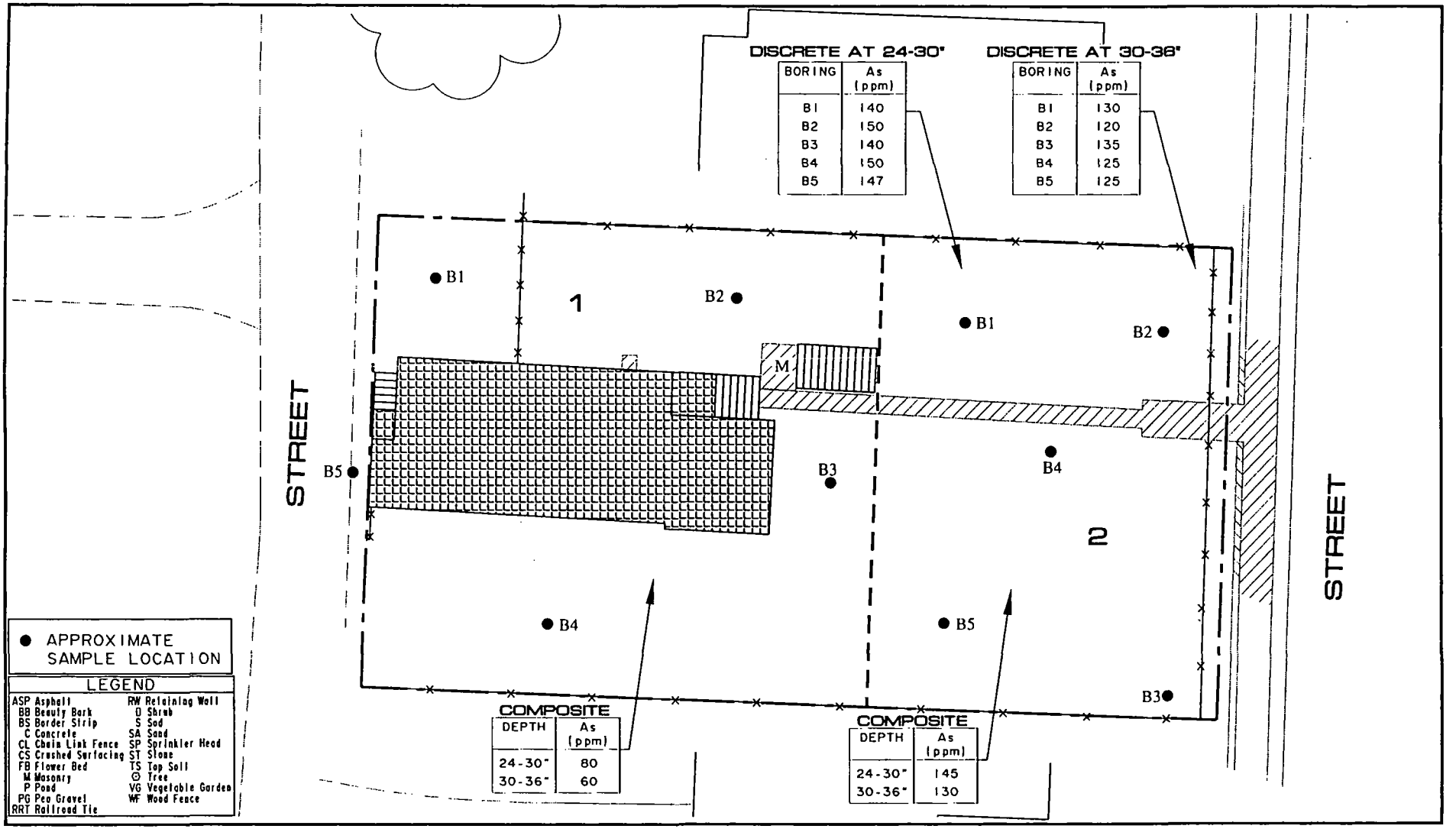
RESIDENTIAL PROPERTIES TO REMEDIATE AROUND FENCED AREA

FIGURE A-1-1



PERFORMANCE MONITORING

NORTH

0 5 10

SCALE IN FEET

ASARCO Consulting, Inc.

EXAMPLE

Asarco - Everett

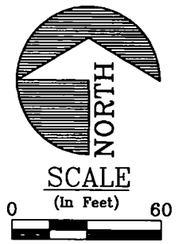
PROPERTY SITE CODE: IAEXAMPLE

SITE ADDRESS: STREET

PROPERTY OWNER: OWNER

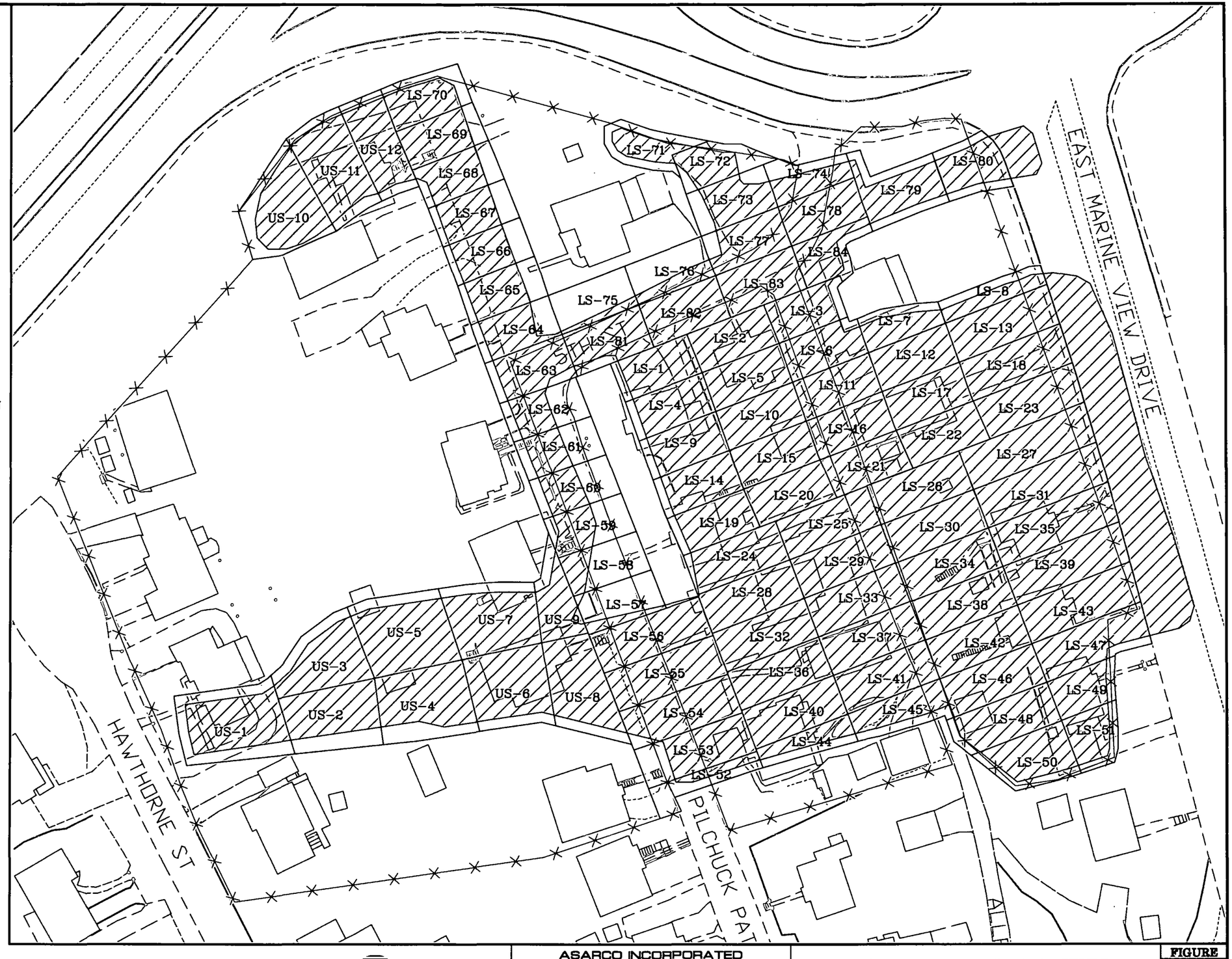
EVERETT-091902-T019

FIGURE A-1-2



LEGEND

- SECURITY FENCE
- ESTIMATED EXTENT OF 3000+ mg/kg ARSENIC
- US-1 UPPER SOURCE AREA UNIT
- LS-1 LOWER SOURCE AREA UNIT
- ESTIMATED EXCAVATION BOUNDARY OF MATERIAL WITH ARSENIC LEVELS ABOVE 3000 mg/kg
- SOURCE/RESIDENTIAL AREA (ie. DECISION UNIT) BOUNDARY



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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A

PHASE 1 (3000 mg/kg+) ARSENIC SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-3

UPDATE TIME: 8pm
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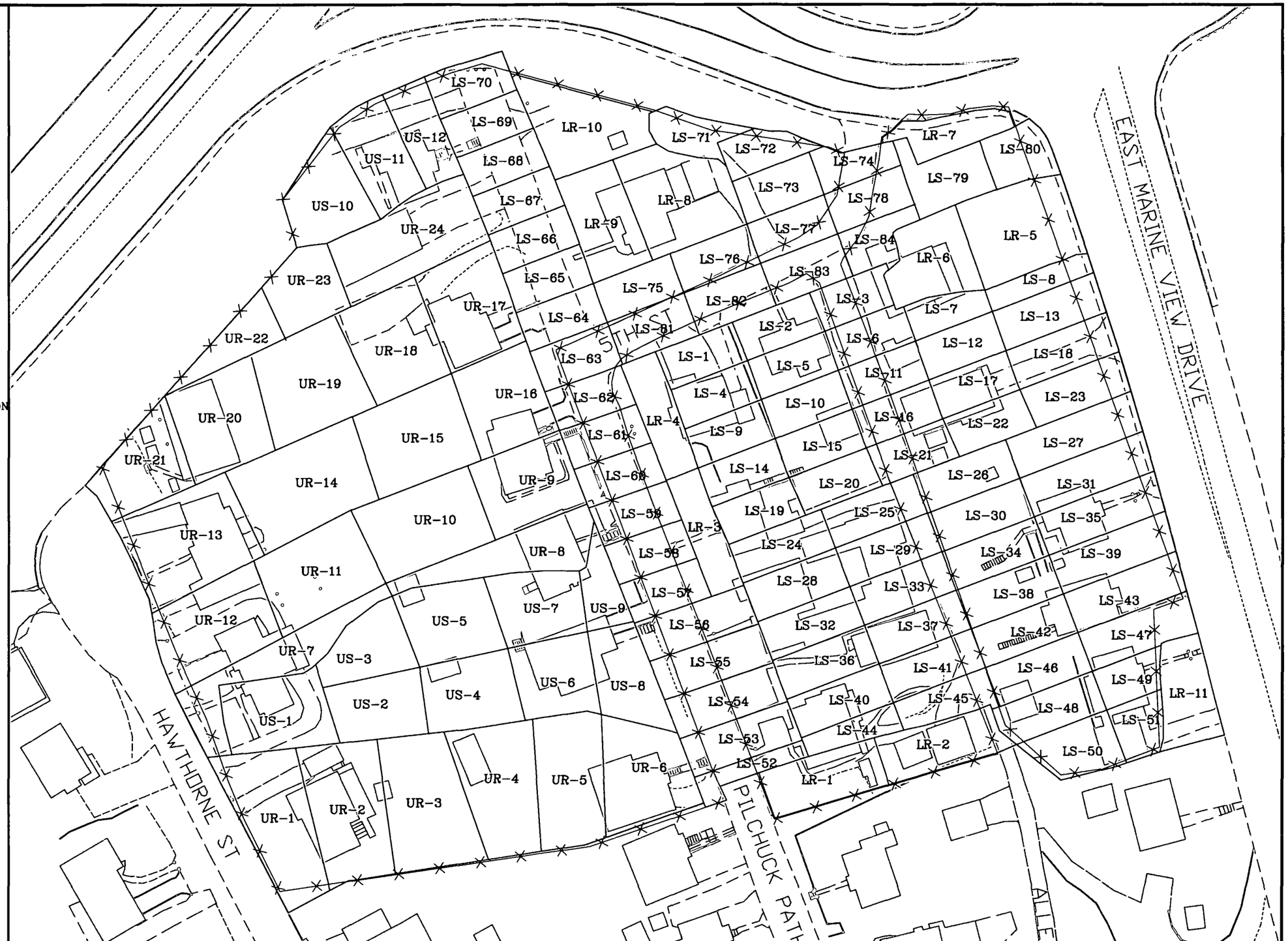

LEGEND

UR-1	UPPER RESIDENTIAL UNIT
LR-1	LOWER RESIDENTIAL UNIT
US-1	UPPER SOURCE AREA UNIT
LS-1	LOWER SOURCE AREA UNIT
———	ESTIMATED EXCAVATION BOUNDARY FOR FENCED AREA
———	RESIDENTIAL/SOURCE AREA (ie. DECISION UNIT) BOUNDARY

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PHASE 2 (150 mg/kg+) ARSENIC SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-4

UPDATE TIME: 8pm
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T012.dwg

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PHASE 3 (POST CUT/FILL)
SOIL SAMPLING IN FENCED AREA

FIGURE
A-1-5

UPDATE TIME: 8pm
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T037.dwg

LEGEND

- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE
- ASARCO OWNED - DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- PROPERTIES TO REMEDIATE
- PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY
- ● MH-3 MANHOLE TO SAMPLE
- ■ CB-17 CATCH BASIN TO SAMPLE
- COMBINED STORMDRAIN/ SANITARY SEWER SYSTEM
- STORM DRAIN SYSTEM

NORTH

SCALE (In Feet) 0 100

ASARCO Consulting, Inc.

ASARCO INCORPORATED INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A	SURFACE WATER SAMPLE LOCATIONS EVERETT SMELTER	FIGURE A-3-1

UPDATE TIME: 8pm
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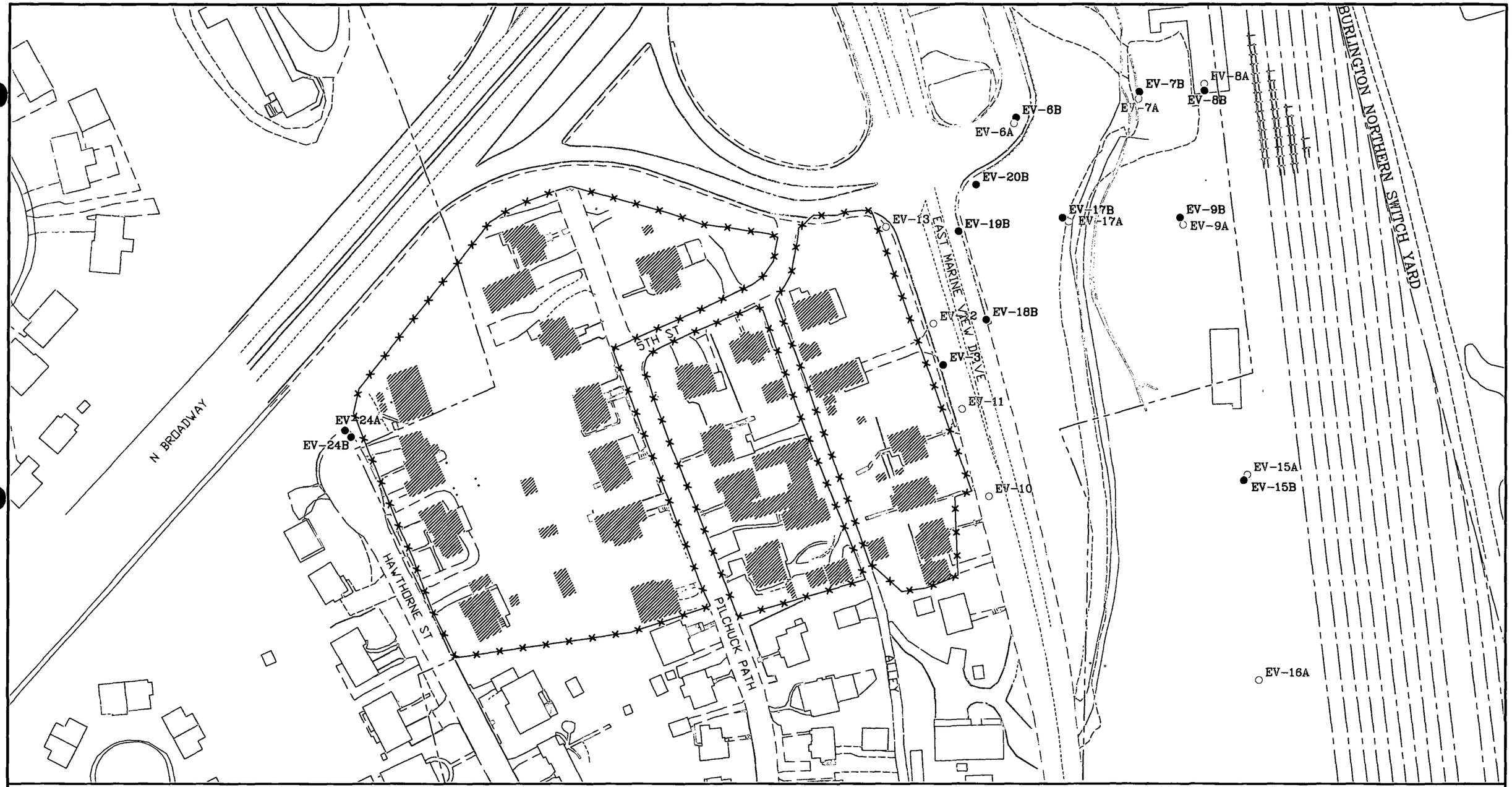

LEGEND

- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE
- ASARCO OWNED – DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- ● EV-24B NEW DEEP MONITORING WELL TO BE INSTALLED
- ● EV-24A NEW SHALLOW MONITORING WELL TO BE INSTALLED
- ● EV-13 EXISTING DEEP MONITORING WELL
- ○ EV-12 EXISTING SHALLOW MONITORING WELL

NORTH

SCALE (In Feet) 0 100

ASARCO Consulting, Inc.

ASARCO INCORPORATED
INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A

GROUNDWATER MONITORING WELL LOCATIONS

FIGURE A-4-1

UPDATE TIME. 8am
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T013 dwg

UPDATE TIME: 8am
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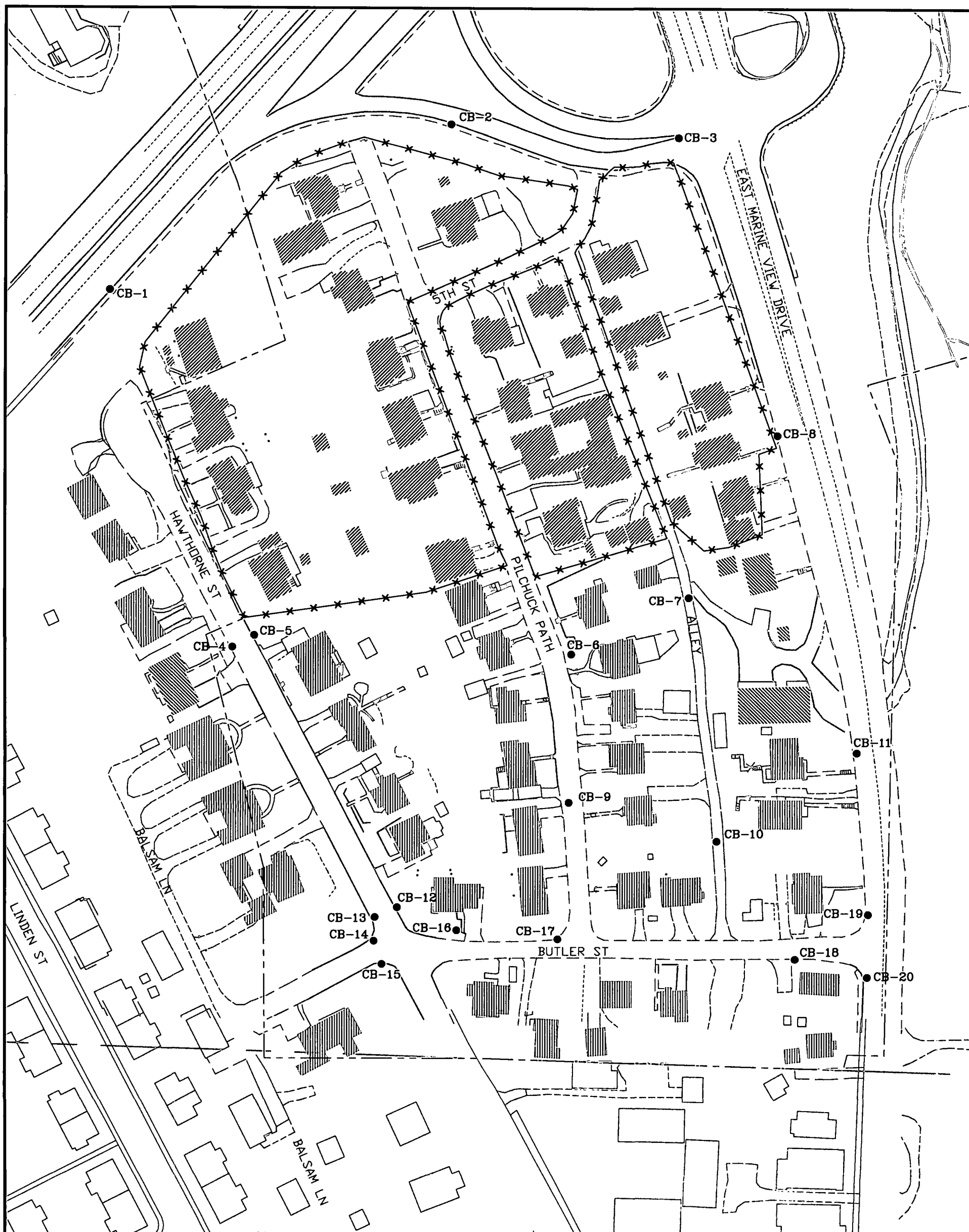

LEGEND

- APPROXIMATE LOCATION OF HISTORICALY OWNED ASARCO PROPERTY BOUNDARY
- SECURITY FENCE
- ASARCO OWNED – DEMOLISHED SUPERSTRUCTURE IN FENCED AREA
- PROPERTIES TO REMEDIATE
- PROPERTIES PREVIOUSLY REMEDIATED BY ECOLOGY
- ● CB-1 CATCH BASIN TO SAMPLE

NORTH

SCALE (In Feet) 0 100

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INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A

STORM DRAIN SEDIMENT SAMPLING LOCATIONS EVERETT SMELTER

FIGURE A-5-1

Appendix B

APPENDIX B

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

Prepared for:

ASARCO Incorporated

Prepared by:

Asarco Consulting, Inc.
5219 N Shirley St
Suite100
Tacoma, WA 98407

December 2002

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FIRE PROTECTION PLAN	ATTACHMENT B-14

1.0 INTRODUCTION

This Site Health and Safety Plan (HSP) is for all employees, contractors, visitors, or observers conducting or observing remedial and/or sampling activities associated with the interim action at the Everett Smelter Site located in Everett, Washington. It is intended to satisfy the requirements of WAC 173-340-810.

Any on-site activities associated with soils potentially containing elevated concentrations of arsenic and lead or activities that potentially pose a physical hazard must be performed in accordance with this HSP. This HSP is designed to ensure that field personnel and the surrounding community are adequately protected from chemical and physical hazards present during implementation of the interim action.

2.0 PURPOSE OF THE SITE HEALTH AND SAFETY PLAN

This HSP establishes policies and procedures to protect personnel from the potential hazards posed by field activities associated with the interim action. The HSP provides measures to minimize exposure, accidents, and physical injuries that may occur during daily site activities and details actions to be taken during a site emergency. This HSP complies with provisions of the Washington State Industrial Safety and Health Agency (WISHA) standard for personal safety for hazardous waste investigation personnel as required under WAC 296-62-300, Part P as well as requirements under OSHA 29 CFR 1910.120.

This HSP must be observed by all personnel which includes Asarco employees, contractors, subcontractors, visitors and observers participating in the interim action. To help ensure safety compliance, all field personnel and observers must read this plan and sign a certification stating that they agree to comply with the HSP (see Attachments B-1,

B-2, and B-3). Additional hazards identified by contractors or subcontractors as part of their operations must be addressed in their respective HSP.

3.0 KEY MANAGEMENT

Efficient on-site operation requires that key personnel be identified and that their roles, responsibilities, and scope of authority be clearly defined.

Project Health & Safety Officer

Prior to work commencing, the Project Health & Safety Officer will be identified. This position should not be confused with the Site Health & Safety Officer described later. The Project Health & Safety Officer is responsible for the contents of, distribution of, and modifications to this HSP. The Project Health & Safety Officer is responsible for reviewing all contractor and subcontractor HSPs, for surveying work operations periodically, and for notifying responsible Site Health & Safety Officers or other responsible individuals with oral notification of deviations from the HSP. Weekly progress meetings will be held between the contractors and the Project Health & Safety Officer to report progress and address issues of concern. As the Project Health & Safety Officer, he/she is responsible for providing direction to Site Health & Safety Officer. The Project Health & Safety Officer will also serve as a central contact regarding health and safety issues encountered at the site.

Site Health & Safety Officer

Prior to work commencing, the Site Health & Safety Officer will be identified. The Site Health & Safety Officer is responsible for contractor-specific decisions related to daily field operations. The individual responsible for supervising employees engaged in hazardous waste operations are described in the WISHA Standard for Hazardous Waste Operations and Emergency Response (HAZWOPER) WAC 296-62-3010.

Specific duties shall include the following:

- Stopping work if any operation threatens worker or public health and safety.
- Selecting appropriate protective clothing and equipment in consultation with the Project Health & Safety Officer.
- Periodically inspecting protective clothing and equipment.
- Ensuring that protective clothing and equipment are properly stored and maintained.
- Controlling entry and exit to work zones.
- Coordinating health and safety program activities with the Project Health & Safety Officer.
- Confirming each team member's suitability for work based on a physician's recommendation and training.
- Monitoring the work parties for signs of stress, such as fatigue, cold exposure, or heat stress.
- Monitoring on-site hazards and conditions.
- Participating in the preparation of and implementing the Contractor HSP.
- Conducting periodic inspections to determine if the Contractor's HSP is being adhered to.
- Knowing emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Notifying, when necessary, local public emergency officials.
- Coordinating emergency medical care.

The Project Health & Safety Officer reserves the authority to select protective clothing and health and safety monitoring equipment based on the guidelines contained in this HSP or to augment the plans as necessary. The Site Health & Safety Officer may stop work if any activity or conditions threaten worker or public health or safety. The Site Health & Safety Officer will inform the Project Health & Safety Officer as soon as

reasonably possible whenever there are questions regarding the safety of continued operations.

The Site Health & Safety Officer shall also be responsible for overseeing the decontamination of the contractor's personnel, equipment, and samples before they leave the site. These responsibilities shall include:

- Emergency decontamination of contaminated accident victims or warning emergency personnel should this activity be impossible due to increasing the injury to the victim.
- Setting up decontamination areas. Decontamination solutions will consist of tap water or water mixed with common detergents. Water use in decontamination will be minimized.
- Controlling the decontamination of all equipment, personnel, and supplies withdrawn from the contaminated areas.
- Assisting in the disposal of contaminated clothing and materials.
- Ensuring that all required safety equipment is available.
- Advising medical personnel of potential exposures of incident victims and consequences.

Project Manager

Prior to work commencing, the Project Manager will be identified. The Project Manager will be responsible for project oversight and interact with the Project Health & Safety Officer to ensure proper implementation of the required actions.

4.0 SITE CONTROL DURING INTERIM ACTIONS

4.1 FENCED AREA

The fenced area will have three work zones established including an exclusion zone, a decontamination zone, and a clean zone. Currently, each block is bordered with a six-foot chain link fence. Work conducted within the fence will be considered an exclusion zone and be under the surveillance of the work crews. To reduce the public's exposure to site physical and chemical hazards, the exclusion zone access will be restricted to trained, authorized personnel with personal protective equipment. Resident or other unauthorized entry into the exclusion zone will cause work to stop until the zone is cleared of the unauthorized personnel. At the end of each day, the contractor will ensure the section of fence, if any, that is removed will be replaced or ensure that temporary fencing is erected to secure the exclusion zone.

A decontamination zone(s) will be set up for equipment and personnel for access ways in and out of the exclusion zones. Decontamination is discussed further in Section 8.

An area outside the security fence, a clean zone, may also be needed for staging operations or for protection of the community. Although they are clean zones, these areas will have restricted access through the use of barricades and/or barricade tape. An attempt will be made to store equipment within the fence at night and on weekends. If equipment is left outside the fence, it cannot interfere with traffic.

It is noted that these three zones will be adjusted as the interim action proceeds. In addition to the established zones, the safety of the general population will also be protected by ensuring that the work performed complies with the Dust Control Plan (see Attachment B-4) and the Peripheral Monitoring Plan (see Attachment B-5).

4.2 RESIDENTIAL PROPERTIES

The area containing the selected residential properties which may be remediated will be considered a general work zone. During soil removal and replacement at a given decision unit(s), the work zone access will be restricted to trained, authorized personnel with personal protective equipment. Most residences are expected to be occupied during remedial activities. Therefore, only reasonable and prudent access will be maintained. However, while equipment is operating, the area will be under the surveillance of the work crews. Resident or other unauthorized entry will cause work to stop.

During soil removal, decision units will be surrounded with yellow barrier tape if not backfilled prior to the end of the work day. Any area backfilled is considered as lacking hazards unless exposed utilities are present. Equipment may be left overnight or over the weekend within the area taped off.

In addition, the safety of the general population will be protected by ensuring that the work performed complies with the Dust Control Plan (see Attachment B-4) and the Peripheral Monitoring Plan (see Attachment B-5).

5.0 HAZARD EVALUATION

5.1 CHEMICAL SUBSTANCES OF CONCERN

Arsenic, lead, and cadmium are known or suspected to be present at elevated concentrations within the interim action area and may affect human health. Concentrations are highest in the fenced area. Arsenic and lead are considered the primary chemicals of concern with levels ranging 5 to 727,000 mg/Kg and 5 to 11,000 mg/Kg respectively. Cadmium has also been detected at concentrations from 5 to 230 mg/Kg. Chemical concentrations decrease markedly outside the fenced area.

The following describes the primary hazards associated with each chemical:

Chemical	Primary Hazard
Arsenic	Toxic on inhalation, ingestion; skin irritant; known human carcinogen for inhalation and ingestion.
Lead	Toxic on inhalation, ingestion.
Cadmium	Toxic on inhalation, ingestion, suspected human carcinogen through inhalation only.

More detailed information concerning chemical, physical, and toxicological properties of arsenic, lead, and cadmium are contained in Attachments B-6, B-7, and B-8 respectively. A summary of the relevant standards and exposure guidelines for these substances is in Attachment B-9.

5.2 PHYSICAL SAFETY CONCERNS

Work activities may expose field personnel to many physical hazards. To reduce the potential for accidents in the work zones, it is important to identify the hazards. The following is a list of the hazards that may be encountered and that can result in injury:

- Slips, trips, and falls
- Sharp or protruding objects
- Electrical shock
- Burns
- Noise
- Overexertion
- Explosion/ignition hazards (underground gas lines)
- Overhead obstructions
- Domestic animals
- Struck By Falling Objects

Slips, Trips, and Falls - Each area may have its own peculiar hazards for trips and falls, such as uneven steps, slippery ground, debris, and other trip hazards. Personnel must be careful to protect themselves by finding and pointing out hazards.

Sharp and Protruding Objects - Some areas may have hazards such as stakes in the ground, half-buried debris, and projections from fences and buildings which are capable of impaling.

Electrical Shock - All utilities must be located, whether they are overhead or underground, and plans made to avoid them prior to work beginning. If it is suspected that equipment has become energized due to contact with an electrical line, the operator must get away from the equipment, prevent others from approaching it, and contact the power utility to disconnect power.

Burns – Most equipment will create a substantial amount of heat, especially at the muffler. Personnel must avoid contact with the hot parts.

Noise – Some powered equipment, though muffled, may exceed the noise limits under WISHA. Personnel working in the immediate area of these machinery must wear hearing protection.

Overexertion – Some work must be done by hand including shoveling and lifting. When lifting, field personnel must keep the weight carried centered within their bodies and be aware of their limitations. Communication is the key in the coordinated lifting and movement of equipment.

Explosion/Ignition Hazards - Underground utilities such as gas lines must be located and their locations given adequate distance from work. If it is suspected that a gas line has been hit, the operator must turn off the equipment and evacuate the area, including notifying nearby residents. The gas utility must be called to repair the break.

Overhead Obstructions - Each area will be surveyed prior to work beginning for hazards such as overhead obstructions which may contact equipment during operation or movement. Specific plans must be made for avoiding these hazards.

Domestic Animals – At residential properties, personnel must be aware that some pets and neighborhood animals may become aggressive without warning. Any animal on the property which may potentially be a problem must be restrained by the owner or their representative prior to site entry.

Struck By Falling Objects - Debris can fall suddenly or be thrown by equipment. No personnel should go near running equipment until he/she has communicated to the operator to stop.

All field personnel must be continually aware of these hazards and take appropriate precautions as part of their daily activities. Prior to startup of each operation, any hazards discovered by surveying will be noted in a leader/crew meeting.

The interim action requires a variety of tasks including sampling, analysis, excavation, and other construction activities. The following subsections identify potential hazards that may be associated with these tasks.

5.2.1 Soil Sampling

Most soil samples will be collected in excavations. Sampling personnel need to ensure that the excavation is in accordance with Chapter 296-155-WAC, Part N, Excavation Trenching and Shoring. Typically, if excavations are deeper than four feet, shoring or sloping will be required for man-entry. If the excavation area does not meet the requirements of the regulation, samples will be collected from the excavator bucket.

Some residential properties may require samples to be collected from maintenance areas not normally occupied (crawl spaces). Sampling personnel must ensure that there is safe entry in these areas and utilize the "buddy system". In addition, personnel need to be cognizant of structural and electrical hazards as well as rodents.

5.2.2 Sediment and Groundwater Sampling

Traffic control will be required while collecting storm drain sediment from catch basins and groundwater samples from several monitoring wells. Personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic.

5.2.3 Surface Water Sampling

Traffic control will be required while collecting storm water runoff samples from catch basins and manholes. Personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic. In addition, manholes are considered a confined space. Any personnel entering a manhole must comply with applicable confined space standards.

5.2.4 Soil Removal

The contractor must comply with Chapter 296-155-WAC, Part N, Excavation Trenching and Shoring during soil removal and replacement. Appropriate precautions must be taken to ensure the safety of equipment operators and other field personnel.

5.2.5 Soil Loading and Transportation

Traffic control may be required at some locations while loading soil that is scheduled to be removed and transported off-site. At these locations, personnel must utilize signs, cones, barriers, and/or flaggers as necessary for protection from traffic.

6.0 TRAINING

6.1 GENERAL TRAINING

All field personnel must have the 40 hours of initial safety training (or equivalent in accordance with 29 CFR 1910.120) as required by WISHA under WAC 296-62-300 Part P, Hazardous Waste Operations and Emergency Response (HAZWOPER). Workers and supervisors must maintain eight hours of refresher training annually to re-emphasize the initial training and to get updated on new policies and procedures in accordance with WAC 296-62-3040 (10).

All new field personnel shall receive a minimum of three days of initial field experience under the direct supervision of experienced supervisors, ensuring protection of worker health and safety consistent with the requirements under WAC 296-62-300. The worker's training will be consistent with their job function and responsibilities.

All personnel involved in remedial and/or sampling work will undergo a safety orientation by the Project Health & Safety Officer or the Site Health & Safety Officer. This instruction, held prior to initiating any site activity, is to ensure that employees are apprised of this HSP and includes the following:

- Proper handling of all solid and liquid materials,
- Proper sampling procedures, as appropriate,
- Operation and maintenance of safety equipment,
- Requirements for use of respirators and other PPE,
- Required personal hygiene practices,
- Effective responses to emergencies and emergency procedures, and
- General safety precautions.

Lastly, a minimum of one person for every two working on-site must be trained in first-aid and CPR per WAC 296-155-120. This training, in part, may be included in the eight hour HAZWOPER refresher training.

6.2 RESPIRATOR TRAINING

All field personnel must be trained in the use of half-face mask air purifying respirators with HEPA cartridges. Workers will be administered a fit test and instruction on maintenance, fit, and precautions on at least an annual basis. Respirator-wearing personnel will receive training in the proper use of respirators including techniques used to determine good respirator fit. The use of respirators will be consistent with WAC 296-62-071-07121 and is discussed further in Section 7 and Attachment B-10 (Personnel Monitoring Plan).

6.3 HAZARD COMMUNICATION

A Hazard Communication Program must be provided to field personnel sharing the knowledge of the chemicals they may come in contact with along with the knowledge of hazards in the area required to protect their health. Figure 6-2-1 shows the Hazard Warning Notification for arsenic and lead, which are the main chemicals of concern, that must be read by all field personnel.

FIGURE 6-2-1

HAZARD WARNING NOTIFICATION

The Everett Smelter Site is a hazardous waste site with the following hazards in the soils:

ARSENIC is a carcinogen and is toxic to humans if overexposed. Arsenic overexposure by ingestion causes stomach pains, nausea, vomiting, and watery diarrhea. Arsenic overexposure by inhalation can cause cough, chest pain, headache, and the stomach problems above. Long-term symptoms of arsenic overexposure include organ damage. Arsenic cannot be absorbed through the skin.

LEAD is a poison and can cause problems with blood-forming systems and the kidneys if overexposed over a period of time. Lead overexposure by ingestion or inhalation causes loss of appetite, metallic taste in mouth, anxiety, constipation, nausea, and weakness. Lead cannot be absorbed through the skin.

The amount of soil ingested which could cause the symptoms above is more than that which could normally be associated with unintentional ingestion in an industrial setting. The levels of arsenic and lead within the surface of the Everett Smelter Site properties do not present a hazard to health if the procedures below are followed. The areas inside the perimeter fence are exclusion zones. Personnel who are not trained in the hazards of working in hazardous waste sites are not allowed entry unless a specific defined area has been set up as 'clean'.

PROCEDURES to follow include avoid contact with soils and remain outside restricted areas. If soils do contact the skin, wash the area clean. Smoking, drinking, or eating are not allowed in the work areas except in specific break areas.

SIGNATURE STATEMENT

I have read the information above and understand the hazards of working in an area that contains arsenic and lead. I also understand the procedures above and agree to follow these procedures. I also understand that if I experience any of the symptoms listed above for arsenic or lead, that I should report this to my employer immediately.

_____	_____	_____
SIGNATURE	PRINTED NAME	DATE

7.0 SAFETY PROTECTION

7.1 GENERAL PROTECTION REQUIREMENTS

Whenever routine work practices cannot effectively reduce excessive exposures, personal protective equipment (PPE) will be used by field personnel. Work practices using PPE shall be instituted to ensure worker exposure remains below the applicable Permissible Exposure Limits (PELs). Information on PELs is discussed further in Attachment B-10 (Personnel Monitoring Plan).

7.2 PERSONAL PROTECTIVE EQUIPMENT

Basic required PPE for field personnel will be "Level D". Field personnel will be required to wear "Level D" PPE at all times while performing any task in the field related to the interim action. The following safety equipment constitutes "Level D" protection:

- Hard hat
- Steel-toed, steel-shanked safety boots
- Safety glasses and/or goggles
- Work gloves
- Cotton or cotton/poly coveralls
- Foam ear protectors, if noise levels warrant

Any task that may expose field personnel to levels beyond the PEL for any element of concern requires the implementation of "Level C" protection. "Level C" protection will be the same as "Level D" except that a half-face mask air purifying respirator will be used with MSHA-approved HEPA cartridges.

While removing source area soil (soil with arsenic concentrations greater than 3,000 mg/Kg in the fenced area), field personnel must wear "Level C" PPE. If any personnel monitoring results show levels above the PELs, activities will be re-evaluated and modified.

"Level C" PPE must also be worn by field personnel at the beginning of residential soil removal (soil with arsenic concentrations between 150 and 3,000 mg/Kg in the fenced area) and soil removal at residential properties outside the fenced area until personnel monitoring results show levels are less than the PELs for three consecutive days. At that time, PPE requirements can be downgraded from "Level C" to "Level D". If personnel monitoring results show levels above the PELs, activities will be re-evaluated and modified. Workers will revert to "Level C" PPE until analytical results are below the PELs for three consecutive days.

7.3 SITE STANDARD OPERATING PROCEDURES

Field operations will be conducted in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersion of dust as much as practical. A safety meeting will be held at the start of field work. The meeting will focus on standard operating procedures (SOPs) associated with specific tasks and equipment. A mandatory tailgate safety meeting will be held at the beginning of each week and documented consistent with WISHA requirements.

The following is a list of general site SOPs that will be enforced:

1. Legible and understandable precautionary labels shall be prominently affixed to containers of raw materials, intermediates, products, by-products, mixtures, scrap, waste, debris and protective clothing.
2. PPE shall not be removed until it has been cleaned, stored, or properly packaged and labeled.
3. Employees will not be allowed to exit the exclusion and/or decontamination zones until decontamination has taken place as per procedures listed in Section 8. The exception is a medical emergency, whereby the delay or the extra movement may endanger the employee. However, medical response personnel must be made aware of the chemicals of concern.
4. Removal of materials from PPE by blowing, shaking, or any other means that may disperse materials into the air is prohibited.

5. The clean zone must have potable water with hygienic dispensation available.
6. The clean zone must have a hand cleaning facility. All employees shall be required to clean their hands before eating, drinking, or smoking.
7. No smoking or eating (including the chewing of tobacco, gum and/or sunflower seeds) is permitted in the work zones.
8. As appropriate, equipment on-site shall be bonded and grounded, spark proof, and explosion resistant.
9. All personnel shall avoid contact with potentially contaminated substances. Walking through puddles or mud, kneeling on the ground, or leaning against soiled surfaces should be avoided whenever possible.
10. Monitoring equipment shall not be placed on dusty surfaces.
11. Field personnel must observe each other for signs of chemical exposure. Indications of adverse effects include, but are not limited to:
    a) Changes in complexion and skin discoloration;
    b) Changes in coordination;
    c) Changes in demeanor;
    d) Excessive salivation and pupillary response; and
    e) Changes in speech pattern.
12. Field personnel must inform the Site Health & Safety Officer of non-visual effects of potential chemical exposure such as:
    a) Headaches;
    b) Dizziness;
    c) Nausea;
    d) Blurred vision;
    e) Cramps; and
    f) Irritation of eyes, skin, or respiratory tract.
13. Prompt remedial action shall be taken whenever a spill/ release occurs. Fuel spill response supplies will be at the staging area and will consist of oil absorbent pads and plastic bags. Wash water spills will be contained and absorbed. Soil spills will be collected and removed immediately.

14. All earth moving, rubber-tired equipment will be equipped with audible backup alarms.
15. All speed limits will be observed by equipment operators.
16. A fire extinguisher (minimum 5A-20BC) will be on-site each day and available whenever gasoline or other flammable material is transferred (with the exception of transfers at a gas station).
17. A first-aid kit, WISHA acceptable (determined by the number of personnel on site) will be on-site each day.
18. All buckets and blades will be lowered to the ground before shutting off the equipment.
19. A minimum of two personnel will be on-site for any activity exclusive of operating peripheral monitoring equipment.
20. Backhoes or other equipment with tall booms shall not be operated within 20 feet of any electrical conductor without first getting approval from the Site Health & Safety Officer.
21. Engines will be shut off while fueling.
22. Unauthorized riding on excavation equipment is prohibited.
23. All personnel must stay clear of the backhoe bucket, and the operator must never swing the bucket over other personnel.
24. Utility companies will be contacted prior to any excavating or drilling to ensure that no underground utilities are present.
25. Dust will be kept at a minimum.
26. All portable electrical equipment that is not double-insulated will be run through a portable ground-fault interrupter.
27. For extended operations that are distant from sanitary facilities, chemical toilets will be provided.

7.4 LUNCHES/BREAKS

All eating must take place in an area specifically provided for that purpose. No food, with the exception of water, will be consumed unless personnel are in a designated

"approved" zone. All breaks must also take place in an area specifically provided for that purpose. No eating, chewing, or smoking is to take place at the work site. Personnel must also remove coveralls and wash hands and face before eating.

7.5 HEAT STRESS

Heat stress could potentially affect field personnel. The potential for heat stress depends on the type of protective gear being worn, the ambient temperature, and the amount of activity. Work cycle lengths will be based initially on subjective input from field personnel. Workers will report any cases of dizziness, excessive sweating, increased respiratory rate or pulse and are to leave the work area immediately if these conditions are noted. Work cycle lengths will be reduced and a monitoring program will be initiated if the above symptoms are noted. Work cycles will be reduced if a pulse rate of greater than 110 is noticed at the beginning of the break. Personnel with elevated rates will not return to work until the pulse has lowered to their resting rate. First aid procedures will be used for heat related conditions, as necessary.

7.6 COLD STRESS

During field activities, workers may also become exposed to cold temperatures. Although frostbite is not a likely hazard during expected operation periods, hypothermia can occur any month of the year in northern climates. Factors leading to hypothermia include ambient temperature, wind velocity, precipitation, exposure time, and type of protective gear being worn.

Signs of excess cold exposure include uncontrollable fits of shivering, slurred speech, memory lapses, immobile hands, stumbling, drowsiness, and exhaustion. Treatment for these symptoms are to remove the victim from the wind and cold, remove wet clothing, supply a warm drink, and keep the victim warm with blankets or clothing.

7.7 NOISE

Field personnel, particularly equipment operators, may be exposed to noise dose levels 85dB or greater. For those employees exposed, hearing protection such as foam ear plugs will be required.

8.0 OTHER REQUIREMENTS

8.1 MEDICAL SURVEILLANCE

A medical surveillance program must be provided for field personnel participating in the interim action. The program includes baseline and routine annual follow-up physical examinations and is specifically designed for personnel working at hazardous waste sites. Field personnel shall also receive a medical examination at the termination of their employment, unless their annual exam has occurred within six months of termination. Specific tests included in the baseline physical examination are detailed in Attachment B-11.

8.2 DECONTAMINATION

8.2.1 Personnel

Field personnel will be required to follow the decontamination procedures prior to leaving the work zone including:

- Gross contamination removal from clothing, boots, and gloves in the exclusion zone.
- Boot wash and glove wash consisting of soap wash tub with a brush and then a rinse tub with a brush in the decontamination zone. Wash waters will be changed frequently as needed.
- Remove respirators, coveralls, then boots, and then gloves in the decontamination zone.
- Contain PPE as appropriate in the decontamination zone (place respirator in storage bag, disposable gloves in trash can, coveralls in storage bin, etc.).

- Leave the decontamination zone. All field personnel are required to thoroughly wash their hands and face before eating, drinking, or smoking. In addition, all field personnel are required to shower at the end of each work day.
- Store used coveralls in containment for laundry service or disposal. Note that coveralls cannot be used more than one day without service while removing source area soils in the Fenced Area.

The decontamination station(s) will be located prior to work commencing. The stations will be discussed at every Monday morning tailgate safety meeting.

8.2.2 Equipment

The decontamination process for equipment leaving the exclusion zone will be:

- Move equipment into the designated wash area.
- Remove the gross contamination.
- Water wash and stiff bristle brush, as necessary.
- Water rinse.

The equipment wash station(s) will be located and wash waters will be managed as specified in the interim action report.

8.2.3 Additional Cleaning for Vehicles

Vehicles shall be cleaned (inside and out) on a regular basis with soap and water outside and vacuuming the interior. Vehicles used continuously in operations are to be cleaned monthly at a minimum. At the conclusion of scheduled work, the construction equipment will be washed thoroughly on-site before de-mobilizing.

9.0 EMERGENCY RESPONSE

9.1 GENERAL ACTIONS

All accidents or potentially hazardous conditions will be handled in a manner to minimize the health risk to personnel. The main emergency contacts are identified in Attachment

B-12 while the emergency route to a local medical facility is included as Attachment B-13. In addition, a Fire Protection Plan is included as Attachment B-14.

In the event that an accident or a hazardous condition develops, the following procedures will be followed:

- First-aid or other appropriate actions will be administered by those closest to the accident/event. Those rendering assistance will not be placed in a situation of unacceptable risk.
- All accidents/hazardous conditions will be reported to the Project Health & Safety Officer and to the Project Manager. The Site Health & Safety Officer is responsible for conducting emergency response in an efficient, rapid, and safe manner.

An assessment of the emergency will be made by the Site Health & Safety Officer. First-aid will be administered to victims and, if necessary, an emergency response vehicle will be summoned. Any doubt as to the condition of the injured employee requires the employee to receive a "Doctor's Permit to Return to Work" prior to resuming his/her duties. Some examples of site emergencies are injury to personnel, damage to utilities, damage to a structure, and injuries to bystanders.

