Everett Smelter / SIT 4.6.4

COMPREHENSIVE LOWLAND AREA REMEDIAL INVESTIGATION REPORT FOR THE EVERETT SMELTER SITE

EVERETT, WASHINGTON

- DRAFT -

Prepared for:

Dr. David South
Toxics Cleanup Program
Washington Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5452

Submitted by:

Mr. Thomas Aldrich
ASARCO Incorporated
P.O. Box 1644
Tacoma, WA 98401

January 2000

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF EXHIBITS

LIST OF APPENDICES

EXECUTIVE SUMMARY

This report describes the findings of a recent investigation to provide additional characterization of the nature and extent of contamination in the lowland area portion of the Everett Smelter Site. The Everett Smelter Site, which is located in northeast Everett, Washington, was established by Ecology in 1990 as a result of a former smelter facility that operated from 1894 to 1912. Ecology has divided the Everett Smelter Site into two investigation areas, the upland area and the lowland area. The upland area's remedial investigation and feasibility study were completed in 1995.

Ecology has defined the lowland area as the area at the base of the bluff immediately east of East Marine View Drive and extending eastward to the Snohomish River. This area is and has been historically used for industrial activities. The lowland area still has remnants of the original slag pile at the base of the bluff. Environmental conditions in the lowland area have been evaluated in previous investigations.

The recent additional characterization described in this report was designed to fulfill the requirements specified in Enforcement Order DE97TC-N119, Task 6 issued by the Washington Department of Ecology:

> "to complete characterization of the nature and extent of contamination in the lowland portion of the site (the area between the base of the bluff below East Marine View Drive and the Snohomish River) and its relationship to the upland area. In addition, the supplemental remedial investigation will be used to install monitoring wells which will be used to provide long-term monitoring of ground water during and after cleanup activities."

In addition to completing the remedial investigation for the lowland area, Asarco and Ecology agreed to integrate relevant results from the smelter area and storm water investigations into this report. This effort allows for a better evaluation of the relationship between conditions in the lowland and upland areas. It also eliminates the need to finalize the draft Supplemental Investigation of the Everett Smelter Site Lowland Area report, which was submitted in 1996.

The additional characterization recently conducted entailed collection and analyses of soil, slag, groundwater, and surface water samples. It also included using a geophysical technique to identify potential groundwater flow paths connecting the upland area to the lowland area, installation of several new groundwater monitoring wells, and aquifer testing.

The principal findings of the additional characterization along with previous investigations are:

Soil

- The maximum concentrations of arsenic in soil occur in upland soils (fill/till unit), within or immediately adjacent to the fenced area. The smelter area investigation established that maximum arsenic concentrations in soils are associated with residual materials in the immediate area of former arsenic processing facilities and include flue dust and arsenic trioxide. Leach test results indicate that these materials contain high concentrations of leachable arsenic that can potentially be mobilized if contacted by infiltrating water.
- Soil samples collected from the bluff separating the upland and lowland areas were significantly lower in arsenic than the upland area soils with concentrations ranging from 5 to 446 mg/kg. The highest concentrations were from sites at the base of the bluff.
- The highest soil arsenic concentrations in the lowland area were present in samples from the slag pile and surrounding fill. Concentrations of arsenic in excess of 1,000 mg/kg were also detected in a thin peat layer that was encountered between the fill and underlying silt units on the Benson Property south of the slag pile. The peat layer was found to extend south to EV-16. Boyd Benson had additional borings completed in the area south of EV-16 (LB-21, 22 and 23).

None of these borings reportedly encountered this peat layer and soil arsenic concentrations were all less than the 200 mg/kg MTCA Method A Industrial cleanup level to a depth of 15.5 feet.

- An area of slightly elevated soil arsenic concentrations (100 to 500 mg/kg) was delineated at the north end of the Port of Everett property.

Groundwater

- The groundwater flow conditions identified in previous investigations have been confirmed and refined by the additional data collected for this recent investigation. Groundwater interactions between the upland area hydrostratigraphic units and the lowland area groundwater systems have not been specifically quantified, but water level relationships and chemistry data from monitoring wells and surface water stations provide evidence of flow and arsenic transport from the upland area to the lowland area.
- Monthly monitoring of water levels over the last several years show that thin zones of saturation occasionally develop at the top of the till unit in the upland during wet seasons. Sampling conducted at EV-11 and EV-13, has shown dissolved arsenic concentrations of 25 to 47 mg/L.
- Water quality data from additional monitoring wells installed in the upland area during this investigation show the presence of a narrow plume of arsenic in the deep outwash groundwater system in the area downgradient of EV-13. These arsenic concentrations, and the plume location within the outwash aquifer are also consistent with downgradient arsenic plumes in the shallow and deep lowland groundwater systems.
- Concentrations of 0.1 to 3 mg/L dissolved arsenic were detected in shallow groundwater in the slag pile area. The highest concentration was observed at EV-17A immediately adjacent to the bluff. The arsenic plume at EV-17A appears to be a continuation of the upland area outwash system arsenic plume described

above. Arsenic concentrations in the slag pile area decrease to near the detection limit east of the BNSF switchyard tracks.

- While there is an overall eastward gradient toward the Snohomish River in the shallow lowland area groundwater system, groundwater flow appears to be northerly in the area between the bluff and the BNSF switchyard tracks. This northward flow reflects the discharge of groundwater to the surface drainages and wet areas, which subsequently discharge across the BNSF tracks near the SR-529 interchange.
- An area of elevated arsenic in shallow groundwater (dissolved arsenic of 0.21 to 0.56 mg/L) was delineated on the north end of the Port of Everett property. Groundwater arsenic concentrations at surrounding upgradient and downgradient sites were comparatively low (0.007 mg/L or less).
- Sampling confirmed the previous delineation of a narrow arsenic plume in the deep groundwater system. This plume is directly downgradient of, and contiguous with the arsenic plume defined in the upland area outwash system. Arsenic concentrations in the deep plume decrease to <0.005 mg/L at monitoring well EV-21B on the Port of Everett property. In addition, arsenic concentrations are less than 0.005 mg/L at shoreline monitoring wells.

Surface Water/Storm Water

- Storm water containing arsenic enters the City's sewer system during the wet season. The highest arsenic concentration (39 mg/L from MH-7) was observed at a storm water sewer coming from the fenced area in the alley between Pilchuck Path and East Marine View Drive. The majority of the arsenic load to the City's combined storm water/sewer system in this area appears to be attributable to short-term groundwater infiltration to the sewer system in the period immediately following storm water events.
- The highest arsenic concentrations in surface water runoff were observed in a series of seeps that developed along the northeast boundary of the fenced area

during January through early March of 1999. Elevated arsenic concentrations of up to 21 mg/L were detected in these upland area seeps. The runoff associated with the seeps entered the SR-529 overpass catch basin system, which discharges to the lowland area via the City outfall. These seeps accounted for the majority of the arsenic load observed in surface water runoff.

- Arsenic concentrations were consistently low (<0.005 mg/L to 0.013 mg/L) at catch basin sites in the surrounding residential areas.
- Weyerhaeuser storm water improvements re-established a surface water outfall to the Snohomish River in 1998. Detectable arsenic concentrations (up to 0.097 mg/L) were measured in discharge at this location.
- Investigations of Snohomish River sediment quality were performed by Weyerhaeuser in areas upriver, parallel and downriver from the former smelter facility. With the exception of one area near an outfall at the former Weyerhaeuser Mill E/Koppers Site (upriver from the former smelter facility), all arsenic concentrations were less than SQS or CSL criteria.

Based on the integration and evaluation of information from several investigations, the following conclusions have been made:

Soil

- Recent investigations provide additional data which have allowed the delineation of arsenic and metals concentrations in lowland soil at the southern and northern boundaries of the lowland area. The resultant soil quality data and maps delineating arsenic and metals in lowland area soils provide a suitable basis for source area delineation.
- Soils showing elevated arsenic and metals are generally present in areas where smelter facility activities are known to have occurred (i.e. the slag pile vicinity) or where smelter soils have been placed as fill material (i.e. the south bound SR-529 overpass lane and in the access ramp to the Port of Everett property). Some localized areas with elevated arsenic and metals also occur on the former

Weyerhaeuser sites. Sources of arsenic at these locations are not readily apparent in all cases.

Groundwater

- With the addition of data from 16 new monitoring wells and 17 new hydropunch sampling locations, the concentrations of arsenic and metals in the shallow and deep groundwater systems have been delineated. Data from the monitoring wells and hydropunch locations define the extent of arsenic and metals in shallow groundwater, and confirm the shape of the arsenic plume in the deep groundwater system east of BNSF railroad tracks. Additional data also confirm that arsenic plumes in shallow groundwater in the slag pile vicinity and in the deep lowland area groundwater system do not extend to the Snohomish River.
- An arsenic plume has also been identified in the upland area. The location of the plume and the magnitude of arsenic concentrations within the plume suggest it is an upland extension of plumes previously defined in the lowland area and that the principal source of arsenic is in the upland area (fenced area).
- Slag leach results show that the slag is a source of elevated pH and may also be a minor, relative to the contribution of the upland area, source of arsenic in shallow groundwater in the slag pile vicinity.
- Other sources may have contributed to elevated concentrations of arsenic but are no longer evident.

Surface Water/Storm Water

- Arsenic and metals concentrations have been delineated in surface runoff in the upland area and in surface water in the lowland area. The primary source of elevated arsenic concentrations in surface water in the upland area appears to be runoff from the fenced area, particularly where groundwater seeps form after periods of prolonged precipitation.

- Short-term storm water and/or groundwater infiltration to the sewers within the fenced area also appear to be a source of arsenic loading.
- The surface drainage features in the lowland area intersect the shallow groundwater system and receive discharge from groundwater or recharge groundwater to varying degrees, depending on seasonal fluctuations in groundwater levels, storm events and runoff patterns, and the nature of the physical interconnections.
- The sources of arsenic in lowland area surface waters include discharge from the shallow groundwater system in the slag pile vicinity, flow from the City's outfall on the north side of the SR-529 overpass, and possibly, accumulated arsenic in lowland wet areas that is remobilized under certain conditions. Other sources may have contributed to the measured concentrations of arsenic but are no longer evident.
- Based on the groundwater and surface water transport analyses, primary sources of arsenic observed in lowland area surface water are groundwater discharge from the upland area and surface water runoff from the fenced area. Slag leaching may also be a relatively minor source to surface water in the lowland area.

Future Remediation Activities

Based upon the data presented in this report, it is likely that remediation activities currently planned for the former smelter area will be successful in intercepting and removing the current sources of metals to lowland area groundwater and surface water. Therefore, the best approach for addressing elevated arsenic concentrations in the lowland area is by the process of elimination beginning with the fenced area..

1.0 INTRODUCTION

ASARCO Incorporated (Asarco) has completed the additional characterization and monitoring investigation for the lowland area of the Everett Smelter Site (Site). The scope and intent of this recent investigative effort was provided in the Supplemental Remedial Investigation Additional Characterization and Monitoring Work Plan for the Lowland Area (Asarco, 1998a). This investigation was designed to fulfill the requirements specified in Enforcement Order (EO) DE97TC-N119, Task 6 issued by the Washington Department of Ecology (Ecology) in 1997.

The field work associated with the additional characterization and monitoring investigation for the lowland area was conducted in the fall of 1998 through the summer of 1999. The field work consisted of soil, surface water, and groundwater sample collection and analysis. Groundwater investigation included the application of a geophysics technology to identify potential flow paths, advancement and sampling of several hydropunch locations, installation of several new monitoring wells, surveying elevations, and two rounds of groundwater sampling from the 48 monitoring well network.

This report describes the findings of the additional characterization and monitoring investigation. In addition, relevant results of several other investigations have been integrated in this report to better evaluate the relationship of the lowland area to the upland area. This integrated data evaluation has been completed to assist in identifying potential sources of elevated arsenic detected in lowland area groundwater and surface water.

1.1 SITE DESCRIPTION AND HISTORY

The Everett Smelter Site (Site) is located in northeast Everett, Washington (see Figure 1-1). The current Site study area, which is shown on Figure 1-2, includes the former smelter property and the surrounding area. The former Everett smelter was built in 1892 and was operated by the Puget Sound Reduction Company for the first ten years. Asarco purchased the smelter in 1903, operated it for about four years and then closed the lead smelting operations. The arsenic roasting plant continued to operate until 1912 when the plant was permanently shut down and subsequently dismantled by 1915. Portions of the former smelter property were redeveloped for residential use in the 1930s and 1940s and construction of a road interchange at East Marine View Drive and State Route (SR) 529 occurred in 1956. A portion of the former smelter property has been purchased by Asarco and fenced off.

The Site study area has increased in size over the last few years but was originally established by Ecology upon completing a pre-investigation in 1990 after an outcrop of slag was discovered on the bluff. In 1992, Ecology issued an EO to Asarco requiring Asarco to perform a remedial investigation (RI) and feasibility study (FS) and certain interim actions. The majority of the work conducted under the 1992 EO dealt with the upland area. Ecology therefore included a task to address the lowland area, Task 6, in the 1997 EO which required Asarco to further characterize the nature and extent of contamination in the lowland area.

As shown on Figure 1-2, Ecology has divided the Site study area into two primary investigative areas: 1.) the upland area, which includes the area above the bluff along the east side of East Marine View Drive and encompasses former smelting property and surrounding land; and 2.) the lowland area, which is the area between the base of the bluff below East Marine View Drive and the Snohomish River and includes the slag pile. A small portion of the lowland area was also former smelter property. The upland area is comprised of residential, commercial, and public properties. The lowland area is and has been historically used for industrial activities. Current property owners in the portion of the lowland area that were involved in the additional characterization and monitoring investigation are shown on Figure 1-3.

The lowland area still has remnants of the original slag pile at the base of the bluff directly east of East Marine View Drive. Slag, which is a by-product of the lead smelting process, has been of particular interest because it represents a potential source of elevated arsenic in lowland area groundwater. It is believed that the slag was poured off the hillside in a molten state. It generally resembles a dark, fractured rock much like basalt, with color ranging from gray to black, with occasional rusty surfaces due to oxidation of iron-bearing constituents. Slag is a hard material with a rough surface, and tends to break into sharp fragments when crushed. Its appearance can vary from massive to vesicular, the latter variety having been caused by entrapment of gas during the cooling process. The texture of slag can range from predominantly crystalline, which is the result of gradual cooling, to amorphous (i.e. vitrified or glassy) caused by rapid cooling. Due to its high hardness and lithification, slag is generally considered to be highly resistant to chemical and physical weathering.

It appears that some slag had been removed since the smelting operation ceased in 1912 based on the fact that the present outline of the slag deposit as determined by visual observation and borings is markedly different from the outline on a 1913 topographic map. The City of Everett (City) had the right to remove up to 4,000 yd^3 of slag per year based on an agreement with Asarco signed in 1933. In addition, it is believed that the Cascade Insulation Company may have used slag in its rock wool manufacturing process which was located at the base of the slag pile (Asarco, 1995). Slag has been found at various locations other than the slag pile itself in the lowland area as well as in the upland area.

Other than the bluff that contains the slag pile, the lowland area is generally a flat flood plain with a drainage ditch system that contains water throughout most of the year. Currently, the drainage ditch system extends from the base of the bluff to an outfall at the Snohomish River. Two principal aquifers exist including the fill (shallow) and alluvium (deep). An intervening silt layer forms a confining layer which limits flow between the shallow and deep aquifers.

1.2 PURPOSE AND SCOPE OF ADDITIONAL CHARACTERIZATION AND MONITORING

The objectives of the additional characterization and monitoring investigation for the lowland area as stated in Task 6 of the 1997 EO are:

> "complete characterization of the nature and extent of contamination in the lowland portion of the site (the area between the base of the bluff below East Marine View Drive and the Snohomish River) and its relationship to the upland area. In addition,

> the supplemental remedial investigation will be used to install monitoring wells which will be used to provide long-term monitoring of ground water during and after cleanup activities."

Specifically, the additional characterization and monitoring investigation addressed the following:

- Complete delineation of the southern boundary of elevated arsenic and metals for the shallow groundwater system and soil.
- Complete delineation of the northern boundary of elevated arsenic and metals for the shallow groundwater system.
- Conduct additional soil sampling in the bluff and on the Benson property in an area of potential development.
- Evaluate site-wide groundwater flow directions in the shallow and deep groundwater systems.
- Confirm previous hydropunch data collected in 1996 by installing monitoring wells.
- Define source(s) of arsenic plumes in the shallow and deep groundwater systems.
- Evaluate elevated pH levels in the shallow groundwater system and in soil/slag.
- Research sediment data for the Snohomish River to determine whether additional data needs to be collected.
- Combine upland data with lowland data to evaluate site-wide fate and transport issues.

Shortly after the EO was issued, Asarco and Ecology met to discuss other objectives of the additional characterization and monitoring investigation. It was agreed to integrate relevant results of several other investigations including previous lowland investigations, the smelter area investigation, and the storm water and storm drain sediment and controls investigation with the results of the additional characterization and monitoring investigation. This effort would better evaluate the relationship between conditions in the lowland and upland areas. This relationship is of special interest due to the potential that the upland area contains sources of the elevated arsenic concentrations detected in lowland area groundwater and surface water. In addition, this effort of combining all relevant results would replace the need for Ecology commenting on, and Asarco finalizing, the draft Supplemental Investigation of the Everett Smelter Site Lowland Area report (Asarco, 1996).

This report is structured as follows:

Section 1.0 Introduction. This section provides a description of the Site and history. In addition, this section presents the objectives of the recent investigation and of this report.

Section 2.0 Summary of Previous Investigations. This section presents principal conclusions from four previous investigations that are relevant to the lowland area characterization. The four previous investigations are the initial remedial investigation for the Site, the supplemental lowland investigation, the smelter area investigation, and the storm water and storm drain sediment investigation.

Section 3.0 Investigation Methods for Additional Characterization and Monitoring. This section presents details on how the recent additional characterization and monitoring investigation was implemented. Information on the nature and types of samples collected is provided along with methods for sample collection, handling, and analysis.

Section 4.0 Integrated Results of all Investigations. This section combines results from the four previous investigations that are relevant to the lowland area evaluation with the results of the recently performed additional characterization and monitoring investigation. Evaluations of soil, groundwater, and surface water conditions, as well as groundwater / surface water interactions are presented.

Section 5.0 Fate and Transport Analysis. This section describes potential source materials and/or areas that may be contributing to elevated arsenic concentrations in the lowland area groundwater and surface water. Also, this section discusses storm water loading estimates and reviews available data for Snohomish River sediments and City of Everett wastewater treatment plant biosolids.

Section 6.0 Summary and Conclusions. This section provides a summary of the principal findings of the additional characterization and monitoring investigation for soil, groundwater, and surface water. This section also summarizes the analyses performed to evaluate the relationship of the lowland area to the upland area and potential source material and/or areas.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS

This section presents principal conclusions from four previous investigations that are relevant to the characterization of the lowland area. The four previous investigations are:

- the RI and FS for the Site,
- the supplemental lowland investigation,
- the smelter area investigation, and
- the storm water and storm drain sediment investigation.

The relevant conclusions from these previous investigations are used to assist in the evaluation of potential source materials and/or areas contributing to elevated arsenic concentrations detected in lowland area groundwater and surface water (see Sections 4 and 5). The following summarizes each of the four investigations.

2.1 RI AND FS

The RI (Asarco, 1995a) and FS (Asarco, 1995b) were conducted to satisfy requirements of the 1992 EO. During the course of the investigation, Ecology determined that the Site should be divided into two separate units, upland and lowland areas. Also, it became apparent that the original scope of work was not sufficient to define the nature and extent of arsenic and metals in the lowland area because Ecology determined that the upland area should be addressed first. As a result, Ecology decided that investigative work for the lowland area would continue at a later date while the RI/FS would focus primarily on the residential properties in the upland area. This action would allow Ecology to develop a cleanup action plan for the upland area sooner.

Limited data collected during the RI/FS for the lowland area indicated that soils, surface water, and groundwater may have been impacted from the former smelting operation. However, there was not enough information to adequately define and evaluate potential cleanup alternatives.

2.1.1 Soil and Slag Data

Soil quality in the lowland area was investigated by collecting a total of 142 samples from 16 monitoring well borings and three slag borings. Data suggested that elevated arsenic, cadmium, and lead concentrations appear to be confined to the fill and slag material present. However, due to the relatively small number of monitoring well locations from which soil samples were obtained, the lateral and vertical distribution of metals in soil were not delineated adequately. The report stated that further collection of soil samples was necessary to satisfactorily characterize the nature and extent of metals in soil and to evaluate their potential role as a source material to surface water and groundwater.

Soil results indicated that highest arsenic concentrations were found in slag and overlying fill. In addition, several samples of the thin underlying silt layer contained elevated arsenic concentrations suggesting that there may have been a downward migration of arsenic where it accumulated in the silt layer. Results also showed that metal concentrations generally decrease with depth, unless slag was encountered. Lastly, metal concentrations in soil generally decreased east of the BNSF switchyard tracks.

Limited testing on slag was also performed including Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP) tests. The SPLP test is intended to provide information on leachate characteristics due to infiltrating rainfall. The results indicated that the slag composition was quite variable. Although the slag routinely exceeded the MTCA soil cleanup standards for arsenic and lead, TCLP tests suggested that only lead concentrations in slag fails dangerous waste criteria. Results also showed that if TCLP criteria were applied to SPLP results, no exceedances would occur.

2.1.2 Surface Water Data

Collection of surface water samples was not required in the work plan. However, some data were gathered to assist in identifying possible migration pathways of metals through surface water. Five locations were sampled in one round and six locations were sampled during two subsequent rounds.

Data indicated that surface water contained arsenic, cadmium, and lead concentrations in excess of their respective freshwater and marine water acute and chronic criteria. The report stated that although slag and upland fill material may act as a limited source of metals to lowland surface water, it appeared that an additional source was responsible for the elevated arsenic, cadmium, and lead levels. Therefore, further investigation was recommended to help identify the source and to delineate the nature and extent of the area with elevated elements of concern.

2.1.3 Groundwater Data

Four monitoring wells were installed at the top of the bluff and an additional 13 monitoring wells were installed east of the bluff to address groundwater quality. Samples were collected from six rounds while water level measurements were collected on a monthly basis for 25 months.

Groundwater data showed that elevated arsenic concentrations in excess of the freshwater and marine water acute and chronic criteria occurred in both the shallow, fill aquifer and the deep, alluvial aquifer. Arsenic concentrations generally were highest in the alluvial aquifer. The report stated that although slag and upland fill material may act as a limited source of metals to lowland groundwater, it appeared that an additional source may be responsible for the elevated arsenic, cadmium, and lead levels. Therefore, further delineation of the groundwater plumes and aquifer characteristics was recommended.

Potentiometric data and stratigraphic relationships suggested that the advance outwash system in the upland area discharges to the alluvial aquifer in the lowland area. A northeast groundwater flow direction was inferred between the two systems in the vicinity of the bluff. Potentiometric data also suggested that the shallow aquifer flow direction was to the east while deep aquifer flow was to the northeast in the lowland area. Water levels for the shallow aquifer showed some variability that may indicate local variations in flow directions. Water levels also indicated a downward hydraulic gradient that suggests potential for downward flow from the shallow to the deep aquifer. However, it was noted that the actual amount of vertical flow is limited by the low permeability of the intervening silt layer.

Slug tests were conducted to estimate hydraulic conductivity for the representative hydrostratigraphic units. Results indicated hydraulic conductivities in the fill ranging from approximately 5 x 10^{-3} to 3 x 10^{-2} cm/sec with areas of slag possibly having higher permeabilities. Slug test results for the alluvial aquifer indicated a hydraulic conductivity range of approximately 9 x 10^{-3} to 1 x 10^{-2} cm/sec. It was also noted that the estimated groundwater flux through the shallow aquifer in the upland was very low (less than 1 gpm per 1,000 feet width). Consequently, the estimated flux could not adequately explain the concentrations and distribution of arsenic measured in the lowland groundwater.

A tidal investigation was conducted to characterize the effect of tides on both shallow and deep groundwater systems. Results indicated that tidally induced groundwater fluctuations in the deep groundwater system exceeded two feet while the fluctuation in the lowland shallow fill were limited to several tenths of a foot. There was no evidence of flow reversals in either system due to tidal fluctuations.

Lastly, an evaluation of hydrochemical facies was performed. This evaluation looked at common ions present in the water. Results indicated that surface water and the shallow aquifer had nearly identical common ion signatures suggesting that the main source of recharge for the shallow aquifer is through infiltration of surface water (i.e., precipitation). Water levels also supported the interconnection of surface water and shallow groundwater because the water levels were close to or at the ground surface during periods of prolonged precipitation. The common ion composition analysis also supported the connection of the upland area till system with the deep aquifer in the lowland area.

2.2 SUPPLEMENTAL LOWLAND AREA INVESTIGATION

Additional investigative work was performed by Asarco to more fully characterize soil and water quality in the lowland area in 1996 (Asarco, 1996). This work was conducted because the RI/FS primarily dealt with the upland area. The supplemental lowland investigation included the following tasks:

- Task 1 consisted of collecting soil and groundwater samples from 22 hydropunch locations in the portion of the lowland area immediately adjacent to the former smelter footprint. This task further defined arsenic and metal concentrations and attempted to account for earlier observed concentrations in the groundwater.
- Task 2 consisted of collecting soil and groundwater samples from 21 hydropunch locations in the former Weyerhaeuser East Site in the lowland area. This task defined arsenic and metal concentrations in the area east of the former smelter footprint extending to the Snohomish River. This task also included sampling all available monitoring wells and performing tidal monitoring.
- Task 3 consisted of investigating the shallow groundwater conditions along the west side of East Marine View Drive in the upland area. This task included excavating two test pits and installing five monitoring wells to evaluate this portion of the upland area as a potential source of arsenic observed in the lowland area groundwater.
- Task 4 consisted of advancing ten borings in the portion of the lowland area near the slag pile. The objective of this task was to define the vertical and lateral extent of the slag.
- Task 5 consisted of collecting soil samples beneath the SR-529 overpass to establish whether smelter debris was used as fill during construction.
- Task 6 consisted of aquifer testing. Slug tests were conducted to provide additional data on the hydraulic characteristics of the two aquifers in the lowland area for evaluating water balance and physical transport.

2.2.1 Soil and Groundwater Quality (Tasks 1 and 2)

The general hydrostratigraphic framework was defined in the RI/FS. The supplemental investigation confirmed that three units are present in the lowland area including the shallow groundwater system (fill), a confining layer (silt), and a deep groundwater system (alluvium).

The shallow fill system consisted of approximately 10 feet of fill material. Groundwater was generally within one to two feet of the ground surface. It was also noted that the fill near the bluff consisted of slag.

The confining silt layer was identified over most of the lowland area. It generally ranged in thickness from five to ten feet. In locations where the confining layer was absent, it was replaced by alluvial channel deposits. In addition, the confining layer was absent adjacent to the bluff , near the Snohomish River shoreline, and in the vicinity of the railroad tracks.

The alluvial sands comprising the deep groundwater system were encountered at a depth of approximately 20 feet. This unit corresponded with the deep sand identified in earlier investigations performed by Asarco and Weyerhaeuser.

Soil results indicated that arsenic was detected with concentrations above the MTCA cleanup level of 200 mg/kg west of the railroad tracks. The results indicated the highest arsenic concentration detected was 3,645 mg/kg. However, the results were highly variable which reflected the lateral heterogeneity of fill. It was estimated that approximately 73,000 cubic yards of soils with arsenic concentrations above 200 mg/kg exist. Only a few surface samples had arsenic concentrations above 100 mg/kg east of the railroad tracks. In addition, the southern extent of arsenic in soils west of the railroad track was not defined.

Groundwater results from hydropunch locations and monitoring wells indicated that arsenic plumes were present in the shallow and deep aquifers. The shallow and deep aquifers showed dissolved arsenic concentrations up to 3 mg/L and 15 mg/L respectively. The arsenic concentrations also showed significant attenuation as the groundwater flows to the east. It was noted that the southern extent of arsenic in groundwater west of the railroad tracks was not defined. In addition, the report explained that elevated arsenic concentrations at Weyerhaeuser's former Mill E Site were not associated with the smelter but rather were associated with a former wood treating facility at that location.

The arsenic concentrations in soil did not identify source materials with sufficient arsenic concentrations to account for measured arsenic concentrations in groundwater. However, the ephemeral discharges of shallow groundwater in the upland area to the lowland area was discussed as a potential source.

Tidal evaluations indicated that hydraulic gradients in the deeper aquifer were tidally influenced. Near the Snohomish River, water levels fluctuated approximately six feet. Consistent with the RI/FS, tidal sampling indicated that the shallow aquifer had minimal water level fluctuations of about 0.1 feet.

2.2.2 Upland Area Shallow Groundwater (Task 3)

The supplemental investigation evaluated the fill/shallow till groundwater system in the upland area. Two test pits were excavated along the west side of East Marine View Drive within the smelter footprint perimeter. No groundwater was encountered in one of the test pits and a small flow of groundwater was encountered in the other (approximately 0.1 gpm), with a measured total arsenic concentration of 58 mg/L.

Five shallow monitoring wells were installed on the west side of East Marine View Drive in the fall of 1996. The wells remained dry after initial purging. In early spring of 1997, measurable water was identified in wells EV-11 and EV-13 for only two months. One round of samples was collected and total arsenic concentrations of 41 and 25 mg/L were measured, respectively.

2.2.3 Slag Borings (Task 4)

Ten soil borings were advanced in the slag pile to further define the vertical and lateral extent of slag. Slag was identified at depths to 15 feet below ground surface. It was estimated that approximately 54,000 cubic yards of slag are present.

Two types of slag were identified with most being coarse-grained, gravel sized material. Along the southern boundary of the original slag pile, a fine-grained granular slag was encountered. The fine-grained slag is believed to be a by-product of the rock wool plant. The granular slag had the highest arsenic concentrations, up to 2,207 mg/kg. Elevated levels of lead were also measured in the granular slag. The highest observed concentration was 24,230 mg/kg. However, based on TCLP and SPLP leaching results, it did not appear that slag was the source of elevated arsenic concentrations in the groundwater (3 to 15 mg/L).

2.2.4 SR-529 Overpass (Task 5)

Several grab soil samples were collected beneath the SR-529 overpass to conduct a reconnaissance level survey of fill materials used during construction. Samples were collected from beneath the northbound and southbound lanes from a depth of 0 to 6 inches.

There was no visible evidence of smelter debris beneath the northbound lane. Brick and wood fragments, typical of smelter debris, were found embedded in the silty sand fill beneath the southbound lane. Arsenic concentrations in samples collected below the northbound lane were all below 20 mg/kg. While all measured concentrations for the southbound lane were above 20 mg/kg, only one was above 200 mg/kg having an arsenic concentration of 1,700 mg/kg.

2.2.5 Aquifer Testing, Water Balance, and Mass Loading (Task 6)

Additional aquifer tests (slug tests) were conducted during the supplemental remedial investigation to further characterize the hydrostratigraphic units. Five monitoring wells were tested in the shallow aquifer and results were consistent for sandy aquifers. Four shallow wells in the slag pile were tested and results indicated that the permeability varied substantially depending on the texture of the slag. However, all slag was highly permeable. Eight wells were tested in the deep system. Results were again consistent for sandy aquifers.

Along with the hydraulic gradients, hydraulic conductivity results were used to derive estimates of the average rate of groundwater flow. The average groundwater velocity was estimated at 0.5 to one ft/day. The vertical rate of flow through the silt layer was estimated at 0.002 ft/day.

In addition, a water balance was developed for the lowland area per Ecology's direction. The water balance was conducted to identify the major flow components and quantify water "inputs" and "outputs". Combined with water quality results, potential arsenic loads to groundwater were estimated.

Water balance results for the shallow aquifer west of the railroad tracks indicated that flow (2 gpm) was largely generated by direct precipitation recharge. The ion analyses supported the water balance by showing similarity in common ion signatures between surface water samples collected from the drainage ditch and shallow groundwater samples. The arsenic mass balance showed more arsenic entering the slag pile (26 lbs./year) than can be accounted for by outputs (13 lbs./year). This may indicate that a modest rate of seepage from the shallow groundwater in the upland area is contributing to the observed arsenic concentrations in the shallow groundwater near the slag pile.

Water balance results for the shallow aquifer east of the railroad tracks indicated a flow of approximately 1.1 gpm/100 foot width. There was also a large mass discrepancy in arsenic as groundwater passes from the slag pile to the east (input of 11 lbs./year, output of 0.1 lbs./year). Available data suggested that low permeabilities in the railroad track vicinity may limit groundwater drainage to the east.

Water balance results for the deep aquifer indicated that groundwater flow through the arsenic plume is about 1 to 1.5 gpm/100 foot width. Most of the flow was attributed to discharge from the upland deep groundwater system, but the upland shallow system was inferred to be the primary source of arsenic. The arsenic mass balance (input of 11.4 lbs./year, output of 66 lbs./year) indicated a significant discrepancy. It was suggested that the discrepancy could be accounted for by a localized source in the upland area.

2.2.6 Fate and Transport of Arsenic in Groundwater

The shallow and deep groundwater aquifers in the lowland area discharge to the Snohomish River. However, it was noted that the actual potential for arsenic to reach the Snohomish River depends on both physical and geochemical processes. Geochemical mobility is commonly affected by adsorption and coprecipitation. It was noted that the geochemical process was responsible for observed attenuation.

Arsenic concentrations in groundwater near the Snohomish River shoreline were 0.026 to 0.05 mg/L in the shallow aquifer and 0.038 mg/L in the deep aquifer. Given minimal attenuation or tidal dilution, these waters would likely meet the marine chronic criteria for arsenic of 0.036 mg/L.

The highest arsenic concentrations near the Snohomish River were detected in the deep aquifer about 600 to 700 feet from the shoreline (0.1 to 2.6 mg/L). It was noted that if the present deep groundwater plume configuration is assumed to represent a gradual advance of arsenic concentrations since operation of the smelter, the calculated rate of plume advancement would be approximately 0.04 ft/day. At this rate, it would take approximately 40 more years before the plume reaches the Snohomish River. It was also noted that it is possible that the plume is already stable or attenuating.

2.2.7 Storm Water Evaluation

In addition to the six identified tasks, storm water runoff potential from the upland to the lowland was briefly evaluated. A site walkthrough was conducted and catch basins in the upland area and outfalls along with the ditch system in the lowland area were documented.

It was determined that very little storm water runoff occurred from the upland area to the lowland area. Based on area calculations, the average annual runoff from the SR-529 overpass in the upland area to the lowland area was estimated at 10 gpm.

2.3 SMELTER AREA INVESTIGATION

The smelter area investigation was conducted in 1998 (Asarco, 1998b). The purpose of the investigation was to identify the nature and extent of different waste categories or any other material that may be a source of elevated arsenic for surface and groundwater in and adjacent to the former smelter footprint. The practical goal was to identify and characterize the location of residual smelter materials within and immediately adjacent to the former smelter property, focusing primarily on the current fenced area.

The smelter area investigation entailed collection of soil samples from 60 locations to depths up to 39 feet. Test pits were used in the smelter footprint to assist in the evaluation of smelter structural remnants and residual materials. The principal findings from the investigation that may be pertinent to the lowland area characterization are:

- Smelter materials of primary interest were residuals of arsenic trioxide (containing arsenic concentrations in the hundreds of thousands up to 760,000 mg/kg) and flue dust (containing arsenic concentrations in the thousands up to 25,000 mg/kg). This material was located mostly within the top four feet in the fenced area east of Pilchuck Path.
- Soil borings drilled in fill beneath the SR-529 overpass indicated that the fill had small amounts of smelter material. Arsenic concentrations were significantly lower than those detected in the fenced area.

- SPLP results demonstrated that smelter materials containing residual arsenic trioxide or flue dust can act as sources of arsenic to groundwater under ambient leaching conditions.
- Soil borings of unweathered glacial till found that till extended further east than previously identified.

The former smelter footprint was segregated into several investigative subareas based on past smelter operations and subsequent land use. The subareas were as follows:

- The former roasting operations area.
- The former blast furnace/lead refining area.
- The former arsenic processing area.
- The general area of the former stacks.
- The former northern smelter area.
- The SR 529 overpass area.

Based on the history and knowledge of past operations and on the potential relationship with the lowland area, findings from the following subareas were identified below as containing relevant information:

- The southern end of the former roasting operations area (north end of the fenced area).
- The former blast furnace/lead refining area (northeast corner of the fenced area and across East Marine View Drive to the bluff).
- The former arsenic processing area (portion of fenced area between Pilchuck Path and East Marine View Drive from 5th Street to the south boundary.
- The SR-529 overpass area.

The findings are discussed in the following subsections.

2.3.1 Former Roasting Operations Area

The northern end of the fenced area contains a portion of the former roasting operations area. The foundations and floors of smelter flues and other structures were found intact in the subsurface. Sampling results indicated that flue dust and debris were present at depths of one to four feet. Arsenic concentrations were detected up to 28,500 mg/kg. In addition, results showed that arsenic has migrated from the smelter material to the underlying soil. However, arsenic concentrations attenuated rapidly.

2.3.2 Former Blast Furnace/Lead Refining Area

Sample results indicated that the largest portion of the former blast furnace/lead refining area, portion north of the fenced area along East Marine View Drive including the cloverleafs, did not contain significant amounts of residual smelter material. Only a few pockets containing small amounts of residual smelter materials were identified. This is consistent with the overall finding that the soils and smelter materials were removed from the cloverleaf area during the construction of the interchange in 1956. Historical information indicated this removed material was likely used as fill for the Weyerhaeuser access road and SR-529 overpass.

A small portion of the former blast furnace/lead refining area is located within the fenced area (northeast corner). Residual flue dust was identified in the footprint of a former flue structure. Arsenic concentrations were detected at 12,000 mg/kg.

2.3.3 Former Arsenic Processing Area

The location of the former arsenic processing area is within the current fenced area from Pilchuck Path (west boundary) and 5th Street (north boundary). The former processing operation produced relatively pure arsenic trioxide using roasting operations flue dust as the primary feed material.

Sampling results indicated that residual arsenic trioxide (up to 760,000 mg/kg arsenic) mixed with demolition debris was present to a depth of 3.5 feet in the western portion and to a depth of two feet in the eastern portion of the former arsenic kitchen. In addition, arsenic trioxide is present near the former arsenic storage bin. Flue dust (up to 25,000 mg/kg arsenic) was identified at other portions of the former arsenic processing area. All these sample locations representing the former arsenic kitchen and storage bin are within the fenced area.

Several borings were advanced south of the fenced area. Results showed no evidence of demolition debris or residual smelter material.

2.3.4 SR-529 Overpass

Historical and documenting photographic evidence indicate that in 1956 significant cut and fill activities occurred as part of the construction of the SR-529 overpass. Material appears to have been removed from the area of the former roasting operations area and used as fill beneath the southbound lane of SR-529 and around and beneath the Weyerhaeuser access road.

Sample results indicated no evidence of the presence of significant quantities of residual flue dust or other high-lead or arsenic materials. Arsenic and lead concentrations were elevated (up to 389 and 7,186 mg/kg respectively), but were much lower than levels measured in debris in the fenced area. In addition, the arsenic concentrations did not show a constant trend with depth, indicating that any smelter materials were well mixed with soil during cut and fill activities.

2.3.5 SPLP Results

Several samples were tested by SPLP which is designed to simulate leaching from materials in the environment when exposed to rainfall. In contrast, TCLP uses a strong acid for leaching materials to simulate leaching in a mixed-waste municipal landfill environment.

Results demonstrated that residual smelter materials containing arsenic trioxide or flue dust can act as sources of arsenic to groundwater and surface water. Flue dust and/or arsenic trioxide material with total arsenic concentrations ranging from 4,699 mg/kg to 12,487 mg/kg resulted in SPLP concentrations ranging from 7 mg/L to 27 mg/L. Therefore, these materials which were identified within the fenced area and in the adjacent East Marine View Drive right-of-way may be a source of elevated arsenic concentrations in groundwater and surface water. It was also noted that the source characteristics of the smelter residuals are dependent on several factors including arsenic concentrations, material volume, local infiltration rates, and subsurface transport pathways.

2.3.6 Extent of Unweathered Glacial Till

This investigation identified the unweathered glacial till as a significant barrier to vertical migration of arsenic. In addition, the till was identified as being present throughout and adjacent to the former smelter area and its presence likely promotes the lateral flow of ephemeral perched water, if any, in the upper portion of the till toward the east. The till outcrops along the slope near the east side of East Marine View Drive.

2.4 STORM WATER AND STORM DRAIN SEDIMENT CHARACTERIZATION INVESTIGATION

The storm water and storm drain sediment characterization investigation was initiated in May 1998 (Asarco, 1998c). The purpose of the investigation was to characterize and implement best management practices (BMPs) designed to eliminate, or substantially reduce, the discharge of storm water from the Site that exceeds the appropriate regulatory limits.

Specific objectives of the investigation were to:

- identify primary flow paths,
- characterize storm water quality,
- estimate storm water volumes, and
- develop a water balance and contaminant loading estimate.

2.4.1 Storm Water Flow Paths

During the first quarter that the investigation commenced (April through June 1998), Asarco met with Ecology, the City, and Weyerhaeuser to discuss flow paths near the SR-529 overpass and in the lowland area. During this walk through, the main locations of interest were identified for upcoming sampling events.

Sediment that had accumulated in the catch basins and storm drain lines in the investigation area were removed and nine catch basins were flushed near the SR-529 and East Marine View Drive interchange. Results indicated that the majority of the intersection catch basins discharge to an outfall in the lowland area. It was noted that while flushing two catch basins in the area, the water did not drain or it came up in nearby catch basins. Therefore, the discharge location for these catch basins could not be verified.

The City explained that catch basins located west and south of the interchange are connected to the City's combined storm water / sanitary sewer system. Flushing a short distance to the north indicated that the catch basins were connected to the lowland area outfall. During a subsequent conversation with the City, personnel explained that a significant portion of East Marine View Drive to the north was connected to the lowland area outfall during the course of the East Marine View Drive widening project performed in 1998. This section of storm drain line also serves as a french drain system.

In the lowland area, a site walk through was also conducted with Ecology, the City, and Weyerhaeuser to evaluate the drainage ditch system. Weyerhaeuser explained that they recently made improvements to the system which provided a connection of the wet areas west of the railroad tracks to an outfall located at the Snohomish River.

2.4.2 Storm Water Quality

Characterization of storm water quality consisted of the following sampling events:

- two rounds of first flush grab sampling at several catch basins,
- reconnaissance grab sampling from 30 locations,

- two rounds of grab sampling at over 20 locations, and
- composite sampling with an autosampler from four sites for about one month.

First flush grab sampling was conducted to determine if storm water runoff at outlying residential sections in the upland area have elevated concentrations of arsenic (several blocks away from the fenced area). Results indicated that there was no evidence of storm water quality concerns in the outlying residential areas.

Reconnaissance grab sampling was performed to further define run-on and run-off patterns and to evaluate storm water quality in the vicinity of potential source areas. Data collected was used to refine the storm water quantity and quality characterization work (two rounds of grab sampling and composite sampling at instrumented sites). Reconnaissance sampling found that typical storm events consisted of a series of intermittent precipitation events over a period of several days. Data showed that individual precipitation events were relatively short without significant periods of sustained precipitation. Laboratory results indicated that only two surface run-off samples in the upland area (northeast corner of the fenced area) and two manholes downgradient (south) of the fenced area exceed the City's sewer discharge limit of 0.5 mg/L for arsenic. The highest arsenic concentration detected in the lowland area was 0.63 mg/L. The sample location was at the very north end of the drainage ditch adjacent to the bluff at the beginning of the wet area. Lastly, reconnaissance sampling indicated seeps were forming on the northern boundary of the fenced area.

Using the reconnaissance sampling results, two complete rounds of grab sampling were conducted at over 20 locations in the upland and lowland areas. Laboratory results indicated that the two rounds of grab sampling was consistent with previous investigations. For locations in the upland area connected to the City's combined system, only surface run-off samples directly northeast and east of the fenced area and manholes south and southeast of the fenced area exceeded the City's sewer discharge limit of 0.5 mg/L for arsenic. The highest arsenic concentration detected was 39 mg/L in a manhole immediately south of the fenced area in the alley. Results for the lowland area indicated that arsenic concentrations were above the laboratory method detection limit for most locations with arsenic concentrations decreasing toward the Snohomish River. In regard to the seeps, it was noted that it seemed likely that they were associated with shallow seasonal groundwater discharge resulting from high rainfall and possibly enhanced by current or former utility trenches serving as more conductive flow paths.

Autosamplers were installed at four locations to collect continuous composite samples (each sample had water collected every 15 minutes for 1.5 hours). Composite samples were collected for approximately four weeks. Laboratory results of numerous samples submitted for analyses were generally consistent with prior grab sampling events.

2.4.3 Storm Water Volumes

Storm water discharge rates were estimated during the two rounds of grab sampling. In addition, more detailed flow monitoring was conducted at the same four sites that had autosamplers using continuous flow monitoring equipment over a period of about four weeks. Of particular interest, results indicated that there was baseflow at an instrumented manhole located southeast of the fenced area at the East Marine View Drive and Butler Street intersection. Although a baseflow was expected due to sewer effluent, baseflow conditions appeared to be extended following precipitation events. Therefore it was noted that there may be a component of groundwater inflow from the fenced area to the City's system along Butler Street following wet periods. Also, results from the manhole upgradient from the City's outfall in the lowland area indicated that a larger volume of storm water was coming from East Marine View Drive than from the intersection. It was noted that this may be due to the french drain system along East Marine View Drive to the north.

2.4.4 Water Balance and Contaminant Loading

The final objective of the investigation was to develop a water balance and estimate the contaminant loading for the principal drainage areas. It was noted that due to the complexity of the lowland area, it would be best if this work would be completed when all groundwater data was available. In addition, a third round of surface water grab sampling at lowland area locations was conducted during the dry season to further assist in the evaluation. This evaluation is presented in Section 5.2.

3.0 INVESTIGATION METHODS FOR ADDITIONAL CHARACTERIZATION AND MONITORING

Field work for the additional characterization and monitoring investigation commenced in the fall of 1998 and was completed in the summer of 1999. Generally, the investigation was performed as specified in the work plan (Asarco, 1998a), with several minor adjustments made in consultation with Ecology. These adjustments include the final placement of several groundwater monitoring wells, advancement of several additional hydropunch locations, and deletion of the CLP documentation requirement during analyses. Also, the proposed schedule in the work plan was adjusted due to difficulty in obtaining an access agreement.

While conducting field work activities, BMPs were employed to minimize potential impacts of the investigation on groundwater and surface water quality. These practices were consistent with those proposed in the Demolition Work Plan (Asarco, 1997) and the Storm Water and Storm Drain Sediment Characterization and Control Work Plan (Asarco, 1998c).

The following subsections describe the investigative methods utilized for each specific task.

3.1 SOIL SAMPLING IN THE BLUFF AREA

Sample locations were placed along four transects (1-4) in the bluff area going from south to north. Each transect had a sample collected from the top (T), middle (M), and bottom (B) to depths of two to three feet below the surface. Sample locations are shown on Figure 3-1 (bluff soil samples).

Blackberry brambles were cut back and samples were collected in one foot intervals using a hand auger. In all locations except for one, conditions did not allow sample collection below a depth of two feet. In one location, samples were collected to three feet. A total of 21 samples and two field duplicates were collected. The hand auger was decontaminated with wash and rinsate water between sample intervals and borings. Table 3-1 summarizes the soil samples collected.

3.2 SOIL BORING SAMPLING

Soil samples were collected from seven soil borings (LB-11 to LB-15 and LB-19 to LB-20) advanced to characterize the southern extent of elevated arsenic and metals. In addition, soil samples were collected from four hydropunch borings (HP-45 to HP-48) and 12 monitoring well borings (EV-15B, EV-16A, EV-17B, EV-18B, EV-20B, EV-21A, EV-21B, EV-22A, EV-22B, EV-23B, MW-107D, and MW-109D). Boring locations are depicted in Figure 3-1. A total of 128 samples and 14 duplicates were collected. Mr. Boyd Benson also collected soil samples from his property in the lowland area. Twenty-one samples and two field duplicates were collected from three soil borings (LB-21 to LB-23). It is Asarco's understanding that Mr. Benson has submitted analytical results associated with these samples to Ecology.

Soil samples were collected from soil, hydropunch, and monitoring well borings in the same manner using a hollow stem auger drill. Soil and shallow monitoring well borings were advanced to depths of 11.5 to 16 feet. Borings associated with deep hydropunch and monitoring wells were advanced to depths of 21.5 to 55 feet.

Generally, samples were collected from intervals including 0-0.5, 2-3.5, 5-6.5, 10-11.5, 15-16.5, and 20-21.5 feet using a standard 18-inch x 1 3/8-inch diameter split spoon. The split spoon sampler was driven with a 140 pound hammer. The split spoon sampler was decontaminated with wash and rinsate water between sample intervals and borings while the augers were decontaminated with wash and rinsate water between borings.

In certain instances, additional samples were collected if the borehole was deeper than 21.5 feet (e.g., EV-18B). In other instances, not all intervals were sampled if there was existing nearby data (e.g., EV-19B). Also, only soil samples below 11.5 feet were collected from deep borings if samples to a depth of 11.5 feet were collected from a paired shallow boring. Otherwise, the shallow boring was not sampled and all the samples were collected from the deep boring. Table 3-1 summarizes the soil samples collected from soil, hydropunch, and monitoring well borings.

Standard penetration data were collected from each sample interval. A hydrologist or geologist from Hydrometrics was present to record this data along with geologic data and sampling information in field logs at the time of drilling. Compiled logs are presented in Appendix A.

Upon completion of sample collection, each soil and hydropunch boring was plugged and abandoned with bentonite chips from the bottom of the borehole up to ground surface.

3.3 SOIL SAMPLE ANALYSIS

The 165 soil samples collected from the bluff and borings including field duplicates were analyzed for total arsenic, cadmium, chromium, copper, lead, and zinc by X-Ray Fluorescence (XRF) spectrometry. The samples were sent under chain-of-custody to Hydrometrics' laboratory located in Ruston, Washington.

Upon completion of XRF analyses, selected samples were sent to Asarco's Technical Services Center laboratory located in Salt Lake City, Utah for wet chemistry analyses to confirm the XRF accuracy. The work plan called for a frequency of at least one in 50. A total of six samples were analyzed using EPA Method 6010. The work plan indicated that analyses performed at the Asarco laboratory would be done using CLP protocol which consists of more detailed documentation. Because the use of CLP protocol does not effect the results and may significantly delay data submittal, Ecology agreed to drop the CLP requirement.

Laboratory results are discussed in Section 4.2. The validation report containing soil sample results from the bluff and borings is included as Appendix B.

3.4 FILL/SLAG SAMPLE COLLECTION AND LEACH TESTS

Two fill/slag samples were collected from each of three borings (LB-16 to LB-18) in the slag pile (see Figure 3-2) to further evaluate the effect of higher pH on arsenic leachabilitiy and subsequently, the potential effect on the shallow groundwater system. Each boring had a sample collected from two depth intervals including the 0-2 foot and 5-7 foot intervals, totaling six samples. The samples were collected using a hollow stem auger and split spoon sampler as described previously in Section 3.2. Upon completion of sample collection, each boring was plugged and abandoned with bentonite chips from the bottom of the borehole up to ground surface.

Samples were sent to Asarco's Technical Services Center laboratory located in Salt Lake City, Utah under chain-of-custody and initially analyzed for total arsenic using method 6010. The samples were then analyzed using four modified SPLP tests (method 150.1). The first SPLP test substituted the dilute acid leach with deionized water. The remaining three tests substituted the dilute acid leach with a carbonate-buffered alkaline water leach with pH ranges of 7, 9, and 11 respectively. In addition to the six samples collected, one sample was crushed and tested by all four SPLP modified procedures. As discussed previously in Section 3.3, CLP procedures were not employed for these analyses.

The validation report containing all fill/slag results is included as Appendix B. Laboratory results are discussed in Section 5.1.1.1.

3.5 GROUNDWATER FLOW PATH MAPPING

Prior to installing groundwater monitoring wells, Hydro Geosciences, Inc. (HGI) of Salt Lake City, Utah was retained to implement their patented geophysical technology, AquaTrack. The main purpose of this effort was to identify potential groundwater flow paths (channels) from the upland area to the lowland area; specifically, to the arsenic plume in the deep groundwater aquifer.

AquaTrack consists of direct energization of groundwater by injecting electricity through a primary electrode so the electrons become tracers. A circuit is then constructed by connecting a return electrode to the primary electrode. Because water is a good conductor, electrons will follow water and its flow path(s).

A moving electron, current, generates a magnetic field that can be measured. The magnetic field produced by the completion of the electrical circuit allows mapping of the location, depth and shape of potential groundwater flow paths and any other good conductor such as utility pipes and ore bodies. A limitation of AquaTrack is that it often cannot differentiate between strong conductors such as groundwater flow, utility lines, water line leaks, and ore bodies. It can however distinguish other conductors that generate weaker magnetic fields.

To implement the AquaTrack technology, HGI established an electrical circuit by placing a primary electrode (two feet of ¼ inch copper pipe) into monitoring well EV-8B in the lowland area. This electrode was energized with a gas generator. A copper wire, transmitter coil, was laid out under the Weyerhaeuser bridges and the SR-529 overpass to get across East Marine View Drive. It was then attached to the security fence between Hawthorne Street and Pilchuck Path in the upland area to complete a circuit. This completed circuit allowed mapping of magnetic fields between the upland and lowland areas.

Several survey lines were established to take readings from EV-8B in the lowland area to Pilchuck Path in the upland area. Generally, survey lines ran parallel with East Marine View Drive. Readings, magnetic field magnitude and direction, were usually taken every 25 feet. Occasionally, readings were taken every 12.5 feet to better define a channel.

Readings were then used to profile each survey line horizontally which in turn maps observed channels of current flow. Channels were identified by connecting similar anomalies based on the size and shape of the curves from one profile to the next. These channels are potential groundwater flow paths. Results of the survey as well as a more detailed description of the technology is presented in the AquaTrack Survey Report by HGI in Appendix C.

The primary channels identified by AquaTrack are depicted in Figure 3-3. Two test pits were excavated near two of the channels (second and third channel from the north) to see if visible evidence of potential groundwater paths exist. The test pits were located within the fenced area as close to East Marine View Drive as possible. The first and fourth channel did not present an accessible area near East Marine View Drive that would allow excavation of test pits. A copper water line was discovered in the test pit associated with the second channel from the north which extended into East Marine View Drive. No evidence of a potential groundwater path or utility was identified in the other test pit associated with the third channel from the north. The channels with the strongest magnetic fields and/or with visible evidence of potential flow paths identified by test pits were used to assist placement of several groundwater monitoring wells as discussed in Section 3.7. This includes the first and second channels from the north.

3.6 HYROPUNCH GROUNDWATER SAMPLING

Initially, four hydropunch locations (HP-45 to HP-48) were advanced to assist in delineation of the northern boundary of elevated arsenic in groundwater in accordance with the work plan. All four locations except for HP-45 had samples collected from the shallow and deep groundwater systems. Location HP-45 only had a sample collected from the deep aquifer.

Later in the investigation, summer of 1999, 13 additional shallow hydropunch locations (HP-50 to HP-59 and HP-61 to HP-63) were advanced and groundwater sampled to fill in groundwater data gaps. Two locations, HP-50 and HP-58, were dry and therefore, 11 samples were collected. In addition to collecting shallow groundwater samples, the 11 additional locations were surveyed and water levels obtained to assist in the evaluation of shallow groundwater and surface water interactions (see Section 4.5). The hydropunch locations are shown on Figure 3-4.

Groundwater samples were collected once the boreholes were advanced to the desired termination depth. The hydropunch was then driven into the aquifer and the outer casing pulled back to expose a 0.02 inch slot sampling screen. Prior to sample collection, approximately three to five gallons of water was purged using a peristaltic pump. Collected purge water was containerized in 55 gallon drums, which are currently stored in the fenced area.

Specific conductivity, temperature, pH, dissolved oxygen, and turbidity were also measured in the field at the time of sample collection using a Horiba U-10 Water Quality Checker. Shallow groundwater samples were collected from 14 of the 17 hydropunch locations. Deep groundwater samples were collected from four hydropunch locations. Samples designated for dissolved analyses were filtered and all samples were preserved with nitric acid and chilled.

3.7 MONITORING WELL INSTALLATION AND SAMPLING

Monitoring wells were installed to confirm previous hydropunch data and establish a network for future long-term groundwater monitoring. Six shallow monitoring wells and ten deep monitoring wells were installed. Four of the 16 new monitoring wells, including EV-17A, EV-17B, EV-18B, and EV-20B, were located based on results of the AquaTrack survey as discussed in Section 3.5. Several of these well locations and types were adjusted from the work plan with Ecology's approval. Wells EV-20B and EV-18B were placed by the first and second channel from the north, respectively. Wells EV-17A and EV-17B were placed at the base of the bluff where the two channels intersect. Well EV-19B was placed as close to the water line tee as possible.

Monitoring wells were installed using a hollow stem auger drill rig. The wells were completed using 2-inch NSF-approved schedule 40 flush-threaded PVC pipe according to State of Washington specifications. Machine-slotted casing was placed opposite the interval of interest, sand-packed, and sealed with bentonite pellets and grout. Screen slot size was 0.01 to 0.02 inches and the sand pack was 10-20 grade silica sand. In addition, due to heaving sands, several wells used a manufactured prepacked well screen. Protective covers were also installed with locks. Either a flush-mount cover or stick-up cover was used based on the property owner's preference.

Following completion, the wells were developed using a bailer and submersible pump to remove fines and ensure good hydraulic connection with the aquifer. Removed water was containerized in 55-gallon drums. Upon development of the 16 new wells, they and 32 previously existing wells were sampled in March 1999 and again in June 1999. The locations of the 48 monitoring wells are shown in Figure 3-5.

Prior to sample collection, each well had the water level measured as described in Section 3.11 and then was purged with a portable peristaltic pump at a rate less than 0.25 gpm. Collected purge water was containerized in 55 gallon drums, which are currently stored in the fenced area. Specific conductivity, temperature, pH, dissolved oxygen, and turbidity were also measured in the field using a Horiba U-10 Water Quality Checker. When these measurements stabilized, they were recorded in the log book and a groundwater sample was collected. Samples designated for dissolved analyses were filtered and all samples were preserved with nitric acid and chilled.

The network of wells changed slightly from the work plan. As discussed previously, based on the AquaTrack survey, the type and number of monitoring wells along the east side of East Marine View Drive were adjusted with Ecology's approval. Specifically, instead of two shallow and deep paired wells, three deep wells were installed (EV-18B, EV-19B, and EV-20B). In addition, proposed well numbers have been changed slightly from the work plan. Also, well number MW-106D(W) listed in the work plan should have been identified as MW-108D(W) and MW-107S(W) should have been MW-107S2(W). Lastly, the following wells listed in the work plan were abandoned by Weyerhaeuser before the first round of sampling commenced in March 1999: MW-3(W), P-6(W), and MW-106S2(W).

Recently, it was brought to Asarco's and Ecology's attention that Weyerhaeuser intends on abandoning MW-5(W), MW-7(W), and MW-8(W) this fall. It is Asarco's belief that these wells will not be needed for any future long-term groundwater monitoring and based on a telephone conversation with Ecology, it is Asarco's understanding that Ecology concurs. Therefore, Asarco did not request Weyerhaeuser to leave the three wells in place.

3.8 GROUNDWATER ANALYSIS

Groundwater samples were analyzed for the parameters listed in Table 3-2. One sample (HP-45) was analyzed by Sound Analytical located in Fife, Washington because an immediate turn-around was desirable. The remaining samples were sent to Asarco's Technical Services Center laboratory located in Salt Lake City, Utah.

A total of 45 samples were analyzed from monitoring wells in the first round (March 1999). Note that three shallow monitoring wells (EV-10, EV-12, and EV-13) were dry. A validation report for the first round of monitoring well sampling is included as Appendix D. The report also contains results of seven samples collected from the initial four hydropunch locations as well as eight field duplicates, eight DI blanks, seven rinsate blanks, and one blind standard collected from October 1998 to March 1999.

Appendix D also contains a validation report for the second round of monitoring well sampling and additional hydropunch and surface water sampling (June 1999). A total of 43 samples were collected from monitoring wells. Note that five shallow monitoring wells (EV-10, EV-11, EV-12, EV-13, and MW-103S(W)) were dry. The report also contains results for the 11 additional shallow hydropunch samples that were analyzed as well as three field duplicates, six DI blanks, six rinsate blanks, and one blind standard collected in June 1999.

As with soil analyses, the work plan indicated that analyses performed at the Asarco laboratory would be done using CLP protocol which consists of more detailed documentation. Because the use of CLP protocol does not effect the results and may significantly delay data submittal, Ecology agreed to drop the CLP requirement.

Laboratory results for groundwater sampling are discussed in Section 4.3.4.

3.9 AQUIFER TESTING

Slug tests were performed on monitoring wells EV-15A, EV-15B, and EV-16A to evaluate aquifer permeability. The results will be used to establish hydraulic conductivities and evaluate groundwater flux at the southern boundary of the lowland area.

The slug test was performed once the well was developed (i.e., water purged). Water level fluctuations were digitally recorded during slug testing using an in-situ datalogger and pressure transducer. The transducer was suspended above the bottom of the well and the datalogger was started prior to slug testing. During testing, the water level recovery was recorded with the datalogger at logarithmic time intervals. The transducer, slug, and rope were washed thoroughly between sites.

Test results from the shallow aquifer (EV-15A and EV-16A) were analyzed according to slug test methodology developed by Bouwer and Rice (1976). Slug tests from the deep aquifer (EV-15B) were analyzed using both Bouwer and Rice, and Cooper et al. (1967) methods. The slug test data were analyzed using AQTESOLV, a computer program developed by Geraghty and Miller, which allows the user to analyze time-drawdown graphically based on curve matching techniques.

Slug test results are discussed further in Section 4.3.2.

3.10 SUPPLEMENTAL SURFACE WATER SAMPLING AND ANALYSIS

Additional surface water sampling in the lowland area was conducted during the second round of groundwater sampling (June 1999). This supplemental sampling was performed to gather data from the dry period to further assist in evaluating the groundwater / surface water relationship. Nine sites were sampled and are shown on Figure 3-6.

The samples were all grabs and collected with a bottle. The samples collected in June 1999 were sent to Asarco's Technical Services Center laboratory located in Salt Lake City, Utah and analyzed for the same parameters as groundwater (see Table 3-2). Another sample from

SW-18 was collected in August 1999 to further evaluate the dry period versus the wet winter period. This sample was analyzed by CCI Laboratories located in Everett, Washington for total and dissolved arsenic, cadmium, and lead. Samples designated for dissolved analyses were filtered and all samples were preserved with nitric acid and chilled.

The laboratory results are included in the validation report in Appendix E. Laboratory results are discussed in Section 4.4.

3.11 WATER LEVEL MEASUREMENTS

Prior to collecting water levels, all groundwater monitoring wells and surface water monitoring points were surveyed to a common datum. Water levels were collected from the network of monitoring wells (see Figure 3-5) on four occasions. Two of the four measuring episodes occurred during sample collection in March and June, 1999. Water levels were also collected from surface water sampling locations (see Figure 3-6) on three occasions including once in June 1999 during groundwater sampling. Lastly, water levels were also obtained from the 13 additional shallow hydropunch locations advanced in June 1999 (HP-50 to HP-62) during the second round of groundwater sampling.

Water levels were collected using an electric probe, a Solinst, attached to a direct reading tape. For groundwater including all monitoring wells and certain hydropunch locations, levels were obtained by lowering the probe down the well until contact was made between the probe tip and the water surface. Upon contact with water, a buzzer was sounded and the water level was then measured to the nearest 0.01 foot from the top of the casing. For surface water locations, the tape was simply used to obtain the level from the respective measuring point. The probe and tape were decontaminated between sites.

Collected water levels are shown in Table 3-3 along with the surveyed elevations. Water levels and respective elevations are discussed in Sections 4.3 and 4.5.

4.0 INTEGRATED RESULTS FROM SEVERAL INVESTIGATIONS

This section combines relevant results from previous investigations that are pertinent to characterization of the lowland area with the results of the recently performed additional lowland area characterization and monitoring investigation. The principal findings of soil, groundwater, and surface water conditions, as well as the nature of groundwater / surface water interactions are described below.

4.1 SITE GEOLOGY

As previously described, Ecology has segregated the Site into two investigative areas, the upland and the lowland areas. The geology in the upland area consists primarily of dense, fine-grained glacial till overlying coarser grained glacial outwash deposits. In contrast, the lowland area contains fill, estuarine deposits, and alluvial sand and gravel associated with the Snohomish River. Generalized geologic cross sections of the Site are shown in two figures, Figure 4-1 and Figure 4-2.

4.1.1 Upland Area

The regional geologic setting has been described by the USGS (Maps MF-1748 and MF-1743, Minard, 1985a,b). Late Pleistocene glacial deposition formed the upland area in northern Everett 20,000 to 13,000 years ago. The geology of the upland area consists of glacial till, underlain by advance outwash sediments. The advance outwash is a thick section of pebbly sand, deposited by melt water in braided streams in front of the advancing glacier. In addition to the pebbly sand, fine-grained sands and silts may be present in the lower part of the deposit, as well as coarse channel deposits cutting into the outwash material, resulting in a complex stratigraphy. The advance outwash may be as thick as 300 feet.

The advance outwash is overlain by glacial till. This till is a non-sorted, compacted mixture of clay, silt, sand, pebbles, cobbles, and boulders, with a thickness ranging from 3 feet to over 90 feet. The till was deposited directly by the advancing ice, which was up to 3,000 feet thick. Compaction of the sediments by the ice resulted in very dense material, described by the USGS as a "concrete-like sediment". Mineralogically, both till and advance outwash are very similar, and contain a wide variety of rock types such as granite, diabase, basalt, sandstone, shale, conglomerate, and quartzite. The till is capable of maintaining a steep slope, as evidenced by the topography of the bluff that separates the upland and lowland areas (directly east of East Marine View Drive). The till is directly underlain by the advance outwash, but transitional beds exist (Minard, 1985a,b).

Locally, the glacial till is overlain by fill material. The composition and thickness of the fill varies widely depending on location and origin. Within the footprint of the former smelter, the fill consists primarily of gravelly silty sand, crushed rock, and demolition debris. The fill typically averages between 2 to 6 feet in depth. However, fill and shallow till from the north end of the former smelter footprint were removed in the 1950s during construction of the SR-529 overpass. The majority of this material was used in constructing the access ramp to the former Weyerhaeuser East Site (currently owned by Port of Everett) and the SR-529 southbound overpass. The fill is over 50 feet thick at the access ramp leading to the Port of Everett property (see Figure 4-1).

A transition from fill/shallow till to very compact, dense till generally occurs in the upland area at depths greater than 10 to 12 feet. This deep till appears unweathered and dry. The till is underlain by sandy outwash deposits. The depth to the base of the deep till ranges from about 33 feet along the east side of East Marine View Drive (borings TB-1, TB-2, TB-3) to greater than 90 feet at TB-4 located in the western part of the fenced area in the general vicinity of the former stacks. Infiltration into the till is very limited due to its dense compaction.

4.1.2 Lowland Area

The lowland area geology consists of Holocene alluvial and estuarine deposits associated with the Snohomish River. These deposits contain sequences of sand, silt, and clay, with considerable amounts of organic matter. The thickness of the alluvial and estuarine deposits exceeds 90 feet (Minard, 1985a,b). Hydrogeologic investigations conducted at various

Weyerhaeuser sites describe three main stratigraphic units in the lowland area. These consist of shallow fill, underlain by silt, followed by a lower alluvial sand unit.

4.1.2.1 Shallow Fill

The fill is described as a shallow grade fill underlain by dredged sand fill. The grade fill is typically comprised of gravely sand, crushed rock, or bark. The dredged fill consists of fine to coarse sands from the Snohomish River. The average thickness of the grade fill is approximately 3 feet. The dredged fill is approximately 9 feet thick.

The fill in the lowland area adjacent to the bluff and west of the Burlington Northern Santa Fe (BNSF) switchyard tracks is more variable in composition than that encountered on former Weyerhaeuser sites to the east of the BNSF railroad tracks, including the Port of Everett property. The fill is composed of coarse-grained slag where the original slag pile once extended. The slag was deposited in this location during the operation of the smelter. Finer grained granular slag is present along the southern margin of the current slag pile (see Figure 4-2) and is a byproduct of a rock wool operation which was present in the 1950s. The fill in the area surrounding the slag pile and extending to the south is finer grained than the dredge fill used on the Port of Everett property. This finer grained fill varies from silty sand to gravelly sandy silt, and was apparently placed by regrading material from the bluff to the lowland area (Boyd Benson, pers. comm., 1998). A very fine-grained sediment with a slag-like appearance was encountered at HP-26 from 10 to 21 feet below ground surface. This material was a similar dark gray color as the slag, but was too fine-grained to identify in hand samples.

The fill material to the north and south of the slag pile is predominantly fine-grained silt and sand as described in the boring logs for HP-4, HP-5, HP-1, EV-5, EV-15A, EV-15B, EV-16A, LB-11, LB-12, LB-13, LB-14, LB-15, LB-19 and LB-20. These fine-grained sediments are similar in texture to the deeper silt layer. Fine-grained sediments were also encountered at monitoring well and hydropunch locations further to the south (MW-1, HP-12).

Across the BNSF switchyard tracks to the east, the fill material is composed of coarser-grained sand and gravelly sand. According to Weyerhaeuser reports (Hart Crowser, 1990, 1991), sand was dredged from the Snohomish River and used as fill in the early 1900s. The exact timing of emplacement of the dredge fill is unknown but it must have occurred prior to construction of the former Weyerhaeuser East Site in 1915. Additional fill materials were placed at this site and include sandy gravel, asphalt, angular pebbles and cobbles of crushed rock, wood debris and bark (Hart Crowser, 1990; Emcon, 1994).

Wood and metal debris were also encountered within the fill layer on BNSF property at monitoring well MW-2. Workers installing an optical fiber cable east of the BNSF tracks reported encountering large amounts of buried debris in the shallow fill south of monitoring well MW-2.

4.1.2.2 Silt

The lowland area fill is underlain by a laterally extensive layer of estuarine/wetland silt containing abundant organic matter. This fine-grained, clayey silt layer overlies the alluvial sand deposits in most portions of the lowland area. The silt layer is typically 6 to 12 feet thick, but can be thinner or absent locally (see Figures 4-1 and 4-2). Ancestral channels of the Snohomish River have incised and eroded through the silt in some areas, replacing the silt with silty sand or alluvial channel deposits. Notably, these channel deposits are incised through the silt unit in a portion of the slag pile at the base of the bluff separating the upland and lowland (see Figure 4-1).

These channel deposits consist of variable sequences of interbedded silt and fine sand, with sandier sequences in some areas. Channel deposits were encountered at several of the hydropunch, monitoring well, and soil boring locations (HP-21, HP-6, HP-7, EV-6B and Geo Engineers [1990] boring B-2), which suggests the silt layer has been breached in at least three locations by stream channels.

As shown in Figure 4-2, the silt layer appears to be absent adjacent to the bluff and near the shoreline of the Snohomish River. Based on soil data from HP-6 and HP-7, the channel deposits are also inferred to be absent beneath the BNSF switchyard tracks. A slough, as shown on a 1913 map of the former smelter, also is present in the vicinity of the BNSF tracks. Hydropunch locations HP-6 and HP-7 were completed along this slough further to the north and there is no evidence of the silt layer at those locations (see Figure 4-2).

A 6 to 12-inch thick peat layer, was encountered at the upper boundary of the silt at a number of soil boring locations south of the slag pile and may represent the original ground surface at the time of smelter operation.

4.1.2.3 Alluvial Sand

Alluvial sand is below the base of the silt layer in the lowland area, typically at a depth of approximately 20 feet. This unit corresponds with the lower sand unit described in Weyerhaeuser investigations (Hart Crowser, 1990; Emcon, 1994). The alluvial material consists predominantly of fine to coarse sand with traces of gravel and was deposited in the lowland area by the Snohomish River. The lower boundary of the alluvium has not been defined. However, previous investigations at the former Weyerhaeuser Mill E Site show these alluvial sands extending to a depth of at least 100 feet below ground surface (Emcon, 1994).

4.2 SOIL CHEMISTRY

Soil samples have been collected for chemical analyses from numerous locations in the upland and lowland areas during several environmental investigations. This section provides an overview of soil chemistry results obtained during previous studies, with emphasis on arsenic as the primary chemical of concern in both smelter-impacted soils and the local groundwater system.

Surface and subsurface soil samples collected during several soil sampling programs have typically been analyzed for total concentrations of one or more of the following constituents:

arsenic, cadmium, chromium, copper, lead, and/or zinc. A comprehensive table listing pertinent soil results from several investigations is included as Table 4-1. Consistent with previous reports, particularly the RI (Asarco, 1995a) and the supplemental lowland investigation (Asarco, 1996), the following items have been prepared to characterize the concentration and distribution of soil arsenic and metals, using pertinent available soils data:

- A statistical summary of soil arsenic and metals concentrations organized by stratigraphic unit (see Table 4-2).
- Three exhibits showing the maximum concentrations of arsenic, cadmium, and lead observed at individual sampling locations (see Exhibits 4-1, 4-2, and 4-3).
- Three geologic cross sections, showing arsenic distribution with depth at various locations across the upland and lowland areas (see Exhibits 4-4, 4-5, and 4-6).

The statistical summary table and exhibits are used to describe the range and variability of soil arsenic and metals concentrations (see Section 4.2.1), as well as the areal and vertical distribution of arsenic in soils throughout the upland and lowland areas (see Sections 4.2.2 and 4.2.3).

Results associated with the smelter area investigation (Asarco, 1998b) are not included in the two tables and six exhibits due to significantly elevated concentrations which would skew statistical evaluations. Therefore, a separate discussion of soil chemistry for the former smelter operation area (including the fenced area) is presented in Section 4.2.4.

4.2.1 Summary Statistics

As part of the RI (Asarco, 1995a) and supplemental lowland area investigation (Asarco, 1996), soil samples were collected from different depths and stratigraphic units throughout the former smelter footprint and the surrounding area. Representative summary statistics (number of samples, mean, median, minimum, and maximum) for soils data were calculated by stratigraphic unit to provide an overview of the range and variability of arsenic and metals concentrations encountered in the primary upland and lowland units (see Table 4-2).

Statistics are presented in Table 4-2 for arsenic, cadmium, chromium, copper, lead, and zinc concentrations in soil. Results reported as below laboratory method detection limits were replaced with a value equal to ½ the detection limit for statistical calculations. Table 4-2 was prepared using data for 528 soil samples. It is noted that not all samples were analyzed for all parameters collected from the 121 discrete sample locations used to summarize soil statistics. These sample locations are listed in Table 4-3 and shown on Exhibits 4-1, 4-2, and 4-3.

As shown in Table 4-2, stratigraphic units used to categorize soil samples for statistical analysis include:

- Upland Fill/Till;
- Upland Outwash;
- Upland Bluff Fill;
- Lowland Slag;
- Lowland Fill (Non-Slag);
- Lowland Peat;
- Lowland Silt;
- Lowland Channel Deposits; and
- Lowland Alluvial Sand.

All parameters show order-of-magnitude variability over the Site, as would be expected in an area with localized sources. In addition, comparison of the arithmetic mean and the median suggests that most of the soil arsenic and metals data sets are positively skewed (the mean value is much greater than the median value). About 70 percent of the cadmium results considered were below laboratory detection limits. Statistical results for arsenic and metals are discussed separately below.

4.2.1.1 Arsenic

Overall, soil arsenic concentrations are greatest in the upland area fill/till unit. Arsenic in soil samples collected at upland area locations included in the statistical analysis ranged from 2 to 11,810 mg/kg, with a mean arsenic concentration of 649 mg/kg. Upland area arsenic concentrations are greatest in the vicinity of the former smelter facilities (see Section 4.2.4), and show a decrease with depth. In the deeper upland area outwash unit, arsenic concentrations ranged from 3 to 14 mg/kg, with a mean concentration of 6 mg/kg. As part of the recent investigation, near-surface (0 to 3 foot) soil samples were collected in the bluff area that divides the upland area from the lowland area (designated as "Bluff Fill" in Table 4-1). Samples were collected along four east-west transects running from the base to the top of the bluff, at three locations per transect (the base or bottom, middle, and top of the bluff). Bluff fill arsenic concentrations ranged from 5 to 446 mg/kg, with a mean concentration of 138 mg/kg. These concentrations are generally lower than upland area fill/till soil arsenic concentrations (especially fill/till samples collected in the immediate vicinity of the former smelter), but higher than typical concentrations in lowland area non-slag fill.

Soil arsenic concentrations in the non-slag lowland area fill are highly variable, ranging from 2.5 mg/kg to 5,996 mg/kg, with a mean concentration of 97 mg/kg. The wide range of lowland area fill arsenic concentrations is attributable to the heterogeneity of fill materials found in the lowland area. Arsenic concentrations in lowland area slag ranged from 25 to 2,207 mg/kg with a mean of 474 mg/kg. As noted in previous reports (Asarco, 1996), the higher arsenic concentrations in the slag are associated with granular slag at the south end of the slag pile. The granular slag is a byproduct of the historic rock wool operation.

Arsenic (and metals) concentrations in slag material are usually elevated compared to native soils, because slag is a byproduct of metal ore refining and processing. In general, potential contaminants in the slag matrix tend to be bound in resistant phases that are difficult to remove through natural weathering, and thus, arsenic and metals are not readily leachable by groundwater or surface water in contact with slag. However, because slag may contain elevated concentrations of arsenic and metals, it may still contribute some metals or arsenic to groundwater or surface water, since even a small percentage of leachable material in slag may be significant if the parameter of interest is present at a high enough concentration. Tests for arsenic leachability were conducted on slag as part of the recent lowland investigation. The results of leach testing are discussed in Section 5.1.2.

Arsenic concentrations as high as 4,194 mg/kg were detected in a thin peat layer that occurs between the lowland fill and underlying silt units. Concentrations of arsenic in the underlying silt layer ranged from 4.8 mg/kg to 1,712 mg/kg with a mean value of 76 mg/kg. Higher arsenic concentrations in the silt are typically present in samples at the silt/slag fill contact and decrease quickly with depth. Lowland soil arsenic concentrations were lowest in samples from the deep alluvium (mean arsenic concentration = 10 mg/kg) and the channel deposits (mean arsenic concentration = 19 mg/kg).

4.2.1.2 Metals

In the upland area, average concentrations of copper (177 mg/kg), lead (575 mg/kg), and zinc (1,287 mg/kg) are highest in the bluff fill unit. Examination of individual data points for the bluff fill indicates that higher metals concentrations were observed in samples collected at the base of the bluff, rather than at the top of the bluff. The upland fill/till soils also showed slightly elevated concentrations of copper, lead, and zinc, although average concentrations were lower than in the bluff fill soils. Cadmium concentrations are generally low at all upland sites with the exception of some soils in the fenced area (see Section 4.2.4).

Metals concentrations in lowland area soils vary both between different soil types and within a single soil type. For example, zinc concentrations in lowland area (non-slag) fill ranged from 19 to 79,380 mg/kg, with a mean of 2,399 mg/kg. Other metals were similarly variable in lowland area fill, with copper concentrations ranging from 14 to 1,350 mg/kg, and lead concentrations ranging from 1.5 to 12,470 mg/kg. In addition to the lowland area fill, metals concentration ranges over several orders of magnitude were observed for the underlying peat and silt layers. Zinc and lead concentrations in the peat and silt layers were exceptionally high (maximum concentrations of 35,480 mg/kg for zinc and 1,614 mg/kg for lead in the peat, and 56,800 mg/kg for zinc and 4,864 mg/kg for lead in the silt). The peat layer presumably represents the original land surface and the silt layer is characterized by abundant organic debris. This suggests that the elevated metals and arsenic concentrations in the peat and silt layers may be attributable to transport from overlying materials or historic deposition, followed by adsorption of metals and arsenic to organic materials or organic coatings at depth.

The lowland area slag is particularly enriched in lead, which showed a concentration range of 18 to 24,230 mg/kg and a mean lead concentration of 8,999 mg/kg. As noted above, metals concentrations are enriched in slag relative to native material. The refractory nature of the slag matrix generally prevents the majority of the slag-bound metals from entering groundwater or surface water through infiltration and natural leaching processes. However, loading of metals to groundwater or surface water, and subsequently to adjacent soils from slag may be significant in areas where slag is more leachable, or where concentrations are particularly high. Metals concentrations were detected at elevated concentrations in some fill materials in the slag pile vicinity. A lead concentration of 12,470 mg/kg was observed at HP-21, and a cadmium concentration of 92 mg/kg was observed at boring LB-7. Both of these locations are in shallow fill material within the slag pile perimeter.

The deeper units (channel deposits and alluvial sands) showed less variability (i.e., lower maximum concentrations) than the shallower fill, peat, and silt units. In the channel deposits, zinc concentrations ranged from 181 to 1,116 mg/kg, with a mean of 649 mg/kg, while lead concentrations in the same unit ranged from 3.1 to 503 mg/kg, with a mean of 131 mg/kg. The deep alluvial sands showed maximum concentrations of 49 mg/kg for lead and 115 mg/kg for zinc.

Chromium concentrations throughout soils in both the upland and lowland areas were remarkably consistent, with mean concentrations ranging from 82 mg/kg in the lowland area deep alluvial sands to 130 mg/kg in the upland area fill/till. A maximum concentration of 502 mg/kg was observed in the lowland area fill.

4.2.2 Areal Distribution of Arsenic and Metals

Exhibit 4-4 shows the areal distribution of arsenic in upland and lowland area soils, based on samples collected during the RI (Asarco, 1995a) and the supplemental lowland investigation (Asarco, 1996). Exhibit 4-1 combines information obtained from concentration maps prepared for the RI (Asarco, 1995a) and the supplemental lowland report (Asarco, 1996), along with recently collected soils data. The maximum soil arsenic concentration observed at each sampling location and the symbol and site code for each location are plotted in color on Exhibit 4-1 according to the arsenic concentration associated with the location.

The maximum concentrations of arsenic in the upland area occur within and immediately adjacent to the fenced area. A maximum arsenic concentration of 727,000 mg/kg was reported at location S-111 in the fenced area. A number of other locations within the fenced area also had arsenic concentrations greater than 10,000 mg/kg. Concentrations greater than 1,000 mg/kg are common throughout the fenced area (see Exhibit 4-1).

In the lowland area, maximum arsenic concentrations occur in the vicinity of the slag pile. Concentrations of arsenic in soils generally decrease with distance from the slag pile to the north, east, and south (see Exhibit 4-1). East of the slag pile (across the BNSF switchyard tracks), soil arsenic concentrations decrease to below 100 mg/kg, and are less than 10 mg/kg further east near the Snohomish River. Higher arsenic and metals concentrations were detected in an area at the north end the Port of Everett property near SR-529 (see Exhibit 4-1). Soil arsenic concentrations in this area ranged from 100 to 500 mg/kg. A maximum concentration of 531 mg/kg was reported at location HP-46.

Cadmium and lead soil maximum concentration maps (see Exhibits 4-2 and 4-3) have been prepared for the lowland area only, including recently collected samples. Contour maps showing cadmium and lead distributions in the upland have previously been presented in the RI (Asarco, 1995a). Overall, cadmium and lead are similar to arsenic in terms of spatial distribution trends (i.e., high concentrations near the former smelter facilities and the slag pile). Lead concentrations greater than 10,000 mg/kg were observed at several sample locations within or immediately adjacent to the slag pile footprint. Elevated lead concentrations also are present at discrete locations to the north (5,619 mg/kg lead at HP-47, and 1,108 mg/kg at EV-22A/22B) and south (2,065 mg/kg at LB-11) of the slag pile.

Concentrations of cadmium in the slag pile area are generally in the 10 to 30 mg/kg range (see Exhibit 4-2). A maximum concentration of 92 mg/kg was observed at location LB-7 at the northern end of the slag footprint. Soil cadmium concentrations are mostly below laboratory method detection limits at sampling locations east of the BNSF switchyard tracks. Cadmium concentrations greater than 5 mg/kg and up to 86 mg/kg (at location EV-13) were found in the upland area fill materials along East Marine View Drive and near the SR-529 and East Marine View Drive interchange.

4.2.3 Vertical Distribution of Arsenic and Metals

The vertical distribution of arsenic is depicted on geologic cross sections (see Exhibits 4-4, 4-5 and 4-6). Overall, arsenic concentrations tend to decrease with depth, although exceptions occur at some locations. A notable exception is the thin peat layer immediately beneath the fill in the lowland area, which shows the highest average arsenic concentration (2,223 mg/kg) of any upland or lowland area stratigraphic unit outside of the fenced area (see Table 4-2).

In the upland area, average arsenic, copper, lead, and zinc concentrations in the fill/till unit are four to over 100 times greater than in the underlying outwash unit (e.g., the mean arsenic concentration of the fill/till is 649 mg/kg versus 6 mg/kg for the outwash (see Table 4-1). Vertical concentration trends in the lowland area are slightly more complex, due to the placement of fill and redistribution of material in parts of the lowland since the former smelter was in operation. The peat layer underneath the lowland fill to the south of the slag pile appears to represent the original ground surface at the time of smelter operation and has accumulated elevated concentrations of arsenic, lead and zinc (mean concentrations of these parameters in the peat layer exceed mean concentrations in the lowland fill). The channel deposits at the base of the bluff also show elevated lead (average = 131 mg/kg) and zinc (average = 649 mg/kg) compared to the deeper alluvial unit. The average concentrations of arsenic and lead in the alluvium are 10 mg/kg and 7 mg/kg, respectively.

4.2.4 Results of Smelter Area Investigation

The smelter area investigation (Asarco, 1998b) focused on the fenced area. The main goals of the investigation were to determine the extent of smelter debris and its distribution with respect to former smelter facilities, and to identify the nature and extent of soils or material that may be a contaminant source for surface water and groundwater. Soil samples were collected from 60 locations and analyzed for arsenic and lead (see Table 4-4). Selected samples were also analyzed for fish bioassay to assist in the determination of potential waste categories and by SPLP to assess leaching characteristics.

Intact floors and foundations of former smelter structures were found within the fenced area at depths between one and four feet below the current ground surface and closely follow historical facility maps. The investigation indicated that soils with flue dust have arsenic concentrations up to 25,000 mg/kg, and soil with residuals of arsenic trioxide have arsenic concentrations up to 760,000 mg/kg. Soils with flue dust and/or arsenic trioxide were usually mixed with smelter demolition debris within and immediately adjacent to the footprints of structures where they were handled, processed, or stored.

Soil borings did not encounter smelter residuals immediately outside the fenced area except in a relatively small area in the adjacent East Marine View Drive right-of-way. These findings indicated that smelter residuals are not present in residential properties adjacent to the fenced area. However, some smelter material with arsenic concentrations significantly lower than soils in the fenced area were encountered in fill beneath the SR-529 overpass.

Previous testing indicated that soil with arsenic concentrations near 3,000 mg/kg can exceed the TCLP standard of 5 mg/L. SPLP results indicated that smelter materials containing residual arsenic trioxide or flue dust can act as sources of arsenic to groundwater under ambient leaching conditions (e.g., rainfall). However, the potential for groundwater impacts from smelter residuals is dependent on several factors including arsenic concentration, material volume, local infiltration rates, and subsurface transport pathways. The smelter area investigation concluded that smelter residual materials in the fenced area were potential sources of elevated arsenic to groundwater and surface water at the Site, particularly in the upland area.

It was estimated that there are approximately 20,000 to 25,000 cubic yards of soil with arsenic concentrations greater than 3,000 mg/kg in an area of about 2.8 acres. Within that area, there are 1.4 acres containing approximately 10,000 to 15,000 cubic yards of soil with arsenic concentrations over 10,000 mg/kg. These areas were found to directly coincide with former arsenic processing facilities located between East Marine View Drive and Pilchuck Path in the fenced area (see Figure 4-3).

4.3 SITE HYDROGEOLOGY

The general hydrostratigraphic framework of the upland and lowland areas was defined in the RI (Asarco, 1995a) and further refined in the supplemental lowland area investigation (Asarco, 1996). Data collected during the recent lowland area investigation are used to further refine the conceptual model of the site hydrogeology, particularly the lowland area.

4.3.1 Hydrostratigraphic Units

There are six principal hydrostratigraphic units; three in the upland area and three in the lowland area (see Table 4-5). These six units are further described in the following subsections.

4.3.1.1 Upland Area Hydrostratigraphic Units

The upland area is underlain by a thick sequence of glacial till over a deeper sequence of advance outwash deposits. Section A to A' (see Figure 4-1) is an east-west cross-section showing the stratigraphy of the upland and its contact with the adjacent lowland system. The till is mantled over much of the upland area by a surficial layer of fill comprised of silt, sand and gravel, which is locally intermixed with smelter debris in and near the fenced area.

Groundwater has been encountered at shallow depths in the shallow till and associated fill at only a few locations and usually for limited periods. Typically these occurrences involve thin zones of saturation that develop seasonally in response to periods of sustained precipitation. The deeper till, below depths of 10 to 15 feet, has been found to be dry at nearly all locations investigated. An unconfined groundwater flow system occurs within the advance outwash deposits, with the water table typically occurring 15 to 20 feet below the base of the overlying till.

Fill/Shallow Till

Seven monitoring wells are completed in the upland fill/till unit (EV-1, EV-10 through EV-14, and EV-4A). Of these wells, three have always been dry (EV-10, EV-12 and EV-14); two have exhibited some saturation during the wet season (EV-11 and EV-13) and two have consistently shown saturation (EV-1 and EV-4A). No saturation was found in the fill/shallow till unit during drilling at multiple locations along East Marine View Drive (TB-1, TB-2, TB-3, EV-3, EV-18B, EV-19B and EV-20B).

Some shallow saturation was encountered in one test pit at the northern end of the fenced area. As part of the supplemental lowland investigation, test pits TP-1 and TP-2 were excavated on February 12, 1996 within the fenced area, and encountered partially intact brick foundations and flue structures within the fill layer. Dense till was encountered at 11 feet below ground surface (bgs) in TP-1 and at 6 feet bgs in TP-2. Very limited groundwater (approximately 0.1 gpm) was encountered in TP-1 at a depth of 6 to 8 feet and no groundwater was encountered in TP-2. No groundwater was encountered in the shallow fill/till in any of the 12 test pits excavated in March of 1998 for the smelter area investigation.

The available data indicate that a continuous, perennial groundwater flow system is not present in the shallow till/fill unit. However, there is ample evidence to suggest that saturated flow conditions in this unit do occur for periods of time in some portions of the Site. Evidence in addition to the monitoring well data include the temporary presence of seeps at the northern edge of the fenced area along the access road to SR-529 and indications of groundwater inflow to the sewer system within the fence area, as noted in subsequent sections addressing surface water hydrology.

Deep Till

As noted in Section 4.1, a transition from fill/shallow till to very compact, dense till generally occurs in the upland at depths greater than 10 to 12 feet. Based on a number of soil borings completed throughout the upland area, the deep till appears unweathered and dry. The only occurrence of saturation noted within the deep till is at a depth of 39-43 feet in boring TB-4, which was located in the western portion of the fenced area during the smelter area investigation. The till is truncated at the bluff separating the upland from the lowland area, and partially to fully mantled by fill material, including slag. The till is entirely absent at boring EV-20B, where fill overlies the outwash sands.

Advance Outwash

Several monitoring wells have been completed in the advance outwash unit, including EV-3, EV-18B, EV-19B, EV-20B and probably EV-4B. The outwash deposits, which typically consist of fine- to medium-grain well sorted sands, are unsaturated at and below the contact with the till. The water table in the outwash is encountered approximately 15 to 20 feet below the contact with the till. The outwash deposit is similarly truncated at the margin of the Snohomish River valley by the incised alluvial deposits and abuts the lowland hydrostratigraphic units described below, including the fill (and slag), the intervening silt unit, and the deeper alluvial sands.

4.3.1.2 Lowland Area Hydrostratigraphic Units

As described in Section 4.1, the stratigraphy in the lowland area consists of fill of varying composition overlying an estuarine silt layer and deeper alluvial sands. The shallow fill layer and the deeper sequence of alluvial sand form the two principal water bearing units - a shallow and a deep groundwater system. These units are separated by a confining layer of fine-grained, clayey silt, which limits flow between the two aquifers.

Fill

The lowland area fill hydrostratigraphic unit includes the widespread sandy fill, an area of silty fill south of the slag pile, and the localized slag deposits at the base of the bluff. Twenty-one monitoring wells are currently installed in this unit. The water table is generally within 1 to 2 feet of the ground surface. Further discussion of the surface water/groundwater interactions is included in Section 4.5.

Silt Layer

No monitoring wells are completed within the silt layer, which forms a confining layer between the overlying fill and the underlying alluvial sands. As previously discussed, the silt layer is absent locally where it has been replaced by coarser channel deposits. The absence of the silt layer in these locations may be hydrologically significant, since it provides a potential conduit for groundwater flow between the shallow and the deep aquifers.

Alluvium

The alluvium forms the deep groundwater system in the lowland area. Fifteen monitoring wells are currently installed in this unit. Alluvial sand has been encountered in all of the lowland area borings that penetrate below the base of the silt layer, typically at a depth of about 20 feet. The alluvial material consists predominantly of fine to coarse sand with traces of gravel and was deposited by the Snohomish River. The lower boundary of the alluvium has not been defined. However, monitoring wells on the former Weyerhaeuser Koppers/Mill E Site show these alluvial sands extending to a depth of at least 100 feet below ground surface (Emcon, 1994).

4.3.2 Aquifer Characteristics

Aquifer test (slug test) results for representative hydrostratigraphic units were presented in the RI (Asarco, 1995a). Additional tests were conducted as part of the supplemental lowland area investigation (Asarco, 1996). The recent investigation in 1998 and 1999 also included three tests to provide additional characterization of the lowland hydrostratigraphic units.

Several limitations should be considered in evaluating these test results relative to site-wide characterization issues.

- Slug tests measure the influence of a relatively small volume of aquifer material compared to longer-term pumping tests. Slug test data are therefore useful in showing the spatial variability in aquifer properties across a site, but taken individually may be strongly influenced by local heterogeneities.
- Slug tests in highly permeable materials or confined units with substantial head may show an oscillatory water level response which makes the interpretation of slug test results more difficult. This phenomena is referred to as an underdamped or critically underdamped response and is described by Van der Kamp (1976). The slag wells, and a number of the slug tests in the confined alluvial aquifer, show a critically underdamped response in which water level oscillations occur superimposed on a conventional response curve. Depending on the degree of response, an analytical solution is difficult to apply on these tests. In addition, the water level recovery in a number of the slag wells was nearly instantaneous, providing minimal data to interpret.

Recognizing these limitations, where possible, attempts to test and compare results from individual hydrostratigraphic units at a number of locations have been made. These data have been used to establish average hydraulic conductivity values for each unit. The results are presented, together with those from previous investigations in Table 4-6. The results for individual upland and lowland area units are discussed and compared to literature values as well as to test results from Weyerhaeuser investigations in the lowland area.

4.3.2.1 Upland Area Till

Split spoon samples from the deeper unsaturated till at EV-1 and EV-2A were submitted to Pacific Testing Laboratories in Bothell, Washington, for permeameter testing to determine the hydraulic conductivity of the deeper till (Asarco, 1995a). Samples were submitted from EV-1 at 17.5 to 19.5 feet, and EV-2A at 10.5 to 12 feet. The tests were run using a flexible wall permeameter according to ASTM Method D-5084. The results are shown in Table 4-6 and indicate a hydraulic conductivity range for the deeper till of approximately 2 x 10^{-7} to 6 x 10^{-8} cm/sec. The hydraulic conductivity results for the deeper till are 3 to 4 orders of magnitude lower than the shallow till which is indicative of the permeability contrast between the weathered and unweathered till.

4.3.2.2 Upland Area Advance Outwash

Slug tests at monitoring wells EV-3 and EV-4B completed in the advance outwash indicate hydraulic conductivities ranging from approximately 6 x 10^{-3} to 3 x 10^{-4} cm/sec, respectively (Asarco, 1995a). The higher results at EV-3 may be a more accurate indication of the permeability of the advance outwash deposits since problems encountered with running sands at EV-4B may have influenced permeability results at that site. When setting the monitoring well at EV-4B, fine sands were forced into the borehole by the hydraulic pressure in the formation and may have reduced the efficiency of the sandpack and well screen. This is suggested by a relatively high turbidity at this well compared to other wells, which persisted after monitoring well development.

4.3.2.3 Lowland Area Fill

Monitoring wells MW-2, MW-3, MW-4A, MW-5, WP-1, EV-15A and EV-16A, which are screened in sand or silt, were tested within the shallow lowland area fill. The hydraulic conductivities at individual monitoring wells ranged from about 0.03 to 87 feet per day (2E-05 to 3.1E-02 cm/sec). The results for EV-15A and EV-16A, which are located south of the slag deposit, were very low (0.03 to 0.05 ft/day) relative to the results at other fill test locations. These two monitoring wells are screened in sandy silt and silt rather than the more typical sand comprising the lowland area fill. The average hydraulic conductivity for the other five fill monitoring wells was 52 ft/day (1.9E-02 cm/sec). Weyerhaeuser tests from 13 monitoring wells in fill material averaged 20 ft/day (Emcon, 1994). These results are consistent with values presented in the literature for sandy aquifers (Freeze and Cherry, 1979).

The results for the hydraulic testing of the wells completed in slag are discussed separately because of the large difference in hydraulic characteristics. Slug tests were conducted within the slag at monitoring wells EV-6A, EV-7A, EV-8A and EV-9A. Monitoring well EV-9A was considered separately since the slag at this location is granular slag versus coarser-grained slag in the other monitoring wells. Test results indicate the granular slag at EV-9A has a hydraulic conductivity of 146 ft/day (5.1E-02 cm/sec). This is within the range of a very well-washed sand. The coarser slag produced hydraulic conductivities ranging from 425 to 1,166 ft/day (1.5E-01 to 4.12 E-03 cm/sec). The slug tests yielded an average hydraulic conductivity of approximately 1,000 ft/day. However, the fit of curve-matching results to conventional analytical solutions was poor. Testing of slag wells at the Tacoma Smelter Site yielded similar hydraulic conductivity values ranging from 510 to 1,050 ft/day (0.18 to 0.37 cm/sec). The permeability varied substantially depending on the texture of the slag. The results of on-site testing confirm the slag is highly permeable. However, the permeability results should be considered a general approximation for purposes of conducting hydrologic flux or potential dewatering characteristics.

4.3.2.4 Lowland Area Silt Layer

No wells are completed within the silt layer and therefore, no testing of the silt layer was conducted by Asarco. However, previous testing by Weyerhaeuser (Hart Crowser, 1989; Emcon, 1994) has indicated an average vertical permeability of the silt of 6.2E-04 ft/day (2.2E-07 cm/sec). As previously discussed, the silt layer is absent locally where it has been replaced by coarser channel deposits.

4.3.2.5 Lowland Area Channel Deposits

The channel fill deposits consist of varying thicknesses of silt, sand, and silty sand. The results of testing at EV-6B yielded a hydraulic conductivity of 32 ft/day (1.13E-02 cm/sec). This is representative of a moderately clean sand (Freeze and Cherry, 1979) and is likely indicative of horizontal permeability in the coarse-grained intervals observed at this well. Monitoring well EV-6B also shows the presence of interlayered silt which may substantially reduce the vertical permeability of this unit. Discrete silt layers were not apparent at all locations where the channel deposits replace the silt unit. For example, channel deposits at HP-6 and HP-7 appear to be predominantly sand. Vertical hydraulic conductivities at these locations may still be 2 to 10 times lower than horizontal hydraulic conductivities due simply to normal, layered heterogeneities (Freeze and Cherry, 1979).

4.3.2.6 Lowland Area Alluvium

The alluvium was slug tested at nine locations (MW-1, MW-4B, EV-5B, EV-7B, EV-8B, EV-9B, EV-15B, MW-103D and MW-108D). Hydraulic conductivities ranged from 1.4 ft/day to 174 ft/day (4.9 E-04 to 6.1 E-02 cm/sec) with an average hydraulic conductivity of 21 ft/day (7.43E-03 cm/sec). Higher hydraulic conductivities were encountered towards the shoreline. Weyerhaeuser reported horizontal hydraulic conductivities for the lower sand unit ranging from 17 to 255 ft/day (0.006 to 0.09 cm/sec) with an average hydraulic conductivity of 142 ft/day (0.05 cm/sec). The somewhat-higher Weyerhaeuser average for this unit appears consistent with values determined by Asarco at MW-103D and MW-108D. The results are consistent with the range of typical values presented in the literature for sand aquifers.

4.3.3 Hydraulic Gradients and Groundwater Flow Velocities

Asarco has conducted routine monitoring of water levels at numerous monitoring wells in the upland and lowland areas. The water level data have shown trends generally consistent with previous data compiled for Weyerhaeuser investigations and for the RI (Asarco, 1995a) and the supplemental lowland area investigation (Asarco, 1996). Previous investigations by Asarco and others have shown that groundwater flow directions in both the shallow and deep lowland aquifers tend to be from the upland area toward the Snohomish River or approximately east/northeast. However, the addition of several new monitoring wells and data from additional Hydropunch locations and surface water measurement locations, in the case of the lowland fill, have allowed some refinement of the apparent groundwater flow patterns.

The advance outwash in the upland, is potentially contiguous with the fill (and slag) and the deeper alluvium within the lowland area. The exact nature of the hydraulic connection between the outwash and these lowland units is difficult to establish. The presence of the channel deposit incised through the lowland area silt unit at the lowland margin (as at location EV-6) further complicates the evaluation. Since the outwash may contribute to both the shallow fill and deeper alluvial groundwater systems in the lowland area, the potentiometric maps for both the shallow and deep groundwater systems include water level data from advance outwash monitoring wells located at the western edge of the lowland area.

4.3.3.1 Tidal Effects

Three tidal investigations have been conducted to assess the effects of tidal variations in the Snohomish River on groundwater levels and flow gradients. The degree to which groundwater levels are influenced by tidal fluctuations is primarily dependent on the aquifer type (confined versus unconfined) and the character of the hydraulic connection to the river. Flow conditions in the lowland alluvial sand unit (the deep groundwater system) are generally confined (i.e., the water level in a well rises above the top of the silt aquitard overlying this unit) and this unit intersects and lies beneath the Snohomish River channel. During low tide, water levels may drop below the top of the unit creating locally unconfined conditions near the river. Groundwater flow in the lowland fill unit is unconfined (e.g., water table conditions) and this thin (usually 10 feet or less) unit outcrops on the riverbank generally above the elevation of the mean river stage.

The first investigation was conducted in July 1990 by Hart Crowser at the former Weyerhaeuser Mill E/Koppers Site, located southeast of the former smelter (Hart Crowser, 1990). The investigation included continuous monitoring over a 72 hour period of the tidal response in two monitoring wells completed in the Lower Sand (lowland alluvial sand unit), three monitoring wells completed in the Upper Sand (lowland fill unit) and the Snohomish River. Four of the five monitoring wells were located within 50 feet of the Snohomish River. The response to tidal fluctuations was large in the alluvial sand wells, with an amplitude of approximately 70-75 percent of the river stage fluctuation, or a maximum of about 8 to 9 feet.

Hart Crowser concluded that flow reversal (away from the river) occurred near the river for 6 to 8 hours a day. Their calculations indicate net flow towards the river, with an average hydraulic gradient of 0.02. The tidal response in the shallow wells was only evident in the water levels in the two wells adjacent to the river with a maximum amplitude of only a few tenths of a foot or less.

Asarco conducted an investigation in May 1993 to assess the tidal effects on the shallow and deep groundwater units in the general area of the former smelter (Asarco, 1995a). Water levels were monitored in the Snohomish River and in wells completed in the advance outwash, the lowland fill unit, and the lowland alluvial sand unit. These wells were located 1,100 to 1,500 feet from the Snohomish River. The maximum amplitude of the response to tidal fluctuations in the two alluvial sand wells monitored was 2.5 to 3 feet. However, no gradient reversals were evident in the area between EV-7B and MW-4B. Tidally-induced water level fluctuations in monitoring wells completed in the upland area advance outwash and the lowland area fill unit were negligible. The minimal response in the advance outwash was believed to be related to the unconfined flow conditions in this unit.

A second tidal investigation was conducted by Asarco in February 1996 to further evaluate the potential effects of tidal fluctuations on groundwater levels and flow in the vicinity of the Snohomish River shoreline (Asarco, 1996). Water level measurements collected at Weyerhaeuser wells MW-103D and MW-105D as part of that investigation showed tidally induced water level fluctuations of approximately 6 feet following a 7.5 foot tidal fluctuation in the Snohomish River. Water level fluctuations of approximately 0.1 feet were observed in shallow monitoring wells MW-103S and MW-105S during this same period.

4.3.3.2 Groundwater Flow - Shallow System

Four rounds of groundwater level measurements were collected as part of the recent lowland area investigation in 1999 on the following dates: March 5, April 9, June 11, and July 29. These static water level measurements were converted to groundwater elevations in order to develop potentiometric maps (see Figures 4-4 and 4-5).

Figures 4-4 and 4-5 are potentiometric maps of the shallow groundwater system for the March 5 and June 11, 1999 water level measuring events. The June 11, 1999 data (see Figure 4-5) was used rather than the most recent July 29, 1999 data for comparison with March 5, 1999 (see Figure 4-4) data because it included the additional shallow hydropunch data.

Water level data are shown for wells completed in the shallow fill unit and at surface water measurement locations along the drainage system in the lowland area. In addition, the water level elevations measured in wells completed in the advance outwash deposit at the western edge of the lowland area are included on the potentiometric maps.

The potentiometric maps for the shallow lowland groundwater system indicate a generally eastward regional groundwater gradient toward the Snohomish River. However, surface water features, drainage improvements and changes in the permeability of the fill create local variations in hydraulic gradients and flow directions. To the west of the BNSF switchyard tracks, groundwater levels are relatively flat and similar to levels in the advance outwash deposits beneath the bluff. A northerly flow component, consistent with surface drainage, appears to be present in this area. The surface water elevations measured in drainage ditches and standing water are generally similar to groundwater elevations, confirming the likely hydraulic connection of these surface drainage features with the shallow groundwater system.

The potentiometric contours show a relatively steep gradient across the BNSF railroad tracks. The gradient across the track area is approximately 0.01 (1 foot of water level change per 100 feet of horizontal distance) while overall gradients elsewhere are much lower, ranging from 0.001 to 0.002. This difference in water levels to the east and west of the BNSF tracks becomes more pronounced seasonally. Water levels decline to the east of the tracks, but show only minimal changes to the west. This condition has been attributed to lower permeability and greater consolidation of the fill beneath the BNSF switchyard and railroad tracks which restricts the eastward flow groundwater.

Two anomalous features are evident on the shallow potentiometric maps on the Port of Everett property to the east: 1) the potentiometric low centered on Weyerhaeuser well MW-108S(W); and 2) the potentiometric high associated with wells EV-21A and MW-104S(W). A decline in the water table near MW-108S(W) became evident in 1996 following Weyerhaeuser's implementation of drainage improvements in this vicinity. Water levels have remained low in this area since that time. The cause of the potentiometric high has not been firmly established but is probably due to several factors, including variations in fill texture and local recharge conditions (e.g., reported closed depressions that may be areas of focused recharge).

4.3.3.3 Groundwater Flow - Deep System

Four rounds of groundwater level measurements were collected as part of the recent lowland area investigation in 1999 on the following dates: March 5, April 9, June 11, and July 29. These static water level measurements were converted to groundwater elevations in order to develop potentiometric maps (see Figures 4-6 and 4-7).

Figures 4-6 and 4-7 are potentiometric maps of the deep groundwater system (alluvial aquifer) for the March 5 and July 29, 1999 water level measuring events. These events are used events because they likely show the most seasonal variability between spring and summer.

Water levels were measured at low tide to minimize the effects of tidal variations. Water levels and thus, hydraulic gradients, in the alluvial aquifer are tidally influenced, as discussed previously. In summary, while large tidal fluctuations have been measured, these effects lessen with distance from the Snohomish River. Actual gradient reversals only occur for limited time periods during high tide within a few hundred feet of the shoreline.

The potentiometric contours for the deep groundwater system indicate that groundwater flow is typically slightly to the north of due east, or very nearly perpendicular to the channel of the Snohomish River. Water level elevations are uniformly higher in March 1999 (see Figure

4-6) and decrease into the summer months (see Figure 4-7). In all cases, the observed gradients are relatively steep in the area just east of the fenced area (vicinity of slag deposit) and much lower from the western edge of the BNSF railroad tracks to the Snohomish River.

4.3.3.4 Groundwater Flow Velocities

Hydraulic conductivity results were evaluated together with hydraulic gradient data to derive estimates of the average rate of groundwater flow in specific hydrostratigraphic units. Estimated groundwater velocities generally average between 0.5 and 2 feet per day in the sandier stratigraphic units (outwash, lowland fill east of the BNSF switchyard tracks, and alluvium). The estimation of groundwater flow velocities in the area between the bluff and the BNSF switchyard tracks is complicated by the complex hydrology of the area and velocities calculated from horizontal gradients within single units may not accurately depict flow vectors. The primary conditions affecting the calculation of flow velocities are the interconnection of the shallow fill (including slag) flow system with surface drainage ditches, and the apparent connections between all permeable hydrostratigraphic units in the general area of the slag pile and bluff.

The vertical rate of flow through the silt layer was estimated to be 0.002 ft/day based on vertical permeability estimates derived by Weyerhaeuser for the silt and typical gradients between the fill and the alluvium.

4.3.4 *Groundwater Quality*

The groundwater quality trends in the upland and lowland areas have been defined in the RI (Asarco 1995a) and further refined in the supplemental lowland investigation (Asarco, 1996). More data collected during the recent investigation in 1999 are presented here with some historical data to further refine water quality relationships in the upland and lowland areas.

Analytical results for groundwater samples were collected at monitoring wells and hydropunch locations in February, March and June of 1999. Results include field parameters (pH, specific conductance, and dissolved oxygen), common ions (calcium, magnesium, sodium, potassium, alkalinity, acidity, bicarbonate, sulfate, and chloride), arsenic (total, dissolved, $As_{(III)}$ and $As_{(V)}$), and metals (cadmium, chromium, copper, lead, and zinc).

4.3.4.1 General Chemistry

The major ion chemistry for sample locations within each of the two principal hydrostratigraphic units in the upland and lowland areas (shallow and deep aquifers) is shown on a Piper trilinear diagram in Figure 4-8. The location of a sample on the trilinear diagram is indicative of the relative concentrations of major anions and cations. As indicated in Figure 4-8, samples from different hydrostratigraphic units group in slightly different areas of the diagram indicating that each unit has a somewhat distinct water quality signature.

The anion composition in both shallow and deep lowland area monitoring wells is dominated by bicarbonate, while upland area monitoring wells tend to show higher proportions of sulfate and chloride relative to the lowland area. Shallow monitoring well EV-6A which is completed within the slag at the boundary between the upland and the lowland areas, shows an increased contribution from sulfate and chloride relative to the other lowland area shallow monitoring wells.

In the shallow lowland area monitoring wells, calcium is the dominant cation, with about equal contributions from magnesium and sodium plus potassium. Slag samples tend to be particularly high in calcium. In contrast, the deep lowland area groundwater samples show a much greater relative contribution of magnesium (45-65 percent of the total milliequivalents/liter [meq/L] of cations present). At locations closer to the Snohomish River shoreline, there is a higher relative concentration of sodium plus potassium.

The water quality trends shown on the piper diagrams can also be used to evaluate potential groundwater mixing relationships and flow paths. For example, the major ion chemistry of the shallow groundwater within the upland area till at well EV-13 is very similar in composition to water quality at the nearby deep upland area well EV-20B. As will be discussed in the next subsection, both of these monitoring wells have high arsenic concentrations. From EV-20B, there is a distinctive progression in water quality along a downgradient flow path to EV-17B, EV-7B, EV-8B, etc. Source areas and transport pathways are discussed further in Section 5.

Groundwater pH typically ranges between 6 to 8 with the majority of values (>90 percent) less than pH 7.0. The pH range is higher (8 to 11), in the slag, with the highest values near well EV-7A and hydropunch locations HP-21 and HP-23.

Minor variations in water quality were previously described in groundwater at shoreline monitoring stations (HP-41, MW-103D and MW-105D) during the tidal investigation (Asarco, 1996). The specific conductance of deep groundwater fluctuated approximately 10 percent to 15 percent over a tidal cycle, while arsenic trends in HP-41 showed a similar trend, fluctuating from 0.032 to 0.042 over a tidal cycle. Minor variations in field parameters (less than 10 percent) were noted in shallow monitoring wells (MW-103S and MW-105S), but these appeared random with no correlation to tidal water level trends.

4.3.4.2 Arsenic

The groundwater arsenic evaluation focuses on dissolved constituents rather totals since a number of the sampling sites produced suspended sediments during sampling that potentially complicated the interpretation of the total arsenic data. Dissolved and total values are similar at most sites. The hydopunch sites, in particular, had very large fractions of suspended material in the samples since these samples were collected directly from the formation without the benefit of a sandpack or well development to eliminate the fines. The hydropunch sites also tended to show slightly higher dissolved concentrations of arsenic than wells in areas where the wells indicated concentrations near the detection limits. These low level discrepancies may be due to aquifer disturbance during hydropunch sampling. As a result, concentration contours were based primarily on the well values, although both the well and hydropunch results are shown.

Dissolved arsenic concentrations ranged from 0.63 mg/L to 47 mg/L in shallow upland groundwater and <0.005 mg/L to 3.7 mg/L in shallow lowland groundwater. Dissolved arsenic in the deep groundwater system ranged from <0.005 to 13 mg/L in the upland and <0.005 to 15 mg/L in the lowland. Exhibits showing dissolved arsenic trends in the shallow and deep groundwater systems were compiled from Asarco and Weyerhaeuser monitoring results (see Exhibits 4-7 and 4-8). Table 4-7 lists total and dissolved arsenic measurements from the two rounds of groundwater monitoring (March and June, 1999).

As shown on these exhibits, the highest arsenic concentrations were detected at EV-11 and EV-13, within the shallow till near the eastern boundary of the fenced area. Both of these locations are immediately downgradient of former flue structures or arsenic processing facilities. As previously described, groundwater is only present at these locations during one or two months of the year at the height of the wet season.

The highest arsenic concentrations in the shallow lowland groundwater system (3.7 mg/L) were detected at EV-17A. This well lies at the base of the bluff immediately downgradient of EV-13 and is also near the area where storm water seeps were detected in the upland (see Exhibit 4-7). EV-17A is also downgradient of the arsenic plume in the deep upland outwash system suggesting that the outwash could be contributing some arsenic to the shallow lowland system at this location. Arsenic concentrations of 2 to 3 mg/L extend east from EV-17A into the slag pile and then north for a short distance. This is consistent with inferred groundwater flow directions. Arsenic concentrations in monitoring wells completed near the perimeter of the slag pile are generally less than 0.5 mg/L arsenic. Groundwater arsenic concentrations in the shallow groundwater system decrease gradually to the north and are at 0.05 mg/L at EV-23A near the SR-529 overpass. Arsenic concentrations drop more abruptly to the east, decreasing to 0.007 mg/L or less immediately east of the BNSF switchyard tracks. The arsenic concentrations also decrease to the south to 0.032 and 0.085 mg/L at EV-15A and EV-16A, respectively. As discussed in Sections 4.2 and 4.3, the fill in the areas south of the slag pile is very fine-grained and produces very little water.

Arsenic concentrations of 0.56 mg/L to less than 0.005 mg/L are present in shallow groundwater at the Port of Everett property. The highest arsenic concentrations (0.56 mg/L to 0.21 mg/L) were detected in the area between SR-529 and the new access ramp to the Port of Everett property. The well logs show very little sand fill at this location. The hydropunch samples were collected from shallow silt which may be a factor in the higher concentrations observed in this area. Very low arsenic concentrations (0.005 mg/L or less) were present in shallow groundwater at the Snohomish River shoreline. Two shoreline sampling locations (HP-21 and HP-53) showed slightly higher arsenic concentrations (0.020 and 0.024 mg/L, respectively).