9.2 NOTIFICATION

In the event that the Site Health & Safety Officer determines that a site emergency is not limited to a minor first-aid case, he/she will immediately notify any or all of the appropriate contacts listed in Attachment B-12. Communications will be provided by the use of cellular phones and/or radios.

9.3 INCIDENT DOCUMENTATION

As soon as practical following an emergency, an injury report form will be submitted by the Site Health & Safety Officer to the Project Health and Safety Officer. In addition, any site incident involving injury, illness or other emergency will be recorded appropriately within the OSHA logs.

ATTACHMENT B-1

ASARCO EMPLOYEE CONSENT AGREEMENT

EVERETT SMELTER SITE

INTERIM ACTION

B.1 ASARCO EMPLOYEE CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines while an employee on the site.

Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date
Employee Signature	Print Name	Date

ATTACHMENT B-2

CONTRACTOR CONSENT AGREEMENT

EVERETT SMELTER SITE

INTERIM ACTION

B.2 CONTRACTOR CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines as a contractor on the site. I also understand that the existence of this plan does not absolve my company of the responsibility to create and comply with our own health & safety policies for our activities on site.

Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company
Signature	Date	Company

ATTACHMENT B-3

VISITOR OR OBSERVER CONSENT AGREEMENT

EVERETT SMELTER SITE

INTERIM ACTION

B.3 VISITOR OR OBSERVER CONSENT AGREEMENT

I have reviewed the Site Health and Safety Plan for the interim action at Everett, Washington. I understand its purpose and consent to adhere to its policies, procedures and guidelines as a visitor or observer on the site.

_____	_____	_____
Signature	Date	Company
_____	_____	_____
Signature	Date	Company
_____	_____	_____
Signature	Date	Company
_____	_____	_____
Signature	Date	Company
_____	_____	_____
Signature	Date	Company

ATTACHMENT B-4

DUST CONTROL PLAN

B.4 DUST CONTROL PLAN

The dust control plan will be maintained at all times and will be implemented in accordance with PSAPCA requirements Regulation 1, Section 9.15 (see Excerpt B-4-1). This regulation addresses the fugitive dust emission standard. Generally, the standard prohibits fugitive dust unless the best available control technology is employed. Most of the work such as soil removal, grading and filling operations, and material handling will utilize a water spray. Stockpiles may be stabilized with water as well. However, if a stockpile consists of contaminated soil, it may be covered with a tarp rather than spraying with water if determined necessary by the Site Engineer.

The following describes other actions to be taken to control dust:

- The dispersion of materials into the air must be minimized to the extent practical.
- Vehicle tires shall be cleaned prior to entering roadways.
- Any accumulations of materials on equipment undercarriages must be removed.
- Vehicles used continuously in operations must be cleaned at least monthly.
- Loads of contaminated materials must be covered during transportation out of the work zones.
- Street and access ways used will be sprayed and or swept periodically as needed.

Visible dust inspections, peripheral air monitoring (see Attachment B-5), and personnel monitoring (see Attachment B-11) will be used to assess the dust control effectiveness. In addition, the water spray used will be controlled to minimize run-off from the area. This will be accomplished by control the pace of the work and using minimal volumes of water for dust suppression.

EXCERPT B-4-1

PUGET SOUND AIR POLLUTION CONTROL AGENCY

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HYDROMETRICS, INC. Received APR 1 1997 TACOMA, WA

EXCERPTS FROM REGULATION I

SECTION 1.07 DEFINITIONS

(e) AIR CONTAMINANT means dust, fumes, mist, smoke, other particulate matter, vapor, gas, odorous substance, or any combination thereof.

(k) BEST AVAILABLE CONTROL TECHNOLOGY means technology that will result in an emission standard, including a visible emission standard, based on the maximum degree of reduction which the Agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable for such source through application of production processes, available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques for control of each air contaminant. In no event shall application of the best available control technology result in emissions of any air contaminant that would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63. The Agency may prescribe a design, equipment, work practice, or operational standard, or combination thereof, to meet the requirements of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means that achieve equivalent results.

(o) CONTROL EQUIPMENT means any device that prevents or controls the emission of any air contaminant.

(q) EMISSION means a direct or indirect release of any air contaminant into the ambient air.

(s) EQUIPMENT means any stationary or portable device or any part thereof that emits or may emit any air contaminant into the atmosphere.

(v) FUEL BURNING EQUIPMENT means equipment that produces hot air, hot water, steam, or other heated fluids by external combustion of fuel.

(w) FUGITIVE DUST means particulate matter or any visible air contaminant other than uncombined water that is not collected by a capture system and emitted from a stack, but is released to the atmosphere at the point of generation.

(ll) PARTICULATE MATTER means any material, except water in an uncombined form, that is, has been, or is likely to become airborne and exists as a liquid or a solid at standard conditions.

(mm) PERSON means and includes any individual, firm, public or private corporation, association, partnership, political subdivision, municipality, or governmental agency.

(qq) REFUSE BURNING EQUIPMENT means equipment employed to burn any solid or liquid combustible refuse.

SECTION 9.03 EMISSION OF AIR CONTAMINANT: VISUAL STANDARD

(a) It shall be unlawful for any person to cause or allow the emission of any air contaminant for a period or periods aggregating more than 3 minutes in any 1 hour, which is:

(1) Darker in shade than that designated as No. 1 (20% density) on the Ringelmann Chart, as published by the United States Bureau of Mines; or

(2) Of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in Section 9.03(a)(1).

(b) The density or opacity of an air contaminant shall be measured at the point of its emission, except when the point of emission cannot be readily observed, it may be measured at an observable point of the plume nearest the point of emission.

(c) This section shall not apply when the presence of uncombined water is the only reason for the failure of the emission to meet the requirements of this section.

(d) This section shall not apply to solid fuel burning devices, permitted fire training facilities, motor vehicles when operated on public roads, or aircraft.

(e) Section 9.03(a) shall not apply to any source which meets the requirements of Section 9.09(c).

SECTION 9.11 EMISSION OF AIR CONTAMINANT: DETRIMENT TO PERSON OR PROPERTY

(a) It shall be unlawful for any person to cause or allow the emission of any air contaminant in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

(b) A Notice of Violation of this section may be issued based upon an affidavit from the person making the complaint and verification by the Control Officer or his duly authorized representative.

(c) Nothing in this Regulation shall be construed to impair any cause of action or legal remedy of any person, or the public for injury or damages arising from the emission of any air contaminant in such place, manner or concentration as to constitute air pollution or a common law nuisance.

SECTION 9.12 ODOR AND NUISANCE CONTROL MEASURES

(a) It is the policy of the Board that effective control equipment and measures shall be installed and operated to control the emission of odor-bearing air contaminants and

(b) It shall be unlawful for any person to cause or allow the emission of odor-bearing air contaminants unless such person uses the best available control technology to control the emissions.

SECTION 9.15 FUGITIVE DUST: EMISSION STANDARD

(a) It shall be unlawful for any person to cause or allow the emission of fugitive dust unless such person uses the best available control technology to control the emissions.

(b) It shall be unlawful for any person to cause or allow a vehicle to be operated on a paved roadway open to the public:

(1) Unless such vehicle is so constructed or loaded as to prevent any of its load from dropping, sifting, leaking, or otherwise escaping therefrom, except that sand may be dropped for the purpose of securing traction, and except road construction and maintenance by public agencies.

(2) With a load of dirt, sand, gravel, or other material susceptible to being dropped, spilled, or otherwise escaping therefrom unless it is covered or has adequate freeboard so as to prevent spillage.

(3) With deposits of mud, dirt, or other debris on the vehicle's body, fenders, frame, undercarriage, wheels, or tires.

Deposits of particulate matter on a paved roadway open to the public shall be prima facie evidence of a violation of Section 9.15(b).

(c) It shall be unlawful for any person to cause or allow the emission of fugitive dust from any refuse burning equipment, fuel burning equipment, equipment used in a manufacturing process, or control equipment.

(d) It shall be unlawful for any person to cause or allow the emission of fugitive dust in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

SECTION 9.20 MAINTENANCE OF EQUIPMENT

(a) It shall be unlawful for any person to cause or allow the operation of any features, machines or devices constituting parts of or called for by plans, specifications, or other information submitted pursuant to Article 6 of Regulation I unless such features, machines or devices are maintained in good working order.

(b) It shall be unlawful for any person to cause or allow the operation of any equipment as defined in Section 1.07 or control equipment not subject to Section 9.20(a) unless the equipment or control equipment is maintained in good

AGENCY POLICY
ON FUGITIVE DUST CONTROLS

DEFINITIONS

FUGITIVE DUST means particulate matter or any visible air contaminant other than uncombined water that is not collected by a capture system and emitted from a stack, but is released to the atmosphere at the point of generation.

PARTICULATE MATTER means any material, except water in an uncombined form, that is, has been, or is likely to become airborne and exists as a liquid or a solid at standard conditions.

BEST AVAILABLE CONTROL TECHNOLOGY means technology that will result in an emission standard, including a visible emission standard, based on the maximum degree of reduction which the Agency, on a case-by-case basis, taking into account energy, environmental, and economic impacts, and other costs, determines is achievable for such source through application of production processes, available methods, systems, and techniques, including fuel cleaning or treatment, clean fuels, or innovative fuel combustion techniques for control of each air contaminant. In no event shall application of the best available control technology result in emissions of any air contaminant that would exceed the emissions allowed by any applicable standard under 40 CFR Parts 60, 61, and 63. The Agency may prescribe a design, equipment, work practice, or operational standard, or combination thereof, to meet the requirements of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation and shall provide for compliance by means that achieve equivalent results.

SECTION 9.15(a)

Prohibits fugitive dust emissions unless the best available control technology is employed. Some examples of fugitive dust control techniques are:

(1) ROADWAYS, ROAD SHOULDERS, PARKING LOTS, AND STORAGE AREAS should be paved, surfaced with gravel, or treated with chemical stabilizers. Good housekeeping measures should be used to minimize the accumulation of mud or dust, to prevent the carry-out of dirt onto paved public roadways, and to prevent the visible emission of dust [see also 9.15(b)].

(2) STORAGE PILES should be stabilized with water spray, chemical stabilizers, or suitable enclosures (e.g., tarps, buildings).

(3) MATERIALS HANDLING AND TRANSFER OPERATIONS should employ control measures such as the use of water sprays at transfer points or total enclosure of the areas in which visible dust is generated (or both). [For transportation requirements, see also 9.15(b).]

(4) DEMOLITION PROJECTS should employ water sprays to prevent visible emission of dust during wrecking. Materials removed during a renovation should be either carefully lowered to the ground (not thrown) or transported to the ground via chutes into dust-tight containers. All demolition and renovation projects involving asbestos should be done in accordance with Article 4 of Regulation III.

(5) GRADE AND FILL OPERATIONS associated with construction and demolition projects should employ water spray as needed to prevent visible dust emissions. [For transport requirements, see 9.15(b).]

(6) ABRASIVE BLASTING AND SPRAY PAINTING OPERATIONS should be performed inside a booth designed to capture the blast grit or overspray. Outdoor blasting or painting of structures or items too large to be reasonably handled indoors should employ control measures such as curtailment during windy periods and enclosure of the area being painted or blasted with tarps. Blasting should be performed with either steel shot or an abrasive containing less than 1% (by mass) which would pass through a #200 sieve. All abrasive blasting with sand must be performed inside a blasting booth or cabinet.

SECTION 9.15(b)

Prohibits the deposition of particulate matter on paved public roads. Some examples of necessary control measures are:

(1) COVERS, WETTING OF MATERIALS, OR ADEQUATE FREEBOARD shall be used to prevent loss of particulate matter in transit [see also RCW 46.61.655(2)(3)].

(2) PAVED ENTRY APRONS AND EFFECTIVE CLEANING TECHNIQUES (e.g., wheel washers) shall be used to prevent carry-out of particulate matter from unpaved areas [see also RCW 46.61.655(4)].

(3) PARTICULATE MATTER deposited on paved public roads shall be cleaned up immediately [see also RCW 46.61.655(1)].

SECTION 9.15(c)

Prohibits fugitive dust emissions from incinerators, boilers, manufacturing equipment (e.g., asphalt plants, electric furnaces), and air pollution control equipment. Sources subject to this section must:

(1) EMPLOY EFFECTIVE CAPTURE SYSTEMS to eliminate fugitive dust. Visible emissions from points other than a stack (e.g., roof monitors, building openings, ductwork) are prohibited.

(2) HANDLE PARTICULATE MATTER collected in air pollution control equipment in a dust-free manner. This means no visible emissions or evidence thereof (e.g., dust accumulation, spills).

SECTION 9.15(d)

Prohibits the emission of fugitive dust in sufficient quantities and of such characteristics and duration as is, or is likely to be, injurious to human health, plant or animal life, or property, or which unreasonably interferes with enjoyment of life and property.

NOTE: THE CONTROL MEASURES MENTIONED ABOVE MERELY REPRESENT SOME EXAMPLES OF CONTROL TECHNIQUES NECESSARY TO PREVENT FUGITIVE DUST EMISSIONS AND ARE NOT TO BE CONSTRUED TO REPRESENT THE BEST AVAILABLE CONTROL TECHNOLOGY.

ATTACHMENT B-5

PERIPHERAL MONITORING PLAN

B.5 PERIPHERAL MONITORING PLAN

Peripheral air monitoring will be conducted daily during soil excavation activities to document the adequacy of dust control measures as they relate to the protection of residents. This program monitors the transport of airborne materials beyond the work zones. It is anticipated that three monitors will be required during soil removal activities in the fenced area. Two samplers will be located downwind of prevailing wind and one sampler will be located upwind in case the wind shifts during the day.

At residential properties outside the fenced area, one monitor will be located near the residential properties being remediated while soil is removed. One monitor may cover up to three residences if the decision units are close in proximity.

B.5.1 TRIGGER LEVELS

There are no dust emission standards for arsenic, cadmium, or lead. However, Asarco has developed trigger levels to assess what additional measures, if any, should be used to control sources of dust generated during soil removal. The trigger levels were developed for work at the Tacoma Smelter Site by Ecology, EPA, and Asarco. The levels were determined to be protective of residential areas near the site. The following trigger levels have been established:

Chemical	Level
Arsenic	0.2 ug/m^3
Lead	0.5 ug/m^3

Cadmium will not be sampled because its trigger level would be the same as arsenic. In addition, all data indicate that arsenic concentrations are significantly higher than cadmium. Given similar risk-based trigger levels, arsenic would be the risk driver because it is much more likely to exceed the trigger level than cadmium.

The trigger levels are based on a 5 x 10^{-5} risk for a 10 year exposure scenario. The exposure calculations are based on a 10 hour day, 350 days per year exposure for 10 years. These numbers represent the trigger levels and should not be confused as allowable emission standards.

Parameters used to calculate the target level for arsenic were derived from the standard risk assessment calculation solved for the air concentration:

$$\text{Risk} = 0.2\text{ug/m}^3 \times 20\text{m}^3 \times \frac{1}{70\text{kg}} \times \frac{10\text{hr/day}}{24\text{hr/day}} \times \frac{350\text{day/year}}{365\text{day/year}} \times \frac{10\text{years}}{70\text{years}} \times 15(\text{mg/kg/day})^{-1} \times \frac{1\text{mg}}{1000\text{ug}}$$

$$\text{Trigger Level} = \frac{1}{20\text{m}^3} \times 70\text{kg} \times \frac{24\text{hr/day}}{10\text{hr/day}} \times \frac{365\text{day/year}}{350\text{day/year}} \times \frac{70\text{years}}{10\text{years}} \times \frac{1}{15(\text{mg/kg-day})^{-1}} \times (5\text{x}10^{-5})$$

Trigger Level = 0.0002 mg/m^3

Trigger Level = 0.2 ug/m^3

If trigger levels are exceeded, Asarco will review the contractor's operation including pace and dust control measures being used. Procedures will be modified as determined appropriate.

B.5.2 SAMPLE COLLECTION

Samples will be collected using personal air quality samplers in accordance with NIOSH Method 7300. Standard operating procedures include:

- Sampling will be conducted over approximately seven to 10 hour periods when work is being performed.
- Remove red plug (save) and connect plastic filter cassette to Tygon tubing.
- The sampling location should be within 50 feet downwind of the work between four and six feet above ground with air flow between the sampler and work unrestricted by trees, buildings, etc.
- Record the cassette number, date, approximate sampler location, and pump number (see Figure B-5-1).
- Remove blue inlet plug from the filter holder (save).

- Turn pump on and adjust flow rate using digital readout. The setting on the rotameter will correspond as closely as possible to a flow rate of between 2.0 and 2.5 liters per minute as calibrated. Record flow setting and time to nearest minute on the sample form (see Figure B-5-1).
- Let sampler run during entire work day of operation or for a minimum of seven hours, whichever is longer.
- Turn pump off and record the flow setting on the rotameter and time pump is turned off on sample form (see Figure B-5-1).
- Re-plug the filter cassette, fill out the proper paperwork, and ship cassettes and sample form to a laboratory for analysis. Filters are mounted in cassettes by the laboratory. Therefore, the filter must remain in the cassettes until received and analyzed by the laboratory.

The personal air samplers must be calibrated in accordance with procedures established under NIOSH. Pump-installed rotameters will be calibrated on a monthly basis using a precision calibrating rotameter. Airflow on the pumps will be checked before and after sampling with the pump-installed digital rotameter.

B.5.3 LABORATORY ANALYSIS

Samples will be analyzed using Zeeman Graphite Furnace method. Results will be submitted to Ecology in a computer file with the monthly report. Ecology will be immediately notified of any exceedance. During the first week of operation, rush (24 hour turn-around time) analyses will be requested of the laboratory each day. Once data indicate that concentrations are below the trigger levels for at least five consecutive days, subsequent analyses will not be rushed. These samples will be sent to a laboratory once per week, likely on Thursday. The results (samples collected on Thursday, Friday, Monday, Tuesday, and Wednesday) will be available by the following Thursday.

FIGURE B-5-1

PUMP # _____

PERIPHERAL AIR MONITORING

DATE _____

ASARCO REPRESENTATIVE _____

TAG # _____

LOT ADDRESS _____

SITE CODE _____

SAMPLING POINT, RELATIVE TO LOT

_____

EXCAVATION EQUIPMENT

_____

WEATHER

WIND DIRECTION & SPEED _____

SKY CLR, CLDY, PCLDY, FOG _____

TEMPERATURE (F) _____

PRECIPITATION RAIN, DRIZZLE, NONE _____

BAROMETRIC PRESSURE _____

STATION _____

TIME ON _____

ROTO BALL ON 2.3

ROTO BALL OFF _____

TIME OFF _____

ELAPSED TIME _____

MEAN CORRECTED FLOW _____

COMMENTS

CALIBRATION

DATE _____

PUMP ROTAMETER	MANO. AVG FLOW	TRIALS
		6
		6
		6
		6
		6

CALIB. PRESSURE _____

CALIB. TEMPERATURE (F) _____

PUMP READING	MEAN CORRECTED FLOW
2.5	-
2.3	
2.1	-
1.9	
1.7	-

ATTACHMENT B-6

ARSENIC HEALTH DATA

B.6 ARSENIC HEALTH DATA

The following information is quoted from 29 CFR 1910.1018. It is noted that the health hazard of inorganic arsenic is high.

B.6.1 WAYS IN WHICH THE CHEMICAL AFFECTS YOUR BODY

Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.

The OSHA standard is based on minimizing risk of exposed workers dying of lung cancer from exposure to inorganic arsenic. It will also minimize skin cancer from such exposures.

B.6.2 NONCARCINOGENIC EFFECTS

The following sections quoted from "Occupational Diseases: A Guide to Their Recognition", Revised Edition, June 1977, National Institute for Occupational Safety and Health is included to provide information on the nonneoplastic effects of exposure to inorganic arsenic. Such effects should not occur if the OSHA standards are followed.

B.6.2.1 Local

Trivalent arsenic compounds are corrosive to the skin. Brief contact has no effect but prolonged contact results in a local hyperemia and later vesicular or pustular eruption. The moist mucous membranes are most sensitive to the irritant action. Conjunctiva, moist and macerated areas of skin, the eyelids, the angles of the ears, nose, mouth, and respiratory mucosa are also vulnerable to the irritant effects. The wrists are common sites of dermatitis, as are the genitalia if personal hygiene is poor. Perforations of the nasal septum may occur. Arsenic trioxide and pentoxide are capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially of the palms and soles.

B.6.2.2 Systemic

The acute toxic effects of arsenic are generally seen following ingestion of inorganic arsenic compounds. This rarely occurs in an industrial setting. Symptoms develop within 1/2 to 4 hours following ingestion and are usually characterized by constriction of the throat followed by dysphagia, epigastric pain, vomiting, and watery diarrhea. Blood may appear in vomitus and stools. If the amount ingested is sufficiently high, shock may develop due to severe fluid loss, and death may ensue in 24 hours. If the acute effects are survived, exfoliative dermatitis and peripheral neuritis may develop.

Cases of acute arsenic poisoning due to inhalation are exceedingly rare in industry. When it does occur, respiratory tract symptoms -- cough, chest pain, dyspnea -- giddiness, headache, and extreme general weakness precede gastrointestinal symptoms. The acute toxic symptoms of trivalent arsenic poisoning are due to severe inflammation of the mucous membranes and greatly increased permeability of the blood capillaries.

Chronic arsenic poisoning due to ingestion is rare and generally confined to patients taking prescribed medications. However, it can be a concomitant of inhaled inorganic arsenic from swallowed sputum and improper eating habits. Symptoms are weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, and peripheral neuritis. Chronic hepatitis and cirrhosis have been described. Polyneuritis may be the salient feature, but more frequently there are numbness and parasthenias of "glove and stocking" distribution. The skin lesions are usually melanotic and keratotic and may occasionally take the form of an intradermal cancer of the squamous cell type, but without infiltrative properties. Horizontal white lines (striations) on the fingernails and toenails are commonly seen in chronic arsenic poisoning and are considered to be a diagnostic accompaniment of arsenic polyneuritis.

Inhalation of inorganic arsenic compounds is the most common cause of chronic poisoning in the industrial situation. This condition is divided into three phases based on signs and symptoms.

First Phase: The worker complains of weakness, loss of appetite, some nausea, occasional vomiting, a sense of heaviness in the stomach, and some diarrhea.

Second Phase: The worker complains of conjunctivitis, a catarrhal state of the mucous membranes of the nose, larynx, and respiratory passage. Coryza, hoarseness, and mild tracheobronchitis may occur. Perforation of the nasal septum is common, and is probably the most typical lesion of the upper respiratory tract in occupational exposure to arsenic dust. Skin lesions, eczematoid and allergic in type, are common.

Third Phase: The worker complains of symptoms of peripheral neuritis, initially of hands and feet, which is essentially sensory. In more severe cases, motor paralyses occur; the first muscles affected are usually the toe extensors and the perinea. In only the most severe cases will paralysis of flexor muscles of the feet or of the extensor muscles of hands occur.

Liver damage from chronic arsenic poisoning is still debated, and as yet the question is unanswered. In cases of chronic and acute arsenic poisoning, toxic effects to the myocardium have been reported based on EKG changes. These findings, however, are now largely discounted and the EKG changes are ascribed to electrolyte disturbances concomitant with arsenic overexposure. Inhalation of arsenic trioxide and other inorganic arsenic dusts does not give rise to radiological evidence or pneumoconiosis. Arsenic does have a depressant effect upon the bone marrow, with disturbances of both erythropoiesis and myelopoiesis.

ATTACHMENT B-7

LEAD HEALTH DATA

B.7 LEAD HEALTH DATA

The following information is quoted from 29 CFR 1910.1025.

B.7.1 WAYS IN WHICH LEAD ENTERS YOUR BODY

When absorbed into your body in certain doses, lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as dust, fume or mist it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or makeup which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream, lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in the blood and other tissues. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to organs and whole body systems.

B.7.2 EFFECTS OF OVEREXPOSURE TO LEAD

B.7.2.1 Short-term (Acute) Overexposure

Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short-term dose of lead can lead to acute encephalopathy. Short-term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes which arise after periods of exposure as short as days or as long as several years.

B.7.2.2 Long-term (Chronic) Overexposure

Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain. Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine

laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood. The levels of lead anticipated in the removal activities are not expected to be near the levels which cause the preceding condition.

ATTACHMENT B-8

CADMIUM HEALTH DATA

B.8 CADMIUM HEALTH DATA

B.8.1 GENERAL INFORMATION

A. Routes of Entry

1. Inhalation
2. Ingestion

B. Acute Effects

1. Inhalation of large doses of cadmium can be fatal. Smaller doses can cause nausea, vomiting, and respiratory distress
2. Ingestion can also cause death. Smaller doses can lead to nausea, salivation, vomiting, diarrhea, and abdominal pain and discomfort. Cadmium is an oral poison, but the body's reaction to larger doses is very strong in vomiting and emetic action, rendering acute poisoning unlikely

C. Chronic Effects

1. Inhalation and ingestion of cadmium can have carcinogenic effects. Other long term effects are respiratory system and kidney damage

ATTACHMENT B-9

STANDARDS AND EXPOSURE GUIDE FOR CHEMICAL SUBSTANCES OF CONCERN

B. 9 STANDARDS AND EXPOSURE GUIDE FOR CHEMICAL SUBSTANCES OF CONCERN

B.9.1 RELEVANT STANDARDS AND EXPOSURE GUIDELINES:

- Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs)
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
- Washington Industrial Safety and Health Act (WISHA), General Occupational Health Standards, (PELs)

B.9.2 OCCUPATIONAL STANDARDS AND EXPOSURE GUIDELINES FOR CHEMICAL SUBSTANCES OF CONCERN

CAS No.	Substance	WISHA/ OSHA PEL	ACGIH TLV
7740-38-2	Arsenic and Compounds	10 $\mu g/M^3$ (1) 8-HR (2) TWA (3)	200 $\mu g/M^3$ TLV-TWA (4)
7439-92-1	Lead, Inorganic Fumes and Dusts (as Pb)	50 $\mu g/M^3$ 8-HR TWA	150 $\mu g/M^3$ TLV-TWA
7440-43-9	Cadmium Dust	5 $\mu g/M^3$ 8-HR TWA	5 $\mu g/M^3$ TLV-TWA

NOTES:
(1) $\mu g/M^3$ = micrograms per cubic meter
(2) HR = Hour
(3) TWA = Time Weighted Average, 8 hour day
(4) TLV-TWA = Threshold Limit Value, Time Weighted Average

ATTACHMENT B-10

PERSONNEL MONITORING PLAN

B.10 PERSONNEL MONITORING PLAN

Personnel monitoring will be conducted to monitor the adequacy of protective equipment and procedures selected for safety. This program, often referred to as industrial hygiene monitoring, will monitor the all the chemicals of concern in the air during removal of contaminated soils.

B.10.1 FENCED AREA

Respiratory protection ("Level C" PPE) and daily personnel monitoring will be required for equipment operators and laborers, if any, during removal of all source area soils (soil with arsenic concentrations greater than 3,000 mg/Kg). In addition, respiratory protection will also be required for sampling personnel if work is being performed nearby removing source area soils.

Respiratory protection and personnel monitoring will be required for equipment operators and laborers, if any, at the beginning of residential soil (soil with arsenic concentrations between 150 and 3,000 mg/Kg) removal until analytical results show levels are less than the PELs for three consecutive days. At that time, PPE requirements can be downgraded from "Level C" to "Level D".

If any personal results show levels above the PELs, activities will be re-evaluated and modified. Field personnel will remain in or revert to "Level C" PPE until analytical results are below the PELs for three consecutive days.

Sample collection is discussed further in Section B.10.3. The WISHA standards for chemicals of concern are as follows:

Chemical	PEL
Arsenic	10 ug/m^3, 8 hour TWA (WAC 296-62-07347)
Cadmium	5 ug/m^3, 8 hour TWA (WAC 296-62-07515)
Lead	50 ug/m^3, 8 hour TWA (WAC 296-62-07521)

B.10.2 RESIDENTIAL PROPERTIES

Respiratory protection and daily personnel monitoring will be required for operators and laborers, if any, at the beginning of the soil removal project until analytical results show levels are less than the PELs for three consecutive days. At that time, PPE requirements can be downgraded from "Level C" to "Level D".

If any personal results show levels above the PELs, activities will be re-evaluated and modified. Workers will revert to "Level C" PPE until analytical results are below the PELs for three consecutive days. Sample collection is discussed further in Section B.10.3.

B.10.3 SAMPLE COLLECTION

Samples will be collected using personal air quality samplers in accordance with NIOSH Method 7300. Standard operating procedures include:

- Sampling will be conducted over approximately seven to 10 hour periods when work is being performed.
- Remove red plug (save) and connect plastic filter cassette to Tygon tubing.
- Record the cassette number, date, approximate sampler location, and pump number on the sample form (see Figure B-10-1).
- Remove blue inlet plug from the filter holder (save).
- Turn pump on and adjust flow rate using digital readout. The setting on the rotameter will correspond as closely as possible to a flow rate of between 2.0 and 2.5 liters per minute as calibrated. Record flow setting and time to nearest minute on the sample form (see Figure B-10-1).
- Let sampler run during entire work day of operation or for a minimum of seven hours, whichever is longer.
- Turn pump off and record the flow setting on the rotameter and time pump is turned off on the sample form (see Figure B-10-1).
- Re-plug the filter cassette, fill out the proper paperwork, and ship cassettes and the sample form to a laboratory for analysis. Filters are mounted in cassettes by the

laboratory. Therefore, the filter must remain in the cassettes until received and analyzed by the laboratory.

The personal air samplers must be calibrated in accordance with procedures established under NIOSH. Pump-installed rotameters will be calibrated on a monthly basis using a precision calibrating rotameter. Airflow on the pumps will be checked before and after sampling with the pump-installed digital rotameter.

B.10.4 LABORATORY ANALYSIS

Samples will be analyzed using NIOSH Method 7900 – flame atomic absorption. Results will be submitted to Ecology in a computer file with the monthly report. Ecology will be immediately notified of any exceedance. Rush (24 hour turn-around time) analyses will be requested of the laboratory.

FIGURE B-10-1

PUMP #
898

PERSONAL AIR MONITORING

DATE _____

CONTRACTOR REPRESENTATIVE _____

TAG # _____

NAME _____

TITLE _____

AREA OF WORK _____

ACTIVITY _____

WEATHER

WIND DIRECTION & SPEED _____

SKY CLR, CLDY, PCLDY, FOG _____

TEMPERATURE (F) _____

PRECIPITATION RAIN, DRIZZLE, NONE _____

BAROMETRIC PRESSURE _____

STATION _____

PUMP # **898**

TIME ON _____

ROTO BALL ON 2.3

ROTO BALL OFF _____

TIME OFF _____

ELAPSED TIME _____

MEAN CORRECTED FLOW _____

COMMENTS

CALIBRATION DATE _____

PUMP ROTAMETER	MANO. AVG FLOW	TRIALS
		6
		6
		6
		6
		6

CALIBRATION PRESSURE _____ CALIBRATION TEMPERATURE (F) _____

PUMP READING	MEAN CORRECTED FLOW
2.5	-
2.3	
2.1	-
1.9	
1.7	-

ATTACHMENT B-11

PHYSICAL EXAMINATION PROGRAM

B.11 PHYSICAL EXAMINATION PROGRAM

All field personnel are required to participate in the Medical Surveillance Program and will undergo the following examination:

A. History and physical examination including:

1) Medical and occupational history, including smoking history
2) Vision testing with use of Titmus type instrumentation
3) Blood pressure, pulse rate, oral temperature
4) Height and weight
5) Physician-administered physical examination, including nasal and skin examination as per Arsenic Standard requirements (WAC 296-62-07347)

B. Chest X-ray; minimum of single view, 14"× 17" posterior-anterior, with interpretation (performed on initial examination and then every other year and at termination)

C. Complete blood count (CBC with differential)

D. Blood chemistry profile including:

Sodium Potassium	Uric Acid	SGPT
Creatinine	Glucose	Calcium
Phosphorus	GGT	SGOT
BUN	Alkaline Phosphatase	Cholesterol
HDL/Cholesterol Ratio	Triglyceride	Total Protein
Albumin	Total Bilirubin	T-4
LDH		

E. Urinalysis with microscopic exam

F. Pulmonary function test

G. Electrocardiogram

H. Blood lead

I. Urine arsenic

ATTACHMENT B-12

EMERGENCY NOTIFICATION CONTACTS

B.12 EMERGENCY NOTIFICATION CONTACTS

General Emergency Numbers

Fire Department	911
Ambulance	911
Police	911

Hospitals

Nearest Location:
Everett General Hospital
14th and Colby
Everett, WA
(425) 258-6300

Other Location:
Providence Hospital
916 Pacific Ave
Everett, WA
(425) 258-7123

Poison Control Center

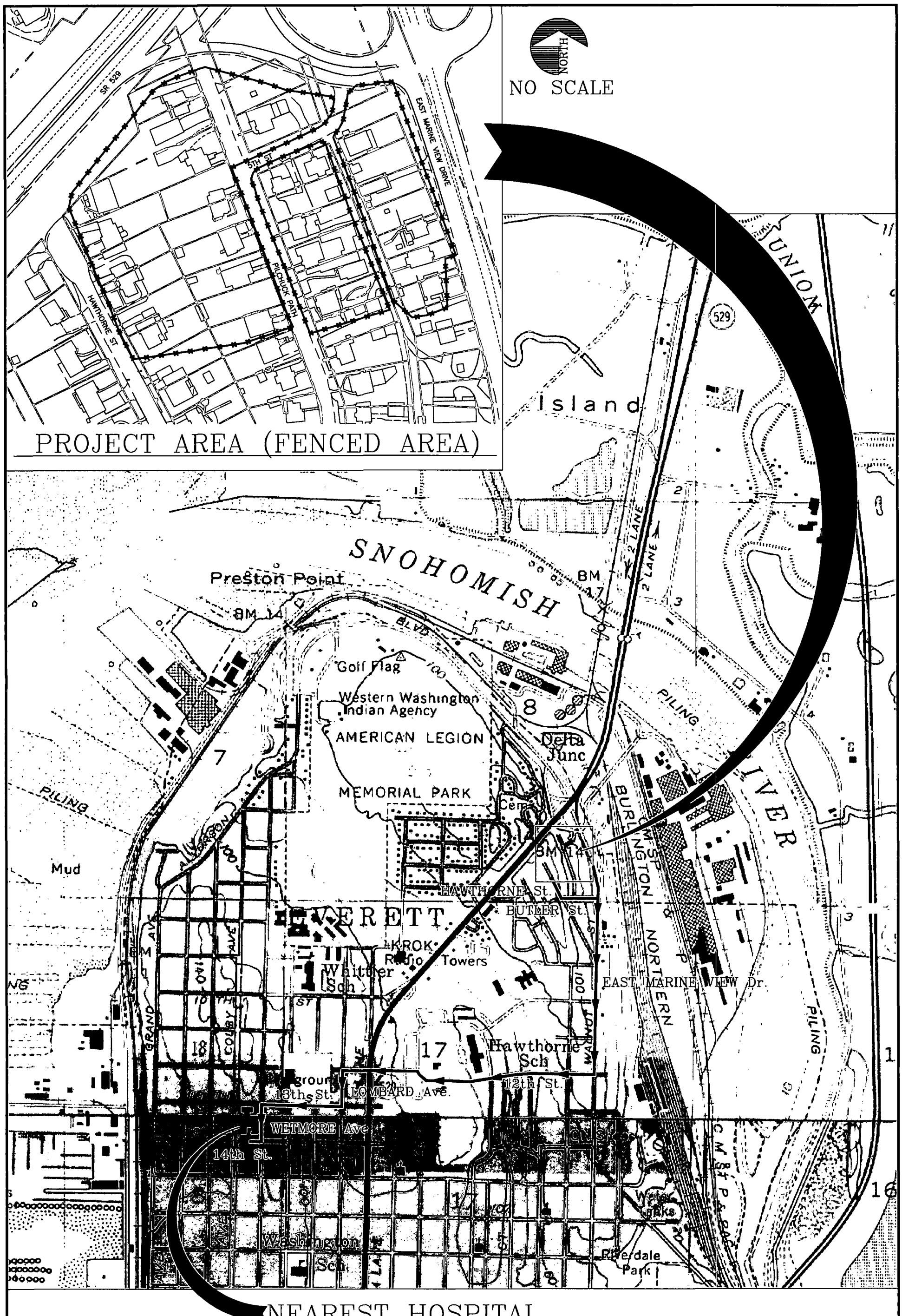
1-800-525-5042

Other Resources

National Response Center		(800) 424-8802
Superfund/RCRA Hotline		(800) 424-9346
TSCA Hotline		(800) 424-9065
Centers for Disease Control	Day:	(404) 329-3311
	Night:	(404) 329-2888
Washington State Department of Ecology General Information		(425) 649-7000

ATTACHMENT B-13

NEAREST HOSPITAL LOCATION MAP



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INTERIM ACTION REPORT
EVERETT SMELTER SITE
EVERETT, WASHINGTON

NEAREST HOSPITAL LOCATION MAP

FIGURE B-13-1

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ATTACHMENT B-14

FIRE PROTECTION PLAN

B.14 FIRE PROTECTION PLAN

This Fire Protection Plan shall be part of the HSP and is intended to make all field personnel aware of their roles in preventing and controlling fire while conducting interim action operations. Reasonable efforts to mitigate fire danger shall be employed by all personnel visiting or working at the site. The Project Health & Safety Officer shall enforce the provisions contained herein:

Specific precautions include the following:

1) All motor vehicles and equipment on-site shall be provided with exhaust spark arrestors approved by the State Fire Marshal or Underwriters Laboratories.
2) Smoking on-site is prohibited.
3) Welding equipment, grinders and open-flame devices shall not be used without a fire watch posted for a half hour beyond hot work.
4) Electrical equipment shall be maintained in good repair to prevent sparks.
5) All applicable portable extinguisher regulations shall be complied with.
6) All personnel on-site must be diligently observant for signs of fire or fire danger and report any signs of fire to the Site Health & Safety Officer immediately.
7) All visitors must be escorted when on-site.
8) All site SOPs shall be complied with.

The Site Health & Safety Officer, or in his/her absence, the Site Engineer, shall be the Incident Commander for all notification, evacuation, and response activities undertaken from initial discovery to completion of mop up EXCEPT when duly authorized Emergency Response Teams such as the Fire Department are on-site and have assumed that role.

In the event a fire is discovered, the following actions shall be taken:

1) Notice and Evacuation

a) Immediately notify the Site Health & Safety Officer.

b) Notify all personnel to evacuate the area as necessary except for those volunteering to fight the fire.

c) The Site Health & Safety Officer shall notify all other on-site personnel to evacuate the area as necessary.

d) The Site Health & Safety Officer shall notify the Fire Department via the 911 emergency system, and all other emergency contacts as he/she deems appropriate.

e) The Site Safety Officer will account for all personnel and notify emergency response personnel of any missing personnel.

2) Response

a) The Site Health & Safety Officer shall direct personnel and materials in fire suppression response activities until the Fire Department arrives. In cases of localized fire only, he/she may elect to suppress it without the aid of the Fire Department.

b) The Site Health & Safety Officer must prepare an incident report at the conclusion of the event, regardless of who responded to the incident.

Appendix C

APPENDIX C

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

Prepared for:

ASARCO Incorporated

Prepared by:

Asarco Consulting, Inc.
5219 N Shirley St
Suite100
Tacoma, WA 98407

December 2002

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SAMPLING AND ANALYSIS PLAN

This Sampling and Analysis Plan (SAP) is prepared to satisfy the requirements of WAC 173-340-820 and WAC 173-340-830 for the interim action. This SAP contains two sections:

- Sample Collection and Handling Procedures, and
- Laboratory Analysis Protocol and Data Management

The objective of this SAP is to provide a framework for sampling and analytical criteria and protocol to ensure that data of sufficient quality are obtained to support remedial action decisions. Soil samples will be collected from selected residential properties in the peripheral area, from the Former Arsenic Trioxide Processing Area (fenced area) and from import material sources including backfill and topsoil. In addition, storm drain sediment will be sampled from selected catch basins, storm water will be collected from selected catch basins and manholes, and groundwater will be sampled from selected monitoring wells.

1.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

1.1 SOIL SAMPLING PROCEDURES

1.1.1 Residential Properties

Soil sampling will include the collection of composite and discrete samples for performance monitoring. Discrete samples will be collected from a specific depth interval from a specific borehole. Composite samples will consist of mixing a portion of all discrete samples from the same depth interval from boreholes within a unique decision unit. Therefore, composite samples will represent a given depth interval for a specific decision unit (e.g., the 24-30 inch depth interval in a front yard).

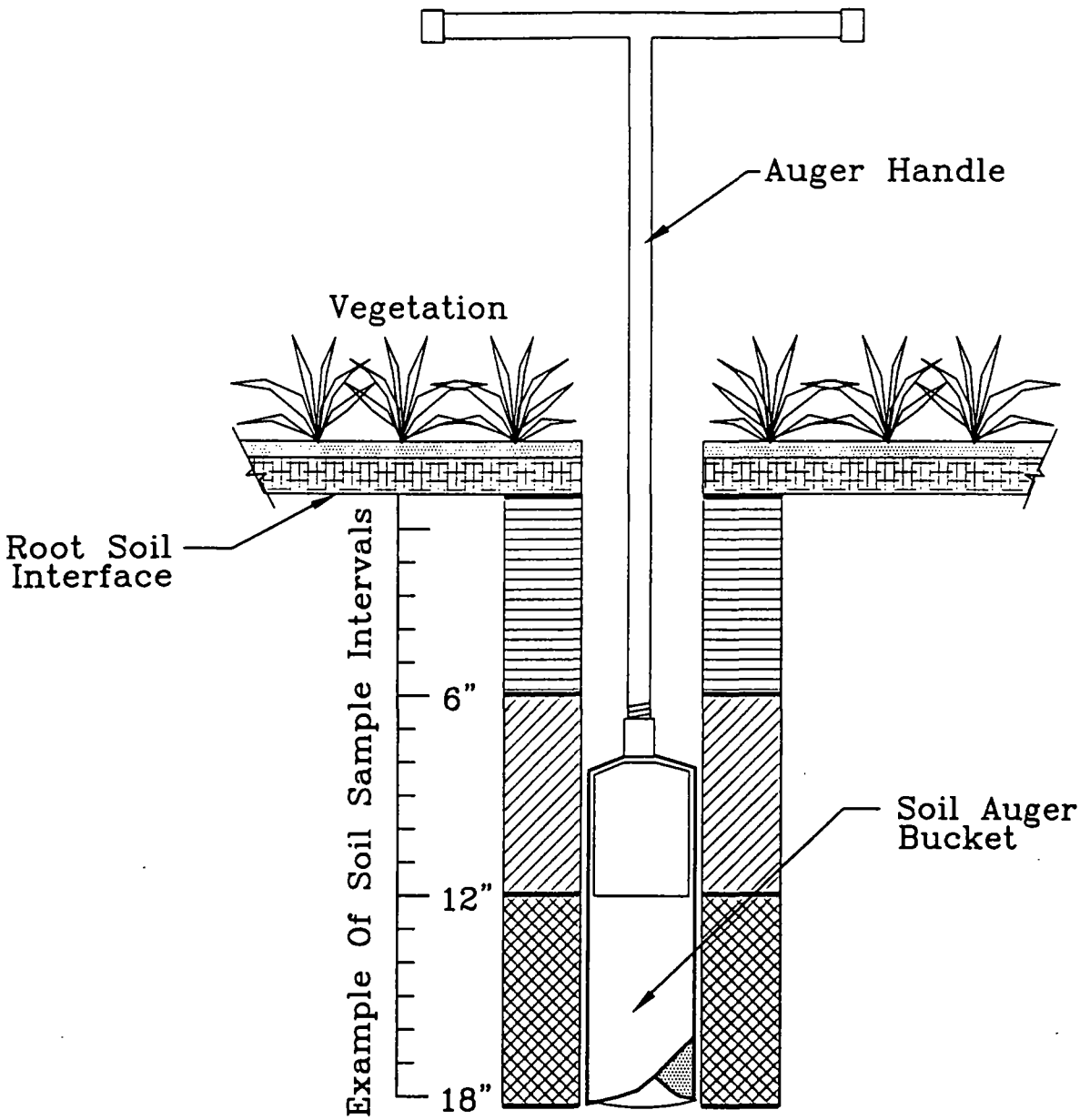
Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the frequency of composite and discrete samples as well as sample designation. All bore hole locations will be documented on site maps. Surveying the boreholes will not be necessary.

It is anticipated that the soil samples will be collected using a soil recovery auger that is 2 inches in diameter by 6 inches long (see Figure C-1-1). Samples collected from the soil recovery auger will be removed with a screwdriver or similar instrument. The discrete sample will be placed in a stainless steel bowl and homogenized. A portion of each homogenized sample will be placed in another stainless steel bowl designated for compositing. Discrete and composite samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled. Following completion of soil bore sampling, excess soil cuttings, if any, will be returned to the excavation area. Subsequently, the boreholes will be filled with backfill material during soil replacement.

During confirmational monitoring, samples will be collected using a portable powered split spoon sampler (see Figure C-1-2) or a small drill rig. Excess soil cuttings, if any, will be returned to the borehole. Since most of the bore hole soil will have been removed for sampling purposes, the remaining portion of the bore hole will be filled with bentonite chips and potting soil followed by replacement of the root grass turf cap that was previously removed.

1.1.2 Fenced Area

Soil sampling will include the collection of composite and/or discrete samples for all three phases of performance monitoring. The discrete sample will be placed in a stainless steel bowl and homogenized. A portion of each homogenized sample will be placed in another stainless steel bowl designated for compositing. Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the frequency of composite and discrete samples as well as sample designation.



Note: The top of the soil profile is defined as that interface between mineral soil and the root mat.

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ASARCO INCORPORATED INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX C - EVERETT, WASHINGTON -	SOIL SAMPLE RECOVERY AUGER SCHEMATIC	FIGURE C-1-1

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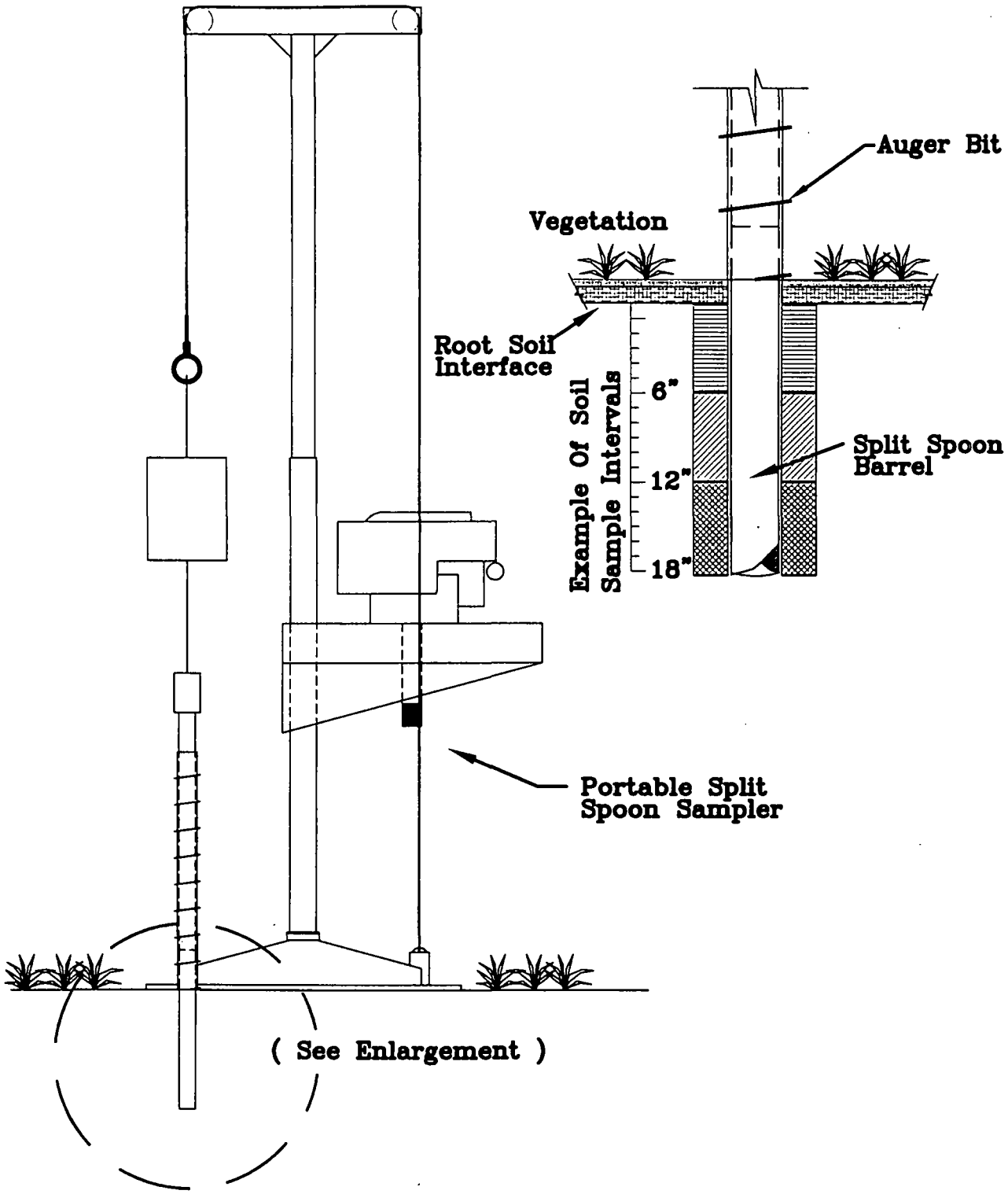

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ASARCO INCORPORATED INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX C - EVERETT, WASHINGTON -	SPLIT SPOON SAMPLER SCHEMATIC	FIGURE C-1-2

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Phase 1 sampling will be conducted following the removal of soils with arsenic concentrations greater than 3,000 mg/Kg. Phase 2 sampling will be conducted following the removal of soils with arsenic concentrations greater than 150 mg/Kg. Phase 3 sampling will be conducted following the cut and fill operations prior to backfilling import material.