The previous lowland investigations established the presence of a relatively narrow plume of arsenic in the deep alluvial groundwater system at concentrations greater than 1 mg/L. Monitoring wells EV-18B, EV-19B and EV-20B were completed in the deep upland outwash aquifer to determine whether this plume originates from an upland source. Monitoring well EV-20B is immediately upgradient of the arsenic plume in the lowland groundwater system and was found to have a dissolved arsenic concentration of 13 mg/L. Shallow monitoring well EV-13 in the upland area and the area of storm water seeps lie immediately upgradient of monitoring well EV-20B. In the lowland area, arsenic concentrations in the deep plume gradually decrease to the east and then abruptly drop off over two orders of magnitude to 0.04 mg/L in a relatively short distance at the Port of Everett property (see Exhibit 4-8). Arsenic concentrations are generally less than 0.005 mg/L in the deeper alluvial groundwater system to the north and south with the exception of HP-45 which reported an arsenic concentration of 0.034 mg/L. Arsenic concentrations at hydropunch locations east of the plume ranged from 0.005 to 0.060 mg/L. However, subsequent sampling at well locations in this same area all showed arsenic results of less than 0.005 mg/L (see Exhibit 4-8).

A separate arsenic plume was detected in the deep groundwater system further to the south at the former Weyerhaeuser Mill E/Koppers Site during previous investigations. Weyerhaeuser data from this site show arsenic concentrations in the deep groundwater system of 1.5 mg/L (see Exhibit 4-8).

4.3.4.3 Metals

Dissolved lead concentrations in the shallow and deep groundwater systems are shown in Figures 4-9 and 4-10 respectively. Lead is present in shallow groundwater at a number of locations in the immediate slag pile vicinity. Concentrations of dissolved lead are extremely variable ranging from 0.89 mg/L at HP-45 to less than detection (<0.005 mg/L). Concentrations away from the slag pile are all less than 0.005 mg/L.

Lead was also present at detectable concentrations at a few locations in the deep groundwater system. Dissolved lead was present at 0.088 mg/L at HP-21, 0.04 mg/L at HP-23 and 0.029 mg/L at HP-26. These locations correspond to the same area (slag pile) where lead is present in the shallow groundwater system.

Zinc concentrations in the shallow and deep groundwater systems are shown in Figures 4-11 and 4-12. Zinc was detected at EV-6A (monitoring well near the slag pile) at a concentration of 24 mg/L and at HP-26 (also near the slag pile) at 3 mg/L. The remainder of the locations reported zinc concentrations of less than 1 mg/L.

Cadmium was not present at detectable concentrations at any of the groundwater sampling locations and therefore, no figures have been prepared. Most other metals are rarely present in groundwater at detectable concentrations as well. Where metals do occur at detectable concentrations, it is generally within the slag pile or in the particulate phase (i.e., total rather than dissolved concentrations).

4.4 SURFACE WATER / STORM WATER CONDITIONS

Various surface water investigations have been conducted at the Site, primarily directed towards characterization of storm runoff. Extensive storm water sampling occurred recently in the upland and lowland areas as part of the storm water and storm drain sediment characterization investigation. The storm water results for the upland and lowland areas are reviewed in this report to identify how these processes potentially affect water quality in the lowland area. Data collected throughout the investigation were submitted to Ecology in quarterly task reports. However, some additional sampling of lowland area surface water was conducted during the second groundwater sampling round in June 1999 to further assist in identifying possible transport processes for metals in surface water during the dry season.

4.4.1 Upland Area Hydrology

There are no surface water features in the portion of the upland area that is adjacent to the lowland area with the exception of several small surface seeps observed near the SR-529 northbound off ramp and East Marine View Drive (northeast of the fenced area). These seeps were observed following a period of prolonged precipitation (see Exhibit 4-9).

Storm water runoff analyses from the supplemental lowland area investigation (Asarco, 1996) estimated that a third of the rainfall in the upland area potentially becomes runoff. Approximately 60 percent of the precipitation near the SR-529 overpass is predicted to runoff under similar conditions because of increased percent pavement.

Storm water runoff throughout the upland area drains to a series of catch basins within the residential areas, along East Marine View Drive and in the overpass/access ramp area to SR-529. Storm water catch basins and monitoring locations are shown on Exhibit 4-9.

There is no direct storm water runoff from the upland area to the lowland area. Catch basins within the residential area and on East Marine View Drive south of the SR-529 overpass are connected to the City's combined sewer/storm water system. Catch basins on the SR-529 interchange and the portion of East Marine View Drive north of the overpass discharge to the lowland area through an outfall located beneath the SR-529 overpass (City outfall and original SW-17 location) as shown on Exhibit 4-9.

Storm water flows have been measured at various surface water sampling sites in the upland area as part of the RI (Asarco, 1995a) and more recently as part of the storm water investigation (Asarco, 1998c). Several sites were instrumented with continuous flow recorders and automated samplers during the storm water investigation. The hydrograph data from the sites with continuous recorders are particularly useful for evaluating the hydrologic response of the upland area to rainfall runoff and are included as Appendix E. The sites that were instrumented in the upland area were CB-9, a catch basin on Pilchuck Path which receives runoff from a portion of the fenced area; and MH-2, which is in the City's storm water/sewer system at the corner of East Marine View Drive and Butler Street (see Exhibit 4-9). Two separate flow meters were installed at MH-2 to determine flow rates for inlet lines on East Marine View Drive (EMV) and Butler Street (BL).

Flow was only present at CB-9 in direct response to precipitation. MH-2 showed some component of "baseflow" during dry periods reflecting discharge sources other than direct rainfall runoff. The time of concentration of runoff at CB-9 was nearly instantaneous, and the hydrographs dropped abruptly at the end of a rainfall event indicating that the runoff originates primarily from impervious paved areas (see Appendix E). Residential areas appeared to contribute little runoff at this site. Maximum peak discharge recorded at CB-9 for the monitoring periods January 28-31, 1999, February 5-9, 1999, and February 17-18, 1999 was approximately 0.15 cubic feet per second (cfs). This peak discharge resulted from a precipitation intensity of 0.06 inches of rain within a 15 minute period.

Hydrographs for MH-2 (see Appendix E) show storm water discharge patterns in the City's sewer/storm water system at a point immediately downstream of the fenced area (see Exhibit 4-9). Hydrographs for both of the inlets (EMV and BL) show the presence of some baseflow during intervals between storms, that likely represent sewer discharge and groundwater inflows. The hydrograph for MH-2 EMV inlet rises and declines rapidly in direct response to precipitation events indicating that the primary source of inflow is likely direct runoff from East Marine View Drive which is immediately upgradient (north) of the manhole. In contrast, the hydrographs for MH-2 BL inlet taper off gradually after rainfall ends. After a sustained wet period in the beginning of February 1999, it took almost a week before MH-2 BL returned to baseflow conditions. The extended period of discharge following a precipitation event indicates a component of groundwater inflow to the storm water system following wet periods.

Baseflows at MH-2 EMV and MH-2 BL were approximately 0.06 cfs and 0.02 cfs, respectively. The maximum discharge recorded at MH-2 over the period of monitoring was 0.9 cfs (approximately 400 gpm). This peak discharge resulted from a precipitation intensity of 0.05 inches over a 15 minute period.

As previously noted, several small seeps formed along the south side of the SR-529 off-ramp (northeast of the fenced area) after prolonged periods of precipitation this past winter. SEEP-1 was identified in January 1999 during the storm water investigation and was sampled twice during that month. Flow rates at SEEP-1 were between 1 and 2 gpm. Another smaller seep (SEEP-2) formed approximately 30 feet west of SEEP-1 in the latter part of January (see Exhibit 4-9). Samples were collected from both SEEP-1 and SEEP-2 in February 1999. Two additional seeps (SEEP-3 and SEEP-4) were observed in March 1999 on the steep slope bordering the SR-529 off-ramp (further west of SEEP-2). Since mid March, 1999 through August, 1999, Asarco did not observe measurable flow at any of the four seeps.

In January, 1999. the City noted that sand was being eroded from the sidewalk adjacent to SEEP-1 and evaluated the location for a possible water line leak. No leaking water lines were discovered, but the City did uncover a six-inch drain line running parallel to the off-ramp. The City did not have any knowledge or documentation of the drain line, so Asarco further investigated the drain line by identifying the source or beginning of the line. Asarco's investigation indicated that the drain line did not originate from the fenced area, but ran parallel to the offramp beyond the seeps. Because the line did not appear to originate from the fenced area and continued to Broadway Street, Asarco did not continue its investigation of the source of the line. Ruling out the drain line, the source of the seeps appears to be shallow groundwater seepage from the fenced area that occurs when local soils are fully saturated. The observed drain line and the sand bedding for the sidewalk may be providing a conduit for drainage. SEEP-1 formed at the edge of the sidewalk at a point where a new sidewalk concrete panel was recently pored. This modification may have blocked the drainage through the sand substrate beneath the sidewalk. Discharge from the seeps flowed onto East Marine View Drive and then north to catch basins beneath the SR-529 overpass.

4.4.1.1 Upland Area Surface Water/ Storm Water Quality

Total arsenic concentrations from grab samples at storm water and surface water sampling sites are shown on Exhibit 4-9. The data validation report is included as Appendix E. Total arsenic concentrations in direct runoff (catch basin sampling sites) ranged from <0.005 mg/L to 1.9 mg/L. The catch basins showing the highest arsenic concentrations (CB-14, CB-15) receive direct runoff from the former arsenic processing location within the fenced area. Total arsenic concentrations in residential properties outside of the fenced area ranged from <0.005 mg/L to 0.013 mg/L. The highest arsenic concentrations were observed in the surface seeps and in samples from manhole sampling sites. SEEP-1 had total arsenic concentrations ranging from 8.4 mg/L to 21 mg/L. SEEP-2 had a total arsenic concentration of 16 mg/L. These seeps are immediately adjacent to a flue structure with high residual soil arsenic concentrations (Asarco, 1998b).

Manhole sampling sites (MH1, MH-2, MH-3, MH-6 and MH-7) collected samples coming from the fenced area and showed the highest arsenic concentrations. Total arsenic concentrations at these sites ranged from 1.2 mg/L to 39 mg/L. The highest arsenic concentration was detected in MH-7 which is located in the alley between Pilchuck Path and East Marine View Drive and receives flow from the fenced area. In general, the manhole sample results are much higher than the surface water runoff samples from the same locations.

Autosamplers were also installed at two locations (CB-9 and MH-2) which collected continuous (every 15 minutes) 1.5 hour composite samples. A data validation report for the autosampler results is included in Appendix E. Discharge and water quality results from the continuous monitoring period at MH-2 indicate that the high arsenic concentrations are associated with periods of elevated baseflow after the direct runoff peak. These late stage flows appear to originate from groundwater infiltration to the sewers in the fenced area. This infiltration may be due to direct infiltration as a result of leaks in the sewer line or there may be foundation drains in the fenced area which are connected to the sewer line.

Total arsenic concentrations decrease in downgradient manholes. Where the sewer lines converge at MH-2 downstream of the fenced area, total arsenic concentrations ranged from 1.8 to 4.6 mg/L.

Total lead concentrations in direct runoff ranged from 0.11 mg/L to less than detection (<0.005 mg/L). The location with the highest lead concentrations were associated with runoff from the fenced area. However, low levels of lead (0.005 mg/L to 0.055 mg/L) were present at catch basins throughout the upland area. Dissolved lead was less than detection at virtually all of the sites indicating that it is primarily present as suspended solids. Total lead concentrations in the seeps (<0.005 to 0.37 mg/L) and manhole samples (<0.005 to 0.047 mg/L) were low compared to arsenic concentrations. Since arsenic is present primarily in the dissolved phase and lead in the particulate phase, the high arsenic and low lead concentrations are characteristic of a groundwater source.

Cadmium was detected at sites where arsenic was present at concentrations greater than 1 mg/L. Of these locations, only one had direct runoff (CB-9) which measured 0.004 mg/L total cadmium during one event. Cadmium was present in total and dissolved samples at SEEP-1 and ranged from 0.014 mg/L to 0.024 mg/L. Total and dissolved cadmium were also present at the manhole sampling locations. Total cadmium at the manhole monitoring sites ranged from < 0.002 mg/L to 0.009 mg/L. Dissolved cadmium ranged from < 0.002 mg/L to 0.006 mg/L.

In summary, arsenic was found to be present in surface runoff at concentrations in excess of 1 mg/L at two catch basin locations which lie directly downgradient from former arsenic processing facilities in the fenced area. Arsenic concentrations were consistently low (<0.005 mg/L to 0.013 mg/L) at catch basin sites in the surrounding residential properties. The highest arsenic concentrations (16 mg/L to 39 mg/L) were detected in seeps directly north and northeast of the fenced area and at the manhole sampling sites in the alley east of Pilchuck Path and directly south of the fenced area. These sites appear to be subject to localized groundwater discharge following periods of prolonged precipitation.

4.4.2 Lowland Area Hydrology

Surface water is present in various ditches and low-lying depressions (wet areas) throughout the lowland area (see Exhibit 4-9). These features intersect the shallow groundwater table within the lowland area fill. There is typically no observable flow in most of the ditches and wet areas except when there is active storm water runoff. The lowland area receives some storm water runoff from the SR-529 overpass which has an outfall (City outfall and original SW-17 location) beneath the overpass (see Exhibit 4-9). The City also recently connected an additional storm drain system on East Marine View Drive to this same outfall. The connection of this new storm drain system likely increased the drainage area covered by this outfall substantially. With the exception of this one outfall, surface water in the lowland area is derived either from direct precipitation or from shallow groundwater discharge.

Drainage is poorly developed in the lowland area. There are a series of ditches at the base of the slag pile that carry storm water to a wet area (WA-1) beneath the SR-529 overpass. A culvert allows water to cross beneath the BNSF switchyard tracks and discharge to another wet area (WA-3) east of the BNSF railroad tracks (see Exhibit 4-9). According to Weyerhaeuser personnel (Harold Rupert, pers comm., 1998), wet area WA-3 was once a maintained ditch that led to an outfall at the Snohomish River. However, the ditch was not maintained and the lower portion of the trench connecting wet area WA-3 to the Snohomish River outfall was filled in. As a result, the wet area formed a closed depression with no outlet. Storm water runoff would simply collect and infiltrate to groundwater.

In 1998, Weyerhaeuser re-established the drainage ditch connecting the lower end of this wet area to the outfall on the Snohomish River (see Exhibit 4-9). This was one of a series of drainage improvements that Weyerhaeuser made prior to the sale of the Weyerhaeuser East Site to the Port of Everett. As a result of these improvements, storm water runoff can now potentially flow directly to the Snohomish River, rather than infiltrating to groundwater. Additional storm water improvements made by Weyerhaeuser in 1998 included excavation of a trench from the City outfall (original SW-17 location) to another large wet area (SW-2) north of the PUD substation (see Exhibit 4-9).

A number of stations were established in the lowland area to monitor storm water flows and water quality during the storm water investigation (Asarco, 1998c). Two sites, relocated SW-17 and SW-18 were instrumented with continuous flow meters and automated water quality samplers for several weeks during January and February of 1999. Instruments were initially installed at relocated SW-17 immediately upgradient of the City outfall (original SW-17) because the City outfall was submerged. However, problems with sediment accumulation prevented flow measurements at the relocated SW-17 site. To address this problem, two flow meters were re-installed further upgradient from relocated SW-17. A flow meter, SW-17 SBL, was installed in the south line coming from the SR-529 overpass and a second flow meter, SW-17 WBL, was installed in the west line coming down the Snohomish County PUD access road from East Marine View Drive (see Exhibit 4-9).

Hydrographs from the two SW-17 flow monitoring stations (SBL and WBL) are included in Appendix E. There was no flow measured in SW-17 SBL except during rainfall events and the runoff response at this station was rapid. In contrast, SW-17 WBL had continuous baseflow of approximately 0.1 cfs (45 gpm) and a much slower runoff response during storm events. SW-17 WBL showed an approximate time of concentration of one hour. The maximum peak discharge recorded for the monitoring periods February 16-17, February 18-19, and February 20, 1999 at site SW-17 was 0.8 cfs (approximately 350 gpm). This peak discharge resulted from a precipitation intensity of 0.04 inches of rain over a 30 minute period.

The lowland area to the south of SR-529 does not receive runoff from the upland area. Consequently, flow rates are much more limited. The ditch system along the slag pile was flooded during the wet season but there was no actual flow visible during the storm sampling events. A flow of 0.35 gpm was measured in June, 1999 at SW-2 after water levels had declined.

As described previously, the only location where surface water can cross under the BNSF railroad tracks to discharge to the Snohomish River is through a culvert at SW-14 (see

Exhibit 4-9). The vegetation in the wet area (WA-3) east of the BNSF railroad tracks is so dense that evidence of any surface flow cannot be seen. Flow is evident however, at SW-18 downgradient of the wet area (see Exhibit 4-9).

As previously noted, Weyerhaeuser recently constructed a trench connecting this wet area to a storm water outfall on the Snohomish River. The hydrographs for SW-18 (see Appendix E) show continuous outflow with diurnal variations due to tidal flooding of the ditch. Broader scale fluctuations are superimposed on these tidal effects in response to wet periods. The hydrographs also show a short duration anomaly when the high tide exceeds 4.2 feet (MSL). These spikes are believed to be recorder error that occurred when the discharge pipe was fully submerged.

Baseflow from the wet area ranged from 0.1 cfs to 0.2 cfs (45 gpm to 90 gpm) during a two week period in January, 1999 with little precipitation. Flow increased to a maximum of 0.9 cfs (approximately 400 gpm) following a wet period in early February, 1999. The hydrograph shows no distinct discharge spikes following precipitation events of high intensity and short-duration. Instead, the hydrograph shows gradual increases and decreases associated with periods of precipitation. Runoff effects appear to be buffered by either surface water storage in the wet area or groundwater storage.

Several additional instantaneous flow measurements were taken after the wet season ended to determine seasonal flow variations. By mid June, 1999 flow at SW-18 had decreased to 4 gpm; by August to 1 gpm; and by September, 1999, flow at SW-18 was less than ¼ gpm.

4.4.2.1 Lowland Area Surface Water / Storm Water Quality

Water quality grab samples were collected at surface water stations in the lowland area as part of the storm water investigation (Asarco, 1998c). Arsenic results for grab samples collected in 1999 are depicted in Exhibit 4-9. Water quality samples were also collected using automated samplers at relocated SW-17 as well as SW-18 in January and February 1999. These results are shown on hydrographs in Appendix E. Additional grab samples were collected as part of the recent investigation in June 1999 during groundwater sampling. These results are shown on Exhibit 4-9 as well as with shallow groundwater sampling results on Exhibit 4-7. Data validation reports for the grab sample results and for the composite sample results from the autosamplers are included in Appendix E.

Arsenic results from grab sampling are listed in Table 4-8 and show wet season arsenic concentration trends in the lowland area. Arsenic in surface water south of SR-529 (SW-1) was 0.34 mg/L. This location receives drainage from the ditch system in the slag pile vicinity. North of the SR-529 overpass at original SW-17 (City outfall), arsenic concentrations were comparatively low (0.016 mg/L). Data from the autosampler showed short-term increases in arsenic at relocated SW-17 up to 0.21 mg/L. The source of these short-term increases in arsenic at relocated SW-17 appear to be attributable to the seeps northeast of the fenced area which discharge to the overpass catch basins.

Surface waters from either side of the SR-529 overpass combine and cross under the BNSF railroad tracks at SW-14 producing intermediate arsenic concentrations (0.069 to 0.088 mg/L). Downstream at the lower end of the eastern wet area, arsenic concentrations at SW-18 were 0.086 mg/L, virtually the same as the concentrations upgradient. A second set of samples were collected at SW-18 and at the Snohomish River outfall in March 1999. Samples were collected at low tide to avoid tidal backwater effects. Arsenic concentrations dropped by approximately 30 percent between SW-18 and the Snohomish River outfall, decreasing from 0.08 mg/L to 0.054 mg/L.

Grab sampling conducted during June, 1999 shows a change in arsenic concentrations and flow trends during non-storm water periods (<u>see</u> Exhibit 4-7). During June 1999, the only observable flow entering wet areas (WA-1 and WA-3) was baseflow from the slag pile ditch system. Arsenic concentrations decreased from 0.54 mg/L leaving the slag pile area to 0.13 mg/L entering the wet area WA-3. Arsenic concentrations then increased at SW-18 to 0.18 mg/L. Observed flow rates also increased at SW-18 suggesting there may have been a groundwater flow component contributing flow and arsenic to the surface water in the wet area WA-3. The source of this groundwater is not immediately evident, since arsenic does not appear to be elevated at any of the groundwater sampling sites surrounding the wet area (see Exhibit 4-7). Groundwater could be discharging to the wet area and mobilizing arsenic that has accumulated in the sediments. This issue is discussed further in Section 5.1.

Lead was detected in lowland area surface water at widely varying concentrations ranging from 0.005 to 0.65 mg/L (total concentrations). The results at individual sample sites were also highly variable. For example, the high lead value of 0.65 mg/L was collected at SW-18 using an automated sampler. Sequential samples taken before and after this one were very low (<0.005 to 0.008 mg/L). As in most samples, no dissolved lead was present, indicating that the lead is contained in particulate matter. While the lead in slag is a potential source for these detected values, the highest lead values were detected upgradient of the slag pile at SW-19. This site has had various industrial uses including use as an auto salvage yard. In all likelihood, there may be numerous sources for particulate lead at this location. There was no detectable cadmium in any of the lowland area surface water samples.

4.5 DISCUSSION OF LOWLAND AREA GROUNDWATER / SURFACE WATER INTERACTION

In the lowland area, groundwater is present near the ground surface (static water levels in shallow wells are typically within a few feet of the ground surface). Therefore, surface water features in the lowland area intersect the shallow groundwater table at many locations and there is a significant potential for mixing of surface water and shallow groundwater. This interaction between shallow groundwater and surface water can affect both surface water and groundwater quality, depending on seasonal fluctuations in groundwater flow, recharge and discharge relationships, storm events and runoff patterns, and the concentrations of parameters of interest (e.g., arsenic) in various surface water and groundwater sources.

Groundwater and surface water interactions are evaluated based on the hydrology and water chemistry of the shallow groundwater and surface water systems. In particular, the major ion composition and arsenic speciation (As^{+3} and As^{+5} ratios) of surface water and shallow groundwater have been reviewed to evaluate locations of potential mixing. This evaluation is based on June 1999 samples since this sampling round included the most comprehensive suite of parameters for both surface water and shallow groundwater. Two general locations have been evaluated. One is the ditch system and wet area, WA-1, south of the SR-529 overpass. The other location is wet area WA-3 east of the BNSF railroad tracks.

4.5.1 Surface Water/Groundwater Interactions South of SR-529 and West of BNSF Switchyard Tracks

As previously noted, flow gain and loss and mixing relationships presumably change throughout the year in the lowland area, in response to seasonal variations in precipitation. Potentiometric maps of the shallow groundwater system (see Figures 4-4 and 4-5) indicate that regional shallow groundwater flow is to the east toward the Snohomish River. However, between the upland area bluff and the slag pile, the potentiometric data indicate that flow may be to the north parallel to the surface water drainage ditch at the base of the slag pile. Compacted, less permeable subsurface material below the BNSF switchyard tracks may be responsible for this alteration in shallow groundwater flow direction.

A surface water drainage ditch is present in this area and the surface water levels in the ditch are identical to the shallow groundwater levels in the adjacent monitoring well EV-7A. Figure 4-13 shows the major ion composition of shallow groundwater in three units including the lowland area fill, the upland area fill/till, and the lowland area slag, as well as the composition of surface water samples collected during the same period in the lowland area. A comparison of water quality indicates that surface water and shallow groundwater within the slag pile footprint are virtually identical in terms of chemical composition. Therefore, surface water in the drainage ditch is essentially an expression of the shallow groundwater table.

Groundwater and surface water in the slag pile area flow north toward wet area WA-1 near the SR-529 overpass. Water elevation and flow data in this location are limited, and are insufficient to assess whether surface water gains or loses flow. However, this wet area receives drainage from the ditch system to the south and appears to be a natural discharge point. Major ion chemistry and arsenic speciation data suggest that this wet area is receiving shallow groundwater discharge. The major ion chemistry at SW-14 as shown on the Piper diagram (see Figure 4-13) is of intermediate composition between surface water north and south of the SR-529 overpass and the shallow groundwater at EV-23A. These data again suggest that this wet area is a natural discharge point for both surface water and shallow groundwater.

Arsenic speciation data from SW-14 also appears to support a mixture of nearby shallow groundwater and surface water sources at this location. Arsenic speciation analyses (separation of dissolved arsenic concentrations into fractions of As^{+3} and As^{+5}) were conducted on samples collected during the June 1999 sampling event. Figure 4-14 summarizes arsenic speciation, along with dissolved arsenic concentrations, for surface water and shallow groundwater in the lowland area during this event. A schematic representation of general surface water flow paths also is included for reference on Figure 4-14. Because of the relative stability of arsenic species in the natural environment (species usually interconvert very slowly in the presence of the most common environmental oxidizing agent, molecular oxygen), speciation results may provide additional information on potential groundwater/surface water mixing in the lowland area since a mixture of two or more sources will likely have a speciation composition that is proportional to that of the end members.

Assuming that water at SW-14 is derived from a mixture of shallow groundwater (EV-23A) and surface water (SW-1), a mixing proportion of 80 percent groundwater and 20 percent surface water yields a water with the approximate arsenic concentration and speciation of the June 1999 sample at SW-14 (see Figure 4-14).

4.5.2 Surface Water/Groundwater Interactions East of BNSF Switchyard Tracks

A culvert installed by Weyerhaeuser passes beneath the BNSF switchyard tracks and connects wet area WA-1 at the base of the SR-529 overpass with wet area WA-3 directly east of the tracks. Flow is rarely visible at the head of wet area WA-3 (SW-14) but there is consistent flow at its lower end (SW-18). Even during periods of relatively high discharges in January and February 1999, water did not appear to be moving at the head of wet area WA-3, yet discharges of 45 to 90 gpm were measured at SW-18 at the downstream end. During June 1999, location SW-2 (the ditch discharging from the slag pile into the south end of wet area WA-1 west of BNSF switchyard tracks) was flowing at approximately 0.35 gpm. No measurable flow was noted at original SW-17 (City outfall) from the north of wet area WA-1. Location SW-18 and the Snohomish River outfall were both flowing at approximately 4 gpm. This apparent gain in flow through the surface water system appears to indicate discharge from the shallow groundwater to surface water.

Major ion chemistry provides no clear indication of groundwater/surface water mixing relationships, in part due to the general similarity of shallow groundwater and surface water (see Figure 4-13). Therefore, no clear end members exist to define mixing relationships. Arsenic speciation ratios are similar between SW-14 and SW-18 (see Figure 4-14). However, concentrations are much higher at SW-18 (0.22 mg/L) than at SW-14 (0.095 mg/L). The low arsenic concentrations in nearby shallow groundwater (e.g., 0.009 mg/L at HP-57) suggest an arsenic source other than shallow groundwater.

The groundwater potentiometric contours wrap around the lower end of wet area WA-3 (see Figures 4-4 and 4-5). This indicates that surface water may lose flow to the shallow groundwater system at the lower boundary of this wet area. Major ion chemistry at sampling points near the east end of wet area WA-3 are highly variable and show no clear link between surface water quality and nearby shallow groundwater quality. The arsenic speciation in shallow groundwater is also ambiguous. While composition of arsenic species between surface water and shallow groundwater are similar, the shallow groundwater shows much lower total arsenic concentrations.

Overall, arsenic speciation, major ion chemistry, and flow/water elevation data, and visual observations suggest that shallow groundwater/surface water interactions do occur throughout the lowland area. However, the system is complex and is subject to seasonal variability in surface water flow and quality, as well as shallow groundwater quality. In addition, analysis of surface water and shallow groundwater relationships in the lowland area is complicated by the typically low flows (near the limits of field measurement capabilities) and the possible presence of multiple arsenic source areas other than the shallow groundwater including the slag pile, an upland area outfall, and the wet area sediments.

5.0 FATE AND TRANSPORT ANALYSIS

This section evaluates potential source materials and areas that may cause or contribute to elevated arsenic concentrations detected in lowland area groundwater and surface water. In addition, a fate and transport evaluation has been performed to identify potential routes of migration and geochemical controls. Discussion on water balance and loading, as well as City of Everett biosolid data and Snohomish River sediment data are also included.

5.1 POTENTIAL SOURCE MATERIALS AND SOURCE AREAS

5.1.1 Lowland Area Shallow Groundwater

5.1.1.1 Slag Pile Vicinity

Arsenic concentrations of 1 to 3 mg/L have been detected in shallow groundwater in the slag pile vicinity to the west of the BNSF switchyard tracks (see Exhibit 4-7). The extent of arsenic in this shallow groundwater system was described previously in Section 4.3.4. The following potential sources of arsenic in shallow groundwater in this vicinity have been identified:

- Slag.
- Overlying soils or other non-slag fill materials within the slag pile vicinity.
- Diffuse inflow of shallow groundwater from the fenced area in the upland area.
- Inflow from a localized source in the upland area.

Other sources may have contributed to elevated concentrations of arsenic but are no longer evident.

Arsenic is present in slag in the lowland area at concentrations ranging from 65 mg/kg to 2,200 mg/kg and in the shallow overlying soils at concentrations ranging from less than 0.5 mg/kg to 400 mg/kg. The maximum arsenic concentration in lowland soils (4,194 mg/kg) was detected at HP-4 in a thin peat layer underlying the fill south of the slag pile (see Exhibit 4-1). As part of the recent lowland area investigation, Asarco conducted a series of leaching tests on shallow (0'-2') and deep (5'-7') soil samples from the slag pile area (see Figure 3-2). A modified SPLP analysis was conducted on seven samples at varying pH levels ranging between 7 and 11. The results are summarized in Table 5-1.

Average arsenic concentrations produced during leaching tests were generally less than 0.5 mg/L. However, one sample from boring LB-16 produced arsenic concentrations ranging from 1.3 mg/L to 1.67 mg/L under varying pH conditions. All of the samples produced elevated pHs (8.5 to 10.5) when starting with a neutral leaching solution.

The arsenic concentrations and pHs produced in the extractions are generally similar to those observed in shallow groundwater in the slag pile vicinity. Arsenic concentration trends in upgradient wells, however, suggest there are other potential sources for the higher arsenic concentrations observed in the slag pile vicinity.

The arsenic trend maps in Exhibits 4-7 and 4-8 show a relatively narrow arsenic plume in the upland shallow and deep groundwater systems that coincides with arsenic concentrations in EV-17A at the upgradient margin of the slag pile. The seasonal occurrence of shallow groundwater in the upland area and the complex geology separating it from the shallow lowland area make it very difficult to define or quantify its influence on shallow groundwater quality in the lowland area. However, the comparatively high arsenic concentrations in this upgradient area (>25 mg/L) and the consistent pattern of elevated arsenic along this flow path suggest that an upland source probably accounts for the higher arsenic concentrations observed in shallow groundwater in the slag pile vicinity.

Arsenic speciation results from EV-20B are similar to groundwater in the slag pile area. This upland area source of arsenic is most likely contributing to both the shallow and deep groundwater systems in the lowland area.

5.1.1.2 Port of Everett Property

Hydropunch sampling conducted during the recent lowland area investigation shows an area of elevated arsenic concentrations of 0.21 to 0.56 mg/L in shallow groundwater at the north end of the Port of Everett (see Exhibit 4-7). The supplemental lowland investigation (Asarco, 1996) identified in-place soils, upgradient surface water, and the soils in the SR-529 overpass area as potential source areas for detected arsenic concentrations in shallow groundwater. Additional groundwater sampling was conducted in upgradient areas to help define the source of this arsenic. The results (see Exhibit 4-7) indicate that dissolved arsenic concentrations in upgradient areas are comparatively low (0.007 mg/L) and suggest that the source of arsenic is on-site soils. Elevated arsenic concentrations were also detected in shallow soils from this area (see Exhibit 4-1).

5.1.1.3 Former Weyerhaeuser West Site

Monitoring data for the former Weyerhaeuser West Site (Emcon, 1994) show arsenic concentrations in groundwater ranging from less than 0.003 mg/L to 0.1 mg/L (see Exhibit 4-7). There are no comprehensive soil data available that show the distribution of arsenic at this site. Dissolved arsenic concentrations in groundwater are at or near laboratory method detection limits (<0.003 to 0.007 mg/L) in the lowland area at the upgradient boundary of the former Weyerhaeuser West Site. The irregular occurrence of arsenic on this site and the low concentrations along the upgradient boundary of the site suggest the smelter impacted soils are not contributing to arsenic loading on the former Weyerhaeuser West Site.

5.1.1.4 Former Weyerhaeuser Mill E/Koppers Site

Dissolved arsenic concentrations ranging from 0.1 to greater than 10 mg/L have been detected in shallow groundwater at the former Weyerhaeuser Mill E/Koppers Site with a mean concentration in shallow groundwater of 2.17 mg/L (Emcon, 1994). Concentrations of arsenic in soils range from 0.4 to over 400 mg/kg (Emcon, 1994). Emcon attributed the highest concentrations of arsenic to wood treatment facilities (Emcon, 1994). In addition to use of arsenic at on-site wood treatment facilities, Emcon cited the smelter operation as potentially contributing to arsenic in soils and groundwater at this site. However, groundwater samples collected as part of the former Weyerhaeuser Mill E/Koppers Site studies and as part of Asarco's recent lowland area investigation show a pattern of dissolved arsenic concentrations decreasing upgradient of the site. Arsenic concentrations are at or near the laboratory method detection limit (<0.005 to 0.006 mg/L) in the area between former Weyerhaeuser Mill E/Koppers Site and the fenced area and slag pile vicinity (HP-111, HP-8, MW-3, MW-5, MW-109S, HP-13, and HP-14). This indicates that dissolved arsenic in shallow groundwater in the vicinity of the fenced area in the upland area and slag pile vicinity in the lowland area (see Exhibit 4-7) are not contributing arsenic to the former Weyerhaeuser Mill E/Koppers Site.

Dissolved arsenic concentrations ranging from approximately 0.04 to 0.05 mg/L have been detected in shallow groundwater at MW-2. As discussed in the RI (Asarco, 1995a), this monitoring well appeared to penetrate a waste pile within the shallow fill layer, which included abundant metal and wood debris. The results are not believed to be representative of water quality from upgradient areas. Monitoring wells and hydropunch sampling to the east (HP-12 and MW-1) of MW-2 have generally encountered fine-grained material in the area west of the BNSF railroad tracks. Where it has been encountered (EV-15 and EV-16), groundwater flux is estimated to be very low. Even in the slag pile area where permeabilities are high and arsenic is present at concentrations greater than 1 mg/L, arsenic does not show evidence of migrating to the east of the switchyard tracks. There is evidence that the low permeability of the fill beneath the switchyard tracks effectively limits arsenic migration in the shallow groundwater system.

5.1.2 Lowland Area Deep Groundwater

The supplemental lowland area report (Asarco, 1996) identified a relatively narrow plume of arsenic in deep groundwater within the lowland area alluvium. The maximum concentration of arsenic detected in deep groundwater within the lowland area was 15 mg/L at HP-23. This hydropunch location is at the upgradient boundary of the lowland area (see Exhibit 4-8). TCLP analyses conducted during the RI (Asarco, 1995a) suggest that soil arsenic concentrations well in excess of 10,000 mg/kg would be required to generate the arsenic concentrations observed in groundwater in the alluvium, which effectively eliminates the alluvial soils and other lowland area soils, including slag, sampled to date. Consequently, the supplemental lowland area investigation (Asarco, 1996) concluded that there must be an upgradient source for this plume.

The recent lowland area investigation identified similar arsenic concentrations in the deep upland area outwash deposits immediately upgradient of the lowland area plume (EV-19B and EV-20B). These results clearly indicate an upland source for the arsenic plume. Storm water sampling conducted during this period identified shallow groundwater seeps in this same area following periods of prolonged precipitation. Arsenic concentrations in the seeps (SEEP1 and SEEP 2) ranged from 8.4 to 21 mg/L. This area (northern portion of the fenced area) is a likely source for the observed arsenic.

5.2 FATE AND TRANSPORT OF TRACE METALS

5.2.1 Water Balance and Loading Analysis

A water balance was developed for the lowland area during the supplemental lowland area investigation (Asarco, 1996). The water balance provided quantitative flow data that, combined with water quality data, were used to assess the potential arsenic loading to surface water and groundwater.

Data collected during the recent lowland area investigation are consistent with the 1996 supplemental lowland area investigation. Therefore, a new water balance has not been developed. However, flow paths are discussed in detail in Section 5.2.2 and new loading estimates for surface water using recently collected water quality data are presented in Section 5.2.3.

5.2.2 Groundwater Transport

Groundwater in both the fill (shallow groundwater system) and alluvium (deeper groundwater system) in the lowland area discharge to the Snohomish River, providing a potential pathway for arsenic movement. However, the actual potential for dissolved arsenic to reach the Snohomish River in these shallow and deep groundwater systems depends on both physical and geochemical process occurring in the aquifers.

The geochemical mobility of arsenic in groundwater is commonly affected by adsorption and coprecipitation processes. Adsorption, the binding and retention of soluble ions by solid material, may occur through two general mechanisms, specific and non-specific. Specific adsorption is a process of chemical bond formation between the adsorbed ion and a constituent of the solid matrix. Non-specific adsorption is an ion exchange process, where the interaction between the adsorbed ion and the solid is controlled by electrostatic (charge) factors only, rather than by the chemical bonding properties of individual elements. Coprecipitation of arsenic with iron oxide in the form of ferric arsenate and/or ferric hydroxy arsenate is another attenuation mechanism that may be occurring.

The relationship between estimated groundwater travel times and actual plume migration rates can be used to assess the prevalence of geochemical attenuation mechanisms. Average groundwater velocities for both the shallow and deep groundwater systems are approximately 0.4 to 1 foot per day. At these rates of flow, groundwater would cross the approximate 1,700-foot distance to the Snohomish River in 5 to 12 years. The former smelter ceased operations over 84 years ago, yet mg/L arsenic concentrations in the shallow groundwater system have not been detected east of the BNSF railroad tracks. In addition, the mg/L arsenic plume in the deep groundwater system remains over 500 feet from the Snohomish River.

The contrast in dissolved arsenic concentrations in shallow groundwater west and east of the BNSF railroad tracks (1 to 3 mg/L west versus 0.007 mg/L or less east) is also accompanied by changes in general water chemistry (pH, dissolved oxygen and major ion concentrations). These distinct geochemical changes combined with potentiometric relationships discussed previously in Section 4.3 suggest there is minimal flow across the BNSF switchyard tracks through the shallow groundwater system. In contrast, the deep groundwater system has a more extensive arsenic plume that shows a progressive decrease in concentrations, which is more indicative of attenuation process.

Although current data from the lowland area do not suggest a definitive mechanism for arsenic attenuation, it is likely that adsorption and/or coprecipitation of arsenic species is an important process in removing arsenic from groundwater. Attenuation of arsenic would significantly reduce the rate of migration in the groundwater system and slow the migration process.

Physical processes such as dispersion and mixing also have a significant effect on arsenic transport. Unlike geochemical processes, physical flow processes can significantly reduce arsenic concentrations but do not affect overall loading. The potential for reduction of arsenic concentrations due to dispersion and mixing are significantly increased in a tidally influenced aquifer. Tidal oscillations have two effects. First, physical dispersion of the arsenic within the aquifer is greatly increased by continuously alternating flow directions and gradients. Second, fresh water enters the aquifer during a rising tide, which dilutes ambient groundwater prior to discharge during the falling tide. Since the tidally induced gradients near the Snohomish River shoreline can be much larger than the ambient groundwater gradient, significant dilution of a contaminant plume can occur. In a case study of an arsenic plume in a sand aquifer in New Jersey, Yim and Mohson (1992) showed groundwater arsenic concentrations were reduced from 0.6 mg/L to concentrations of less than 0.02 mg/L within 100 feet of a shoreline due to the effect of 6 foot tidal fluctuations in the receiving water. Yim and Mohson developed a one dimensional mixing model for tidally induced flow systems and concluded that discharge concentrations will be very close to ambient concentrations in receiving waters on sites where the tidal amplitude is high and regional gradients low.

In the area west of the Snohomish River, the deep groundwater system in the alluvium is subject to 10-foot tidal fluctuations. Water quality data from the former Weyerhaeuser Mill E/Koppers Site (Emcon, 1994) show reductions in arsenic concentrations similar to those described by Yim and Mohson in the vicinity of the Snohomish River shoreline. Arsenic concentrations up to 15 mg/L in groundwater at the former Weyerhaeuser Mill E/Koppers Site decrease to 0.2 mg/L or less at the Snohomish River shoreline within a distance of less than 100 feet. Emcon calculated a further dilution factor of approximately 650:1 within a distance of 1 foot from the bulkhead due to instantaneous mixing with river waters (Emcon, 1994).

Arsenic concentrations in groundwater near the Snohomish River shoreline range from <0.005 mg/L to 0.024 mg/L. These waters meet the marine chronic criteria of 0.036 mg/L arsenic prior to any dilution. The higher concentration arsenic plume in the deep groundwater system (0.1 to 2.6 mg/L) is 600 to 700 feet from the Snohomish River shoreline (see Exhibit 4-8). If the present plume configuration is assumed to represent a gradual advance of arsenic concentrations since operation of the smelter, the calculated rate of plume advance is approximately 0.04 ft/day. At this rate, it would take approximately 40 more years before the plume would reach the Snohomish River. This assumes the plume is not already stable or attenuating. The long-term potential for continued migration will depend in part on whether the source area(s) is stabilized and the extent to which natural attenuation is occurring.

5.2.3 Surface Water / Storm Water Transport

Arsenic concentration and flow data from the storm water investigation were used to assess surface water arsenic loading relationships. The results are somewhat qualitative because of variations in the timing of storm water samples, but are still useful as an indicator of the magnitude of loading associated with surface water runoff from specific areas. The results are compiled in Table 5-2 and indicate the following:

- Upland area neighborhoods outside the fenced area account for less than 1/100th of 1 percent of the arsenic load observed in storm water samples.
- Arsenic loading from the fenced area was on the order of 3-4 pounds per day during periods of storm water sampling in January and February of 1999. Over 75 percent of the observed arsenic load discharges to the City's sewer/storm water system. Further

discussion of arsenic loading to the City's system is presented in Section 5.2.3.1. Most of the remaining arsenic load was derived from SEEP 1 (0.5 lbs./day) at the northeast corner of the fenced area. Runoff from the seep flowed to storm water catch basins in the SR-529 and East Marine View Drive interchange. At least half of the arsenic load from SEEP 1 can be accounted for by catch basin CB-46 where East Marine View Drive passes beneath SR-529. This location and others in the SR-529 and East Marine View Drive interchange discharge to the lowland area via the City outfall (original SW-17).

- The City outfall (original SW-17) as well as upgradient relocated SW-17 receives flow from two sources: East Marine View Drive north of the SR-529 overpass and from the SR-529 and East Marine View Drive intersection itself. The observed arsenic load at relocated SW-17 averaged 0.035 lbs./day during a period in January when an automated sampler and flow meter was installed. The arsenic load appeared to be derived almost completely from the intersection's catch basins based on representative loads measured flowing from the north portion of the fenced area to the intersection's catch basins.
- The only point where surface water in the lowland area crosses under the BNSF switchyard tracks is at SW-14. Location SW-14 receives surface water runoff from the slag pile vicinity and from the City outfall (original SW-17). No storm water flow data was collected at SW-14 due to very high water levels and submerged conditions at the culvert. However, arsenic concentrations during periods of storm water runoff at SW-14 were generally twice that at original SW-17 indicating that the arsenic load from surface water in the slag pile area likely contributes a roughly equivalent load to that derived from original SW-17.
- Storm water sampling data show little increase in arsenic concentrations and arsenic load between SW-18 and upgradient surface water stations during storm events. However, arsenic loads and flows did increase at SW-18 during non-storm periods. No specific groundwater or surface water sources have been identified that can account for the concentration and load increase between the upper and lower ends of this wet area, WA-3. As noted, in 1998 Weyerhaeuser's drainage modifications

created an avenue for discharge of affected storm water directly to the Snohomish River.

- Arsenic loads at SW-18, upgradient of the Snohomish River outfall, ranged from 0.21 lbs./day during the height of the wet season, to less than 0.003 lbs./day in mid summer. Flows and arsenic loads showed a rapidly decreasing trend after the wet season concluded (184 gpm in January, 4 gpm in July, 1 gpm in August, and less than ¼ gpm in September 1999). The arsenic load at SW-18 dropped from 0.01 lbs./day in June, 1999 to less than 0.005 lbs./day in August, 1999. Discussion of Snohomish River sediment data are presented in Section 5.2.3.2.

5.2.3.1 Arsenic Data for Wastewater and Biosolids

An evaluation of arsenic levels in biosolids and effluent from the Everett Water Pollution Control Facility was conducted in 1998 by Asarco with the City's assistance. Asarco attempted to define the relationship between arsenic input and the biosolids and effluent output. Information provided by the City that was reviewed by Asarco were the 1995, 1996, and 1997 Residual Solids Monitoring Reports, the City's NPDES permit (WA-002449-0), spreadsheets containing influent and effluent water quality data for arsenic for samples taken between January 1995 and April 1998, and spreadsheets containing laboratory results of biosolids samples taken in 1993, 1994, and 1998.

To summarize Asarco's evaluation, arsenic concentrations and loading were reviewed for wastewater influent and pond effluent from 1995 through April of 1998. Arsenic concentrations were also reviewed for accumulated biosolids from 1993 through May of 1998. Short term variations in arsenic levels in wastewater influent, pond effluent and accumulated biosolids were observed. Average monthly arsenic concentrations and loading in influent were observed to vary with monthly rainfall. A weaker relationship between average monthly arsenic concentrations in pond effluent and rainfall was also observed. Information regarding Asarco's evaluation is included as Appendix F.

Linear regression analysis was used to evaluate possible trends in arsenic levels in wastewater influent, effluent, and biosolids. Trend lines are shown on several figures (see Appendix F). The slopes of the trend lines were relatively flat and do not indicate any clear increasing or decreasing concentration trends with time.

Average quarterly arsenic concentrations in biosolids are consistently below the ceiling concentrations of 75 mg/kg established in WAC 173-308 Table 1 for the time period evaluated. Average quarterly arsenic concentrations in biosolids occasionally exceed the concentration limit (41 mg/kg) established to help define exceptional quality biosolids (see Appendix F). However, other factors affect whether or not biosolids may be defined as exceptional quality biosolids, including the results of the composite land application characterization sample. These factors include pathogen reduction requirements, vector attraction requirements, and concentrations of other metals. Data indicated that average quarterly cadmium and zinc concentrations also occasionally exceed the concentration limit and average quarterly lead concentrations routinely exceed the concentration limit for exceptional quality biosolids (see Appendix F).

5.2.3.2 Available Snohomish River Sediment Data

Sediment samples adjacent to the lowland area were collected and analyzed by Weyerhaeuser during 1992 to 1995. Three sites were investigated including:

- Former Mill E/Koppers Site
- Former East Site (currently Port of Everett)
- Former Kraft Pulp Mill (West) Site

These sites are shown in Figure 5-1. The following summarizes the principal findings related to arsenic concentrations.

Former Mill E/Koppers Site

Sediment sampling adjacent to the former Mill E/Koppers Site was conducted in three phases. Phases I and II were conducted in 1992 (Emcon, 1993) while Phase III was conducted in 1995 (Emcon, 1996). Phase I sampling consisted of collecting surface grab samples (0-0.06') and/or core composite samples (0-3') along the western shoreline of the Snohomish River during low tide while Phase II consisted of sampling further out in the river channel (see Figure 5-1). Samples were analyzed for volatile organics, metals, semivolatile organics, sediment quality, and sediment conventionals data.

Samples were collected from 30 locations for both, Phase I and II. Fourteen surface grab samples and 18 core composite samples were collected during Phase I while 20 surface grab samples and 20 core composite samples were collected during Phase II. Results of Phase I and II sampling indicated that five samples from three locations (SR-01, SR-02, and SR-05) had arsenic levels exceeding the Sediment Quality Standard (SQS) of 57 mg/kg for arsenic and four samples from two locations (SR-01 and SR-05) exceeded the Cleanup Screening Level (CSL) of 93 mg/kg for arsenic (see Table 5-3). All samples exceeding the SQS and CSL for arsenic were collected during the Phase I investigation, which is near the shoreline.

Phase III was conducted in 1995 to augment data collected from Phases I and II. A total of 18 samples were collected from six locations including SR-01, SR-05, SR-07, SR-10, SR-11, and SR-13 (see Figure 5-1). These six locations were selected because they had samples with levels of arsenic, naphthalene, or acenaphthene that exceeded the CSL criterion during Phase I. Three samples were collected from each location. Sample "A" was placed approximately 10 feet downstream, "B" was placed approximately 10 feet out toward the channel, and "C" was placed approximately 10 feet upstream from the Phase I location.

Results of Phase III sampling indicated that arsenic concentrations from two locations (SR-01 and SR-05) exceeded the SQS criteria while all samples were below the CSL arsenic criteria (see Table 5-3). The report concluded that the outfall near location SR-01 may be on-going source of arsenic. Results at location SR-05 were lower than previously detected during Phase I sampling three years earlier which may be due to a different sampling horizon or to a previously existing outfall that was in the area.

Former East Site

Sediment sampling adjacent to the East Site was performed to assess the suitability of sediments that may be dredged for possible disposal (PTI, 1996). The investigation consisted of sampling the upper four feet of sediments from ten locations (see Figure 5-1). Parameters analyzed were compared to Puget Sound Dredged Disposal Analysis screening levels which included the SQS and CSL criteria.

The ten locations were generally placed downstream of outfalls or other potential sources and within 20 feet of the bulkhead. Samples were analyzed for selected metals, selected VOCs, selected semivolatile organic compounds, organochlorine pesticides and PCBs, PCDDs and PCDFs, ammonia, total sulfides, TOC, TVS, total solids, and grain-size. Laboratory results indicated that all samples had arsenic concentrations less than the SQS level of 57 mg/kg for arsenic. In fact, all arsenic concentrations were less than 17 mg/kg.

Former West Site

Baseline sediment sampling adjacent to the West Site was conducted in 1994 to determine the impact of wastewater outfalls that served the former Kraft pulp mill facility (PTI, 1994). Although the facility no longer operates, it was noted that storm water continues to be discharged from two outfalls. One outfall is near sample location W4-01 (see Figure 5-1) and the other outfall is located on the north side of the Snohomish River. This investigation consisted of collecting surface sediment samples on both shorelines of the Snohomish River as well as across Smith Island in Streamboat Slough and Ebey Slough. A total of 23 locations were sampled. Samples were analyzed for chemical, physical, and biological parameters. Eight samples were collected adjacent to the West Site (see Figure 5-1).

Results indicated that concentrations of metals were low and relatively uniform at all locations. No metals concentrations exceeded either the SQS or CSL criteria. In fact, all arsenic concentrations were less than 12 mg/Kg.

6.0 SUMMARY AND CONCLUSIONS

6.1 FINDINGS

The recent lowland area investigation was performed to fulfill the requirements specified in EO DE97TC-N119, Task 6 issued by Ecology. The investigation provided additional characterization of the nature and extent of contamination in the lowland area portion of the Everett Smelter Site. Details of the investigation were outlined in a work plan (Asarco 1998a) based on the requirements of the EO and also on discussions with Ecology staff before and during the investigation.

6.1.1 Soil

The recent soils investigation consisted of collection of 165 soil samples from 35 locations. Samples were analyzed for total arsenic, cadmium, chromium, copper, lead, and zinc. Six slag samples from three borings were also collected and tested for arsenic leachability at different pH levels. Principal findings of the recent and previous investigations are:

- The maximum concentrations of arsenic in soil occur in upland soils (fill/till unit), within or immediately adjacent to the fenced area. The smelter area investigation established that maximum arsenic concentrations in soils are associated with residual materials in the immediate area of former arsenic processing facilities and include flue dust and arsenic trioxide. Leach test results indicate that these materials contain high concentrations of leachable arsenic that can potentially be mobilized if contacted by infiltrating water.
- Soil samples collected from the bluff separating the upland and lowland areas were significantly lower in arsenic than the upland area soils with concentrations ranging from 5 to 446 mg/kg. The highest concentrations were from sites at the base of the bluff.
- The highest soil arsenic concentrations in the lowland area were present in samples from the slag pile and surrounding fill. Concentrations of arsenic in excess of 1,000 mg/kg were also detected in a thin peat layer that was encountered between the fill and underlying silt units on the Benson Property south of the slag pile. The peat

layer was found to extend south to EV-16. Boyd Benson had additional borings completed in the area south of EV-16 (LB-21, 22 and 23). None of these borings reportedly encountered this peat layer and soil arsenic concentrations were all less than the 200 mg/kg MTCA Method A Industrial cleanup level to a depth of 15.5 feet.

- An area of slightly elevated soil arsenic concentrations (100 to 500 mg/kg) was delineated at the north end of the Port of Everett property.

6.1.2 Groundwater

The recent groundwater investigation consisted of collection of 117 groundwater samples from 63 locations and included several rounds of water level measurements. A total of 16 new groundwater monitoring wells were installed (six shallow and ten deep wells). Groundwater samples were analyzed for field parameters, major ions, and total and dissolved metals. One round of groundwater samples was analyzed for arsenic speciation (As^{+3} and As^{+5}). In addition, slug tests were performed on three newly installed monitoring wells to estimate hydraulic conductivity. Principal findings of the recent and previous investigations are:

- The groundwater flow conditions identified in previous investigations have been confirmed and refined by the additional data collected for this recent investigation. Groundwater interactions between the upland area hydrostratigraphic units and the lowland area groundwater systems have not been specifically quantified, but water level relationships and chemistry data from monitoring wells and surface water stations provide evidence of flow and arsenic transport from the upland area to the lowland area.
- Monthly monitoring of water levels over the last several years show that thin zones of saturation occasionally develop at the top of the till unit in the upland during wet seasons. Sampling conducted at EV-11 and EV-13, has shown dissolved arsenic concentrations of 25 to 47 mg/L.
- Water quality data from additional monitoring wells installed in the upland area during this investigation show the presence of a narrow plume of arsenic in the deep

outwash groundwater system in the area downgradient of EV-13. These arsenic concentrations, and the plume location within the outwash aquifer are also consistent with downgradient arsenic plumes in the shallow and deep lowland groundwater systems.

- Concentrations of 0.1 to 3 mg/L dissolved arsenic were detected in shallow groundwater in the slag pile area. The highest concentration was observed at EV-17A immediately adjacent to the bluff. The arsenic plume at EV-17A appears to be a continuation of the upland area outwash system arsenic plume described above. Arsenic concentrations in the slag pile area decrease to near the detection limit east of the BNSF switchyard tracks.
- While there is an overall eastward gradient toward the Snohomish River in the shallow lowland area groundwater system, groundwater flow appears to be northerly in the area between the bluff and the BNSF switchyard tracks. This northward flow reflects the discharge of groundwater to the surface drainages and wet areas, which subsequently discharge across the BNSF tracks near the SR-529 interchange.
- An area of elevated arsenic in shallow groundwater (dissolved arsenic of 0.21 to 0.56 mg/L) was delineated on the north end of the Port of Everett property. Groundwater arsenic concentrations at surrounding upgradient and downgradient sites were comparatively low (0.007 mg/L or less).
- Sampling confirmed the previous delineation of a narrow arsenic plume in the deep groundwater system. This plume is directly downgradient of, and contiguous with the arsenic plume defined in the upland area outwash system. Arsenic concentrations in the deep plume decrease to <0.005 mg/L at monitoring well EV-21B on the Port of Everett property. In addition, arsenic concentrations are less than 0.005 mg/L at shoreline monitoring wells.

6.1.3 Surface Water/Storm Water

In addition to the previous storm water investigations, 11 surface water samples were collected during the recent lowland area investigation from nine locations during the second round of groundwater monitoring in June 1999. Samples were analyzed for common ions, metals, and arsenic speciation. Principal findings from the recent and previous investigations are:

- Storm water containing arsenic enters the City's sewer system during the wet season. The highest arsenic concentration (39 mg/L from MH-7) was observed at a storm water sewer coming from the fenced area in the alley between Pilchuck Path and East Marine View Drive. The majority of the arsenic load to the City's combined storm water/sewer system in this area appears to be attributable to short-term groundwater infiltration to the sewer system in the period immediately following storm water events.
- The highest arsenic concentrations in surface water runoff were observed in a series of seeps that developed along the northeast boundary of the fenced area during January through early March of 1999. Elevated arsenic concentrations of up to 21 mg/L were detected in these upland area seeps. The runoff associated with the seeps entered the SR-529 overpass catch basin system, which discharges to the lowland area via the City outfall. These seeps accounted for the majority of the arsenic load observed in surface water runoff.
- Arsenic concentrations were consistently low (<0.005 mg/L to 0.013 mg/L) at catch basin sites in the surrounding residential areas.
- Weyerhaeuser storm water improvements re-established a surface water outfall to the Snohomish River in 1998. Detectable arsenic concentrations (up to 0.097 mg/L) were measured in discharge at this location.
- Investigations of Snohomish River sediment quality were performed by Weyerhaeuser in areas upriver, parallel and downriver from the former smelter facility. With the exception of one area near an outfall at the former Weyerhaeuser Mill E/Koppers Site (upriver from the former smelter facility), all arsenic concentrations were less than SQS or CSL criteria.