Prior to sampling, the grids (decision units) will be surveyed and marked by the field engineer with either stakes, flags, or paint. The area of the decision unit will be measured and subsequently, will determine the required number of sample locations. All sample locations will be documented on site maps. Surveying the sample locations will not be necessary.

During Phase 1 sampling, only composite samples will be collected from the excavation floor of each decision unit and outer perimeter of certain decision units. During Phase 2 sampling, composite and discrete samples will be collected from the excavation floor of each decision unit and outer perimeter of certain decision units. Composite floor samples will consist of mixing a portion of all respective discrete samples from a given decision unit. Composite perimeter samples will represent a specific depth interval from a given decision unit. During Phase 3 sampling, only discrete samples will be collected from each decision unit.

The samples will be collected using a hand trowel or auger. In locations where excavation areas or conditions are not suitable for man entry because of safety concerns, samples will be obtained directly from the backhoe bucket. Discrete and composite samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled.

During confirmational monitoring, samples will be collected using a portable powered split spoon sampler or drill rig, depending on selected location and termination depth. Excess soil cuttings, if any, will be returned to the borehole. Since most of the bore hole soil will have been removed for sampling purposes, the remaining portion of the bore hole will be filled

with bentonite chips and potting soil followed by replacement of the root grass turf cap that was previously removed.

1.1.3 Import Material

Backfill and topsoil samples will be collected with a hand trowel at the supplier's location. Samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.1.4 Storm Drain Sediment

Sediment samples will be collected with a hand trowel or a conventional shovel upon removing the catch basin cover. Samples will be double bagged using new, one-gallon size zip-lock storage bags and labeled.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.2 WATER SAMPLING PROCEDURES

1.2.1 Surface Water

Grab samples of storm water runoff will be collected from catch basins and manholes. Sample bottles will be filled directly from the runoff stream at the selected catch basins. At manholes, a peristaltic pump may be used.

Samples collected for dissolved parameters will be filtered using a disposable 0.45-micron filter. Both filtered and unfiltered samples will be preserved and chilled to 4 degrees Celsius in the field. Pre-cleaned, contaminant-free sample containers that are provided by the laboratory will be used.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation.

1.2.2 Groundwater

Prior to sampling, depth to groundwater will be recorded for each monitoring well. The water level elevations will then be calculated to common datum to develop a potentiometric map for interpretation of groundwater flow directions for both the shallow and deep aquifers.

Monitoring wells will be purged and sampled using a portable peristaltic pump or equivalent, which purges water at a slow rate (less than 0.25 gpm) to minimize the potential for turbidity in the sample. Management of purged water is discussed in Section 1.3.2.

Samples collected for dissolved parameters will be filtered in the field using a disposable 0.45-micron filter. Both filtered and unfiltered samples will be preserved and chilled to 4 degrees Celsius in the field. Pre-cleaned, contaminant-free sample containers that are provided by the laboratory will be used for sample collection.

Refer to the Compliance Monitoring Plan (Appendix A) for discussion on the sample frequency and sample designation. In addition to the required analyses specified by the FCAP, samples will have pH, specific conductivity, turbidity, dissolved oxygen, temperature, and salinity measured in the field.

1.3 WASTE MANAGEMENT AND DECONTAMINATION PROCEDURES

1.3.1 Soil and Sediment

Specific waste material management procedures will not be required. Sampling activities will not require containerization of soil waste because excess soil cuttings, if any, will be returned to the excavation area or bore hole. If PPE is worn such as tyvek suits and latex gloves, it will be managed as typical solid waste.

Sampling equipment will be decontaminated between sampling locations and depth intervals using a metal-free detergent wash such as alconox followed by tap water and deionized water rinses. Wash waters will be changed frequently and thereby will not contain significant concentrations of metals. Wash water from sampling equipment decontamination will be periodically applied to selected areas in a manner so that runoff or ponding does not occur.

1.3.2 Surface Water and Groundwater

Specific waste material management procedures will not be required for surface water sampling. However, the situation is different for groundwater sampling due to the requirement of purging monitoring wells that may contain higher concentrations of contaminants. Purge water will be containerized in 55 gallon drums. Containerized water will be sampled and analyzed for arsenic. If concentrations are less than 0.5 mg/L, it will be discharged to the City of Everett's combined sewer system in accordance with Asarco's discharge authorization permit No. 144-97. If concentrations exceed 0.5 mg/L, the drums will be managed through a permitted disposal facility. If PPE is worn such as tyvek suits and latex gloves, it will be managed as typical solid waste.

Sampling equipment will be decontaminated between monitoring sites using a metal-free detergent wash such as alconox followed by tap water and deionized water rinses. Wash waters will be changed frequently and thereby will not contain significant concentrations of metals. Wash water from sampling equipment decontamination will be periodically applied to selected areas in a manner so that runoff or ponding does not occur.

1.4 SAMPLE DOCUMENTATION

Sampling information including sample numbers, sampling date, and sampling time, will be recorded in the field sampler's log book to allow positive identification of samples.

Documentation of all samples will be an important aspect of the project quality assurance program. Sample documentation will involve use of the following:

- Sample Identification (Labeling Bags or Using Labels)

- Chain-of-Custody Forms
- Field Notebooks

1.4.1 Sample Identification

Sample identification will consist of labeling the bag or labels to identify each sample. Each designated sample number will be written on the respective bag or label as well as being recorded in the field notebook and on the chain-of-custody form. The information recorded will include the following:

- Date. A six-digit number indicating the year, month and day of collection (for example, 07/01/03 for July 1, 2003).
- Time. A four-digit number indicating the 24-hour clock time of collection (for example, 1345 for 1:45 p.m.).
- Sampler. The sampler's name.
- Analysis. The type of analysis requested (for example, total arsenic).
- Sample Number. A unique number as discussed in the Compliance Monitoring Plan (Appendix A).

Since soil sample containers will consist of two one-gallon zip-lock storage bags (one inside the other), the inside bag with the sample will be labeled. If labels are used, they will be inserted between the outer bag and the inner bag of individual soil samples. After collection, separation, and identification, the sample will be handled using chain-of-custody procedures.

1.4.2 Transfer of Custody and Shipment

Samples collected must be traceable from the time the samples are collected until they are analyzed. To document sample possession, the chain-of-custody procedure is followed.

Samples will be accompanied by a chain-of-custody form. When transferring samples, the individuals relinquishing and receiving will sign, date and note the time on the form. The method of shipment, courier name(s) and other pertinent information is entered in the

"Remarks" section of the chain-of-custody form. This form documents sample custody transfer from the sampler, often through another person (shipper), to the analyst at the laboratory.

The person relinquishing the samples to the laboratory will request the chain-of-custody form, with the signature of a representative of the party acknowledging receipt of the samples. If the samples are not hand-delivered, the laboratory will send the copy of the signed chain-of-custody form to the Project Manger.

All shipments will be accompanied by the chain-of-custody form identifying its contents. The original record will accompany the shipment. Also, freight bills, Postal Service receipts and Bills of Lading will be retained as part of the permanent documentation if used.

1.4.3 Field Notebooks

A bound field notebook(s) must be maintained by the Field Team Leader to provide a daily record of significant events, observations, and measurements during sampling events. All entries will be signed and dated. All members of the field investigation will use this notebook and it will be kept as a permanent record.

1.4.4 Corrections to Documentation

All original data will be recorded in field notebooks or labels and chain-of-custody forms with waterproof ink. None of these documents will be destroyed or discarded.

If an error is made on a document, corrections will be made by crossing a line through the error and entering the correct information. The erroneous information should not be obliterated. All corrections must be initialed.

1.5 SAMPLE HANDLING

An important aspect of obtaining representative samples of some media is proper preservation and storage prior to analysis. All samples will be labeled with waterproof ink

and stored in metal or plastic coolers for shipment or delivery to the laboratory along with the chain-of-custody form. For all coolers that are shipped rather than delivered, a custody seal will be placed on the front and back of the cooler lid and overlapped with clear strapping tape.

No preservatives will be required for soil or sediment samples. The maximum holding time for most soil and sediment samples collected will be six (6) months. Note that the holding time is recommended for general total metal analyses for soil samples. This recommended holding time will not prevent some sample material remaining after analyses from being archived. Archived samples will be kept in a secured area. All water samples will be properly preserved and chilled as discussed in Section 2.4.2.

1.6 FIELD QUALITY CONTROL AND SPLIT SAMPLES

Field quality control samples will be used to provide quality assurance for field sampling and subsequent laboratory analysis. The field quality control sampling will consist of field duplicates and field rinsate blank samples. Field duplicates will assess the reproducibility of sample collection procedures as well as analytical reproducibility. Rinsate blanks will identify the potential for cross-contamination.

For soil and sediment samples, field duplicates will be obtained at a frequency of 1 per 20 collected samples or 1 per day, whichever is greater. For groundwater and surface water samples, field duplicates will be obtained at a frequency of 1 per 10 collected samples or 1 per day, whichever is greater. Field duplicates for soil and sediment samples will be split in the field during sample collection. Field duplicates for water samples will be collected by filling two sample containers consecutively from the sampling location.

For soil and sediment samples, rinsate blanks will be collected by pouring rinsate water over the sampling equipment into the same containers used for water samples when it is being decontaminated. For water samples, rinsate blanks will consist of aqueous rinsate collected into the same containers used for water samples from the filter apparatus prior to the

collection of sample. Rinsate samples will be collected once per event including residential sampling, phase 1 sampling in the fenced area, phase 2 sampling in the fenced area, phase 3 in the fenced area, sediment sampling, all storm water sampling events if a peristaltic pump is used, and each groundwater sampling event.

In addition to duplicate and rinsate samples, blind field standards will be purchased and submitted for groundwater sampling events. Based on availability, one standard will be submitted per major sampling event.

Split samples will be collected for Ecology's field representative upon request at the time of sample collection. Ecology will provide sampling containers for the split samples. Whenever samples are split, it will be noted in the "Remarks" section of the chain-of-custody form. The note indicates with whom the samples are being split and will be signed by both the sampler and recipient.

As noted in the Compliance Monitoring Plan (Appendix A), many discrete samples, particularly with residential properties, may not contain a sufficient quantity of material to split. In addition, split samples for groundwater and or surface water will be obtained by collecting the sample from the same sampling location in immediate succession of the original sample.

2.0 LABORATORY ANALYSIS PROTOCOL AND DATA MANAGEMENT

This section describes laboratory protocol including quality assurance procedures to be employed during sample analysis and data generation. Designation of quality assurance and quality control (QA/QC) objectives and of specific analytical techniques for determining parameter concentrations will ensure that data of known and acceptable quality are collected.

The following subsections present in detail the laboratory analytical requirements and quality assurance objectives including:

- Projected Data Uses and Needs,
- Organization and Responsibilities,
- Custody Procedures,
- Analytical Methods,
- Quality Assurance Objectives,
- Data Reduction, Validation, and Reporting,
- Audits,
- Preventive Maintenance, and
- Corrective Actions.

2.1 DATA USES AND NEEDS

Generally, the soil data collected under this plan from excavation areas will be used to determine what decision units require additional soil removal in order to meet the appropriate remediation level. Data generated from import material, sediment, surface water, and ground water analyses will be used to assess overall cleanup goals, chemical quality trends, and disposal requirements.

2.2 ORGANIZATION AND RESPONSIBILITIES

This plan will be administered under the Project Manager who is responsible for the content and implementation. The Project Manager will be responsible for assigning each task and ensuring its completion under the plan and will serve as the central contact regarding sample and analysis issues for the site. The Project Manager is also responsible for revisions to the plan or procedures and to ensure that the applicable personnel and agencies are made aware of those revisions.

Field sampling activities will be the responsibility of the Field Supervisor as well as ensuring that the sampling and documentation protocols are provided to the field crews and that the field crews implement these procedures properly. The Field Supervisor will interact with the Project Manager and QA Officer to ensure procedures are up-to-date and correct.

Quality assurance including validation and report preparation is the primary responsibility of the QA Officer. However, meeting QA objectives depends on all project members. The QA Officer's responsibilities include:

- Overview QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions

Laboratory Managers are responsible for ensuring the lab resources are available as required and overview preparation of data reports. They are responsible for coordination of project requirements including:

- In-house chain of custody
- Scheduling sample analysis
- Overseeing data review
- Preparation of analytical data reports
- Approval of final reports prior to submission to the field investigation project manager.

- Designate a Laboratory Sample Custodian.

Asarco will identify the Project Manager, Field Supervisor, QA Officer, and Laboratory Managers prior to beginning the work. In addition, Asarco will submit the office locations and telephone numbers of the identified individuals to Ecology.

2.3 CUSTODY PROCEDURES

Custody procedures begin prior to sample analysis and help to satisfy the two major requirements of admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is under custody if:

- The item is in actual possession of a person; or
- The item is in the view of the person after being in actual possession of the person; or
- The item was in actual physical possession but is locked up to prevent tampering: or
- The item is in a designated and identified secure area.

2.3.1 Field Custody Procedures

Field custody procedures are described in Section 1.4.2.

2.3.2 Laboratory Custody Procedures

Each Laboratory Manager will designate a Laboratory Sample Custodian. The Laboratory Sample Custodian is responsible for internal laboratory custody procedures. Procedures to be followed by the Laboratory Sample Custodian at each laboratory include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers;
- Signing the appropriate documents;
- Verifying chain-of-custody and its correctness;
- Notifying the Laboratory Manager of sample receipt and inspection;

- Entering each sample container into the sample receiving log;
- Transferring samples to appropriate lab sections; and
- Controlling and monitoring access/storage of samples and extracts.

2.3.3 Final Evidence Files

The final evidence file will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities. The final evidence file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs, if any
- Drawings
- Data validation reports
- Progress reports
- All custody documentation (tags, forms, airbills, etc.)

2.4 ANALYTICAL METHODS

The majority of the laboratory analyses will be soil samples analyzed for arsenic by utilizing a Spectrace Model 5000 Energy Dispersive X-Ray Fluorescence Spectrometer (XRF). This includes the soil samples collected to determine if remediation levels are met at residential properties and the fenced area. The EPA has approved the use of XRF methods for soil sampling at several Superfund sites and Ecology's Southwest and Northwest Regional Offices have approved the XRF for several MTCA sites as well.

The XRF provides rapid analytical turnaround time, if needed, and accurate, cost-effective measurements of soil metal concentrations. It is also a non-destructive method, allowing samples to be retained for future additional analysis if necessary.

The XRF will also be used to analyze most inorganic chemicals for sediment, backfill, and topsoil samples. Inorganic parameters for soil and sediment samples not analyzed by the XRF is further discussed in Section 2.4.1.3.

2.4.1 XRF Procedures

The following discusses key points of the instrument and procedure.

Theory of Operation

XRF analysis measures the fluorescence intensity of a sample. The XRF analytical procedure uses an X-ray source to bombard the sample with X-rays, which in turn causes elements in the sample to produce a specific spectral emission pattern. Element concentrations in the soil sample are quantified by comparing the intensities of spectral emissions in the sample to an initial calibration curve generated from standards with known concentrations. Concentrations will be determined by using the following equations (derived from regression equations): concentration = (fluorescence intensity – y intercept / slope).

Initial calibrations may be performed with standard reference materials (fundamental parameters method) or with well characterized samples from the area under investigation (site-specific or matrix-specific method).

Initial Instrument Calibration

The fundamental parameters method was chosen for the initial calibration for this interim action. This selection was based on the potential to receive several physical types of soil samples including smelter debris, fill, till, topsoil, sediment, etc. This method is more quickly and easily employed than a matrix specific method which would require a specific calibration for each material type with additional calibration efforts for the large concentration ranges expected.

Detection Limit Performance Requirements

The XRF instrument will be required to achieve specified detection limits in order to provide the necessary information for making remedial decisions. The lowest possible detection limits have been established to attain Ecology requirements for cleanup standards and remediation levels while ensuring the highest possible level of precision. The instrument detection limit (IDL) for the parameters to be analyzed are listed in Table C-2-1.

Because the detection limits are precision (i.e., repeatability) dependent, some parameters cannot be analyzed by the XRF because the listed standard is too low. As XRF results increase numerically, it is easier to attain the required precision. If the IDL is higher than the required standard, then that parameter will be analyzed by wet chemistry methods rather than by the XRF. As shown on Table C-2-1, cadmium and mercury will not be analyzed by the XRF due to the respective IDLs. In addition, beryllium, selenium, and thallium do not have available standards for the XRF. Therefore, required beryllium, cadmium, mercury, selenium, and thallium analyses for import material (backfill and topsoil) will not be analyzed by the XRF. In addition, required thallium analyzes for sediment samples will not be analyzed by the XRF.

A recommended six-month holding time is presented in SW-846 for most inorganic soil analyses using wet chemistry methodologies. The exception is mercury which has a recommended 28 day holding time. It should be noted that these holding times do not affect metal analyses by XRF. Therefore, remaining sample portions will be archived for future analyses, if needed, for the duration of the project. If a sample(s) is selected to be analyzed at a later date that exceeds the holding time, the results will still be acceptable.

TABLE C-2-1. XRF SOIL AND SEDIMENT ANALYSES

Parameter	Digestion Or Extraction	IDL (mg/Kg)	Standard (mg/Kg)	MTCA METHOD	HOLDING TIME
Antimony	None	30	32 (a,b)	B	6 months
Arsenic	None	10	20 (a,b,c)	A	6 months
Beryllium	None	NA	160 (b)	B	6 months
Cadmium	None	10	2 (a,b)	A	6 months
Chromium	None	20	100 (b)	A	6 months
Copper	None	10	2,960 (b)	B	6 months
Lead	None	10	250 (a,b)	A	6 months
Mercury	None	10	1 (a,b)	A	28 days
Nickel	None	20	1,600 (b)	B	6 months
Selenium	None	NA	400 (b)	B	6 months
Silver	None	20	400 (b)	B	6 months
Thallium	None	NA	5.6 (a,b)	B	6 months
Zinc	None	10	24,000 (b)	B	6 months

Note: NA – not analyzed by XRF method

Method B value obtained from CLARC spreadsheet

(a) - sediment
(b) - backfill and topsoil
(c) - soil in excavation area

Laboratory Quality Control Checks

In addition to XRF detection limit performance requirements, laboratory quality control measures will be employed to ensure data quality. Quality control measures used to ensure the integrity of the XRF calibration will include using the laboratory control standard (LCS), continuing calibration verification (CCV) samples, and confirmation samples.

Use of LCS and CCV samples will determine the accuracy of XRF analyses. See Section 2.5.2 for a more detailed discussion on accuracy. A summary of XRF data quality control limits is presented in Table C-2-2.

TABLE C-2-2. XRF QUALITY CONTROL LIMITS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Instrument Calibration	Yearly	Acceptable correlation coefficient of ≥ 0.995	Recalibrate
Instrument Detection Limit (IDL) determination	Once per year following calibration	IDL less than the identified standard	Recalibrate
Check system status display	Daily, before calibration check standard run	No unusual changes in system status	Correct problem, recheck system status
Energy Calibration	Daily	Successful completion	Correct problem, recalibrate
Intensity Correction Standard	Daily, before sample runs	Within ±5% of standard's intensity at the time of calibration	Correct problem, rerun intensity correction standard
Laboratory Control Standard (LCS)	Minimum of 1 per 24 hour, prior to analyses run	Recovery of 75% to 125% or within 95% confidence limits for standard	Rerun standard, if still not within limits, correct problem and rerun standard
Continuing Calibration Verification (CCV)	One per run (up to 14 samples)	Recovery of 75% to 125% or within 95% confidence limits for standard	Rerun samples associated with CCV, if still not within limits, correct problem and rerun associated samples
Laboratory Duplicates	One per run (up to 14 samples)	RPD of $\leq$ 35% or ±2X PDLG for samples <5X PDLG	Flag associated sample results with "OUT"

Results of QC checks will be evaluated during the data validation procedure (see Section 2.6.2).

XRF results will also be confirmed by wet chemistry analytical methodologies. At a frequency of 1 per 50 samples analyzed by XRF, randomly selected samples will be split and submitted for traditional wet chemistry analyses. The purpose of confirmation sample analysis is to evaluate the comparability of XRF-generated data to data generated by wet chemical methods, thereby ensuring that systematic errors in quantification are not occurring. In general, experience with XRF soil analysis has shown that XRF provides results that are equivalent to other analytical methods (wet chemistry) for the determination of total element concentrations in soil. However, is should be noted that sample inhomogeneity and difficulties associated with complete digestion of a solid sample may contribute to differences between reported XRF and wet chemistry sample concentrations.

The results of wet chemistry analysis will be compared to XRF results using the following data analysis techniques:

- Calculation of relative percent differences (RPD) will be calculated for XRF sample/confirmation sample pairs using the same formula used for field and laboratory duplicated pairs.
- Calculation of Recovery Rate - percent recoveries, calculated as [(XRF concentration/wet chemistry concentration) x 100], will be determined for each confirmation pair.
- Linear Regression - regression analysis of XRF vs. wet chemistry data will be performed and the resulting coefficient of determination (R^2) and slope and intercept of the regression line will be compared to the "ideal" comparison values of slope = 1 and y-intercept = 0.

Confirmation sample results will be presented as part of the validation report. It should be noted that RPDs calculations will not be used to qualify (flag) samples in the database.

Sample Preparation

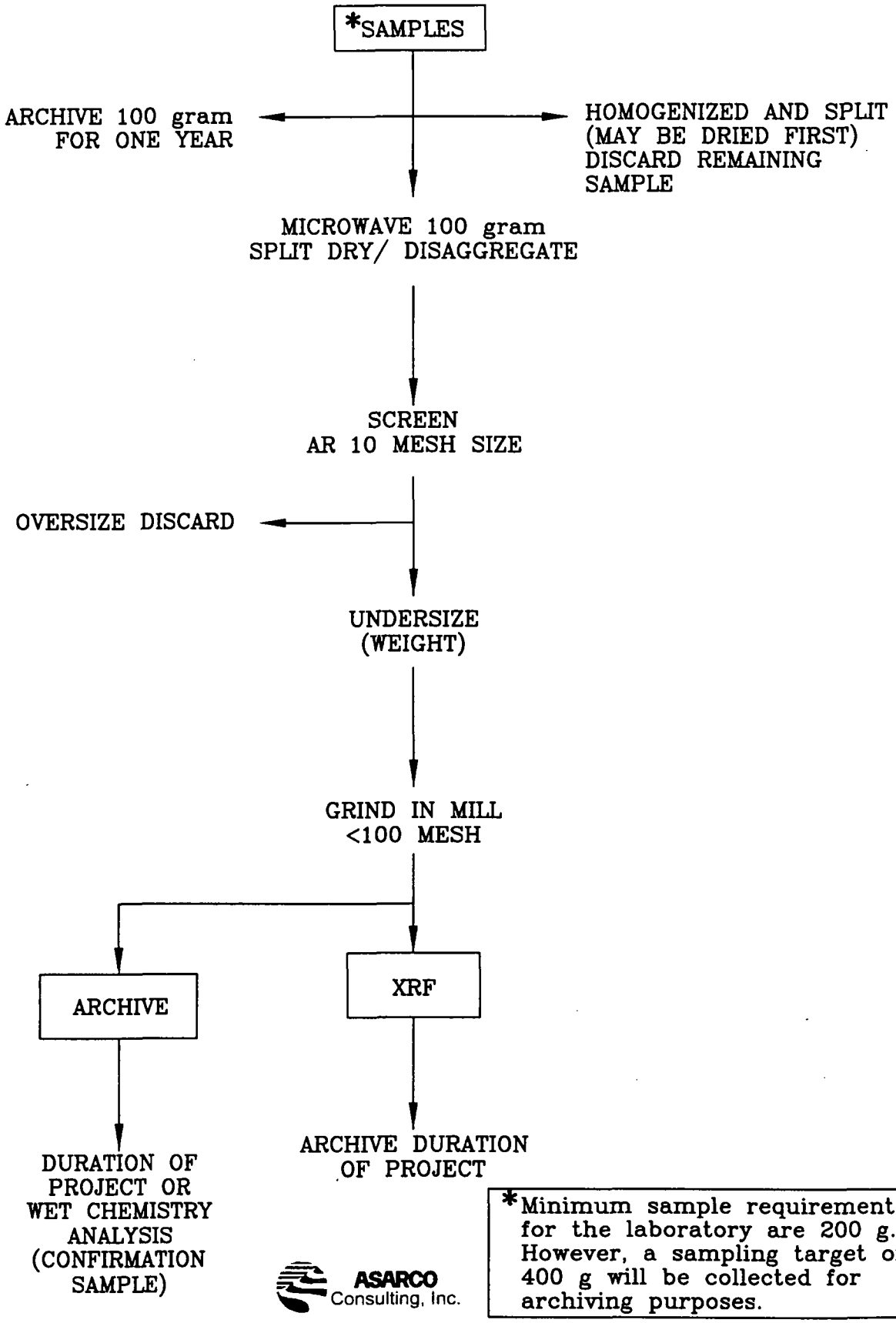
A sample preparation diagram for XRF analysis is shown in Figure C-2-1. Samples will be homogenized and split using the "cone and quartering" method. A split of 100 grams will be dried in a microwave or conventional soil drying oven and disaggregated using a 10-mesh sieve.

The sample portion that remains on the 10-mesh sieve will be discarded and the portion of the sample that passes through the sieve will be mill ground to less than 100-mesh size. The remaining unused sample will be archived for the duration of the project.

Ten grams of ground sample will be used for XRF analysis. The remaining ground sample will be marked and archived for the duration of the project or sent for confirmation wet chemistry analysis. Prepared XRF samples will be marked and archived in XRF sample cups for the duration of the project.

Sample Cleanup

Sample handling equipment will be decontaminated between samples by cleaning the preparation area with a fine bristled brush. Disposable containers will be used for sample drying and compressed air will be used to remove fine-grained soil and dust material. The sample-grinding mill will be decontaminated using compressed air to remove residual dust. Archived samples will be stored and locked in a secure area, and will be available for additional testing, if necessary.



ASARCO Consulting, Inc.

ASARCO INCORPORATED INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX C – EVERETT, WASHINGTON –	SOIL SAMPLE PREPARATION AND HANDLING FOR XRF ANALYSIS	FIGURE C-2-1

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2.4.2 Wet Chemistry Procedures

Wet chemistry analytical procedures will be used to analyze soil and sediment samples for inorganic parameters that cannot be analyzed by the XRF (beryllium, cadmium, mercury, selenium, and thallium) as well as XRF confirmation samples. In addition, wet chemistry procedures will be used to analyze all water samples and soil samples for organic parameters.

Soil and sediment samples will be digested in accordance with the appropriate mineral acid digestion procedure. However, XRF confirmation sample analyses will use a strong or total acid (HF) digestion.

Selected laboratories will implement standard operating procedures and following appropriate methods based on SW-846 for sample analyses. A summary of test methods that will be employed for soil and sediment samples are listed in Table C-2-3 while water sample tests are in Table C-2-4.

Calibration Procedures

The laboratories will maintain sample logbooks for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run and the samples associated with these calibrations. Calibration of laboratory equipment will be performed in accordance with SW-846 procedures. Records of calibration, repairs, or replacement will be filed and maintained. These records will be filed at the location where the work is performed.

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES

Parameter	Digestion Or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
Antimony	3050	6010B	1.16	32 [a,b,d]	B	6 months
Arsenic	3050	6010B	1.49	20 [a,b,c,d]	A	6 months
Beryllium	3050	6010B	0.009	160 [b,d]	B	6 months
Cadmium	3050	6010B	0.029	2 [a,b,d]	A	6 months
Chromium	3050	6010B	0.048	100 [b,d]	A	6 months
Copper	3050	6010B	0.2	2,960 [b,d]	B	6 months
Cyanide	335.2	335.2	0.13	1,600 [d]	B	6 months
Lead	3050	6010B	0.62	250 [a,b,d]	A	6 months
Mercury	7471	7471	0.0047	1 [a,b,d]	A	28 days
Nickel	3050	6010B	0.093	1,600 [b,d]	B	6 months
PCBs (Aroclor's 1016, 1221, 1232, 1242, 1248, 1254, 1260)	3550	8082	0.003	1 [d]	A	14 days
Selenium	3050	6010B	1.45	400 [b,d]	B	6 months
Silver	3050	6010B	0.058	400 [b,d]	B	6 months
Thallium	3050	6010B	1.78	5.6 [a,b,d]	B	6 months
Zinc	3050	6010B	0.16	24,000 [b,d]	B	6 months
Organochlorine Pesticides						
Aldrin	3550	8081	0.0001	0.0588 [d]	B	14 days
alpha-BHC	3550	8081	0.00004	NL	-	14 days
Alpha-Chlordane	3550	8081	0.0001	NL	-	14 days
beta-BHC	3550	8081	0.0003	NL	-	14 days
Chlordane	3550	8081	0.0025	2.86 [d]	B	14 days
4,4-DDD	3550	8081	0.0002	547 [d]	B	14 days
4,4-DDE	3550	8081	0.0002	386 [d]	B	14 days
4,4-DDT	3550	8081	0.0004	1 [d]	A	14 days
delta-BHC	3550	8081	0.0002	NL	-	14 days
Dieldrin	3550	8081	0.0004	0.0625 [d]	B	14 days
Endosulfan I	3550	8081	0.00009	480 [d]	B	14 days
Endosulfan II	3550	8081	0.0001	480 [d]	B	14 days
Endosulfan Sulfate	3550	8081	0.0006	NL	-	14 days
Endrin	3550	8081	0.0002	24 [d]	B	14 days
Endrin Aldehyde	3550	8081	0.0004	NL	-	14 days
Endrin Ketone	3550	8081	0.0003	NL	-	14 days
gamma-BHC (Lindane)	3550	8081	0.0001	1 [d]	A	14 days
Gamma-Chlordane	3550	8081	0.0001	NL	-	14 days
Heptachlor	3550	8081	0.0002	0.222 [d]	B	14 days
Heptachlor Epoxide	3550	8081	0.00009	0.11 [d]	B	14 days
Methoxychlor	3550	8081	0.0014	400 [d]	B	14 days
Toxaphene	3550	8081	0.0161	0.909 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
SVOCs						
Acenaphthene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Acenaphthylene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzidine	3550	8270	0.677	0.043 [d]	B	14 days
Benzo(a)anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzofluoranthene (PAH)	3550	8270	0.0267	1 [d]	A	14 days
Benzoic Acid	3550	8270	0.667	320,000 [d]	B	14 days
Benzo(ghi)perylene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzo(a)pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Benzyl Alcohol	3550	8270	0.133	24,000 [d]	B	14 days
bis(2-Chloroethoxy)methane	3550	8270	0.133	NL	-	14 days
bis(2-Chloroethyl)ether	3550	8270	0.133	0.909 [d]	B	14 days
bis(2-Chloroisopropyl)ether	3550	8270	0.133	3,200 [d]	B	14 days
bis(2-Ethlyhexyl)phthalate	3550	8270	0.133	71.4 [d]	B	14 days
4-Bromophenylphenylether	3550	8270	0.133	NL	-	14 days
Butylbenzylphthalate	3550	8270	0.133	16,000 [d]	B	14 days
Carbazole	3550	8270	0.133	50 [d]	B	14 days
4-Chloroaniline	3550	8270	0.133	320 [d]	B	14 days
4-Chloro-3-methylphenol	3550	8270	0.133	NL	-	14 days
2-Chloronaphthalene (PAH)	3550	8270	0.013	1 [d]	A	14 days
2-Chlorophenol	3550	8270	0.013	400 [d]	B	14 days
4-Chlorophenylphenylether	3550	8270	0.133	NL	-	14 days
Chrysene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Decane	3550	8270	0.133	NL	-	14 days
Dibenzo(a,h)anthracene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Dibenzofuran	3550	8270	0.133	-	NS	14 days
2,3-Dichloroaniline	3550	8270	0.133	NL	-	14 days
1,2-Dichlorobenzene	3550	8270	0.133	7,200 [d]	B	14 days
1,3-Dichlorobenzene	3550	8270	0.133	NL	-	14 days
1,4-Dichlorobenzene	3550	8270	0.133	41.7 [d]	B	14 days
3,3-Dichlorobenzidine	3550	8270	0.133	2.22 [d]	B	14 days
2,4-Dichlorophenol	3550	8270	0.133	240 [d]	B	14 days
Diethylphthalate	3550	8270	0.133	64,000 [d]	B	14 days
Dimethylphenol	3550	8270	0.133	48 [d]	B	14 days
Dimethylphthalate	3550	8270	0.133	80,000 [d]	B	14 days
Di-N-butylphthalate	3550	8270	0.133	8,000 [d]	B	14 days
Di-N-octylphthalate	3550	8270	0.133	NL	-	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
SVOCs Continued						
4,6-Dinitro-2-methylphenol	3550	8270	0.677	NL	-	14 days
2,4-Dinotrophenol	3550	8270	0.677	160 [d]	B	14 days
2,4-Dinitrotolune	3550	8270	0.133	160 [d]	B	14 days
2,6-Dinitrotolune	3550	8270	0.133	80 [d]	B	14 days
1,2-Diphenylhydrazine	3550	8270	0.133	1.25 [d]	B	14 days
Fluoranthene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Fluorene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Hexachlorobenzene	3550	8270	0.133	0.625 [d]	B	14 days
Hexachlorobutadiene	3550	8270	0.133	12.8 [d]	B	14 days
Hexachlorocyclopentadiene	3550	8270	0.133	480 [d]	B	14 days
Hexachloroethane	3550	8270	0.133	71.4 [d]	B	14 days
Indeno(1,2,3-cd)pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Isophorone	3550	8270	0.133	1,050 [d]	B	14 days
1-Methylnaphthalene (PAH)	3550	8270	0.013	1 [d]	A	14 days
2-Methylnaphthalene (PAH)	3550	8270	0.033	1 [d]	A	14 days
2-Methylphenol (o-cresol)	3550	8270	0.133	4,000 [d]	B	14 days
3 and 4-Methylphenol (s-cresol)	3550	8270	0.267	400 [d]	B	14 days
Naphthalene (PAH)	3550	8270	0.033	1 [d]	A	14 days
2-Nitroaniline	3550	8270	0.133	-	NS	14 days
3-Nitroaniline	3550	8270	0.133	NL	-	14 days
4-Nitroaniline	3550	8270	0.133	NL	-	14 days
Nitrobenzene	3550	8270	0.133	4 [d]	B	14 days
2-Nitrophenol	3550	8270	0.133	NL	-	14 days
4-Nitrophenol	3550	8270	0.677	NL	-	14 days
N-nitrosodimethylamine	3550	8270	0.677	2.57 [d]	B	14 days
N-nitroso-di-n-propylamine	3550	8270	0.133	1.88 [d]	B	14 days
N-nitrosodiphenylamine	3550	8270	0.133	26,800 [d]	B	14 days
Octadecane	3550	8270	0.133	NL	-	14 days
Pentachlorophenol	3550	8270	0.133	8.33 [d]	B	14 days
Phenanthrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Phenol	3550	8270	0.133	48,000 [d]	B	14 days
Pyrene (PAH)	3550	8270	0.013	1 [d]	A	14 days
Pyridine	3550	8270	0.677	3,500 [d]	B	14 days
2,3,4,6-Tetrachlorophenol	3550	8270	0.133	105,000 [d]	B	14 days
2,3,5,6-Tetrachlorophenol	3550	8270	0.133	NL	-	14 days
1,2,4-Trichlorobenzene	3550	8270	0.133	NL	-	14 days
2,4,5-Trichlorophenol	3550	8270	0.133	350,000 [d]	B	14 days
2,4,6-Trichlorophenol	3550	8270	0.133	11,900 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs						
Acetone	5035	8260B	1	8,000 [d]	B	14 days
Acrolein	5035	8260B	1	1,600 [d]	B	14 days
Acrylonitrile	5035	8260B	1	1.85 [d]	B	14 days
Benzene	5035	8260B	0.2	0.5 [d]	A	14 days
Benzyl Chloride	5035	8260B	0.2	5.88 [d]	B	14 days
Bromobenzene	5035	8260B	0.2	NL	-	14 days
Bromochloromethane	5035	8260B	0.2	NL	-	14 days
Bromodichloromethane	5035	8260B	0.2	1.61 [d]	B	14 days
Bromoform	5035	8260B	0.2	127 [d]	B	14 days
Bromomethane	5035	8260B	0.4	112 [d]	B	14 days
2-Butanone	5035	8260B	1	NL	-	14 days
n-Butylbenzene	5035	8260B	0.2	NL	-	14 days
sec-Butylbenzene	5035	8260B	0.2	NL	-	14 days
t-Butylbenzene	5035	8260B	0.2	NL	-	14 days
Carbon Disulfide	5035	8260B	0.2	8,000 [d]	B	14 days
Carbon Tetrachloride	5035	8260B	0.2	7.69 [d]	B	14 days
Chlorobenzene	5035	8260B	0.2	1,600 [d]	B	14 days
Chloroethane	5035	8260B	0.2	NL	-	14 days
2-Chloroethyl vinyl ether	5035	8260B	2	NL	-	14 days
Chloroform	5035	8260B	0.2	164 [d]	B	14 days
Chloromethane	5035	8260B	0.4	76.9 [d]	B	14 days
2-Chlorotoluene	5035	8260B	0.2	1,600 [d]	B	14 days
4-Chlorotoluene	5035	8260B	0.2	1,600 [d]	B	14 days
Dibromochloromethane	5035	8260B	0.2	11.9 [d]	B	14 days
1,2-Dibromo-3-chloropropane	5035	8260B	0.4	0.714 [d]	B	14 days
1,2-Dibromoethane	5035	8260B	0.2	NL	-	14 days
Dibromomethane	5035	8260B	0.2	NL	-	14 days
1,2-Dichlorobenzene	5035	8260B	0.2	7,200 [d]	B	14 days
1,3-Dichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,4-Dichlorobenzene	5035	8260B	0.2	41.7 [d]	B	14 days
Cis-1,4-Dichloro-2-butene	5035	8260B	2	-	NS	14 days
Trans-1,4-Dichloro-2-butene	5035	8260B	2	-	NS	14 days
Dichlorodifluoromethane	5035	8260B	0.2	16,000 [d]	B	14 days
1,1-Dichloroethane	5035	8260B	0.2	8,000 [d]	B	14 days
1,2-Dichloroethane (Ethlyene Dibromide)	5035	8260B	0.2	0.001 [d]	A	14 days
1,1-Dichloroethene	5035	8260B	0.2	1.67 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs Continued						
Cis-1,2-Dichloroethene	5035	8260B	0.2	800 [d]	B	14 days
Trans-1,2-Dichloroethene	5035	8260B	0.2	1,600 [d]	B	14 days
1,2-Dichloropropane	5035	8260B	0.2	14.7 [d]	B	14 days
1,3-Dichloropropane	5035	8260B	0.2	NL	-	14 days
2,2-Dichloropropane	5035	8260B	0.2	NL	-	14 days
1,1-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
Cis-1,3-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
Trans-1,3-Dichloropropene	5035	8260B	0.2	5.56 [d]	B	14 days
1,4-Dioxane	5035	8260B	4	90.9 [d]	B	14 days
Ethlybenzene	5035	8260B	0.2	20 [d]	A	14 days
Hexanone	5035	8260B	1	NL	-	14 days
Hexachlorobutadiene	5035	8260B	0.2	12.8 [d]	B	14 days
Hexane	5035	8260B	0.2	4,800 [d]	B	14 days
Iodomethane	5035	8260B	1	NL	-	14 days
Isopropylbenzene	5035	8260B	0.2	NL	-	14 days
Isopropyltoluene	5035	8260B	0.2	NL	-	14 days
Methacrylonitrile	5035	8260B	1	8 [d]	B	14 days
Methylene Chloride	5035	8260B	0.2	0.5 [d]	A	14 days
4-Methly-2-pentanone	5035	8260B	1	NL	-	14 days
Methyl Tert-Butyl Ether	5035	8260B	0.2	NL	-	14 days
Naphthalene	5035	8260B	0.2	1,600 [d]	B	14 days
n-Propylbenzene	5035	8260B	0.2	NL	-	14 days
Styrene	5035	8260B	0.2	33.3 [d]	B	14 days
1,1,1,2-Tetrachloroethane	5035	8260B	0.2	38.5 [d]	B	14 days
1,1,2,2-Tetrachloroethane	5035	8260B	0.2	5 [d]	B	14 days
Tetrachloroethene	5035	8260B	0.2	0.5 [d]	A	14 days
Tetrahydrofuran	5035	8260B	1	NL	-	14 days
Toluene	5035	8260B	0.2	40 [d]	A	14 days
1,2,3-Trichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,2,4-Trichlorobenzene	5035	8260B	0.2	800 [d]	B	14 days
1,3,5-Trichlorobenzene	5035	8260B	0.2	NL	-	14 days
1,1,1-Trichloroethane	5035	8260B	0.2	20 [d]	A	14 days
1,1,2-Trichloroethane	5035	8260B	0.2	17.5 [d]	B	14 days
Trichloroethene	5035	8260B	0.2	0.5 [d]	A	14 days
Trichlorofluoromethane	5035	8260B	0.2	24,000 [d]	B	14 days
1,2,3-Trichloropropane	5035	8260B	0.2	0.143 [d]	B	14 days
1,1,2-Trichlorotrifluoroethane	5035	8260B	0.2	2,400,000 [d]	B	14 days

TABLE C-2-3. WET CHEMISTRY SOIL AND SEDIMENT ANALYSES
Continued

Parameter	Digestion or Extraction	Method	MDL (mg/Kg)	Standard (mg/Kg)	MTCA Method	Holding Time
VOCs Continued						
1,2,4-Trimethlybenzene	5035	8260B	0.2	NL	-	14 days
1,3,5-Trimethlybenzene	5035	8260B	0.2	NL	-	14 days
Vinyl Acetate	5035	8260B	1	80,000 (d)	B	14 days
Vinyl Chloride	5035	8260B	0.2	0.667 (d)	B	14 days
m,p-Xylenes	5035	8260B	0.4	20 (d)	A	14 days
o-Xylene	5035	8260B	0.2	20 (d)	A	14 days

Note: MTCA Method B obtained from "unrestricted land use" in CLARC spreadsheet (carcinogen value used if carcinogen and non-carcinogen values listed)
NL – chemical not listed in Method A table or CLARC
NS – no standard identified for Method A or Method B
a - sediment
b - backfill
c - soil in excavation area
d - topsoil

TABLE C-2-4. WET CHEMISTRY WATER ANALYSES

Parameter	Method	MDL (mg/L)	Ground Water Standard (mg/L)	Surface Water Standard (mg/L)	Preservative	Holding Time
Antimony	6020	0.00018	Background	NS	HNO_3	6 months
Arsenic	6020	0.000128	0.19 (a)	0.5	HNO_3	6 months
Cadmium	6020	0.000021	(a,b)	0.24	HNO_3	6 months
Lead	6020	0.000163	(a,c)	1.89	HNO_3	6 months
Hardness as Calcium Carbonate	2340B	0.086	(d)	NS	HNO_3	6 months
Mercury	245.1	0.000047	0.000012 (a)	0.1	HNO_3	28 days
Thallium	6020	0.000045	Background	NS	HNO_3	6 months

Note: Groundwater and Surface Water Standards are from the FCAP
NS - no standard listed in FCAP
a - chronic level
b - $\leq (0.687)(e^{(1.273[\ln(hardness)]-4.705)})$
c - $\leq (0.865)(e^{(0.7852[\ln(hardness)]-3.49)})$
d - value used for b and c equation

List of Project Target Compounds and Laboratory Detection Limits

A complete listing of project target compounds, method detection limits (MDLs), and holding times for each chemical of concern are listed in Table C-2-3 for soil and sediment samples and Table C-2-4 for water samples. The detection limits are at concentrations normally achieved by routine analytical testing in the absence of unusual matrix interference. Laboratory MDLs will be determined in accordance with 40 CFR Part 136 Appendix B procedures.

Laboratory Quality Control Checks

Each laboratory has QC programs that address the minimum QC requirements for the procedure as outlined in SW-846. The internal quality control checks might differ slightly for individual procedures, but in general the QC requirements include the following:

- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks (applicable to inorganic analysis)
- Matrix spikes and matrix spike duplicates
- Laboratory control standards
- Serial Dilutions

A summary of wet chemistry data quality control limits is presented in Tables C-2-5, C-2-6, and C-2-7.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary. Results of the QC checks will be evaluated during the data validation procedure (see Section 2.6.2).

TABLE C-2-5. QUALITY CONTROL PROCEDURES FOR WET CHEMISTRY INORGANIC ANALYSES

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Detection Limit (MDL) Determination	Annually, or if instrument is adjusted in any way that may affect MDLs	Less than PRDL	Review and use alternative methodology
Initial multipoint calibration • ICP, ICP-MS- 1 standard and 1 blank • AA - 3 standards (1 at contract required detection limit (CRDL level) and 1 blank • CVAA – 4 standards (1 at CRDL level) and 1 blank	Daily (per 24 hours), prior to sample analyses	Correlation coefficient ≥ 0.995 for linear regression	Correct problem; recalibrate
Initial/Continuing calibration verification (ICV/CCV)	All instruments – after calibration, after every 10 samples, and at the end of the sample run	Recovery of 90% to 110% of true value	Correct problem; recalibrate, and reanalyze all samples since last successful calibration
Initial/Continuing calibration blank (ICB/CCB)	After ICV/CCV	No analytes detected ≥ PRDL	Correct problem; analyze calibration blank and previous 10 samples
CRDL Standard • ICP, ICP-MS - 2 times the CRDL or 2 times the MDL, whichever is greater • AA, CVAA – at CRDL or MDL, whichever is greater	• Beginning and end of analytical run (immediately preceding interference check sample) • Beginning of each analytical run (after ICV)	ICP/MS only – recovery of 50% to 150% (no criteria is specified by the other methods)	ICP/MS only – terminate analysis and recalibrate; if corrective action is not taken, flag associated samples with "C"
Matrix Spikes	One per analytical batch, per method	Spike recovery of 75% to 125%	Flag associated sample results with "N" for values less than 4X the spike concentration
Laboratory Blank (Prep or Method)	One per analytical batch, per method	No analytes detected ≥ PRDL	Correct Problem. Redigest and reanalyze associated samples unless sample concentrations are 10X the blank value
Matrix Spike Duplicate	One per analytical batch, per method	Soil samples – RPD of ≤35% for values ≥5X PDLG; ±PDLG for values <5X PDLG	Flag associated sample results with "*"
Laboratory Control Sample (LCS)	One per analytical batch, per method	Recovery of 80% to 120% of true value, or within the 95% confidence level for the true value	Terminate analyses; correct problem; reanalyze LCS and associated samples

TABLE C-2-6. ADDITIONAL QUALITY CONTROL PROCEDURES FOR ICP/CP-MS

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Interelement Corrections – determination of interelement correction factors	Annually, or when instrument is adjusted in any way that may affect the correction factors	N/A	N/A
Linear Range Analysis – standard run to determine upper concentration limit	Annually, or when instrument is adjusted in any way that may affect the linear range	The highest standard with a recovery rate of 95% to 105%, determines the upper concentration limit which may be reported without dilution	N/A
Memory Test Solution and Memory Test Blank (ICP-MS only)	Daily, after calibration and before sample run	Memory Test Blank target analytes <PDLG	Rerun test until criteria is met before running samples
• ICP Interference Check Sample (ICS) • ICP/MS Interference Check Sample (ICS)	• Beginning and end of analytical run • Beginning or end of analytical run (right before CCV)	ICS AB solution analytes recovery of 80% to 120% of true value	Terminate analysis correct problem; reanalyze ICS and affected analytes
Serial Dilution	One per analytical batch	Percent difference within ±10% for concentrations >50X the IDL (>20X the CRDL for ICP-MS)	Flag associated sample results with "E"
Internal Standard(s) (ICP-MS only) – must be in the same mass bracket as the target analyte(s)	Analyzed with every sample	≥30% of the intensity of 1st standard used for the initial calibration	Sample must be diluted fivefold (1+4) and reanalyzed for affected analytes

TABLE C-2-7. QUALITY CONTROL PROCEDURES FOR WET CHEMISTRY ORGANIC ANALYSES

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Method Detection Limit (MDL) Determination	Annually, or if instrument is adjusted in any way that may affect MDLs	Less than PRDL	Review and use alternative methodology
Initial multipoint calibration • 3 standards	As needed	Correlation coefficient ≥ 0.995 for linear regression	Correct problem; recalibrate
Matrix Spikes	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Flag associated sample results with "N" for values less than 4X the spike concentration
Laboratory Blank (Prep or Method)	One per analytical batch, per method	Common laboratory contaminants must be <5xPQL	Correct Problem. Redigest and reanalyze associated samples unless sample concentrations are 10X the blank value
Matrix Spike Duplicate	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Flag associated sample results with "*"
Laboratory Control Sample (LCS)	One per analytical batch, per method	In-house calculated limits as specified by SW-846	Terminate analyses; correct problem; reanalyze LCS and associated samples

Sample Preparation and Cleanup

Each laboratory will implement standard operating procedures for sample preparation and cleanup based on SW-846 requirements.

2.5 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to ensure that data are acceptable for use in remediation decisions. Several evaluations have been formulated for this objective that includes precision, accuracy, completeness, representativeness, and comparability.

2.5.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. To evaluate precision, the following effort will be conducted:

Field Effort

Field precision will be assessed through the collection and measurement of field duplicates. For soil and sediment samples, the control limit for field precision is a RPD of 35 percent or less for field duplicates with concentrations greater than 5 times the Project Required Detection Limit (PRDL). For this interim action, the PRDLs are essentially the identified cleanup standards. Control limits for low concentration data (< 5 x PRDL) are ± 2 x PRDL. For water samples, the control limit for field precision is a RPD of 20 percent or less for field duplicates with concentrations greater than 5 times the PRDL. Control limits for low concentration data (< 5 x PRDL) are ± 1 x PRDL.

The target precision for the project is acceptance of 90 percent of the field duplicates as valid and within control limits.

Laboratory Effort

Precision in the laboratory is assessed through the calculation of RPD for laboratory matrix spike duplicates (MSD). For soil, the control limit for laboratory precision is a RPD of 35

percent or less or in-house calculated limits as specified by SW-846. For water samples, the control limit for precision is a RPD of 20 percent or less.

The target precision for the project is acceptance of 90 percent of the laboratory duplicates as valid and within control limits.

XRF Analyses

Laboratory duplicate samples for XRF analyses will consist of using the last sample from the previous run (sample tray). The RPD between the two analyses will be calculated and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{|\text{Original} - \text{Duplicate}|}{0.5(\text{Amount in Original} + \text{Duplicate})} \times 100$$

Wet Chemistry Analyses

For soil samples, laboratory MSD samples will be prepared by choosing a sample at random from a shipment received and dividing the sample into equal aliquots. In general, MSD samples will be prepared at a frequency of 1 per 20 samples tested. The RPD between the sample and the duplicate will be calculated in the same manner as with the XRF. For water samples a split is taken prior to sample digestion with a frequency of 1 per 20 samples tested.

2.5.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. To evaluate accuracy, the following effort will be conducted:

Field Effort

Field accuracy will be evaluated by ensuring the sampling procedures and sample handling requirements are met through the use of field blanks. In addition, for water sampling, blind field standards will be used. The blind field standards will be standard reference materials (SRM) of known concentrations and will be treated as field samples. The control limits for these standards will be a recovery of 80 to 120 percent.

The target accuracy for the project is acceptance of 90 percent of the blind field standards as valid and within control limits.

Laboratory Effort

XRF Analyses

Accuracy of XRF data will be assessed using laboratory control samples (LCS) and calibration verification standards (CCV). The control limits for both LCS and CCV will be a recovery of 75 percent to 125 percent. The target accuracy for the project is acceptance of 90 percent of the laboratory control samples and 90 percent of the calibration verifications as valid and within control limits.

Additional information on accuracy of XRF soil analyses will be evaluated by submitting selected samples (confirmation samples) to a laboratory for traditional wet chemistry analytical techniques. Confirmation samples will be sent off for wet chemistry analyses at a frequency of one per 50 samples analyzed by the XRF.

Wet Chemistry Analyses

Accuracy of wet chemistry data will be assessed through the analysis of matrix spikes (MS) and MSD samples and SRM samples. The control limits for MS/MSD will be a recovery of 75 percent to 125 percent or in-house calculated limits as specified by SW-846. The control limits for SRM samples will be a recovery of 80 percent to 120 percent or the 95 percent confidence interval as established by the reference material provider. The target accuracy for the project is acceptance of 90 percent as valid and within control limits.

A spike will consist of randomly selecting a sample from a shipment. It will be spiked, prior to digestion, with a known amount of the analyte or analytes to be evaluated. The spike sample will be then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery.

The percent recovery for a spiked sample is calculated according to the following formula (excluding ICP-MS):

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100$$

The percent recovery for a spiked sample is calculated according to the following formula for ICP-MS:

$$\%R = \frac{\text{Amount in Spiked Sample}}{\text{Known Amount Added} + \text{Amount in Sample}} \times 100$$

2.5.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Completeness will be the ratio of the number of valid sample results to the total number of samples submitted for analysis with a specific matrix and/or analysis.

Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{(Number of Valid Measurements)}}{\text{(Number of Measurements Requested)}} \times 100$$

The target completeness for the project is greater than 95 percent.

2.5.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is dependent upon the proper design of

the sampling program and will be satisfied by ensuring that the proper procedures are followed. This may include using proper sampling techniques, using proper analytical procedures, meeting holding times, and analyzing field duplicates.

2.5.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. Comparability is dependent upon the proper design of the sampling and analysis program and will be satisfied by ensuring that the procedures specified by this plan are followed. This goal may be achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units.

2.6 DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by the laboratory operation shall be reduced, validated, and reported.

2.6.1 Data Reduction and Evaluation

Data reduction procedures will be followed according to the following protocol. All raw analytical data will be recorded in numerically identified laboratory notebooks. The notebooks will be issued by the Laboratory Manager. Data are recorded in this notebook along with other pertinent information such as the sample identification number. Other details will also be recorded in the lab notebook such as the analytical method used, name of analyst, date of analysis, matrix sampled, reagent concentrations, instrument settings, and the raw data. Each page of the notebook shall be signed and dated by the analyst. Periodic review of those notebooks by the Laboratory Manager takes place prior to final data reporting.

The equations that will be employed in reducing data are those specified in the laboratory standard operating procedures and/or EPA method documents. Any errors will be noted and corrections made but the original notations will be crossed out legibly.

Quality control data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the QA Officer for review. If approved, data are logged into the project database format. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the QA Officer approves these data, they are considered ready for validation.

2.6.2 Data Validation

XRF Results

XRF results will be validated using an automated validation computer program (AutoVal). AutoVal extracts data directly from data diskettes provided by the XRF laboratory, processes the information into temporary files, reviews and flags data in the temporary files, and transfers validated data to a database (DataMan). Briefly stated, the program:

- Summarizes the flagged data including reason for flagging (see Table C-2-8);
- Summarizes overall completeness including percent rejected, percent without flags, and percent without frequency violation;
- Summarizes completeness of quality control sample types including the percent in control limits and percent without quality control frequency violations;
- Summarizes accuracy calculations for laboratory control samples and calibration verifications for all parameters using Chauvenet's Criterion to identify outliers; and
- Summarizes precision calculation for laboratory and field duplicates for all parameters using Dixon's Q test to identify outliers.

TABLE C-2-8. DATA VALIDATION CODES AND DEFINITIONS

CODE		DEFINITION
J	-	The associated numerical value is an estimated quantity because quality control criteria were not met. Subscripts for the "J" qualifier: 2- Deviation from required calibration procedures, calibration range exceeded or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates low bias. 4 - Other quality control outside control limits.
UJ	-	The "U" indicates that the material was analyzed for, but was not detected. The "J" indicates that the associated value is an estimate. Subscripts for the "UJ" qualifier are applied as follows: 1- Blank contamination. Indicates possible high bias and/or false positive. 2- Deviation from required calibration procedures, calibration range exceeded or poor recovery on a known standard. Possible bias. 3- Holding time not met. Indicates low bias. 4 - Other quality control outside control limits.
R	-	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis are necessary for verification.
A	-	An anomalous result as defined by the Laboratory QA Officer.

All entries made at the laboratory will be compared by the QA Officer to hard copy reports to ensure hand entries are free of transcription errors. In addition, the validation procedure for the QA Officer will include ensuring that specific requirements have been fulfilled and also include an assessment of data quality and usability. The QA Officer will identify any quality control exceedences and data omissions and interact with the laboratory to correct data deficiencies. Data qualifiers will be assigned to any data which are associated with quality control exceedences.

Wet Chemistry Results

Wet chemistry batch QC data will be reviewed for compliance with the specified control limits. The QA Officer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Data qualifiers will be assigned to any data which are associated with quality control exceedences.

If results of data quality review indicate that corrective action is required, several options are available to the QA Officer:

- Notify the laboratory of the problem and initiate laboratory corrective action.
- Flag the data with the appropriate codes to indicate data is qualified.
- Re-sample or re-analyze, if necessary. Decisions to repeat sample collection and/or analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for the project will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags as well as additional comments of the QA Officer. The QA Officer's comments will indicate that the data are: 1) usable as a quantitative concentration, 2) usable with caution as an estimated concentration, or 3) unusable due to out-of-control QC results.

2.6.3 Data Reporting

The task of reporting laboratory data begins after the analysis has been concluded. All data will be reported to Ecology as hard copy and electronically on disk. Hard copy reports or

tables and site maps, when applicable, will be submitted to Ecology as data becomes available and remedial decisions are made. Several summary reports (see Section 2.6.3.2) will be submitted to Ecology at the end of each construction season and/or monitoring task. In addition, the residential property-specific summary will also be submitted to the respective homeowner (existing site map, proposed site map, site map with arsenic results, and copy of "Sign Up/Sign Off" authorization form).

Electronic data will be submitted to Ecology after the data is validated along with a hard copy validation report. Section 2.6.3.1 further describes the validation report and Section 2.6.3.2 describes the anticipated schedule. The electronic data will be organized in a tabular format to facilitate cross-referencing of sample results to sample locations. The database will include the following information:

- Sample Number
- Sample Date
- Laboratory Number
- Analysis Date
- Parameter(s)
- Concentration
- Unit
- Data Qualifier

Data Validation Reports

Reports summarizing the overall quality of the data in terms of meeting the data quality objectives will be prepared for each construction season's collected data and/or monitoring event. These reports shall consist of a summary of all the data validation quality review conducted for XRF and/or wet chemistry analyses, an assessment of the overall completeness objectives, and a summary of any relevant corrective action measures that were implemented.

Schedule

Data will be submitted to Ecology in the form of summary reports and data validation reports. The summary reports will include a brief description of work performed, laboratory

results, site maps, and other pertinent information. Validation reports will include the validated data along with a CD containing data in an electronic format. The following is the anticipated schedule:

1.) Fenced Area-Upper Level
   - Performance Monitoring Summary Report by December of the respective construction season.
   - Data Validation Report by March of the year following the respective construction season.
2.) Fenced Area-Lower Level
   - Performance Monitoring Summary Report by December of the respective construction season.
   - Data Validation Report by March of the year following the respective construction season.
3.) Fenced Area
   - Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.
4.) Residential Properties
   - Performance Monitoring Summary Report by December of the respective construction season.
   - Data Validation Report by March of the year following the respective construction season.
   - Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.
5.) Storm Drain Sediment
   - Performance Monitoring Summary and Data Validation Report within six months of sample collection.
   - Confirmational Monitoring Summary and Data Validation Report within six months of sample collection.
6.) Storm Water

- Data Validation Report for each sampling episode within six months of sample collection.

7.) Groundwater

- Data Validation Report for each sampling episode within six months of sample collection. These reports will also provide a water level table, field measurement data table, two potentiometric figures for both aquifers (shallow and deep), and two arsenic concentration figures for each aquifer.

2.7 AUDITS

Audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in this plan. The audits of field and laboratory activities include two independent parts: internal and external audits.

2.7.1 Field Audits

Internal Field Audits

Internal audits of field activities will be conducted. These audits will verify that all established procedures are being followed. Internal field audits will be conducted by the Project Manager at least once at the beginning of each sample collection activity.

The audits will include examination of field sampling records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. Follow up audits may be conducted if necessary to correct deficiencies, and to verify that QA procedures are maintained throughout the project.

External Field Audits

External field audits may be conducted by Ecology. External field audits may occur any time during the field operations by Ecology with notification to the Project Manager.

2.7.2 Laboratory Audits

Internal Laboratory Audits

Internal laboratory audits (system audits) are qualitative on-site evaluations conducted for the purpose of determining compliance with the organizational procedural requirements presented in this plan. These audits will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc. These audits may be conducted at the beginning of the project and during start-up of major operational elements. Non-compliance with procedures and corrective actions will be documented and reported to Ecology.

Performance audits are quantitative determinations consisting of the separation and assessment of data used to monitor the performance of the total measurement system (i.e., including errors associated with field sample handling procedures and laboratory analytical processes). For this project, performance audits shall be conducted by the use of field duplicate samples.

External Laboratory Audits

An external audit may be conducted by Ecology with notification to the Project Manager. External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

2.8 PREVENTATIVE MAINTENANCE AT LABORATORIES

As part of their QA/QC programs, a routine preventative maintenance program will be conducted by the laboratories to minimize the occurrence of instrument failure and other system malfunctions. For all instruments, including the XRF, each laboratory will perform routine scheduled maintenance and perform necessary repairs or coordinate with the vendor for such repairs. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled

manufacture's maintenance is typically provided under a repair and maintenance contract with factory representatives.

2.9 CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented will be documented in the regular QA reports to management. Corrective action should only be implemented after approval by the Project Manager, or his designee. If immediate corrective action is required, approvals from the Project Manager should be documented in an additional memorandum. Any nonconformance with the established quality control procedures will be identified and corrected.

2.9.1 Field Corrective Action

Corrective action in the field may be needed if the sample network is changed (e.g., more/less samples, sampling locations other than those specified in the plan, etc.) and/or sampling procedures are modified due to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Field Manager or designee. The Field Manager will be responsible for assessing the suspected problems in consultation with the QA Officer on making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the Project Manager and sent to Ecology.

The Project Manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- Evaluating all reported nonconformances;
- Controlling additional work on nonconforming items;
- Determining disposition or action to be taken;

- Maintaining a log of nonconformances;
- Reviewing nonconformance reports and corrective actions taken;
- Ensuring nonconformance reports are included in the final site documentation in project files.

If appropriate, the Field Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Officer will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field Manager and field team. Corrective action will be documented in QA reports.

2.9.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after analyses. A number of conditions such as broken sample containers may be identified during sample log-in or just prior to analysis. These conditions must be immediately reported by the laboratory to the Project Manager. Other conditions such as analyte concentrations not in instrument range may not be apparent until sample analysis. Following consultation with lab analysts, it may be necessary for the Laboratory Manager to approve the implementation of corrective action. Some conditions that may trigger corrective action or optional procedures during or after analysis include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain quality control criteria are not met, etc.

Corrective action for any nonconformance identified by audits or data validation may include:

- Re-analyzing the samples, if holding time criteria permits;
- Re-sampling and analyzing,
- Evaluating and amending sample procedures,
- Evaluating and amending analytical procedures,

- Accepting data and acknowledging the level of uncertainty.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The action taken is somewhat dependent on the analysis and the event. If re-sampling is deemed necessary due to laboratory problems, the Project Manager must identify the necessary approach.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples; or
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Manager and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed. These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in narrative data report sent from the laboratory to the QA Officer.

2.9.3 Corrective Action During Data Validation and Data Assessment

The need for additional corrective action may be identified during either the data validation or data assessment by the QA Officer. Potential types of corrective action may include re-sampling by the field team or re-analysis of samples by the laboratory.

These actions depend upon the ability to mobilize the field team and or whether the data are necessary to meet the project's objectives and QA requirements. When the QA Officer identifies a corrective action situation, it is the Project Manager who will be responsible for approving the implementation of corrective action, including re-sampling, during data assessment. All corrective actions of this type will be documented.

Appendix D

APPENDIX D

LIST OF STANDARD CONSTRUCTION SPECIFICATIONS AND SPECIAL PROVISIONS AND PLAN SHEET INDEX

SECTION I

LIST OF CONSTRUCTION PLANS

Title and Index Sheet

General Legend and Abbreviations

Existing Site Plan

Existing Utility Plan

Utility Abandonment Plan and Details

Demolition Plan

Excavation and Sampling Unit Grid Plan

Stage I Excavation Plan

Stage I Backfill Plan

Stage I Cross Sections and Details

Stage II Excavation Plan

Stage II Backfill Plan

Stage II Cross Sections and Details

Stockpile Locations and Haul Routes

Surface Water Management Plan

Surface Water Management Details

Note: The above list is a general plan list. The actual number of plans sheets and sheet titles may change as plan sheets are drafted.

SECTION II

STANDARD SPECIFICATIONS

The 2002 Standard Specifications for Road, Bridge and Municipal Construction, prepared by the Washington State Department of Transportation and the American Public Works Association, Washington State Chapter, as modified by the 2002 APWA Amendments to Division One, hereinafter called the Standard Specifications are the construction specifications for this project.

The Standard Specifications are modified by Special Provisions as detailed in the following divisions. Division and subdivision numbers refer to corresponding numbers of the Standard Specifications. Additional Division or Subdivision numbers may be used to specify items of work or materials not included in the Standard Specifications.

Where applicable, the Plans and/or Special Provisions may refer to the City of Everett Design and Construction Standards and Specifications for Development and/or the City of Everett Stormwater Management Manual.

SECTION III

SPECIAL PROVISIONS

DIVISION 1 GENERAL REQUIREMENTS----------
DIVISION 2 EARTHWORK----------
DIVISION 8 MISCELLANEOUS CONSTRUCTION----------
DIVISION 9 MATERIALS----------

DIVISION I – GENERAL REQUIREMENTS

Work at the Everett site will conducted under ASARCO's standard contract documents.

DIVISION 2 – EARTHWORK

2-01 – CLEARING, GRUBBING, AND ROADSIDE CLEANUP

2-02 – REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Delete the above sections and replace with the following

2-01 - PREPARING WORK AREAS

2-01.1 Description.

(1) Clear and Grub

(2) Structure Demolition

(3) Utility Removal or Abandonment

2-01.2 Construction Requirements

(1) General

(2) Disposal of Material.

2-01.3 Measurement and Payment

(1) Clear and Grub

(2) Structure Demolition

(3) Utility Removal or Abandonment

2-03 - ROADWAY EXCAVATION AND EMBANKMENT

Delete this section and replace with the following

2-03 - EXCAVATION, EMBANKMENT AND GRADING

2-03.1 Description

2-03.2 Construction Requirements

(1) Grade Control and Layout of Work

(2) Inspection and Testing

(3) Protection and Safety

(4) Subgrade Protection

(5) Site Drainage

(6) Dust Control

2-03.3 Excavation and Stockpile

(1) General Requirements

(2) Source Material (S) Excavation

(3) Residential Material (R) Excavation

2-03.4 Load and Haul

(1) General Requirements

(2) Source Material (S) Excavation

(3) Residential Material (R) Excavation

2-03.5 Embankment and Grading

(1) General Requirements

(2) Subgrade Preparation

(3) Materials

(4) Placement & Compaction

2-03.6 Tolerances

(1) Excavation

(2) Embankment and Grading

(3) Density

2-03.7 Measurement and Payment

DIVISION 8 – MISCELLANEOUS CONSTRUCTION

Add the following Section

8-30 STORMWATER MANAGEMENT

8-30.1 Description

8-30.2 Construction Requirements

8-30.3 Measurement and Payment

DIVISION 9 - MATERIALS

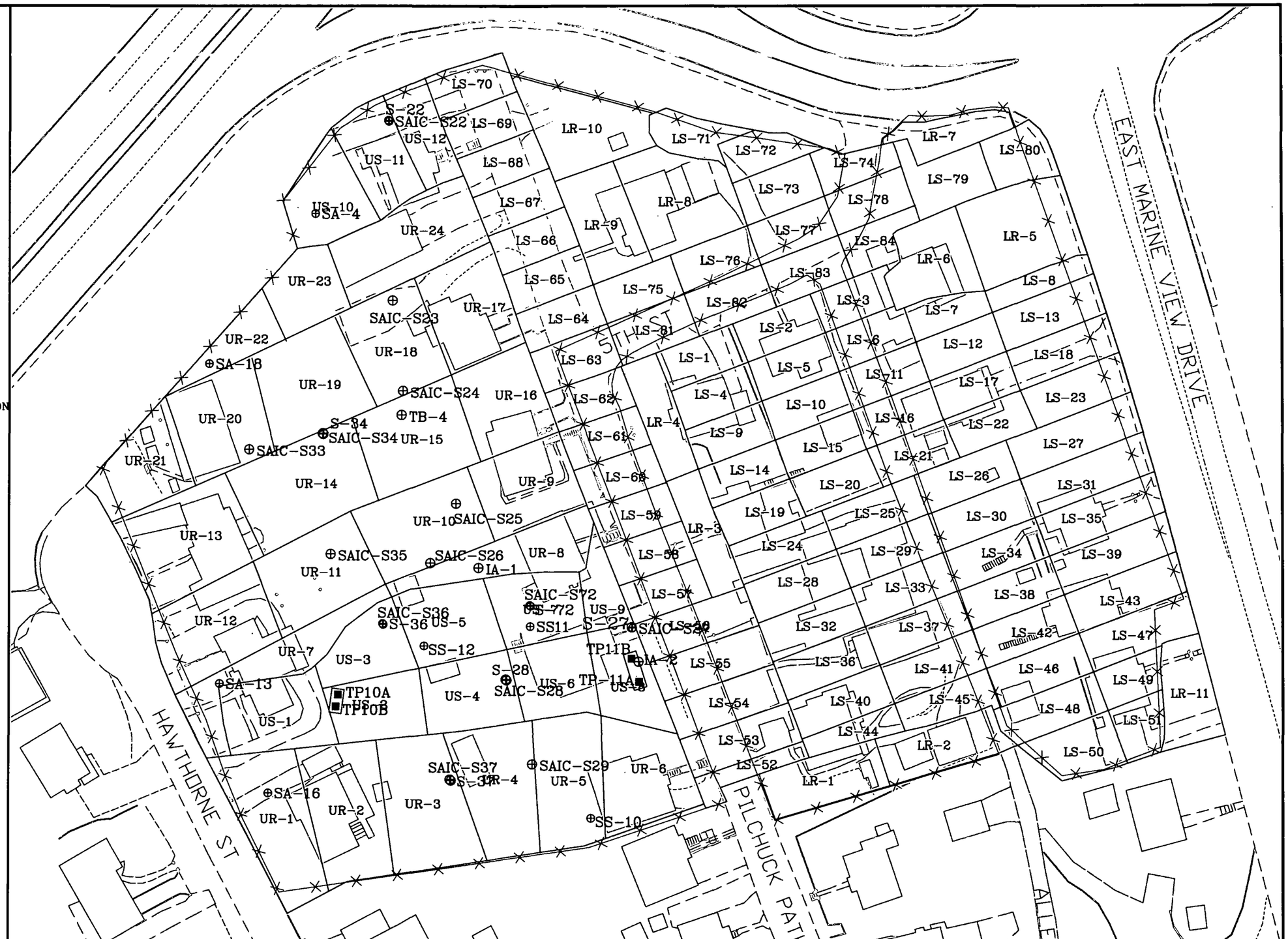
This division may or may not require Special Provisions

Appendix E

APPENDIX E

ARSENIC CONCENTRATIONS FOR SOIL SAMPLES
AND
AVAILABLE SOIL BORING LOGS FOR FENCED AREA

E.1
UPPER AREA
ARSENIC CONCENTRATIONS



UR-1 UPPER RESIDENTIAL UNIT

LR-1 LOWER RESIDENTIAL UNIT

US-1 UPPER SOURCE AREA UNIT

LS-1 LOWER SOURCE AREA UNIT

ESTIMATED EXCAVATION BOUNDARY FOR FENCED AREA

RESIDENTIAL/SOURCE AREA (ie. DECISION UNIT) BOUNDARY

⊕SA-13 SAMPLE POINT

ASARCO Consulting, Inc.

ASARCO INCORPORATED
INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A

PREVIOUS SAMPLE LOCATIONS IN UPPER FENCED AREA

FIGURE
E-1

UPDATE TIME: 8am
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T038.dwg

UPPER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
IA-1	surface	300	NO	-
	1.0	990		
	2.0	3,100		
IA-2	surface	510	NO	-
	1.0	3,400		
	2.0	6,800		
IA-3	surface	230	NO	-
	1.0	360		
	2.0	650		
IA-9	surface	14	NO	-
SA-4	0.0-1.0	11,792	YES	2.0
	1.0-2.0	2,618		
	2.0-3.0	13		
	3.0-4.0	26		
	4.0-5.0	14		
	5.0-6.0	10		
SA-13	0.0-1.0	846	YES	2.0
	1.0-2.0	1,024		
	2.0-3.0	13		
	3.0-4.0	227		
	4-0-5.0	42		
SA-14	0.0-1.0	11	YES	3.0
	1.0-2.0	10		
	2.0-3.0	10		
	3.0-4.0	10		
	4-0-5.0	10		
SA-15	0.0-1.0	113	YES	2.0
	1.0-2.0	10		
	2.0-3.0	10		
	3.0-4.0	10		
	4-0-5.0	10		
SA-16	0.0-1.0	405	YES	3.0
	1.0-2.0	51		
	2.0-3.0	166		
	3.0-4.0	10		
	4-0-5.0	10		
SA-17	0.0-1.0	811	YES	2.0
	1.0-2.0	610		
	2.0-3.0	10		
	3.0-4.0	10		
	4-0-5.0	10		

UPPER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
SA-18	0.0-1.0	1,798	YES	3.0
	1.0-2.0	288		
	2.0-3.0	18		
	3.0-4.0	10		
	4-0-5.0	13		
SAI-SS-4	surface	64	NO	-
SAIC-S22	surface	1,490	NO	-
	0.5	4,230		
	1.0	3,590		
	2.0	1,710		
	3.0	455		
S-22	4.0	18	YES	4.0
	6.0	450		
	7.0	236		
	9.0	233		
	11.0	58		
	13.0	19		
	15.0	18		
SAIC-S23	surface	475	NO	-
SAIC-S24	surface	395	NO	-
	0.5	456		
	1.0	152		
	2.0	48		
	3.0	3		
SAIC-S25	surface	311	NO	-
	0.5	146		
	1.0	272		
	2.0	80		
	3.0	5		
SAIC-S26	surface	421	NO	-
	0.5	800		
	1.0	642		
	2.0	80		
	3.0	62		
SAIC-S27	surface	2,600	NO	-
	0.5	2,090		
	1.0	3,010		
	2.0	930		
	3.0	1,880		

UPPER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
S-27	surface	390	YES	8.0
	0.5	3,510		
	1.0	4,620		
	2.0	5,306		
	3.0	660		
	4.0	2,530		
	6.0	2,480		
	7.0	1,773		
	9.0	1,355		
SAIC-S28	surface	1,190	NO	-
	0.5	1,800		
	1.0	4,810		
	2.0	6,230		
	3.0	6,020		
S-28	surface	3,010	YES	5.0
	0.5	5,620		
	1.0	14,740		
	2.0	16,840		
	3.0	7,030		
	4.0	7,480		
	6.0	6,240		
SAIC-S29	surface	484	NO	-
	0.5	935		
	1.0	737		
	2.0	488		
	3.0	188		
SAIC-S30	surface	432	NO	-
	0.5	203		
	1.0	319		
	2.0	338		
	3.0	43		
SAIC-S33	surface	240	NO	-
SAIC-S34	surface	276	NO	-
	0.5	312		
	1.0	415		
	2.0	1,550		
	3.0	1,160		

UPPER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
S-34	6.0	118	YES	7.0
SAIC-S35	surface	298	NO	-
	0.5	435		
	1.0	239		
	2.0	727		
	3.0	849		
SAIC-S36	surface	764	NO	-
	0.5	1,100		
	1.0	994		
	2.0	1,420		
	3.0	849		
S-36	4.0	3,260	YES	6.5
	6.0	775		
SAIC-S37	surface	857	NO	-
	0.5	1,900		
	1.0	1,550		
	2.0	328		
	3.0	99		
S-37	4.0	18	YES	4.0
	6.0	5		
SAIC-S72	surface	891	NO	-
	0.5	1,140		
	1.0	5,360		
	3.0	53,100		
S-72	surface	295	YES	5.0
S-72	0.5	380		
S-72	1.0	1,300		
S-72	2.0	8,000		
S-72	3.0	21,200		
S-72	4.0	5,400		
S-72	6.0	1,700		
S-72	7.0	489		
S-72	9.0	263		
SS-10	surface	381	NO	-
SS-11	surface	4,670	NO	-

UPPER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
TB-4	-	-	YES	2.0
TP-10A	0.0-1.0	473	YES	NE
	1.0-2.0	2,460		
	2.0-3.0	3,571		
	3.0-4.0	2,399		
	4.0-5.0	12,491		
	5.0-6.0	2,209		
TP-10B	0.0-1.0	866	YES	6.0
	1.0-2.0	1,356		
	2.0-3.0	3,151		
	3.0-4.0	3,277		
	4.0-5.0	15,433		
	5.0-6.0	6,748		
	6.0-7.0	453		
	8.0-9.0	401		
	10.0-11.0	490		
TP-11A	0.0-1.0	3,148	YES	NE
	1.0-2.0	4,692		
	2.0-3.0	12,893		
	3.0-4.0	53,824		
	4-0-5.0	23,094		
TP-11B	0.0-1.0	1,722	YES	7.0
	1.0-2.0	6,869		
	2.0-3.0	19,691		
	3.0-4.0	19,937		
	4-0-5.0	36,165		
	5.0-6.0	11,897		
	6.0-7.0	8,408		
	8.0-9.0	1,450		
	10.0-11.0	504		
	12.0-13.5	212		

Note: NE – glacial till not encountered.

E.2
UPPER AREA
AVAILABLE SOIL BORING LOGS

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-4

Date Hole Started: 03/25/98 Date Hole Finished: 03/25/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: End of North Pilchuck
Descriptive Location: West side behind last foundation.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 6

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-391	SS		0.75	0.0 - 1.0'		0.0 - 1.0' **Silty LOAM** Dark Brown, moist to slightly moist, roots to 4", trace brick fragments at 1". [Fill]
	EVT-9803-392	SS		0.75	1.0 - 2.0'		1.0 - 2.0' **Sandy SILT** Dark brown to yellow brown, slightly moist to dry.; Sand is fine grained; trace 1/2" subrounded gravel; Brick fragments 2" chunk of wood at top. [Smelter Debris]
	EVT-9803-393	SS		1.00	2.0 - 3.0'		2.0 - 6.0' **Silty SAND** Grayish brown (orange brown at top) with bands of oxidationat 2-3', slightly moist to dry, medium to fine grained, trace root matter to 4"; Trace 2" and smaller subrounded gravel. [Glacial Till]
	EVT-9803-394	SS		1.00	3.0 - 4.0'		
	EVT-9803-395	SS		0.75	4.0 - 5.0' Duplicate sample EVT-9803-397 at 0830		
5	EVT-9803-396	SS		0.75	5.0 - 6.0'	5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-13

Date Hole Started: 03/25/98 Date Hole Finished: 03/25/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 511 Hawthorne
Descriptive Location: Adjacent to N driveway to former house

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on a Piper 2000 Drill mounted on a pickup . Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-414	SS		0.60	0.0 - 1.0'		0.0 - 2.0' **Sandy SILT** Dark Brown, slightly moist, roots at 0-1", loose, trace 1/4" and sn... gravel. [Fill]
	EVT-9803-415	SS		0.60	1.0 - 2.0'		
	EVT-9803-416	SS		0.70	2.0 - 3.0'		2.0 - 5.0' **Sandy SILT** Light brown to orange-brown with orange mottling, moist to slightly moist, some vegetative matter, medium dense. [Glacial Till]
	EVT-9803-417	SS		0.70	3.0 - 4.0' Duplicate sample #419 @ 15:00		
	EVT-9803-418	SS		0.80	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-14

Date Hole Started: 03/24/98 Date Hole Finished: 03/2

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 516 Hawthorne
Descriptive Location: Front Yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on a Piper 2000 Drill mounted on a pickup . Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-385	SS		0.70	0.0 - 1.0' Duplicate sample at 17:05 # 390		0.0 - 1.0' **Sandy SILT** Light brown, moist, organic matter, moist. (Fill)
	EVT-9803-386	SS		0.70	1.0 - 2.0'		1.0 - 3.0' **Silty SAND** Orange-brown, slightly moist to moist, med to fine grained, some band of oxidation; trace 1/4" subrounded gravel. (Fill)
	EVT-9803-387	SS		0.75	2.0 - 3.0'		
	EVT-9803-388	SS		0.75	3.0 - 4.0'		3.0 - 5.0' **Silty SAND** Gray, very fine to fine grained, slightly moist to moist; Some 1" subrounded gravel. (Glacial Till)
	EVT-9803-389	SS		1.20	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

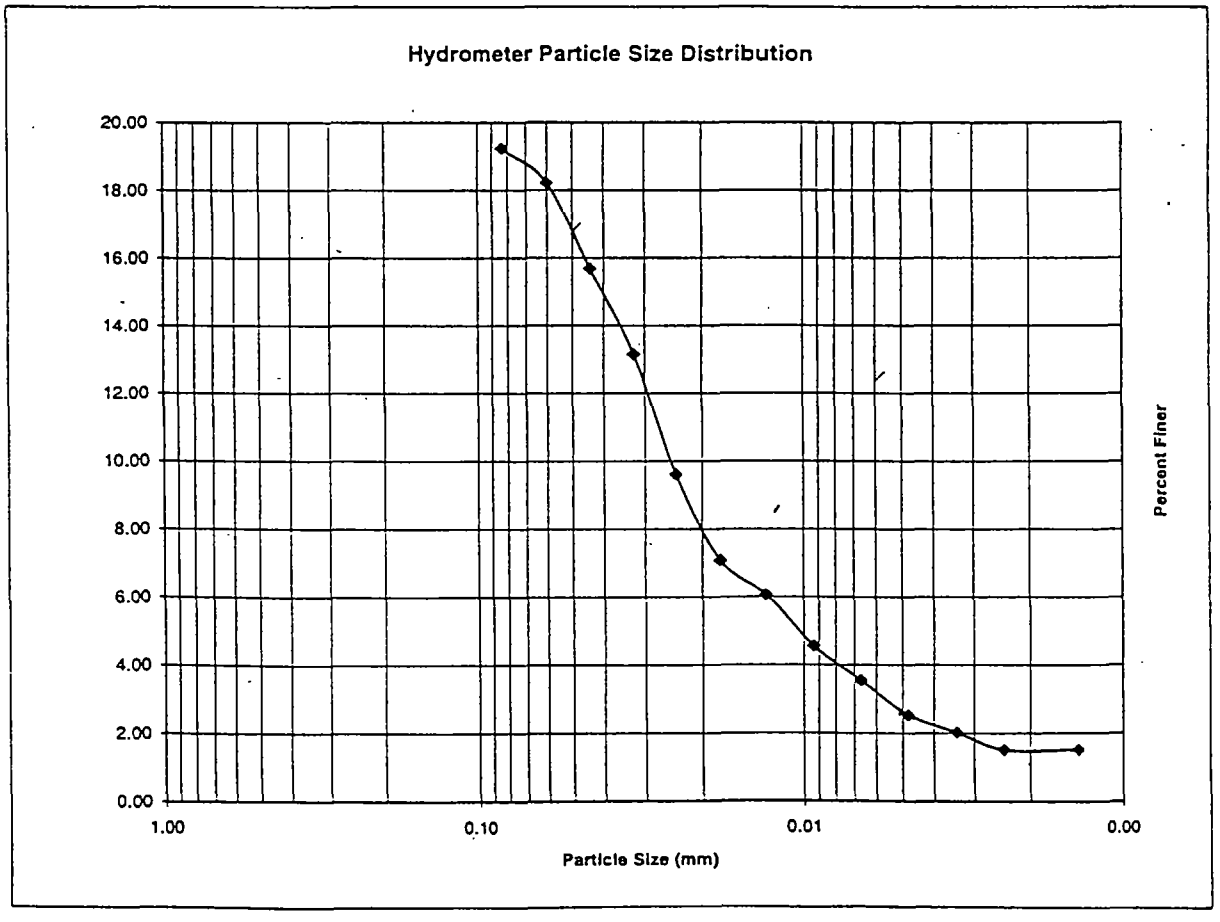
SA-14
3-4'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-00977
SAMPLE NUMBER	EVT-9803-388
DATE	6/25/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	43	38	76.00	44	9.3	0.0137	0.08	19.23
0.5	41	36	72.00	42	9.6	0.0137	0.06	18.22
1	36	31	62.00	37	10.4	0.0137	0.04	15.69
2	31	26	52.00	32	11.2	0.0137	0.03	13.16
4	24	19	38.00	25	12.4	0.0137	0.02	9.61
8	19	14	28.00	20	13.2	0.0137	0.02	7.08
15	17	12	24.00	18	13.4	0.0137	0.01	6.07
30	14	9	18.00	15	14	0.0137	0.01	4.55
60	12	7	14.00	13	14.3	0.0137	0.01	3.54
120	10	5	10.00	11	14.7	0.0137	0.00	2.53
240	9	4	8.00	10	14.8	0.0137	0.00	2.02
480	8	3	6	9	15	0.0137	0.00	1.52
1440	8	3	6	9	15	0.0137	0.00	1.52



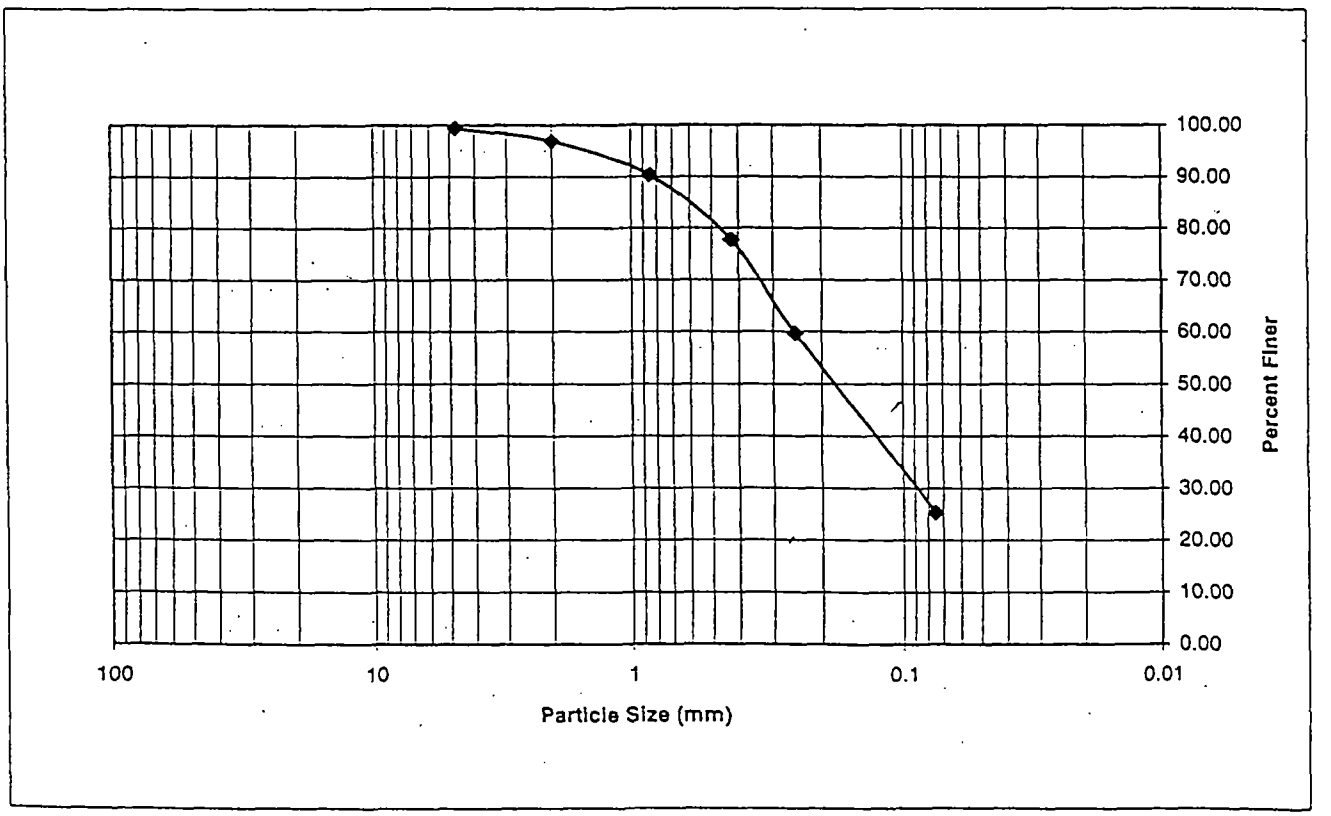
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-00977
Sample Number: EVT-9803-388
Date: 6/25/98

Weight of Oven Dry Sample (g): 678.5

Sieve Number	Sieve Opening (mm)	Weight Retained	Percent Retained	Cumulative Retained	Percent Finer
4	4.75	4.2	0.62	0.62	99.38
10	2.00	16.90	2.51	3.13	96.87
20	0.85	44.30	6.57	9.70	90.30
40	0.425	84.70	12.56	22.26	77.74
60	0.250	122.10	18.10	40.36	59.64
200	0.075	231.60	34.34	74.70	25.30
PAN	< 0.075	174.70	25.90		

sum = 678.5



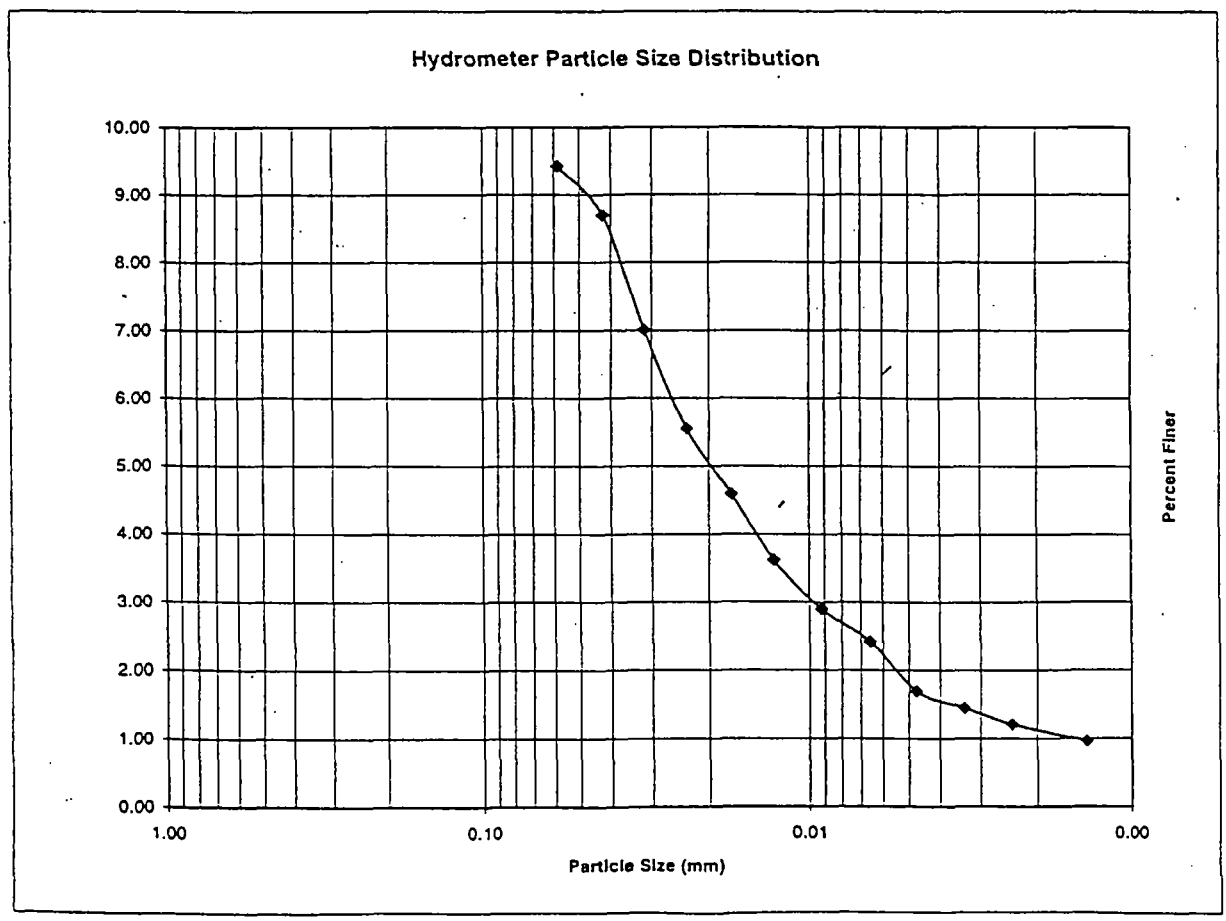
SA-14
4-5'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-00978
SAMPLE NUMBER	EVT-9803-389
DATE	6/25/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	47	42	84.00	48	8.6	0.0137	0.08	10.15
0.5	44	39	78.00	45	9.1	0.0137	0.06	9.42
1	41	36	72.00	42	9.6	0.0137	0.04	8.70
2	34	29	58.00	35	10.7	0.0137	0.03	7.01
4	28	23	46.00	29	11.7	0.0137	0.02	5.56
8	24	19	38.00	25	12.4	0.0137	0.02	4.59
15	20	15	30.00	21	13	0.0137	0.01	3.62
30	17	12	24.00	18	13.5	0.0137	0.01	2.90
60	15	10	20.00	16	13.8	0.0137	0.01	2.42
120	12	7	14.00	13	14.3	0.0137	0.00	1.69
240	11	6	12.00	12	14.5	0.0137	0.00	1.45
480	10	5	10	11	14.7	0.0137	0.00	1.21
1440	9	4	8	10	14.8	0.0137	0.00	0.97



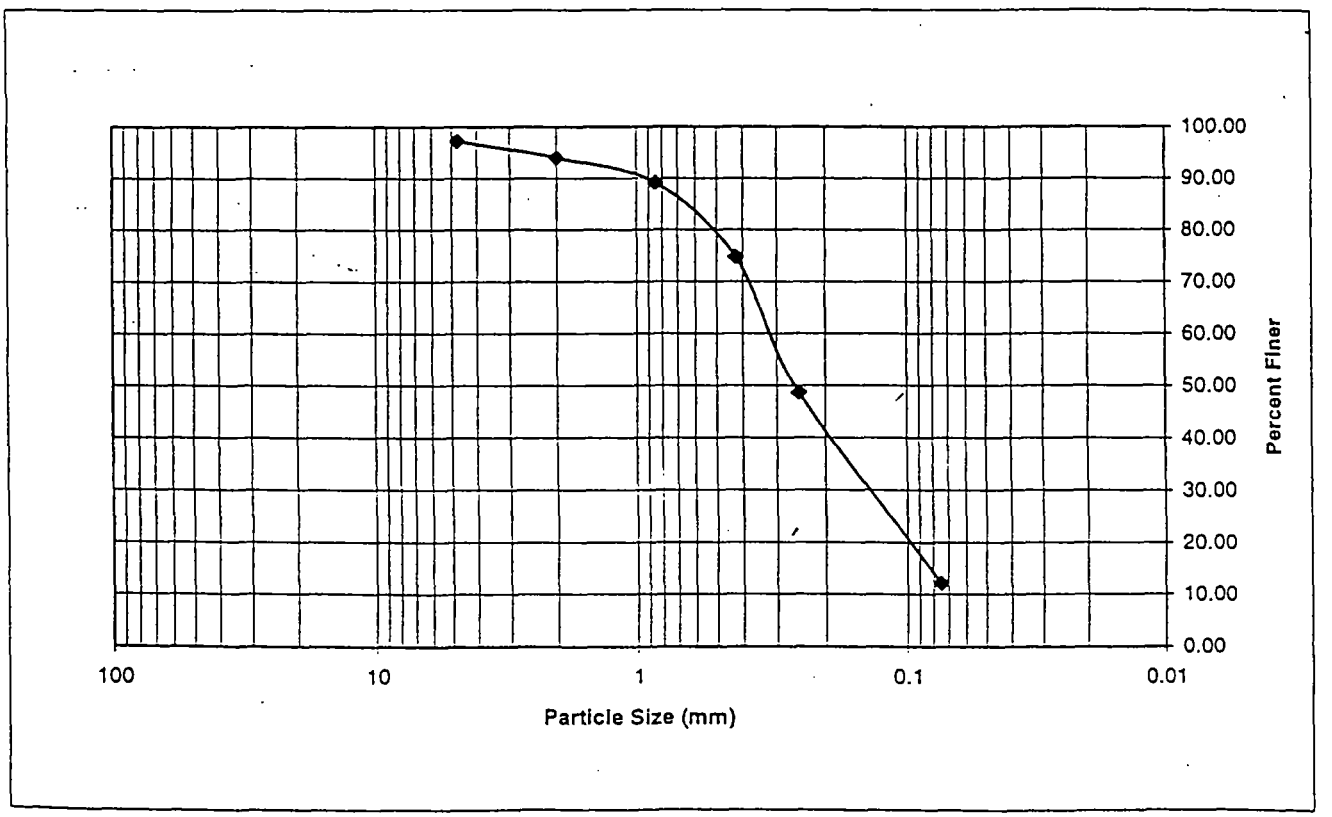
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-00978
Sample Number: EVT-9803-389
Date: 6/25/98

Weight of Oven Dry Sample (g): 773.2

Sieve Number	Sieve Opening (mm)	Weight Retained	Percent Retained	Cumulative Retained	Percent Finer
4	4.75	21.3	2.75	2.75	97.25
10	2.00	25.10	3.25	6.00	94.00
20	0.85	37.50	4.85	10.85	89.15
40	0.425	111.20	14.38	25.23	74.77
60	0.250	201.90	26.11	51.35	48.65
200	0.075	282.80	36.58	87.92	12.08
PAN	< 0.075	94.50	12.22		

sum = 774.3



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-15

Date Hole Started: 03/25/98 Date Hole Finished: 03/25/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: R/W Hawthorne St.
Descriptive Location: Asphalt parking strip in front of 522 Hawthorne

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on a Piper 2000 Drill mounted on a pickup . Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-398	SS		0.65	0.0 - 1.0'		0.0 - 2.0' Silty SAND Orange-brown to light brown some orange mottling, medium to grained, dry, medium dense; Trace red brick, and wood. [Smelter Debris]
	EVT-9803-399	SS		0.65	1.0 - 2.0'		
	EVT-9803-400	SS		0.70	2.0 - 3.0'		2.0 - 5.0' Silty SAND Grayish brown mottled orange (diminishes with depth), medium to fine grained, slightly moist to dry, med dense, 1" subrounded gravel. [Glacial Till]
	EVT-9803-401	SS		0.70	3.0 - 4.0'		
	EVT-9803-402	SS		0.80	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-16

Date Hole Started: 03/25/98 Date Hole Finished: 03/25/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: Former site of 515 Hawthorne St
Descriptive Location: In front yard adjacent to driveway

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Hole abandoned with Bentonite chips and 1' concrete cap with Aluminum ID Tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-408	SS		0.65	0.0 - 1.0'		0.0 - 3.0' **Silty SAND** Dark brown to orange brown, with orange mottling, moist to slightly moist; medium to fine grained, trace red brick fragments at 0-2'; 1" and smaller subrounded gravel. [Smelter Debris]
	EVT-9803-409	SS		0.65	1.0 - 2.0'		
	EVT-9803-410	SS		0.60	2.0 - 3.0' Duplicate sample at 12:00, # 413.		
	EVT-9803-411	SS		0.60	3.0 - 4.0'		3.0 - 5.0' **Silty SAND** Gray-brown, with orange staining at 3', dry, dense, with 3" and smaller subrounded gravel. [Glacial Till]
	EVT-9803-412	SS		0.80	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-17

Date Hole Started: 03/25/98 Date Hole Finished: 03/25/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: Former site of 515 Hawthorne St
Descriptive Location: SE corner of yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Hole abandoned with Bentonite chips and 1' concrete cap with Aluminum ID Tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-403	SS		0.60	0.0 - 1.0'		0.0 - 2.0' **Silty LOAM/Sandy SILT** Dark brown to yellow brown, trace orange mottling, slightly moi. moist, root mass, trace red brick fragments. [Smelter Debris]
	EVT-9803-404	SS		0.60	1.0 - 2.0'		
	EVT-9803-405	SS		0.50	2.0 - 3.0'		2.0 - 5.0' **Silty SAND** Light Brown grading to gray brown with some orange mottling; moist to slightly moist, medium to fine grained, medium dense, 3" and smaller subrounded gravel. [Glacial Till]
	EVT-9803-406	SS		0.50	3.0 - 4.0'		
	EVT-9803-407	SS		1.10	4.0 - 5.0'		
5					5		
10					10		
15					15		
20					20		

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/1/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-18

Date Hole Started: 03/25/98 Date Hole Finished: 03/2

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: Former site of 505 Hawthorne St
Descriptive Location: 10' from NE corner of foundation

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Hole abandoned with Bentonite chips and 1' concre cap with Aluminum ID Tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-420	SS		0.80	0.0 - 1.0'		0.0 - 1.0' **Silty LOAM** Dark brown, slightly moist, worms, root matter. [Fill]
	EVT-9803-421	SS		0.80	1.0 - 2.0'		1.0 - 3.0' **Silty SAND** Light brown mottled orange, fine to medium grained, medium dense to loose, trace 1/2" subrounded gravel. [Fill]
	EVT-9803-422	SS		0.75	2.0 - 3.0'		
	EVT-9803-423	SS		0.75	3.0 - 4.0'		3.0 - 5.0' **Sandy SILT** Gray with some orange staining, dry, dense to hard, trace 1" subrounded gravel; 1" lense of coarse yellowish white and black sand at 4-5'. [Glacial Till]
	EVT-9803-424	SS		0.60	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

TEST HOLE LOG

HYDROMETRICS

HELENA, MONTANA

PROJECT Everett Smelter JOB NUMBER ASEV-01 HOLE NUMBER S-22

STATE Washington COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 440 Pilchuck Path ELEVATION G.S. ____ DATE 07/22/93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER Ritch Gibson DRILLING COMPANY Boretec

TOTAL DEPTH 15.7' CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Till @ <4'.