6.2 CONCLUSIONS

The lowland investigation was designed to complement previous Everett Smelter Site investigations. The data collected from the recent lowland area investigation have been integrated with relevant results from previous investigations to draw overall conclusions regarding smelter-related environmental impacts. The primary conclusions for soil, groundwater and surface water are as follows:

6.2.1 Soil

- Recent investigations provide additional data which have allowed the delineation of arsenic and metals concentrations in lowland soil at the southern and northern boundaries of the lowland area. The resultant soil quality data and maps delineating arsenic and metals in lowland area soils provide a suitable basis for source area delineation.
- Soils showing elevated arsenic and metals are generally present in areas where smelter facility activities are known to have occurred (i.e. the slag pile vicinity) or where smelter soils have been placed as fill material (i.e. the south bound SR-529 overpass lane and in the access ramp to the Port of Everett property). Some localized areas with elevated arsenic and metals also occur on the former Weyerhaeuser sites. Sources of arsenic at these locations are not readily apparent in all cases.

6.2.2 Groundwater

- With the addition of data from 16 new monitoring wells and 17 new hydropunch sampling locations, the concentrations of arsenic and metals in the shallow and deep groundwater systems have been delineated. Data from the monitoring wells and hydropunch locations define the extent of arsenic and metals in shallow groundwater, and confirm the shape of the arsenic plume in the deep groundwater system east of BNSF railroad tracks. Additional data also confirm that arsenic plumes in shallow groundwater in the slag pile vicinity and in the deep lowland area groundwater system do not extend to the Snohomish River.

- An arsenic plume has also been identified in the upland area. The location of the plume and the magnitude of arsenic concentrations within the plume suggest it is an upland extension of plumes previously defined in the lowland area and that the principal source of arsenic is in the upland area (fenced area).
- Slag leach results show that the slag is a source of elevated pH and may also be a minor, relative to the contribution of the upland area, source of arsenic in shallow groundwater in the slag pile vicinity.
- Other sources may have contributed to elevated concentrations of arsenic but are no longer evident.

6.2.3 Surface Water/Storm Water

- Arsenic and metals concentrations have been delineated in surface runoff in the upland area and in surface water in the lowland area. The primary source of elevated arsenic concentrations in surface water in the upland area appears to be runoff from the fenced area, particularly where groundwater seeps form after periods of prolonged precipitation.
- Short-term storm water and/or groundwater infiltration to the sewers within the fenced area also appear to be a source of arsenic loading.
- The surface drainage features in the lowland area intersect the shallow groundwater system and receive discharge from groundwater or recharge groundwater to varying degrees, depending on seasonal fluctuations in groundwater levels, storm events and runoff patterns, and the nature of the physical interconnections.
- The sources of arsenic in lowland area surface waters include discharge from the shallow groundwater system in the slag pile vicinity, flow from the City's outfall on the north side of the SR-529 overpass, and possibly, accumulated arsenic in lowland wet areas that is remobilized under certain conditions. Other sources may have contributed to the measured concentrations of arsenic but are no longer evident.
- Based on the groundwater and surface water transport analyses, the primary sources of arsenic observed in lowland area surface water are groundwater discharge from the

upland area and surface water runoff from the fenced area. Slag leaching may also be a relatively minor source to surface water in the lowland area.

6.2.4 Future Remediation Activities

Based upon the data presented in this report, it is likely that remediation activities currently planned for the former smelter area will be successful in intercepting and removing the current sources of metals to lowland area groundwater and surface water. Therefore, the best approach for addressing elevated arsenic concentrations in the lowland area is by the process of elimination beginning with the fenced area.

7.0 REFERENCES

Asarco 1995a. Everett Smelter Site Remedial Investigation, Everett, Washington, September 1995.

Asarco 1995b. Everett Smelter Site Feasibility Study, Everett, Washington, September 1995.

Asarco 1996. Supplemental Investigation of the Everett Smelter Site Lowland Area, Everett, Washington, July 1996.

Asarco 1997. Demolition and Debris Disposal Work Plan, Everett Smelter Site, Everett, Washington, September, 1997.

Asarco 1998a. Supplemental Remedial Investigation Additional Characterization and Monitoring Work Plan for the Lowland Area, Everett Smelter Site, Everett, Washington, June, 1998.

Asarco 1998b. Smelter Area Investigation Report Everett Smelter Site, Everett, Washington, October, 1998.

Asarco 1998c. Storm Water and Storm Drain Sediment Characterization and Controls Work Plan, Everett Smelter Site, Everett, Washington, April, 1998.

Asarco 1998d. Storm Water and Storm Drain Sediment Characterization and Controls Quarterly Task Report – July through September, 1998, October, 1998.

Emcon 1993. Attachment A, Sediment Sample Details and Sampling Locations (Remedial Investigation/Feasibility Study of the Former Mill E/Koppers Facility), April, 1993.

Emcon 1994. Remedial Investigation Report for Former Mill E/Koppers Facility, Everett, Washington, Project 0141-037.17, May, 1994.

Emcon 1996. Results of Phase III Sediment Sampling, Weyerhaeuser Everett Former Mill E/Koppers Facility, April, 1996.

Freeze and Cherry 1979. Groundwater. Prentice-Hall, Englewood Cliffs, NJ. 1979.

GeoEngineers 1990. Weyerhaeuser New Mill Access. October, 1990.

Hart Crowser 1990. Model Toxics Control Act Site Discovery Report, October, 1990.

Hart Crowser 1991. Phase I Site Characterization Report, Weyerhaeuser-Everett Mill E Site, Everett, Washington, March, 1991.

Minard 1985a. Geologic Map of the Everett 7.5-Minute Quadrangle, Snohomish County, Washington. Miscellaneous Field Studies Map MF-1748. U.S. Geological Survey, Reston, VA.

Minard 1985b. Geologic Map of the Marysville Quadrangle, Snohomish County, Washington. Miscellaneous Field Studies Map MF-1743. U.S. Geological Survey, Reston, VA.

PTI 1994. Baseline Sediment Assessment, Weyerhaeuser's Former Kraft Pulp Mill Facility, Everett, Washington, September, 1994.

PTI 1996. Preliminary Sediment Assessment for PSDDA Parameters, Weyerhaeuser East Site, Everett, Washington, August, 1996.

Van der Kamp 1976. Determining Aquifer Transmissivity by Means of Well Response Tests: The Underdamped Case. Water Resources Research, Vol. 12, No. 1, pp. 71-77, 1976.

Yim and Mohson 1992. Simulation of Tidal Effects on Contaminant Transport in Porous Media, Groundwater Vol. 30, No. 1, pp. 78-86, 1992.

TABLE 3-1 SUMMARY OF SOIL SAMPLE COLLECTION

Sample Location	Depth Intervals	Analytical Parameters	Analytical Methodology	Field QC Samples
Bluff				
1T	0-12"	As, Cd, Cr, Cu, Pb, Zn	XRF	
1M	0-12"	As, Cd, Cr, Cu, Pb, Zn	XRF	
1B	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
2T	0-12"	As, Cd, Cr, Cu, Pb, Zn	XRF	
2M	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	1
2B	0-12"	As, Cd, Cr, Cu, Pb, Zn	XRF	
3T	0-12", 12-24", 24-36"	As, Cd, Cr, Cu, Pb, Zn	XRF	1
3M	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
3B	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
4T	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
4M	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
4B	0-12", 12-24"	As, Cd, Cr, Cu, Pb, Zn	XRF	
Bore Hole				
LB-11	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
LB-12	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
LB-13	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
LB-14	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
LB-15	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
LB-19	0-.5', 2-3.5', 4-5.5', 6-7.5', 8-9.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
LB-20	0-.5', 2-3.5', 4-5.5', 6-7.5', 8-9.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
HP-45	0-.5', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5', 25-26.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
HP-46	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
HP-47	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
HP-48	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
EV-15B	0-.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
EV-16A	0-.5', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
EV-17B	0-.5', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5', 25-26.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
EV-18B	1-1.5', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5', 25-26.5' 30-31.5', 35-36.5', 40-41.5', 45-46.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
EV-20B	0-.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
EV-21A	0-.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
EV-21B	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
EV-22A	0-.5', 2-3.5', 5-6.5', 10-11.5',	As, Cd, Cr, Cu, Pb, Zn	XRF	
EV-22B	15-16.5', 20-21.5', 25-26.5', 30-31.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	
EV-23B	0-.5', 2-3.5', 5-6.5', 10-11.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
MW-107D	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1
MW-109D	0-.5', .5-2', 2-3.5', 5-6.5', 10-11.5', 15-16.5', 20-21.5'	As, Cd, Cr, Cu, Pb, Zn	XRF	1

k:tac-sect/files/008/030/excel/ri/soil samplesTable 3-1

TABLE 3-2 WATER PARAMETERS

Sample Location	Field Parameters	Laboratory Parameters (unfiltered or total)	Laboratory Parameters (filtered or dissolved)	Total No. Samples	Total No. Field QC Samples
Hydropunch					
HP-45D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-46S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-46D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	1
HP-47S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-47D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-48S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	1
HP-48D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-51S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-52S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-53S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-54S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-55S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-56S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	1
HP-57S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-59S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	1
HP-61S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-62S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
HP-63S	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
Monitoring Well					
EV-3B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-4A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-4B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-6A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-6B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-7A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-7B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-8A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-8B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-9A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-9B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-11A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
EV-15A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-15B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-16A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-17A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-17B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-18B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-19B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-20B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	

TABLE 3-2 WATER PARAMETERS

Sample Location	Field Parameters	Laboratory Parameters (unfiltered or total)	Laboratory Parameters (filtered or dissolved)	Total No. Samples	Total No. Field QC Samples
EV-21A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-21B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
EV-22A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-22B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-23A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
EV-23B	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-3A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-4A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-5A	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-5S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-7D(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-8D(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-102S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-103S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-103D(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
MW-104S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
MW-105S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-105D(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-107S2(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-107D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	1
MW-108S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-108D(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-109S(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
MW-109D	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
WP-1(W)	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
Surface Water					
MP-13	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-1	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-2	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-14	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-15	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-16	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-17	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	
SW-18	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	2	
River Outfall	DO, turb., pH, salinity, SC, temp.	pH, SC, TSS, alk., acid., HCO_3, CO_3, SO_4, Cl, As, As^{+3}, As^{+5}, Cd, Cr, Cu, Pb, Zn	TDS, Ca, Mg, Na, K, As, Cd, Cr, Cu, Pb, Zn	1	1

Note: Wells with A or S are shallow and wells with in B or D are deep. Wells with (W) are owned by Weyerhaeuser.
Only samples collected in June 1999 (second round) had As^{+3} and As^{+5} analyzed. This excludes the first round (March 1999) of samples collected from monitoring wells.
The second sample from SW-18 collected in August 1999 was analyzed only for total and dissolved As, Cd, and Pb.

TABLE 3-3 WATER LEVEL MEASUREMENTS

LOCATION	WATER LEVEL				MEASURING POINT	ELEVATION
	ROUND 1 (3/5/99)	ROUND 2 (4/9/99)	ROUND 3 (6/11/99)	ROUND 4 (7/29/99)		
MONITORING WELLS						
EV-3	46.26	46.10	46.35	46.50	Top of casing	56.59
EV-4A	7.47	8.70	9.80	10.22	Top of casing	57.49
EV-4B	50.60	50.84	51.10	51.08	Top of casing	57.07
EV-6A	47.10	43.61	47.72	48.08	Top of casing	57.35
EV-6B	50.73	51.48	52.25	51.37	Top of casing	57.32
EV-7A	1.01	1.48	1.60	1.95	Top of casing	11.27
EV-7B	6.34	6.08	7.18	7.51	Top of casing	11.14
EV-8A	1.49	1.95	2.09	2.41	Top of casing	11.73
EV-8B	6.20	6.92	8.22	8.54	Top of casing	10.91
EV-9A	1.98	2.62	2.56	3.16	Top of casing	12.52
EV-9B	5.10	5.85	6.42	6.73	Top of casing	12.37
EV-10	Dry	Dry	Dry	Dry	Top of casing	53.64
EV-11	9.60	Dry	Dry	Dry	Top of casing	55.43
EV-12	Dry	Dry	Dry	Dry	Top of casing	57.30
EV-13	Dry	Dry	Dry	Dry	Top of casing	58.27
EV-15A	3.27	3.52	3.37	3.95	Top of casing	14.27
EV-15B	7.55	7.98	8.46	8.98	Top of casing	14.37
EV-16A	4.20	5.09	3.87	4.62	Top of casing	16.13
EV-17A	4.08	4.71	4.84	5.17	Top of casing	14.49
EV-17B	4.72	4.95	5.38	5.56	Top of casing	14.58
EV-18	46.82	46.68	46.96	47.11	Top of casing	57.16
EV-19	47.21	47.14	47.32	47.44	Top of casing	57.54
EV-20	50.05	50.07	50.36	50.51	Top of casing	60.60
EV-21A	7.25	9.00	9.50	10.09	Top of casing	14.92
EV-21B	12.50	12.47	15.84	16.21	Top of casing	14.84
EV-22A	13.95	14.41	14.91	15.22	Top of casing	25.02
EV-22B	19.90	19.51	19.72	19.89	Top of casing	25.27
EV-23A	0.87	0.90	0.41	1.68	Top of casing	10.40
EV-23B	7.00	7.20	9.27	8.49	Top of casing	10.76
MW-3	0.25	0.98	1.40	2.19	Top of casing	8.03
MW-4A	0.50	0.32	1.65	2.20	Top of casing	8.25
MW-5	1.42	2.45	2.95	3.54	Top of casing	7.54
MW-5(W)	0.50	0.40	0.45	1.15	Top of casing	10.51
MW-7(W)	30.75	31.13	31.40	31.56	Top of casing	37.01
MW-8(W)	7.25	7.85	9.68	9.93	Top of casing	9.94
MW-102 S(W)	7.50	8.04	8.42	Dry	Top of casing	11.49
MW-103S(W)	9.80	11.30	Dry	Dry	Top of casing	14.01
MW-103D(W)	11.54	11.45	14.66	15.22	Top of casing	13.52
MW-104S(W)	6.53	7.61	8.64	9.42	Top of casing	14.83
MW-105S(W)	7.14	8.22	8.88	8.98	Top of casing	11.81
MW-105D(W)	12.20	10.21	13.15	13.85	Top of casing	12.19
MW-107S2(W)	1.65	2.54	2.83	3.45	Top of casing	7.60
MW-107D	7.67	10.02	12.98	13.23	Top of casing	12.77
MW-108S(W)	8.05	8.34	8.35	8.44	Top of casing	11.24
MW-108D(W)	8.54	9.18	11.91	12.20	Top of casing	11.89
MW-109S(W)	6.39	No access	7.39	No access	Top of casing	11.36
MW-109D	8.30	10.50	13.35	13.59	Top of casing	13.03
WP-1	4.27	4.42	4.77	5.43	Top of casing	14.36
SURFACE WATER						
MP-1		+0.55	+0.09	Dry	Hub	10.4
MP-2		Dry	Dry	Dry	Invert of culvert	10.8
MP-3		Dry	Dry	Dry	Invert of culvert	10.6
MP-4		-1.69	-1.81	-1.97	Top of culvert	11.2
MP-5		-0.67	-0.28	-0.80	Top of culvert	9.8
MP-6		+1.44	+1.24	+0.72	Top of culvert	8.1
MP-7		+0.57	+0.78	+0.10	Top of culvert	8.7
MP-8		-0.09	-0.10	-0.52	Top of culvert	9.5
MP-9		Could not locate	-0.04	Could not locate	Hub	9.4
MP-10		Could not locate	-0.05	Could not locate	Hub	9.4
MP-11A		+0.36	Dry	Dry	Hub	7.4
MP-11B		+0.15	+0.92	+0.04	Invert of culvert	5.9
MP-12		-0.37	-0.40	-0.43	Hub	4.8
MP-13			-0.02	Dry	Hub	8.2
HYDROPUNCH						
HP-50			Dry		Temporary screen	10.11
HP-51			8.26		Temporary screen	12.53
HP-52			7.51		Temporary screen	11.98
HP-53			7.20		Temporary screen	11.55
HP-54			3.24		Temporary screen	8.08
HP-55			8.25		Temporary screen	12.49
HP-56			4.73		Temporary screen	10.25
HP-57			7.20		Temporary screen	12.37
HP-58			Dry		Temporary screen	12.17
HP-59			1.28		Temporary screen	8.47
HP-61			7.13		Temporary screen	9.13
HP-62			3.21		Temporary screen	11.43
HP-63			3.11		Temporary screen	11.37

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
EV-14	2/23/96	EVT-9602-255	0-0.5 ft.	Upland Fill/Till	53	3			164	51
EV-14	2/23/96	EVT-9602-256	2-3.5 ft.	Upland Fill/Till	24	6			35	77
EV-14	2/23/96	EVT-9602-258	5-6.5 ft.	Upland Fill/Till	4	27			7	61
EV-14	2/23/96	EVT-9602-259	10-11.5 ft.	Upland Fill/Till	20	7			46	110
EV-3-S	1/22/93	EVT-9301-102	1-2.5 ft. S-1A	Upland Fill/Till	288	2			66	
EV-3-S	1/22/93	EVT-9301-102	1-2.5 ft. S-1B	Upland Fill/Till	166	1			13	
EV-3-S	1/22/93	EVT-9301-102	4-5.5 ft. S-3	Upland Fill/Till	248	1			44	
EV-3-S	1/22/93	EVT-9301-102	10-11.5 ft. S-7	Upland Fill/Till	34	1			4	
EV-4B-S	1/20/93	EVT-9301-101	0-1.5 ft. S-1	Upland Fill/Till	16	1			12	
EV-4B-S	1/20/93	EVT-9301-101	1.5-3 ft. S-2	Upland Fill/Till	7	1			11	
EV-4B-S	1/20/93	EVT-9301-101	4.5-6 ft. S-4	Upland Fill/Till	3	1			4	
EV-4B-S	1/20/93	EVT-9301-101	9-10.5 ft. S-7A	Upland Fill/Till	14	1			8	
EV-4B-S	1/20/93	EVT-9301-101	15-17 ft. S-9	Upland Fill/Till	138	2			140	
EV-3-S	1/22/93	EVT-9301-102	14.5-16.9S-10	Upland Fill/Till	83	1			7	
EV-3-S	1/22/93	EVT-9301-102	8.5-10 ft. S-6	Upland Fill/Till	212	0.5			4	
EV-3-S	1/22/93	EVT-9301-102	24-25.5 ft. S-12	Upland Fill/Till	66	0.5			4	
EV-4B-S	1/20/93	EVT-9301-101	24-25.5 ft. S-13	Upland Fill/Till	5	1			7	
EV-18B	9/24/98	EVT-9809-122	1-1.25 ft.	Upland Fill/Till	5	5	111	28	27	41
EV-18B	9/24/98	EVT-9809-123	2-3.5 ft.	Upland Fill/Till	44	5	131	25	77	112
EV-18B	9/24/98	EVT-9809-124	5-6.5 ft.	Upland Fill/Till	133	5	118	157	720	948
EV-18B	9/24/98	EVT-9809-125	10-11.5 ft.	Upland Fill/Till	912	24	118	224	1789	689
EV-18B	9/24/98	EVT-9809-126	15-16.5 ft.	Upland Fill/Till	588	5	147	16	21	36
EV-18B	9/24/98	EVT-9809-127	20-21.5 ft.	Upland Fill/Till	5	5	142	28	11	22
EV-18B	9/24/98	EVT-9809-128	25-26.5 ft.	Upland Fill/Till	5	5	195	31	5	62
EV-20B	9/28/98	EVT-9809-145	20-21.5 ft.	Upland Fill/Till	598	5	118	40	5	42
EV-20B	9/28/98	EVT-9809-140	0-0.5 ft.	Upland Fill/Till	80	5	130	61	290	247
EV-20B	9/28/98	EVT-9809-141	5-6.5 ft.	Upland Fill/Till	25	5	131	35	75	343
EV-20B	9/28/98	EVT-9809-142	10-11.5 ft.	Upland Fill/Till	33	5	106	33	132	109
EV-20B	9/28/98	EVT-9809-143	15-16.5 ft.	Upland Fill/Till	2570	5	113	409	282	86
EV-20B	9/28/98	EVT-9809-144	15-16.5 ft.	Upland Fill/Till	2236	5	126	269	261	78

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
EV-5-S	2/2/93	EVT-9302-226	25-26.5 ft.	Alluvial Sand	8	0.5			6	
MW-4B-S	4/13/93	EVT-9304-284	20-21.5 ft. S-11	Alluvial Sand	27	0.5			3.4	
EV-8B-S	8/19/93	EVT-9308-153	22-23.5 ft. S-9	Alluvial Sand	14	0.5			2.5	
EV-7B-S	8/20/93	EVT-9308-158	28-29.5 ft. S-12	Alluvial Sand	30	0.5			2.5	
EV-9B-S	8/23/93	EVT-9308-162	23-24.5 ft.S-11B	Alluvial Sand	9.5	0.5			2.5	
EV-9B-S	8/23/93	EVT-9308-163	28-29.5 ft. S-12	Alluvial Sand	14	0.5			5.7	
HP04 (S)	8/24/95	EVT-9508-114	22-24 ft.	Alluvial Sand	34	0.5		47	7	
HP06 (S)	8/25/95	EVT-9508-126	20-21.5 ft.	Alluvial Sand	5	0.5		20	4	
HP41 (S)	1/24/96	EVT-9601-208	5-6.5 ft.	Alluvial Sand	6	0.5	54	17	1.5	
HP41 (S)	1/24/96	EVT-9601-209	9-10.5 ft.	Alluvial Sand	8	0.5	59	19	3	
HP41 (S)	1/24/96	EVT-9601-210	12-13.5 ft.	Alluvial Sand	5	0.5	77	19	1.5	
HP43 (S)	1/25/96	EVT-9601-217	5-6.5 ft.	Alluvial Sand	5	0.5	46	18	1.5	
HP43 (S)	1/25/96	EVT-9601-218	10-11.5 ft.	Alluvial Sand	3	0.5	101	18	1.5	
EV-22B	9/22/98	EVT-9809-107	30-31.5 ft.	Alluvial Sand	5	5	284	23	10	114
EV-17B	9/23/98	EVT-9809-120	20-21.5 ft.	Alluvial Sand	5	5	81	22	49	115
EV-17B	9/23/98	EVT-9809-121	25-26.5 ft.	Alluvial Sand	18	5	72	23	23	73
HP-45	9/23/98	EVT-9809-113	20-21.5 ft.	Alluvial Sand	5	5	97	23	10	35
HP-45	9/23/98	EVT-9809-114	25-26.5 ft.	Alluvial Sand	5	5	125	27	5	41
EV-21B	2/8/99	EV-21B-7		Alluvial Sand	20	5	66	32	5	32
MW-107D	2/4/99	MW-107D-6		Alluvial Sand	5	5	60	27	10	37
MW-107D	2/4/99	MW-107D-7		Alluvial Sand	13	5	66	24	5	42
MW-109D	2/3/99	MW-109D-6		Alluvial Sand	5	5	74	22	5	28
MW-109D	2/3/99	MW-109D-7		Alluvial Sand	5	5	56	18	5	29
HP-46	2/9/99	HP-46-6		Alluvial Sand	5	5	58	25	5	32
HP-46	2/9/99	HP-46-7		Alluvial Sand	5	5	66	25	5	35
HP-47	2/10/99	HP-47-5		Alluvial Sand	5	5	63	22	5	36
HP-47	2/10/99	HP-47-5		Alluvial Sand	6.7	1	43	18	5.3	78
HP-47	2/10/99	HP-47-6		Alluvial Sand	5	5	73	17	11	40
HP-48	2/10/99	HP-48-6		Alluvial Sanc	15	5	101	32	5	42
1B	8/28/98	EVT-9808-1BA	0-1 ft.	Bluff Fill	112	5	133	248	1527	4063
1B	8/28/98	EVT-9808-1BB	2 ft.	Bluff Fill	109	5	113	235	1404	3391
1M	8/28/98	EVT-9808-1MA	0-1 ft.	Bluff Fill	262	5	133	100	407	456
1T	8/28/98	EVT-9808-1TA	0-1 ft.	Bluff Fill	92	5	107	77	408	400
2B	8/28/98	EVT-9808-2BA	0-1 ft.	Bluff Fill	100	5	97	84	343	693
2M	8/28/98	EVT-9808-2MA	0-1 ft.	Bluff Fill	47	5	134	63	208	384
2M	8/28/98	EVT-9808-2MB	2 ft.	Bluff Fill	342	5	161	123	450	480
2T	8/28/98	EVT-9808-2TA	0-1 ft.	Bluff Fill	34	5	150	44	117	168
3B	8/28/98	EVT-9808-3BA	0-1 ft.	Bluff Fill	220	5	113	1359	2302	8001
3B	8/28/98	EVT-9808-3BB	2 ft.	Bluff Fill	184	5	114	601	1703	4698
3M	8/28/98	EVT-9808-3MA	0-1 ft.	Bluff Fill	107	5	133	72	373	510
3M	8/28/98	EVT-9808-3MB	2 ft.	Bluff Fill	88	5	122	80	257	400
3T	8/28/98	EVT-9808-3TA	0-1 ft.	Bluff Fill	30	5	135	45	196	172
3T	8/28/98	EVT-9808-3TB	2 ft.	Bluff Fill	15	5	133	30	71	64
3T	8/28/98	EVT-9808-3TC	3 ft.	Bluff Fill	5	5	98	32	45	55
4B	8/28/98	EVT-9808-4BA	0-1 ft.	Bluff Fill	168	5	114	265	1294	2385
4B	8/28/98	EVT-9808-4BB	2 ft.	Bluff Fill	154	5	140	171	1114	1377
4M	8/28/98	EVT-9808-4MA	0-1 ft.	Bluff Fill	446	5	113	96	153	196
4M	8/28/98	EVT-9808-4MB	2 ft.	Bluff Fill	228	2.9	99	40	67	135
4M	8/28/98	EVT-9808-4MB	2 ft.	Bluff Fill	266	5	150	51	79	82
4T	8/28/98	EVT-9808-4TA	0-1 ft.	Bluff Fill	12	5	111	38	90	114
4T	8/28/98	EVT-9808-4TB	2 ft.	Bluff Fil	16	5	130	33	52	86
EV-6B-S	8/25/93	EVT-9308-165	60-61.5 ft.	Channel Deposits	22	0.5			133	
EV-6B-S	8/25/93	EVT-9308-168	67.5-68 ft.	Channel Deposits	7.5	0.5			29	
EV-6B-S	8/25/93	EVT-9308-169	68-68.5 ft.	Channel Deposits	2.5	0.5			12	
HP06 (S)	8/25/95	EVT-9508-124	15-16.5 ft.	Channel Deposits	4	0.5		17	4	
HP06 (S)	8/25/95	EVT-9508-125	17.5-19 ft.	Channel Deposits	4	0.5		17	3	
HP07 (S)	8/29/95	EVT-9508-131	15-16 ft.	Channel Deposits	5	0.5		21	4	
HP21 (S)	12/14/95	EVT-9512-134	20-21.5 ft.	Channel Deposits	20	0.5	75	93	503	
EV-17B	9/23/98	EVT-9809-118	10-11.5 ft.	Channel Deposits	79	5	116	45	428	1116
EV-17B	9/23/98	EVT-9809-119	15-16.5 ft.	Channel Deposits	24	5	117	27	63	181
EV-5-S	1/26/93	EVT-9302-212	0-1 ft.	Lowland Fill	20	7			1300	
EV-5-S	2/1/93	EVT-9302-213	1.5-3 ft.	Lowland Fill	7	0.5			53	
EV-5-S	2/1/93	EVT-9302-216	4.5-6 ft.	Lowland Fill	19	0.5			23	
MW-3-S	4/12/93	EVT-9304-259	0-2 in. S-1	Lowland Fill	13	0.5			20	68
MW-3-S	4/12/93	EVT-9304-260	1-2.5 ft. S-2	Lowland Fill	5.3	0.5			3.4	39
MW-3-S	4/12/93	EVT-9304-262	4-5.5 ft. S-4	Lowland Fill	4.5	0.5			4.1	33
MW-3-S	4/12/93	EVT-9304-263	8.5-9 ft. S-7A	Lowland Fill	10	0.5			10	40
MW-4B-S	4/12/93	EVT-9304-250	0-2 in. S-1	Lowland Fill	36	1			180	44
MW-4B-S	4/12/93	EVT-9304-251	1-2.5 ft. S-2	Lowland Fill	7.3	0.5			10	48
MW-4B-S	4/12/93	EVT-9304-252	4-5.5 ft. S-3	Lowland Fill	5.9	0.5			5.2	86
MW-2-S	4/13/93	EVT-9304-267	0-.5 ft. S-1	Lowland Fill	23	1			120	61
MW-2-S	4/13/93	EVT-9304-268	1-2.5 ft. S-2	Lowland Fill	22	3			330	58
MW-2-S	4/13/93	EVT-9304-270	4-5.5 ft. S-4	Lowland Fill	64	6			470	43
MW-2-S	4/13/93	EVT-9304-273	8.5-10 ft. S-7	Lowland Fill	74	2			490	76
MW-5-S	4/13/93	EVT-9304-275	0-.5 ft. S-1	Lowland Fill	5.3	1			10	47
MW-5-S	4/13/93	EVT-9304-276	1-2.5 ft. S-2	Lowland Fill	6.9	0.5			4.4	47
MW-5-S	4/13/93	EVT-9304-278	4-5.5 ft. S-4	Lowland Fill	6.7	0.5			5	38
EV-7A-S	8/16/93	EVT-9308-107	0-1.5 ft. S-1	Lowland Fill	100	1.6			1875	
EV-7A-S	8/16/93	EVT-9308-108	2-3.5 ft. S-2	Lowland Fill	359	3			8708	
EV-7A-S	8/16/93	EVT-9308-109	4-5.5 ft. S-3	Lowland Fill	428	3			11000	
EV-8A-S	8/16/93	EVT-9308-100	0-1.5 ft. S-1	Lowland Fill	21	13			457	
EV-9A-S	8/16/93	EVT-9308-115	0-1.5 ft. S-1	Lowland Fill	46	0.5			605	
EV-9A-S	8/16/93	EVT-9308-116	2-3.5 ft. S-2	Lowland Fill	34	0.5			60	

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
EV-9A-S	8/16/93	EVT-9308-117	4-5.5 ft. S-3	Lowland Fill	540	0.5			2979	
EV-6A-S	8/17/93	EVT-9308-125	0-1.5 ft. S-1	Lowland Fill	2.5	0.5			5.4	
EV-6A-S	8/17/93	EVT-9308-126	2-3.5 ft. S-2	Lowland Fill	12	0.5			32	
EV-6A-S	8/17/93	EVT-9308-128	5 ft. S-3	Lowland Fill	18	0.5			70	
EV-6A-S	8/17/93	EVT-9308-129	10-11.5 ft. S-4	Lowland Fill	37	1.2			64	
EV-6A-S	8/17/93	EVT-9308-130	15-16.5 ft. S-5	Lowland Fill	87	4.3			359	
EV-6A-S	8/17/93	EVT-9308-132	25-26.5 ft. S-7	Lowland Fill	138	0.5			131	
HP01 (S)	8/23/95	EVT-9508-100	0-0.5 ft.	Lowland Fill	8	2		47	97	2490
HP02 (S)	8/24/95	EVT-9508-104	0.25-0.5 ft.	Lowland Fill	59	4		396	794	
HP04 (S)	8/24/95	EVT-9508-109	0.25-0.5 ft.	Lowland Fill	69	2		147	2334	
HP04 (S)	8/24/95	EVT-9508-110	0.5-2.0 ft.	Lowland Fill	4	0.5		20	15	
HP04 (S)	8/24/95	EVT-9508-111	5-6.5 ft.	Lowland Fill	11	0.5		39	20	
HP05 (S)	8/25/95	EVT-9508-115	0.25-0.5 ft.	Lowland Fill	101	1		210	1175	
HP05 (S)	8/25/95	EVT-9508-116	0.5-2.5 ft.	Lowland Fill	85	2		159	824	
HP05 (S)	8/25/95	EVT-9508-117	5-6.5 ft.	Lowland Fill	9	0.5		28	14	
HP06 (S)	8/25/95	EVT-9508-121	0.25-0.5 ft.	Lowland Fill	40	2		120	162	
HP06 (S)	8/25/95	EVT-9508-122	0.25-0.5 ft.	Lowland Fill	6	0.5		18	5	
HP06 (S)	8/25/95	EVT-9508-123	5-6.5 ft.	Lowland Fill	5	0.5		18	3	
HP07 (S)	8/29/95	EVT-9508-127	0-2 in.	Lowland Fill	19	1		77	86	
HP07 (S)	8/29/95	EVT-9508-128	2-3.5 ft.	Lowland Fill	5	0.5		18	5	
HP07 (S)	8/29/95	EVT-9508-129	5-6.5 ft.	Lowland Fill	4	0.5		23	4	
HP07 (S)	8/29/95	EVT-9508-130	10-11.5 ft.	Lowland Fill	5	0.5		19	4	
HP11 (S)	8/29/95	EVT-9508-132	0-2 in.	Lowland Fill	7	0.5		23	33	
HP11 (S)	8/29/95	EVT-9508-133	2-3.5 ft.	Lowland Fill	5	0.5		18	4	
HP11 (S)	8/29/95	EVT-9508-134	5-6.5 ft.	Lowland Fill	31	0.5		51	14	31870
HP10 (S)	8/30/95	EVT-9508-136	0-2 in.	Lowland Fill	6	0.5		18	14	
HP10 (S)	8/30/95	EVT-9508-137	2-3.5 ft.	Lowland Fill	6	0.5		21	5	
HP10 (S)	8/30/95	EVT-9508-138	5-6.5 ft.	Lowland Fill	10	0.5		16	4	
HP10 (S)	8/30/95	EVT-9508-139	10-11.5 ft.	Lowland Fill	14	0.5		16	3	
HP08 (S)	8/31/95	EVT-9508-150	0-2 in.	Lowland Fill	29	1		87	112	
HP08 (S)	8/31/95	EVT-9508-152	5-6.5 ft.	Lowland Fill	12	0.5		17	4	
HP09 (S)	8/31/95	EVT-9508-141	0-2 in.	Lowland Fill	7	0.5		16	7	
HP09 (S)	8/31/95	EVT-9508-142	2-3.5 ft.	Lowland Fill	5	0.5		16	3	
HP09 (S)	8/31/95	EVT-9508-143	5-6.5 ft.	Lowland Fill	9	0.5		19	5	
HP13 (S)	8/31/95	EVT-9508-145	0-2 in.	Lowland Fill	31	0.5		124	33	79380
HP13 (S)	8/31/95	EVT-9508-146	2-3.5 ft.	Lowland Fill	26	0.5		18	4	
HP13 (S)	8/31/95	EVT-9508-147	5-6.5 ft.	Lowland Fill	40	0.5		21	43	77
HP13 (S)	8/31/95	EVT-9508-148	10-11.5 ft.	Lowland Fill	8	0.5		16	3	286
HP08 (S)	8/31/95	EVT-9508-151	2-3.5 ft.	Lowland Fill	7	0.5		19	4	327
HP12 (S)	9/1/95	EVT-9508-160	0-2 in.	Lowland Fill	4	0.5		16	8	
HP12 (S)	9/1/95	EVT-9508-161	2-3.5 ft.	Lowland Fill	3	0.5		14	2	
HP12 (S)	9/1/95	EVT-9508-162	5-6.5 ft.	Lowland Fill	3	0.5		19	3	67410
HP14 (S)	9/1/95	EVT-9508-155	0-2 in.	Lowland Fill	53	2		157	184	94
HP14 (S)	9/1/95	EVT-9508-156	2-3.5 ft.	Lowland Fill	29	3		666	268	88
HP14 (S)	9/1/95	EVT-9508-157	5-6.5 ft.	Lowland Fill	10	0.5		18	4	79
HP14 (S)	9/1/95	EVT-9508-158	10-11.5 ft.	Lowland Fill	110	0.5		65	29	92
HP15 (S)	12/5/95	EVT-9512-100	0-6 in.	Lowland Fill	57	2	370	170	253	184
HP15 (S)	12/5/95	EVT-9512-101	2-3.5 ft.	Lowland Fill	9	0.5	226	18	1.5	141
HP15 (S)	12/5/95	EVT-9512-102	5-6 ft.	Lowland Fill	12	0.5	161	39	29	36
HP16 (S)	12/7/95	EVT-9512-104	0-6 in.	Lowland Fill	31	1	331	170	144	26
HP16 (S)	12/7/95	EVT-9512-105	2-3.5 ft.	Lowland Fill	8	0.5	156	18	4	64
HP16 (S)	12/7/95	EVT-9512-106	5-6.5 ft.	Lowland Fill	24	0.5	203	82	261	26
HP17 (S)	12/8/95	EVT-9512-109	0-0.5 ft.	Lowland Fill	419	0.5	112	170	1160	31
HP18 (S)	12/11/95	EVT-9512-114	0-0.5 ft.	Lowland Fill	320	0.5	116	49	405	41
HP19 (S)	12/12/95	EVT-9512-119	0-0.5 ft.	Lowland Fill	56	23	139	1120	1690	35
HP19 (S)	12/12/95	EVT-9512-121	5-6.5 ft.	Lowland Fill	255	2	126	552	5220	74
HP20 (S)	12/13/95	EVT-9512-124	0-0.5 ft.	Lowland Fill	28	1	268	75	246	32
HP20 (S)	12/13/95	EVT-9512-125	2-3.5 ft.	Lowland Fill	10	2	257	37	147	31
HP21 (S)	12/14/95	EVT-9512-129	0-0.5 ft.	Lowland Fill	410	4	502	1350	12470	28
HP24 (S)	1/8/96	EVT-9601-140	0-0.5 ft.	Lowland Fill	36	2	296	135	400	
HP24 (S)	1/8/96	EVT-9601-141	2-3.5 ft.	Lowland Fill	18	0.5	146	37	12	
HP25 (S)	1/9/96	EVT-9601-145	0-0.5 ft.	Lowland Fill	42	1	347	116	173	
HP25 (S)	1/9/96	EVT-9601-146	2-3.5 ft.	Lowland Fill	15	0.5	122	18	1.5	
HP25 (S)	1/9/96	EVT-9601-147	5-6.5 ft.	Lowland Fill	16	0.5	98	29	17	
HP25 (S)	1/9/96	EVT-9601-148	10-11.5 ft.	Lowland Fill	32	0.5	84	40	8	
HP26 (S)	1/10/96	EVT-9601-149	0-0.5 ft.	Lowland Fill	59	1	187	134	1090	
HP27 (S)	1/11/96	EVT-9601-155	0-0.5 ft.	Lowland Fill	153	0.5	183	50	75	
HP27 (S)	1/11/96	EVT-9601-156	2-3.5 ft.	Lowland Fill	9	0.5	68	17	3	
HP27 (S)	1/11/96	EVT-9601-157	5-6.5 ft.	Lowland Fill	9	0.5	96	17	5	
HP27 (S)	1/11/96	EVT-9601-158	10-11.5 ft.	Lowland Fill	10	0.5	96	18	6	
HP28 (S)	1/11/96	EVT-9601-161	0-0.5 ft.	Lowland Fill	28	1	199	91	168	
HP28 (S)	1/11/96	EVT-9601-162	2-3.5 ft.	Lowland Fill	18	0.5	202	59	116	
HP28 (S)	1/11/96	EVT-9601-163	5-6.5 ft.	Lowland Fill	15	0.5	185	29	91	
HP28 (S)	1/11/96	EVT-9601-164	10-11.5 ft.	Lowland Fill	8	0.5	48	22	14	
HP29 (S)	1/18/96	EVT-9601-165	0-0.5 ft.	Lowland Fill	13	0.5	136	19	7	
HP29 (S)	1/18/96	EVT-9601-167	2-3.5 ft.	Lowland Fill	17	0.5	53	23	4	
HP29 (S)	1/18/96	EVT-9601-168	5-6.5 ft.	Lowland Fill	18	0.5	57	24	4	
HP29 (S)	1/18/96	EVT-9601-169	10-11.5 ft.	Lowland Fill	18	0.5	50	21	6	
HP30 (S)	1/18/96	EVT-9601-171	0-0.5 ft.	Lowland Fill	4	0.5	69	39	76	
HP30 (S)	1/18/96	EVT-9601-172	2-3.5 ft.	Lowland Fill	31	0.5	68	25	38	
HP30 (S)	1/18/96	EVT-9601-173	5-6.5 ft.	Lowland Fill	14	0.5	72	50	8	
HP31 (S)	1/19/96	EVT-9601-175	0-0.5 ft.	Lowland Fill	5	0.5	68	22	1.5	
HP31 (S)	1/19/96	EVT-9601-176	2-3.5 ft.	Lowland Fill	9	0.5	102	55	45	

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
HP31 (S)	1/19/96	EVT-9601-177	5-6.5 ft.	Lowland Fill	10	0.5	55	128	48	
HP32 (S)	1/19/96	EVT-9601-179	0-0.5 ft.	Lowland Fill	5	0.5	68	23	4	177
HP32 (S)	1/19/96	EVT-9601-180	2-3.5 ft.	Lowland Fill	5	0.5	57	22	4	67
HP33 (S)	1/20/96	EVT-9601-182	0-0.5 ft.	Lowland Fill	42	0.5	63	30	12	90
HP33 (S)	1/20/96	EVT-9601-184	2-3.5 ft.	Lowland Fill	52	0.5	103	93	4	3654
HP34 (S)	1/20/96	EVT-9601-186	0-0.5 ft.	Lowland Fill	18	0.5	99	71	88	17070
HP34 (S)	1/20/96	EVT-9601-187	2-3.5 ft.	Lowland Fill	6	0.5	66	24	5	18150
HP34 (S)	1/20/96	EVT-9601-188	5-6.5 ft.	Lowland Fill	9	0.5	127	35	25	15520
HP35 (S)	1/21/96	EVT-9601-190	0-0.5 ft.	Lowland Fill	198	5	98	259	224	142
HP35 (S)	1/21/96	EVT-9601-191	2-3.5 ft.	Lowland Fill	81	2	56	92	155	1786
HP36 (S)	1/22/96	EVT-9601-193	0-0.5 ft.	Lowland Fill	7	0.5	110	109	102	54
HP37 (S)	1/22/96	EVT-9601-196	0-0.5 ft.	Lowland Fill	8	0.5	109	33	10	91
HP37 (S)	1/22/96	EVT-9601-197	2-3.5 ft.	Lowland Fill	6	0.5	77	26	13	194
HP38 (S)	1/23/96	EVT-9601-199	0-0.5 ft.	Lowland Fill	6	0.5	70	21	1.5	86
HP38 (S)	1/23/96	EVT-9601-200	2-3.5 ft.	Lowland Fill	8	0.5	69	19	1.5	73
HP39 (S)	1/23/96	EVT-9601-202	2-3.5 ft.	Lowland Fill	41	0.5	60	20	4	3187
HP40 (S)	1/24/96	EVT-9601-204	0-0.5 ft.	Lowland Fill	3	0.5	139	33	16	2180
HP40 (S)	1/24/96	EVT-9601-205	2-3.5 ft.	Lowland Fill	6	0.5	73	18	1.5	77
HP40 (S)	1/24/96	EVT-9601-206	5-6.5 ft.	Lowland Fill	7	0.5	49	18	1.5	385
HP41 (S)	1/24/96	EVT-9601-207	2-3.5 ft.	Lowland Fill	6	0.5	62	18	1.5	80
HP42 (S)	1/25/96	EVT-9601-211	0-0.5 ft.	Lowland Fill	5	0.5	52	18	9	77
HP42 (S)	1/25/96	EVT-9601-213	2-3.5 ft.	Lowland Fill	3	0.5	70	19	1.5	322
HP42 (S)	1/25/96	EVT-9601-214	5-6.5 ft.	Lowland Fill	6	0.5	59	18	1.5	44
HP42 (S)	1/25/96	EVT-9601-215	10-11.5 ft.	Lowland Fill	13	0.5	74	45	1.5	43
HP43 (S)	1/25/96	EVT-9601-216	2-3.5 ft.	Lowland Fill	6	0.5	60	21	1.5	47
LB-1	2/23/96	EVT-9602-260	0-0.5 ft.	Lowland Fill	30	0.5			167	43
LB-2	2/26/96	EVT-9602-264	0-0.5 ft.	Lowland Fill	53	1			1057	46
LB-2	2/26/96	EVT-9602-266	5-6.5 ft.	Lowland Fill	3645	7			1720	43
LB-3	2/27/96	EVT-9602-269	0-0.5 ft.	Lowland Fill	39	0.5			733	45
LB-3	2/27/96	EVT-9602-270	2-3.5 ft.	Lowland Fill	8	0.5			13	194
LB-3	2/27/96	EVT-9602-271	5-6.5 ft.	Lowland Fill	5	0.5			11	42
LB-4	2/27/96	EVT-9602-274	0-0.5 ft.	Lowland Fill	51	1			786	40
LB-4	2/27/96	EVT-9602-275	2-3.5 ft.	Lowland Fill	7	0.5			83	69
LB-4	2/27/96	EVT-9602-276	5-6.5 ft.	Lowland Fill	465	4			369	73
LB-4	2/27/96	EVT-9602-277	10-11.5 ft.	Lowland Fill	38	0.5			113	47
LB-5	2/27/96	EVT-9602-278	0-0.5 ft.	Lowland Fill	42	0.5			524	40
LB-5	2/27/96	EVT-9602-279	2-3.5 ft.	Lowland Fill	46	6			743	41
LB-5	2/27/96	EVT-9602-280	5-6.5 ft.	Lowland Fill	35	10			1091	73
LB-5	2/27/96	EVT-9602-281	10-11.5 ft.	Lowland Fill	32	0.5			111	44
LB-6	2/27/96	EVT-9602-282	0-0.5 ft.	Lowland Fill	22	0.5			281	48
LB-7	2/28/96	EVT-9602-287	0-0.5 ft.	Lowland Fill	104	92			3083	44
LB-7	2/28/96	EVT-9602-288	2-3.5 ft.	Lowland Fill	24	13			683	45
LB-10	2/29/96	EVT-9602-298	0-0.5 ft.	Lowland Fill	42	33			5304	44
LB-10	2/29/96	EVT-9602-299	2-3.5 ft.	Lowland Fill	6	0.5			54	147
LB-10	2/29/96	EVT-9602-300	5-6.5 ft.	Lowland Fill	3	0.5			36	44
SB-4	4/16/96	SB-4-3.5-5	4.5-5 ft.	Lowland Fill	43	5		90	118	61
SB-4	4/16/96	SB-4-8.5-10	9.5-10 ft.	Lowland Fill	39	5		46	44	536
SB-4	4/16/96	SB-4-13.5-15	14.5-15 ft.	Lowland Fill	17	5		116	40	527
SB-4	4/16/96	SB-4-18.5-20	19.5-20 ft.	Lowland Fill	66	5		95	649	83
SB-4	4/16/96	SB-4-23.5-25	24.5-25 ft.	Lowland Fill	5	5		31	19	95
SB-4	4/16/96	SB-4-28.5-30	29.5-30 ft.	Lowland Fill	698	5		80	165	64
SB-4	4/16/96	SB-4-33.5-35	34.5-35 ft.	Lowland Fill	34	5		21	28	437
SB-4	4/16/96	SB-4-38.5-40	39.5-40 ft.	Lowland Fill	5	5		37	5	52
SB-4	4/16/96	SB-4-43.5-45	44.5-45 ft.	Lowland Fill	83	5		88	338	63
SB-5	4/16/96	SB-5-7-8.5	8-8.5 ft.	Lowland Fill	15	5		34	24	75
SB-5	4/16/96	SB-5-12-13.5	13-13.5 ft.	Lowland Fill	287	5		180	274	247
SB-5	4/16/96	SB-5-17-18.5	18-18.5 ft.	Lowland Fill	33	5		42	26	59
SB-5	4/16/96	SB-5-22-23.5	23-23.5 ft.	Lowland Fill	138	5		127	306	132
SB-6	4/16/96	SB-6-7-8.5	8-8.5 ft.	Lowland Fill	5	5		25	5	77
SB-6	4/16/96	SB-6-12-13.5	13-13.5 ft.	Lowland Fill	46	5		38	80	74
SB-6	4/16/96	SB-6-17-18.5	18-18.5 ft.	Lowland Fill	27	5		45	47	3330
SB-7	4/16/96	SB-7-5-6.5	6-6.5 ft.	Lowland Fill	29	5		43	48	36100
SB-7	4/16/96	SB-7-8.5-10	9.5-10 ft.	Lowland Fill	5	5		28	5	27060
SB-7	4/16/96	SB-7-13.5-15	14.5-15 ft.	Lowland Fill	5	5		32	18	21560
SB-8	4/16/96	SB-8-3.5-5	4.5-5 ft.	Lowland Fill	5	5		40	22	277
SB-8	4/16/96	SB-8-8.5-10	9.5-10 ft.	Lowland Fill	34	5		62	56	421
SB-8	4/16/96	SB-8-15-16.5	16-16.5 ft.	Lowland Fill	34	5		53	45	2000
SB-8	4/16/96	SB-8-20-21.5	21-21.5 ft.	Lowland Fill	147	5		114	143	9820
LB-11	8/25/98	EVT-9808-500	0-0.5 ft.	Lowland Fill	61	5	88	129	529	1279
LB-11	8/25/98	EVT-9808-501	0.5-2 ft.	Lowland Fill	26	5	106	71	120	322
LB-11	8/25/98	EVT-9808-502	2-3.5 ft.	Lowland Fill	31	5	159	35	56	72
LB-11	8/25/98	EVT-9808-503	5-6.5 ft.	Lowland Fill	5966	34	125	292	2065	710
LB-12	8/26/98	EVT-9808-506	0-0.5 ft.	Lowland Fill	37	5	137	107	401	679
LB-12	8/26/98	EVT-9808-507	0.5-2 ft.	Lowland Fill	27	5	138	36	89	192
LB-12	8/26/98	EVT-9808-508	2-3.5 ft.	Lowland Fill	5	5	143	32	16	39
LB-12	8/26/98	EVT-9808-509	5-6.5 ft.	Lowland Fill	5	5	151	29	19	46
LB-13	8/26/98	EVT-9808-511	0-0.5 ft.	Lowland Fill	5	5	134	55	74	145
LB-13	8/26/98	EVT-9808-512	0.5-2 ft.	Lowland Fill	18	5	131	30	22	41
LB-13	8/26/98	EVT-9808-513	2-3.5 ft.	Lowland Fill	5	5	148	33	5	19
LB-13	8/26/98	EVT-9808-514	5-6.5 ft.	Lowland Fill	5	5	145	33	5	33
LB-14	8/26/98	EVT-9808-517	0-0.5 ft.	Lowland Fill	16	5	156	36	31	148
LB-14	8/26/98	EVT-9808-518	0.5-2 ft.	Lowland Fill	5	5	123	37	14	46
LB-14	8/26/98	EVT-9808-519	2-3.5 ft.	Lowland Fill	5	5	160	26	5	24

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
LB-14	8/26/98	EVT-9808-520	5-6.5 ft.	Lowland Fill	5	5	129	24	5	45
LB-15	8/26/98	EVT-9808-522	0-0.5 ft.	Lowland Fill	5	5	139	31	33	83
LB-15	8/26/98	EVT-9808-523	0.5-2 ft.	Lowland Fill	5	5	121	37	5	53
LB-15	8/26/98	EVT-9808-524	2-3.5 ft.	Lowland Fill	5	5	128	33	14	42
LB-15	8/26/98	EVT-9808-525	5-6.5 ft.	Lowland Fill	5	5	171	33	12	44
LB-17	8/27/98	LB-17A	0-2 ft.	Lowland Fill	360					
LB-19			0-0.5 ft.	Lowland Fill	49	5	110	116	471	1044
LB-19			2-3.5 ft.	Lowland Fill	34	5	126	24	33	82
LB-19			4-5.5 ft.	Lowland Fill	12	5	134	33	25	62
LB-19			6-7.5 ft.	Lowland Fill	121	5	133	33	37	71
LB-20			0-0.5 ft.	Lowland Fill	76	5	100	166	928	1728
LB-20			2-3.5 ft.	Lowland Fill	19	5	154	31	11	63
LB-20			4-5.5 ft.	Lowland Fill	5	5	144	30	5	31
LB-20			6-7.5 ft.	Lowland Fill	968	5	158	116	411	434
LB-20			8-9.5 ft.	Lowland Fill	205	5	150	45	87	96
MW-107D	2/4/99	MW-107D-1		Lowland Fill	5	5	65	25	14	49
MW-107D	2/4/99	MW-107D-2		Lowland Fill	207	5	130	219	742	796
MW-107D	2/4/99	MW-107D-3		Lowland Fill	14	5	53	28	5	21
MW-107D	2/4/99	MW-107D-4		Lowland Fill	14	5	70	27	21	78
MW-109D	2/3/99	MW-109D-1		Lowland Fill	13	5	91	54	51	74
MW-109D	2/3/99	MW-109D-2		Lowland Fill	15	5	69	72	243	100
MW-109D	2/3/99	MW-109D-3		Lowland Fill	5	5	71	29	16	44
MW-109D	2/3/99	MW-109D-4		Lowland Fill	14	5	59	37	24	44
EV-22A	9/22/98	EVT-9809-100	0-0.5 ft.	Lowland Fill	5	5	115	25	11	47
EV-22A	9/22/98	EVT-9809-101	2-3.5 ft.	Lowland Fill	5	5	132	30	15	40
EV-22A	9/22/98	EVT-9809-102	5-6.5 ft.	Lowland Fill	5	5	115	18	5	40
EV-22A	9/22/98	EVT-9809-103	10-11.5 ft.	Lowland Fill	5	5	59	32	12	35
EV-22A	9/22/98	EVT-9809-104	15-16.5 ft.	Lowland Fill	10	5	65	27	5	38
EV-17B	9/23/98	EVT-9809-115	0-0.5 ft.	Lowland Fill	163	5	110	140	735	1899
EV-17B	9/23/98	EVT-9809-116	2-3.5 ft.	Lowland Fill	516	5	104	664	5638	18395
HP-45	9/23/98	EVT-9809-108	0-0.5 ft.	Lowland Fill	5	5	112	30	17	44
HP-45	9/23/98	EVT-9809-109	2-3.5 ft.	Lowland Fill	5	5	137	25	5	30
HP-45	9/23/98	EVT-9809-110	5-6.5 ft.	Lowland Fill	5	5	108	27	10	39
EV-15B	9/29/98	EVT-9809-167	0-0.5 ft.	Lowland Fill	29	5	121	75	171	453
EV-15B	9/29/98	EVT-9809-168	5-6.5 ft.	Lowland Fill	5	5	114	45	5	52
EV-16A	9/29/98	EVT-9809-152	0-0.5 ft.	Lowland Fill	13	5	158	46	52	92
EV-16A	9/29/98	EVT-9809-153	2-3.5 ft.	Lowland Fill	11	5	137	71	17	60
EV-16A	9/29/98	EVT-9809-154	5-6.5 ft.	Lowland Fill	5	5	141	37	5	60
EV-16A	9/29/98	EVT-9809-155	10-11.5 ft.	Lowland Fill	782	5	143	58	149	135
EV-23B	9/30/98	EVT-9809-175	0-0.5 ft.	Lowland Fill	25	5	144	105	199	669
EV-23B	9/30/98	EVT-9809-176	2-3.5 ft.	Lowland Fill	41	5	139	143	358	463
EV-23B	9/30/98	EVT-9809-177	5-6.5 ft.	Lowland Fill	98	5	143	110	199	269
EV-21A	2/8/99	EV-21A-1		Lowland Fill	18	5	141	65	15	87
EV-21B	2/8/99	EV-21B-1		Lowland Fill	16	5	86	42	50	145
EV-21B	2/8/99	EV-21B-2		Lowland Fill	11	5	139	32	32	94
EV-21B	2/8/99	EV-21B-3		Lowland Fill	5	5	88	30	5	39
EV-21B	2/8/99	EV-21B-4		Lowland Fill	5	5	76	31	43	37
EV-21B	2/8/99	EV-21B-4D		Lowland Fill		5	68	25	74	37
HP-46	2/9/99	HP-46-1		Lowland Fill	5	5	149	33	30	85
HP-46	2/9/99	HP-46-2		Lowland Fill	531	5	118	167	458	1119
HP-46	2/9/99	HP-46-3		Lowland Fill	210	5	74	40	38	54
HP-47	2/9/99	HP-47-1		Lowland Fill	5	5	154	29	5	35
HP-47	2/9/99	HP-47-2		Lowland Fill	299	5	81	1059	5619	23874
HP-48	2/10/99	HP-48-1		Lowland Fill	59	5	111	124	294	1064
HP-48	2/10/99	HP-48-2		Lowland Fill	175	5	51	120	40	194
HP-48	2/10/99	HP-48-3		Lowland Fill	22	5	50	20	5	40
HP12 (S)	9/1/95	EVT-9508-163	10-11.5 ft.	Lowland Fill	8	0.5		21	3	16080
HP12 (S)	9/1/95	EVT-9508-164	15-16.5 ft.	Lowland Fill	3	0.5		17	3	665
HP23 (S)	14/15/95	EVT-9512-135	0-0.5 ft	Lowland Fil						30
EV-18B	9/24/98	EVT-9809-129	30-31.5 ft.	Outwash	5	5	113	25	5	40
EV-18B	9/24/98	EVT-9809-130	35-36.5 ft.	Outwash	5	5	115	24	13	36
EV-18B	9/24/98	EVT-9809-131	40-41.5 ft.	Outwash	5	5	115	20	5	39
EV-18B	9/24/98	EVT-9809-132	45-46.5 ft.	Outwash	5	5	132	29	5	38
EV-3-S	1/22/93	EVT-9301-102	34-35.5 ft.S-14B	Outwash	14	0.5			6	
EV-3-S	1/22/93	EVT-9301-102	44-45.5 ft. S-17	Outwash	5	0.5			3	
EV-3-S	1/22/93	EVT-9301-102	49-50.5 ft. S-18	Outwash	3	0.5			2	
EV-4B-S	1/20/93	EVT-9301-101	39-40.5 ft. S-15	Outwash	4	1			4	
EV-4B-S	1/20/93	EVT-9301-101	55.5-57.5S-19	Outwash	5	1			0.5	
HP04 (S)	8/24/95	EVT-9508-112	10-11.5 ft.	Peat	2227	7		62	234	5310
HP05 (S)	8/25/95	EVT-9508-118	10-11.5 ft.	Peat	4194	16		149	968	35840
LB-19			8-9.5 ft.	Peat	2458	16	122	245	1614	571
HP-45	9/23/98	EVT-9809-112	15-16.5 ft.	Peat	13	5	80	27	14	96
EV-5-S	1/27/93	EVT-9302-222	13.5-15 ft.	Silt	19	2			11	140
EV-5-S	2/1/93	EVT-9302-219	9-10.5 ft.	Silt	131	1			66	626
MW-3-S	4/12/93	EVT-9304-264	9-9.5 ft. S-7B	Silt	25	1			15	72
MW-3-S	4/12/93	EVT-9304-265	10-11.5 ft. S-8	Silt	21	0.5			10	151
MW-4B-S	4/12/93	EVT-9304-255	8.5-10 ft. S-6	Silt	25	0.5			10	282
MW-4B-S	4/13/93	EVT-9304-283	15-16.5 S-10	Silt	15	0.5			10	82
MW-5-S	4/13/93	EVT-9304-281	8.5-10.0 ft. S-7	Silt	18	0.5			10	50
EV-7A-S	8/16/93	EVT-9308-114	14-15.5 ft. S-8	Silt	24	0.5			65	35700
EV-8A-S	8/16/93	EVT-9308-106	10-11.5 ft. S-6	Silt	169	1.2			1584	237
EV-9A-S	8/16/93	EVT-9308-124	16-17.5 ft. S-9B	Silt	119	0.5			337	15350
EV-6A-S	8/17/93	EVT-9308-137	50-51.5 ft. S-12	Silt	418	17			12	251