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	% CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
4		EVT-	9307 782 4-4.2		1145	17/6			Light gray, slightly moist silt with occasional fine gravel.
						22/6	50		
									Coarse gravel at 5.3'.
5						40/2			
6			783 6-6.2		1200	15/6			Slightly moist, light gray, silty fine sand.
						25/6	100		
7			784 7-7.2		1205	35/6			Slightly moist, light gray, uniform, medium-grained sand.
8									
9			785 9-9.2		1210	9/6			Slightly moist, light gray sandy silt.
							100		
						33/6			
						60/6			
10									
11									

TEST HOLE LOG

HYDROMETRICS

HELENA, MONTANA

PROJECT Everett Smelter

HOLE NUMBER S-22

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	% CORE RECOVERY	NOTES ON: WATER LEVELS DRILLING FLUID DRILLING RATE WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
11			786 11-11.2	1215		33/6	100		Light gray sand, silt with large (1") iron stained lenses.
						60/6			
12								1 gallon water added.	
13			787 13.3-13.5	1250		36/6	100		Moist, light gray, sandy silt with occasional fine gravel.
						62/6			
						133/6			
14									
15			788 RV 15-15.2	1300		63/6			Moist, dense, light gray, sandy silt with occasional gravels.
						58/5			
16									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-27

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 520 Pilchuck Path ELEVATION G.S. ___ DATE 1-28-93

RECORDED BY J. C. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-623		1055				Topsoil, organic material, sandy
2"									
6"			9301-624		1100				Brown silty sand, brick chips, small gravel
9"									
1'			9301-625		1105				Tan sandy silt, small gravel
2'			9301-626		1110				Brown silty sand, brick chips, black stains
3'			9301-627 9301-630 Dupl.		1115 1130				Tan, silty sand, oxidized, small gravels
4'			9301-628		1120				Tan, silty sand, oxidized
5'									
6'			9301-629		1125				Tan silty sand
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-27 A

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 520 Pilchuck Path ELEVATION G.S. ____ DATE 7-16-93

RECORDED BY JC DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 7.2' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	7.0 7.2		EVT-9307 721	0920		50/3	100%		Light grey silt, soft, moist, small gravel 7.2 Auger Refusal Hit concrete

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-27 B

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 520 Pilchuck Path ELEVATION G.S. ___ DATE 7-16-93

RECORDED BY JC DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 10.4' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT RECOVERY CORE	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	7.2 7.5		EVT-9307 722	0950		13/6	100%		Light grey silt, stiff, small gravels
8'									
9'	9.0 9.3		EVT-9307 723	1020		50/6	100%		Light grey silt, very dense, small gravel
10'	10.0 10.4		EVT-9307 724	1045		50/4	100%	1 gallon	Light grey silt, very dense, small gravel
									Till started at 8.0'

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-28

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 520 Pilchuck Path ELEVATION G.S. ____ DATE 1-28-93

RECORDED BY J. C. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 5.5' CASING TYPE AND DESCRIPTION ____

TOTAL DEPTH CASED ____ WELL COMPLETION DESCRIPTION ____

REMARKS ____

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-631	1150					Topsoil, organic material, sandy, red brick chips
2"									
6"			9301-632	1155					Brown silty sand, red brick, small gravels
9"									
1'			9301-633	1200					Brown red, white silty sand with brick chips, smelter debris
2'			9301-634	1205					Brown silty sand, red brick smelter debris
3'			9301-635	1210					Tan, silty sand, small gravels
4'			9301-636	1215					Tan, silty sand, small gravels, wet
5'									
5.5'			9301-637	1220					Tan silty sand, wet, auger refusal at 5.5'
6'									
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-28 A,B,C

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 520 Pilchuck Path ELEVATION G.S. ____ DATE 7-16-93

RECORDED BY JC DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 7.2' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	7.0 7.2		EVT-9307 725A	1340		50/3	100%	1 gallon 1 gallon	Light grey silt, very dense, small gravel
									Till started at 4.8'
									S-28A Auger Refusal at 2' (large cobble)
									S-28B Auger Refusal at 7.0'
									S-28C Auger Refusal at 4.0'

TEST HOLE LOG

HYDROMETRICS

HELENA, MONTANA

PROJECT Everett Smelter JOB NUMBER ASEV-01 HOLE NUMBER S-34

STATE Washington COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 507 Hawthorne ELEVATION G.S. ____ DATE 07/19/93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER Ritch Gibson DRILLING COMPANY Boretec

TOTAL DEPTH 11.7' CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Till @ 7.2'.

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	% CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
4				1630		4/6	0		Sand catcher broke, 0% recovery, augered to 5' and resampled.
						10/6			
						23/6			
5									
		EVT-	9307 734 5-5.2	1645		6/6			Slightly moist light brown silt with occasional gravels.
						28/6	70		
6									
			735 6.3-6.5	1050		36/6			Same as above.
7			736 7-7.2	1705		61/6	100	1/2 gallon	Slightly moist, light brown silt with gravel, light gray silt at 7.2'.
			737 7.3-7.5	1710					
8									
9			738 9-9.2	1740		65/6	100	1/4 gallon	Moist, light gray silt, with large (>1") gravel and weathered gravel.
						77/6			
10									
				1800		90/6	0		Apparently sitting on a rock. Stuck, removed. Same as above.
11			739 11.5-11.7	1900		170/2	100		

TEST HOLE LOG

HYDROMETRICS

HELENA, MONTANA

PROJECT Everett Smelter JOB NUMBER ASEV-01 HOLE NUMBER S-36

STATE Washington COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 511 Hawthorne ELEVATION G.S. ___ DATE 07/19/93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER Ritch Gibson DRILLING COMPANY Boretec

TOTAL DEPTH 10.3' CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Till @ 6.5'.

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	% CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
4		EVT-	9307 729 4-4.2	1315		2/6 4/6 5/6	30%		Moist, light brown, silt with small gravel and 5% brick fragments.
5									
6			730 6-6.2	1340		4/6 16/6	100	<1 liter	Moist, light brown silt with >3/4" gravel and brick fragments, moist, light gray silt at 6.5' with small gravel and no brick.
7			731 7-7.2	1345		35/6 47/6			
8									
9			732 9-9.2	1420		100/6		<1 liter	Dry, light gray silt with occasional small gravel.
10			733 10-10.2	1430		100/4		1.0 gallon	Light gray silt with occasional small gravel.
			Auger refused at 10.3'.						

TEST HOLE LOG

HYDROMETRICS

HELENA, MONTANA

PROJECT Everett Smelter JOB NUMBER ASEV-01 HOLE NUMBER S-37

STATE Washington COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 515 Hawthorne ELEVATION G.S. ____ DATE 07/19/93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER Ritch Gibson DRILLING COMPANY Boretec

TOTAL DEPTH 8.2' CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Till @ <4'.

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	% CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
4		EVT-RV	9307 725B 4.5-5	1045		50/6 64/6	100		Moist, light gray silt, dense with gravel, sandy silt from 4.0 - 4.2'. Dup taken EVT-9307-726 1030. 4.5 - 5'
5									
6		EVT-	9307 727 6.3-6.7	1100		70/6	100	Add 1.0 liter	As above, less dense.
7			728 7.0-7.2	1130		36/6 70/3	100	<1 liter	As above, but drier.
8			7.8-8.2			125/5			Dry, light gray silt with gravel.
			Auger refused					TD = 8.2'	

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-72

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 514 Pilchuck Path ELEVATION G.S. ___ DATE 1-20-93

RECORDED BY R. V. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			ASEV01 9301-500		1345				Topsoil, organic - rich
2"									
6"									
9"			9301-501		1350				Topsoil, organic - rich
1'									
			9301-502		1355				Brown sand, silty, organic - rich
2'			9301-503		1400				Brown sand, silty, plus gray material (flue dust?)
3'			9301-504		1405				Light brown sand, silty, brick fragments, gray material (flue dust?)
4'			9301-505		1410				Light brown sand, clayey, oxidation rust spots
5'									
6'			9301-506		1415				Gray, silt, sandy, clayey, pebbles
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-72 A, B

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 514 Pilchuck Path ELEVATION G.S. ____ DATE 7-15-93

RECORDED BY JC DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 10.0' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	7.0 / 7.3		EVT-9307 718	1515		38/6 50/3	100%	1 gallon	Light grey silt, very dense, small gravel
8'									
9'	9.0 / 9.3		EVT-9307 720	1535		50/5	100%	1 gallon	Light grey silt, very dense, small gravel
10'			Auger Refusal						Till - 5.0'

Duplicate 7' sample EVT-9307-719 1600 hrs

S-72A - Auger refusal concrete @ 4.5'

S-72B - Auger refusal split spoon at 10' Blow counts 50/1" No sample

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-4

Date Hole Started: 03/31/98 Date Hole Finished: 03/31/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 450 Pilchuck Path
Descriptive Location: SW corner of back yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Extent of Glacial Till
Target Aquifer: N/A
Hole Diameter (in): 8.5
Total Depth Drilled (ft): 91.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	N/A	5 ft.

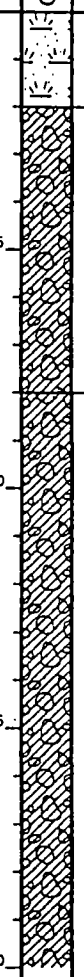
Static Water Level Below MP: 29
Date: 04/02/98
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with a Mobile Drill B-61 with 4 1/4" (ID) Hollow Stem Auger. Samples obtained with a 2" split spoon, and "A" Rod under a 140 lb., 30" drop, winch release safety hammer to 50'. Switched to a 3" split spoon using "N" rod under a 300 lb., 30" drop, winch release safety hammer. Boring abandoned with bentonite grout, bentonite chips, and 1' concrete cap with an aluminum identification tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
		SS	1/0/2	1.50	0.0 - 1.5' 300# hammer, 3" split spoon.
5		SS	49/50-3	0.00	5.0 - 6.5' 140# hammer, 2" split spoon.
10		SS	14/57-6	0.50	10.0 - 11.5'
15		SS	37/50-4	0.30	15.0 - 16.5'
20					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 2.0'
Silty LOAM
Brown, moist to wet.
[Fill]

2.0 - 8.0'
Sandy SILT
Brown, wet, dense.
[Glacial Till]

8.0 - 23.0'
Silty SAND
Gray trace orange mottling, fine grained, dry, hard, trace 1/4" subangular to subrounded gravel; Becomes silty at 20'.
[Glacial Till]

Continued Next Page

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-4

Date Hole Started: 03/31/98 Date Hole Finished: 03/31/9

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
		SS	60/50-4	0.50	20.0 - 21.5'		
25		SS	57/50-3	0.50	25.0 - 26.5' Outside of spoon wet.		23.0 - 39.0' **Gravelly Sandy SILT** Gray, dry, dense to hard, some 1/4" subrounded gravel. [Glacial Till]
30		SS	49/50-2	0.50	30.0 - 31.5'		
35		SS	100-4	0.30	35.0 - 36.5'		
40		SS	46/50-3	1.50	40.0 - 41.5'		39.0 - 43.0' **SAND** Gray, wet, medium to fine grained, some 1" and smaller rounded gravel. [Glacial Till]
45		SS	31/50-4	0.60	45.0 - 46.5'		43.0 - 71.0' **SILT** Gray to dark gray, moist to wet, medium dense; Some 2" subrounded gravel (20-30% at 50-53'); Some medium to fine grained sand interbedded at 55' and 30-40% from 64-71'. [Glacial Till]
50		SS	17/50-4	0.50	50.0 - 51.5' Switch to 300# hammer and 3" split spoon.		

Continued Next Page

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-4

Date Hole Started: 03/31/98 Date Hole Finished: [illegible]/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
55		SS	17/16/32	1.00	55.0 - 56.5'	55	
60		SS	28/50-3	0.75	60.0 - 61.5'	60	
65		SS	15/25/39	1.50	65.0 - 66.5'	65	
70		SS	25/30/50	1.00	70.0 - 71.5'	70	
							71.0 - 76.4' **Silty SAND** Gray, medium to find grained, moist, dense with trace 1" subrounded gravel. [Glacial Till]
75		SS	30/50-5	0.90	75.0 - 76.5'	75	
							76.4 - 85.5' **Clayey SILT** Gray, dry, dense, trace sand and 1/4" subround gravel. [Glacial Till]
80		SS	25/50-2	0.50	80.0 - 81.5'	80	
85						85	

Continued Next Page

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-4

Date Hole Started: 03/31/98 Date Hole Finished: 03/31/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
		SS	32/50-5	1.00	85.0 - 86.5'		85.5 - 91.5' **Sandy SILT** Light brown, dry to slightly moist, sand is fine to medium grained; Some 1/2" rounded gravel. [Glacial Till]
90		SS	100/50-5	0.90	90.0 - 91.5'		
95							
100							
105							
110							
115							

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-10A

Date Hole Staned: 03/20/98 Date Hole Finished: 03/20/

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 511 Hawthorne
Descriptive Location: SW back yard (former Stack area)

Recorded By: JSwortz
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x25'
Total Depth Drilled (ft): 6

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placed at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-163	GRAB			0.0 - 1.0'		0.0 - 1.0' **Silty LOAM** Brown, slightly moist to dry. [Fill]
	EVT-9803-164	GRAB			1.0 - 2.0'		1.0 - 4.0' **Silty SAND** Gray brown, slightly moist, medium to fine grained (becomes finer with depth), red brick fragments. [Smelter Debris]
	EVT-9803-165	GRAB			2.0 - 3.0'		
	EVT-9803-166	GRAB			3.0 - 4.0'		
	EVT-9803-167	GRAB			4.0 - 5.0'		4.0 - 5.0' **Sandy SILT** Light brown mottled black, slightly moist, red brick fragments (flue floor) some 1" rounded gravel. [Smelter Debris]
5	EVT-9803-168	GRAB			5.0 - 6.0'	5	5.0 - 6.0' **Sandy SILT** Light brown moist slightly plastic, trace 1/4" and smaller gravel. [Fill]
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-10B

Date Hole Started: 03/20/98 Date Hole Finished: 04/06/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 511 Hawthorne
Descriptive Location: SW back yard (former Stack area)

Recorded By: JSwortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): TPB 3.5"; TP 3x25'
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 7'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometrics Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag. Borings adjacent to test pits were labeled TPB-[test pit number].

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-156	GRAB			0.0 - 1.0' Duplicate sample at 08:52, EVT-9803-162		0.0 - 5.0' **Silty SAND** Dark brown to yellow gray, medium to fine grained, slightly moist to dry, red brick fragments (2" from 1-2'). [Smelter Debris]
	EVT-9803-157	GRAB			1.0 - 2.0'		
	EVT-9803-158	GRAB			2.0 - 3.0'		
	EVT-9803-159	GRAB			3.0 - 4.0'		
	EVT-9803-160	GRAB			4.0 - 5.0'		
5	EVT-9803-161	GRAB			5.0 - 6.0' Duplicate sample during drilling EVT-9804-100 @ 14:20; Split spoon 15/47.	5	5.0 - 6.0' **SILT** Yellow brown slightly moist to dry, wood fragments, trace red brick frags, some medium to coarse sand in a 1" lense. [Smelter Debris]
	EVT-9804-101	SS	25/44	0.80	6.0 - 7.0'		6.0 - 11.0' **Silty SAND** Brown to gray, fine grained, dry, medium dense to very dense, trace 1/4" subrounded gravel. [Glacial Till]
	EVT-9804-102	SS	29/70	0.70	8.0 - 9.0'		
10	EVT-9804-103	SS	49/82	0.80	10.0 - 11.0' Duplicate sample @ 14:40, EVT-9804-104.	10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

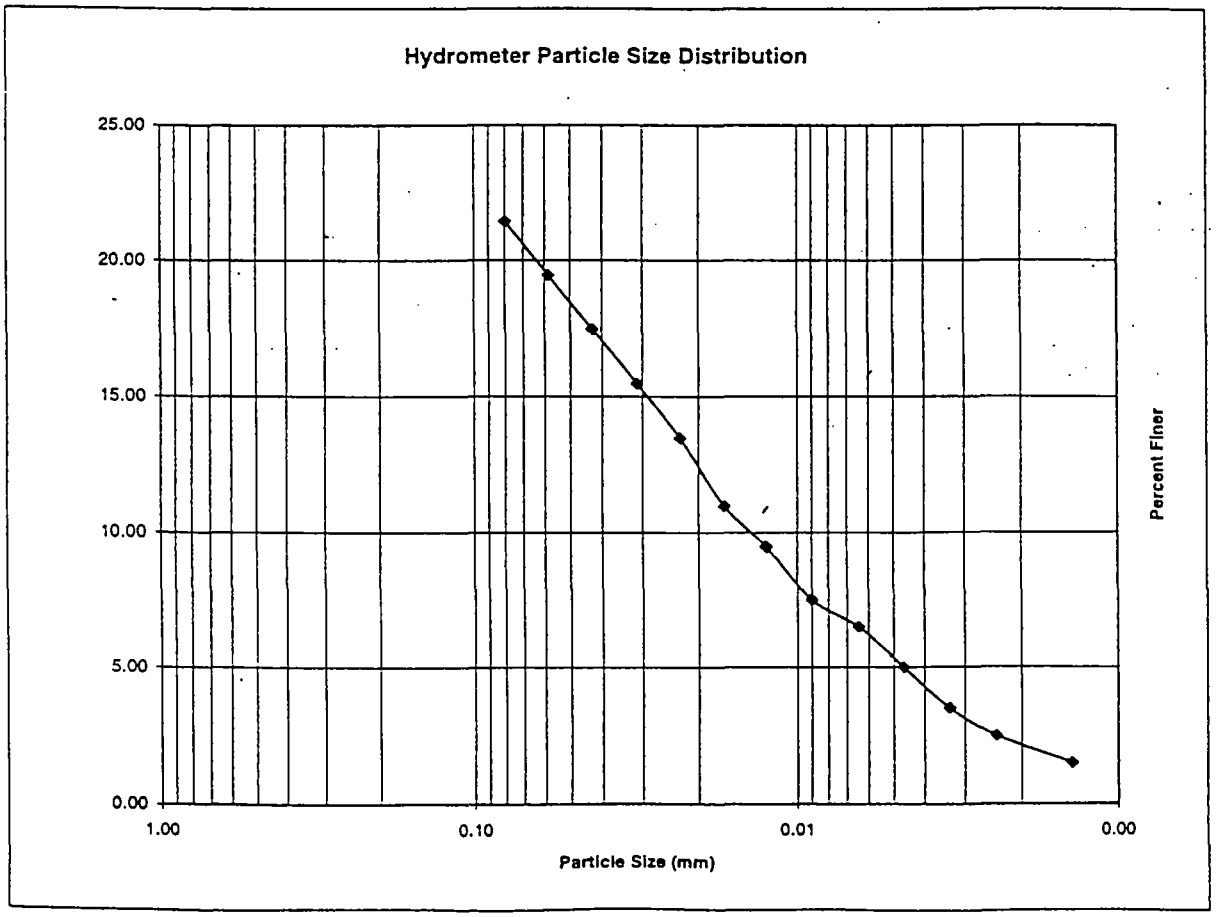
TP-10B
8-9'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-01154
SAMPLE NUMBER	EVT-9804-102
DATE	6/29/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	48	43	86.00	49	8.5	0.0137	0.08	21.45
0.5	44	39	78.00	45	9.1	0.0137	0.06	19.45
1	40	35	70.00	41	9.8	0.0137	0.04	17.46
2	36	31	62.00	37	10.4	0.0137	0.03	15.46
4	32	27	54.00	33	11.1	0.0137	0.02	13.47
8	27	22	44.00	28	11.9	0.0137	0.02	10.97
15	24	19	38.00	25	12.4	0.0137	0.01	9.48
30	20	15	30.00	21	13	0.0137	0.01	7.48
60	18	13	26.00	19	13.3	0.0137	0.01	6.48
120	15	10	20.00	16	13.8	0.0137	0.00	4.99
240	12	7	14.00	13	14.3	0.0137	0.00	3.49
480	10	5	10	11	14.7	0.0137	0.00	2.49
1440	8	3	6	9	15	0.0137	0.00	1.50



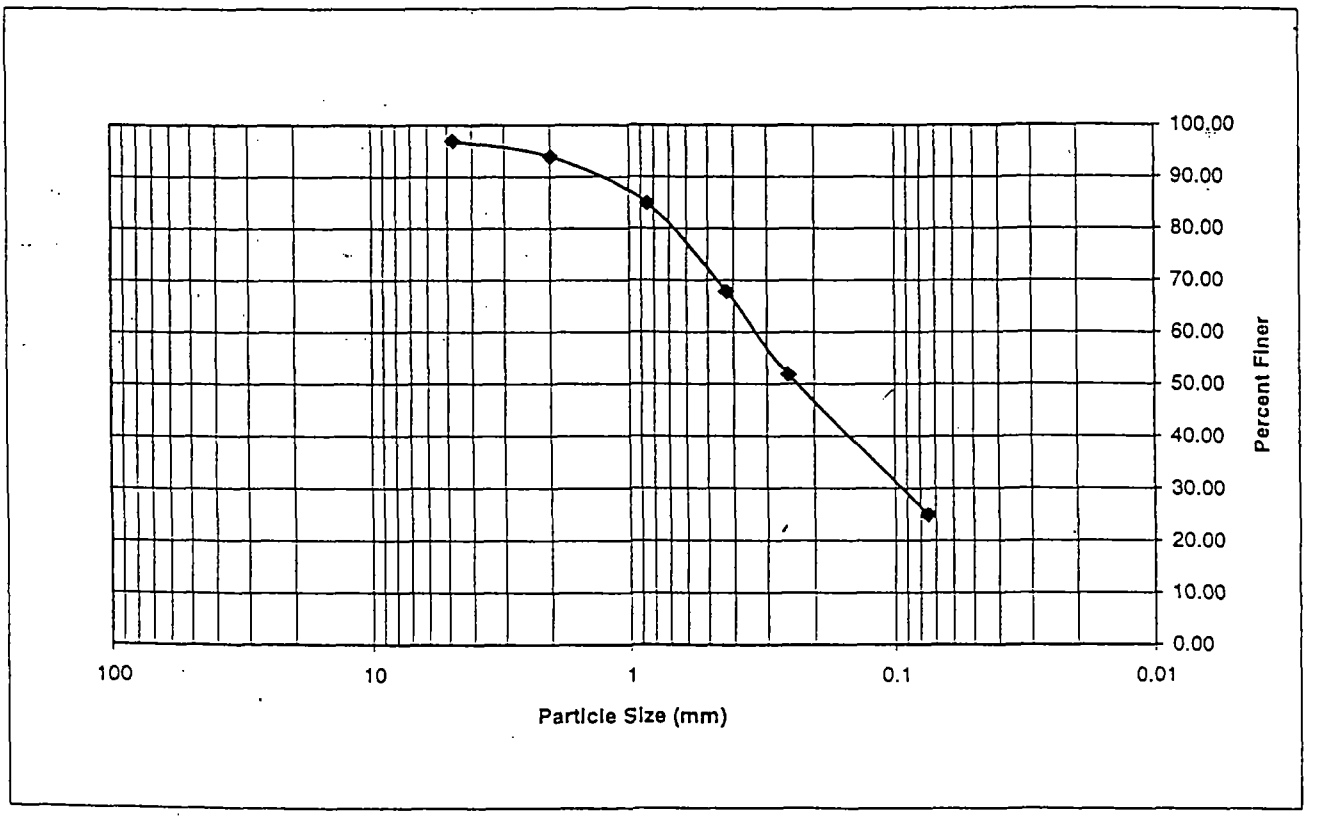
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-01154
Sample Number: EVT-9804-102
Date: 6/26/98

Weight of Oven Dry Sample (g): 241.4

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	7.4	3.07	3.07	96.93
10	2.00	7.40	3.07	6.13	93.87
20	0.85	21.70	8.99	15.12	84.88
40	0.425	41.20	17.07	32.19	67.81
60	0.250	38.50	15.95	48.14	51.86
200	0.075	65.00	26.93	75.06	24.94
PAN	< 0.075	59.60	24.69		

sum = 240.8



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-11A

Date Hole Started: 03/19/98 Date Hole Finishe[illegible]/19/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 520 Pilchuck Path
Descriptive Location: Front yard (former stacks area)

Recorded By: B Thompson
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x45'
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placec at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-151	GRAB			0.0 - 1.0'		0.0 - 1.0' **Silty LOAM** Brown, some gravel. [Fill]
	EVT-9803-152	GRAB			1.0 - 2.0'		1.0 - 3.0' **SAND & SILT** Brown, fine sand & silt, trace gravel, trace red brick fragments, some 2" darker brown horizons at 2-3'. [Smelter Debris]
	EVT-9803-153	GRAB			2.0 - 3.0'		
	EVT-9803-154	GRAB			3.0 - 4.0'		3.0 - 4.0' **BRICK** Four to five rows of mortared brick, gray medium sand and silt. Greenis yellow residue coating bricks and filling cracks (moist). [Smelter Debris]
	EVT-9803-155	GRAB			4.0 - 5.0'		4.0 - 5.0' **SAND & SILT** Orange/brown fine sand and silt with trace gravel. Becomes very dense at 5'. Brown to black trace roots at base of excavation. [Fill]
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-11B

Date Hole Started: 03/19/98 Date Hole Finished: 04/0

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 520 Pilchuck Path
Descriptive Location: Front yard (former stacks area)

Recorded By: JSwortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): TPB 3.5"; TP 3x45'
Total Depth Drilled (ft): 13.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 7'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometric Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag. Borings adjacent to test pits were labeled TPB-[test pit number].

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-145	GRAB			0.0 - 1.0'
	EVT-9803-146	GRAB			1.0 - 2.0'
	EVT-9803-147	GRAB			2.0 - 3.0'
	EVT-9803-148	GRAB			3.0 - 4.0'
	EVT-9803-149	GRAB			4.0 - 5.0'
5	EVT-9803-150	GRAB			5.0 - 6.0' Duplicate sample during drilling EVT-9804-109, 08:20, 3/8
	EVT-9804-110	SS	6/15	0.40	6.0 - 7.0'
	EVT-9804-111	SS	12/18	0.70	8.0 - 9.0' Duplicate sample @ 08:45 EVT-9804-114
10					
	EVT-9804-112	SS	16/40	0.80	10.0 - 11.0'
	EVT-9804-113	SS	22/52	1.00	12.0 - 13.5'
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Silty LOAM
Brown, with trace gravel.
[Fill]

1.0 - 3.0'
SAND & SILT
Brown to dark brown, fine sand and silt with some fine to medium gra trace red brick.
[Smelter Debris]

3.0 - 4.0'
BRICK
Four to five rows of red brick and light gray medium sand. Slight yello to white staining on sand & brick.
[Smelter Debris]

4.0 - 6.0'
SAND & SILT
Orange/brown grading to light brown, fine sand and silt, trace gravel. Tree roots at base of excavation.
[Fill]

6.0 - 7.0'
Silty SAND
Light brown, fine to very fine grained, slightly moist, with 1" rounded gravel.
[Fill]

7.0 - 13.5'
Silty SAND
Light brown with trace orange mottling, dry to slightly moist, medium dense, some interbedded fine grained sand lenses 1/4 to 1/8" thick th transitions to dry silt. Up to 30% silt.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

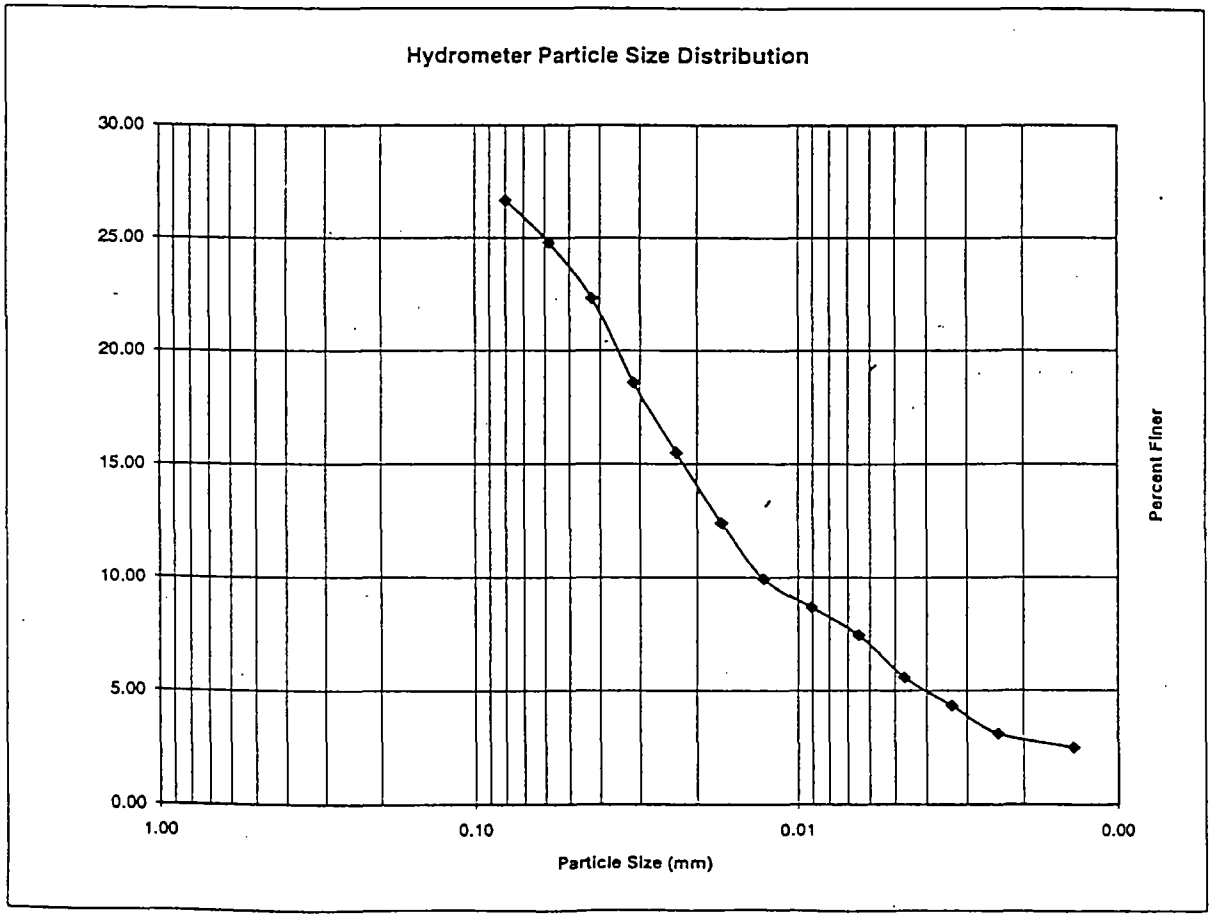
TP-11B
10-11'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-01164
SAMPLE NUMBER	EVT-9804-112
DATE	6/29/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	48	43	86.00	49	8.5	0.0137	0.08	26.65
0.5	45	40	80.00	46	9	0.0137	0.06	24.79
1	41	36	72.00	42	9.6	0.0137	0.04	22.31
2	35	30	60.00	36	10.6	0.0137	0.03	18.59
4	30	25	50.00	31	11.4	0.0137	0.02	15.50
8	25	20	40.00	26	12.2	0.0137	0.02	12.40
15	21	16	32.00	22	12.9	0.0137	0.01	9.92
30	19	14	28.00	20	13.2	0.0137	0.01	8.68
60	17	12	24.00	18	13.5	0.0137	0.01	7.44
120	14	9	18.00	15	14	0.0137	0.00	5.58
240	12	7	14.00	13	14.3	0.0137	0.00	4.34
480	10	5	10	11	14.7	0.0137	0.00	3.10
1440	9	4	8	10	14.8	0.0137	0.00	2.48



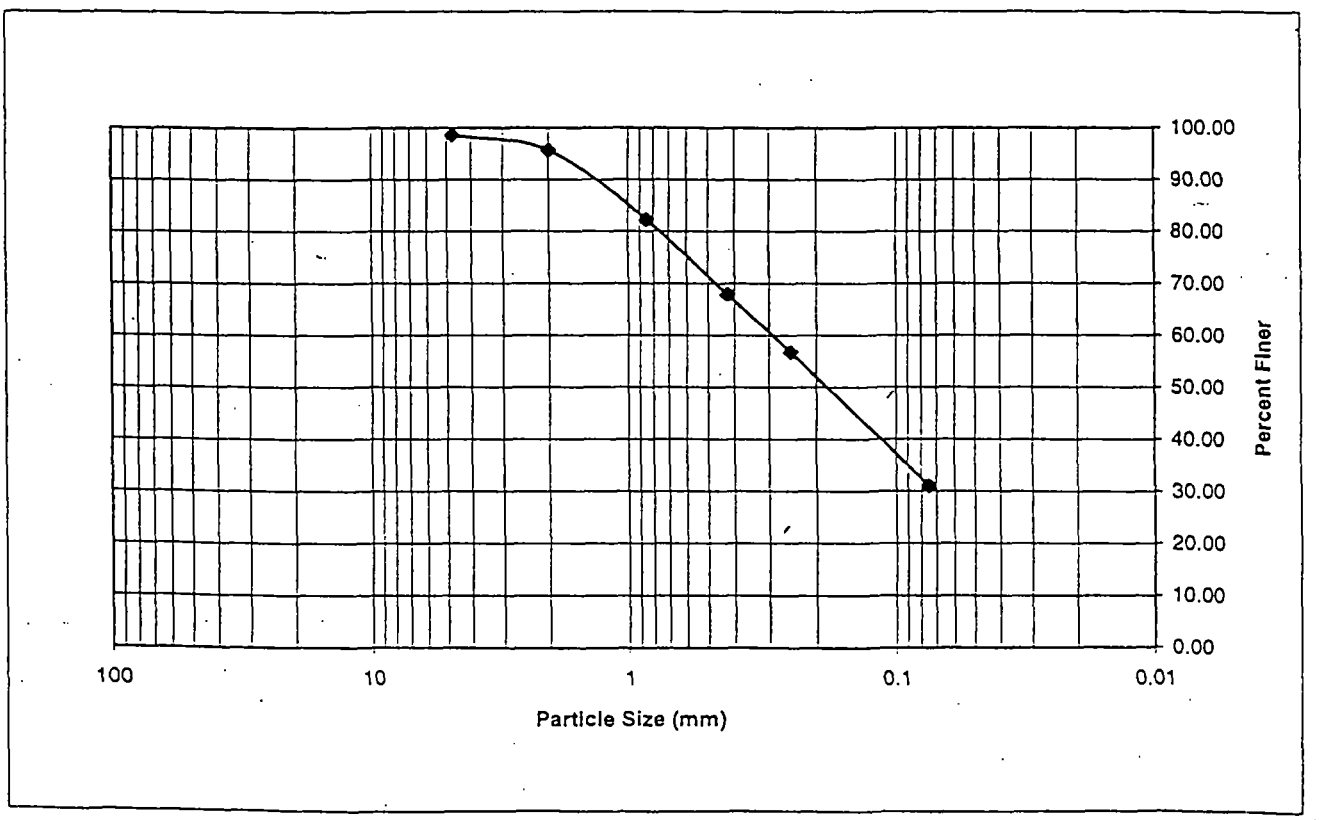
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-01164
Sample Number: EVT-9804-112
Date: 6/26/98

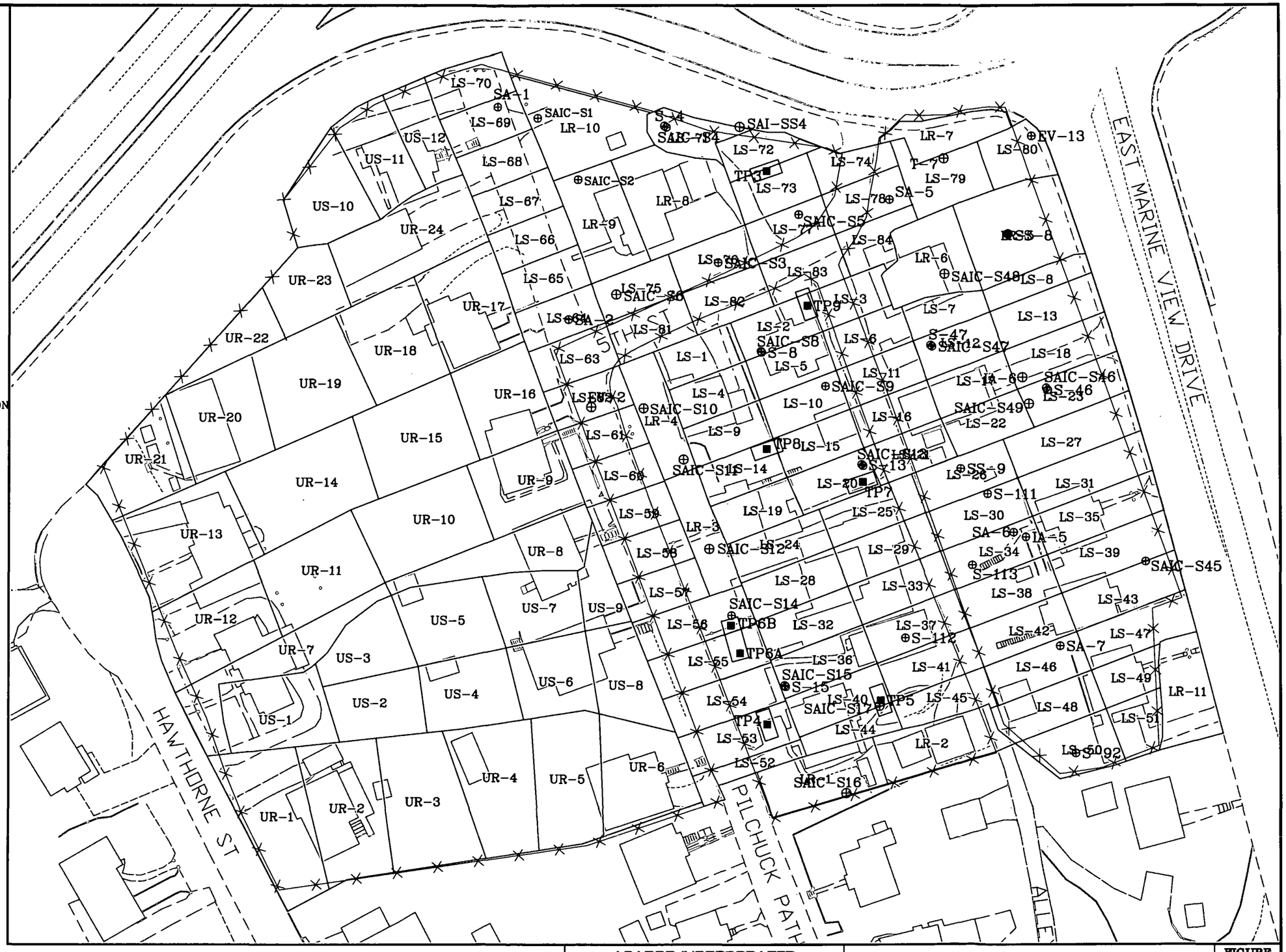
Weight of Oven Dry Sample (g): 301.7

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	4.2	1.39	1.39	98.61
10	2.00	8.90	2.95	4.34	95.66
20	0.85	40.50	13.42	17.77	82.23
40	0.425	43.40	14.39	32.15	67.85
60	0.250	33.60	11.14	43.29	56.71
200	0.075	77.60	25.72	69.01	30.99
PAN	< 0.075	92.50	30.66		

sum = 300.7



E.3
LOWER AREA
ARSENIC CONCENTRATIONS



ASARCO Consulting, Inc.