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
EV-8B-S	8/18/93	EVT-9308-150	15-16.5 ft. S-7	Silt	34	0.5			23	33600
EV-7B-S	8/20/93	EVT-9308-156	17-18.5 ft. S-10	Silt	79	0.5			1941	10910
EV-9B-S	8/23/93	EVT-9308-159	18-19.5 ft. S-10	Silt	12	0.5			14	16670
HP01 (S)	8/23/95	EVT-9508-102	5-7 ft.	Silt	6	1		31	23	17510
HP01 (S)	8/23/95	EVT-9508-103	10-12 ft.	Silt	61	0.5		54	18	22620
HP02 (S)	8/24/95	EVT-9508-108	15-17 ft.	Silt	39	0.5		47	60	887
HP04 (S)	8/24/95	EVT-9508-113	12.5-14 ft.	Silt	26	0.5		57	14	
HP05 (S)	8/25/95	EVT-9508-119	15-16.5 ft.	Silt	43	1		52	9	
HP05 (S)	8/25/95	EVT-9508-120	20-20.5 ft.	Silt	14	1		53	8	
HP11 (S)	8/29/95	EVT-9508-135	10-11.5 ft.	Silt	14	0.5		44	8	27580
HP10 (S)	8/30/95	EVT-9508-140	15-16.5 ft.	Silt	20	0.5		35	8	25660
HP08 (S)	8/31/95	EVT-9508-153	10-11.5 ft.	Silt	20	0.5		51	8	
HP08 (S)	8/31/95	EVT-9508-154	15-16.5 ft.	Silt	47	0.5		44	8	1064
HP09 (S)	8/31/95	EVT-9508-144	10-11.5 ft.	Silt	36	0.5		44	7	58
HP13 (S)	8/31/95	EVT-9508-149	12-13.5 ft.	Silt	20	0.5		36	8	405
HP14 (S)	9/1/95	EVT-9508-159	15-16.5 ft.	Silt	37	0.5		42	7	284
HP15 (S)	12/5/95	EVT-9512-103	10-11.5 ft.	Silt	9	0.5	84	43	3	48
HP16 (S)	12/7/95	EVT-9512-107	10-11.5 ft.	Silt	18	0.5	87	48	14	90
HP16 (S)	12/7/95	EVT-9512-108	15-16.5 ft.	Silt	14	0.5	98	46	8	79
HP17 (S)	12/8/95	EVT-9512-113	15-16.5 ft.	Silt	19	0.5	94	64	106	2730
HP18 (S)	12/11/95	EVT-9512-117	10-11.5 ft.	Silt	110	3	66	280	2550	56800
HP18 (S)	12/11/95	EVT-9512-118	15-16.5 ft.	Silt	32	0.5	65	68	306	56220
HP19 (S)	12/12/95	EVT-9512-122	10-11.5 ft.	Silt	55	0.5	87	58	196	53020
HP19 (S)	12/12/95	EVT-9512-123	15-16.5 ft.	Silt	22	0.5	101	36	19	49980
HP20 (S)	12/13/95	EVT-9512-128	15-16.5 ft.	Silt	42	0.5	107	43	53	49580
HP24 (S)	1/8/96	EVT-9601-143	15-16.5 ft	Silt	33	0.5	78	63	79	48
HP27 (S)	1/11/96	EVT-9601-159	15-16.5 ft.	Silt	15	0.5	67	42	6	50
HP28 (S)	1/11/96	EVT-9601-165	15-16.5 ft.	Silt	16	0.5	95	28	1.5	55
HP29 (S)	1/18/96	EVT-9601-170	15-16.5 ft.	Silt	5	0.5	40	17	1.5	73
HP30 (S)	1/18/96	EVT-9601-174	8-9.5 ft.	Silt	15	0.5	76	44	7	252
HP31 (S)	1/19/96	EVT-9601-178	8-9.5 ft.	Silt	17	0.5	72	49	4	258
HP32 (S)	1/19/96	EVT-9601-181	5-6.5 ft.	Silt	17	0.5	75	47	6	283
HP33 (S)	1/20/96	EVT-9601-185	8-9.5 ft.	Silt	50	0.5	67	57	49	101
HP34 (S)	1/20/96	EVT-9601-189	8-9.5 ft.	Silt	12	0.5	75	48	3	68
HP35 (S)	1/21/96	EVT-9601-192	8-9.5 ft.	Silt	11	0.5	79	46	7	45
HP36 (S)	1/22/96	EVT-9601-195	12-13.5 ft.	Silt	9	0.5	75	33	10	55
HP37 (S)	1/22/96	EVT-9601-198	5-6.5 ft.	Silt	18	0.5	71	50	5	73
HP38 (S)	1/23/96	EVT-9601-201	5-6.5 ft.	Silt	13	0.5	108	26	1.5	63
HP39 (S)	1/23/96	EVT-9601-203	5-6.5 ft.	Silt	13	0.5	62	46	4	39
LB-2	2/26/96	EVT-9602-268	10-11.5 ft.	Silt	30	0.5			13	399
LB-6	2/27/96	EVT-9602-286	15-16.5 ft.	Silt	155	1			4864	146
LB-7	2/28/96	EVT-9602-290	10-11.5 ft.	Silt	41	0.5			250	76
LB-9	2/29/96	EVT-9602-296	5-6.5 ft.	Silt	61	0.5			78	83
SB-4	4/16/96	SB-4-50.5-52	51.5-52 ft.	Silt	5	5		56	27	53
SB-4	4/16/96	SB-4-54-55.5	55-55.5 ft.	Silt	42	5		138	225	72
LB-11	8/25/98	EVT-9808-504	10-11.5 ft.	Silt	37	5	229	64	114	311
LB-12	8/26/98	EVT-9808-510	10-11.5 ft.	Silt	12	5	164	30	15	57
LB-13	8/26/98	EVT-9808-515	10-11.5 ft.	Silt	20	5	152	37	5	35
LB-14	8/26/98	EVT-9808-521	10-11.5 ft.	Silt	5	5	159	27	5	46
LB-15	8/26/98	EVT-9808-526	10-11.5 ft.	Silt	1071	5	127	61	119	155
EV-22A	9/22/98	EVT-9809-105	20-21.5 ft.	Silt	300	5	118	138	1108	459
EV-22B	9/22/98	EVT-9809-106	25-26.5 ft.	Silt	5	5	132	55	5	71
HP-45	9/23/98	EVT-9809-111	10-11.5 ft.	Silt	23	5	102	55	232	322
EV-15B	9/29/98	EVT-9809-169	10-11.5 ft.	Silt	31	5	137	57	5	90
EV-23B	9/30/98	EVT-9809-183	10-11.5 ft.	Silt	28	5	145	52	5	90
EV-21B	2/8/99	EV-21B-5		Silt	14	5	120	62	17	90
EV-21B	2/8/99	EV-21B-6		Silt	5	5	136	33	5	73
LB-19			10-11.5 ft.	Silt	1712	15	136	140	868	376
LB-20			10-11.5 ft.	Silt	26	5	139	72	12	84
MW-107D	2/4/99	MW-107D-5		Silt	15	5	127	50	10	92
MW-109D	2/3/99	MW-109D-5		Silt	17	5	138	48	12	89
HP-46	2/9/99	HP-46-4		Silt	99	5	147	83	64	107
HP-46	2/9/99	HP-46-5		Silt	16	5	124	48	5	86
HP-47	2/9/99	HP-47-4		Silt	24	5	133	50	18	78
HP-47	2/10/99	HP-47-7		Silt	13	5	138	52	14	95
HP-48	2/10/99	HP-48-4		Silt	22	5	137	65	5	88
HP-48	2/10/99	HP-48-5		Silt	10	5	130	49	5	59
HP23 (S)	14/15/95	EVT-9512-138	15.0-16.5	Silt						186
HP26 (S)	1/10/96	EVT-9601-153	15-16.5 ft.	Silty Sand	366	4	106	1660	15340	70
HP26 (S)	1/10/96	EVT-9601-154	20-21.5 ft.	Silty Sand	349	4	87	1600	15520	82
SL-3	2/4/93	EVT-9302-860	12 - 15 ft.	Slag	270	2			486	
SL-4	2/4/93	EVT-9302-850	28-34 ft.	Slag	787	7	44	1767	18800	
SL-4	2/4/93	EVT-9302-855	18 - 20 ft.	Slag	92	5			371	
SL-1	2/5/93	EVT-9302-852	27 ft.	Slag	432	3	145	1011	14790	
SL-1	2/5/93	EVT-9302-853	8 ft. - 14 ft.	Slag	163	2			113	
SL-3	2/5/93	EVT-9302-851	55-60 ft.	Slag	410	1	99	1701	8501	
EV-7A-S	8/16/93	EVT-9308-112	10-11.5 ft. S-6	Slag	385	13			14440	95
EV-8A-S	8/16/93	EVT-9308-101	2-3.5 ft. S-2	Slag	338	0.5			3048	85
EV-8A-S	8/16/93	EVT-9308-103	4-5.5 ft. S-3	Slag	207	5.4			15630	190
EV-9A-S	8/16/93	EVT-9308-119	8-9.5 ft. S-5	Slag	1344	0.5			4415	112
EV-9A-S	8/16/93	EVT-9308-122	14-15.5 ft. S-8	Slag	1394	0.5			4643	68
EV-6A-S	8/17/93	EVT-9308-133	30-31.5 ft. S-8	Slag	423	7.3			24010	87
EV-6A-S	8/17/93	EVT-9308-136	45-46.5 ft. S-11	Slag	484	4.3			24230	278

TABLE 4-1 COMPREHENSIVE SOIL RESULTS

Site	Date	Sample #	Depth	UNIT	As	Cd	Cr	Cu	Pb	Zn
EV-6B-S	8/24/93	EVT-9308-164	54-55.5 ft.	Slag	350	5.2			12140	66
HP02 (S)	8/24/95	EVT-9508-105	1.5-3. ft.	Slag	426	6		1044	14280	147
HP02 (S)	8/24/95	EVT-9508-106	5.0-6.5 ft.	Slag	382	7		1121	14130	55
HP02 (S)	8/24/95	EVT-9508-107	10-12 ft.	Slag	353	5		1114	12180	92
HP17 (S)	12/8/95	EVT-9512-110	2-3.5 ft.	Slag	217	4	159	1760	11440	95
HP17 (S)	12/8/95	EVT-9512-111	5-6.5 ft.	Slag	151	5	175	1310	10120	83
HP17 (S)	12/8/95	EVT-9512-112	10-11.5 ft.	Slag	165	5	143	1200	11380	46
HP18 (S)	12/11/95	EVT-9512-115	2-3.5 ft.	Slag	534	0.5	63	134	1020	46
HP18 (S)	12/11/95	EVT-9512-116	5-6 ft.	Slag	226	6	235	916	9510	58
HP19 (S)	12/12/95	EVT-9512-120	2-3.5 ft.	Slag	199	1	92	1460	6330	45
HP20 (S)	12/13/95	EVT-9512-126	5-6.5 ft.	Slag	124	0.5	161	1470	5420	72
HP20 (S)	12/13/95	EVT-9512-127	10-11.5 ft.	Slag	2075	5	185	471	2140	61
HP21 (S)	12/14/95	EVT-9512-130	2-3.5 ft.	Slag	268	1	95	1030	11040	42
HP21 (S)	12/14/95	EVT-9512-131	5-6.5 ft.	Slag	311	1	92	1298	8181	44
HP21 (S)	12/14/95	EVT-9512-132	10-11.5 ft.	Slag	188	2	186	1392	7142	43
HP21 (S)	12/14/95	EVT-9512-133	15-16.5 ft.	Slag	200	1	164	1523	9121	41
HP24 (S)	1/8/96	EVT-9601-142	5-6.5 ft.	Slag	1175	1	138	1970	4900	48
HP24 (S)	1/8/96	EVT-9601-144	10-11.5 ft	Slag	1124	1	154	1960	5530	43
HP26 (S)	1/10/96	EVT-9601-150	2-3.5 ft.	Slag	355	4	102	1880	21580	43
HP26 (S)	1/10/96	EVT-9601-151	5-6.5 ft.	Slag	345	4	102	1350	18430	84
HP26 (S)	1/10/96	EVT-9601-152	10-11.5 ft.	Slag	399	4	103	1920	15950	55
LB-1	2/23/96	EVT-9602-261	2-3.5 ft.	Slag	297	5			11020	49
LB-1	2/23/96	EVT-9602-262	5-6.5 ft.	Slag	2207	24			5371	45
LB-1	2/23/96	EVT-9602-263	10-11.5 ft.	Slag	369	5			8037	
LB-3	2/27/96	EVT-9602-272	10-11.5 ft.	Slag	1901	11			519	
LB-6	2/27/96	EVT-9602-283	2-3.5 ft.	Slag	326	4			7550	
LB-6	2/27/96	EVT-9602-284	5-6.5 ft.	Slag	235	3			16640	
LB-6	2/27/96	EVT-9602-285	10-11.5 ft.	Slag	205	0.5			8371	
LB-7	2/28/96	EVT-9602-289	5-6.5 ft.	Slag	393	5			9418	
LB-8	2/29/96	EVT-9602-292	0-0.5 ft.	Slag	292	6			4376	
LB-8	2/29/96	EVT-9602-293	2-3.5 ft.	Slag	124	1			4504	
LB-9	2/29/96	EVT-9602-294	0-0.5 ft.	Slag	97	8			1268	
LB-9	2/29/96	EVT-9602-295	2-3.5 ft.	Slag	65	4			1338	
LB-16	8/27/98	LB-16A	0-2 ft.	Slag	550					
LB-16	8/27/98	LB-16B	5-7 ft.	Slag	320					
LB-17	8/27/98	LB-17B	5-7 ft.	Slag	360					
LB-18	8/27/98	LB-18A	0-2 ft.	Slag	220					
LB-18	8/27/98	LB-18B	5-7 ft.	Slag	340					
EV-17B	9/23/98	EVT-9809-117	5-6.5 ft.	Slag	523	5	86	1188	8078	30256
HP-47	2/9/99	HP-47-3		Slag	25	5	51	25	18	58
HP23 (S)	14/15/95	EVT-9512-136	5.0-6.0 ft	Slag						42
HP23 (S)	14/15/95	EVT-9512-137	10.0-11.5 ft	Slag						42
B-3	9/6/95	EVT-9508-165	0-2 in.	Upland Fill/Till	49	0.5		38	63	
B-3	9/6/95	EVT-9508-166	2-3.5 ft.	Upland Fill/Till	1059	18		886	1396	
B-3	9/6/95	EVT-9508-167	5-6.5 ft.	Upland Fill/Till	117	11		123	4	
B-3	9/6/95	EVT-9508-168	10-10.5 ft.	Upland Fill/Till	31	4		25	4	
B-3	9/6/95	EVT-9508-169	15-15.25 ft.	Upland Fill/Till	7	6		27	3	
B-4	9/6/95	EVT-9508-170	0-2 in.	Upland Fill/Till	9	0.5		15	76	
B-4	9/6/95	EVT-9508-171	2-6.5 ft.	Upland Fill/Till	20	0.5		23	60	
B-4	9/6/95	EVT-9508-172	7.5-9 ft.	Upland Fill/Till	7	0.5		17	19	
B-4	9/6/95	EVT-9508-174	10-10.5 ft.	Upland Fill/Till	3	0.5		17	3	
B-4	9/6/95	EVT-9508-175	15-15.5 ft.	Upland Fill/Till	2	0.5		12	2	
B-5	9/7/95	EVT-9508-176	0-2 in.	Upland Fill/Till	18	0.5		37	27	
B-5	9/7/95	EVT-9508-177	2-3 ft.	Upland Fill/Till	3	0.5		12	2	
B-5	9/7/95	EVT-9508-179	5-5.5 in.	Upland Fill/Till	4	0.5		16	3	
B-5	9/7/95	EVT-9508-180	10-10.75 ft.	Upland Fill/Till	5	0.5		20	3	
B-5	9/7/95	EVT-9508-181	15-16 ft.	Upland Fill/Till	3	0.5		16	2	
B-6	9/7/95	EVT-9508-182	0-2 in.	Upland Fill/Till	25	0.5		40	66	
B-6	9/7/95	EVT-9508-183	2-3.5 ft.	Upland Fill/Till	3	0.5		16	3	
B-6	9/7/95	EVT-9508-184	5-5.5 ft.	Upland Fill/Till	4	0.5		14	4	
B-6	9/7/95	EVT-9508-185	10-11 ft.	Upland Fill/Till	2	0.5		12	2	
B-6	9/7/95	EVT-9508-186	15-15.5 ft.	Upland Fill/Till	4	0.5		14	7	
EV-11	2/21/96	EVT-9602-232	0-0.5 ft.	Upland Fill/Till	37	0.5			25	42
EV-11	2/21/96	EVT-9602-233	2-3.5 ft.	Upland Fill/Till	77	0.5			43	35
EV-11	2/21/96	EVT-9602-234	5-6.5 ft.	Upland Fill/Till	2439	9			6	375
EV-11	2/21/96	EVT-9602-236	10-11.5 ft.	Upland Fill/Till	748	0.5			3	581
EV-11	2/21/96	EVT-9602-237	12.5-13.5 ft.	Upland Fill/Till	364	0.5			3	429
EV-10	2/22/96	EVT-9602-238	0-0.5 ft.	Upland Fill/Till	55	0.5			3	81
EV-10	2/22/96	EVT-9602-239	2-2.8 ft.	Upland Fill/Till	1660	7			132	93
EV-10	2/22/96	EVT-9602-240	2.8-3.5 ft.	Upland Fill/Till	7660	30			144	132
EV-10	2/22/96	EVT-9602-241	5-5.5 ft.	Upland Fill/Till	773	4			4	289
EV-10	2/22/96	EVT-9602-243	10-10.5 ft.	Upland Fill/Till	1728	7			16	41
EV-10	2/22/96	EVT-9602-244	10.5-11 ft.	Upland Fill/Till	280	0.5			3	175
EV-12	2/22/96	EVT-9602-245	0-0.5 ft.	Upland Fill/Till	49	0.5			20	57
EV-12	2/22/96	EVT-9602-246	2-3.5 ft.	Upland Fill/Till	56	0.5			29	152
EV-12	2/22/96	EVT-9602-247	5-6.5 ft.	Upland Fill/Till	776	3			6	54
EV-12	2/22/96	EVT-9602-248	10.5-11.5 ft.	Upland Fill/Till	187	0.5			40	155
EV-12	2/22/96	EVT-9602-249	12.5-13.5 ft.	Upland Fill/Till	60	0.5			6	44
EV-13	2/22/96	EVT-9602-250	0-0.5 ft.	Upland Fill/Till	487	7			121	103
EV-13	2/22/96	EVT-9602-251	2-3.5 ft.	Upland Fill/Till	11810	86			141	56
EV-13	2/22/96	EVT-9602-252	5-5.5 ft.	Upland Fill/Till	2785	10			80	69
EV-13	2/22/96	EVT-9602-253	5.5-6.5 ft.	Upland Fill/Till	1831	6			5	27
EV-13	2/22/96	EVT-9602-254	10-11.5 ft.	Upland Fill/Till	2259	16			72	42

TABLE 4-2. SUMMARY STATISTICS FOR SOILS DATA

Location/Unit	Parameter	N	Mean (mg/kg)	Median (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)
Upland *Fill/Till*	As	71	649	53	2	11810
	Cd	71	5	1	1	86
	Cr	13	130	126	106	195
	Cu	33	83	27	12	886
	Pb	71	97	13	2	1789
	Zn	38	162	80	22	948
Upland *Outwash*	As	9	6	5	3	14
	Cd	9	3	1	0.5	5
	Cr	4	119	115	113	132
	Cu	4	25	24.5	20	29
	Pb	9	5	5	0.5	13
	Zn	4	38	38.5	36	40
Upland *Bluff Fill*	As	22	138	108	5	446
	Cd	22	5	5	2.9	5
	Cr	22	124	126	97	161
	Cu	22	177	78.5	30	1359
	Pb	22	575	300	45	2302
	Zn	22	1287	400	55	8001
Lowland *Slag*	As	53	474	340	25	2207
	Cd	48	4	4.3	0.5	24
	Cr	22	126	120.5	44	235
	Cu	25	1281	1310	25	1970
	Pb	48	8999	8276	18	24230
	Zn	34	962	58	41	30256
Lowland *Fill*	As	246	97	15.5	2.5	5966
	Cd	246	3	1.5	0.5	92
	Cr	132	122	115	48	502
	Cu	196	83	33.5	14	1350
	Pb	246	412	31.5	1.5	12470
	Zn	178	2399	73.5	19	79380
Lowland *Peat*	As	4	2223	2343	13	4194
	Cd	4	11	12	5	16
	Cr	2	101	101	80	122
	Cu	4	121	106	27	245
	Pb	4	708	601	14	1614
	Zn	4	10454	2941	96	35840
Lowland *Silt*	As	78	76	21.5	4.8	1712
	Cd	78	2	0.5	0.5	17
	Cr	45	109	107	40	229
	Cu	60	57	49	17	280
	Pb	78	203	12	1.5	4864
	Zn	75	6456	101	35	56800
Lowland *Channel Deposits*	As	9	19	7.5	2.5	79
	Cd	9	2	0.5	0.5	5
	Cr	3	103	116	75	117
	Cu	6	37	24	17	93
	Pb	9	131	29	3.1	503
	Zn	2	649	648.5	181	1116
Lowland *Alluvial Sand*	As	29	10	5	2.9	34
	Cd	29	3	5	0.5	5
	Cr	21	82	66	43	284
	Cu	23	23	22	17	47
	Pb	29	7	5	1.5	49
	Zn	16	51	38.5	28	115

NOTE: Below detect values replaced with 1/2 the detection limit for statistical calculations.

TABLE 4-3 LOCATIONS USED FOR SOIL STATISTICS

1B	4T	EV-16A	EV-5	HP04	HP15	HP27	HP38	LB-10	LB-20	MW-3
1M	B-3	EV-17B	EV-6A	HP05	HP16	HP28	HP39	LB-11	LB-3	MW-4B
1T	B-4	EV-18B	EV-6B	HP06	HP17	HP29	HP40	LB-12	LB-4	MW-5
2B	B-5	EV-20B	EV-7A	HP07	HP18	HP30	HP41	LB-13	LB-5	SB-4
2M	B-6	EV-21A	EV-7B	HP08	HP19	HP31	HP42	LB-14	LB-6	SB-5
2T	EV-10	EV-21B	EV-8A	HP09	HP20	HP32	HP43	LB-15	LB-7	SB-6
3B	EV-11	EV-22A	EV-8B	HP10	HP21	HP33	HP45	LB-16	LB-8	SB-7
3M	EV-12	EV-22B	EV-9A	HP11	HP23	HP34	HP46	LB-17	LB-9	SB-8
3T	EV-13	EV-23B	EV-9B	HP12	HP24	HP35	HP47	LB-18	MW-107D	SL-1
4B	EV-14	EV-3	HP01	HP13	HP25	HP36	HP48	LB-19	MW-109D	SL-3
4M	EV-15B	EV-4B	HP02	HP14	HP26	HP37	LB-1	LB-2	MW-2	SL-4

TABLE 4-4 SUMMARY OF SAMPLES ANALYZED FOR ARSENIC AND LEAD

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
HA1	SR-529 Interchange - North Side	EVT-9804-329	0-6 in.	Fill	91	1221
HA1	SR-529 Interchange - North Side	EVT-9804-330	6 in.-1 ft.	Fill	159	3582
HA1	SR-529 Interchange - North Side	EVT-9804-331	2-2.5 ft.	Fill	10 U	11
HA1	SR-529 Interchange - North Side	EVT-9804-332	4-4.5 ft.	Fill	10 U	10 U
HA10	SR-529 Interchange - North Side	EVT-9804-365	0-6 in.	Fill	22	793
HA10	SR-529 Interchange - North Side	EVT-9804-366	6 in.-1 ft.	Fill	10 U	174
HA10	SR-529 Interchange - North Side	EVT-9804-367	2-2.5 ft.	Fill	10 U	80
HA10	SR-529 Interchange - North Side	EVT-9804-368	4-4.5 ft.	Fill	349	1039
HA11	SR-529 Interchange - Central Median	EVT-9804-353	0-6 in.	Fill	10 U	852
HA11	SR-529 Interchange - Central Median	EVT-9804-354	6 in.-1 ft.	Fill	25	688
HA11	SR-529 Interchange - Central Median	EVT-9804-355	2-2.5 ft.	Fill	10 U	27
HA11	SR-529 Interchange - Central Median	EVT-9804-356	4-4.5 ft.	Fill	31	210
HA12	SR-529 Interchange - South Side	EVT-9804-320	0-6 in.	Fill	21	1086
HA12	SR-529 Interchange - South Side	EVT-9804-321	6 in.-1 ft.	Fill	10 U	181
HA12	SR-529 Interchange - South Side	EVT-9804-322	2-2.5 ft.	Fill	215	7186
HA12	SR-529 Interchange - South Side	EVT-9804-323	4-4.5 ft.	Fill	10 U	13
HA13	SR-529 Interchange - North Side	EVT-9804-341	0-6 in.	Fill	10 U	25
HA13	SR-529 Interchange - North Side	EVT-9804-342	6 in.-1 ft.	Fill	10 U	26
HA13	SR-529 Interchange - North Side	EVT-9804-343	2-2.5 ft.	Fill	10 U	10 U
HA13	SR-529 Interchange - North Side	EVT-9804-344	4-4.5 ft.	Fill	10 U	12
HA14	SR-529 Interchange - North Side	EVT-9804-361	0-6 in.	Fill	12	663
HA14	SR-529 Interchange - North Side	EVT-9804-362	6 in.-1 ft.	Fill	20	62
HA14	SR-529 Interchange - North Side	EVT-9804-363	2-2.5 ft.	Fill	10 U	10 U
HA14	SR-529 Interchange - North Side	EVT-9804-364	4-4.5 ft.	Fill	45	40
HA15	SR-529 Interchange - Central Median	EVT-9804-357	0-6 in.	Fill	17	780
HA15	SR-529 Interchange - Central Median	EVT-9804-358	6 in.-1 ft.	Fill	32	1439
HA15	SR-529 Interchange - Central Median	EVT-9804-359	2-2.5 ft.	Fill	12	56
HA15	SR-529 Interchange - Central Median	EVT-9804-360	4-4.5 ft.	Fill	10 U	1236
HA16	SR-529 Interchange - South Side	EVT-9804-324	0-6 in.	Fill	19	641
HA16	SR-529 Interchange - South Side	EVT-9804-325	6 in.-1 ft.	Fill	32	625
HA16	SR-529 Interchange - South Side	EVT-9804-326	2-2.5 ft.	Fill	10 U	16
HA16	*SR-529 Interchange - South Side*	*EVT-9804-327*	*4-4.5 ft.*	*Fill*	*19*	*15*
HA2	SR-529 Interchange - North Side	EVT-9804-373	0-6 in.	Fill	11	1003
HA2	SR-529 Interchange - North Side	EVT-9804-374	6 in.-1 ft.	Fill	11	539
HA2	SR-529 Interchange - North Side	EVT-9804-375	2-2.5 ft.	Fill	21	331
HA2	SR-529 Interchange - North Side	EVT-9804-376	4-4.5 ft.	Fill	52	219
HA3	SR-529 Interchange - Central Median	EVT-9804-345	0-6 in.	Fill	16 J4	686 J4
HA3	SR-529 Interchange - Central Median	EVT-9804-346	6 in.-1 ft.	Fill	16 J4	1049 J4
HA3	SR-529 Interchange - Central Median	EVT-9804-347	2-2.5 ft.	Fill	296 J4	323 J4
HA3	SR-529 Interchange - Central Median	EVT-9804-348	4-4.5 ft.	Fill	389 J4	758 J4
HA4	SR-529 Interchange - South Side	EVT-9804-312	0-6 in.	Fill	30	925
HA4	SR-529 Interchange - South Side	EVT-9804-313	6 in.-1 ft.	Fill	20	338
HA4	SR-529 Interchange - South Side	EVT-9804-314	2-2.5 ft.	*Fill*	*10 U*	*59*
HA4	SR-529 Interchange - South Side	EVT-9804-315	4-4.5 ft.	Fill	10 U	10 U
HA5	SR-529 Interchange - North Side	EVT-9804-333	0-6 in.	Fill	10 U	14
HA5	SR-529 Interchange - North Side	EVT-9804-334	6 in.-1 ft.	Fill	10 U	10 U
HA5	SR-529 Interchange - North Side	EVT-9804-335	2-2.5 ft.	Fill	10 U	10 U
HA5	SR-529 Interchange - North Side	EVT-9804-336	4-4.5 ft.	Fill	10 U	10 U
HA6	SR-529 Interchange - North Side	EVT-9804-369	0-6 in.	Fill	11	738
HA6	SR-529 Interchange - North Side	EVT-9804-370	6 in.-1 ft.	Fill	10 U	160
HA6	SR-529 Interchange - North Side	EVT-9804-371	2-2.5 ft.	Fill	10 U	13
HA6	SR-529 Interchange - North Side	EVT-9804-372	4-4.5 ft.	Fill	10 U	166
HA7	SR-529 Interchange - Central Median	EVT-9804-349	0-6 in.	Fill	15	295
HA7	SR-529 Interchange - Central Median	EVT-9804-350	6 in.-1 ft.	Fill	15	276
HA7	SR-529 Interchange - Central Median	EVT-9804-351	2-2.5 ft.	Fill	21	351
HA8	SR-529 Interchange - South Side	EVT-9804-316	0-6 in.	Fill	20	755
HA8	SR-529 Interchange - South Side	EVT-9804-317	6 in.-1 ft.	Fill	18 U	20 U
HA8	SR-529 Interchange - South Side	EVT-9804-318	2-2.5 ft.	Fill	10 U	190
HA8	SR-529 Interchange - South Side	EVT-9804-319	4-4.5 ft.	Fill	10 U	10 U
HA9	SR-529 Interchange - North Side	EVT-9804-337	0-6 in.	Fill	10 U	21
HA9	SR-529 Interchange - North Side	EVT-9804-338	6 in.-1 ft.	Fill	10 U	21
HA9	SR-529 Interchange - North Side	EVT-9804-339	2-2.5 ft.	Fill	10 U	23
HA9	SR-529 Interchange - North Side	EVT-9804-340	4-4.5 ft.	Fill	10 U	10 U
SA1	Roasting Area - Dust Chambers	EVT-9803-363	0-1 ft.	Smelter Debris	1427	1038
SA1	Roasting Area - Dust Chambers	EVT-9803-364	1-2 ft.	Smelter Debris	682	387
SA1	Roasting Area - Dust Chambers	EVT-9803-365	2-3 ft.	Smelter Debris	818	89

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
SA1	Roasting Area - Dust Chambers	EVT-9803-366	3-4 ft.	Smelter Debris	320	17
SA1	Roasting Area - Dust Chambers	EVT-9803-367	4-5 ft.	Smelter Debris	3841	1083
SA1	Roasting Area - Dust Chambers	EVT-9803-368	6-6.25 ft.	Smelter Debris	515	77
SA10	South of Arsenic Process Area	EVT-9803-325B	0-1 ft.	Fill	312	113
SA10	South of Arsenic Process Area	EVT-9803-326	1-2 ft.	Fill	10 U	10 U
SA10	South of Arsenic Process Area	EVT-9803-327	2-3 ft.	Fill	70	10 U
SA10	South of Arsenic Process Area	EVT-9803-328	3-4 ft.	Fill	10 U	10 U
SA10	South of Arsenic Process Area	EVT-9803-330	4-5 ft.	Fill	14	10 U
SA11	South of Arsenic Process Area	EVT-9803-310	0-1 ft.	Fill (Loam)	258	101
SA11	South of Arsenic Process Area	EVT-9803-311	1-2 ft.	Fill	231	10 U
SA11	South of Arsenic Process Area	EVT-9803-312	2-3 ft.	Fill	10 U	11
SA11	South of Arsenic Process Area	EVT-9803-313	3-4 ft.	Fill	10 U	10 U
SA11	South of Arsenic Process Area	EVT-9803-314	4-5 ft.	Glacial Till	10 U	12
SA12	South of Arsenic Process Area	EVT-9803-339	0-1 ft.	Fill	968	604
SA12	South of Arsenic Process Area	EVT-9803-340	1-2 ft.	Smelter Debris	125	52
SA12	South of Arsenic Process Area	EVT-9803-341	2-3 ft.	Fill	14	11
SA12	South of Arsenic Process Area	EVT-9803-342	3-4 ft.	Fill	10 U	10 U
SA12	South of Arsenic Process Area	EVT-9803-343	4-5 ft.	Fill	10 U	13
SA13	Stack Area	EVT-9803-414	0-1 ft.	Fill	846	281
SA13	Stack Area	EVT-9803-415	1-2 ft.	Fill	1024	212
SA13	Stack Area	EVT-9803-416	2-3 ft.	Glacial Till	13 J4	12
SA13	Stack Area	EVT-9803-417	3-4 ft.	Glacial Till	227 J4	10 U
SA13	Stack Area	EVT-9803-418	4-5 ft.	Glacial Till	42 J4	10 U
SA14	Stack Area	EVT-9803-385	0-1 ft.	Fill	11	10 U
SA14	Stack Area	EVT-9803-386	1-2 ft.	Fill	10 U	10 U
SA14	Stack Area	EVT-9803-387	2-3 ft.	Fill	10 U	13
SA14	Stack Area	EVT-9803-388	3-4 ft.	Glacial Till	10 U	10
SA14	Stack Area	EVT-9803-389	4-5 ft.	Glacial Till	10 U	10 U
SA15	Stack Area	EVT-9803-398	0-1 ft.	Smelter Debris	113	35
SA15	Stack Area	EVT-9803-399	1-2 ft.	Smelter Debris	10 U	11
SA15	Stack Area	EVT-9803-400	2-3 ft.	Glacial Till	10 U	10 U
SA15	Stack Area	EVT-9803-401	3-4 ft.	Glacial Till	10 U	10 U
SA15	Stack Area	EVT-9803-402	4-5 ft.	Glacial Till	10 U	10 U
SA16	Stack Area	EVT-9803-408	0-1 ft.	Smelter Debris	405	22
SA16	Stack Area	EVT-9803-409	1-2 ft.	Smelter Debris	51	10 U
SA16	Stack Area	EVT-9803-410	2-3 ft.	Smelter Debris	166	23
SA16	Stack Area	EVT-9803-411	3-4 ft.	Glacial Till	10 U	10 U
SA16	Stack Area	EVT-9803-412	4-5 ft.	Glacial Till	10 U	10 U
SA17	Stack Area	EVT-9803-403	0-1 ft.	Smelter Debris	811	239
SA17	Stack Area	EVT-9803-404	1-2 ft.	Smelter Debris	610	103
SA17	Stack Area	EVT-9803-405	2-3 ft.	Glacial Till	10 U	10 U
SA17	Stack Area	EVT-9803-406	3-4 ft.	Glacial Till	10 U	10 U
SA17	Stack Area	EVT-9803-407	4-5 ft.	Glacial Till	10 U	10 U
SA18	Stack Area	EVT-9803-420	0-1 ft.	Fill (Loam)	1798	713
SA18	Stack Area	EVT-9803-421	1-2 ft.	Fill	288	10 U
SA18	Stack Area	EVT-9803-422	2-3 ft.	Fill	18	10 U
SA18	Stack Area	EVT-9803-423	3-4 ft.	Glacial Till	10 U	10 U
SA18	Stack Area	EVT-9803-424	4-5 ft.	Glacial Till	18 U	20 U
SA18	Stack Area	EVT-9803-424	4-5 ft.	Glacial Till	13	10 U
SA19	Medora Way	EVT-9803-453	0-1 ft.	Fill (Loam)	44	84
SA19	Medora Way	EVT-9803-454	1-2 ft.	Fill (Loam)	10 U	11
SA19	Medora Way	EVT-9803-455	2-3 ft.	Glacial Till	10 U	12
SA19	Medora Way	EVT-9803-457	3-4 ft.	Glacial Till	10 U	10 U
SA19	Medora Way	EVT-9803-458	4-5 ft.	Glacial Till	10 U	10 U
SA2	Roasting Area - Dust Chambers	EVT-9803-369	0-1 ft.	Road Pavement/Base Fill	2351	1141
SA2	Roasting Area - Dust Chambers	EVT-9803-370	1-2 ft.	Smelter Debris	4171	1128
SA2	Roasting Area - Dust Chambers	EVT-9803-371	2-3 ft.	Glacial Till	2014	10 U
SA2	Roasting Area - Dust Chambers	EVT-9803-372	3-4 ft.	Glacial Till	158	10 U
SA2	Roasting Area - Dust Chambers	EVT-9803-373	5-6 ft.	Glacial Till	40	11
SA2	Roasting Area - Dust Chambers	EVT-9803-374	6-7 ft.	Glacial Till	17	10 U
SA20	Medora Way	EVT-9803-448	0-1 ft.	Fill (Loam)	589	1123
SA20	Medora Way	EVT-9803-449	1-2 ft.	Fill (Loam)	837	1390
SA20	Medora Way	EVT-9803-450	2-3 ft.	Glacial Till	10 U	13
SA20	Medora Way	EVT-9803-451	3-4 ft.	Glacial Till	10 U	14
SA20	Medora Way	EVT-9803-452	4-5 ft.	Glacial Till	10 U	10 U
SA21	Whitehorse Trail	EVT-9803-444A	0-1 ft.	Fill (Loam)	275	323
SA21	Whitehorse Trail	EVT-9803-444B	1-2 ft.	Fill (Loam)	331	387

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
SA21	Whitehorse Trail	EVT-9803-445	2-3 ft.	Smelter Debris	290	344
SA21	Whitehorse Trail	EVT-9803-446	3-4 ft.	Smelter Debris	104	140
SA21	Whitehorse Trail	EVT-9803-447A	4-5 ft.	Glacial Till	10 U	10 U
SA22	Medora Way	EVT-9804-306	0-1 ft.	Road Pavement/Base Fill	42	20 U
SA22	Medora Way	EVT-9804-306	0-1 ft.	Road Pavement/Base Fill	37	10 U
SA22	Medora Way	EVT-9804-307	1-2 ft.	Road Base Fill	20	10
SA22	Medora Way	EVT-9804-308	2-3 ft.	Road Base Fill	20	11
SA22	Medora Way	EVT-9804-309	3-4 ft.	Road Base Fill	30	50
SA22	Medora Way	EVT-9804-310	4-5 ft.	Glacial Till	10 U	10 U
SA23	SR 529 Median	EVT-9803-425	0-1 ft.	Fill (Loam)	25	211
SA23	SR 529 Median	EVT-9803-426	1-2 ft.	Glacial Till	12	28
SA23	SR 529 Median	EVT-9803-427	2-3 ft.	Glacial Till	10 U	19
SA23	SR 529 Median	EVT-9803-428	3-4 ft.	Glacial Till	12	82
SA23	SR 529 Median	EVT-9803-429	4-5 ft.	Glacial Till	10 U	36
SA24	East Marine View Drive	EVT-9804-300	0-1 ft.	Road Pavement	18 U	20 U
SA24	East Marine View Drive	EVT-9804-301	1-2 ft.	Road Base Fill	10 U	10 U
SA24	East Marine View Drive	EVT-9804-302	2-3 ft.	Glacial Till	36	63
SA24	East Marine View Drive	EVT-9804-303	3-4 ft.	Glacial Till	10 U	10 U
SA24	East Marine View Drive	EVT-9804-304	4-5 ft.	Glacial Till	10 U	17
SA25	South of Arsenic Process Area	EVT-9803-315	0-1 ft.	Road Pavement/Base Fill	249	36
SA25	South of Arsenic Process Area	EVT-9803-316	1-2 ft.	Road Base Fill	429	43
SA25	South of Arsenic Process Area	EVT-9803-317	2-3 ft.	Road Base Fill	122	10
SA25	South of Arsenic Process Area	EVT-9803-318	3-4 ft.	Road Base Fill	10 U	10 U
SA25	South of Arsenic Process Area	EVT-9803-320	4-5 ft.	Road Base Fill	140	12
SA26	South of Arsenic Process Area	EVT-9803-321	0-1 ft.	Road Pavement/Base Fill	228	72
SA26	South of Arsenic Process Area	EVT-9803-322	1-2 ft.	Road Base Fill	1105	257
SA26	South of Arsenic Process Area	EVT-9803-323	2-3 ft.	Road Base Fill	390	10
SA26	South of Arsenic Process Area	EVT-9803-324	3-4 ft.	Road Base Fill	54	10 U
SA26	South of Arsenic Process Area	EVT-9803-325A	4-5 ft.	Road Base Fill	97	20 U
SA26	South of Arsenic Process Area	EVT-9803-325A	4-5 ft.	Road Base Fill	101	10 U
SA3	Roasting Area - Ore Shed	EVT-9803-431	0-1 ft.	Loam	13	1315
SA3	Roasting Area - Ore Shed	EVT-9803-432	1-2 ft.	Sand	21	118
SA3	Roasting Area - Ore Shed	EVT-9803-433	2-3 ft.	Glacial Till	21	106
SA3	Roasting Area - Ore Shed	EVT-9803-434	3-4 ft.	Glacial Till	10 U	10 U
SA4	Roasting Area - Southwest Part	EVT-9803-391	0-1 ft.	Fill (Loam)	11792	12116
SA4	Roasting Area - Southwest Part	EVT-9803-392	1-2 ft.	Smelter Debris	2618	530
SA4	Roasting Area - Southwest Part	EVT-9803-393	2-3 ft.	Glacial Till	13	22
SA4	Roasting Area - Southwest Part	EVT-9803-394	3-4 ft.	Glacial Till	26	14
SA4	Roasting Area - Southwest Part	EVT-9803-395	4-5 ft.	Glacial Till	14	10 U
SA4	Roasting Area - Southwest Part	EVT-9803-396	5-6 ft.	Glacial Till	10 U	10 U
SA5	Blast Furnace/Lead Refining Area	EVT-9803-376	0-1 ft.	Fill (Loam)	4750	947
SA5	Blast Furnace/Lead Refining Area	EVT-9803-377	1-2 ft.	Smelter Debris	808	115
SA5	Blast Furnace/Lead Refining Area	EVT-9803-378	2-3 ft.	Smelter Debris	47	14
SA5	Blast Furnace/Lead Refining Area	EVT-9803-379	3-4 ft.	Smelter Debris	60	14
SA5	Blast Furnace/Lead Refining Area	EVT-9803-380	4-5 ft.	Smelter Debris	11	15
SA5	Blast Furnace/Lead Refining Area	EVT-9803-381	5-6 ft.	Smelter Debris	35	17
SA5	Blast Furnace/Lead Refining Area	EVT-9803-382	8-9 ft.	Glacial Till	317	10 U
SA5	Blast Furnace/Lead Refining Area	EVT-9803-383	11-12 ft.	Glacial Till	280	10 U
SA5	Blast Furnace/Lead Refining Area	EVT-9803-384	14-15 ft.	Glacial Till	61	13
SA6	Arsenic Process Area - Ovens	EVT-9803-353	0-1 ft.	Loam	3633 J4	304
SA6	Arsenic Process Area - Ovens	EVT-9803-354	1-2 ft.	Loam/Smelter Debris	39777	1327
SA6	Arsenic Process Area - Ovens	EVT-9803-356	2-3 ft.	Smelter Debris	40938	41
SA6	Arsenic Process Area - Ovens	EVT-9803-357	3-4 ft.	Smelter Debris	33201	20
SA6	Arsenic Process Area - Ovens	EVT-9803-359	4-5 ft.	Glacial Till	7903 J4	10
SA6	Arsenic Process Area - Ovens	EVT-9803-360	5-6 ft.	Glacial Till	1260 J4	10 U
SA6	Arsenic Process Area - Ovens	EVT-9803-361	7.5-9 ft.	Glacial Till	2761 J4	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-344	0-1 ft.	Fill (Loam)	19122	486
SA7	Arsenic Process Area - Storage Bin	EVT-9803-345	1-2 ft.	Fill (Loam)	38751	563
SA7	Arsenic Process Area - Storage Bin	EVT-9803-346	2-3 ft.	Fill	14277	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-347	3-4 ft.	Fill	7476	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-348	4-5 ft.	Fill	5245	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-349	5-6 ft.	Fill	1348	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-351	7.5-9 ft.	Glacial Till	402	10 U
SA7	Arsenic Process Area - Storage Bin	EVT-9803-352	10-11 ft.	Glacial Till	258	10 U
SA8	South of Arsenic Process Area	EVT-9803-305	0-1 ft.	Fill	1208	199
SA8	South of Arsenic Process Area	EVT-9803-306	1-2 ft.	Fill	111	12
SA8	South of Arsenic Process Area	EVT-9803-307	2-3 ft.	Glacial Till	79	10 U

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
SA8	South of Arsenic Process Area	EVT-9803-308	3-4 ft.	Glacial Till	42	10 U
SA8	South of Arsenic Process Area	EVT-9803-309	4-5 ft.	Glacial Till	52	10 U
SA9	South of Arsenic Process Area	EVT-9803-300	0-1 ft.	Fill	798	473
SA9	South of Arsenic Process Area	EVT-9803-301	1-2 ft.	Fill	813	625
SA9	South of Arsenic Process Area	EVT-9803-302	2-3 ft.	Fill	1078	436
SA9	South of Arsenic Process Area	EVT-9803-303	3-4 ft.	Glacial Till	1189	221
SA9	South of Arsenic Process Area	EVT-9803-304	4-5 ft.	Glacial Till	51	11
HA17	SR 529 Hwy Interchange - Field ID #1	EVT-9804-600	SURFACE	Fill/Soil	18	35
HA18	SR 529 Hwy Interchange - Field ID #2	EVT-9804-601	SURFACE	Fill/Soil	82	364
HA19	SR 529 Hwy Interchange - Field ID #3	EVT-9804-602	SURFACE	Fill/Soil	15	14
HA20	SR 529 Hwy Interchange - Field ID #4	EVT-9804-603	SURFACE	Fill/Soil	64	403
TB1	East Marine View Drive	EVT-9804-520	2-3.5 ft.	Fill	46	27 J4
TB1	East Marine View Drive	EVT-9804-521	5-6.5 ft.	Fill	48	417
TB1	East Marine View Drive	EVT-9804-522	10-11.5 ft.	Glacial Till	695	63 J4
TB1	East Marine View Drive	EVT-9804-523	15-16.5 ft.	Glacial Till	455	13 J4
TB1	East Marine View Drive	EVT-9804-524	20-21.5 ft.	Glacial Till	197	12 J4
TB1	East Marine View Drive	EVT-9804-525	25-26.5 ft.	Glacial Till	201	10 U,U
TB1	East Marine View Drive	EVT-9804-526	30-31.5 ft.	Glacial Till	120	10 U,U
TB1	East Marine View Drive	EVT-9804-527	35-36.5 ft.	Fluvial Sand	76	10 U,U
TB1	East Marine View Drive	EVT-9804-519	0-0.5 ft.	Road Pavement	18 U	20 U
TB2	East Marine View Drive	EVT-9803-511	0-0.5 ft.	Road Pavement/Fill	10 U	10 U
TB2	East Marine View Drive	EVT-9803-512	2-3.5 ft.	Fill	115	297
TB2	East Marine View Drive	EVT-9803-513	5-6.5 ft.	Fill	28	222
TB2	East Marine View Drive	EVT-9803-514	10-11.5 ft.	Fill	47	51
TB2	East Marine View Drive	EVT-9803-514	10-11.5 ft.	Fill	47	52
TB2	East Marine View Drive	EVT-9803-515	15-16.5 ft.	Glacial Till	502	10 U
TB2	East Marine View Drive	EVT-9803-516	20-21.5 ft.	Glacial Till	15	10 U
TB2	East Marine View Drive	EVT-9803-517	30-31.5 ft.	Glacial Till	10 U	10 U
TB2	East Marine View Drive	EVT-9803-518	35-36.5 ft.	Fluvial Sand	10 U	10 U
TB3	East Marine View Drive	EVT-9803-501	2-3.5 ft.	Road Base Fill	218	158
TB3	East Marine View Drive	EVT-9803-502	5-6.5 ft.	Glacial Till	20	31
TB3	East Marine View Drive	EVT-9803-503	10-11.5 ft.	Glacial Till	660	40
TB3	East Marine View Drive	EVT-9803-504	15-16.5 ft.	Glacial Till	194	10 U
TB3	East Marine View Drive	EVT-9803-505	20-21.5 ft.	Glacial Till	206	10 U
TB3	East Marine View Drive	EVT-9803-506	25-26.5 ft.	Glacial Till	10 U	13
TB3	East Marine View Drive	EVT-9803-507	30-31.5 ft.	Glacial Till	10 U	10 U
TB3	East Marine View Drive	EVT-9803-509	35-36.5 ft.	Fluvial Sand	10 U	10 U
TB3	East Marine View Drive	EVT-9803-510	37.5-39 ft.	Fluvial Sand	291	10 U
TB3	East Marine View Drive	EVT-9803-500	0-.5 ft.	Road Pavement/Base Fill	18 U	20 U
TP10A	Stack Area - Flue Structure	EVT-9803-163	0-1 ft.	Fill (Loam)	473	112
TP10A	Stack Area - Flue Structure	EVT-9803-164	1-2 ft.	Smelter Debris	2460	331
TP10A	Stack Area - Flue Structure	EVT-9803-165	2-3 ft.	Smelter Debris	3571	445
TP10A	Stack Area - Flue Structure	EVT-9803-166	3-4 ft.	Smelter Debris	2399	224
TP10A	Stack Area - Flue Structure	EVT-9803-167	4-5 ft.	Smelter Debris	12491	1309
TP10A	Stack Area - Flue Structure	EVT-9803-168	5-6 ft.	Fill	2209	20
TP10B	Stack Area - Flue Structure	EVT-9803-156	0-1 ft.	Smelter Debris	866	420 J4
TP10B	Stack Area - Flue Structure	EVT-9803-157	1-2 ft.	Smelter Debris	1356	268 J4
TP10B	Stack Area - Flue Structure	EVT-9803-158	2-3 ft.	Smelter Debris	3151	284 J4
TP10B	Stack Area - Flue Structure	EVT-9803-159	3-4 ft.	Smelter Debris	3277	298 J4
TP10B	Stack Area - Flue Structure	EVT-9803-160	4-5 ft.	Smelter Debris	15433	599 J4
TP10B	Stack Area - Flue Structure	EVT-9803-161	5-6 ft.	Smelter Debris	6748	24 J4
TP10B-BH	Adjacent to TP10	EVT-9804-100	5-6 ft.	Smelter Debris	1455	14
TP10B-BH	Adjacent to TP10	EVT-9804-101	6-7 ft.	Glacial Till	453	10 U
TP10B-BH	Adjacent to TP10	EVT-9804-102	8-9 ft.	Glacial Till	401	10 U
TP10B-BH	Adjacent to TP10	EVT-9804-103	10-11 ft.	Glacial Till	490	10 U
TP11A	Stack Area - Flue Structure	EVT-9803-151	0-1 ft.	Fill (Loam)	3148	101
TP11A	Stack Area - Flue Structure	EVT-9803-152	1-2 ft.	Smelter Debris	4692	209
TP11A	Stack Area - Flue Structure	EVT-9803-153	2-3 ft.	Smelter Debris	12893	558
TP11A	Stack Area - Flue Structure	EVT-9803-154	3-4 ft.	Smelter Debris	53824	186
TP11A	Stack Area - Flue Structure	EVT-9803-155	4-5 ft.	Fill	23094	22
TP11B	Stack Area - Flue Structure	EVT-9803-145	0-1 ft.	Fill (Loam)	1722	87
TP11B	Stack Area - Flue Structure	EVT-9803-146	1-2 ft.	Smelter Debris	6869	267
TP11B	Stack Area - Flue Structure	EVT-9803-147	2-3 ft.	Smelter Debris	19691	742
TP11B	Stack Area - Flue Structure	EVT-9803-148	3-4 ft.	Smelter Debris	19937	86
TP11B	Stack Area - Flue Structure	EVT-9803-149	4-5 ft.	Fill	36165	30
TP11B	Stack Area - Flue Structure	EVT-9803-150	5-6 ft.	Fill	12033	20 U
TP11B	Stack Area - Flue Structure	EVT-9803-150	5-6 ft.	Fill	11897	10 U

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
TP11B-BH	Adjacent to TP11	EVT-9804-109	5-6 ft.	Fill	10359	13
TP11B-BH	Adjacent to TP11	EVT-9804-110	6-7 ft.	Fill	8408	11
TP11B-BH	Adjacent to TP11	EVT-9804-111	8-9 ft.	Glacial Till	1450	10 U
TP11B-BH	Adjacent to TP11	EVT-9804-112	10-11 ft.	Glacial Till	504	10 U
TP11B-BH	Adjacent to TP11	EVT-9804-113	12-13.5 ft.	Glacial Till	212	10
TP3	Roaster Area - Southeast Roaster	EVT-9803-169	0-1 ft.	Fill (Loam)	1704	911
TP3	Roaster Area - Southeast Roaster	EVT-9803-170	1-2 ft.	Smelter Debris	9043	2425
TP3	Roaster Area - Southeast Roaster	EVT-9803-171	2-3 ft.	Smelter Debris	21686	89
TP3	Roaster Area - Southeast Roaster	EVT-9803-172	3-4 ft.	Smelter Debris	28579	51
TP3	Roaster Area - Southeast Roaster	EVT-9803-173	4-5 ft.	Smelter Debris	1883	58
TP3	Roaster Area - Southeast Roaster	EVT-9803-174	5-6 ft.	Smelter Debris	1259	34
TP3-BH	Adjacent to TP3	EVT-9803-175	5-6 ft.	Smelter Debris	6902	792
TP3-BH	Adjacent to TP3	EVT-9803-176	6-7 ft.	Smelter Debris	7084	275
TP3-BH	Adjacent to TP3	EVT-9803-177	7-8 ft.	Glacial Till	203	13
TP3-BH	Adjacent to TP3	EVT-9803-178	8-9 ft.	Glacial Till	507	10 U
TP3-BH	Adjacent to TP3	EVT-9803-179	9-10 ft.	Glacial Till	655	10 U
TP3-BH	Adjacent to TP3	EVT-9803-180	10-11 ft.	Glacial Till	744	12
TP4	Processing Area - Arsenic Kitchens	EVT-9803-112	0-1 ft.	Fill (Loam)	565	152
TP4	Processing Area - Arsenic Kitchens	EVT-9803-113	1-2 ft.	Smelter Debris	1981	144
TP4	Processing Area - Arsenic Kitchens	EVT-9803-114	2-3 ft.	Smelter Debris	8799	533
TP4	Processing Area - Arsenic Kitchens	EVT-9803-115	3-4 ft.	Smelter Debris/Fill	32918	468
TP4	Processing Area - Arsenic Kitchens	EVT-9803-116	4-5 ft.	Fill/Glacial Till	4724	30
TP4	Processing Area - Arsenic Kitchens	EVT-9803-117	5-6 ft.	Glacial Till	1600	16
TP4-BH	Adjacent to TP4	EVT-9804-120	5-6 ft.	Glacial Till	631	10 U
TP4-BH	Adjacent to TP4	EVT-9804-121	6-7 ft.	Glacial Till	225	10 U
TP4-BH	Adjacent to TP4	EVT-9804-122	8-9 ft.	Glacial Till	219	10 U
TP4-BH	Adjacent to TP4	EVT-9804-123	10-11 ft.	Glacial Till	206	10 U
TP5	Processing Area - Arsenic Kitchens	EVT-9803-126	0-1 ft.	Fill (Loam)	1161	473
TP5	Processing Area - Arsenic Kitchens	EVT-9803-127	1-2 ft.	Smelter Debris	5370	92
TP5	Processing Area - Arsenic Kitchens	EVT-9803-128	2-3 ft.	Fill	2777	34
TP5	Processing Area - Arsenic Kitchens	EVT-9803-129	3-4 ft.	Glacial Till	827	13
TP5	Processing Area - Arsenic Kitchens	EVT-9803-130	4-5 ft.	Glacial Till	502	10 U
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-106	0-1 ft.	Smelter Debris	4373	289
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-107	1-2 ft.	Smelter Debris	12487	458
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-108	2-3 ft.	Fill	9726	38
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-109	3-4 ft.	Fill	9252	29
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-110	4-5 ft.	Glacial Till	4305	10 U
TP6A	Processing Area - Arsenic Kitchens	EVT-9803-111	5-6 ft.	Glacial Till	3235	10 U
TP6A-BH	Adjacent to TP6A	EVT-9804-115	5-6 ft.	Glacial Till	2335	10 U
TP6A-BH	Adjacent to TP6A	EVT-9804-116	6-7 ft.	Glacial Till	353	10 U
TP6A-BH	Adjacent to TP6A	EVT-9804-117	8-9 ft.	Glacial Till	706	10 U
TP6A-BH	Adjacent to TP6A	EVT-9804-118	10-11 ft.	Glacial Till	412	10 U
TP6A-BH	Adjacent to TP6A	EVT-9804-119	12-13 ft.	Glacial Till	249	10 U
TP6B	Processing Area - Flue Structure	EVT-9803-100	0-1 ft.	Smelter Debris/Loam	9576	582
TP6B	Processing Area - Flue Structure	EVT-9803-100	0-1 ft.	Smelter Debris/Loam	9388	544
TP6B	Processing Area - Flue Structure	EVT-9803-101	1-2 ft.	Smelter Debris	14223	505
TP6B	Processing Area - Flue Structure	EVT-9803-102	2-3 ft.	Fill	13985	10 U
TP6B	Processing Area - Flue Structure	EVT-9803-103	3-4 ft.	Fill	13537	14
TP6B	Processing Area - Flue Structure	EVT-9803-104	4-5 ft.	Glacial Till	5497	10 U
TP6B	Processing Area - Flue Structure	EVT-9803-105	5-6 ft.	Glacial Till	2740	10 U
TP7	Processing Area - Dust Chambers	EVT-9803-132	0-1 ft.	Fill (Loam)	2220	523
TP7	Processing Area - Dust Chambers	EVT-9803-133	1-2 ft.	Smelter Debris	8771	594
TP7	Processing Area - Dust Chambers	EVT-9803-134	2-3 ft.	Smelter Debris	9935	415
TP7	Processing Area - Dust Chambers	EVT-9803-135	3-4 ft.	Fill	10644	47
TP7	Processing Area - Dust Chambers	EVT-9803-136	4-5 ft.	Fill	6586	10 U
TP7	Processing Area - Dust Chambers	EVT-9803-137	5-6 ft.	Glacial Till	2952	12
TP7-BH	Adjacent to TP7	EVT-9804-105	5-6 ft.	Glacial Till	815	10 U
TP7-BH	Adjacent to TP8	EVT-9804-106	6-7 ft.	Glacial Till	684	10 U
TP7-BH	Adjacent to TP9	EVT-9804-107	8-9 ft.	Glacial Till	698	10 U
TP7-BH	Adjacent to TP10	EVT-9804-108	10-11 ft.	Glacial Till	541	10 U
TP8	Processing Area - Dust Chambers	EVT-9803-138	0-1 ft.	Smelter Debris	3738	625
TP8	Processing Area - Dust Chambers	EVT-9803-139	1-2 ft.	Smelter Debris	2797	415
TP8	Processing Area - Dust Chambers	EVT-9803-140	2-3 ft.	Smelter Debris	4619	309
TP8	Processing Area - Dust Chambers	EVT-9803-141	3-4 ft.	Smelter Debris	7237	200
TP8	Processing Area - Dust Chambers	EVT-9803-142	4-5 ft.	Fill	4669	17
TP8	Processing Area - Dust Chambers	EVT-9803-143	5-6 ft.	Glacial Till	564	11
TP9	Processing Area - Dust Chambers	EVT-9803-119	0-1 ft.	Loam Fill/Smelter Debris	33665	947