ASARCO INCORPORATED
INTERIM ACTION REPORT, FENCED AREA CLEANUP, EVERETT SMELTER SITE APPENDIX A

PREVIOUS SAMPLE LOCATIONS IN LOWER FENCED AREA

FIGURE
E-2

UPDATE TIME: 8am
PG \TAC\112502\I:\Land Projects\Everett-091902\Everett-091902-T039.dwg

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
IA-5	Surface	23,000	NO	-
	1.0	28,000		
	2.0	20,000		
IA-6	Surface	16,000	NO	-
	1.0	1,400		
	2.0	3,500		
IA-8	Surface	1,400	NO	-
EV-2	Surface	660	YES	10.0
	1.0	117		
	2.0	1,090		
	3.0	1,687		
	11.0	7		
EV-3	1.0-2.5	288	YES	10.5
	4.0-5.5	248		
	8.5-10.0	212		
	10.0-11.5	34		
	14.5-16.8	83		
	24.0-25.5	66		
	34.0-35.5	14		
	44.0-45.5	5		
	49.0-50.5	3		
EV-10	0.0 - 0.5	55	YES	10.5
	2.0 - 2.8	1,660		
	2.8 - 3.5	7,660		
	5.0 - 5.5	773		
	10.0 - 10.5	1,728		
	10.5 - 11.0	280		
EV-11	0.0 - 0.5	37	YES	11.5
	2.0 - 3.5	77		
	5.0 - 6.5	3,112		
	10.0 - 11.5	748		
	12.5 - 13.5	364		
EV-12	0.0 - 0.5	49	YES	11.5
	2.0 - 3.5	56		
	5.0 - 6.5	776		
	10.5 - 11.5	187		
	12.5 - 13.5	60		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
EV-13	0.0 – 0.5	487	YES	6.0
	2.0 – 3.5	11,810		
	5.0 – 5.5	2,785		
	5.5 – 6.5	1,831		
	10.0 - 11.5	2,259		
SA-1	0.0-1.0	1,427	YES	NE
	1.0-2.0	682		
	2.0-3.0	818		
	3.0-4.0	320		
	4.0-5.0	3,841		
	6.0-6.25	515		
SA-2	0.0-1.0	2,351	YES	2.0
	1.0-2.0	4,171		
	2.0-3.0	2,014		
	3.0-4.0	158		
	5.0-6.0	40		
	6.0-7.0	17		
SA-5	0.0-1.0	4,677	YES	8.0
	1.0-2.0	808		
	2.0-3.0	47		
	3.0-4.0	60		
	4.0-5.0	11		
	5.0-6.0	35		
	8.0-9.0	317		
	11.0-12.0	280		
	14.0-15.0	61		
SA-6	0.0-1.0	3,633	YES	4.0
	1.0-2.0	39,777		
	2.0-3.0	40,938		
	3.0-4.0	33,201		
	4.0-5.0	7,903		
	5.0-6.0	1,260		
	7.5-9.0	2,761		
SA-7	0.0-1.0	19,122	YES	6.5
	1.0-2.0	38,751		
	2.0-3.0	14,277		
	3.0-4.0	7,476		
	4.0-5.0	5,245		
	5.0-6.0	1,348		
	7.5-9.0	402		
	10.0-11.0	258		
Location	Sampling	Arsenic	Soil Boring	Depth Till

LOWER AREA ARSENIC CONCENTRATIONS

	Depth (feet)	Concentration (mg/Kg)	Log Attached (Y/N)	Identified (feet)
SA-8	0.0-1.0	1,208	YES	2.0
	1.0-2.0	111		
	2.0-3.0	79		
	3.0-4.0	42		
	4-0-5.0	52		
SA-9	0.0-1.0	798	YES	3.0
	1.0-2.0	813		
	2.0-3.0	1,078		
	3.0-4.0	1,189		
	4-0-5.0	51		
SA-10	0.0-1.0	312	YES	NE
	1.0-2.0	10		
	2.0-3.0	70		
	3.0-4.0	10		
	4-0-5.0	14		
SA-11	0.0-1.0	258	YES	4.0
	1.0-2.0	231		
	2.0-3.0	10		
	3.0-4.0	10		
	4-0-5.0	10		
SA-12	0.0-1.0	968	YES	NE
	1.0-2.0	125		
	2.0-3.0	14		
	3.0-4.0	10		
	4-0-5.0	10		
SA-25	0.0-1.0	249	YES	NE
	1.0-2.0	429		
	2.0-3.0	122		
	3.0-4.0	10		
	4.0-5.0	140		
SA-26	0.0-1.0	228	YES	NE
	1.0-2.0	1,105		
	2.0-3.0	390		
	3.0-4.0	54		
	4.0-5.0	101		
SAIC-S1	Surface	319	NO	-
	0.5	215		
	1.0	438		
	2.0	1,010		
	3.0	333		

Location	Sampling Depth (feet)	Arsenic Concentration	Soil Boring Log Attached	Depth Till Identified

LOWER AREA ARSENIC CONCENTRATIONS

		(mg/Kg)	(Y/N)	(feet)
SAIC-S2	Surface	309	NO	-
	0.5	142		
	1.0	112		
	2.0	952		
	3.0	865		
SAIC-S3	surface	286	NO	-
	0.5	257		
	1.0	915		
	2.0	4,700		
	3.0	2,340		
SAIC-S4	surface	4,800	NO	-
	0.5	2,380		
	1.0	2,860		
	2.0	5,820		
	4.0	10,500		
S-4	surface	1,340	YES	7.5
	0.5	2,460		
	1.0	4,290		
	2.0	1,330		
	3.0	2,720		
	4.0	4,840		
	6.0	270		
	7.0	136		
	11.0	11		
SAIC-S5	surface	6,890	NO	-
SAIC-S6	surface	138	NO	-
SAIC-S7	surface	480	NO	-
SAIC-S8	surface	917	NO	-
S-8	surface	10,800	YES	6.0
	0.5	6,700		
	1.0	5,300		
	2.0	18,000		
	3.0	1,500		
	4.0	1,400		
	6.0	1,000		
	7.0	129		
SAIC-S9	surface	1,030	NO	-
	0.5	7,210		
	1.0	6,170		
	2.0	3,300		
	3.0	1,080		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
SAIC-S10	surface	194	NO	-
	0.5	32		
	1.0	34		
	2.0	147		
	3.0	25		
SAIC-S11	surface	114	NO	-
	0.5	130		
	1.0	355		
	2.0	192		
	3.0	336		
SAIC-S12	surface	38	NO	-
	0.5	412		
	1.0	266		
	2.0	255		
	3.0	758		
SAIC-S13	surface	1,350	NO	-
	0.5	1,500		
	1.0	9,150		
	2.0	6,100		
	3.0	2,620		
S-13	surface	1,400	YES	5.0
	0.5	1,600		
	1.0	14,000		
	2.0	4,500		
	3.0	11,200		
	4.0	6,500		
	6.0	1,100		
	7.0	214		
	9.0	717		
	11.0	313		
	13.0	409		
	15.0	490		
SAIC-S14	surface	833	NO	-
	0.5	2,190		
	1.0	3,330		
	2.0	6,490		
	3.0	2,410		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
SAIC-S15	surface	50	NO	-
	0.5	313		
	1.0	577		
	2.0	2,650		
	3.0	44,700		
S-15	surface	103	YES	7.5
	0.5	230		
	1.0	870		
	2.0	1,670		
	3.0	1,780		
	4.0	650		
	6.0	3,040		
	7.0	1,074		
	9.0	293		
	11.0	526		
	13.0	123		
	15.0	258		
SAIC-S16	surface	235	NO	-
SAIC-S17	surface	235	NO	-
	0.5	241		
	1.0	366		
	2.0	976		
	3.0	1,190		
SAIC-S18	surface	131	NO	-
SAIC-S44	surface	341	NO	-
SAIC-S45	surface	7,450	NO	-
	1.0	13,700		
	2.0	4,730		
	3.0	1,940		
SAIC-S46	surface	1,860	NO	-
	0.5	2,590		
	1.0	3,170		
	2.0	3,120		
	3.0	2,440		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
S-46	surface	1,600	YES	6.0
	0.5	1,600		
	1.0	2,100		
	2.0	3,400		
	3.0	3,300		
	4.0	900		
	6.0	900		
	7.0	603		
	9.0	1,052		
	11.0	512		
	13.0	134		
	15.0	133		
SAIC-S47	surface	3,880	NO	-
	0.5	4,080		
	1.0	5,380		
	2.0	5,130		
	3.0	2,150		
S-47	surface	2,580	YES	7.0
	0.5	3,420		
	1.0	4,980		
	2.0	2,890		
	3.0	1,660		
	4.0	1,630		
	6.0	1,670		
	7.0	466		
	11.0	642		
SAIC-S48	surface	791	NO	-
	0.5	584		
	1.0	780		
	2.0	49		
	3.0	97		
SAIC-S49	surface	2,010	NO	-
SAIC-S54	surface	35	NO	-

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
S-92	surface	2,569	YES	6.0
	0.5	29,000		
	1.0	7,534		
	2.0	3,215		
	3.0	3,681		
	4.0	1,780		
	6.0	753		
	7.0	435		
	9.0	253		
S-111	surface	205	YES	7.0
	0.5	4,100		
	1.0	727,000		
	2.0	430,000		
	3.0	622,500		
	4.0	150,000		
	7.0	19,140		
	9.0	11,950		
	11.0	1,800		
S-112	surface	1,510	YES	NE
	0.5	143,600		
	1.0	143,500		
	2.0	83,600		
	3.0	34,950		
	4.0	20,550		
S-113	surface	26,550	YES	7.0
	0.5	38,650		
	1.0	30,150		
	2.0	25,540		
	3.0	9,060		
	4.0	2,620		
	6.0	13,030		
	7.0	4,795		
	9.0	864		
	11.0	389		
	13.0	346		
	15.0	282		
SS-5	surface	541	NO	-
SS-6	surface	131	NO	-
SS-8	surface	345	NO	-
SS-9	surface	182	NO	-

Location	Sampling	Arsenic	Soil Boring	Depth Till

LOWER AREA ARSENIC CONCENTRATIONS

	Depth (feet)	Concentration (mg/Kg)	Log Attached (Y/N)	Identified (feet)
T-7	surface	931	NO	-
	1.0	1,050		
	2.0	468		
TB-1	0.0-0.5	18	YES	13.5
	2.0-3.5	46		
	5.0-6.5	48		
	10.0-11.5	695		
	15.0-16.5	455		
	20.0-21.5	197		
	25.0-26.5	201		
	30.0-31.5	120		
	35.0-36.5	76		
TB-2	0-0.5	10	YES	15.0
	2-3.5	115		
	5-6.5	28		
	10-11.5	47		
	15-16.5	502		
	20-21.5	15		
	30-31.5	10		
	35-36.5	10		
TB-3	0-0.5	18	YES	15.0
	2-3.5	218		
	37.5-39.0	291		
	5-6.5	20		
	10-11.5	660		
	15-16.5	194		
	20-21.5	206		
	25-26.5	10		
	30-31.5	10		
	35-36.5	10		
TP-3	0.0-1.0	1,704	YES	7.0
	1.0-2.0	9,043		
	2.0-3.0	21,686		
	3.0-4.0	28,579		
	4.0-5.0	1,883		
	5.0-6.0	6,902		
	6.0-7.0	7,084		
	7.0-8.0	203		
	8.0-9.0	507		
	9.0-10.0	655		
	10.0-11.0	744		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
TP-4	0.0-1.0	565	YES	4.5
	1.0-2.0	1,981		
	2.0-3.0	8,799		
	3.0-4.0	32,918		
	4-0-5.0	4,724		
	5.0-6.0	1,600		
	6.0-7.0	225		
	8.0-9.0	219		
	10.0-11.0	206		
TP-5	0.0-1.0	1,161	YES	3.0
	1.0-2.0	5,370		
	2.0-3.0	2,777		
	3.0-4.0	827		
	4-0-5.0	502		
TP-6A	0.0-1.0	4,373	YES	4.0
	1.0-2.0	12,487		
	2.0-3.0	9,726		
	3.0-4.0	9,252		
	4-0-5.0	4,305		
	5.0-6.0	3,235		
	6.0-7.0	353		
	8.0-9.0	706		
	10.0-11.0	412		
	12.0-13.0	249		
TP-6B	0.0-1.0	9,388	YES	4.0
	1.0-2.0	14,223		
	2.0-3.0	13,985		
	3.0-4.0	13,537		
	4-0-5.0	5,497		
	5.0-6.0	2,740		
TP-7	0.0-1.0	2,220	YES	5.0
	1.0-2.0	8,771		
	2.0-3.0	9,935		
	3.0-4.0	10,644		
	4-0-5.0	6,586		
	5.0-6.0	2,952		
	6.0-7.0	684		
	8.0-9.0	698		
	10.0-11.0	541		

LOWER AREA ARSENIC CONCENTRATIONS

Location	Sampling Depth (feet)	Arsenic Concentration (mg/Kg)	Soil Boring Log Attached (Y/N)	Depth Till Identified (feet)
TP-8	0.0-1.0	3,738	YES	5.0
	1.0-2.0	2,797		
	2.0-3.0	4,619		
	3.0-4.0	7,237		
	4.0-5.0	4,669		
	5.0-6.0	564		
TP-9	0.0-1.0	33,665	YES	5.0
	1.0-2.0	10,503		
	2.0-3.0	5,668		
	3.0-4.0	7,821		
	4-0-5.0	1,564		
	5.0-6.0	535		

Note: NE – glacial till not encountered.

E.4
LOWER AREA
AVAILABLE SOIL BORING LOGS

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Asarco Everett JOB NUMBER ASEV01 HOLE NUMBER EV-2A

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION Pilchuck Path ELEVATION G.S. ___ DATE 2-01-93

RECORDED BY B. Thompson DRILL METHOD H.S.A. DRILLER S. Hauman DRILLING CO. Holt Drilling

TOTAL DEPTH 20' CASING TYPE AND DESCRIPTION 4 1/4" ID Hollow Stem Augers

DEPTH	BLOW COUNT	SAMPLE #	SAMPLE TYPE	GEOLOGIC DESCRIPTION	NOTES ON: WATER LEVELS, DRILLING WELL COMPLETION, ETC.
0	NA	S-1	Grab	Brown fine-coarse sand, some silt, little gravel, trace clay contains some brick fragments	(Damp)
	11, 4, 4	S-2	S.S.	As above with fragments of brick & slag Trace white oxidation on sediment	
	11, 6, 9	S-3 A B	S.S.	6" as above with increased white & green oxidation 6" (light brown/ grey silt & fine sand little clay, trace gravel	(Damp)
5'	6, 5, 8	S-4	S.S.	Light brown/grey silt, little fine sand, trace clay, trace fine-medium gravel, gravel is subrounded, mixed lithologies	(Damp)
	19, 40, 50	S-5	S.S.	As above	
	21, 39, 50/5"	S-6	S.S.	As above	
10'	36, 50/4 1/2"	S-7	S.S.	As above, with intervals fine-coarse sand & silt	(Dry)
	25, 50/4"	S-8	S.S.	As above	
	21, 44, 47	S-9	S.S.	As above	(Dry)
	18, 42, 50/3"	S-10	S.S.	As above	
15'					
20'	40, 50/3"	S-11	S.S.	As above No well installed	Boring backfilled with bentonite chips cement surface seal B.O.H. @ 20'

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Asarco Everett JOB NUMBER ASEV01 HOLE NUMBER EV-3

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION East Marine View Drive ELEVATION G.S. 56.85 DATE 1-22-93

RECORDED BY B. Thompson DRILL METHOD H.S.A. DRILLER M. Hickman DRILLING CO. Holt Drilling

TOTAL DEPTH 55' CASING TYPE AND DESCRIPTION Drilled with 4 1/2" ID Hollow Stem Augers
Dames & Moore Sampler; well completed with 2" PVC casing

DEPTH	BLOW COUNT	SAMPLE #	SAMPLE TYPE	GEOLOGIC DESCRIPTION		NOTES ON: WATER LEVELS, DRILLING WELL COMPLETION, ETC.
0	-	-	-	4" asphalt, 6" concrete		Flush mount, steel protective casing cemented to grade
				3" brown gravel light clay		Locking expansion plug in top of PVC
	12, 29, 21	S-1 A B		3" dark brown (resinous) fine gravel 6" grey/brown sand & gravel some silt		
	9, 8, 4	S-2	S.S.	6" grey/brown sand & gravel, some silt 7" dark brown very coarse sand 3" orange/brown fine sand, little, silt, trace fine gravel (moist)	FILL	2" Sch 40, Flush-threaded PVC well casing
5'	8, 4, 4	S-3	S.S.	As above (moist)		
	8, 20, 17	S-4	S.S.	6" as above 6" gray/brown silt and fine sand light fine gravel, trace clay (dry)		
	4, 19, 18	S-5	S.S.	As above with light fine-coarse gravel, red oxidized surface staining (dry)		
	5, 10, 12	S-6	S.S.	As above		
10'	3, 11, 13	S-7	S.S.	As above	Spun	augers, no water
	7, 42, 50/3"	S-8	S.S.	As above with trace coarse sand		
	29, 45, 34	S-9	S.S.	As above		
15'	18, 24, 30	S-10	S.S.	As above with fine-coarse sand		
20'	20, 50/6"	S-11	S.S	As above	FILL	Back filled with bentonite chips hydrated with water

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Asarco Everett JOB NUMBER ASEV01 HOLE NUMBER EV-3

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION East Marine View Drive ELEVATION G.S. 56.85 DATE 1-22-93

RECORDED BY B. Thompson DRILL METHOD H.S.A. DRILLER M. Hickman DRILLING CO. Holt Drilling

TOTAL DEPTH 55' CASING TYPE AND DESCRIPTION Drilled with 4 1/2" ID Hollow Stem Augers
Dames & Moore Sampler; well completed with 2" PVC casing

DEPTH	BLOW COUNT	SAMPLE #	SAMPLE TYPE	GEOLOGIC DESCRIPTION		NOTES ON: WATER LEVELS, DRILLING WELL COMPLETION, ETC.
25'	9, 39, 50/4"	S-12	S.S.	As above with little clay	TILL	
				Drilling rate increased Augers advancing smoothly		
30'	6, 11, 10	S-13	S.S.	Light brown fine-medium sand	FLUVIAL	Well annulus grouted up to 25' starting to lose grout at least 25'
				Light brown fine-coarse sand (damp) 2" light brown silt, some clay (oxidized along laminations) (dry)		
35'	12, 12, 17	S-14	S.S.			
	8, 22, 26	S-15	S.S.	2 light brown silt, some clay light brown fine-coarse sand (damp)	SAND	
40'	12, 15, 18	S-16	S.S.	As above		2" SCH 40 flush-threaded PVC casing
					FLUVIAL SAND	
45'	24, 41, 50/5"	S-17	S.S.	Light brown, very coarse sand, little fine-medium sand (damp)		2' seal - bentonite pellets
50'	23, 30, 40	S-18	S.S.	Light brown, fine sand (wet)		2" x 5' SCH 40, flush-thread PVC well screen with 0.020" factory cut slots; backfilled with #20 silica sand, PVC end cap
55'				No sample, running sands		B. O. H. @ 55'
60'						
65'						

HYDROMETRICS INC.

Consulting Scientists and Engineers
2727 Airport Rd. Helena Mt, 59601

GEOTECHNICAL WELL LOG DIAGRAM

Hole Name: EV-10

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96

Project: ASEV01 Everett Smelter Site
County: Snohomish State: WA
Legal Description: East Marine View Drive
Descriptive Location: 142' S, 3' E of EV-3

Recorded By: Jim Swortz
Drilling Company: Hydrometrics
Driller: J.Neiderkorn
Drilling Method: Hollow Stem Augers
Drilling Fluids Used: None

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2"SCH 40 PVC, flush thread Casing	-0.5 - 11.0
Surface Casing Used?	Y	Flush mount steel protective casing	0.0 - 1.2
Screen/Perforations?	Y	0.010 slotted screen	4.5 - 10.0
Sand Pack?	Y	silica sand	3.5 - 10.0
Annular Seal?	Y	bentonite chips	1.5 - 3.5
Surface Seal?	Y	cement pad	0.0 - 1.5
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Purpose of Hole: Monitoring Well
Target Aquifer: Shallow fill/till
Hole Diameter (in): 7"OD
Total Depth Drilled (ft): 11.00

Static Water Level Below MP: Dry Hole
Date: 02/22/96
MP Description: Top of PVC casing
MP Height Above or Below Ground (ft): 0.00

Surface Casing Height (ft): 0.00
Riser Height (ft): -0.50
Ground Surface Elevation (ft): 0.00
MP Elevation (ft): 0.00

Remarks: All sample numbers preceeded by EVT-9602

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION (GRAPHICS: ■ = Screened Interval)
	238	grab		0.00	0.0 - 0.5'	0.0 - 0.5' Sand & Gravel - brown/gray, medium to coarse Sand, 50% Gravel, semi-rounded; trace Silt; moist. [road base fill].
						0.5 - 11.0'
	239	ss	10,9,9	1.50	2.0 - 2.8' Two samples collected from split spoon obtained from 2.0 to 3.5.	Silty Sand - dark to light brown, trace gravel, 1/2 inch black layer; moist.
	240	ss		0.00	2.8 - 3.5'	Fine Sand & Silt - brown/orange, trace gravel, moist.
5	241	ss	5,13,16,	1.00	5.0 - 5.5' Sample 242 is a duplicate to sample 241.	Sandy Silt - light brown, mottled orange, trace gravel, moist.
10	243	ss	10,40,50/6"	0.50	10.0 - 10.5'	Silty Sand - gray brown, trace gravel, moist, dense from 10.5 to 11.0 feet, cobble at 11.0 feet.
	244	ss		0.50	10.5 - 11.0' Sample 243 collected from 10.0 to 10.5'. sample 244 collected from 10.5 to 11.0'.	

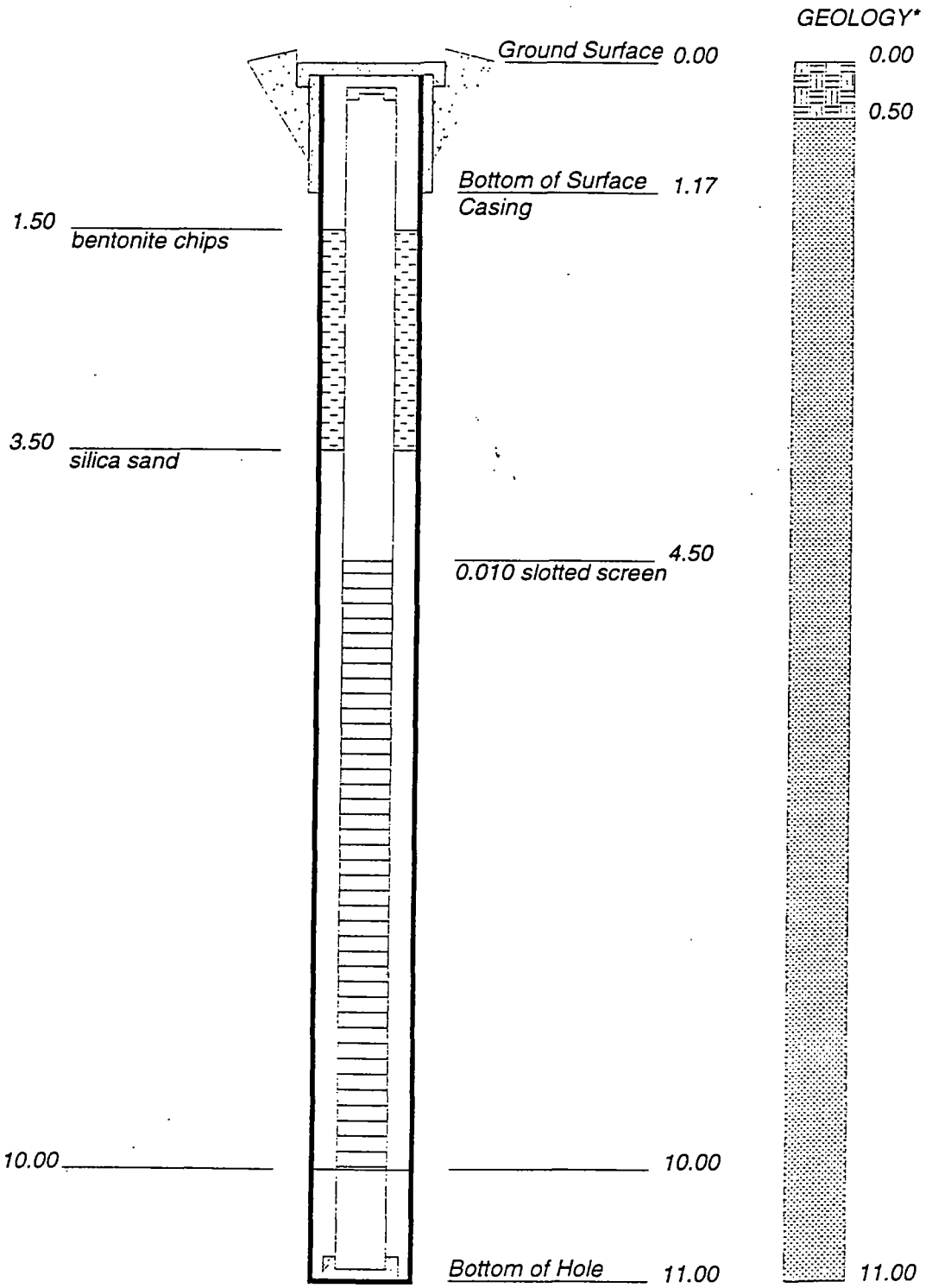
HYDROMETRICS INC.

Consulting Scientists and Engineers
2727 Airport Rd. Helena Mt, 59601

WELL COMPLETION DIAGRAM

Hole Name: EV-10

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96



*Detailed geologic descriptions are provided on Standard Well Log.

W098869 03/20/96 11:06:35

HYDROMETRICS INC.

Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

GEOTECHNICAL WELL LOG DIAGRAM

Hole Name: EV-11

Date Hole Started: 02/21/96 Date Hole Finished: 02/21/96

Project: ASEV01 Everett Smelter Site

County: Snohomish State: WA

Legal Description: East Marine View Drive

Descriptive Location: 48 ft south of EV-3

Recorded By: Jim Swortz

Drilling Company: Hydrometrics

Driller: J.Neiderkorn

Drilling Method: Hollow Stem Augers

Drilling Fluids Used: None

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2"SCH 40 PVC, flush thread Casing	-0.5 - 12.5
Surface Casing Used?	Y	Flush mount steel protective casing	0.0 - 1.2
Screen/Perforations?	Y	0.010 slotted screen	4.0 - 12.5
Sand Pack?	Y	silica sand	3.5 - 12.5
Annular Seal?	Y	bentonite chips	1.5 - 3.5
Surface Seal?	Y	cement Pad	0.0 - 1.5
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Purpose of Hole: Monitoring Well

Target Aquifer: Shallow fill/till

Hole Diameter (in): 7"OD

Total Depth Drilled (ft): 13.50

Static Water Level Below MP: Dry Hole

Date: 02/21/96

MP Description: Top of PVC casing

MP Height Above or Below Ground (ft): 0.00

Surface Casing Height (ft): 0.00

Riser Height (ft): -0.50

Ground Surface Elevation (ft): 0.00

MP Elevation (ft): 0.00

Remarks: All sample numbers preceeded by EVT-9602

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION (■ = Screened Interval)
	232	grab		0.00	0.0 - 0.5'	0.0 - 0.5' Sand & Gravel - tan to gray, medium to coarse grained sand, 50% gravel, moist (road base fill)
						0.5 - 13.5'
	233	ss	16,8,6	0.75	2.0 - 3.5'	Sandy Silt - brown, sandy silt mixed with dark brown and black fine gravel, cemented in part, interbedded with silty sand, trace gravel, slightly moist.
5	234	ss	8,25,25	1.50	5.0 - 6.5' Sample 235 is a duplicate to sample 234.	Sandy Silt - tan to gray, mottled orange, trace gravel, moist.
10	236	ss	5, 34, 26	1.00	10.0 - 11.5'	Sandy Silt - tan to gray, mottled orange, trace gravel, moist.
						Sandy Silt - gray, trace gravel, dense, slightly moist.
	237	ss	18, 50/5"	1.00	12.5 - 13.5'	

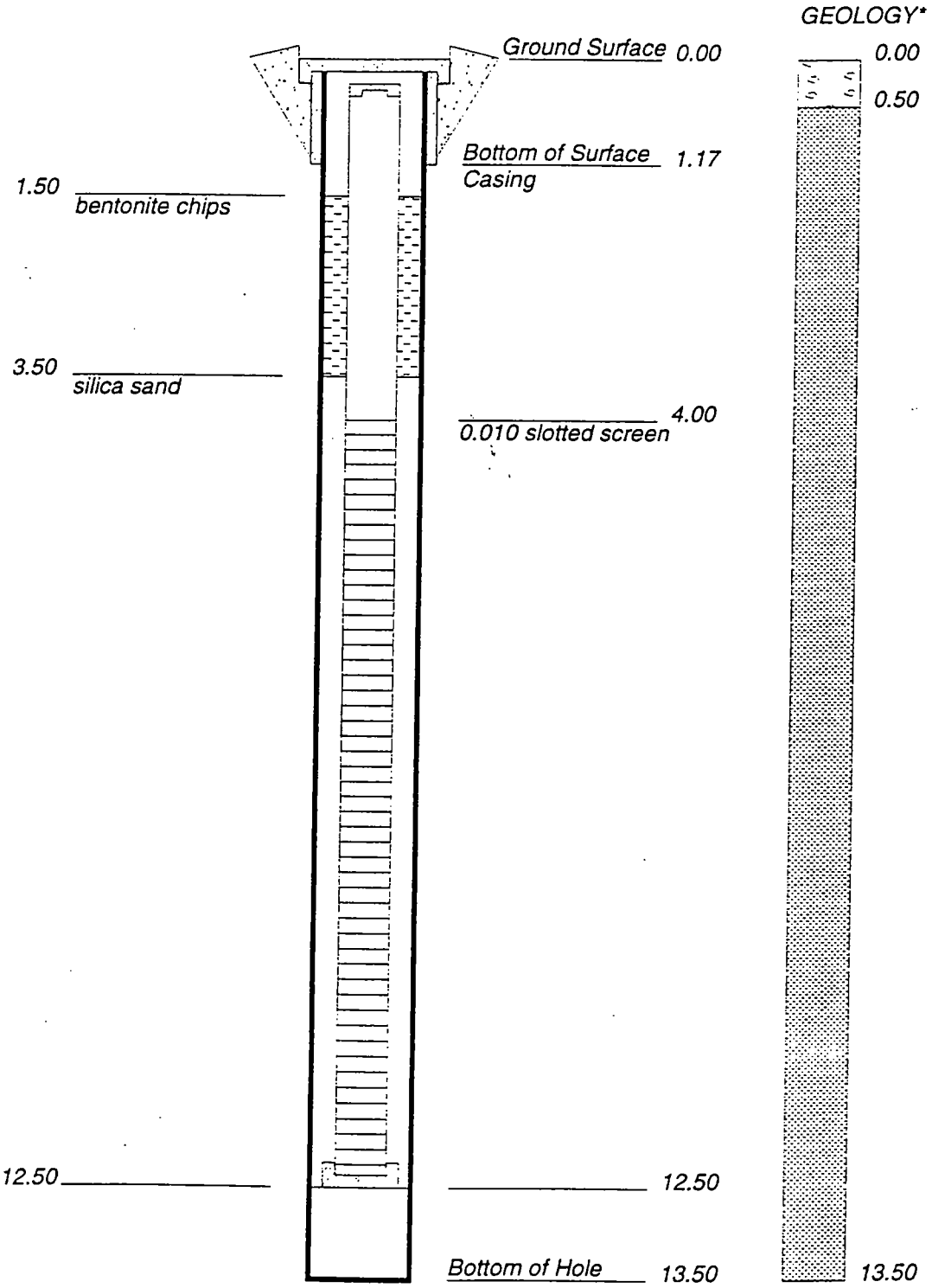
HYDROMETRICS INC.

Consulting Scientists and Engineers
2727 Airport Rd. Helena Mt, 59601

WELL COMPLETION DIAGRAM

Hole Name: EV-11

Date Hole Started: 02/21/96 Date Hole Finished: 02/21/96



*Detailed geologic descriptions are provided on Standard Well Log.

W479833 03/20/96 11:07:43

HYDROMETRICS INC.

Consulting Scientists and Engineers
2727 Airport Rd. Helena Mt, 59601

GEOTECHNICAL WELL LOG DIAGRAM

Hole Name: EV-12

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96

Project: ASEV01 Everett Smelter Site
County: Snohomish State: WA
Legal Description: East Marine View Drive
Descriptive Location: 34' North, 4' East of EV-3

Recorded By: Jim Swortz
Drilling Company: Hydrometrics
Driller: J.Neiderkorn
Drilling Method: Hollow Stem Augers
Drilling Fluids Used: None

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2"SCH 40 PVC, flush thread Casing	-0.5 - 12.5
Surface Casing Used?	Y	Flush mount steel protective casing	0.0 - 1.2
Screen/Perforations?	Y	0.010 slotted screen	4.0 - 12.0
Sand Pack?	Y	silica sand	3.5 - 12.0
Annular Seal?	Y	bentonite chips	1.5 - 3.5
Surface Seal?	Y	cement pad	0.0 - 1.5
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Purpose of Hole: Monitoring Well
Target Aquifer: Shallow fill/till
Hole Diameter (in): 7"OD
Total Depth Drilled (ft): 13.50

Static Water Level Below MP: Dry Hole
Date: 02/22/96
MP Description: Top of PVC Casing
MP Height Above or Below Ground (ft): 0.00

Surface Casing Height (ft): 0.00
Riser Height (ft): -0.50
Ground Surface Elevation (ft): 0.00
MP Elevation (ft): 0.00

Remarks: All sample numbers preceeded by EVT-9602

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION (■ = Screened Interval)
	245	grab		0.00	0.0 - 0.5'	0.0 - 0.5' Sand & Gravel - grey, medium grained sand, 50% fine gravel, moist (road base fill)
						0.5 - 13.5'
	246	ss	15, 7, 6	0.50	2.0 - 3.5'	Sandy Silt - gray, trace gravel, moist.
5	247	ss	4,11,15	1.50	5.0 - 6.5'	Sandy Silt - tan to gray, mottled orange, coarse sand lense at 6.25', moist.
10						Silty Sand - tan to gray, mottled orange, loose, moist.
	248	ss	11, 50/5"	1.00	10.5 - 11.5'	
	249	ss	15, 50/6"	1.00	12.5 - 13.5'	Silty Sand - gray, trace gravel, dense, slightly moist.

HYDROMETRICS INC.

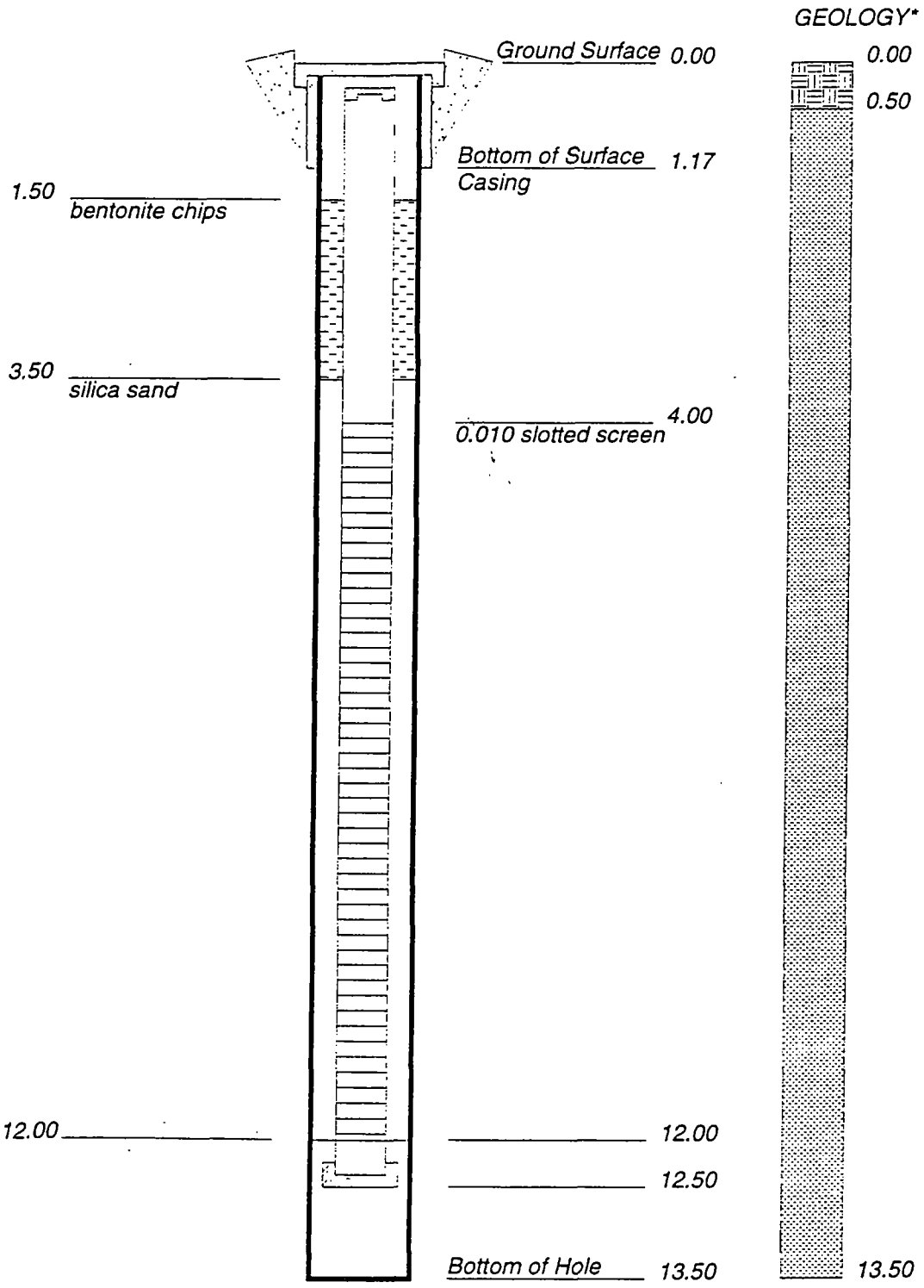
Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

WELL COMPLETION DIAGRAM

Hole Name: EV-12

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96



*Detailed geologic descriptions are provided on Standard Well Log.

W673340 03/20/96 11:08:38

HYDROMETRICS INC.

Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

GEOTECHNICAL WELL LOG DIAGRAM

Hole Name: EV-13

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96

Project: ASEV01 Everett Smelter Site

County: Snohomish State: WA

Legal Description: East Marine View Drive

Descriptive Location: 25' S of intersection, 5' W of street

Recorded By: Jim Swortz

Drilling Company: Hydrometrics

Driller: J.Neiderkorn

Drilling Method: Hollow Stem Augers

Drilling Fluids Used: None

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2"SCH 40 PVC, flush thread Casing	-0.5 - 11.5
Surface Casing Used?	Y	Flush mount steel protective casing	0.0 - 1.2
Screen/Perforations?	Y	0.010 slotted screen	4.0 - 10.0
Sand Pack?	Y	sand pack	3.5 - 10.0
Annular Seal?	Y	bentonite chips	1.5 - 3.5
Surface Seal?	Y	cement pad	0.0 - 1.5
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Purpose of Hole: Monitoring Well

Target Aquifer: Shallow fill/till

Hole Diameter (in): 7"OD

Total Depth Drilled (ft): 11.50

Static Water Level Below MP: Dry Hole

Date: 02/22/96

MP Description: Top of PVC casing

MP Height Above or Below Ground (ft): 0.00

Surface Casing Height (ft): 0.00

Riser Height (ft): -0.50

Ground Surface Elevation (ft): 0.00

MP Elevation (ft): 0.00

Remarks: All sample numbers preceeded by EVT-9602

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION (■ = Screened Interval)
	250	grab		0.00	0.0 - 0.5'	0.0 - 0.5' Silty Sand - dark brown, trace gravel, very moist, [road base fill].
						0.5 - 11.5'
	251	ss	2, 9, 24	0.00	2.0 - 3.5'	Silty Sand - gray to tan, mottled orange, trace gravel, slightly dense, moist.
5	252	ss	18, 35,40	0.50	5.0 - 5.5'	Silty Sand - tan to brown, mottled orange, trace gravel, becoming moist and dense at 6.0 feet.
	253	ss		1.00	5.5 - 6.5' Sample 252 collected from 5.0 to 5.5'. Sample 253 collected from 5.5 to 6.5 feet.	
10	254	ss	40, 50/2"	0.75	10.0 - 11.5'	Silty Sand - gray, trace gravel, dense, slightly moist.

HYDROMETRICS INC.

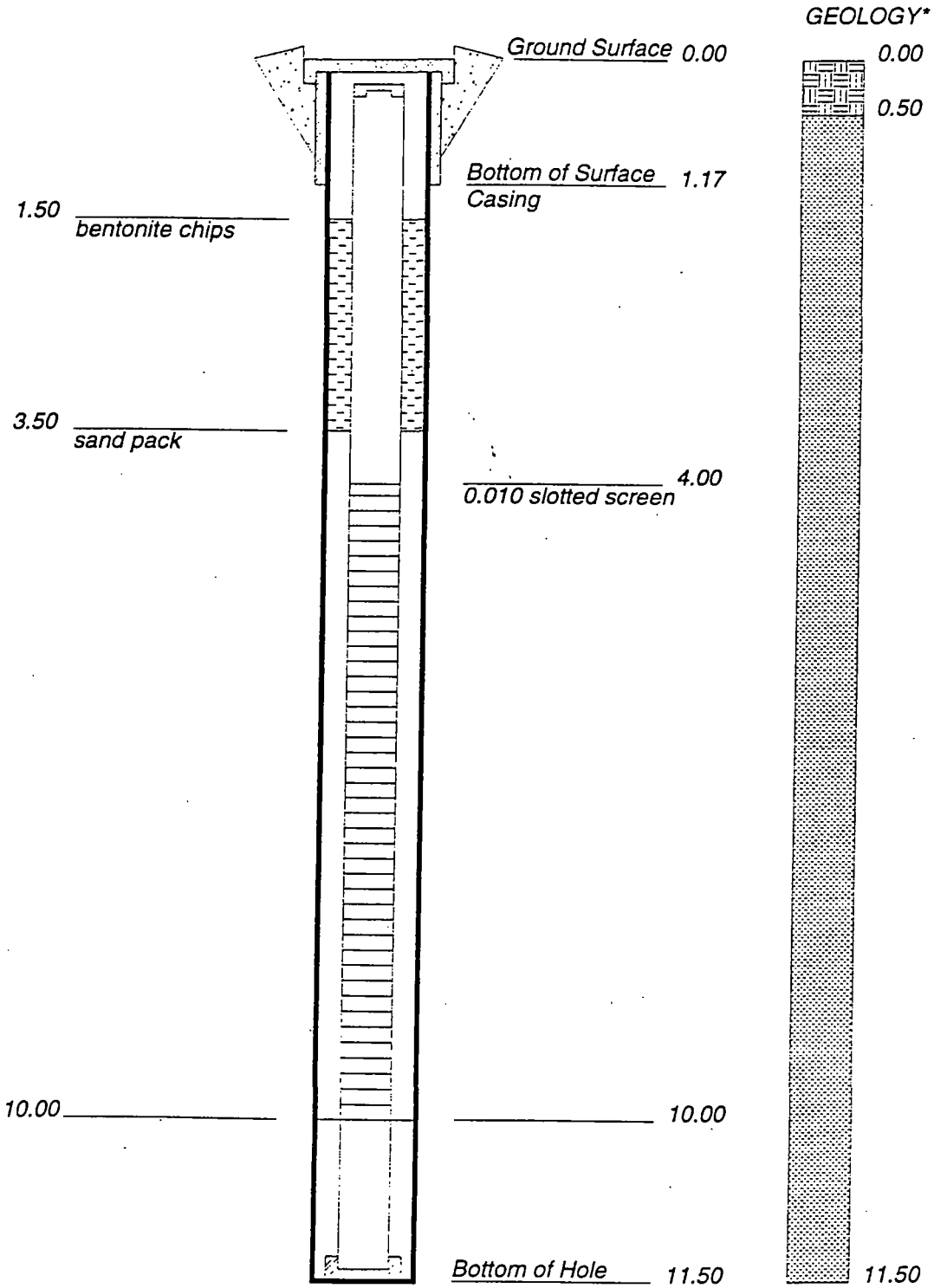
Consulting Scientists and Engineers

2727 Airport Rd. Helena Mt, 59601

WELL COMPLETION DIAGRAM

Hole Name: EV-13

Date Hole Started: 02/22/96 Date Hole Finished: 02/22/96



*Detailed geologic descriptions are provided on Standard Well Log.