SITE CODE	SAMPLE SITE	SAMPLE NO.	SAMPLE DEPTH	SAMPLED UNIT	As (mg/kg)	Pb (mg/kg)
TP9	Processing Area - Dust Chambers	EVT-9803-120	1-2 ft.	Fill	10503	795
TP9	Processing Area - Dust Chambers	EVT-9803-121	2-3 ft.	Fill	5668	672
TP9	Processing Area - Dust Chambers	EVT-9803-122	3-4 ft.	Fill	7821	16
TP9	Processing Area - Dust Chambers	EVT-9803-123	4-5 ft.	Fill	1564	14
TP9	Processing Area - Dust Chambers	EVT-9803-124	5-6 ft.	Glacial Till	535	14

TABLE 4-5 PRINCIPAL HYDROSTRATIGRAPHIC UNITS

UPLAND AREA			LOWLAND AREA		
Unit	**Aquifer**	**Lithology**	**Unit**	**Aquifer**	**Lithology**
Fill/ Shallow Till	Shallow Groundwater System	Silt, Sand, Gravel	Fill/Slag	Shallow Groundwater System	Silt, Sand, Gravel/ Slag
Deep Till	Unsaturated Low K Layer	Silt, Sand, Gravel	Silt/ Channel Deposits	Confining Layer	Clayey Silt/ Sand and Silt
Advance Outwash	Deep Groundwater System	Sand	Alluvium	Deep Groundwater System	Sand

TABLE 4-6 SUMMARY OF HYDRAULIC CONDUCTIVITY RESULTS

Well No.	Unit	Aquifer Type	Test Method	Analytical Method	Hydraulic Conductivity	
					(ft/day)	(cm/sec)
EV-1	Shallow Till	Unconfined	Slug Test	Bouwer & Rice	0.30	1.04 E-04
EV-1	Deep Till	Unsaturated	Permeameter	ASTM D-5084	5.7 E-04	2.0 E-07
EV-2A	Deep Till	Unsaturated	Permeameter	ASTM D-5084	1.7 E-04	5.9 E-08
EV-3	Adv. Outwash	Unconfined	Slug Test	Bouwer & Rice	16.55	5.84 E-03
EV-4B	Adv. Outwash	Unconfined	Slug Test	Bouwer & Rice	0.83	2.93 E-04
EV-5	Alluvium	Confined	Slug Test	Bouwer & Rice	36.72	1.30 E-02
EV-5	Alluvium	Confined	Slug Test	Cooper et al.	26.21	9.25 E-03
MW-1	Alluvium	Confined	Slug Test	Bouwer & Rice	3.37	1.19 E-03
MW-1	Alluvium	Confined	Slug Test	Cooper et al.	3.37	1.19 E-03
MW-2	Fill	Unconfined	Slug Test	Bouwer & Rice	58.82	2.08 E-02
MW-3	Fill	Unconfined	Slug Test	Bouwer & Rice	71.37	2.52 E-02
MW-4A	Fill	Unconfined	Slug Test	Bouwer & Rice	87.19	3.08 E-02
MW-4B	Alluvium	Confined	Slug Test	Bouwer & Rice	34.70	1.22 E-02
MW-4B	Alluvium	Confined	Slug Test	Cooper et al.	31.45	1.11 E-02
MW-5	Fill	Unconfined	Slug Test	Bouwer & Rice	30.38	1.07 E-02
WP-1	Fill	Unconfined	Slug Test	Bouwer & Rice	14.44	5.10 E-03
EV-16A	Fill	Unconfined	Slug Test In	Bouwer & Rice	0.047	
EV-16A	Fill	Unconfined	Slug Test In	Hvorslev	0.043	
EV-16A	Fill	Unconfined	Slug Test Out	Bouwer & Rice	0.042	
EV-16A	Fill	Unconfined	Slug Test Out	Hvorslev	0.054	
EV-15A	Fill	Unconfined	Slug Test In	Bouwer & Rice	0.069	
EV-15A	Fill	Unconfined	Slug Test In	Hvorslev	0.025	
EV-15A	Fill	Unconfined	Slug Test Out	Bouwer & Rice	0.019	
EV-15A	Fill	Unconfined	Slug Test Out	Hvorslev	0.026	
EV-15B	Alluvium	Confined	Slug Test In	Bouwer & Rice	1.656	
EV-15B	Alluvium	Confined	Slug Test In	Hvorslev	1.469	
EV-15B	Alluvium	Confined	Slug Test Out	Bouwer & Rice	0.998	
EV-15B	Alluvium	Confined	Slug Test Out	Hvorslev	1.440	

TABLE 4-7 ARSENIC CONCENTRATIONS IN GROUNDWATER SAMPLES (MARCH AND JUNE 1999)

Site Code	Well Type	Sample Date	Sample Number	As (Dissolved) (mg/L)		As (Total) (mg/L)
EV-3	deep	3/1/99	EVT-9903-100	<0.005	U	<0.005 U
EV-3	deep	6/14/99	EVT-9906-225	<0.005	U	<0.005 U
EV-4A	shallow	3/1/99	EVT-9903-101	0.095		0.039
EV-4A	shallow	6/14/99	EVT-9906-224	0.630		1.100
EV-4B	deep	3/1/99	EVT-9903-102	0.085		0.096
EV-4B	deep	6/14/99	EVT-9906-223	0.110		0.110
EV-6A	shallow	3/2/99	EVT-9903-103	0.260		0.240
EV-6A	shallow	6/14/99	EVT-9906-220	0.990		0.980
EV-6B	deep	3/2/99	EVT-9903-104	0.026		0.041
EV-6B	deep	6/14/99	EVT-9906-221	0.021		0.025
EV-7A	shallow	3/1/99	EVT-9903-105	1.700		1.700
EV-7A	shallow	6/15/99	EVT-9906-239	2.000		2.100
EV-7B	deep	3/1/99	EVT-9903-106	7.100		7.000
EV-7B	deep	6/15/99	EVT-9906-238	6.900		6.800
EV-8A	shallow	3/1/99	EVT-9903-107	1.300		1.400
EV-8A	shallow	6/15/99	EVT-9906-235	1.000		1.000
EV-8B	deep	3/1/99	EVT-9903-108	3.500		3.800
EV-8B	deep	6/15/99	EVT-9906-234	3.500		3.500
EV-9A	shallow	3/2/99	EVT-9903-109	2.300		2.300
EV-9A	shallow	6/15/99	EVT-9906-242	2.200		2.200
EV-9B	deep	3/2/99	EVT-9903-110	0.490		0.460
EV-9B	deep	6/15/99	EVT-9906-241	0.400		0.420
EV-10	shallow	3/1/99	dry	---		---
EV-10	shallow	6/14/99	dry	---		---
EV-11	shallow	3/3/99	EVT-9903-165	47.000		51.000
EV-11	shallow	6/14/99	dry	---		---
EV-12	shallow	3/1/99	dry	---		---
EV-12	shallow	6/14/99	dry	---		---
EV-13	shallow	3/1/99	dry	---		---
EV-13	shallow	6/14/99	dry	---		---
EV-15A	shallow	3/2/99	EVT-9903-116	0.040		0.240
EV-15A	shallow	6/14/99	EVT-9906-228	0.032		0.140
EV-15B	deep	3/2/99	EVT-9903-117	0.006		0.006
EV-15B	deep	6/14/99	EVT-9906-227	<0.005	U	<0.005 U
EV-16A	shallow	3/2/99	EVT-9903-118	0.063		0.099
EV-16A	shallow	6/14/99	EVT-9906-226	0.085		0.093
EV-17A	shallow	3/2/99	EVT-9903-119	3.000		3.200
EV-17A	shallow	6/15/99	EVT-9906-244	2.700		3.000
EV-17B	deep	3/2/99	EVT-9903-120	0.610		0.740
EV-17B	deep	6/15/99	EVT-9906-243	0.380		0.450
EV-18B	deep	3/1/99	EVT-9903-121	<0.005	U	0.011
EV-18B	deep	6/14/99	EVT-9906-217	<0.005	U	<0.005 U
EV-19B	deep	3/1/99	EVT-9903-122	5.200		5.300
EV-19B	deep	6/14/99	EVT-9906-218	4.500		4.800
EV-20B	deep	3/2/99	EVT-9903-123	11.000		11.000

Site Code	Well Type	Sample Date	Sample Number	(mg/L)		(mg/L)
EV-20B	deep	6/14/99	EVT-9906-219	13.000		12.000
EV-21A	shallow	3/2/99	EVT-9903-124	0.006		0.005
EV-21A	shallow	6/16/99	EVT-9906-254	<0.005	U	<0.005 U
EV-21B	deep	3/2/99	EVT-9903-125	<0.005	U	<0.005 U
EV-21B	deep	6/16/99	EVT-9906-255	<0.005	U	<0.005 U
EV-22A	shallow	3/3/99	EVT-9903-126	0.015		0.016
EV-22A	shallow	6/16/99	EVT-9906-263	<0.005	U	0.011
EV-22B	deep	3/3/99	EVT-9903-127	0.880		0.032
EV-22B	deep	6/16/99	EVT-9906-262	<0.005	U	0.011
EV-23A	shallow	3/2/99	EVT-9903-128	0.064		0.071
EV-23A	shallow	6/15/99	EVT-9906-233	0.051		0.089
EV-23B	deep	3/2/99	EVT-9903-129	<0.005	U	<0.005 U
EV-23B	deep	6/15/99	EVT-9906-232	<0.005	U	<0.005 U
MW-102S(W)	shallow	3/5/99	EVT-9903-137	<0.005	U	0.020
MW-102S(W)	shallow	6/17/99	EVT-9906-266	<0.005	U	<0.005 U
MW-103D(W)	deep	3/5/99	EVT-9903-139	<0.005	U	<0.005 U
MW-103D(W)	deep	6/17/99	EVT-9906-267	<0.005	U	<0.005 U
MW-103S(W)	shallow	3/5/99	EVT-9903-138	<0.005	U	<0.005 U
MW-103S(W)	shallow	6/17/99	dry			
MW-104S(W)	shallow	3/5/99	EVT-9903-140	<0.005	U	<0.005 U
MW-104S(W)	shallow	6/17/99	EVT-9906-268	<0.005	U	<0.005 U
MW-105D(W)	deep	3/5/99	EVT-9903-142	<0.005	U	<0.005 U
MW-105D(W)	deep	6/17/99	EVT-9906-270	<0.005	U	<0.005 U
MW-105S(W)	shallow	3/5/99	EVT-9903-141	<0.005	U	<0.005 U
MW-105S(W)	shallow	6/17/99	EVT-9906-271	<0.005	U	<0.005 U
MW-107D	deep	3/3/99	EVT-9903-130	<0.005	U	<0.005 U
MW-107D	deep	6/16/99	EVT-9906-257	<0.005	U	<0.005 U
MW-107S2(W)	shallow	3/5/99	EVT-9903-144	0.022		0.031
MW-107S2(W)	shallow	6/16/99	EVT-9906-251	0.040		0.042
MW-108D(W)	deep	3/5/99	EVT-9903-146	3.000		2.900
MW-108D(W)	deep	6/16/99	EVT-9906-258	3.700		3.800
MW-108S(W)	shallow	3/5/99	EVT-9903-145	<0.005	U	<0.005 U
MW-108S(W)	shallow	6/16/99	EVT-9906-252	<0.005	U	<0.005 U
MW-109D	deep	3/3/99	EVT-9903-131	<0.005	U	<0.005 U
MW-109D	deep	6/16/99	EVT-9906-259	<0.005	U	<0.005 U
MW-109S(W)	shallow	3/5/99	EVT-9903-147	<0.005	U	<0.005 U
MW-109S(W)	shallow	6/16/99	EVT-9906-253	<0.005	U	0.023
MW-3	shallow	3/2/99	EVT-9903-112	<0.005	U	<0.005 U
MW-3	shallow	6/15/99	EVT-9906-245	<0.005	U	<0.005 U
MW-4A	shallow	3/2/99	EVT-9903-113	<0.005	U	<0.005 U
MW-4A	shallow	6/15/99	EVT-9906-246	<0.005	U	<0.005 U
MW-5	shallow	3/2/99	EVT-9903-115	<0.005	U	<0.005 U
MW-5	shallow	6/15/99	EVT-9906-247	<0.005	U	<0.005 U
MW-5(W)	shallow	3/5/99	EVT-9903-133	<0.005	U	<0.005 U
MW-5(W)	shallow	6/16/99	EVT-9906-250	<0.005	U	<0.005 U
MW-7(W)	deep	3/5/99	EVT-9903-135	<0.005	U	0.014
MW-7(W)	deep	6/16/99	EVT-9906-264	<0.005	U	<0.005 U
MW-8(W)	deep	3/5/99	EVT-9903-136	<0.005	U	<0.005 U

Site Code	Well Type	Sample Date	Sample Number	(mg/L)		(mg/L)
MW-8(W)	deep	6/16/99	EVT-9906-249	<0.005	U	<0.005 U
WP-1	shallow	3/2/99	EVT-9903-111	0.980		1.000
WP-1	shallow	6/15/99	EVT-9906-240	0.820		0.890

TABLE 4-8 SURFACE WATER / STORM WATER GRAB SAMPLE SUMMARY STATISTICS

Site Type	Statistic	As (D) (mg/L)	As (T) (mg/L)	Cd (D) (mg/L)	Cd (T) (mg/L)	Pb (D) (mg/L)	Pb (T) (mg/L)
Fenced Area Direct Runoff To Catch Basins ***(Upland Area)***	**# of Samples**	13	13	13	13	13	13
	# above Detection Limit	13	13	0	0	1	13
	Average	0.213	0.218	<0.003	<0.003	0.0034	0.062
	Median	0.060	0.037	<0.003	<0.003	<0.005	0.040
	Minimum	0.007	0.008	<0.003	<0.003	<0.005	0.005
	Maximum	1.0	1.1	<0.003	<0.003	0.014	0.33
Non-Smelter Site Runoff To Catch Basins ***(Upland Area)***	**# of Samples**	26	26	26	26	26	26
	# above Detection Limit	1	13	0	0	1	25
	Average	0.003	0.006	0.002	0.002	0.002	0.020
	Median	<0.005	0.0043	<0.003	<0.003	<0.005	0.0155
	Minimum	<0.005	<0.005	<0.003	<0.003	<0.004	<0.005
	Maximum	0.006	0.014	<0.003 <0.003	<0.003 <0.003	0.005	0.063
Manholes ***(Upland Area)***	**# of Samples**	13	15	13	15	13	15
	# above Detection Limit	13	15	3	5	0	7
	Average	2.44	6.29	0.0022	0.0026	<0.005	0.0146
	Median	1.5	1.8	<0.003	<0.003	<0.005	<0.005
	Minimum	0.005	0.032	<0.003	<0.003	<0.005	<0.005
	Maximum	14	38.98	0.006	0.006	<0.005	0.13
Seeps ***(Upland Area)***	**# of Samples**	2	4	2	2	2	2
	# above Detection Limit	2	4	2	2	0	1
	Average	8.05	13.6	0.015	0.019	<0.005	0.0198
	Median	8.05	12.5	0.015	0.019	<0.005	0.0198
	Minimum	7.6	8.4	0.014	0.014	<0.005	0.0025
	Maximum	8.5	21	0.015	0.024	<0.005	0.037
Surface Water ***(Lowlamd Area)***	**# of Samples**	31	30	31	31	31	31
	# above Detection Limit	28	27	0	0	9	23
	Average	0.128	0.188	<0.003	<0.003	0.015	0.027
	Median	0.043	0.061	<0.003	<0.003	<0.005	0.008
	Minimum	<0.005	<0.005	<0.001	<0.001	<0.003	<0.003
	Maximum	0.6	1.5	<0.003	<0.003	0.17	0.25

NOTES:

(D) = dissolved, (T) = total

Grab samples collected from November 1998 through August 1999.

Values below analytical detection limits were replaced with 1/2 the detection limit for calculation of averages.

TABLE 5-1. RESULTS OF BULK LEACH ANALYSIS OF SOILS FROM SLAG PILE VICINITY

	Sample							*Statistics by Analysis Type*		
Parameter	LB-16 (0-2’)	LB-16 (5-7’)	LB-17 (0-2’)	LB-17 (5-7’)	LB-17 (5-7’) (crushed)	LB-18 (0-2’)	LB-18 (5-7’)	*Min*	*Max*	*Mean*
Total As (mg/kg)	550	320	360	360	360	220	340	220	550	359
DI Leach										
pH	9.7	10.5	8.4	9.2	9.1	10.0	9.9	8.4	10.5	9.54
As (mg/L)	1.4	0.27	0.11	<0.1	<0.1	0.36	0.22	<0.1	1.4	0.37
pH 7 Leach										
pH	ND	10.5	8.5	9.5	9.3	10.2	10.1	8.5	10.5	9.68
As (mg/L)	ND	0.3	<0.1	<0.1	<0.1	0.32	0.41	<0.1	0.41	0.22
pH 9 Leach										
pH	9.3	10.1	9.1	9.3	9.1	10.2	9.9	9.1	10.2	9.57
As (mg/L)	1.3	0.26	<0.1	<0.1	<0.1	0.69	0.32	<0.1	1.3	0.41
pH 11 Leach										
pH	10.6	11.1	10.4	11.1	10.9	10.9	11.0	10.4	11.1	10.86
As (mg/L)	2.3	0.25	0.4	0.16	0.27	0.61	0.41	0.16	2.3	0.63
								Statistics by Depth		
Statistics by Sample								*0-2’*	*5-7’*	
pH Min	9.3	10.1	8.4	9.2	9.1	10.0	9.9	8.4	9.2	
pH Max	10.6	11.1	10.4	11.1	10.9	10.9	11	10.9	11.1	
pH Mean	9.87	10.55	9.10	9.78	9.60	10.33	10.23	9.8	10.2	
As Min	1.3	0.25	<0.1	<0.1	<0.1	0.32	0.22	<0.1	<0.1	
As Max	2.3	0.3	0.4	0.16	0.27	0.69	0.41	2.3	0.41	
As Mean	1.67	0.27	0.18	0.12	0.14	0.50	0.34	0.70	0.24	

TABLE 5-2 CALCULATED ARSENIC LOADING FROM STORM WATER RUNOFF OR SURFACE WATER

Site	Location	Sample Date(s)	Flow (gpm)	As Conc. (mg/L)	Load (lb/day)	Percent of Overall Total(3)	Percent of Non-MH Total (4)	Data Source
UPLAND AREA								
Fenced Area and Associated Receptors								
CB-9	Pilchuck Path	1/18/99-1/28/99	9.0	0.29	0.0312	1.4%	5.4%	(1)
CB-10	Pilchuck Alley	1/18/99	2.4	0.03	0.0009	0.0%	0.2%	(2)
CB-15	E. Marine View Drive	1/18/99	1.7	1.10	0.023	1.0%	4.0%	(2)
440 Pilchuck Outfall	SR-529 Off Ramp	1/18/99	0.8	0.42	0.0040	0.2%	0.7%	(2)
Seep 1	E. Marine View Drive and SR-529 Intersection	2/5/99	2	21	0.50	23.1%	87.5%	(2)
MH-2	Sewer Line at E. Marine View Drive and Butler	1/18/99-1/28/99	43	3.1	1.61	73.6%	--	(1)
CB-46	E. Marine View Drive Underpass Catchbasin	1/18/99	85	0.01	0.01	0.5%	1.8%	(2)
Neighborhood North of SR-529 Overpass								
CB-29	SR-529 South On-Ramp	1/18/99	3.2	0.011	0.0004	0.019%	0.07%	(2)
CB-42	E. Marine View Drive at Skyline Drive	1/18/99	4.8	0.007	0.0004	0.018%	0.07%	(2)
CB-20	Whitehorse Trail	1/18/99	5.5	0.009	0.0006	0.027%	0.10%	(2)
CB-83	Bridgeway	1/18/99	0.3	0.013	0.0000	0.002%	0.01%	(2)
Neighborhood South of Butler Street								
CB-44	E. Marine View Drive at Hawthorne Street	1/18/99	1.5	0.069	0.0012	0.057%	0.22%	(2)
CB-43	Hawthorne btwn Butler and E.Marine View Drive	1/18/99	2.4	0.005	0.0001	0.007%	0.03%	(2)
UPLAND AREA TOTAL CALCULATED LOAD					**2.18**			
UPLAND AREA TOTAL CALCULATED LOAD EXCLUDING MANHOLES					**0.58**			
LOWLAND AREA								
SW-2	Drainage Ditch from Slag Pile	6/17/99	0.36	1.5	0.006			(2)
SW-17	Relocated Site Upgradient From City Outfall	1/28/99-2/1/99	58	0.051	0.035			(1)
SW-18	Eastern Most Ditch	1/18/99-1/28/99	184	0.094	0.21			(1)
SW-18	Eastern Most Ditch	6/17/99	4	0.37	0.0178			(2)
SW-18	Eastern Most Ditch	8/3/99	1	0.24	0.0029			(2)
Outfall	Snohomish River Outfall	6/17/99	3.7	0.097	0.0043			(2)

Notes:

(1) Calculated average from automated sampler data

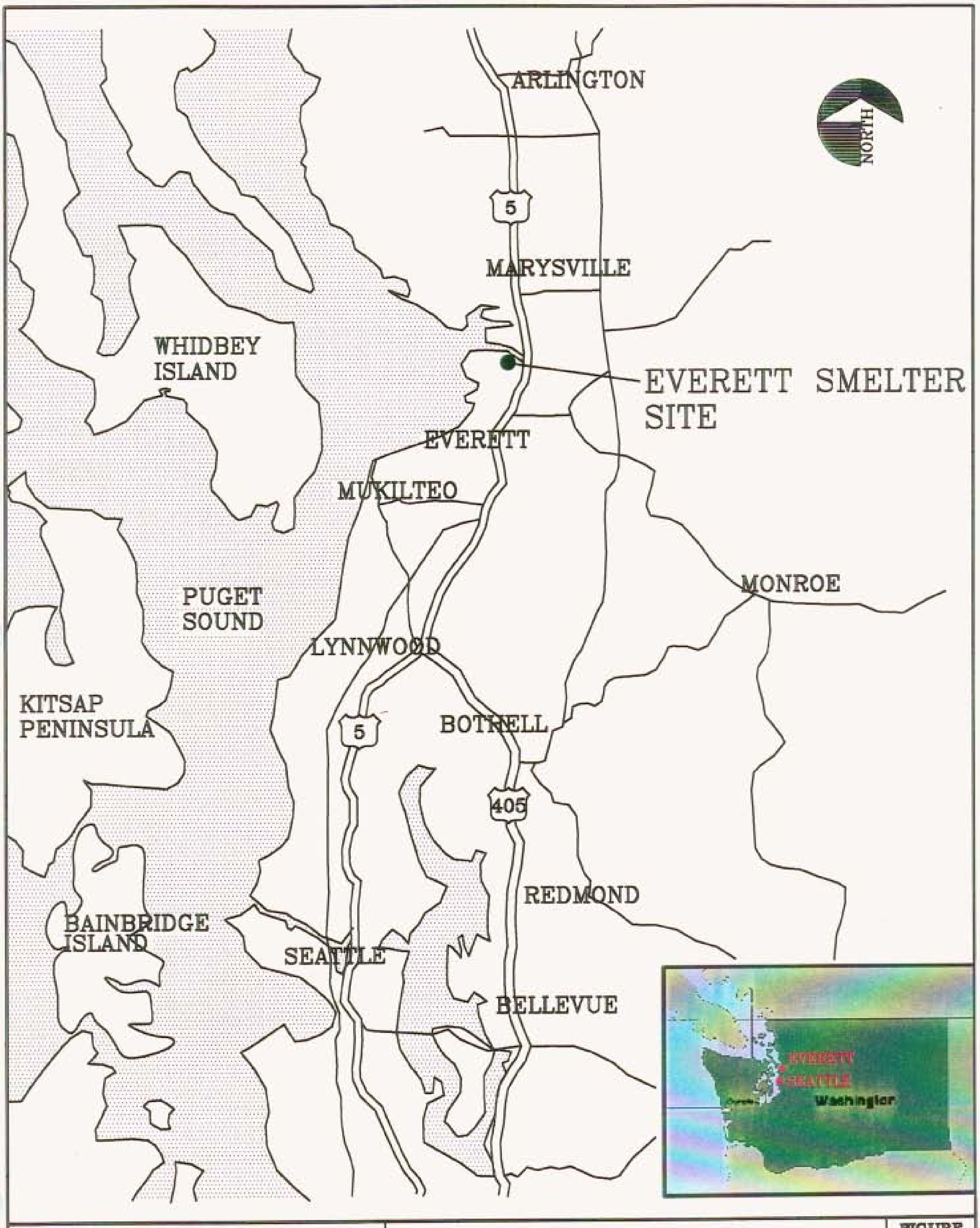
(2) Maximum results from grab samples

(3) Percent of Total Observed Load (2.18 lb/day)

(4) Percent of Total Observed Load Excluding Manholes (0.58 lb/day)

TABLE 5-3
SEDIMENT SAMPLES WITH ARSENIC EXCEEDING SQS AND/OR CSL CRITERIA

Site	Task	Sample Location	Sample Number	Arsenic (mg/Kg)	SQS (mg/Kg)	CSL (mg/Kg)
Mill E	Phase I	SR-01	SR-01-01	103.0	57	93
Mill E	Phase I	SR-02	SR-02-01	67.8	57	93
Mill E	Phase I	SR-05	SR-05-01	253.0	57	93
Mill E	Phase I	SR-05	SR-05-02	426.0	57	93
Mill E	Phase I	SR-05	SR-05-03	239.0	57	93
Mill E	Phase III	SR-01	SR-01-B	66.5	57	93
Mill E	Phase III	SR-01	SR-01-C	91.8	57	93
Mill E	Phase III	SR-05	SR-05-B	84.5	57	93



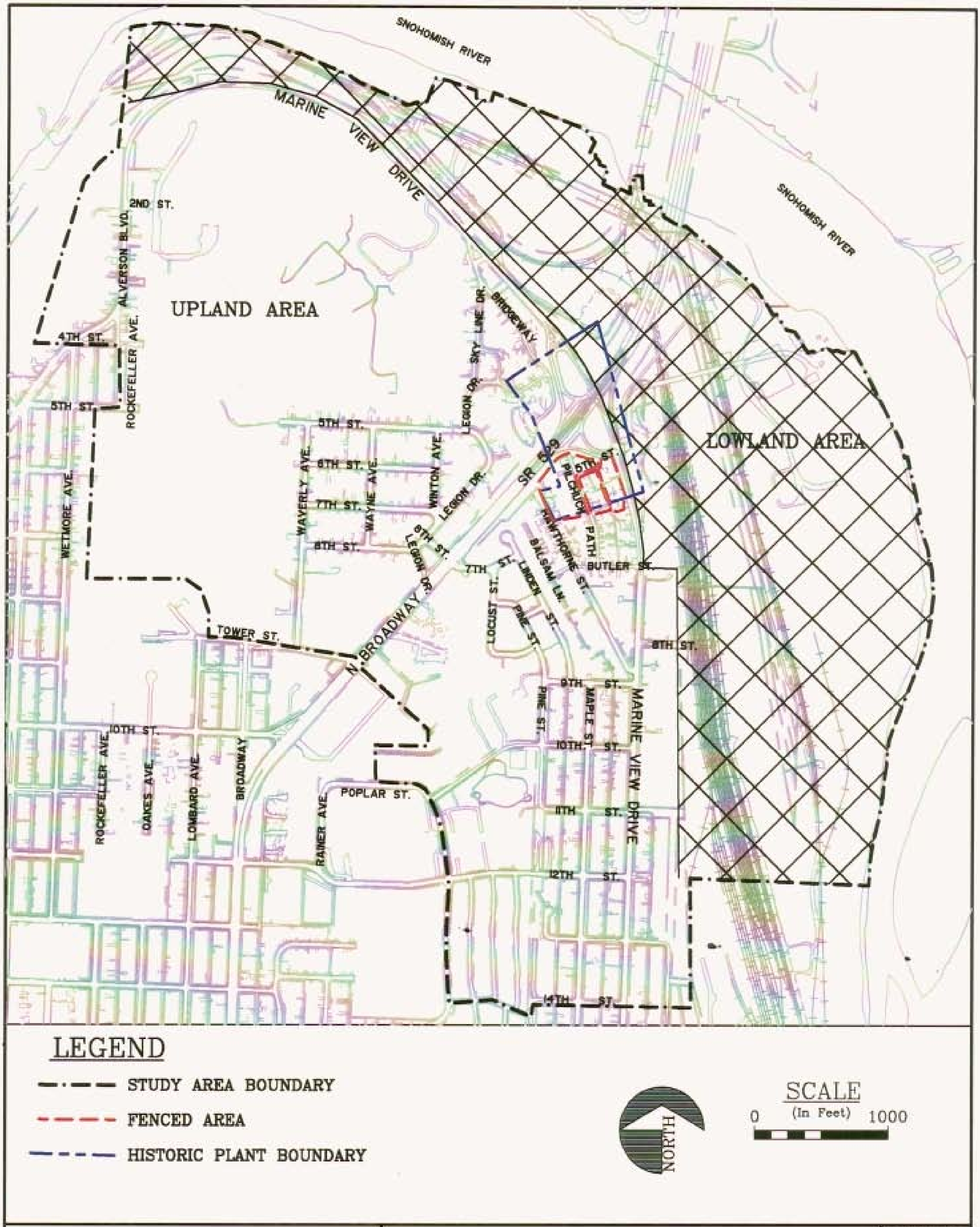
COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

SITE LOCATION

FIGURE

1-1

UPDATE TIME: 3:15PM
002\0030\065\0034\SPO\120699\I-\STORAGE\03099S17.PLT



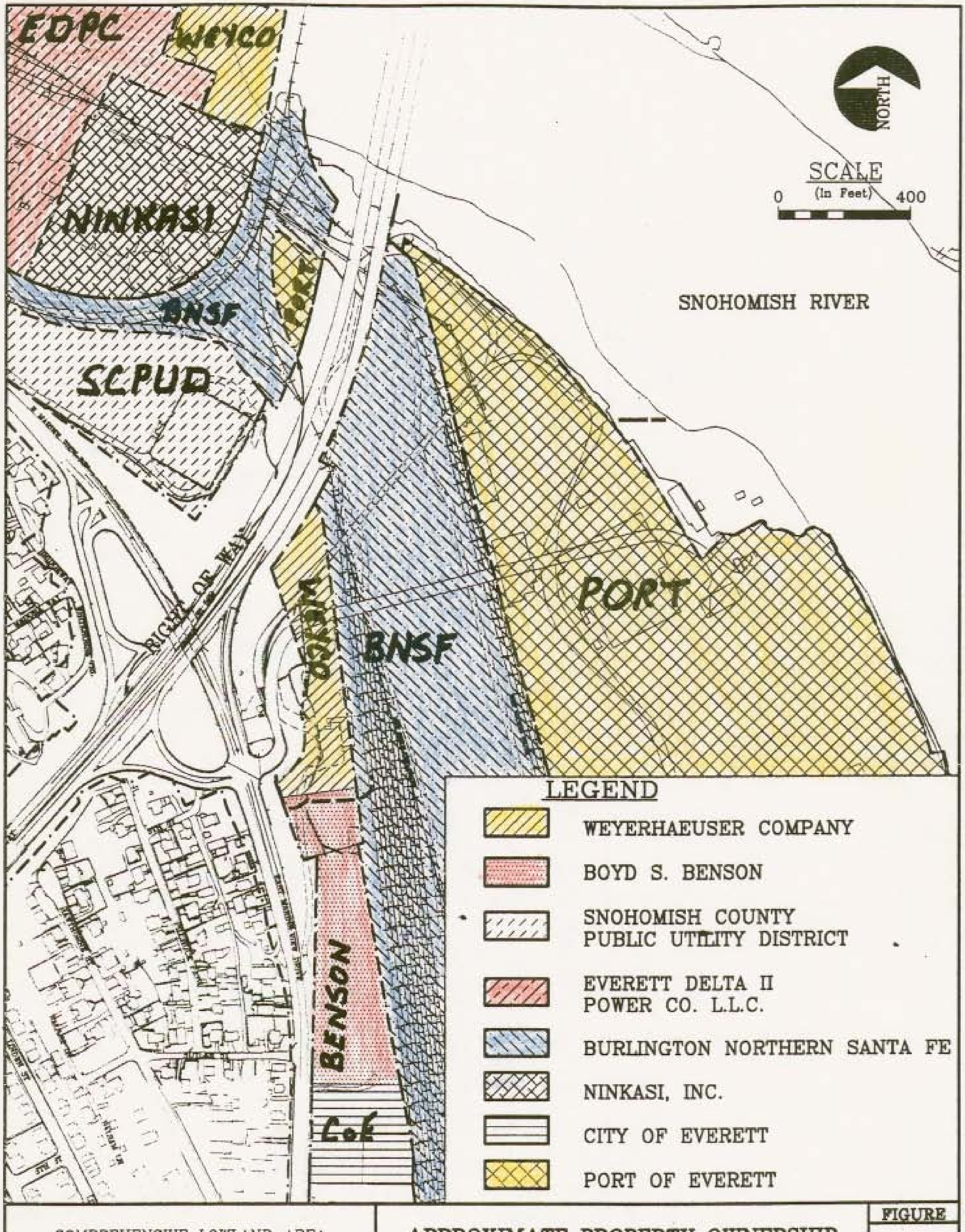
COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

SITE STUDY AREA

FIGURE
1-2

UPDATE TIME: 4:10PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099516.DWG

Hydrometrics, Inc.



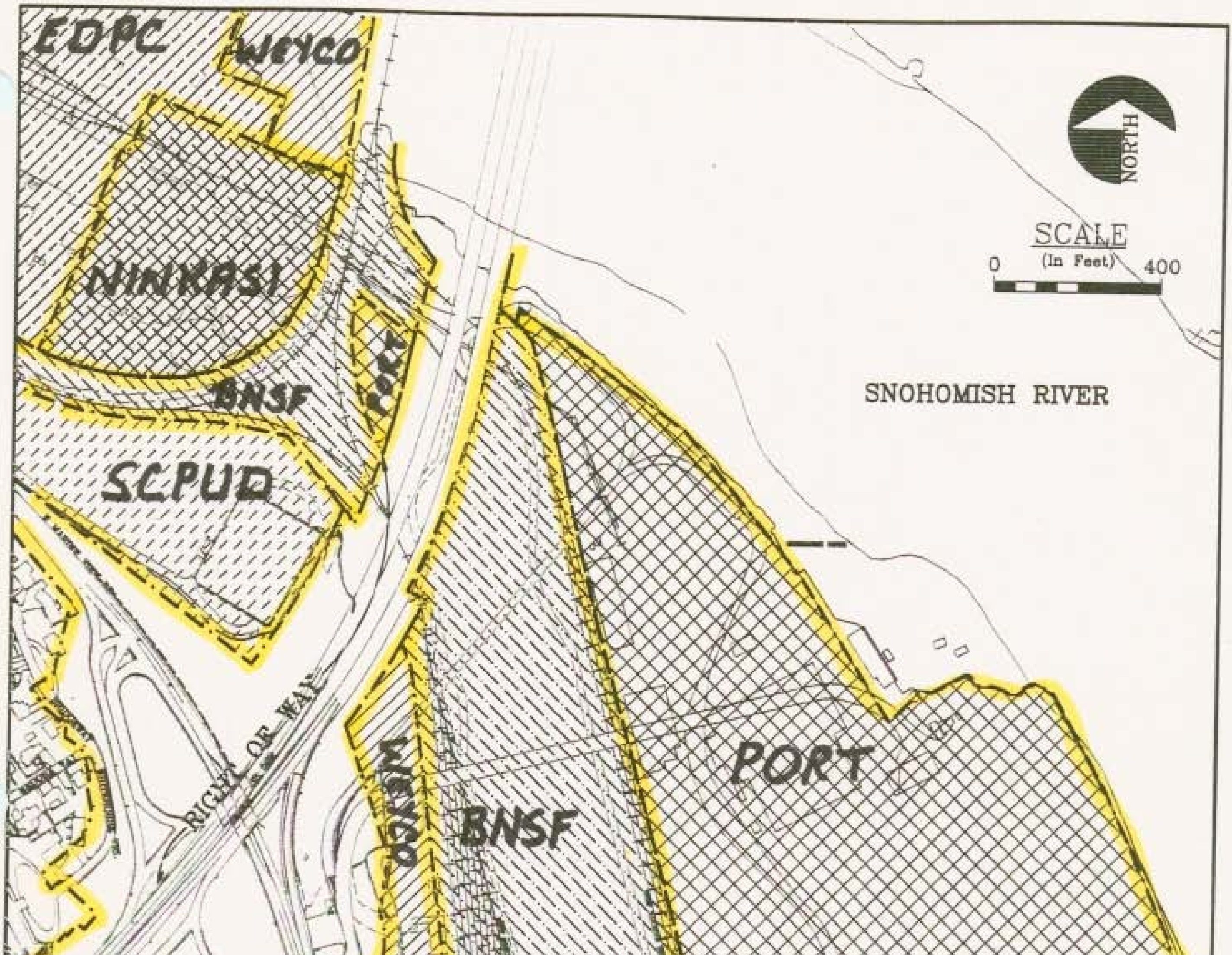
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

APPROXIMATE PROPERTY OWNERSHIP IN THE LOWLAND AREA

FIGURE
1-3

UPDATE TIME: 4:15PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099S18

Hydrometrics, Inc.



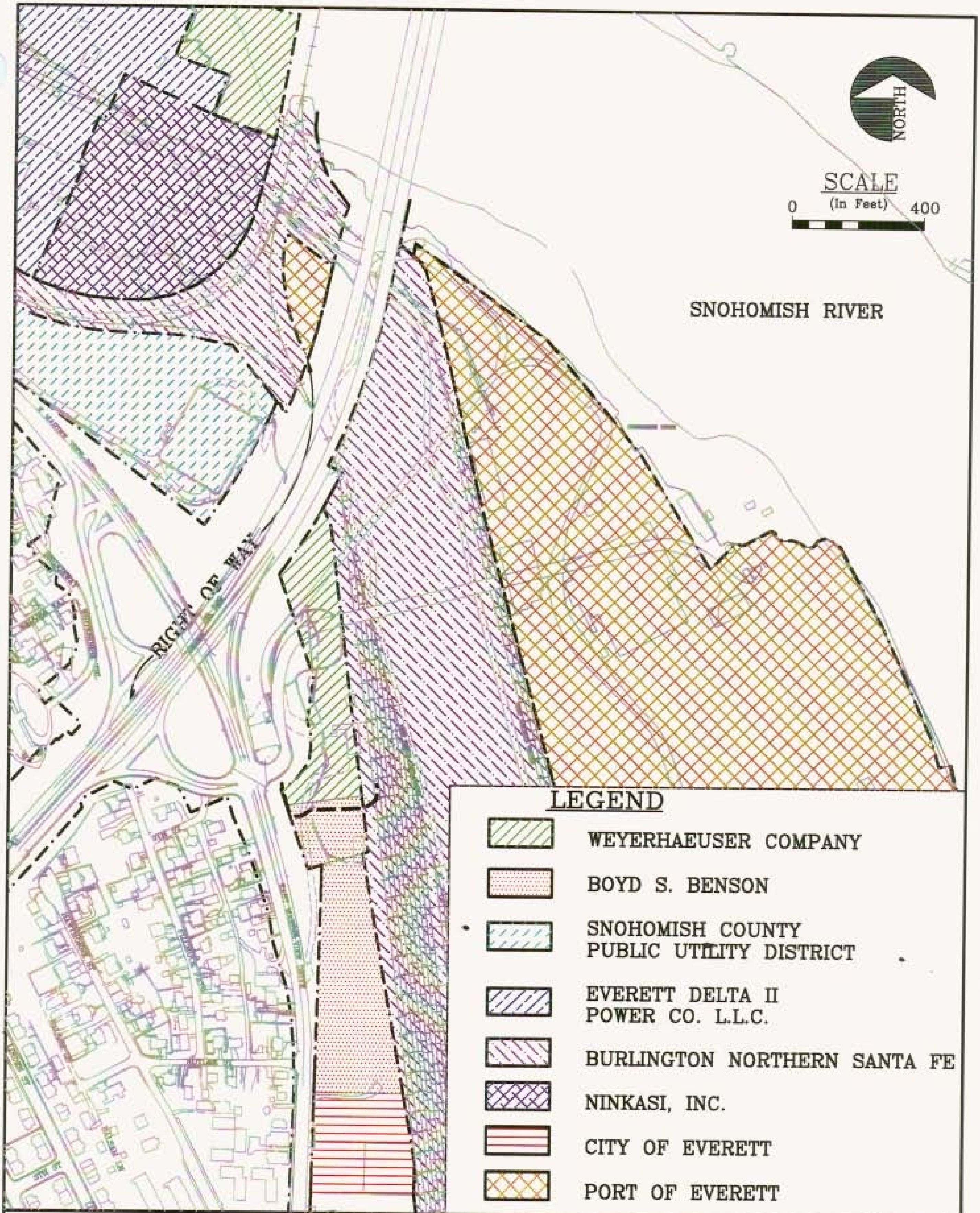
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

APPROXIMATE PROPERTY OWNERSHIP IN THE LOWLAND AREA

FIGURE
1-3

UPDATE TIME: 4:15PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099518

Hydrometrics, Inc.



COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

APPROXIMATE PROPERTY OWNERSHIP IN THE LOWLAND AREA

FIGURE
1-3

UPDATE TIME: 4:15PM
008\0030\065\0034\SP0\102699\I:\STORAGE\03099S18

Hydrometrics, Inc.

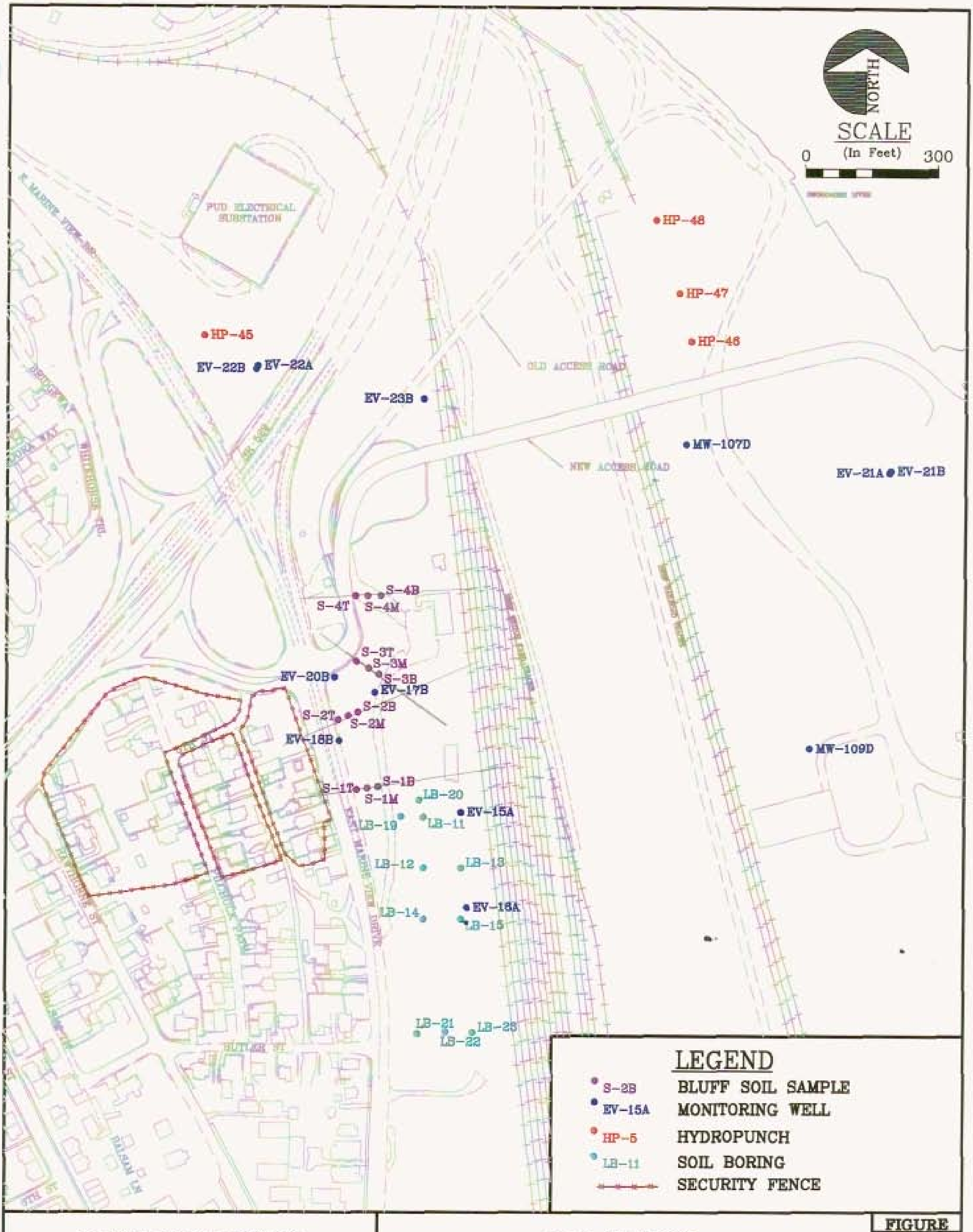
COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

SLAG/FILL BORINGS

FIGURE
3-2

UPDATE TIME: 3:40PM
008\0030\065\0034\SPO\102599\I:\STORAGE\03099S10

Hydrometrics, Inc.®



COMPREHENSIVE LOWLAND
AREA REMEDIAL
INVESTIGATION REPORT

SOIL SAMPLE COLLECTION LOCATIONS

FIGURE

3-1

UPDATE TIME: 2:55PM
008\0030\065\0034\SPO\100499\I:\STORAGE\03099S09

Hydrometrics, Inc.®

COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

PRIMARY CHANNELS

FIGURE

3-3

UPDATE TIME: 3:35PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099S11

Hydrometrics, Inc.

COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

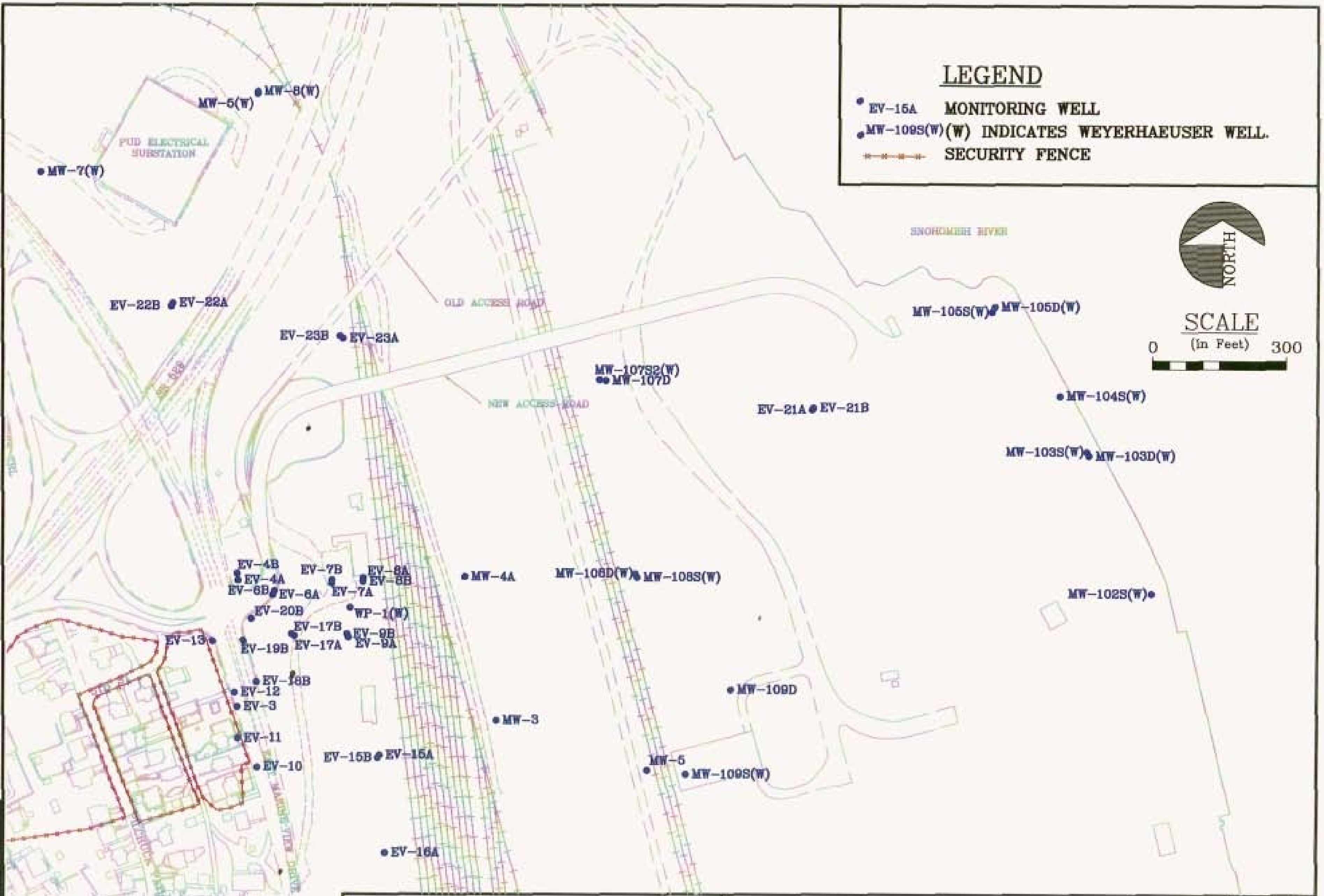
HYDROPUNCH LOCATIONS

FIGURE
3-4

UPDATE TIME: 3:45PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099S12

Hydrometrics, Inc.®

UPDATE TIME: 4:00PM
008\0030\065\0034\SPO\102699\I:\STORAGE\0309S14

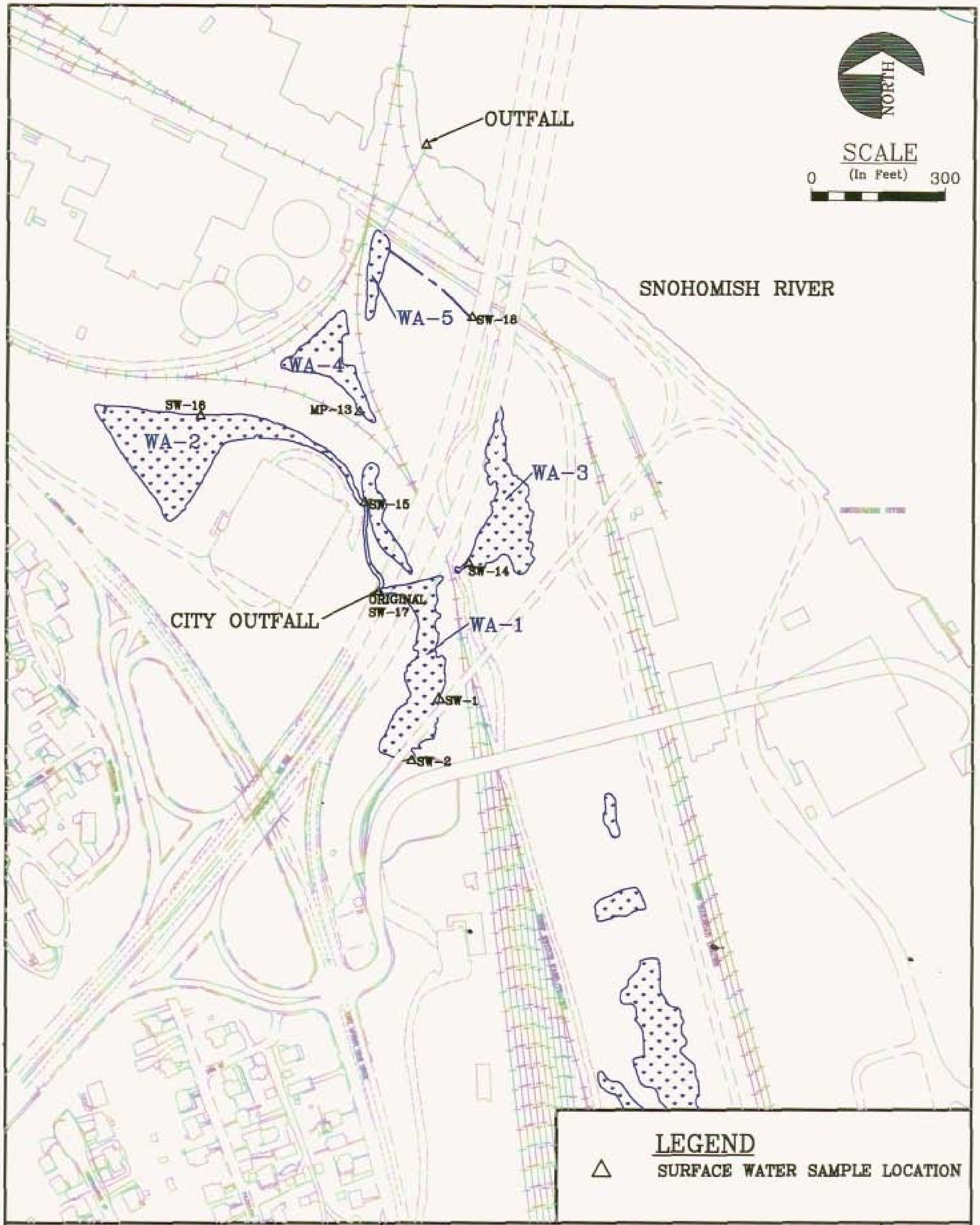


Hydrometrics, Inc.

COMPREHENSIVE LOWLAND
AREA RI REPORT
EVERETT, WASHINGTON

**GROUNDWATER MONITORING
WELL NETWORK**

FIGURE
3-5



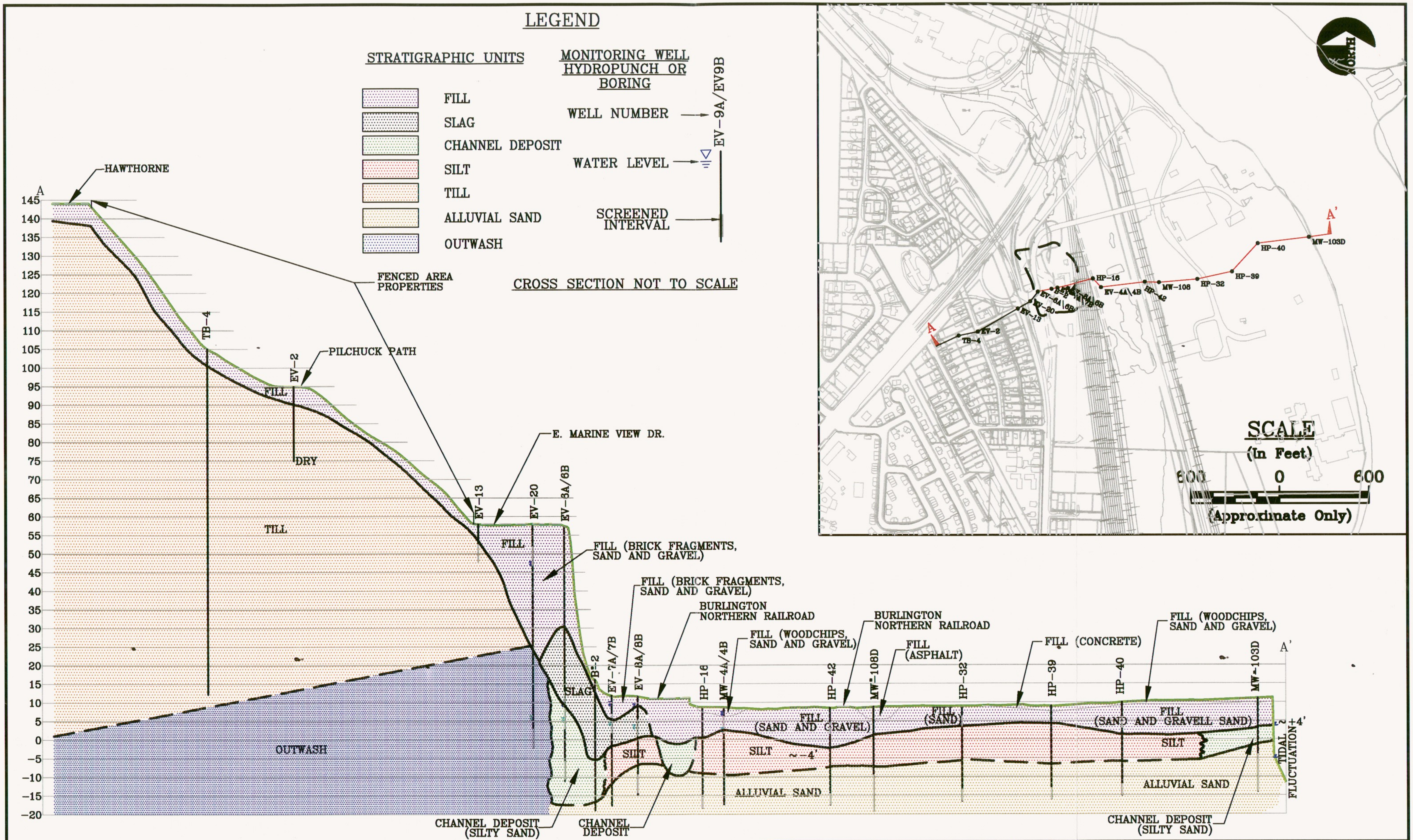
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

SURFACE WATER SAMPLE LOCATIONS

FIGURE
3-6

UPDATE TIME: 4:35PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099S13

Hydrometrics, Inc.



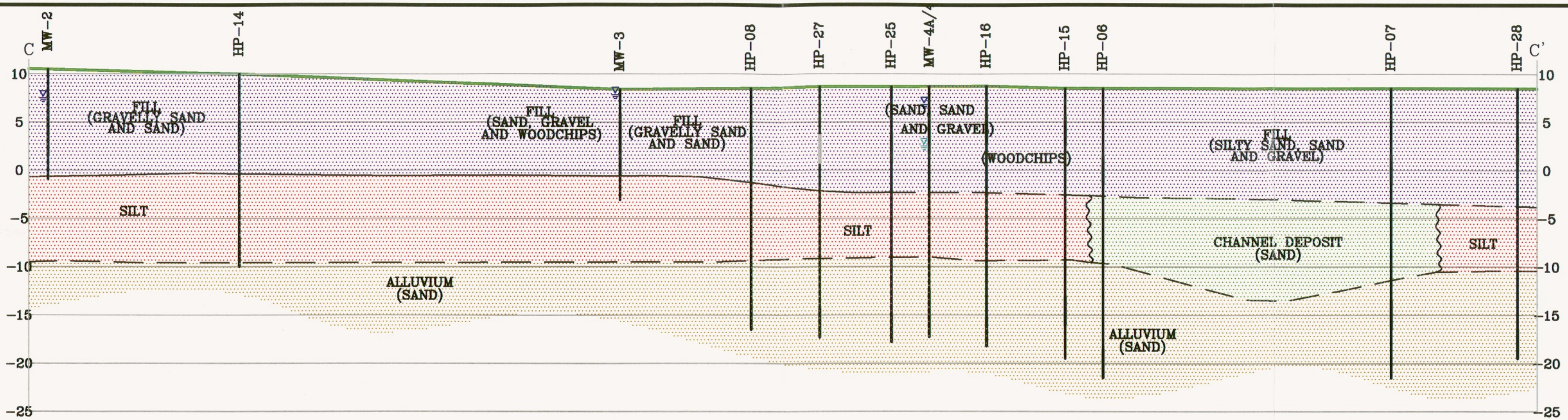
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

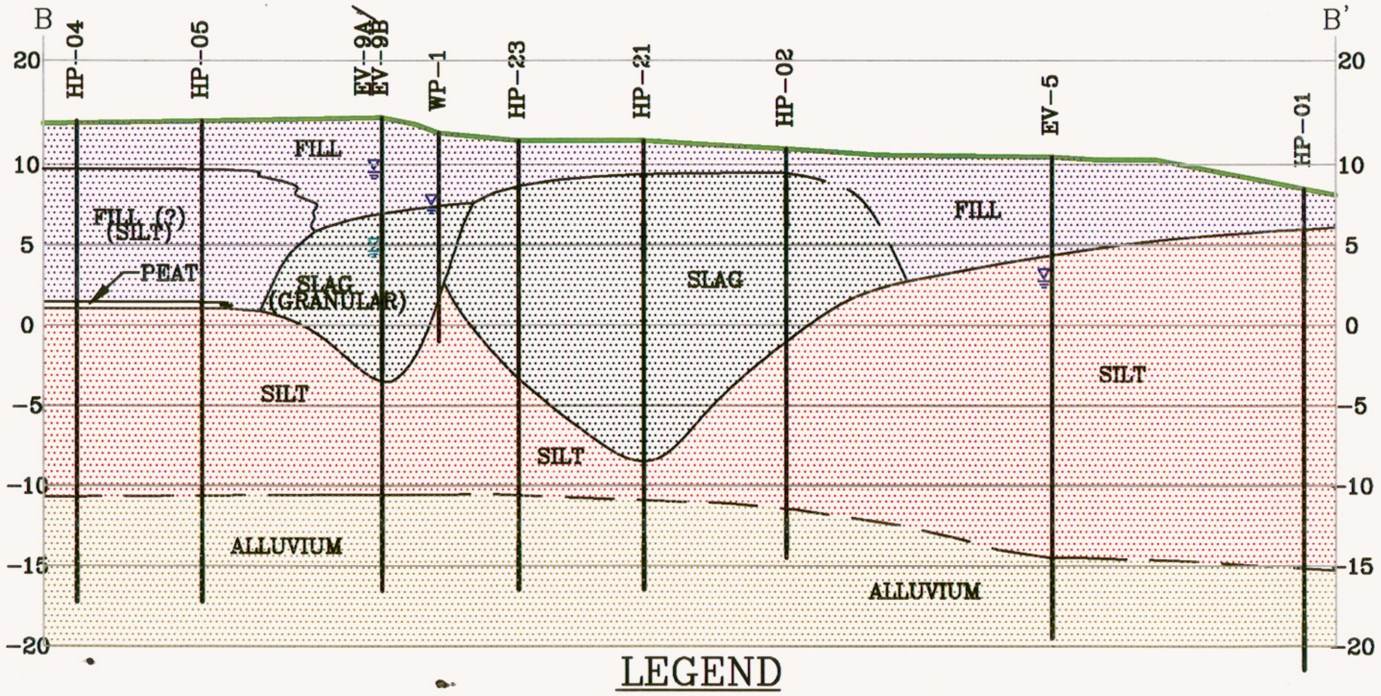
GENERALIZED GEOLOGIC CROSS SECTION A-A'

FIGURE
4-1

UPDATE TIME: 10:55AM
008\0030\065\0249\HEL\101499\I:\STORAGE\03099a17.dwg

Hydrometrics, Inc.
consulting scientists, engineers and contractors





LEGEND

STRATIGRAPHIC UNITS

- ▨ FILL
- ▨ SLAG
- ▨ CHANNEL DEPOSIT
- ▨ SILT
- ▨ TILL
- ▨ ALLUVIAL SAND
- ▨ OUTWASH

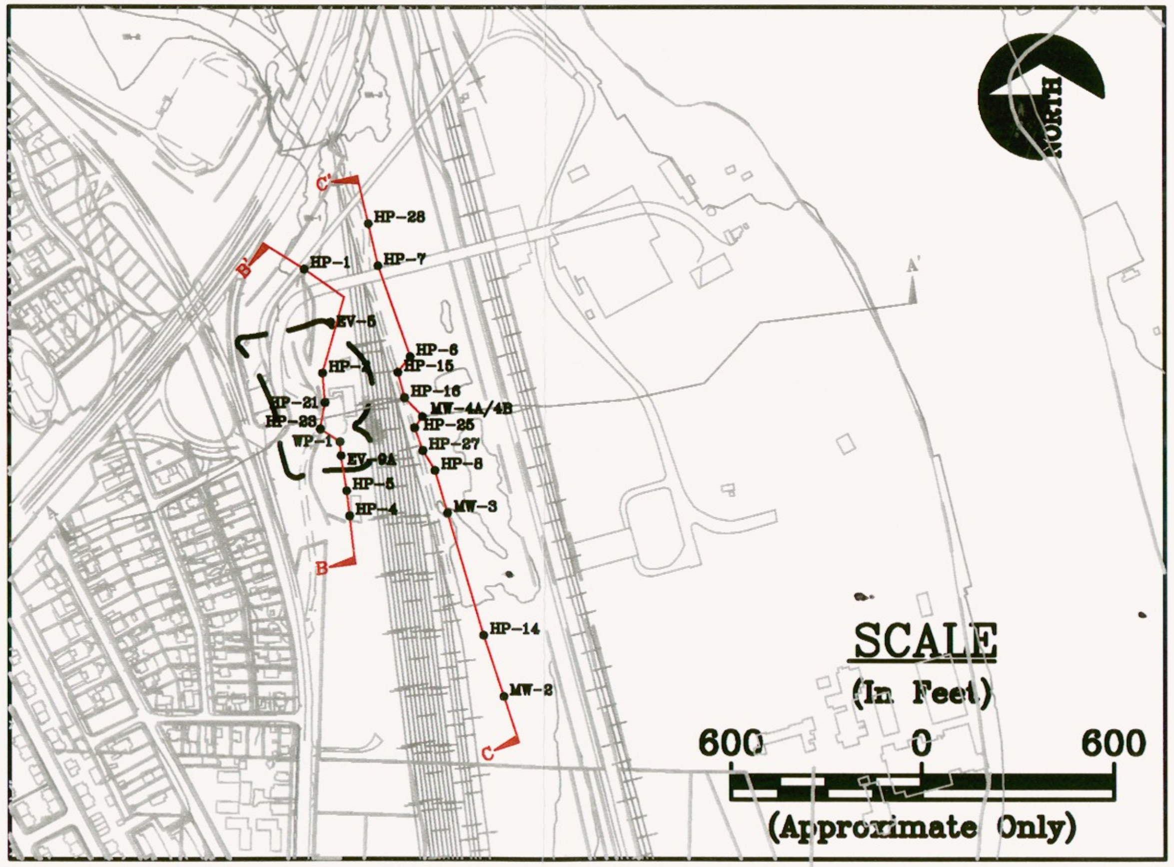
MONITORING WELL HYDROPUNCH OR BORING

WELL NUMBER → EV-9A/EV9B

WATER LEVEL → ▽

SCREENED INTERVAL →

CROSS SECTIONS NOT TO SCALE



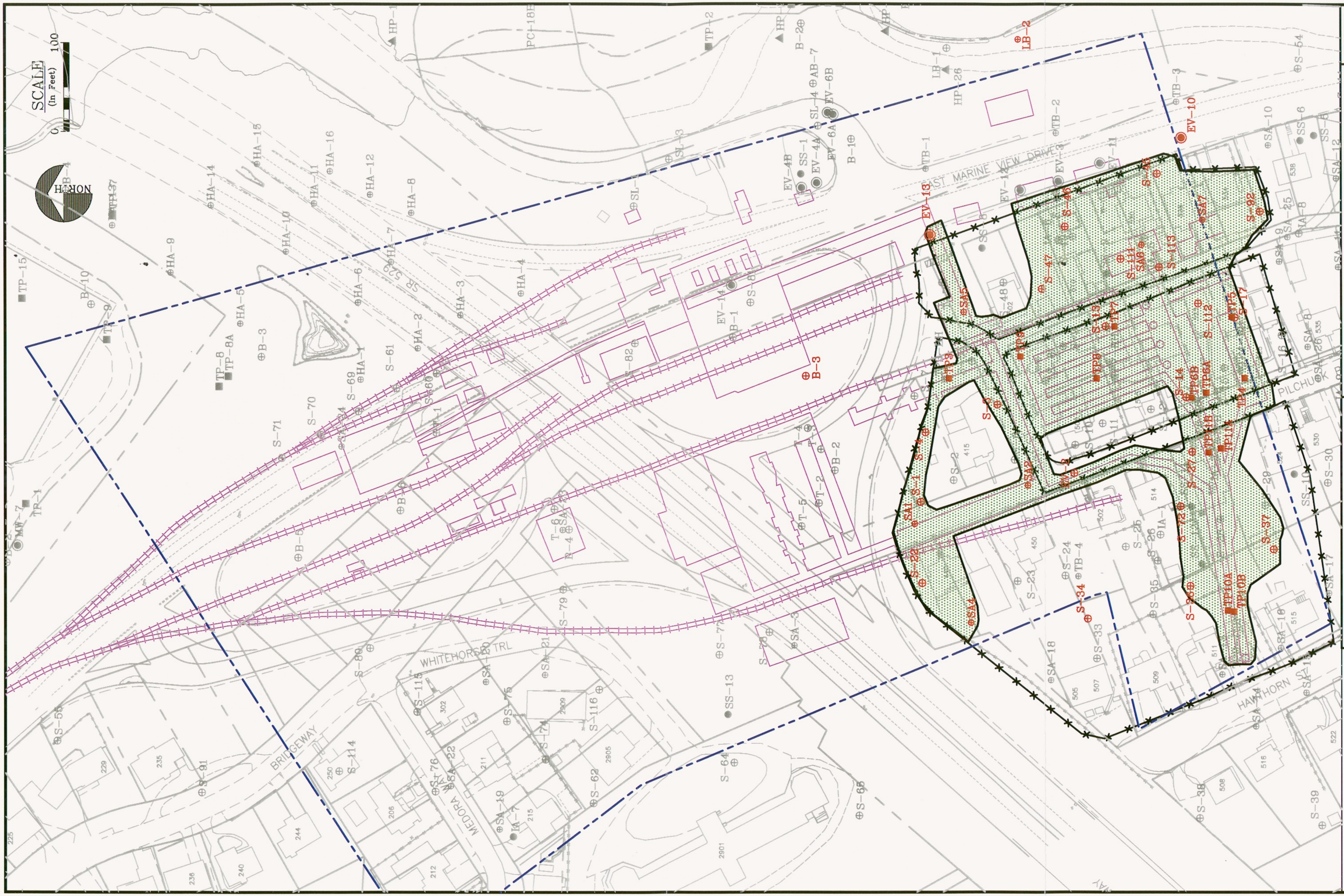
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT WASHINGTON

GENERALIZED GEOLOGIC CROSS SECTION B-B' AND C-C'

FIGURE
4-2

UPDATE TIME: 12:30AM
008\0030\065\0249\HEL\101499\I:\STORAGE\03099a18.dwg

Hydrometrics, Inc.
consulting scientists, engineers and contractors



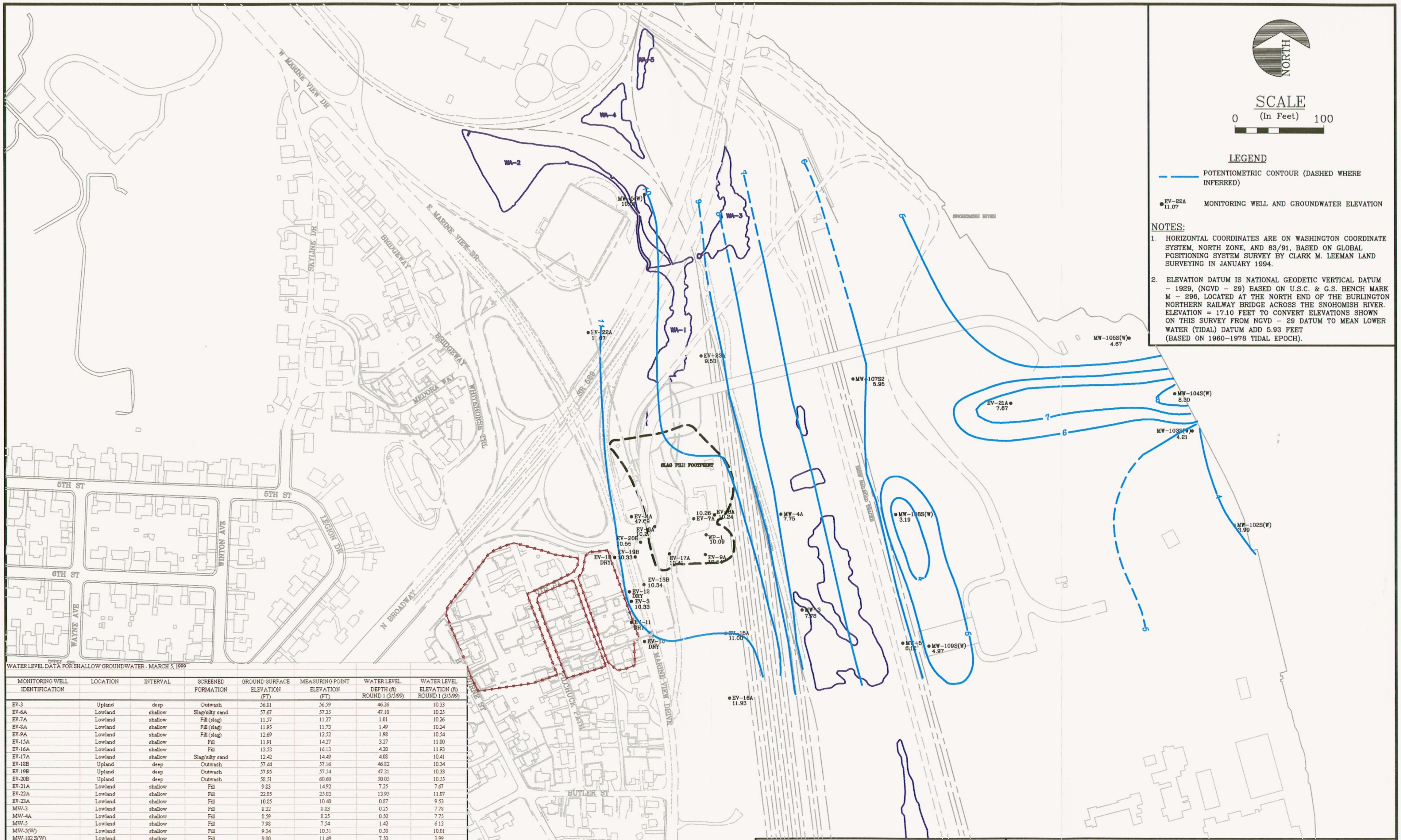
ESTIMATED EXTENT OF SMELTER RESIDUAL CONTAINING ARSENIC TRIOXIDE OR FLUE DUST

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

FIGURE
4-3

UPDATE TIME: 3:30PM
008\0668\065\0083\TAC\100198\I:\STORAGE\6898T05 .DWG

Hydrometrics, Inc. Consulting Scientists, Engineers and Contractors



LEGEND

- POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)
- ● EV-22A 11.07 — MONITORING WELL AND GROUNDWATER ELEVATION

NOTES:

1. HORIZONTAL COORDINATES ARE ON WASHINGTON COORDINATE SYSTEM, NORTH ZONE, AND 83/91, BASED ON GLOBAL POSITIONING SYSTEM SURVEY BY CLARK M. LEEMAN LAND SURVEYING IN JANUARY 1994.

2. ELEVATION DATUM IS NATIONAL GEODETIC VERTICAL DATUM – 1929, (NGVD – 29) BASED ON U.S.C. & G.S. BENCH MARK M – 296, LOCATED AT THE NORTH END OF THE BURLINGTON NORTHERN RAILWAY BRIDGE ACROSS THE SNOHOMISH RIVER. ELEVATION = 17.10 FEET TO CONVERT ELEVATIONS SHOWN ON THIS SURVEY FROM NGVD – 29 DATUM TO MEAN LOWER WATER (TIDAL) DATUM ADD 5.93 FEET (BASED ON 1960–1978 TIDAL EPOCH).

WATER LEVEL DATA FOR SHALLOW GROUNDWATER - MARCH 5, 1999

MONITORING WELL IDENTIFICATION	LOCATION	INTERVAL	SCREENED FORMATION	GROUND SURFACE ELEVATION (FT)	MEASURING POINT ELEVATION (FT)	WATER LEVEL DEPTH (ft) ROUND 1 (3/5/99)	WATER LEVEL ELEVATION (ft) ROUND 1 (3/5/99)
EV-3	Upland	deep	Outwash	56.81	56.59	46.26	10.33
EV-6A	Lowland	shallow	Slag/silty sand	57.67	57.35	47.10	10.25
EV-7A	Lowland	shallow	Fill (slag)	11.57	11.27	1.01	10.26
EV-8A	Lowland	shallow	Fill (slag)	11.95	11.73	1.49	10.24
EV-9A	Lowland	shallow	Fill (slag)	12.69	12.52	1.98	10.54
EV-15A	Lowland	shallow	Fill	11.91	14.27	3.27	11.00
EV-16A	Lowland	shallow	Fill	13.53	16.13	4.20	11.93
EV-17A	Lowland	shallow	Slag/silty sand	12.42	14.49	4.08	10.41
EV-18B	Upland	deep	Outwash	57.44	57.16	46.82	10.34
EV-19B	Upland	deep	Outwash	57.95	57.54	47.21	10.33
EV-20B	Upland	deep	Outwash	58.51	60.60	50.05	10.55
EV-21A	Lowland	shallow	Fill	9.83	14.92	7.25	7.67
EV-22A	Lowland	shallow	Fill	22.85	25.02	13.95	11.07
EV-23A	Lowland	shallow	Fill	10.85	10.40	0.87	9.53
MW-3	Lowland	shallow	Fill	8.32	8.03	0.25	7.78
MW-4A	Lowland	shallow	Fill	8.59	8.25	0.50	7.75
MW-5	Lowland	shallow	Fill	7.98	7.54	1.42	6.12
MW-5(W)	Lowland	shallow	Fill	9.34	10.51	0.50	10.01
MW-102 S(W)	Lowland	shallow	Fill	9.00	11.49	7.50	3.99
MW-103S(W)	Lowland	shallow	Fill	11.00	14.01	9.80	4.21
MW-104S(W)	Lowland	shallow	Fill	12.00	14.83	6.53	8.30
MW-105S(W)	Lowland	shallow	Fill	9.40	11.81	7.14	4.67
MW-107S2(W)	Lowland	shallow	Fill	NA	7.60	1.65	5.95
MW-108S(W)	Lowland	shallow	Fill	8.73	11.24	8.05	3.19
MW-109S(W)	Lowland	shallow	Fill	11.50	11.36	6.39	4.97
WP-1	Lowland	shallow	Fill	NA	14.36	4.27	10.09

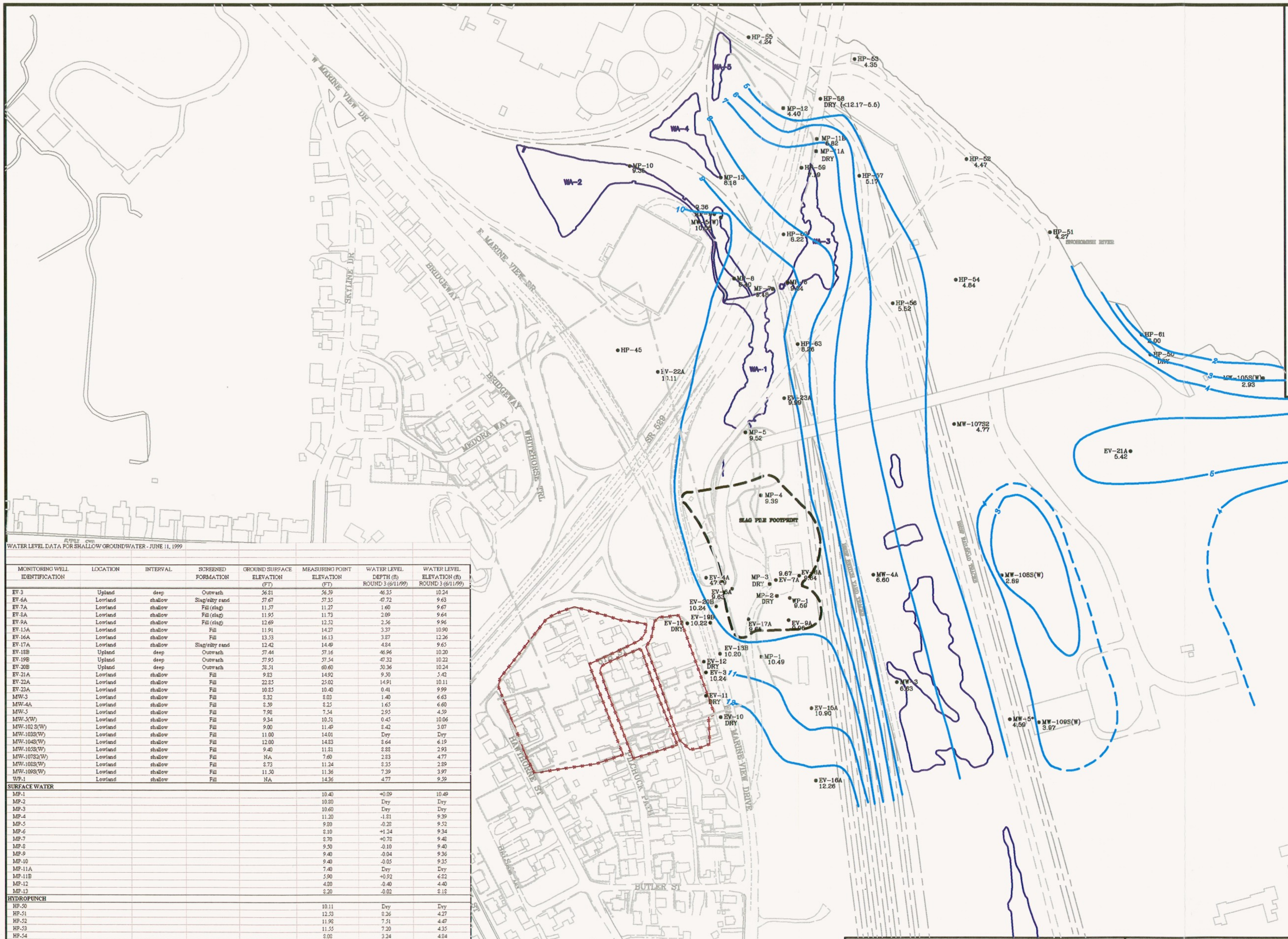
COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

POTENTIOMETRIC CONTOURS FOR SHALLOW GROUNDWATER - MARCH 5, 1999

FIGURE
4-4

UPDATE TIME: 1:56PM
007\0030\065\0249\HEL\102799\I:\STORAGE\03099a12.dwg

Hydrometrics, Inc.
consulting scientists, engineers and contractors



WATER LEVEL DATA FOR SHALLOW GROUNDWATER - JUNE 11, 1999

MONITORING WELL IDENTIFICATION	LOCATION	INTERVAL	SCREENED FORMATION	GROUND SURFACE ELEVATION (FT)	MEASURING POINT ELEVATION (FT)	WATER LEVEL DEPTH (ft) ROUND 3 (6/11/99)	WATER LEVEL ELEVATION (ft) ROUND 3 (6/11/99)
EV-3	Upland	deep	Outwash	56.81	56.59	46.35	10.24
EV-6A	Lowland	shallow	Slag/silty sand	57.67	57.35	47.72	9.63
EV-7A	Lowland	shallow	Fill (slag)	11.57	11.27	1.60	9.67
EV-8A	Lowland	shallow	Fill (slag)	11.95	11.73	2.09	9.64
EV-9A	Lowland	shallow	Fill (slag)	12.69	12.52	2.56	9.96
EV-15A	Lowland	shallow	Fill	11.91	14.27	3.37	10.90
EV-16A	Lowland	shallow	Fill	13.53	16.13	3.87	12.26
EV-17A	Lowland	shallow	Slag/silty sand	12.42	14.49	4.84	9.65
EV-18B	Upland	deep	Outwash	57.44	57.16	46.96	10.20
EV-19B	Upland	deep	Outwash	57.95	57.54	47.32	10.22
EV-20B	Upland	deep	Outwash	58.51	60.60	50.36	10.24
EV-21A	Lowland	shallow	Fill	9.83	14.92	9.50	5.42
EV-22A	Lowland	shallow	Fill	22.85	25.02	14.91	10.11
EV-23A	Lowland	shallow	Fill	10.85	10.40	0.41	9.99
MW-3	Lowland	shallow	Fill	8.32	8.03	1.40	6.63
MW-4A	Lowland	shallow	Fill	8.59	8.25	1.65	6.60
MW-5	Lowland	shallow	Fill	7.98	7.54	2.95	4.59
MW-5(W)	Lowland	shallow	Fill	9.34	10.51	0.45	10.06
MW-102 S(W)	Lowland	shallow	Fill	9.00	11.49	8.42	3.07
MW-103S(W)	Lowland	shallow	Fill	11.00	14.01	Dry	Dry
MW-104S(W)	Lowland	shallow	Fill	12.00	14.83	8.64	6.19
MW-105S(W)	Lowland	shallow	Fill	9.40	11.81	8.88	2.93
MW-107S2(W)	Lowland	shallow	Fill	NA	7.60	2.83	4.77
MW-108S(W)	Lowland	shallow	Fill	8.73	11.24	8.35	2.89
MW-109S(W)	Lowland	shallow	Fill	11.50	11.36	7.39	3.97
WP-1	Lowland	shallow	Fill	NA	14.36	4.77	9.59
SURFACE WATER							
MP-1					10.40	+0.09	10.49
MP-2					10.80	Dry	Dry
MP-3					10.60	Dry	Dry
MP-4					11.20	-1.81	9.39
MP-5					9.80	-0.28	9.52
MP-6					8.10	+1.24	9.34
MP-7					8.70	+0.78	9.48
MP-8					9.50	-0.10	9.40
MP-9					9.40	-0.04	9.36
MP-10					9.40	-0.05	9.35
MP-11A					7.40	Dry	Dry
MP-11B					5.90	+0.92	6.82
MP-12					4.80	-0.40	4.40
MP-13					8.20	-0.02	8.18
HYDROPUNCH							
HP-50					10.11	Dry	Dry
HP-51					12.53	8.26	4.27
HP-52					11.98	7.51	4.47
HP-53					11.55	7.20	4.35
HP-54					8.08	3.24	4.84
HP-55					12.49	8.25	4.24
HP-56					10.25	4.73	5.52
HP-57					12.37	7.20	5.17
HP-58					12.17	Dry	Dry
HP-59					8.47	1.28	7.19
HP-61					9.13	7.13	2.00
HP-62					11.43	3.21	8.22
HP-63					11.37	3.11	8.26

LEGEND

▬ ▬	POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)
● EV-22A 10.11	MONITORING WELL AND GROUNDWATER ELEVATION
⊕ MP-4 9.39	SURFACE WATER MONITORING SITE SURFACE WATER ELEVATION
● HP-51 4.27	HYDROPUNCH AND GROUNDWATER ELEVATION

NOTES:

1. HORIZONTAL COORDINATES ARE ON WASHINGTON COORDINATE SYSTEM, NORTH ZONE, AND 83/91, BASED ON GLOBAL POSITIONING SYSTEM SURVEY BY CLARK M. LEEMAN LAND SURVEYING IN JANUARY 1994.
2. ELEVATION DATUM IS NATIONAL GEODETIC VERTICAL DATUM – 1929, (NGVD – 29) BASED ON U.S.C. & G.S. BENCH MARK M – 296, LOCATED AT THE NORTH END OF THE BURLINGTON NORTHERN RAILWAY BRIDGE ACROSS THE SNOHOMISH RIVER. ELEVATION = 17.10 FEET TO CONVERT ELEVATIONS SHOWN ON THIS SURVEY FROM NGVD – 29 DATUM TO MEAN LOWER WATER (TIDAL) DATUM ADD 5.93 FEET (BASED ON 1960–1978 TIDAL EPOCH).

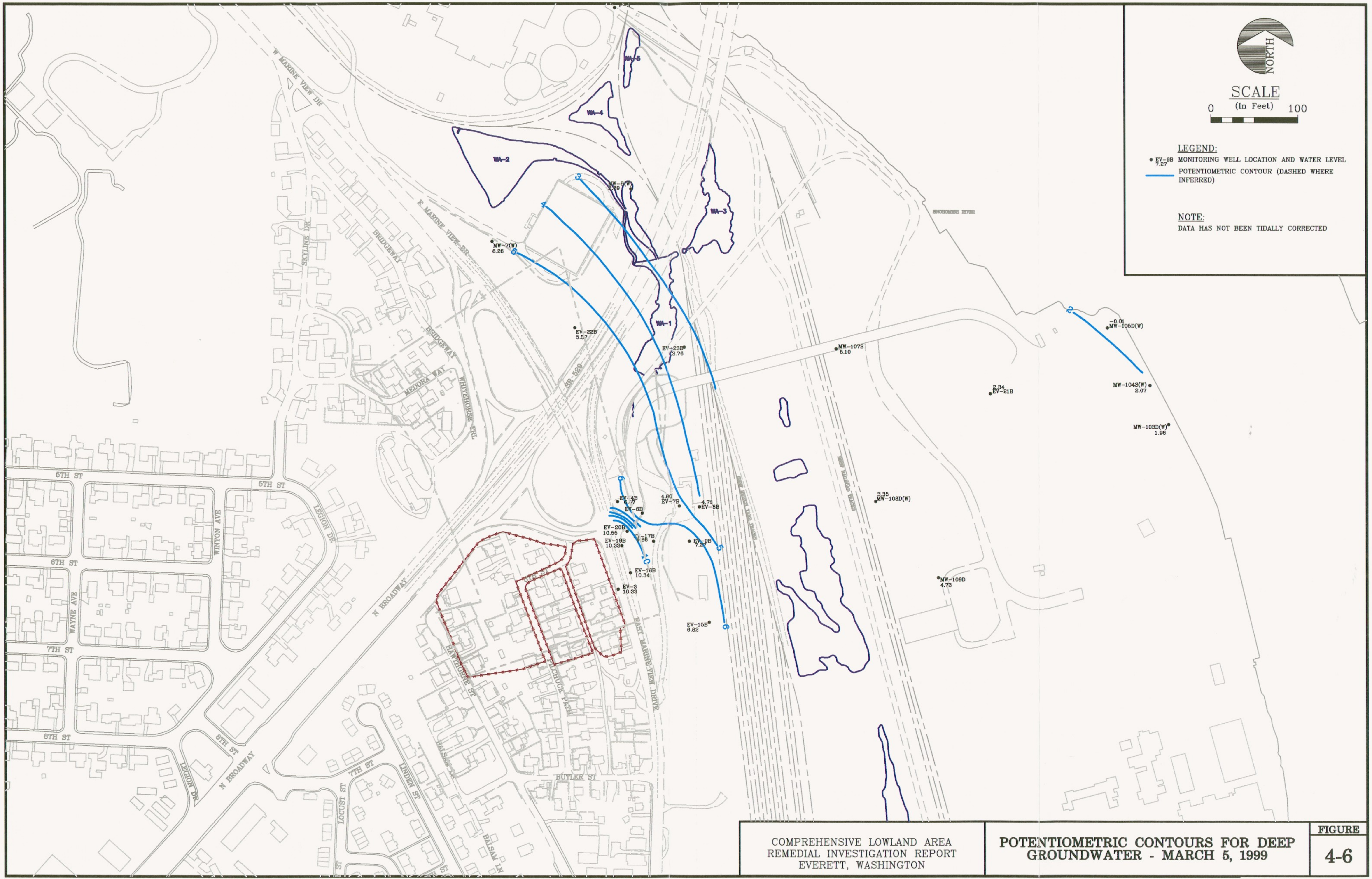
COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

POTENTIOMETRIC CONTOURS FOR SHALLOW GROUNDWATER - JUNE 11, 1999

FIGURE
4-5

UPDATE TIME: 2:04PM
007\0030\065\0249\HEL\102799\I:\STORAGE\03099a11.dwg

Hydrometrics, Inc.
consulting scientists, engineers and contractors



LEGEND:

● EV-9B 7.27 MONITORING WELL LOCATION AND WATER LEVEL

━ POTENTIOMETRIC CONTOUR (DASHED WHERE INFERRED)

NOTE:

DATA HAS NOT BEEN TIDALLY CORRECTED

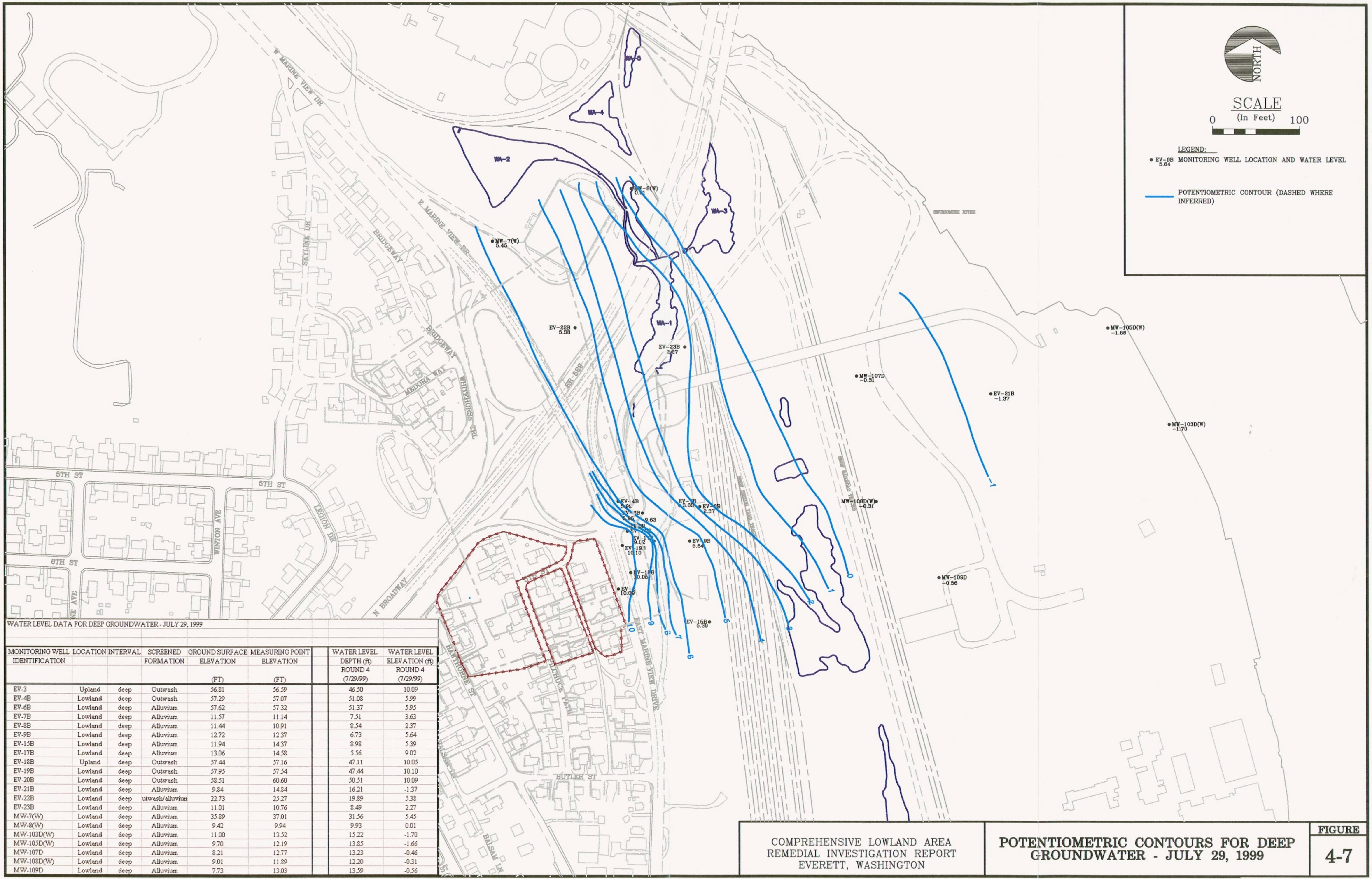
COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

POTENTIOMETRIC CONTOURS FOR DEEP GROUNDWATER - MARCH 5, 1999

FIGURE
4-6

UPDATE TIME: 2:40PM
007\0030\065\0249\HEL\102799\I:\STORAGE\03099o07.dwg

Hydrometrics, Inc. ®
consulting scientists, engineers and contractors



WATER LEVEL DATA FOR DEEP GROUNDWATER - JULY 29, 1999

MONITORING WELL IDENTIFICATION	LOCATION	INTERVAL	SCREENED FORMATION	GROUND SURFACE ELEVATION (FT)	MEASURING POINT ELEVATION (FT)		WATER LEVEL DEPTH (ft) ROUND 4 (7/29/99)	WATER LEVEL ELEVATION (ft) ROUND 4 (7/29/99)
EV-3	Upland	deep	Outwash	56.81	56.59		46.50	10.09
EV-4B	Lowland	deep	Outwash	57.29	57.07		51.08	5.99
EV-6B	Lowland	deep	Alluvium	57.62	57.32		51.37	5.95
EV-7B	Lowland	deep	Alluvium	11.57	11.14		7.51	3.63
EV-8B	Lowland	deep	Alluvium	11.44	10.91		8.54	2.37
EV-9B	Lowland	deep	Alluvium	12.72	12.37		6.73	5.64
EV-15B	Lowland	deep	Alluvium	11.94	14.37		8.98	5.39
EV-17B	Lowland	deep	Alluvium	13.06	14.58		5.56	9.02
EV-18B	Upland	deep	Outwash	57.44	57.16		47.11	10.05
EV-19B	Lowland	deep	Outwash	57.95	57.54		47.44	10.10
EV-20B	Lowland	deep	Outwash	58.51	60.60		50.51	10.09
EV-21B	Lowland	deep	Alluvium	9.84	14.84		16.21	-1.37
EV-22B	Lowland	deep	utwash/alluvium	22.73	25.27		19.89	5.38
EV-23B	Lowland	deep	Alluvium	11.01	10.76		8.49	2.27
MW-7(W)	Lowland	deep	Alluvium	35.89	37.01		31.56	5.45
MW-8(W)	Lowland	deep	Alluvium	9.42	9.94		9.93	0.01
MW-103D(W)	Lowland	deep	Alluvium	11.00	13.52		15.22	-1.70
MW-105D(W)	Lowland	deep	Alluvium	9.70	12.19		13.85	-1.66
MW-107D	Lowland	deep	Alluvium	8.21	12.77		13.23	-0.46
MW-108D(W)	Lowland	deep	Alluvium	9.01	11.89		12.20	-0.31
MW-109D	Lowland	deep	Alluvium	7.73	13.03		13.59	-0.56

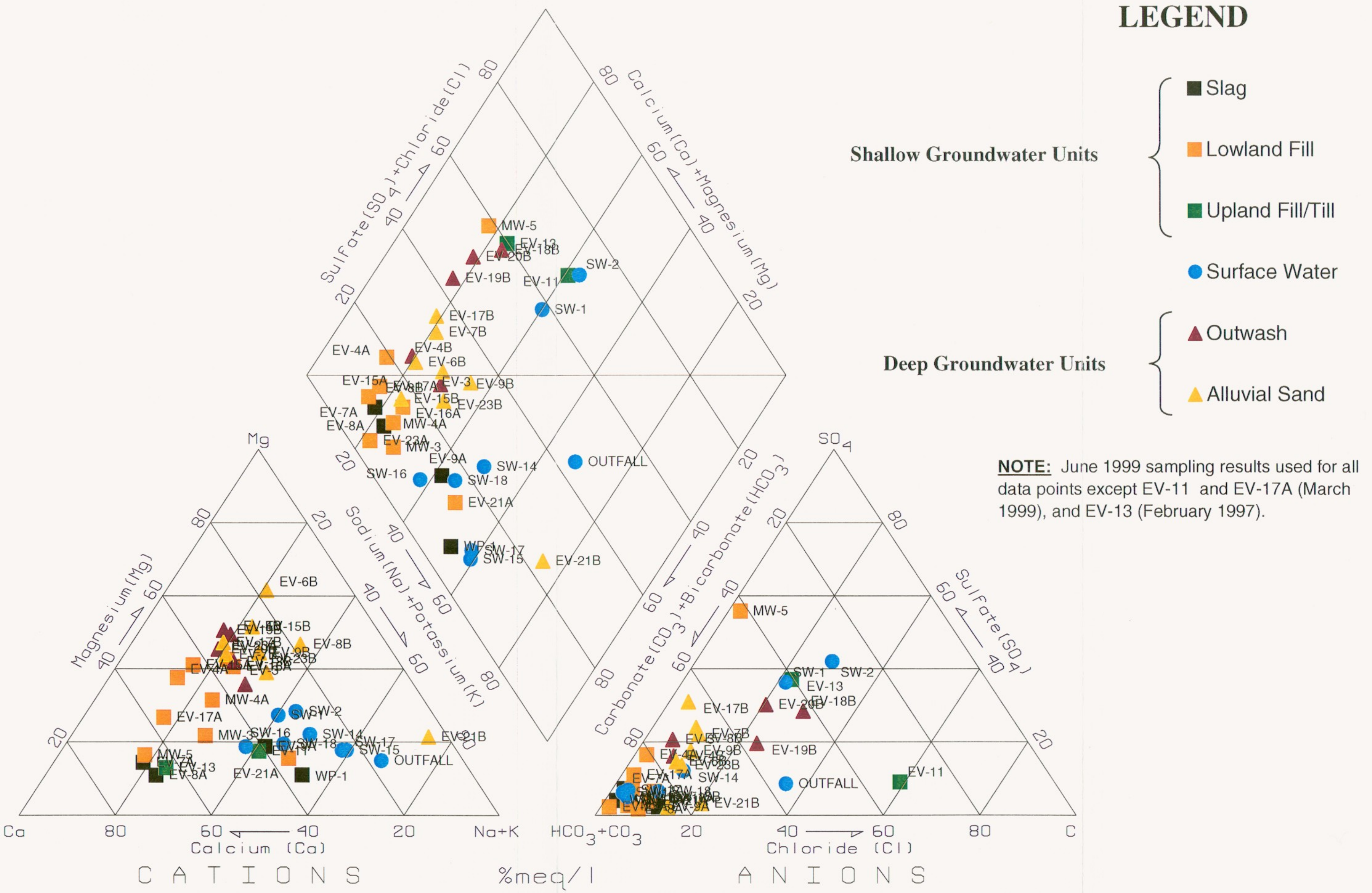
COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

POTENTIOMETRIC CONTOURS FOR DEEP GROUNDWATER - JULY 29, 1999

FIGURE
4-7

UPDATE TIME: 3:11PM
007\ 0030\065\0249\HEL\102799\I:\STORAGE\03099a14.dwg

Hydrometrics, Inc. ®
consulting scientists, engineers and contractors



NOTE: June 1999 sampling results used for all data points except EV-11 and EV-17A (March 1999), and EV-13 (February 1997).

Comprehensive Lowland Area
Remedial Investigation Report
Everett, Washington

Major Ion Composition of Shallow and Deep Groundwater and Surface Water Samples

FIGURE

4-8

NOTES:

(1) The most recent sampling result was plotted for locations with multiple data points.

(2) Isocontours generated for groundwater data only using Surfer (v6.0); surface water data was not used in generating isocontours.

(3) Results below the laboratory reporting limit were plotted as equal to the reporting limit.

Comprehensive Lowland Area Remedial Investigation Report
Everett, Washington

Dissolved Lead Concentrations in Surface Water and Shallow Groundwater

FIGURE
4-9

HEL/0104/K:/PROJECT/0030/SURF/EVPBSHAL.SRF

Legend

0.10

0.05

0.01

dissolved Pb concentration (mg/L)

■ EV-4B 0.005 1999 Groundwater Sampling Result

□ HP17 0.044 Historic (pre-1999) Groundwater Sampling Result

NOTES:

(1) The most recent sampling result was plotted for locations with multiple data points.

(2) Isocontours generated for groundwater data using Surfer (v6.0).

(3) Results below the laboratory reporting limit were plotted as equal to the reporting limit. EXCEPTION: one value of <0.15 mg/L at location HP45 was disregarded due to the skewing effect of this elevated reporting limit (30 times the typical limit of 0.005 mg/L) on the isocontours.

Comprehensive Lowland Area Remedial Investigation Report Everett, Washington	Dissolved Lead Concentrations in Deep Groundwater	FIGURE 4-10

K:/PROJECT/0030/SURF/EVPBDEEP.SRF

Legend

10.00
5.00
1.00
0.50
0.10
0.01

dissolved Zn concentration (mg/L)

■ EV-4A 0.023 1999 Groundwater Sampling Result

☐ HP44 0.025 Historic (pre-1999) Groundwater Sampling Result

▲ SW-18 0.015 1999 Surface Water Sampling Result

NOTES:
(1) The most recent sampling result was plotted for locations with multiple data points.

(2) Isocontours generated for groundwater data only using Surfer (v6.0); surface water data was not used in generating isocontours.

(3) Results below the laboratory reporting limit were plotted as equal to the reporting limit.

Comprehensive Lowland Area Remedial Investigation Report
Everett, Washington

Dissolved Zinc Concentrations in
Surface Water and Shallow Groundwater

FIGURE
4-11

Legend

0.50	dissolved Zn concentration (mg/L)
0.10	
0.05	
0.01	

■ EV-4B 0.036 1999 Groundwater Sampling Result

☐ HP27 0.034 Historic (pre-1999) Groundwater Sampling Result

NOTES:
(1) The most recent sampling result was plotted for locations with multiple data points.

(2) Isocontours generated for groundwater data using Surfer (v6.0).

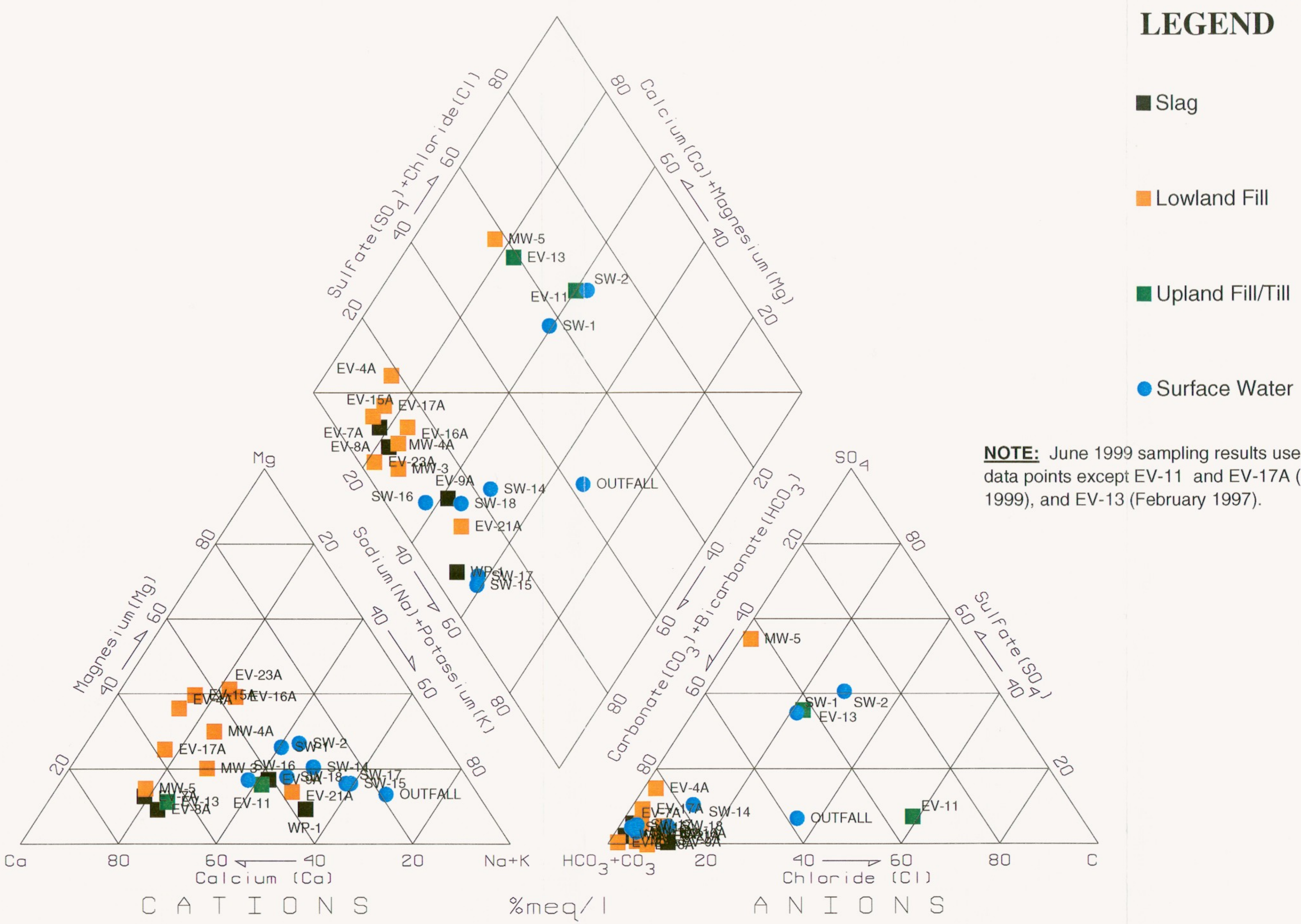
(3) Results below the laboratory reporting limit were plotted as equal to the reporting limit.

Comprehensive Lowland Area Remedial Investigation Report
Everett, Washington

Dissolved Zinc Concentrations in Deep Groundwater

FIGURE
4-12

K:/PROJECT/0030/SURF/EVZNDEEP.SRF



NOTE: June 1999 sampling results used for all data points except EV-11 and EV-17A (March 1999), and EV-13 (February 1997).