W618035 03/20/96 11:09:23

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-1

Date Hole Started: 03/23/98 Date Hole Finished: 03/23/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: North End of Pilchuck Path
Descriptive Location: North End of Pilchuck Path inside fenced area.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 6.25

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface S[illegible]	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with Piper 2000 mounted on F-250. Drilled with 2 1/4" (ID) hollow stem augers. Samples obtained with "A" rod and a 2" (OD) split spoon under a 140 pound, 30 inch drop, safety hammer using a cat head at 0-1' and 6'. Switched to 3" (OD) split spoon at 2-5'. Boring abandoned with bentonite chips, 1' concrete cap with an aluminum ID tag on top. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-363	SS		0.50	0.0 - 1.0' 2" SS		0.0 - 0.2' **Asphalt** Black asphalt [Road Pavement]
	EVT-9803-364	SS		0.50	1.0 - 2.0' 3" SS		
	EVT-9803-365	SS		0.40	2.0 - 3.0'		0.2 - 4.0' **BRICK, SAND, & GRAVEL** Red brick fragments getting larger with depth (3" at 3-4'), slightly moist to dry; Sand is black/white/gray, medium to fine grained (mortar?); Gravel 1" and smaller subrounded to 2'. [Smelter Debris]
	EVT-9803-366	SS		0.40	3.0 - 4.0'		
	EVT-9803-367	SS		0.90	4.0 - 5.0'		4.0 - 6.3' **BRICK** Red, dry, intact with 1/4" gray and white sand layers approximately 3" apart. At 4' Sand appears to be yellow stained. [Smelter Debris]
5		SS		0.00	5.0 - 6.0' Refusal @ 5'. Drill to 6' and sample with 2" SS.		
	~~EVT-9803-368~~	~~SS~~	~~100~~	~~0.25~~	6.0 - 6.3' 2" SS		
10							
15							
20							

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-2

Date Hole Started: 03/23/98 Date Hole Finished: 03/23/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: North End of Pilchuck Path
Descriptive Location: 5th & Pilchuck Path inside fenced area.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 7

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with Piper 2000 mounted on F-250. Drilled with 2 1/4" (ID) hollow stem augers. Samples obtained with "A" rod and a 2" (OD) split spoon under a 140 pound, 30 inch drop, safety hammer using a cat head. Boring abandoned with bentonite chips, 1' concrete cap with a aluminum ID tag on top. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-369	SS		0.80	0.0 - 1.0'
	EVT-9803-370	SS		0.80	1.0 - 2.0'
	EVT-9803-371	SS	9/12	0.80	2.0 - 3.0'
	EVT-9803-372	SS	19/20	0.80	3.0 - 4.0' Duplicate sample 375 at 08:50
					4.0 - 5.0' Inadvertently drilled past 4-5' interval.
5	EVT-9803-373	SS	12/14	0.90	5.0 - 6.0'
	EVT-9803-374	SS	21/26	0.70	6.0 - 7.0'
10					
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 0.2'
ASPHALT
Black Asphalt
[Road Pavement]

0.2 - 1.0'
Gravelly SAND
Dark brown, slightly moist to dry, fine to medium grained, medium den with 1" subround to round gravel with trace red brick fragments at 1'.
[Road Base Fill]

1.0 - 2.0'
Sandy SILT
Brown, some black staining at 1.5', fine to medium grained, medium dense, slightly moist; trace 1/4" round to subrounded gravel; 1.5" intact red brick chunks; trace wood chunks.
[Smelter Debris]

2.0 - 7.0'
Silty SAND
Gray-brown with orange mottling at 2-3', slightly moist to dry, medium fine grained, fining with depth, medium dense; trace 1/4" subrounded gravel at 2-3'.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-5

Date Hole Started: 03/24/98 Date Hole Finished: 03/24/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: Intersection at 5th and Alley betw Mar Vw Dr & Pilchuck
Descriptive Location: Just inside gate of fenced area.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 15

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 6'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with Piper 2000 mounted on F-250. Drilled with 2 1/4" (ID) hollow stem augers. Samples obtained with "A" rod and a 2" (OD) split spoon under a 140 pound, 30 inch drop, safety hammer using a cat head. Boring abandoned with bentonite chips, 1' concrete cap with an aluminum ID tag on top. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-376	SS	6/8	0.75	0.0 - 1.0'
	EVT-9803-377	SS	27/50-2"	0.75	1.0 - 2.0'
	EVT-9803-378	SS	100-5"	0.30	2.0 - 3.0' Difficult drilling; Brick tends to crumble and plug augers.
	EVT-9803-379	SS	200-6"	0.50	3.0 - 4.0'
	EVT-9803-380	SS	100-3"	0.40	4.0 - 5.0'
5	EVT-9803-381	SS	100-3"	0.50	5.0 - 6.0'
	EVT-9803-382	SS	15/24	0.70	8.0 - 9.0'
10					
	EVT-9803-383	SS	22/31	0.80	11.0 - 12.0'
	EVT-9803-384	SS	23/100-5"	0.80	14.0 - 15.0'
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Silty LOAM
Dark Brown, slightly moist, root matter, trace 1/2" subrounded to rounded gravel.
[Fill]

1.0 - 8.0'
BRICK
Red, dry, hard, intact, with 1/4" layers of white and gray sand 3" apart. (mortar)
[Smelter Debris]

8.0 - 15.0'
Silty SAND
Gray to brown, trace dark orange staining, slightly moist to dry, fine grained to silty, medium dense to very dense (becomes more dense with depth).
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

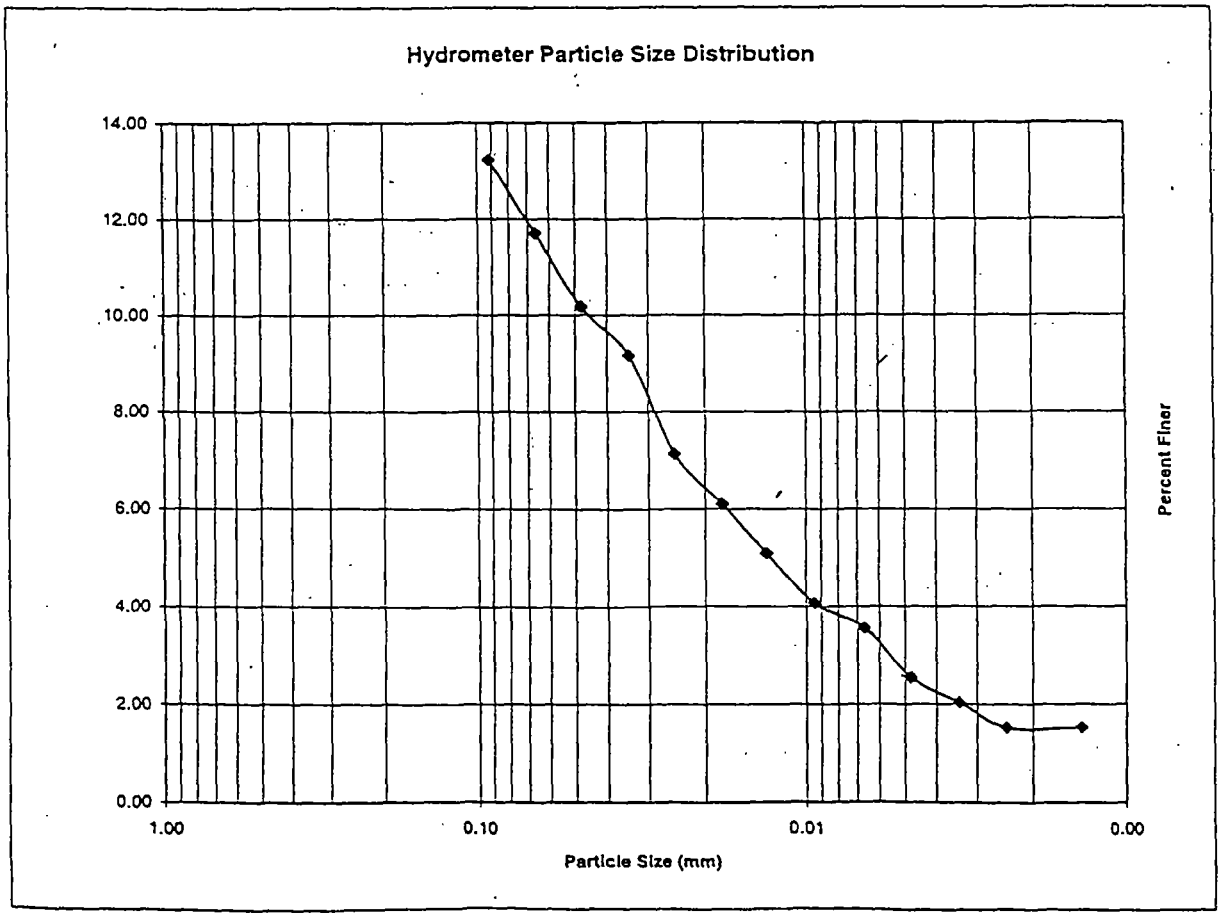
SA-5
11-12'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-00972
SAMPLE NUMBER	EVT-9803-383
DATE	6/25/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	31	26	90.66	32	11.2	0.0137	0.09	13.23
0.5	28	23	80.20	29	11.7	0.0137	0.07	11.70
1	25	20	69.74	26	12.2	0.0137	0.05	10.17
2	23	18	62.76	24	12.6	0.0137	0.03	9.16
4	19	14	48.81	20	13.2	0.0137	0.02	7.12
8	17	12	41.84	18	13.5	0.0137	0.02	6.10
15	15	10	34.87	16	13.8	0.0137	0.01	5.09
30	13	8	27.89	14	14.2	0.0137	0.01	4.07
60	12	7	24.41	13	14.3	0.0137	0.01	3.56
120	10	5	17.43	11	14.7	0.0137	0.00	2.54
240	9	4	13.95	10	14.8	0.0137	0.00	2.03
480	8	3	10.46025105	9	15	0.0137	0.00	1.53
1440	8	3	10.46025105	9	15	0.0137	0.00	1.53



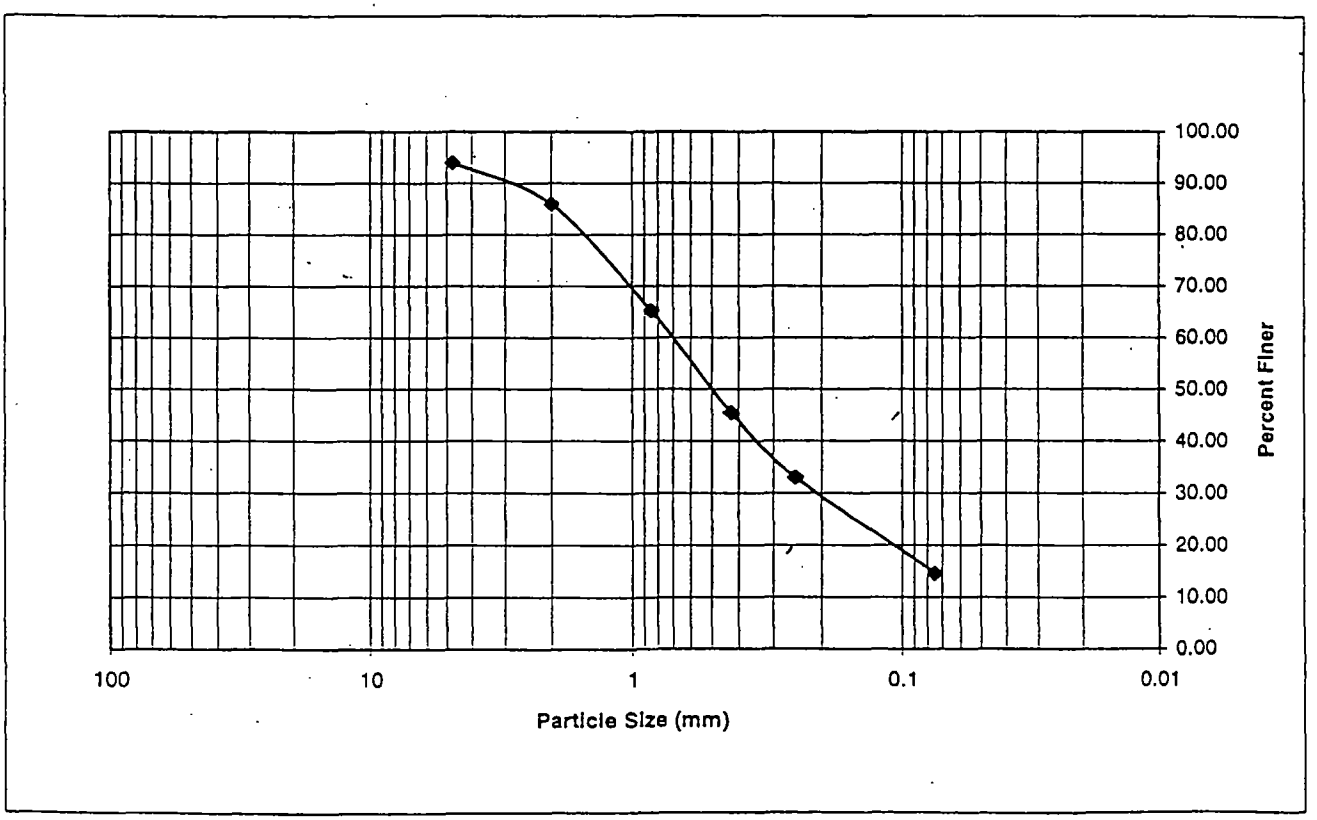
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-00972
Sample Number: EVT-9803-383
Date: 6/25/98

Weight of Oven Dry Sample (g): 194

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	11.7	6.03	6.03	93.97
10	2.00	15.60	8.04	14.07	85.93
20	0.85	40.20	20.72	34.79	65.21
40	0.425	38.30	19.74	54.54	45.46
60	0.250	24.20	12.47	67.01	32.99
200	0.075	35.70	18.40	85.41	14.59
PAN	< 0.075	28.70	14.79		

sum = 194.4



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-6

Date Hole Started: 03/21/98 Date Hole Finished: 03/21/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: E of Pilchuck Alley
Descriptive Location: At former Arsenic ovens

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 6'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with Acker Drill mounted on Bobcat. Drilled with 2 1/4" (ID) hollow stem augers. Samples obtained with "A" rod and a 2" (OD) split spoon under a 140 pound, 30 inch drop, safety hammer using a cat head. Boring abandoned with bentonite chips, 1' concrete cap with aluminum ID tag on top. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-353	SS	4/8	0.60	0.0 - 1.0' Refusal at 2'. Moved 4' NW; Duplicate sample EVT-9803-358 @ 1100.
	EVT-9803-354	SS	12/12	0.60	1.0 - 2.0' White substance (gypsum like) in side wall of first hole. sample EVT-9803-355 @ 1000
	EVT-9803-356	SS	4/7	0.40	2.0 - 3.0'
	EVT-9803-357	SS	20/13	0.40	3.0 - 4.0'
	EVT-9803-359	SS	4/26	0.70	4.0 - 5.0' Difficult Drilling
5	EVT-9803-360	SS	37/34	0.70	5.0 - 6.0'
	EVT-9803-361	SS	14/17/32	1.20	7.5 - 9.0'
10		SS	50/99-2"	0.00	10.0 - 11.0' NoRecovery no sample.
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.5'
Silty LOAM
Brown, slightly moist, with organic matter.

1.5 - 4.0'
BRICK
Red, slightly moist to dry, trace gravel with white material fragments. (same as sample EVT-9803-353)
[Smelter Debris]

4.0 - 9.0'
Silty SAND
Yellow brown grading to gray with depth, some oxidation mottling, slightly moist, medium to fine grained, medium dense to dense, some subrounded 1" gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-7

Date Hole Started: 03/19/98 Date Hole Finished: [illegible]/19/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: E of Pilchuck Alley
Descriptive Location: At former Arsenic mill storage bins

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-344	SS		0.30	0.0 - 1.0'
	EVT-9803-345	SS		0.30	1.0 - 2.0'
	EVT-9803-346	SS	13/8	0.40	2.0 - 3.0'
	EVT-9803-347	SS	13/8	0.40	3.0 - 4.0'
	EVT-9803-348	SS	15/30	0.80	4.0 - 5.0' Slow Drilling with Acker
5	EVT-9803-349	SS	45/50	0.80	5.0 - 6.0' Duplicate sample number EVT-9803-350 @ 1437
	EVT-9803-351	SS	32/50	0.80	7.5 - 9.0'
10	EVT-9803-352	SS	100-6"	0.50	10.0 - 11.0'
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 2.0'
Silty LOAM
Dark brown, slighlty moist to dry, some medium grained sand, organic matter. Trace brick fragments at 2'.
[Fill]

2.0 - 6.5'
Sandy SILT
Light brown to gray brown, with some orange mottling, medium dense, slightly moist to dry, some 1" subrounded gravel.
[Fill]

6.5 - 11.0'
Silty SAND w/ Gravel
Gray to brown, slighlty moist to dry, fine grained to silt, dense to very dense (ore dense with depth), trace vegetative matter, some 1/4" subrounded gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

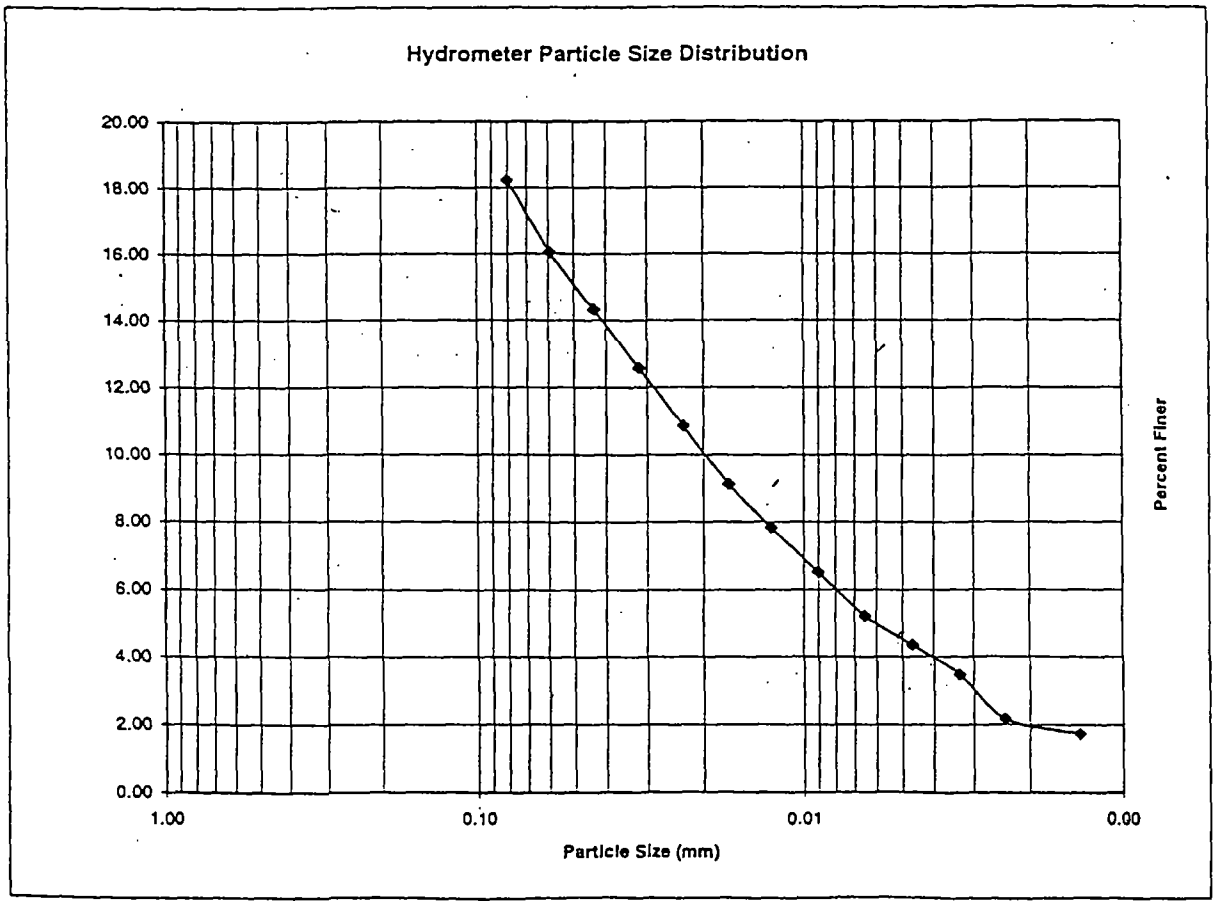
SA-7
10-10.5'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-00907
SAMPLE NUMBER	EVT-9803-352
DATE	6/29/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	47	42	91.98	48	8.6	0.0137	0.08	18.23
0.5	42	37	81.03	43	9.4	0.0137	0.06	16.06
1	38	33	72.27	39	10.1	0.0137	0.04	14.32
2	34	29	63.51	35	10.8	0.0137	0.03	12.59
4	30	25	54.75	31	11.4	0.0137	0.02	10.85
8	26	21	45.99	27	12	0.0137	0.02	9.12
15	23	18	39.42	24	12.5	0.0137	0.01	7.81
30	20	15	32.85	21	13	0.0137	0.01	6.51
60	17	12	26.28	18	13.5	0.0137	0.01	5.21
120	15	10	21.90	16	13.8	0.0137	0.00	4.34
240	13	8	17.52	14	14.2	0.0137	0.00	3.47
480	10	5	10.95	11	14.7	0.0137	0.00	2.17
1440	9	4	8.76	10	14.8	0.0137	0.00	1.74



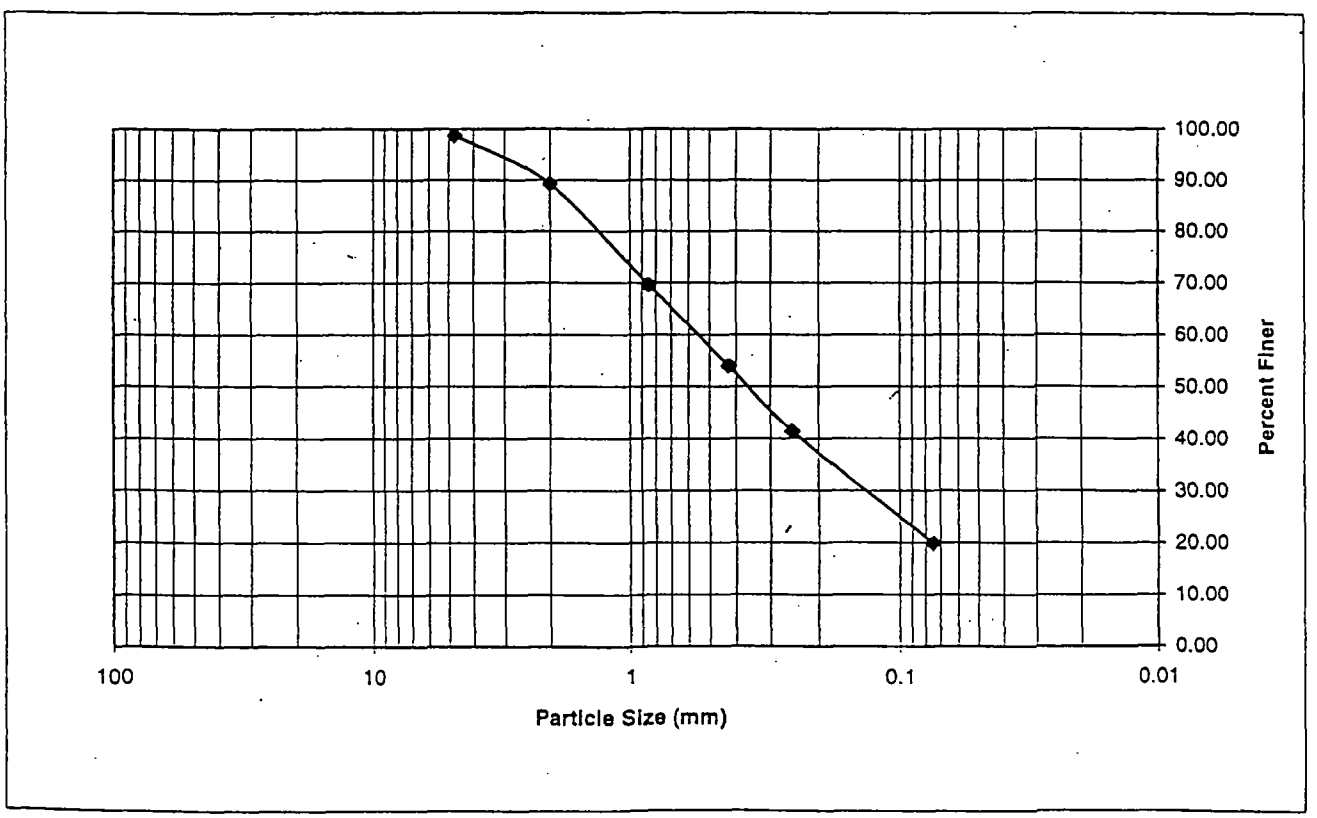
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-00907
Sample Number: EVT-9803-352
Date: 6/25/98

Weight of Oven Dry Sample (g): 194

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	3	1.32	1.32	98.68
10	2.00	21.50	9.43	10.74	89.26
20	0.85	44.90	19.68	30.43	69.57
40	0.425	35.60	15.61	46.03	53.97
60	0.250	28.60	12.54	58.57	41.43
200	0.075	49.30	21.61	80.18	19.82
PAN	< 0.075	45.50	19.95		

sum = 194.4



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-8

Date Hole Started: 03/18/98 Date Hole Finished: 03/18/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 535 Pilchuck Path
Descriptive Location: NW corner of front yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-305	SS		0.70	0.0 - 1.0'		0.0 - 2.0' **Silty Gravelly SAND** Brown to yellowish brown, slighlty moist to dry, fine grained to silt, medium dense to loose, 2" and smaller subrounded gravel. [Fill]
	EVT-9803-306	SS		0.70	1.0 - 2.0'		
	EVT-9803-307	SS		0.75	2.0 - 3.0'		2.0 - 4.0' **Gravelly Silty SAND** Grayish brown, with some orange mottling, fine grained to medium grained, slightly moist to dry, some 2"and smaller subangular to subrounded gravel. [Glacial Till]
	EVT-9803-308	SS		0.75	3.0 - 4.0'		
	EVT-9803-309	SS		1.00	4.0 - 5.0'		
5						5	4.0 - 5.0' **Sandy SILT** Gray mottled brown, coarse grined, dry, dense, trace subangular gravel. [Glacial Till]
10						10	
15						15	
20						20	

GEOTECH EVTSA-HYD-TUC.GDT 7/1/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-9

Date Hole Started: 03/18/98 Date Hole Finishe 18/

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 535 Pilchuck Path
Descriptive Location: NE corner of back yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-300	SS		0.60	0.0 - 1.0'		0.0 - 3.0' **Silty SAND** Dark brown with some yellowish orange mottling, slightly moist , some root matter, medium dense to loose; Some wood chips at 3'. [Fill]
	EVT-9803-301	SS		0.50	1.0 - 2.0'		
	EVT-9803-302	SS		0.40	2.0 - 3.0'		
	EVT-9803-303	SS		0.40	3.0 - 4.0'		3.0 - 5.0' **Silty SAND** Brown to orange, medium to fine grained, slightly moist to dry, loose to medium dense some 3" and smaller subrounded gravel. [Glacial Till]
	EVT-9803-304	SS		1.40	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-10

Date Hole Started: 03/19/98 Date Hole Finished: 03/1

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Taylor
Legal Description: 538 E Marine View Dr
Descriptive Location: NE corner of front yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-325B	SS		0.50	0.0 - 1.0'		0.0 - 1.0' **Silty LOAM** Dark brown, slightly moist, trace rounded to subrounded gravel, some root matter, loose. [Fill]
	EVT-9803-326	SS		0.50	1.0 - 2.0'		1.0 - 5.0' **Silty SAND** Orange-brown grading to gray-brown with depth, mottled orange; slightly moist to dry, medium to fine grained; medium dense to loose; trace 2" and smaller gravel. [Fill]
	EVT-9803-327	SS		0.40	2.0 - 3.0'		
	EVT-9803-328	SS		0.40	3.0 - 4.0' Duplicate sample at 10:12 EVT-9803-329		
	EVT-9803-330	SS		0.60	4.0 - 5.0'		
5					5		
10					10		
15					15		
20					20		

GEOTECH EVTSA.GPJ HYD-TUC GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-11

Date Hole Started: 03/18/98 Date Hole Finished: [illegible]/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 541 Pilchuck Path
Descriptive Location: NE portion of back yard

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-310	SS		0.70	0.0 - 1.0'		0.0 - 1.0' **Sandy LOAM** Dark brown, slightly moist, some organics, trace subrounded gravel. (Fill)
	EVT-9803-311	SS		0.70	1.0 - 2.0'		1.0 - 4.0' **Silty SAND** Light brown, slightly moist to moist, fine to medium grained, medium to fine grained, medium to loose, trace wood fibers, oxidized in bands. (Fill)
	EVT-9803-312	SS		0.80	2.0 - 3.0'		
	EVT-9803-313	SS		0.80	3.0 - 4.0'		
	EVT-9803-314	SS		0.60	4.0 - 5.0'		4.0 - 5.0' **Silty SAND** Gray, fine to coarse grained, slightly moist to dry, dense, trace gravel subrounded. (Glacial Till)
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/23/98

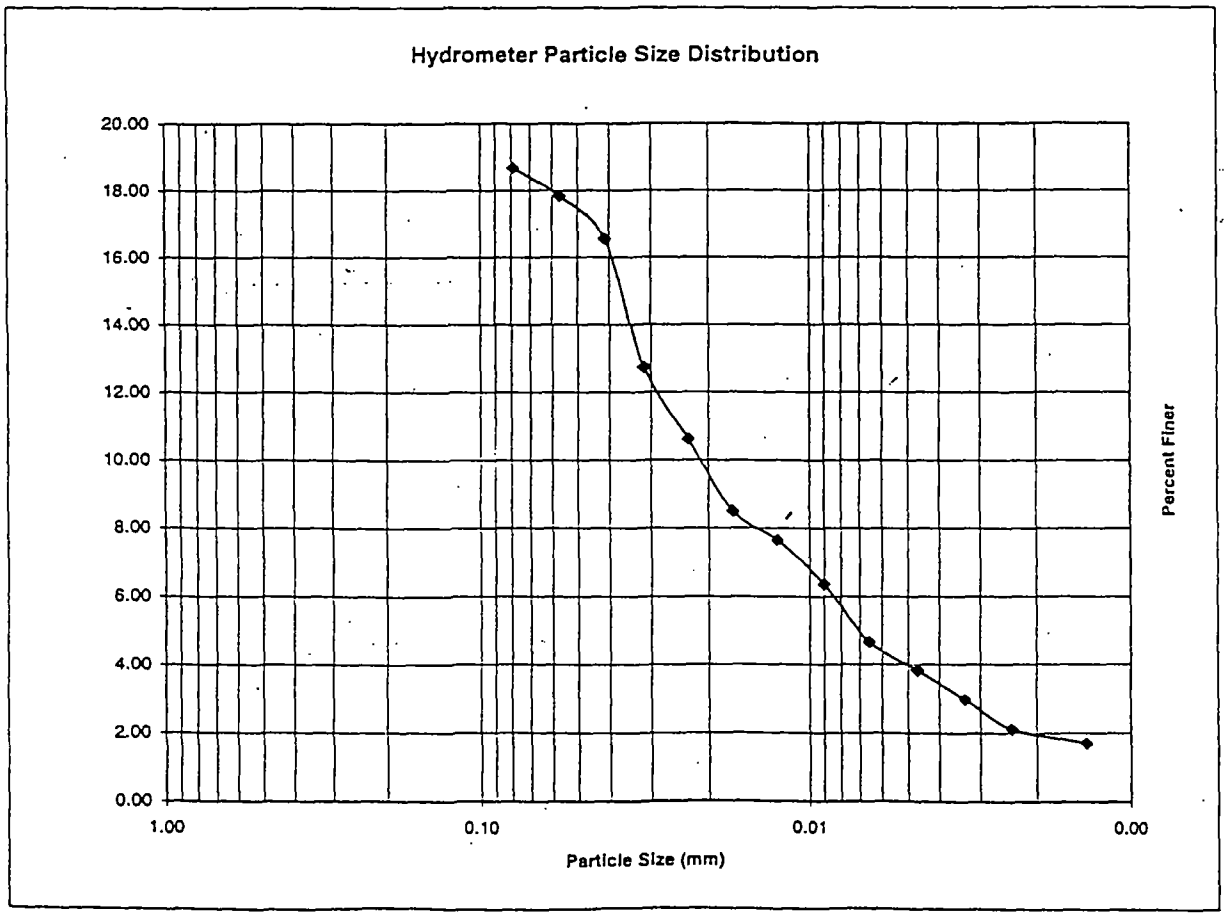
SA-11
4-5'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-00873
SAMPLE NUMBER	EVT-9803-314
DATE	6/25/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	49	44	88.00	50	8.3	0.0137	0.08	18.67
0.5	47	42	84.00	48	8.6	0.0137	0.06	17.82
1	44	39	78.00	45	9.1	0.0137	0.04	16.55
2	35	30	60.00	36	10.6	0.0137	0.03	12.73
4	30	25	50.00	31	11.4	0.0137	0.02	10.61
8	25	20	40.00	26	12.2	0.0137	0.02	8.49
15	23	18	36.00	24	12.5	0.0137	0.01	7.64
30	20	15	30.00	21	13	0.0137	0.01	6.37
60	16	11	22.00	17	13.7	0.0137	0.01	4.67
120	14	9	18.00	15	14	0.0137	0.00	3.82
240	12	7	14.00	13	14.3	0.0137	0.00	2.97
480	10	5	10.00	11	14.7	0.0137	0.00	2.12
1440	9	4	8	10	14.8	0.0137	0.00	1.70



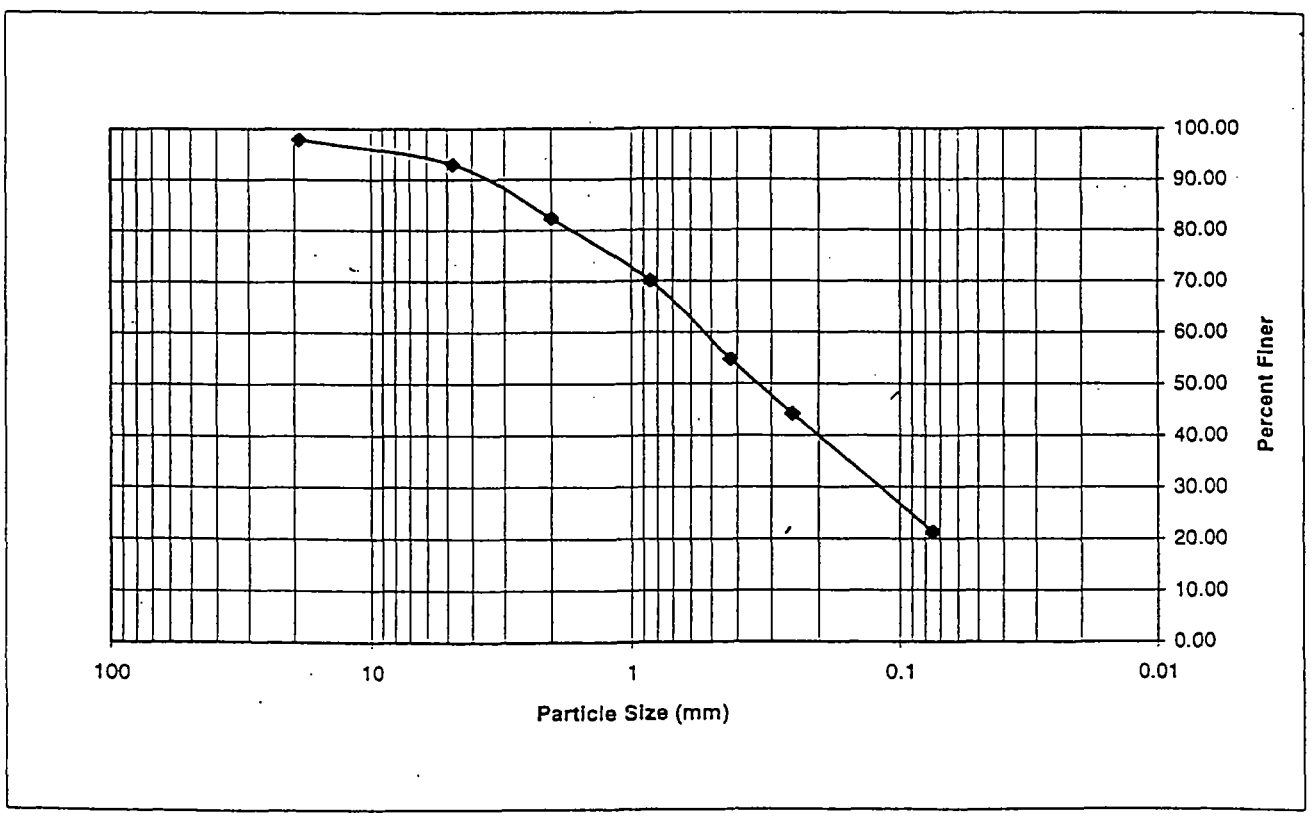
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-00873
Sample Number: EVT-9803-314
Date: 6/25/98

Weight of Oven Dry Sample (g):

Sieve Number	Sieve Opening (mm)	Weight Retained	Percent Retained	Cumulative Retained	Percent Finer
.75 inch	19.05	16.7	2.15	2.15	97.85
4	4.75	38.20	4.91	7.06	92.94
10	2.00	82.80	10.65	17.71	82.29
20	0.85	95.60	12.29	30.00	70.00
40	0.425	118.30	15.21	45.22	54.78
60	0.25	82.60	10.62	55.84	44.16
200	0.075	178.40	22.94	78.78	21.22
PAN	< 0.075	163.40	21.01		

sum = 776



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-12

Date Hole Started: 03/19/98 Date Hole Finished: 03/1

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Taylor
Legal Description: 538 E Marine View Dr
Descriptive Location: Between driveway from alley and parking strip.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-339	SS		0.70	0.0 - 1.0'		0.0 - 1.0' **Silty SAND** Dark brown, medium to fine grained, some 1/2" subangular gravel, slighlty moist to dry, loose, some vegetative matter. [Fill]
	EVT-9803-340	SS		0.70	1.0 - 2.0'		1.0 - 2.0' **Gravelly Sandy SILT** Reddish brown, slightly moist to dry, silt to fine grained sand; Brick fragments, some charred wood,; some 1" subrounded gravel. [Smelter Debris]
	EVT-9803-341	SS		0.70	2.0 - 3.0'		2.0 - 5.0' **Gravelly SAND & SILT** Orange Brown grading to Brown gray some orange mottling; Silt grad to Sand, root matter, medium dense, moist at 2' dry at 4'; 2" and smalle rounded to subrounded gravel. [Fill]
	EVT-9803-342	SS		0.70	3.0 - 4.0'		
	EVT-9803-343	SS		1.00	4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTS.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-25

Date Hole Started: 03/18/98 Date Hole Finished: 03/18/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: Alley between Pilchuck Path and E Mar. Vw.
Descriptive Location: In alley behind 535 Pilchuck Path Garage

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on a Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-315	SS		0.50	0.0 - 1.0'		0.0 - 0.5' **Asphalt** Black asphalt [Road Pavement]
	EVT-9803-316	SS		0.50	1.0 - 2.0'		
	EVT-9803-317	SS		0.70	2.0 - 3.0'		0.5 - 2.0' **Gravelly SAND** Gray, dry, medium to coarse grained, loose; 2" and smaller subrounded gravel. [Road Base Fill]
	EVT-9803-318	SS		0.70	3.0 - 4.0' Duplicate sample @ 1705, EVT-9803-319		
	EVT-9803-320	SS		0.80	4.0 - 5.0'		2.0 - 5.0' **Silty SAND** Orange brown to light brown, medium to fine grained, slightly moist to dry, trace organic matter. 2" and smaller subangular gravel. [Road Base Fill]
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: SA-26

Date Hole Started: 03/19/98 Date Hole Finished: 03/19/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: Pilcuck Path
Descriptive Location: In front of 530 Pilchuck Path

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Split Spoon
Drilling Fluids Used: None
Purpose of Hole: Source Area Investigation
Target Aquifer: N/A
Hole Diameter (in): 3.0
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring sampled with 3" (OD) split spoon on "A" rod under a 140 lb, 30" drop safety hammer on a cat head on an Acker Drill mounted on Bobcat. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-321	SS		0.20	0.0 - 1.0'		0.0 - 0.5' **ASPHALT** Black Asphalt; Difficult drilling. [Road Pavement]
	EVT-9803-322	SS		0.20	1.0 - 2.0'		
	EVT-9803-323	SS		0.70	2.0 - 3.0'		0.5 - 2.0' **Gravelly SAND** Dark gray, medium to coarse grained, slightly moist to dry; approximately 20-30% 1/4" subrounded gravel. [Road Base Fill]
	EVT-9803-324	SS		0.70	3.0 - 4.0'		
	EVT-9803-325A	SS		1.00	4.0 - 5.0'		2.0 - 5.0' **Gravelly Sandy SILT** Light brown to orange brown with trace orange mottling, slightly moist, medium dense, gets sandier with depth; some 2" and smaller subrounded gravel. [Road Base Fill]
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-4

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 415 Pilchuck Path ELEVATION G.S. ___ DATE 1-28-93

RECORDED BY J. C. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-616		0930				Brown to black topsoil, sandy, small gravels
2"									
6"			9301-617		0935				Brown sandy silt
9"									
1'			9301-618		0940				Brown silty sand (brick chips)
2'			9301-619		0945				Brown silty sand, small gravel
3'			9301-620		0950				Black organic material, silty (brick chips)
4'			9301-621		0955				Dark brown silty, mainly wood fibers
5'									
6'			9301-622		1000				Tan silty sand, small gravels
7'									

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-4

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 415 Pilchuck Path ELEVATION G.S. ___ DATE 7-13-93

RECORDED BY RV DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 13' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'			EVT-9307 700 (7'-7'4")		0830	9/6 17/6 23/6 27/6	10%	Dup. 701 (0845) sample: mixture fill/till	7-7.2 olive grey fill >7.2 light grey till, sandy silt, angular gravel (GM)
8'									
9'			702 (9'-9'2")		0930	50/5	100%	1 gallon	Light grey silt, very dense, dry, some gravel
10'			703 (10'-10'2")		1015	>50/6 >50/6	100%	2 gallon	Light grey silt, very dense, dry, angular gravel (GM)
11'			704 (11'10"-12')		1130	50/6	100%	Split: 704 to SAS >5 gallon	Light grey silt, very dense, dry, some gravel (GM, ML)
12'									
13'									
14'									
15'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-8

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 3010 Fifth Street ELEVATION G.S. ___ DATE 1-20-93

RECORDED BY R. V. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			ASEV01 9301-507	1500					Topsoil, organic - rich
2"									
6"									
9"			9301-508	1505					Brown silt, sandy, gravelly
1'									
			9301-509	1510					Brown silt, sandy, gravelly
			9301-510 Dupl. of 509	1515					
2'			9301-511	1520					Gray silt, gravelly, clayey, dark organic material
3'			9301-512	1525					Hit water at 2.5', gray silt, clayey, oxidation spots
4'			9301-513	1530					Gray silt, clayey, some gravel
5'									
6'			9301-514	1535					Gray, silt, clayey, dense
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-8

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 3010 5th Street ELEVATION G.S. ___ DATE 7-13-93

RECORDED BY RV/JC DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 15.5' CASING TYPE AND DESCRIPTION NA

TOTAL DEPTH CASED NA WELL COMPLETION DESCRIPTION NA

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'			EVT-9307 705 (7'-7'2")		1415	39/6	100%	0.5 gallon	Light grey silt, very dense, dry, some gravel (GM) (1" sand layer at 6.5' medium-fine, well sorted)
8'								0.5 gallon	
9'			706 (10'-10'2")		1600	47/6 50/3 34/6 50/4	0% 100%	1 gallon	Light grey silt, very dense, dry, some gravel (MC, GM)
10'									
11'			707 (11'-11'2")		0815	50/3	100%	1 gallon	Light grey silt, very dense, dry, small gravel (ML, GM)
12'			708 (13'-13'2")		0830				Light grey silt, fine sand (SM)
13'						20/6 50/6	100%	1 gallon	Light grey silt, fine sand, coarser than previous sample, possible water (SM)
14'									
14.75' 15'									Hard drilling, dense silt
15.5'			709 (15'-15'2")		0845	33/6	100%		Light grey silt, small gravel (5%) (ML, GM) Till first encountered at 5'8"

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-13

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 515 Pilchuck Path ELEVATION G.S. ____ DATE 1-21-93

RECORDED BY V. S. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ____

TOTAL DEPTH CASED ____ WELL COMPLETION DESCRIPTION ____

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-528		1030				Topsoil, organic material, clay
2"									
6"									
9"			9301-529		1035				Topsoil, sandy, silty, organic material
1'			9301-530		1040				Sandy silt, gravel, brown with light gray sand, brick
2'			9301-531		1045				Light gray silt, clayey, sandy
3'			9301-532		1050				Brown sand, some gravel, silt
4'			9301-533		1055				Sand, gravel, light brown, clayey
5'									
6'			9301-534		1100				Light gray sandy silt, some brick
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-13 Al,B,C

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 515 Pilchuch Path ELEVATION G.S. ___ DATE 7-14-93

RECORDED BY J.C. DRILL Method HSA DRILLER ___ DRILLING CO. ___

TOTAL DEPTH 4.75' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0'									Topsoil
								Spud Bar & Drill	Smelter debris
								Spud Bar & Drill	Bricks
1'									
2'									Smelter debris Bricks
3'									Bricks
4'	4.25 4.5		EVT-9507-713	1430	28-6	100%			Smelter debris-till interface Till light grey, silt, dense, small gravel. Light grey silt, very dense small gravel.
5'	4.75 5.0		EVT-9307 714	1550	35-6	100%			S-13 A Auger Refusal 3' S-13 B Auger Refusl Concrete 4' S-13 C Auger Refusal 3.5' Talked to property owner, he said when he added addition to house, they hit an old brick roadway, approximately 7 layers of brick.

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-13

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 515 Pilchuck Path ELEVATION G.S. ___ DATE 7-20-93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 17.0' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS (Note bit-auger size) Till @ <7'

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7		EVT-	9307 742 7-7.2		1045	55/6 51/6	100%		Slightly moist, gray silt with occasional gravel.
8									
9			748 9-9.2		1120	37/6 53/6	100%		Dry as above
10						59/6			
11			749 11-11.2		1145	26/6 77/6	100%		Two-inch uniform fine sand lens at 22', dry, gray silt from 11.2-12'.
12									
13			750 13-13.2			24/6 88/6	100%		Dry, gray silt with occasional well rounded gravel <3/4"
14									

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ashi01 HOLE NUMBER S-13

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 515 Pilchuck Path ELEVATION G.S. ___ DATE 7-20-93

RECORDED BY S. Billin DRILL METHOD H S A DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 17.0' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
14						34/6			
						29/6			
15		EVT-	9307 731 15-15.2			22/6	100%		Moist sandy gray silt, some silty sand, Lenses
						17/6			
16						16/6			Slightly moist, gray si\ilt with gravel
17			752 16.6-17		1235	60/6			

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-15

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 523 Pilchuck Path ELEVATION G.S. ___ DATE 1-26-93

RECORDED BY J. C. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-595		1550				Organic material, sandy, crushed gravel
2"									
6"			9301-596		1555				Brown, silty sand
9"									
1'			9301-597		1600				Brown silty sand, 5% clays, brick material
2'			9301-598		1605				Brown silty clay, small gravels
3'			9301-599		1610				Brown silty/very little clay, wet
4'			9301-600		1615				Tan, silty clay Hit top of flume? Hard, pipe? Sized off & had 1' void
5'									
6'			9301-601		1620				Tan, silty clay
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-15

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 523 Pilchuck Path ELEVATION G.S. ___ DATE 7-20-93

RECORDED BY S. Billin DRILL METHOD HSA DRILLER R Gibson DRILLING CO. Boretec

TOTAL DEPTH 15.0' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7		EVT-	9307 753 7-7.2		1345	11/6 27/6	100		Moist, light gray silt with occasional gravel
8									
9			754 9-9.2		1400	19/6 29/6	100		slightly moist as above
10									Sandy silt Lens 10.7-11'
11			755 11-11.2		1420	25/6 39/6	100		Very moist, light gray silt with occasional <1% well rounded gravel
12									
13			756 13-13.2		1400	45/6 50/3	100		Dry, light gray silt with occasional <1% coarse gravel
14									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-15

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 523 Pilchuck Path ELEVATION G.S. ___ DATE 7-20-93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 15.0' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
14						14/6			
						91/6			
15			757 144.8-15		1455				As above

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-46

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 510 East Marine View Drive ELEVATION G.S. ___ DATE 1-21-93

RECORDED BY V. S. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT RECOVERY CORE	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-515		0930				Topsoil, piece of brick
2"									
6"									
9"			9301-516		0935				Brown silt, sandy, gravelly
1'									
			9301-517		0940				Topsoil, piece of brick
2'			9301-518		0945				Topsoil, some gravel, brick
3'			9301-519		0950				Topsoil, black clay, brick
4'			9301-520		0955				Topsoil, black clay
5'									
6'			9301-521		1000				Tan sand, silt, gravel, some clay
7'									

TEST HOLE LOG

HYDROMETRICS — TACOMA, WASHINGTON

PROJECT Everett Smelter — JOB NUMBER ASEV01 — HOLE NUMBER S-46

STATE WA — COUNTY Snohomish — LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 510 E. Marine View Drive — ELEVATION G.S. ___ — DATE 7/21/93

RECORDED BY Sam Billin — DRILL METHOD HSA — DRILLER ___ — DRILLING CO. Boretec

TOTAL DEPTH 16.7' — CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ — WELL COMPLETION DESCRIPTION ___

REMARKS (Note bit/auger size) Till @ approximately 6'

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
									0-4" Topsoil with brick fragments 3-4'
									4-5' very wet, loose, brown silt
6		EVT-	9307 758 6-6.2		0900	9/6 19/6	100		Moist, light gray silt
7			759 7-7.2		0905	26/6	100		Moist, light gray, gravelly, sandy silt, EVT 93076-760 Dup at 7-7.2 0910
8						7/6 34/6	30		Sample was 7.5-9'-no effective recovery
9						28/0			

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-46

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 510 Marine View Drive ELEVATION G.S. ___ DATE 7-21-93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 16.7' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS (Note bit/auger size) Till @ approximately 6'

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
9			761 9-9.2	09L5		39/6	100		Slightly moist, light gray sandy silt, few gravels
						63/6			Dryer at 10'
10									
11			762 13-13.2	0930		24/6 30/6	100		Slightly moist, light gray silt with occasional fine gravel
12									
13			763 13-13.2	0950		33/6 50/4 54/6	100 100		Dry as above
14						100/5			
15			764 14.3-15	1030					As above with coarse gravel
								1 gallon water added	
16						111/6			Dry as above with large gravel apparently large cobbles at 16.7. Auger refuseed

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-46

STATE WA COUNTY Snohomish LOCATION T R SEC. TRACT

SITE DESCRIPTION 510 Marine View Drive ELEVATION G.S. DATE 7-21-93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 16.7' CASING TYPE AND DESCRIPTION

TOTAL DEPTH CASED WELL COMPLETION DESCRIPTION

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT RECOVERY CORE	NOTES ON: WATER LEVELS DRILLING FLUID DRILLING RATE WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
17			765 16.5-16.7		1100	100/2	100		

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-47

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 502 East Marine View Drive ELEVATION G.S. ____ DATE 1-22-93

RECORDED BY V. S. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 6' CASING TYPE AND DESCRIPTION ____

TOTAL DEPTH CASED ____ WELL COMPLETION DESCRIPTION ____

REMARKS ____

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT RECOVERY CORE	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-567		1130				Topsoil, sandy, organic material, brick pieces
2"									
6"			9301-568		1135				Topsoil, sandy, organic material
9"									
1'			9301-569		1140				Gravel, sandy, little silt
2'			9301-570 9301-574 Dupl. of 570		1145 1205				Brown sand, gravelly, little silt, some brick
3'			9301-571		1150				Brown sand, silty, black clay lenses, trace gravel
4'			9301-572		1155				Tan sand, clayey, little gravel, oxidation staining
5'									
6'			9301-573		1200				Light gray sand, silty, clay lenses some organic material
7'									

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-47

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 502 E. Marine View Drive ELEVATION G.S. ___ DATE 7-14-94

RECORDED BY J.C. DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 11.2' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	7.0 / 7.2		EVT-9307 710		1100	20/6 50/6	100%		Light grey silt, very dense, small gravel
8'									
9'						50/6	0%		No Sample Recovery Large gravel stuck in spoon shoe
10'	10.0 / 10.2		EVT-9307 711		1210	28/6	100%		Light grey silt, dense 1/2" gravel
11'	11.0 / 11.2		EVT-9307 712		1325	50/5	100%		Light grey silt, dense 1/2" to 3/4" gravel
12'									Auger Refusal at 11.2' Till from 4.5 to 6.5' very moist, moldable. Mud rings coming off auger.

TEST HOLE LOG

HYDROMETRICS — TACOMA, WASHINGTON

PROJECT ASEV-01 JOB NUMBER _____ HOLE NUMBER S-92

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 534 East Marine View Drive ELEVATION G.S. _____ DATE 1-12-94

RECORDED BY V. S. DRILL METHOD HSA DRILLER Jeff C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 14.25' CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Powers Residence

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0		0-2	287	0935				2 1/4" I.D. auger	Black sandy silt, grass & roots
		6"	288	0940		1		4 1/2" O.D.	Brown fine-medium sand, small gravels, brick fragments, some root material
1		12"	289	0945		2		3" spoon 0-2'	Brown silt, fine sand, trace clay
						2			
2		24"	290	0950		2		2" spoon 2'-15' depth	Light brown silt, fine sand, small gravel
						2			
3		36"	291	0955		2			Light brown silt, fine sand, small gravel, w/black silt layer (2")
						3			
4		48"	292	1000		3			Light brown fine sand, some silt, trace small gravel
5		5'				4			
6		6'	293	1005		15			Gray brown fine sand, trace silt/small gravel, dense
						23			
7		7'	294	1010		26			Gray fine sand, little silt, trace small gravel

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT ASEV-01 JOB NUMBER HOLE NUMBER S-92

STATE WA COUNTY Snohomish LOCATION T R SEC. TRACT

SITE DESCRIPTION 534 East Marine View Drive ELEVATION G.S. DATE 1-12-94

RECORDED BY V. S. DRILL METHOD HSA DRILLER Jeff C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 14' 3" CASING TYPE AND DESCRIPTION --

TOTAL DEPTH CASED -- WELL COMPLETION DESCRIPTION --

REMARKS (Note bit/auger size) Powers Residence

DEPTH	LOG GRAPHICAL	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS DRILLING FLUID DRILLING RATE WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7									
8		8'				24			
9		9'	295		1015	54 60/3"		added 1.5 gallons drilling water starting at 9'5	Gray-brown-silty fine sand trace small gravel
10		10'				48		added 2 gallons water at 10'	
11		11'	296		1020	81			Gray brown fine sand, gravelly, little silt, dense
12		12'				18			
13		13'	297		1025	12	30%		Brown silty fine sand wet
14		14'							

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT ASEV-01 JOB NUMBER HOLE NUMBER S-92

STATE WA COUNTY Snohomish LOCATION T R SEC. TRACT

SITE DESCRIPTION 534 East Marine View Drive ELEVATION G.S. DATE 1-12-94

RECORDED BY V. S. DRILL METHOD HSA DRILLER Jeff C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 14' 3" CASING TYPE AND DESCRIPTION —

TOTAL DEPTH CASED — WELL COMPLETION DESCRIPTION —

REMARKS (Note bit/auger size) Powers Residence

DEPTH	GRAPHICAL LOG	WELL COMPLETION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
14		14.25	298	1030		60/3"	—		Brown fine sand, stiff, small gravel, dry
15						ns			

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-111

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 520 East Marine View Drive ELEVATION G.S. ___ DATE 1-21-93

RECORDED BY V.S. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics Inc.

TOTAL DEPTH 5' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9302-522		0825				Brown sand, silt, tan clay, organic material
2"									
6"			9302-523		0830				Sand, silt, some ggravel, organic material
9"									
1'			9302-524		0835				Brown silty clay, white sand, brick
2'			9302-525		0840				White sand, brown silt, brick
3'			9302-526		0845				White sand, (crystalline), brick, brown silt
4'			9301-527		0850				Gray sand, silt, brick, dark gray clay pebbles
5'									
6'									No sample collection; could not auger past 5 feet
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-111

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 520 East Marine View Drive ELEVATION G.S. ___ DATE 7-15-93

RECORDED BY J.C. DRILL METHOD H S A DRILLERJ. Lewis DRILLING CO Boretec

TOTAL DEPTH 11.3' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0									Topsoil, fill material, brown medium sand, silt organic material, small gravel
1'									Multi-colored smelter debris (white, red, grey) brick chips mortar, medium sand
2'						3/6 2/6	50%		White crystalline material strong odor
3'						2/6 2/6			Brick material, medium sand, silt, brown, white specks, small gravel
4'						8/6 2/6			
5'	5.0	EVT9307 714A		0900		1/6 1/6	90%		Moist gray, medium sand, silt, black streaks, small gravel, strong odor
6'	6.0					8/6 11/6			Moist brown fine sand, silt, black streaks, brick material
7'									

TEST HOLE LOG

HYDROMETRICS TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-111

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 520 E. Marine View Drive ELEVATION G.S. ___ DATE 7-15-93

RECORDED BY J. C. DRILL METHOD H S A DRILLER J. Lewis DRILLING CO. Boretec

TOTAL DEPTH 11.3' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
7'	6.25		EVT-9307	0935		50/4	90%		Light grey silt, fine sand, small gravel, dense
	7.25		714B						
8'	8.0		EVT-9307	1055		28/6	100%		Light grey silt, very dense, small gravel
	8.5		715			50/3			
9'	9.0		EVT-9307	1135		50/5	100%		Light grey silt, very dense, small gravel
	9.2		716						
10'									
			EVT-9307	1145		28/6	100%		Light grey silt, very dense, small gravel
	10.8		717			50/5			
11'	11.3								Auger refusal at 11.0'
									Collected samples 2-4' and 5-6' for archivery

TEST HOLE LOG

HYDROMETRICS — TACOMA, WASHINGTON

PROJECT Everett RI/FS — JOB NUMBER ASEV01 — HOLE NUMBER S-112

STATE WA — COUNTY Snohomish — LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 523 Pilchuck Path — ELEVATION G.S. ___ — DATE 1-26-93

RECORDED BY J. C. — DRILL METHOD Hand Auger — DRILLER J.C. — DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 4' — CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ — WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT RECOVERY CORE	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-602		1700				Brown to black organic material, sandy, some small gravel
2"									
6"			9301-603		1705				Silty, red (brick color) little clays, some oxidation
9"									
1'			9301-604		1710				Brown silty sand, some red, some oxidation HARD
2'			9301-605		1715				Red silty/(brick), some oxidation, little clays
3'			9301-606 9301-608 Dupl.		1720 1730				Sandy silt, red, some oxidation
4'			9301-607		1725				Brown sandy silt (brick chips) & had 1' void
5'									
6'									
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett RI/FS JOB NUMBER ASEV01 HOLE NUMBER S-113

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 528 Pilchuck Path ELEVATION G.S. ___ DATE 1-28-93

RECORDED BY J. C. DRILL METHOD Hand Auger DRILLER J.C. DRILLING CO. Hydrometrics, Inc.

TOTAL DEPTH 4' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS ___

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
0			EVT 9301-609	0830					Topsoil, organic material (brick chips), sandy
2"									
6"			9301-610	0835					Brown sandy silt, brick chips, small slag
9"									
1'			9301-611	0840					Brownish-red silts with brick chips
2'			9301-612 9301-615 Dupl.	0845 0900					Brownish-red silts, small gravels, small slag
3'			9301-613	0850					Brown silty sand, small gravels
4'			9301-614	0855					Tan sandy silt, small gravels
5'									
6'									
7'									

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-113

STATE WA COUNTY Snohomish LOCATION T ____ R ____ SEC. ____ TRACT ____

SITE DESCRIPTION 528 East Marine View Drive ELEVATION G.S. ____ DATE 7/20/93

RECORDED BY Sam Bittin DRILL METHOD HSA DRILLER R. Gipson DRILLING CO. Boretec

TOTAL DEPTH 15.0' CASING TYPE AND DESCRIPTION ____

TOTAL DEPTH CASED ____ WELL COMPLETION DESCRIPTION ____

REMARKS (Note bit/auger size) Till @ 6.8'

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICATION
6		EVT	9307 740 6-6.2		850	2/6 2/6	100		Brown, silt with black organic? streaking.
7			741 7-7.2		855	2/6	100		EVT-9307-742 Duplicate of 7-2.2' 1005 Light gray silt with light brown marbelling, moist
8						10/6 26/6	100		Very wet 8-9'
9			743 9-9.2		910	44/6 50/6	100		Very densew, light gray silt, with gravels, slightly moist
10						10/6 39/6	100		
11			744 11-11.2		915	50/6			Dense, Light gray, sandy silt with occasional <1/2" gravel moist
12						38/6 88/6	100		
13			745 12.8-13		0930				As above with sandy silt, Lense at 13', slightly moist

TEST HOLE LOG

HYDROMETRICS

TACOMA, WASHINGTON

PROJECT Everett Smelter JOB NUMBER ASEV01 HOLE NUMBER S-113

STATE WA COUNTY Snohomish LOCATION T ___ R ___ SEC. ___ TRACT ___

SITE DESCRIPTION 528 East Marine View Drive ELEVATION G.S. ___ DATE 7/20/93

RECORDED BY Sam Billin DRILL METHOD HSA DRILLER R. Gibson DRILLING CO. Boretec

TOTAL DEPTH 15.0' CASING TYPE AND DESCRIPTION ___

TOTAL DEPTH CASED ___ WELL COMPLETION DESCRIPTION ___

REMARKS

DEPTH	GRAPHICAL LOG	WELL ELEVATION	SAMPLE	SAMPLE TYPE	TIME	HAMMER BLOWS	PERCENT CORE RECOVERY	NOTES ON: WATER LEVELS, DRILLING FLUID, DRILLING RATE, WELL COMPLETION	DESCRIPTION AND CLASSIFICA ION
13									
14						43/6 100/6	100		Dry, dense, light gray silt with occasional gravel
15			746 14.8-15	1000					

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-1

Date Hole Started: 04/01/98 Date Hole Finished: 04/01/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: E Marine View Dr.
Descriptive Location: 20' S of Wrhsr access on E side.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Extent of Glacial Till
Target Aquifer: N/A
Hole Diameter (in): 8.5
Total Depth Drilled (ft): 36.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	5 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with a Mobile Drill B-61 with 4 1/4" (ID) Hollow Stem Auger. Samples obtained with a 2" split spoon, and "A" Rod under a 140 lb., 30" drop, winch release safety hammer. Samples submitted to Hydrometrics, Inc. Ruston lab for XRF analysis (As, Pb). Boring abandoned with bentonite grout, bentonite chips, and 1' concrete cap with an aluminum identification tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9804-519	GRAB			0.0 - 0.5'
	EVT-9804-520	SS	5/10/98	1.40	2.0 - 3.5' Brick in cuttings.
5	EVT-9804-521	SS	18/10/10	1.40	5.0 - 6.5'
10	EVT-9804-522	SS	25/14/8	0.50	10.0 - 11.5'
15	EVT-9804-523	SS	60/30/50-4	0.50	15.0 - 16.5'
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
ASPHALT
Black asphalt and 1/2" angular gravel.
[Road Pavement]

1.0 - 8.0'
SILT
Blue-green to gray, slightly moist to dry, trace gravel and coarse sand; Concrete at 6-6.3'.
[Fill]

8.0 - 13.5'
Gravelly Sandy SILT
Gray, slightly moist, slightly plastic; Sand is coarse to fine grained, angular to subrounded 1/2" gravel.
[Till/Fill]

13.5 - 18.5'
Silty Gravelly SAND
Light brown, medium to fine grained, slightly moist to dry; Gravel 1/2" subangular to subrounded.
[Glacial Till]

18.5 - 23.0'
SAND& GRAVEL
Brown, medium to fine grained, dry, dense to medium dense; Gravel is 3"

Continued Next Page

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-1

Date Hole Started: 04/01/98 Date Hole Finished: 04/0

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9804-524	SS	30/32/50-4	0.50	20.0 - 21.5'		and smaller subrounded, green. [Glacial Till]
25	EVT-9804-525	SS	27/42/50-5	1.30	25.0 - 26.5'		23.0 - 28.5' **Silty SAND** Brown, medium to fine grained, slightly moist to dry, dense. [Glacial Till]
30	EVT-9804-526	SS	16/37/50-5	1.40	30.0 - 31.5'		28.5 - 33.0' **SILT** Light brown, dry, dense to hard, 1" sand lense at 31'. [Glacial Till]
35	EVT-9804-527	SS	19/33/38	1.50	35.0 - 36.5'		33.0 - 36.5' **SAND** Brown, black, and white, medium to coarse grained, slightly moist to dry clean, dense to medium dense. [Advance Outwash]
40							
45							
50							

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-2

Date Hole Started: 03/31/98 Date Hole Finished: 03/31/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: E Marine View Dr.
Descriptive Location: 195' S of Wrhsr access on E side.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Extent of Glacial Till
Target Aquifer: N/A
Hole Diameter (in): 8.5
Total Depth Drilled (ft): 36.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	5 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with a Mobile Drill B-61 with 4 1/4" (ID) Hollow Stem Auger. Samples obtained with a 2" split spoon, and "A" Rod under a 140 lb., 30" drop, winch release safety hammer. Samples submitted to Hydrometrics, Inc. Ruston lab for XRF analysis (As, Pb). Boring abandoned with bentonite grout, bentonite chips, and 1' concrete cap with an aluminum identification tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-511	SS			0.0 - 0.5'
	EVT-9803-512	SS	12/9/10	1.00	2.0 - 3.5'
5	EVT-9803-513	SS	3/5/7	1.20	5.0 - 6.5' Smelter debris in cuttings; Red brick and yellow concrete.
10	EVT-9803-514	SS	3/4/2	1.00	10.0 - 11.5'
15	EVT-9803-515	SS	14/17/30	1.50	15.0 - 16.5'
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 0.5'
ASPHALT
Black, dry with 1/2" angular gravel.
[Road Pavement]

0.5 - 8.0'
Sandy SILT
Light brown to gray with some orange staining, slightly moist, some red brick fragments and subrounded gravel.
[Fill]

8.0 - 15.0'
Silty SAND
Orange-gray with some black staining, fine grained to silty, dry, some wood fragments and root matter.
[Till/Fill]

15.0 - 25.0'
Silty SAND w/ Gravel
Light brown w/ some orange mottling, fine grained to silty, dry, medium dense to dense. Some 1/2" subrounded gravel.
[Glacial Till]

Continued Next Page

GEOTECH EVTSA-1 HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-2

Date Hole Started: 03/31/98 Date Hole Finished: [illegible]/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-516	SS	14/50-4	0.50	20.0 - 21.5'		
25		SS	100-4	0.00	25.0 - 26.5'		25.0 - 33.0' **SILT** Light brown with trace orange staining, dry, very dense, trace medium sand. [Glacial Till]
30	EVT-9803-517	SS	60/30/34	1.00	30.0 - 31.5' J Niederkorn est. from drilling sand 33'.		
35	EVT-9803-518	SS	6/22/19	1.00	35.0 - 36.5'		33.0 - 36.5' **SAND** Black, brown, and white, medium grained, medium dense, clean, dry. [Advance Outwash]
40							
45							
50							

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-3

Date Hole Started: 03/31/98 Date Hole Finished: 03/31/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: City of Everett
Legal Description: E Marine View Dr.
Descriptive Location: 355' S of Wrhsr access off on E side.

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: J Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Extent of Glacial Till
Target Aquifer: N/A
Hole Diameter (in): 8.5
Total Depth Drilled (ft): 39

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	5 ft.

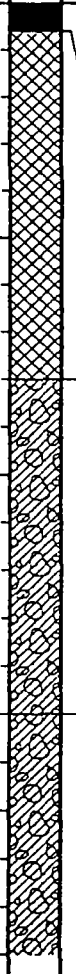
Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Boring drilled with a Mobile Drill B-61 with 4 1/4" (ID) Hollow Stem Auger. Samples obtained with a 2" split spoon, and "A" Rod under a 140 lb., 30" drop, winch release safety hammer. Samples submitted to Hydrometrics, Inc. Ruston lab for XRF analysis (As, Pb). Boring abandoned with bentonite grout, bentonite chips, and 1' concrete cap with an aluminum identification tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-500	GRAB			0.0 - 0.5'
	EVT-9803-501	SS	4/40/50-2	0.50	2.0 - 3.5' Cuttings had trace red brick frags.
5	EVT-9803-502	SS	6/3/6	0.50	5.0 - 6.5'
10	EVT-9803-503	SS	4/3/3	0.40	10.0 - 11.5'
15	EVT-9803-504	SS	7/15/21	1.50	15.0 - 16.5' Duplicate sample @ 08:40 EVT-9803-508
20					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 0.6'
ASPHALT
Black asphalt and 1/2" angular gravel.
[Road Pavement]

0.6 - 8.0'
Silty SAND
Gray to light brown, slightly moist, loose, trace 1/4" subrounded gravel.
[Road Base Fill]

8.0 - 15.0'
Silty SAND
Light brown, medium to fine grained, slightly moist, 1/4 subrounded gravel trace wood fragments with purple staining at 10-11.5'.
[Till/Fill]

15.0 - 27.0'
Silty SAND
Light brown some orange mottling at 15', fine grained to silty, slightly moist to dry, medium dense, trace 1/4" subrounded gravel.
[Glacial Till]

Continued Next Page

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Till Boring

Hole Name: TB-3

Date Hole Started: 03/31/98 Date Hole Finishe 1/9

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-505	SS	8/17/22	1.20	20.0 - 21.5'		
25	EVT-9803-506	SS	10/23/26	1.40	25.0 - 26.5'		
							27.0 - 33.0' **Sandy SILT** Grayish brown, dry, medium to fine grained, medium dense to dense, gravel, subrounded to round. [Glacial Till]
30	EVT-9803-507	SS	20/40/48	1.20	30.0 - 31.5' J Niederkorn says it drill like sand about 33'.		
							33.0 - 39.0' **SAND** Brown, gray, and white, coarse to medium grained clean sand, medium dense, slightly moist to moist. [Advance Outwash]
35	EVT-9803-509	SS	15/21/26	1.50	35.0 - 36.5'		
	EVT-9803-510	SS	8/16/13	1.00	37.5 - 39.0'		
40							
45							
50							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-3

Date Hole Started: 03/20/98 Date Hole Finished: 03/23/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 415 Pilchuck Path
Descriptive Location: Back Yard (Former roaster area)

Recorded By: J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 6'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-169	GRAB			0.0 - 1.0'
	EVT-9803-170	GRAB			1.0 - 2.0' Complete flue structure, see field book for sketches.
	EVT-9803-171	GRAB			2.0 - 3.0'
	EVT-9803-172	GRAB			3.0 - 4.0'
	EVT-9803-173	GRAB			4.0 - 5.0'
5	EVT-9803-174	GRAB			5.0 - 6.0' Duplicate SS (blow count 5/8) sample for TPB-3 @ 5-6' on 3/23 @ 13:15 #175.
	EVT-9803-176	SS	12/33	0.75	6.0 - 7.0'
	EVT-9803-177	SS	26/43	0.75	7.0 - 8.0'
	EVT-9803-178	SS	87/50-4	0.75	8.0 - 9.0'
	EVT-9803-179	SS	27/24	0.70	9.0 - 10.0'
10	EVT-9803-180	SS	56/60	0.70	10.0 - 11.0' Duplicate sample @ 13:45; EVT-9803-181
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Silty LOAM
Brown, slightly moist to dry.
[Fill]

1.0 - 2.0'
Silty SAND
Brown, medium to fine grained, slightly moist to cry, some 1/2" subrounded gravel. Abundant red brick fragments.
[Smelter Debris]

2.0 - 3.0'
Gravelly SAND
Yellow to white, medium grained, slightly moist to dry, 20-30% 1" subrounded gravel with abundant red brick debris.
[Smelter Debris]

3.0 - 4.0'
Gravelly SAND
Same as above no brick or gravel.
[Smelter Debris]

4.0 - 7.0'
BRICK
red, crumbled w/ white-gray, sandsized particles (mortar), dry.
[Smelter Debris]

7.0 - 8.0'
SILT
Light brown to gray brown, dry, stiff; trace medium to coase sand w/ fine subrounded gravel.
[Glacial Till]

8.0 - 9.0'
SAND & SILT
4" of medium grained, gray, slightly moist sand; 4" fo gray-brown, slightly moist to dry, very stiff to hard silt; trace gravel.
[Glacial Till]

9.0 - 11.0'
Slightly Silty SAND
Brown-gray, moist, medium to fine grained, medium dense, trace gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-4

Date Hole Started: 03/18/98 Date Hole Finishe

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 525 Pilchuck Path
Descriptive Location: Front Yard (Former As kitchens)

Recorded By: B Thompson/J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3.5
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 7'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometr Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-112	GRAB			0.0 - 1.0'
	EVT-9803-113	GRAB			1.0 - 2.0'
	EVT-9803-114	GRAB			2.0 - 3.0'
	EVT-9803-115	GRAB			3.0 - 4.0'
	EVT-9803-116	GRAB			4.0 - 5.0'
5	EVT-9803-117	GRAB			5.0 - 6.0' Duplicate EVT-9803-118 @ 12:12; 2nd Duplicate @ 15:00 4/7/98 at TPB-4 EVT-9804-120 (blow count, 12/18 .6' recovered.
	EVT-9804-121	SS	15/31	1.00	6.0 - 7.0'
	EVT-9804-122	SS	13/35	1.00	8.0 - 9.0'
10	EVT-9804-123	SS	15/20	1.00	10.0 - 11.0'
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Sandy LOAM
Dark Brown
[Fill]

1.0 - 2.5'
Gravelly SILT
Brown, gravel well rounded to 2"; Occasional brick debris.
[Smelter Debris]

2.5 - 3.5'
SILT
Dark brown, and abundant brick debris, discontinuoous lenses of me sand (very limited in extent).
[Smelter Debris]

3.5 - 4.5'
SAND
1-2" of sand underlain by orange to light brown silt and fine sand with trace fine gravel.
[Fill]

4.5 - 6.0'
SAND & SILT
Transition to light brown/gray, silt and sand, moist becomes drier at 6'.
[Glacial Till]

6.0 - 11.0'
Sandy SILT
Light brown to gray mottled orange, dry, medium dense to loose, trace fine gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-5

Date Hole Started: 03/19/98 Date Hole Finished: 03/19/

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 525 Pilchuck Path
Descriptive Location: Back Yard (Former roaster area)

Recorded By: B Thompson
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x31'
Total Depth Drilled (ft): 5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 5', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placed at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-126	GRAB			0.0 - 1.0'		0.0 - 1.0' **Sandy LOAM** Brown, little fine well rounded gravel. [Fill]
	EVT-9803-127	GRAB			1.0 - 2.0' Duplicate sample at 08:50 EVT-9803-131		1.0 - 2.0' **SAND** Gray/Brown sandy interval with abundant red brick fragments, some white mottling. [Smelter Debris]
	EVT-9803-128	GRAB			2.0 - 3.0'		2.0 - 3.0' **Gravelly SILT & SAND** Orange/brown, transitioning into light brown silt and sand with trace gravel. [Fill]
	EVT-9803-129	GRAB			3.0 - 4.0'		3.0 - 5.0' **SILT & SAND** Light brown/gray silt & fine sand, with trace of fine gravel, moist (no free water) drier at 4-5' and very dense.. [Glacial Till]
	EVT-9803-130	GRAB			4.0 - 5.0'		
5						5	
10						10	
15						15	
20						20	

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-6A

Date Hole Started: 03/18/98 Date Hole Finishe

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 521 Pilchuck Path
Descriptive Location: North side of front yard. (As Kitchens)

Recorded By: B Thompson/J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): TPB 3.5"; TP 3x12'
Total Depth Drilled (ft): 13

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 7'; 2' thereafter

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometric Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag. Borings adjacent to test pits were labeled TPB-[test pit number].

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-106	GRAB			0.0 - 1.0'
	EVT-9803-107	GRAB			1.0 - 2.0'
	EVT-9803-108	GRAB			2.0 - 3.0'
	EVT-9803-109	GRAB			3.0 - 4.0'
	EVT-9803-110	GRAB			4.0 - 5.0'
5	EVT-9803-111	GRAB			5.0 - 6.0' A sample from 5-6' was also obtained at time of drilling TPB; EVT-9804-115 @ 1140 on 04/07/98
	EVT-9804-116	SS	7/25	0.70	6.0 - 7.0'
	EVT-9804-117	SS	15/22	0.70	8.0 - 9.0'
10	EVT-9804-118	SS	10/30	0.60	10.0 - 11.0'
	EVT-9804-119	SS	30/50-5	0.70	12.0 - 13.0'
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Silty LOAM
Brown, trace gravel to 1' well rounded brick fragments.
[Smelter Debris]

1.0 - 2.0'
BRICK
Brown sandy SILT overlying brick layer consisting of three rows of red mortared brick; approximately two 1/2" gray sand underlying brick.
[Smelter Debris]

2.0 - 4.0'
Silty SAND
Orange/brown silty sand some brown to black mottling; black charcoal fragments; trace gravel.
[Fill]

4.0 - 6.0'
SILT & SAND
Light brown sitl and sand, trace gravel well rounded.
[Glacial Till]

6.0 - 12.0'
Sandy SILT
Light brown to gray mottled orange, dry, medium dense, trace fine gravel
[Glacial Till]

12.0 - 13.0'
SILT
Light brown to gray, dry, dense, trace fine gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-6B

Date Hole Started: 03/18/98 Date Hole Finished: 03/18/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 521 Pilchuck Path
Descriptive Location: South side of front yard.

Recorded By: B Thompson
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x7.5'
Total Depth Drilled (ft): 6

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

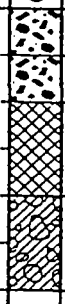
Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 5', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placed at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-100	GRAB			0.0 - 1.0'
	EVT-9803-101	GRAB			1.0 - 2.0'
	EVT-9803-102	GRAB			2.0 - 3.0'
	EVT-9803-103	GRAB			3.0 - 4.0'
	EVT-9803-104	GRAB			4.0 - 5.0'
5	EVT-9803-105	GRAB			5.0 - 6.0'
10					
15					
20					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Silty LOAM
Brown silty loam with trace of fine gravel. Abundant brick fragments.
[Fill]

1.0 - 2.0'
BRICK
Brick floor intact at 1.5';
0.2' dark brown silty sand over orange brick
0.2' medium sand under brick
underlain by orange/brown silty sand with trace clay, some gravel and cobbles to 2".
[Smelter Debris]

2.0 - 4.0'
Silty SAND
Orange brown silty sand some gravel trace clay; some dark brown to black mottling in soil for 1' below brick layer, wood debris in darker areas
[Fill]

4.0 - 6.0'
SILT & SAND
Transition to light gray/brown silt to fine sand, trace gravel & cobbles, some orange to gray mottling; very dense.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-7

Date Hole Started: 03/19/98 Date Hole Finished: 7/98

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 515 Pilchuck Path
Descriptive Location: Back yard (Former As dust chambers)

Recorded By: B Thompson/J Swortz
Drilling Company: Hydrometrics, Inc.
Driller: JN/RY
Drilling Method: Hollow Stem Auger/Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): TPB 3.5"; TP 3x47'
Total Depth Drilled (ft): 11

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft. to 7'; 2' thereafter

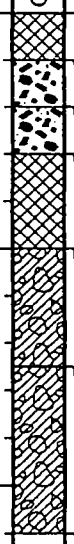
Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe; Continued drilling from 5' to 11' with Piper 2000 2 1/4" (ID) HSA, sampled with a 2" split spoon using "A" rod, a 140 lb. 30 inch drop safety hammer on a cat head. Samples submitted to Hydrometric Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied while test pit borings were abandoned with bentonite chips and a one foot concrete cap with an aluminium ID tag. Test pits also were topped with a concrete patch and aluminum ID tag. Borings adjacent to test pits were labeled TPB-[test pit number].

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-132	GRAB			0.0 - 1.0'
	EVT-9803-133	GRAB			1.0 - 2.0'
	EVT-9803-134	GRAB			2.0 - 3.0'
	EVT-9803-135	GRAB			3.0 - 4.0'
	EVT-9803-136	GRAB			4.0 - 5.0'
5	EVT-9803-137	GRAB			5.0 - 6.0' A sample from 5-6' was also obtained at time of drilling TPB; EVT-9804-105 @ 1655 on 04/07/98
	EVT-9804-106	SS	14/21	1.00	6.0 - 7.0'
	EVT-9804-107	SS	8/10	1.00	8.0 - 9.0'
10	EVT-9804-108	SS	12/26	0.75	10.0 - 11.0'
15					
20					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Sandy LOAM
Brown Sandy LOAM
[Fill]

1.0 - 2.0'
Silty SAND
Brown loam radinf into silty sand and gravel with traced of red brick fragments, some black mottling.
[Smelter Debris]

2.0 - 3.0'
Silty SAND & GRAVEL
Gray silty fine sand and gravel with yellowish staining and trace red b fragments.
[Smelter Debris]

3.0 - 5.0'
Silty SAND and GRAVEL
Orange Silty SAND grading to orange/brown to light brown Silty SAND and GRAVEL.
[Fill]

5.0 - 7.5'
Silty SAND
Light brown to gray with some orange mottling, fine to very fine graine mosit, med dense, trace fine gravels.
[Glacial Till]

7.5 - 11.0'
Silty SAND
Light brown, fine grained, loose to medium dense, moist.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 8/5/98

TP-7

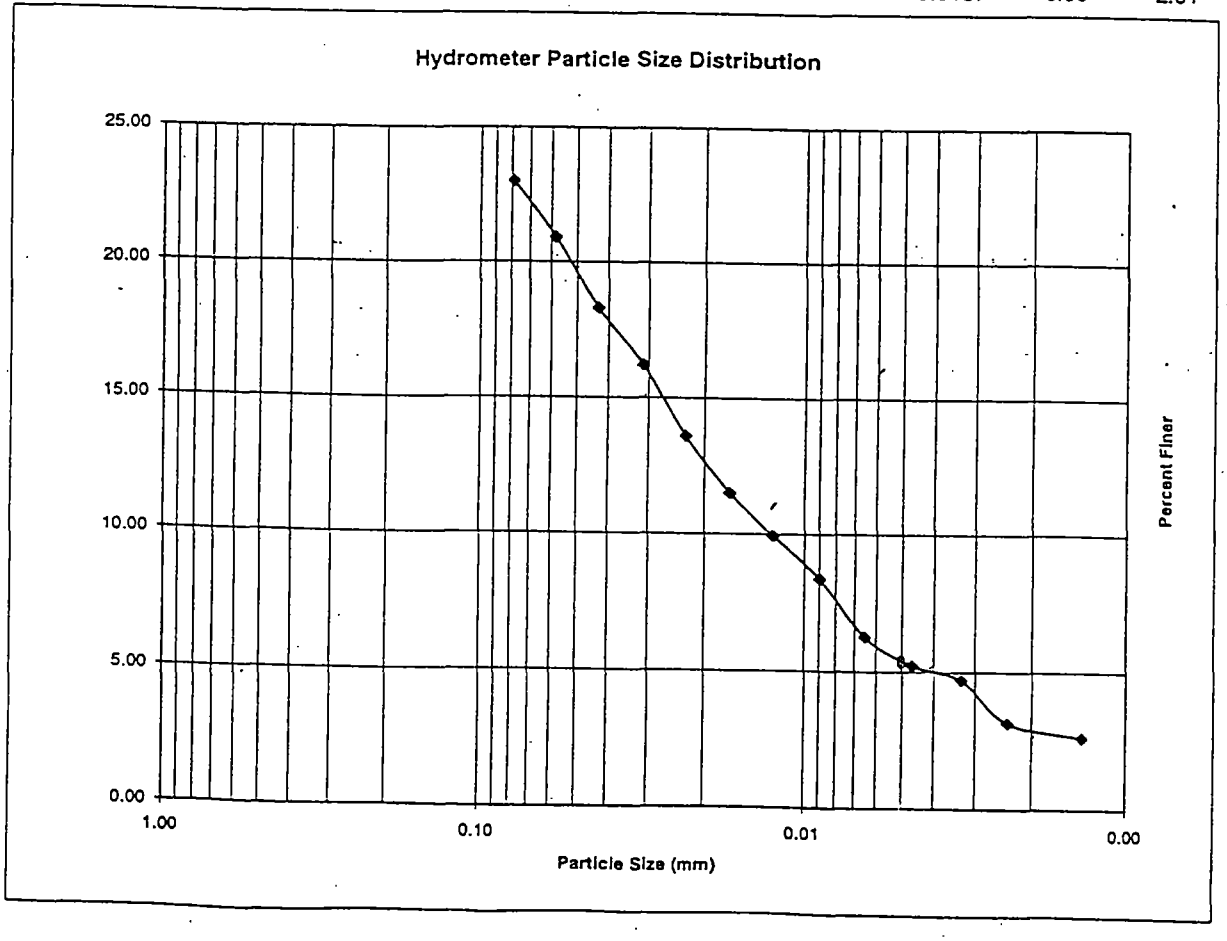
8-9'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-01159
SAMPLE NUMBER	EVT-9803-107
DATE	6/29/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	49	44	88.00	50	8.3	0.0137	0.08	22.99
0.5	45	40	80.00	46	9	0.0137	0.06	20.90
1	40	35	70.00	41	9.8	0.0137	0.04	18.29
2	36	31	62.00	37	10.4	0.0137	0.03	16.20
4	31	26	52.00	32	11.2	0.0137	0.02	13.59
8	27	22	44.00	28	11.9	0.0137	0.02	11.50
15	24	19	38.00	25	12.4	0.0137	0.01	9.93
30	21	16	32.00	22	12.9	0.0137	0.01	8.36
60	17	12	24.00	18	13.5	0.0137	0.01	6.27
120	15	10	20.00	16	13.8	0.0137	0.00	5.23
240	14	9	18.00	15	14	0.0137	0.00	4.70
480	11	6	12	12	14.5	0.0137	0.00	3.14
1440	10	5	10	11	14.7	0.0137	0.00	2.61



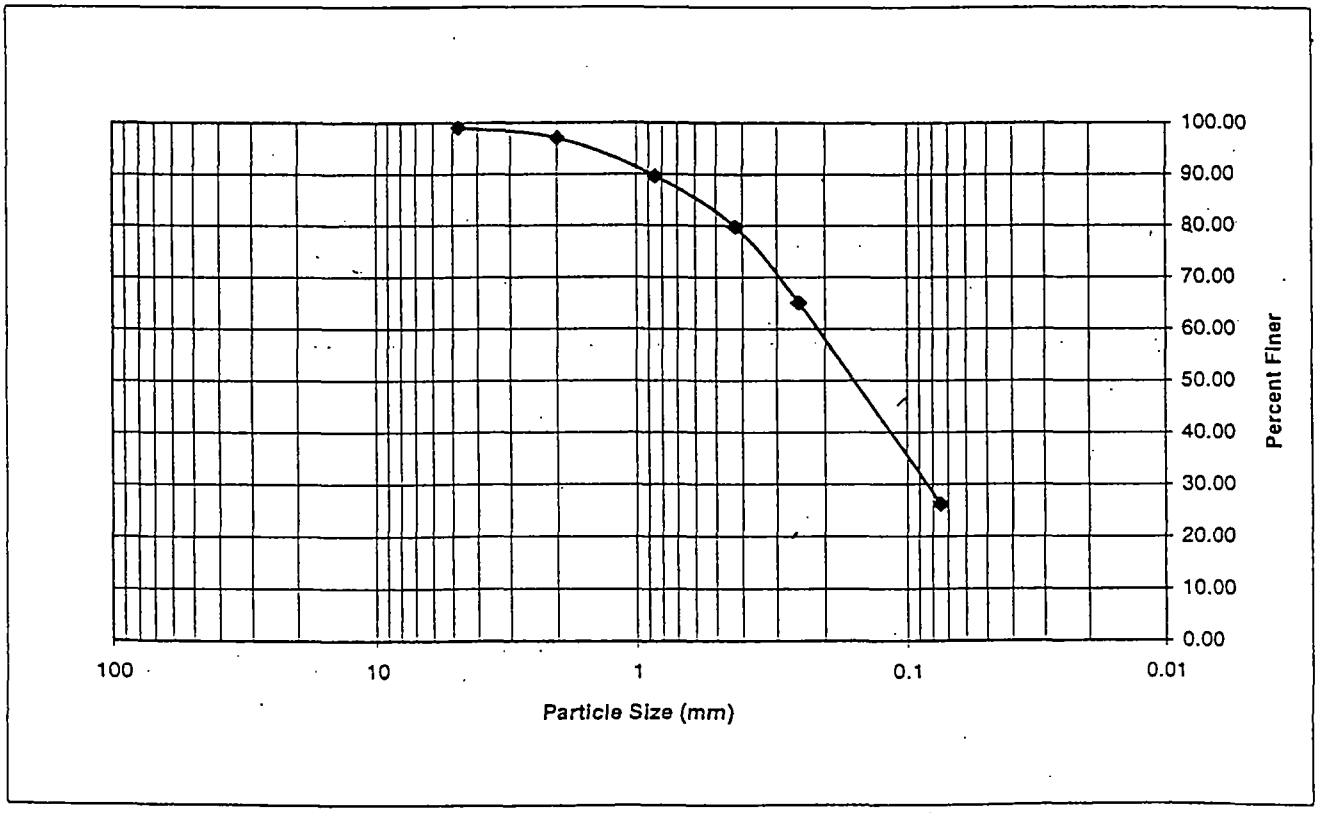
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-01159
Sample Number: EVT-9803-107
Date: 6/25/98

Weight of Oven Dry Sample (g): 255.3

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	2.5	0.98	0.98	99.02
10	2.00	5.00	1.96	2.94	97.06
20	0.85	19.00	7.44	10.38	89.62
40	0.425	25.20	9.87	20.25	79.75
60	0.250	37.60	14.73	34.98	65.02
200	0.075	99.30	38.90	73.87	26.13
PAN	< 0.075	67.10	26.28		

sum = 255.7



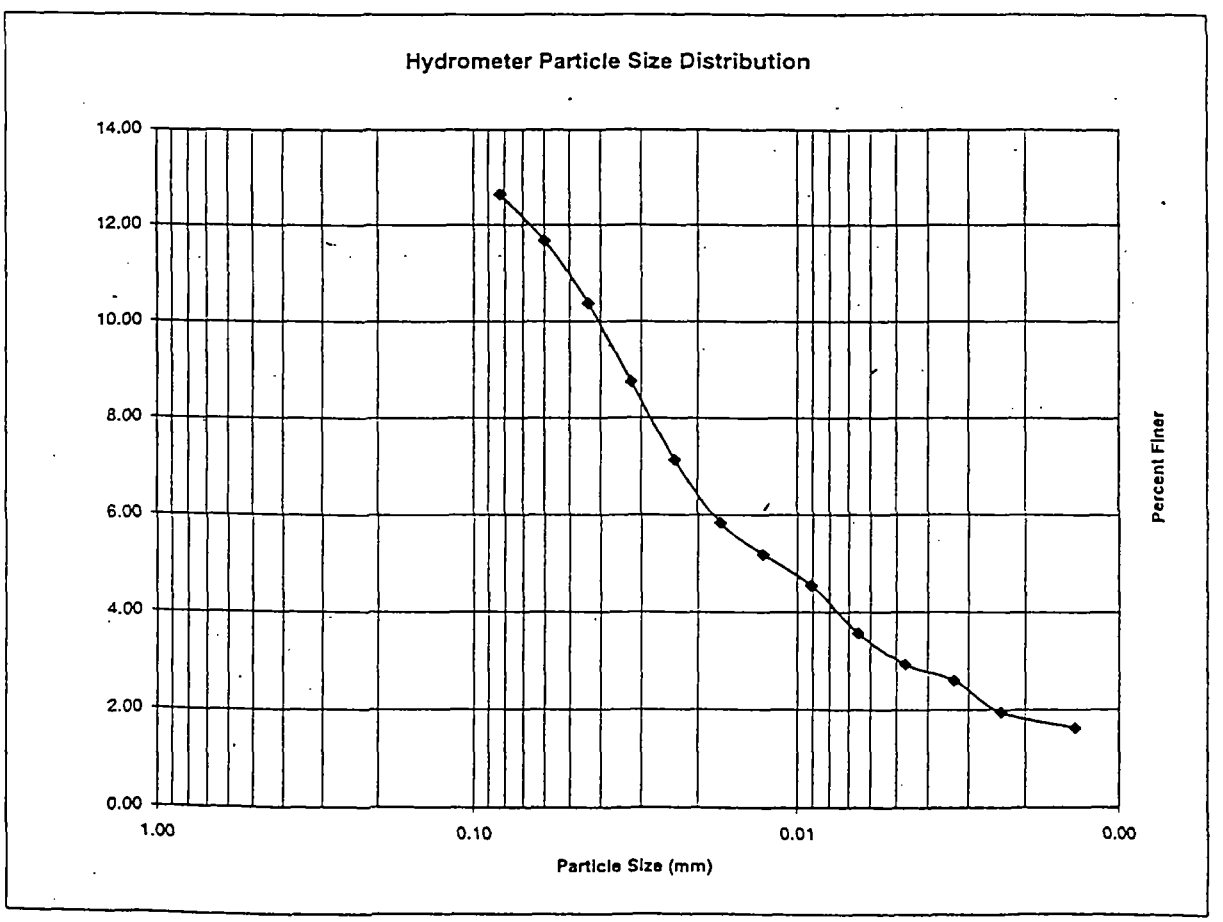
TP-7
10-11'

HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
TACOMA, WASHINGTON 98407

HYDROMETER ANALYSIS

LABORATORY NUMBER	98R-01160
SAMPLE NUMBER	EVT-9804-108
DATE	6/29/98
ANALYST	SM

Time	Reading	Rcp	% Finer	Rcl	L	A	D	% Finer of Total
0.25	44	39	84.23	45	9.1	0.0137	0.08	12.64
0.5	41	36	77.75	42	9.6	0.0137	0.06	11.67
1	37	32	69.11	38	10.2	0.0137	0.04	10.37
2	32	27	58.32	33	11.1	0.0137	0.03	8.75
4	27	22	47.52	28	11.8	0.0137	0.02	7.13
8	23	18	38.88	24	12.5	0.0137	0.02	5.84
15	21	16	34.56	22	12.9	0.0137	0.01	5.19
30	19	14	30.24	20	13.2	0.0137	0.01	4.54
60	16	11	23.76	17	13.7	0.0137	0.01	3.57
120	14	9	19.44	15	14	0.0137	0.00	2.92
240	13	8	17.28	14	14.2	0.0137	0.00	2.59
480	11	6	12.96	12	14.5	0.0137	0.00	1.95
1440	10	5	10.80	11	14.7	0.0137	0.00	1.62



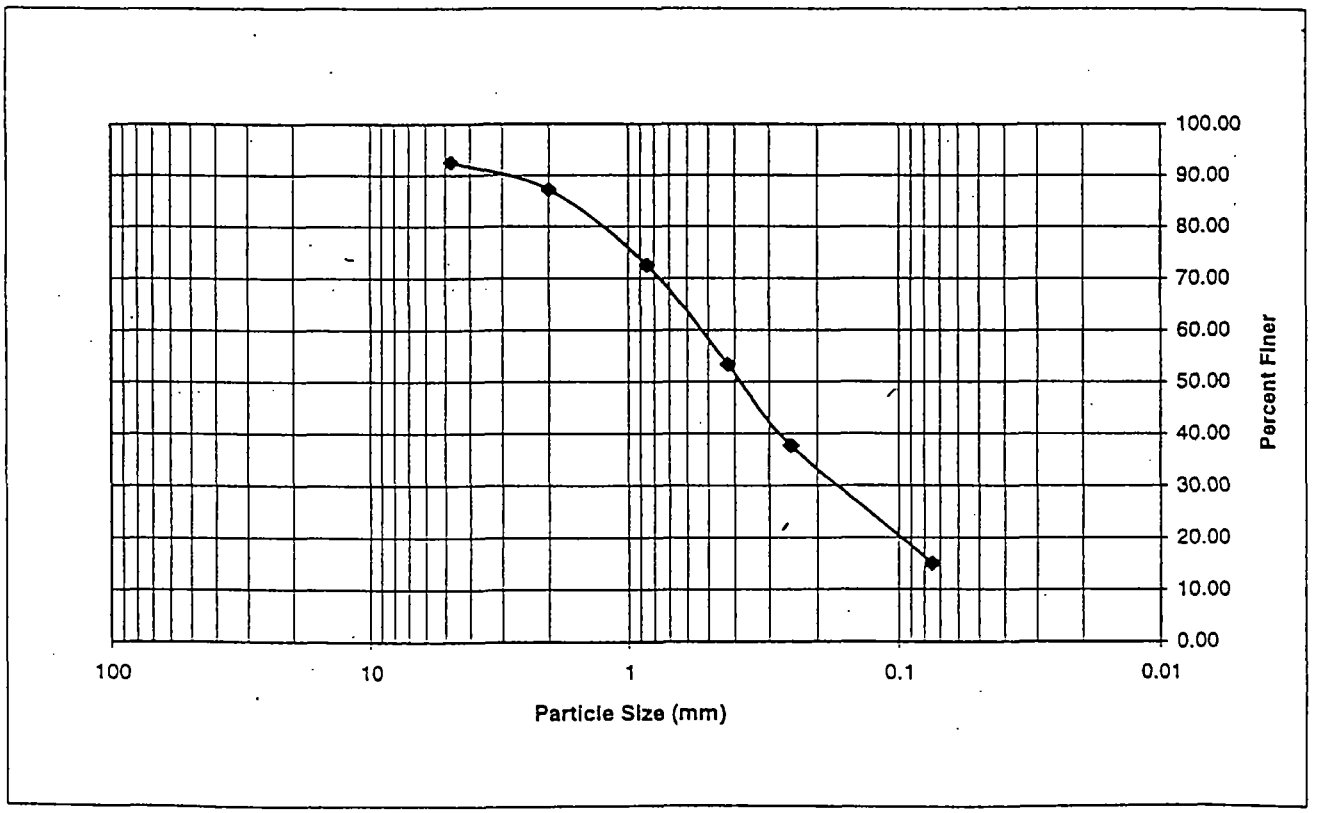
HYDROMETRICS, INC.
RUSTON LABORATORY
5227 NORTH 49TH STREET
RUSTON, WASHINGTON 98407

Laboratory Number: 98R-01160
Sample Number: EVT-9804-108
Date: 6/26/98

Weight of Oven Dry Sample (g): 287.8

Sieve Number	Sieve Opening (mm)	Weight Retained			
4	4.75	21.5	7.47	7.47	92.53
10	2.00	15.40	5.35	12.82	87.18
20	0.85	42.10	14.63	27.45	72.55
40	0.425	55.30	19.21	46.66	53.34
60	0.250	45.10	15.67	62.33	37.67
200	0.075	65.20	22.65	84.99	15.01
PAN	< 0.075	43.70	15.18		

sum = 288.3



HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-8

Date Hole Started: 03/19/98 Date Hole Finished: 03/19/9

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 503 Pilchuck Path
Descriptive Location: SE back yard (Former dust chamber area)

Recorded By: JSwortz
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x22'
Total Depth Drilled (ft): 6

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placed at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9803-138	GRAB			0.0 - 1.0'
	EVT-9803-139	GRAB			1.0 - 2.0' Duplicate sample at 13:52, EVT-9803-144
	EVT-9803-140	GRAB			2.0 - 3.0'
	EVT-9803-141	GRAB			3.0 - 4.0'
	EVT-9803-142	GRAB			4.0 - 5.0'
5	EVT-9803-143	GRAB			5.0 - 6.0'
10					
15					
20					

GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 2.0'
Sandy LOAM
Brown, trace 1/2" subrounded gravel and red brick fragments.
[Smelter Debris]

2.0 - 4.0'
Gravelly Silty SAND
Yellow-brown to gray some black staining at 2-3', slightly moist, medium to fine grained; approximately 10-20% 2" and smaller subrounded gravel abundant brick fragments.
[Smelter Debris]

4.0 - 5.0'
Sandy SILT
Yellow brown with some orange mottling, moist, fine to coarse sand, trac rounded 1/4" gravel.
[Fill]

5.0 - 6.0'
Gravelly SAND
Light gray, medium grained, slightly moist to dry, <10% subrounded gravel.
[Glacial Till]

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Evaluate structures

Hole Name: TP-9

Date Hole Started: 03/18/98 Date Hole Finished: 03/18/

Client: Asarco
Project: Smelter Area Investigation
County: Snohomish State: WA
Property Owner: Asarco
Legal Description: 3010 5th St
Descriptive Location: Front Yard (former As dust chambers)

Recorded By: B Thompson
Drilling Company: Hydrometrics, Inc.
Driller: R Yeager
Drilling Method: Backhoe
Drilling Fluids Used: None
Purpose of Hole: Evaluate structures
Target Aquifer: N/A
Hole Diameter (in): 3x22'
Total Depth Drilled (ft): 6

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	N		
Surface Casing Used?	N		
Screen/Perforations?	N		
Sand Pack?	N		
Annular Seal?	N		
Surface Seal?	N		
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	Metals Analysis	1 ft.

Static Water Level Below MP: N/A
Date: N/A
MP Description: Ground Surface
MP Height Above or Below Ground (ft): N/A

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Test pit dug with a backhoe to 6', grab samples collected with a hand trowel and hoe. Samples submitted to Hydrometrics, Inc. Ruston laboratory for XRF analysis (As, Pb). Test pits were backfilled and BMPs were applied. A one foot concrete cap with an aluminium ID tag was placed at the sample locations.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9803-119	GRAB			0.0 - 1.0'		0.0 - 1.0' **Sandy LOAM** brown, sandy loam, some fine ravel and red brick fragments. (Fill)
	EVT-9803-120	GRAB			1.0 - 2.0' Duplicate sample EVT-9803-125		1.0 - 3.0' **Silty GRAVEL** 2 in gray, medium sand underlain by light brown to gray to black mottled silty gravel. Gravel to 2" and well rounded; Black wood fragments. (Fill)
	EVT-9803-121	GRAB			2.0 - 3.0'		3.0 - 5.0' **Silty SAND & GRAVEL** Orange/brown sitly sand & gravel; transitioning to light gray/ brown silt and sand with traced fine gravel; very minor weep @ 5'. (Fill)
	EVT-9803-122	GRAB			3.0 - 4.0'		5.0 - 6.0' **SILT & SAND** Light brown/ gray silt and fine sand, trace fine gravel, becoming very dense and dry @ 6'. (ti)
	EVT-9803-123	GRAB			4.0 - 5.0'		
5	EVT-9803-124	GRAB			5.0 - 6.0'		
10							
15							
20							

GEOTECH EVTSA-1.GPJ HYD-TUC.GDT 7/13/98

Sheet

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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Site Name: EVSSF

EXHIBIT 2.1
EXISTING TOPOGRAPHY OF FENCED AREA
OCTOBER 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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Site Name: EVSSF

EXHIBIT 2.2
EXISTING UTILITIES IN FENCED AREA
OCTOBER 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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Site Name: EVSSF

EXHIBIT 2.3
EXISTING OVERHEAD UTILITIES IN FENCED AREA
OCTOBER 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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File #: 1.9.7 VOL 3
Site Name: EVSSF

EXHIBIT 2.4
CROSS SECTIONS A-A' TO C-C' (ARSENIC LEVELS ABOVE 3000MG/KG AND ABOVE 150 MG/KG)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

TARGET SHEET

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EXHIBIT 2.5
CROSS SECTIONS D-D' TO H-H' (ARSENIC LEVELS ABOVE 3000MG/KG AND ABOVE 150 MG/KG)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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EXHIBIT 3.1
UPPER AREA REMOVAL AND
REPLACEMENT PLAN
OCTOBER 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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EXHIBIT 3.2
LOWER AREA REMOVAL AND
REPLACEMENT PLAN
OCTOBER 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 SIXTH AVENUE
SEATTLE, WA 98101

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EXHIBIT 3.3
FINAL GRADE CROSS SECTIONS