Comprehensive Lowland Area
Remedial Investigation Report
Everett, Washington

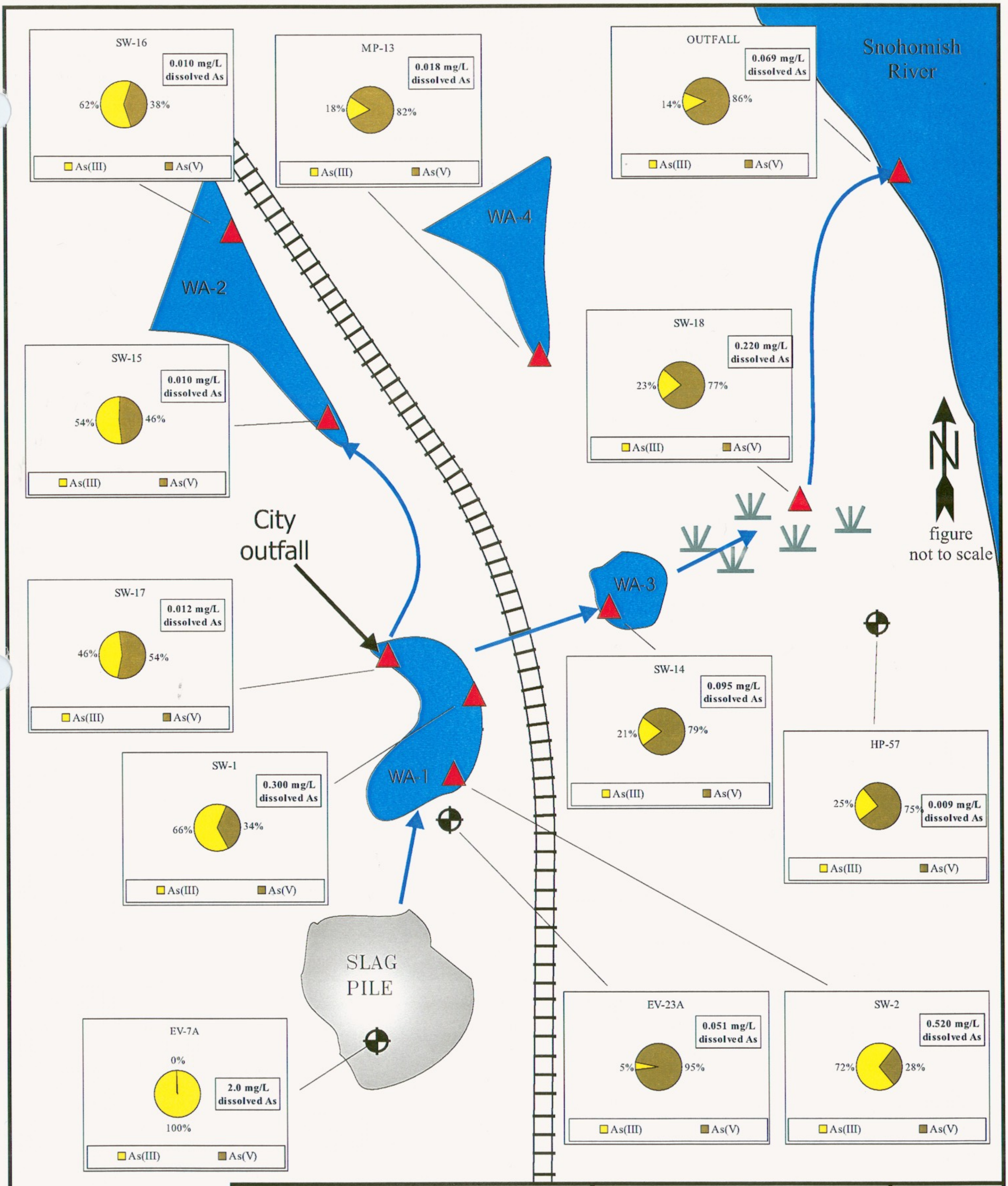
Major Ion Composition of Shallow Groundwater and Surface Water Samples

FIGURE

4-13

HEL\0104\K:\PROJECT\0030\sumpiper.xls\Piper2

10/27/99 10:49 AM



COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

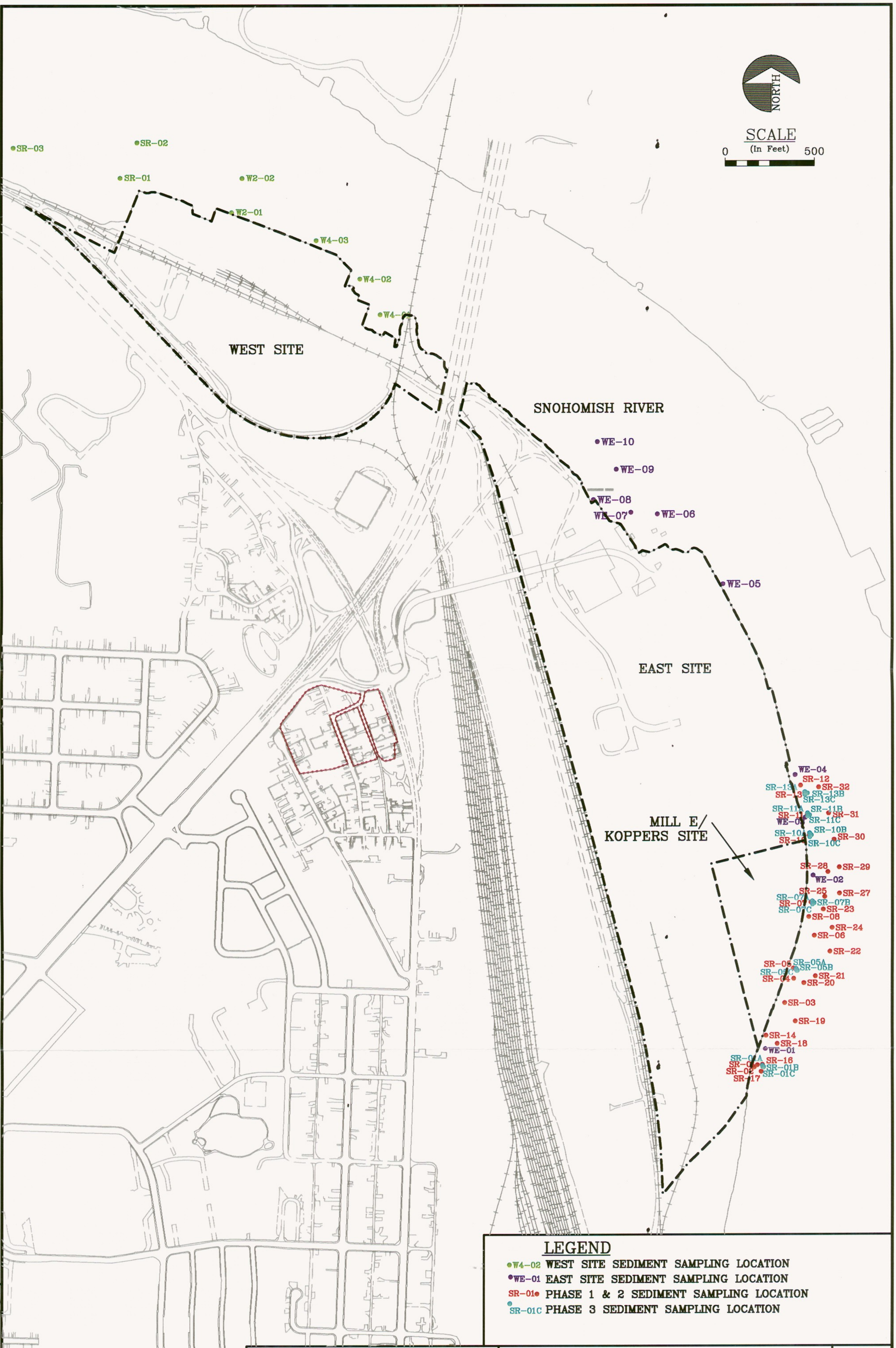
ARSENIC SPECIATION FOR
SURFACE WATER AND
SHALLOW GROUNDWATER

FIGURE

4-14

0104\K:\PROJECT\0030\SWAS3_5.CDR
revised 10/27/99 11:29 am

UPDATE TIME: 4:05PM
008\0030\065\0034\SPO\102699\I:\STORAGE\03099S15

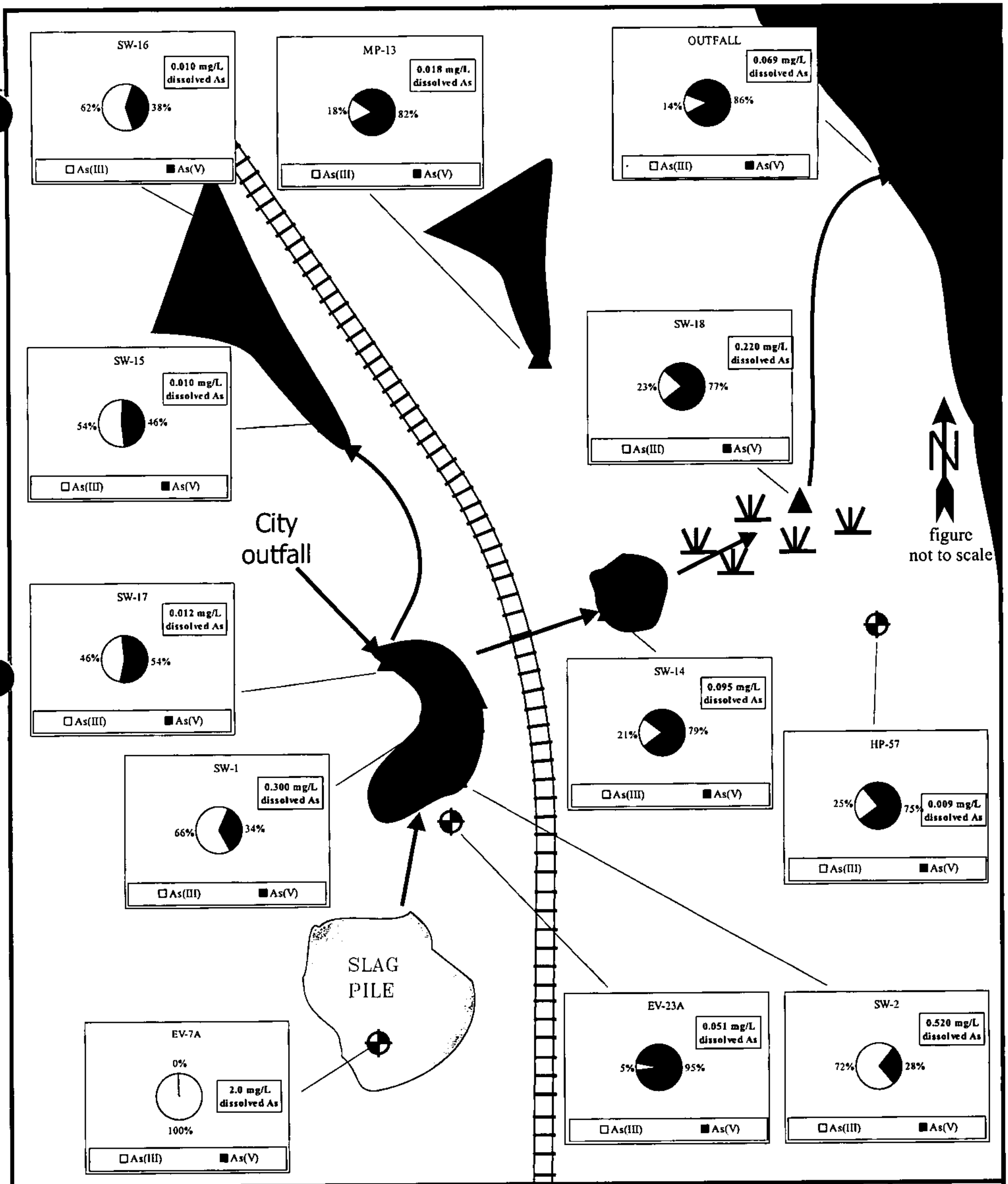


Hydrometrics, Inc.

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

APPROXIMATE SEDIMENT SAMPLE LOCATIONS

FIGURE
5-1



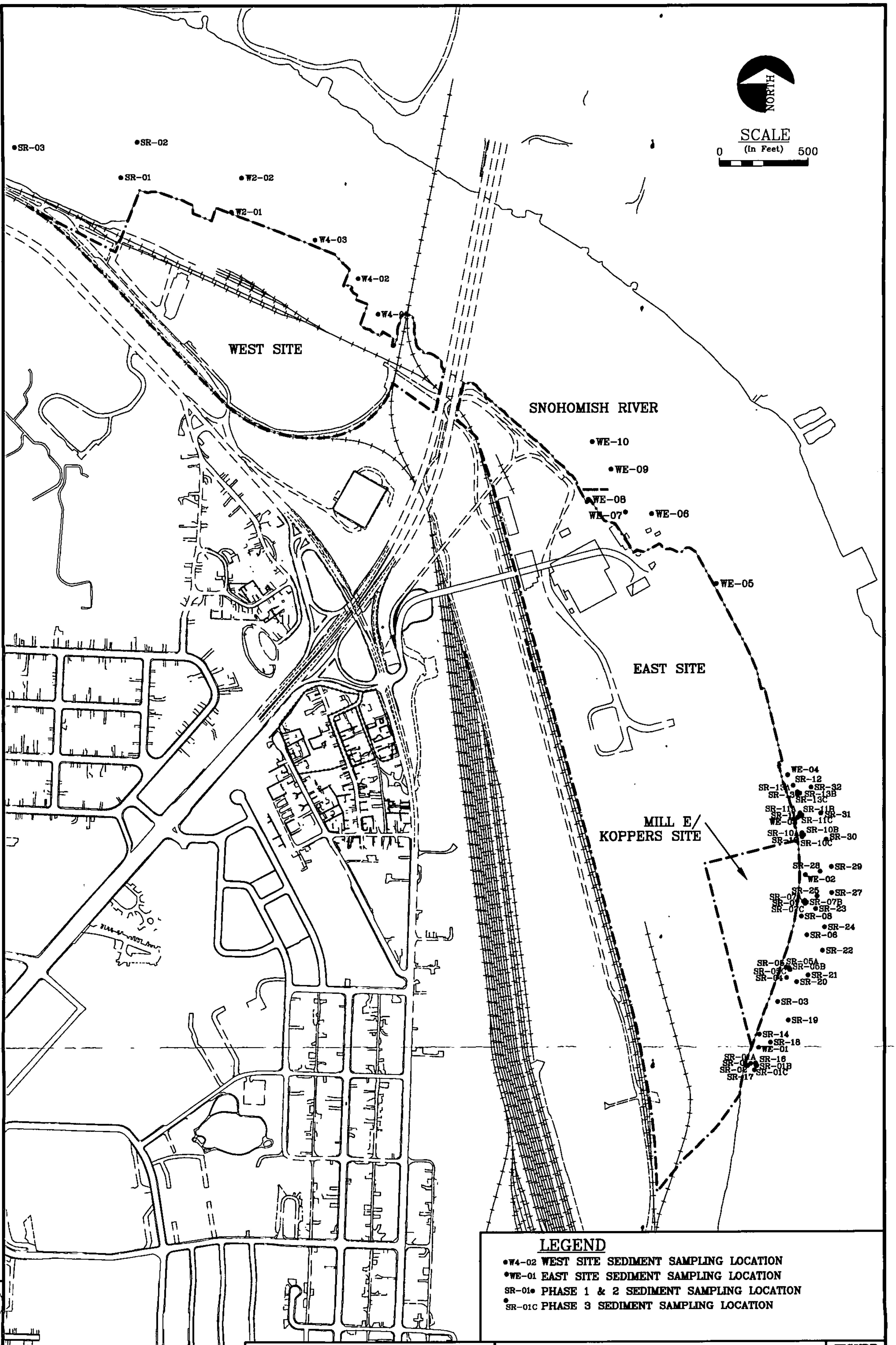
COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

ARSENIC SPECIATION FOR
SURFACE WATER AND
SHALLOW GROUNDWATER

FIGURE
4-14

0104\K:\PROJECT\0030\SWAS3_5.CDR
revised 10/27/99 11:29 am

UPDATE TIME: 4:05PM
008\0030\065\0034\SPO\102699\:\STORAGE\03099S15



LEGEND

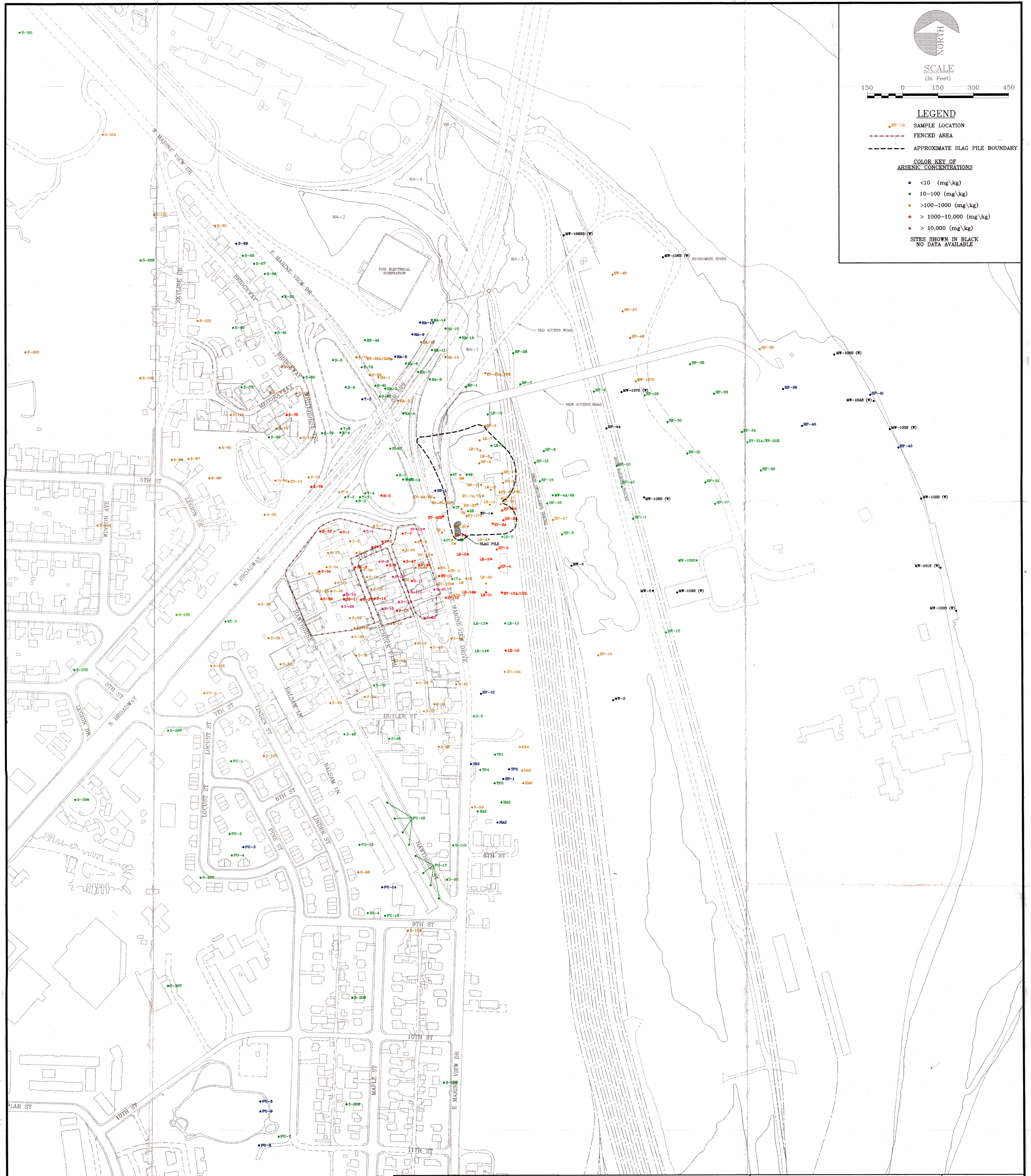
- ●W4-02 WEST SITE SEDIMENT SAMPLING LOCATION
- ●WE-01 EAST SITE SEDIMENT SAMPLING LOCATION
- SR-01● PHASE 1 & 2 SEDIMENT SAMPLING LOCATION
- ●SR-01C PHASE 3 SEDIMENT SAMPLING LOCATION

Hydrometrics, Inc.

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

APPROXIMATE SEDIMENT SAMPLE LOCATIONS

FIGURE
5-1



SCALE
(In Feet)
150 0 150 300 450

LEGEND

HP-14	SAMPLE LOCATION
-x-x-x-x-x-x-	FENCED AREA
- - - - - - -	APPROXIMATE SLAG PILE BOUNDARY

COLOR KEY OF
ARSENIC CONCENTRATIONS

- ● <10 (mg\kg)
- ● 10–100 (mg\kg)
- ● >100–1000 (mg\kg)
- ● > 1000–10,000 (mg\kg)
- ● > 10,000 (mg\kg)

SITES SHOWN IN BLACK
NO DATA AVAILABLE

Hydrometrics, Inc. ®
consulting scientists, engineers and contractors

Helena, Montana 59601
2727 Airport Road
(406) 443-4150

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

MAXIMUM ARSENIC
CONCENTRATIONS IN SOIL

DRAWING FILE NUMBER
HEL 03099a15.dwg
AUTOCAD REL. 14 DRAWING (DWG)
EXHIBIT
4–1

UPDATE TIME: 1:36PM
008\0030\065\0072\HEL\101299\I:\STORAGE\03099a15.dwg

Hydrometrics, Inc. ® consulting scientists, engineers and contractors **Helena, Montana 59601** **2727 Airport Road** **(406) 443-4150**	COMPREHENSIVE LOWLAND AREA RI REPORT EVERETT, WASHINGTON	MAXIMUM LEAD CONCENTRATIONS IN SOIL

DRAWING FILE NUMBER
HEL 03099a19.dwg
AUTOCAD REL. 14 DRAWING (DWG)
EXHIBIT
4-2

UPDATE TIME: 3:05PM
008\0030\065\0249\HEL\101499\I:\STORAGE\03099a19.dwg

MAXIMUM CADMIUM CONCENTRATIONS IN SOIL

Hydrometrics, Inc. ®
consulting scientists, engineers and contractors
Helena, Montana 59601
2727 Airport Road
(406) 443-4150

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

DRAWING FILE NUMBER
HEL 03099a20.dwg
AUTOCAD REL. 14 DRAWING (DWG)
EXHIBIT
4-3

UPDATE TIME: 3:37PM
008\0030\065\0249\HEL\101499\I:\STORAGE\03099a20.dwg

LEGEND

EXISTING TOPOGRAPHY
GEOLOGIC CONTACT (DASHED WHERE INFERRED)
RAILROAD TRACKS
ROAD
A A' GEOLOGIC CROSS SECTION TRACE

MONITORING WELL HYDROPUNCH OR BORING

WELL NUMBER — EV-9A/EV9B
WATER LEVEL IN SHALLOW WELL
SCREENED INTERVAL OF SHALLOW WELL
WATER LEVEL IN DEEP WELL
SCREENED INTERVAL OF DEEP WELL

STRATIGRAPHIC UNITS

- ▨ FILL
- ▨ SLAG
- ▨ CHANNEL DEPOSIT
- ▨ SILT
- ▨ TILL
- ▨ ALLUVIAL SAND
- ▨ OUTWASH

COLOR KEY OF ARSENIC CONCENTRATIONS

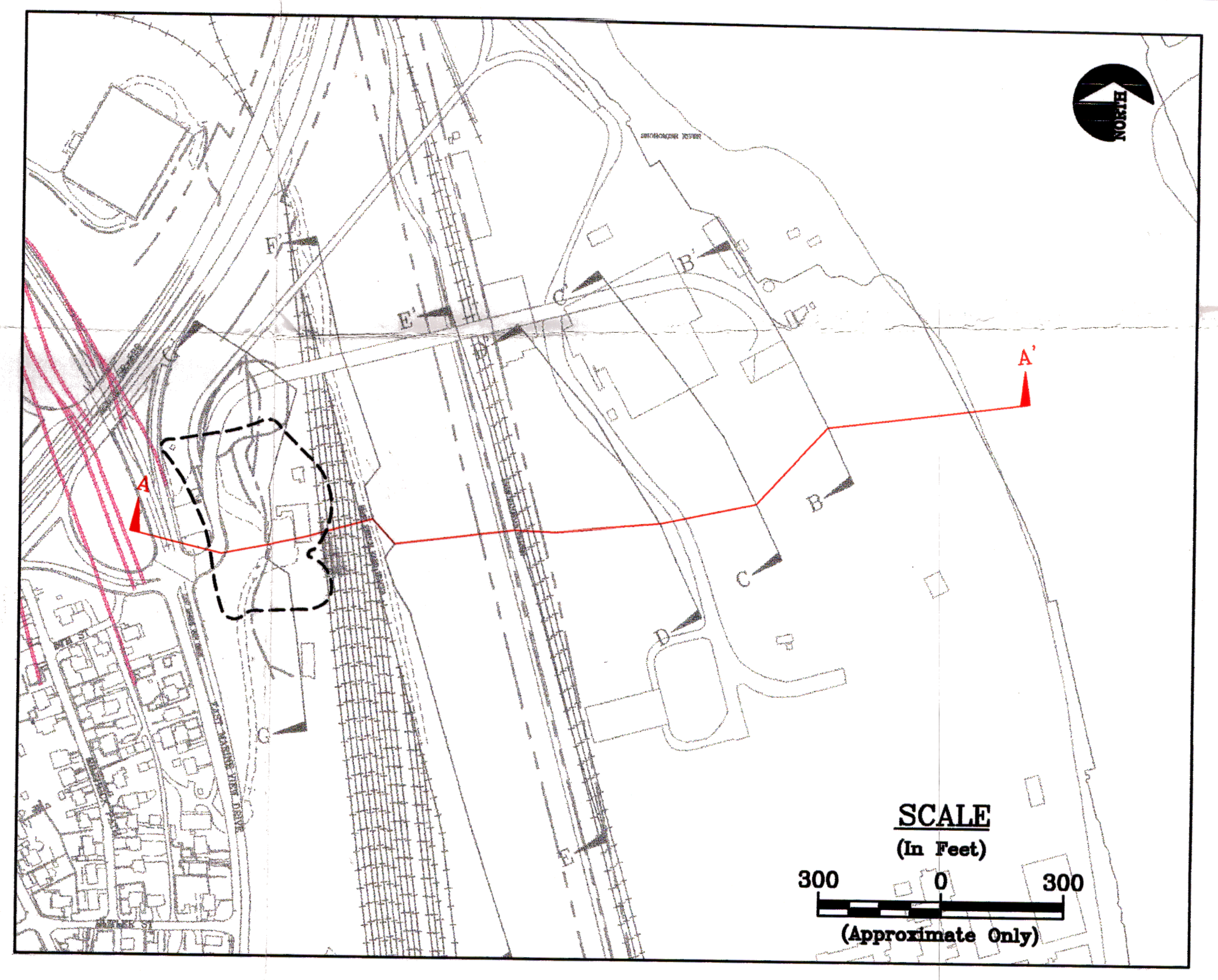
■	0 – 7 mg/kg	■	153 – 230 mg/kg
■	8 – 20 mg/kg	■	231 – 500 mg/kg
■	21 – 50 mg/kg	■	501 – 1000 mg/kg
■	51 – 76 mg/kg	■	1001 – 10,000 mg/kg
■	77 – 100 mg/kg	■	10,001 – 100,000 mg/kg
■	101 – 152 mg/kg	■	100,001 – 700,000 mg/kg

HORIZONTAL SCALE: 1"=60'
VERTICAL SCALE: 1"=6'
VERTICAL EXAGGERATION = 10:1

NOTES:

(1). SOURCE: GEOENGINEERS (1990)

(2). WATER LEVEL DATA UNAVAILABLE



SCALE
(In Feet)
300 0 300
(Approximate Only)

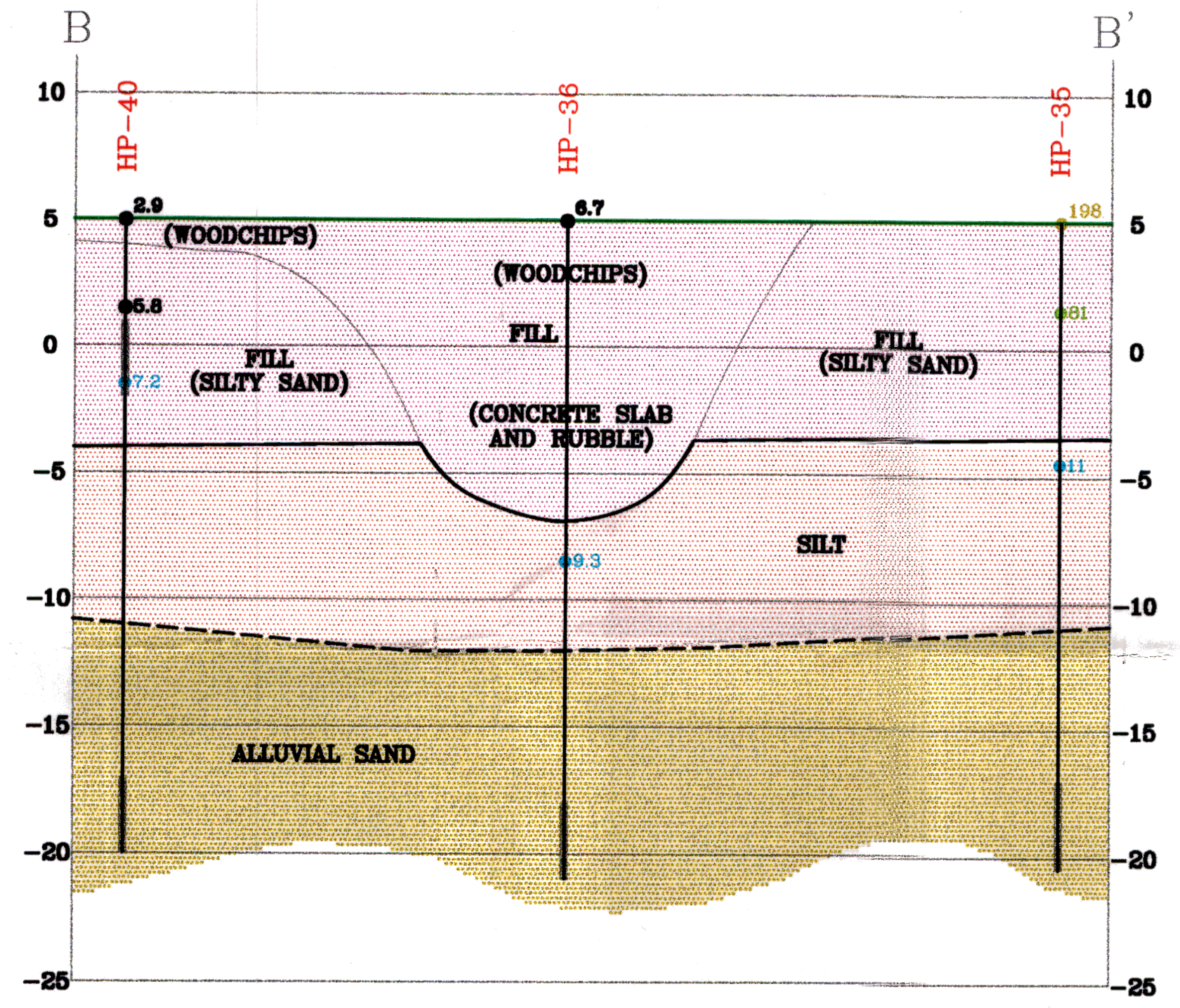
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

GEOLOGIC CROSS SECTION
A-A'
SHOWING ARSENIC CONCENTRATIONS

Hydrometrics, Inc.
Consulting Scientists, Engineers, and Contractors
Helena, Montana
2727 Airport Road
(406) 443-4150

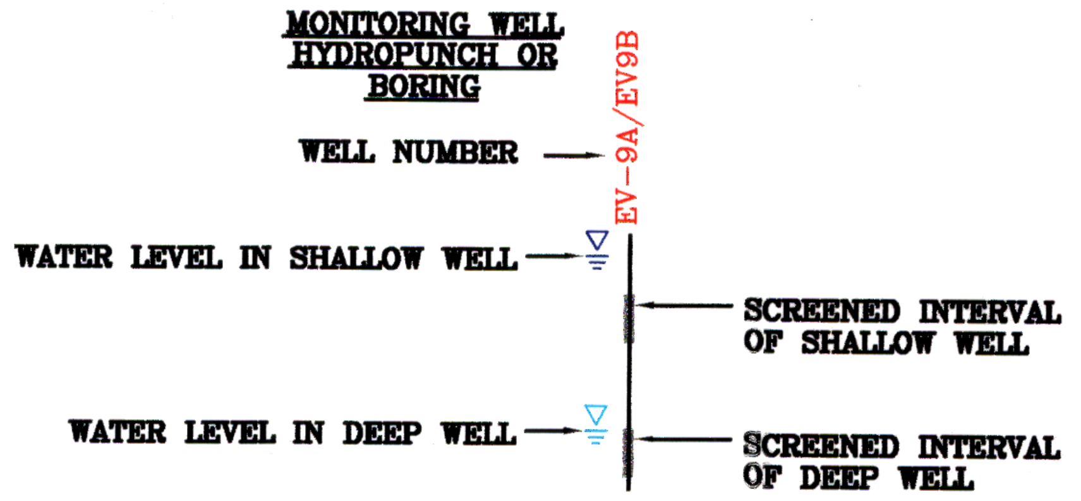
EXHIBIT
4-4

UPDATE TIME: 1:11PM
008\0030\065\0072\HEL\072596\I:\STORAGE\03096A15.DWG



LEGEND

EXISTING TOPOGRAPHY
GEOLOGIC CONTACT (DASHED WHERE INFERRED)
RAILROAD TRACKS
ROAD
A A' GEOLOGIC CROSS SECTION TRACE



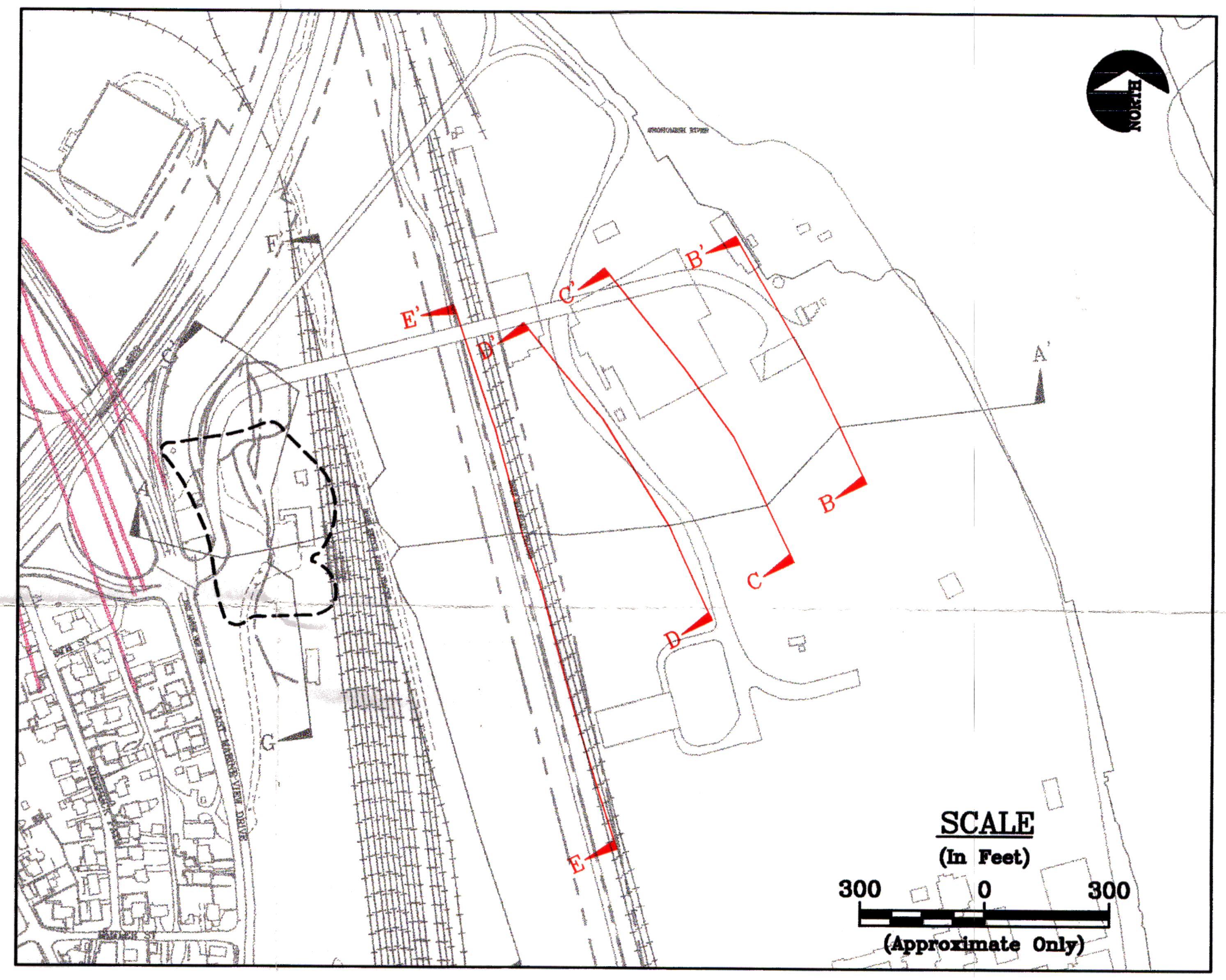
STRATIGRAPHIC UNITS

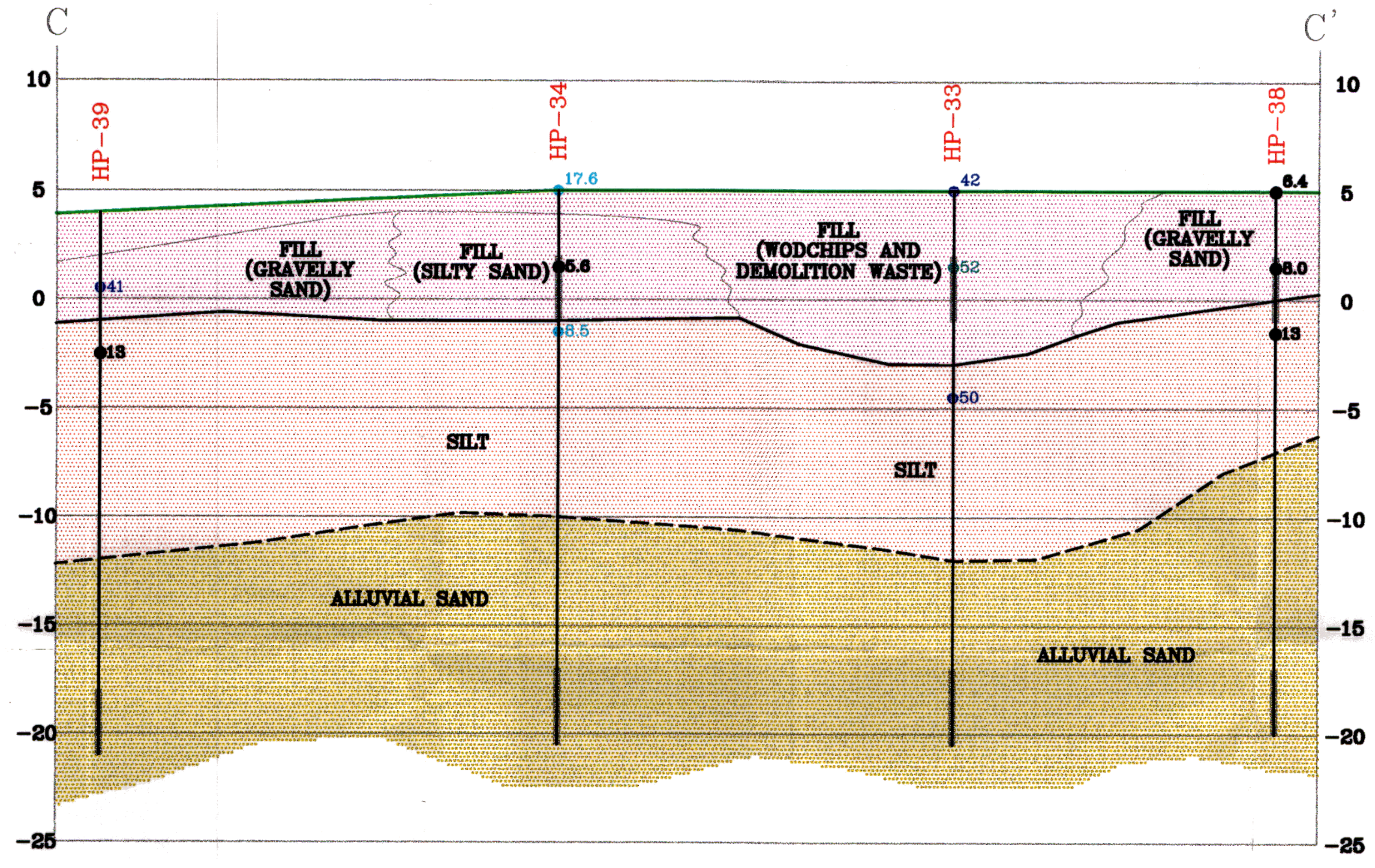
▨	FILL
▨	SLAG
▨	CHANNEL DEPOSIT
▨	SILT
▨	TILL
▨	ALLUVIAL SAND
▨	OUTWASH

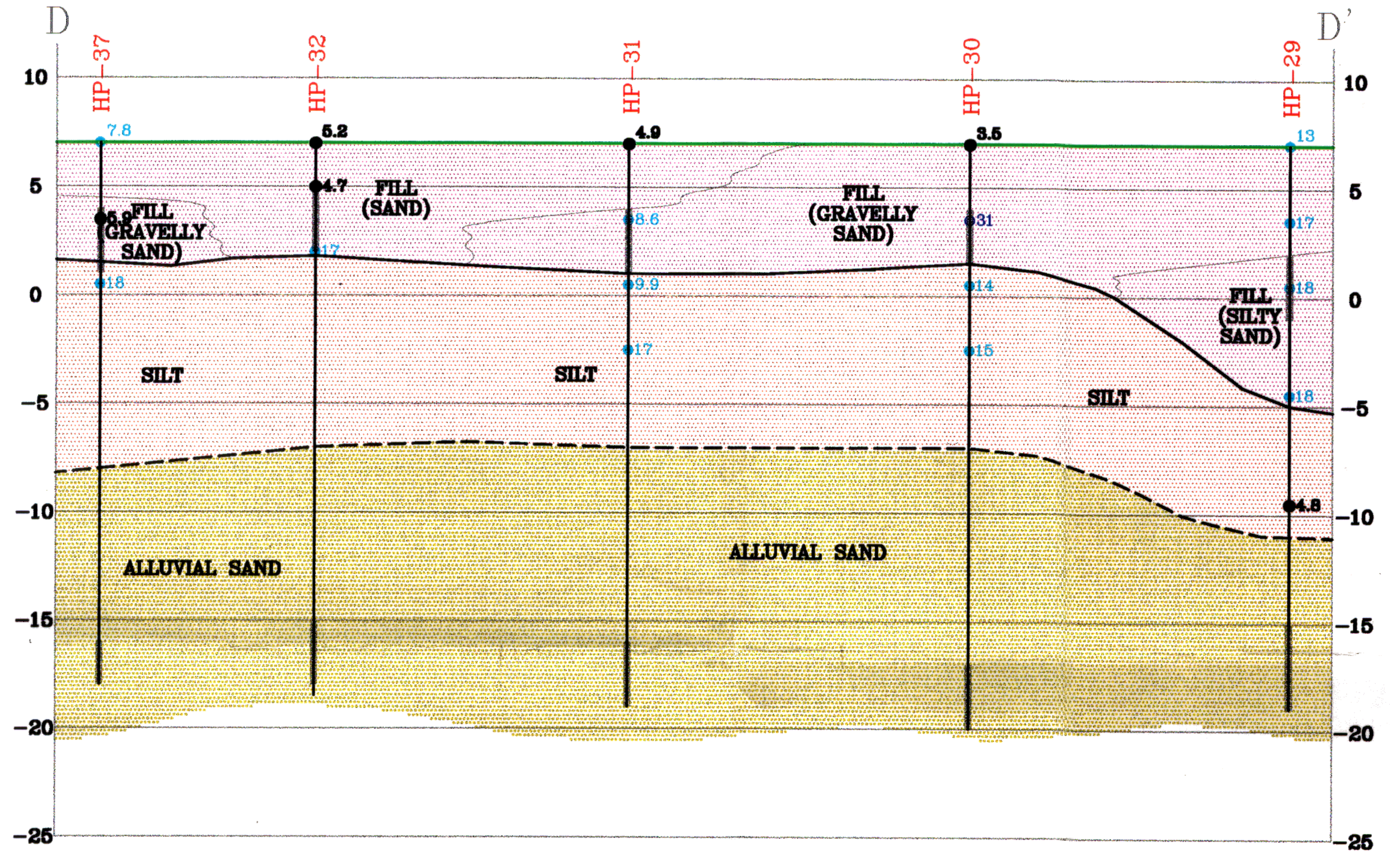
COLOR KEY OF ARSENIC CONCENTRATIONS

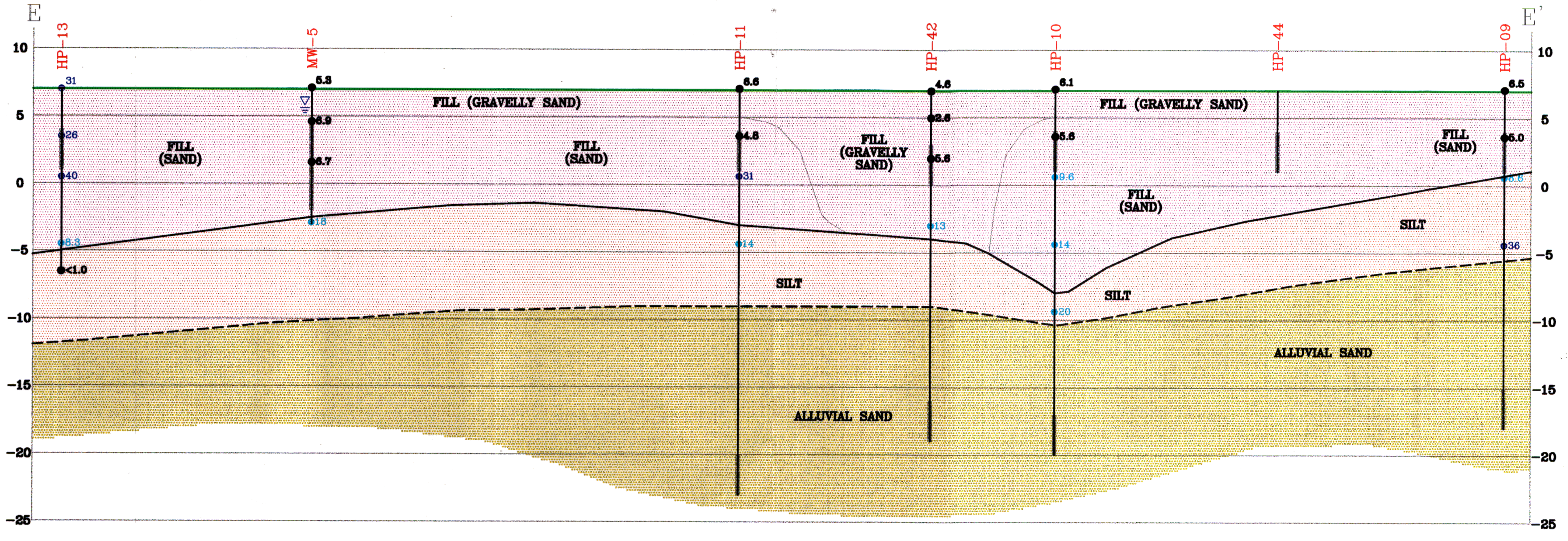
■	0 – 7 mg/kg	■	153 – 230 mg/kg
■	8 – 20 mg/kg	■	231 – 500 mg/kg
■	21 – 50 mg/kg	■	501 – 1000 mg/kg
■	51 – 76 mg/kg	■	1001 – 10,000 mg/kg
■	77 – 100 mg/kg	■	10,001 – 100,000 mg/kg
■	101 – 152 mg/kg	■	100,001 – 700,000 mg/kg

HORIZONTAL SCALE: 1"=60'
VERTICAL SCALE: 1"=6'
VERTICAL EXAGGERATION = 10:1









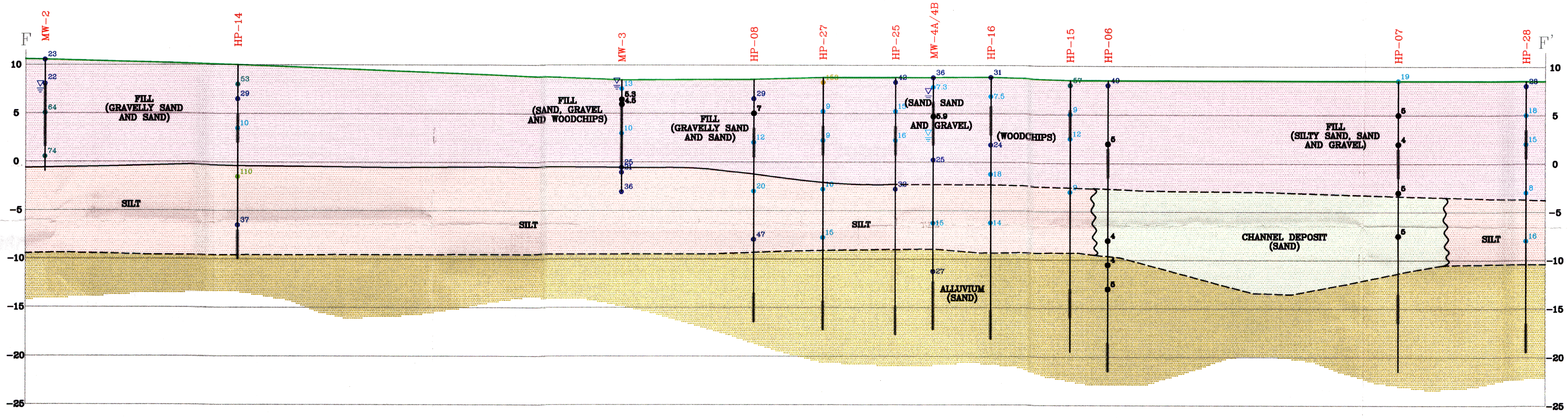
COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

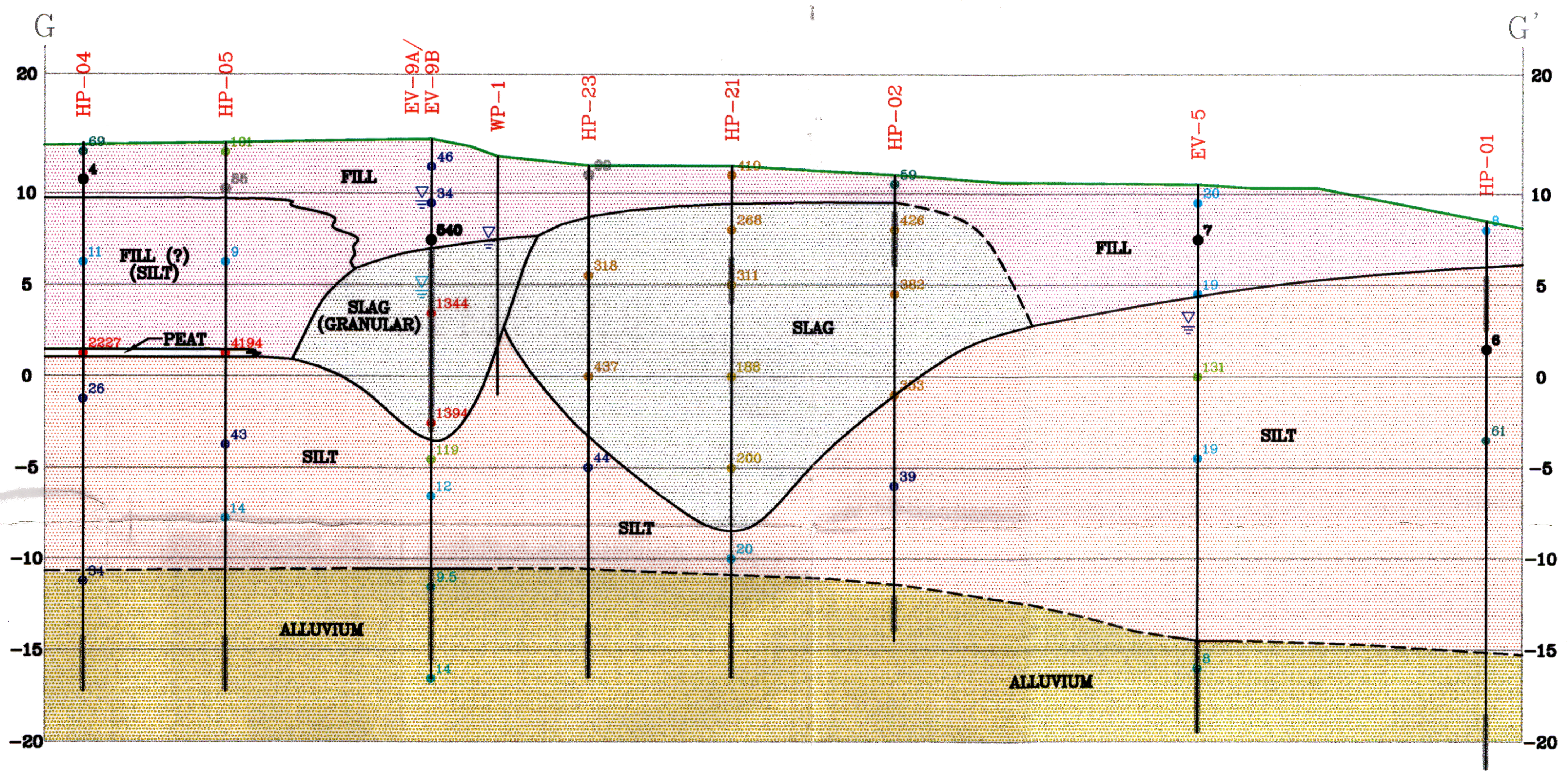
GEOLOGIC CROSS SECTIONS
B–B', C–C', D–D', E–E'
SHOWING ARSENIC CONCENTRATIONS

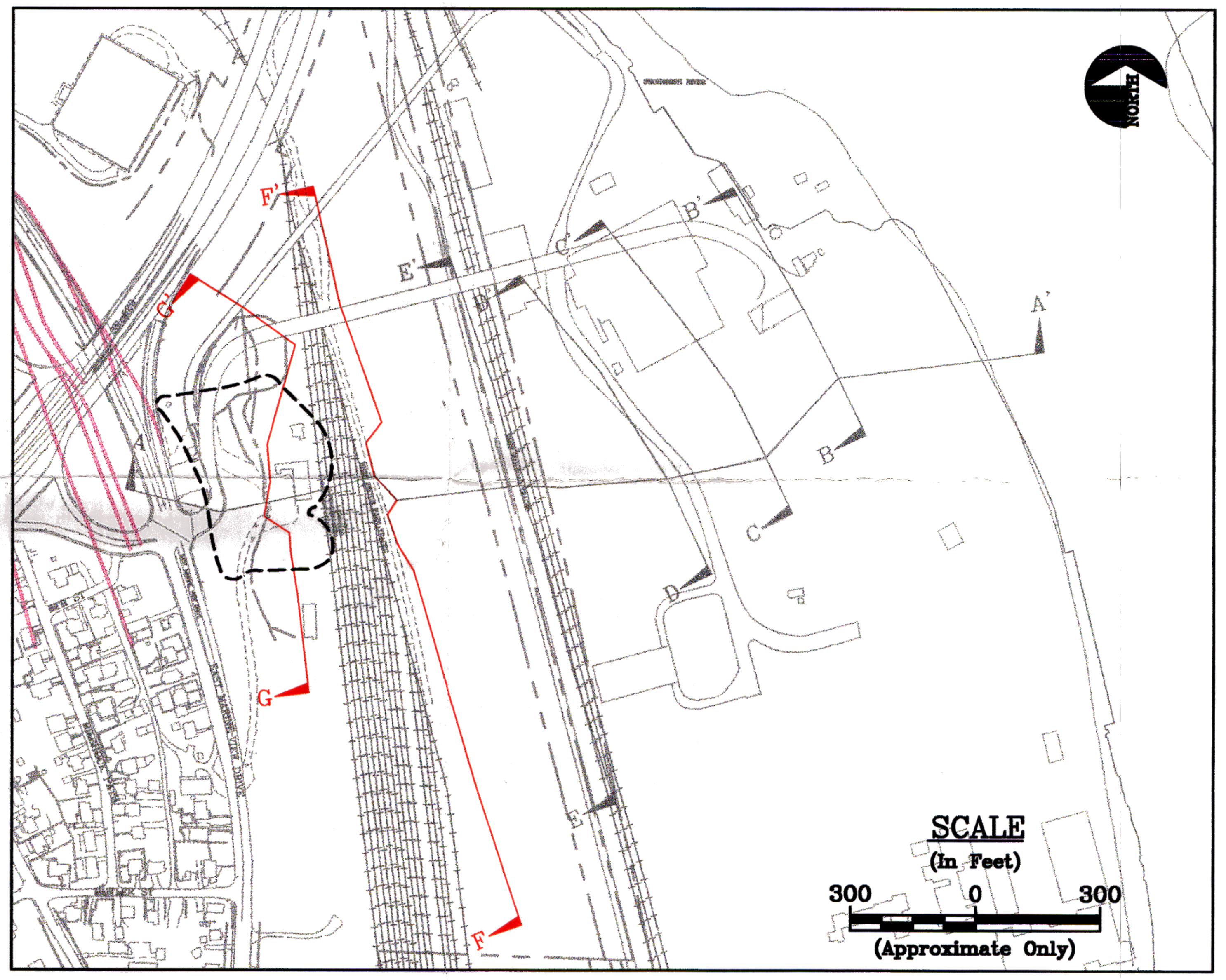
Hydrometrics, Inc.
Consulting Scientists, Engineers, and Contractors
Helena, Montana
2727 Airport Road
(406) 443-4150

EXHIBIT
4–5

UPDATE TIME: 1:14PM
005\0030\065\0072\HEL\072596\I:\STORAGE\03095A16.DWG







LEGEND

— EXISTING TOPOGRAPHY

– – –— GEOLOGIC CONTACT (DASHED WHERE INFERRED)

RAILROAD TRACKS

ROAD

A A' GEOLOGIC CROSS SECTION TRACE

MONITORING WELL HYDROPUNCH OR BORING

WELL NUMBER → EV-9A/EV9B

WATER LEVEL IN SHALLOW WELL →

← SCREENED INTERVAL OF SHALLOW WELL

WATER LEVEL IN DEEP WELL →

← SCREENED INTERVAL OF DEEP WELL

STRATIGRAPHIC UNITS

▨	FILL
▨	SLAG
▨	CHANNEL DEPOSIT
▨	SILT
▨	TILL
▨	ALLUVIAL SAND
▨	OUTWASH

COLOR KEY OF ARSENIC CONCENTRATIONS

■	0 – 7 mg/kg	■	153 – 230 mg/kg
■	8 – 20 mg/kg	■	231 – 500 mg/kg
■	21 – 50 mg/kg	■	501 – 1000 mg/kg
■	51 – 76 mg/kg	■	1001 – 10,000 mg/kg
■	77 – 100 mg/kg	■	10,001 – 100,000 mg/kg
■	101 – 152 mg/kg	■	100,001 – 700,000 mg/kg

HORIZONTAL SCALE: 1"=60'
VERTICAL SCALE: 1"=6'
VERTICAL EXAGGERATION = 10:1

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

GEOLOGIC CROSS SECTIONS
F–F' AND G–G'
SHOWING ARSENIC CONCENTRATIONS

Hydrometrics, Inc.
Consulting Scientists, Engineers, and Contractors
Helena, Montana
2727 Airport Road
(406) 443-4150

EXHIBIT
4–6

UPDATE TIME: 2:46PM
008\0030\065\0072\HEL\072596\I:\STORAGE\03096A17.DWG

LEGEND

CONCENTRATIONS SHOWN IN COLOR ARE FROM JUNE 1999 SAMPLING DATA

COLOR KEY OF DISSOLVED ARSENIC CONCENTRATIONS

▨	>10 (mg\L)
▨	1.0–10 (mg\L)
▨	0.1–1.0 (mg\L)
▨	0.01–0.1 (mg\L)
▨	<0.005–0.01 (mg\L)

NOTE:
HATCHED BOUNDARIES DASHED WHERE INFERRED AND LEFT OPEN IN AREAS WITHOUT DATA COVERAGE.

●MW–109S <0.005/<0.005	MONITORING WELL DISSOLVED/TOTAL ARSENIC CONCENTRATION mg/L
△SW–23 0.42/0.39	SURFACE WATER DISSOLVED/TOTAL ARSENIC CONCENTRATION mg/L
●HP–14 <0.005/<005	HYDROPUNCH DISSOLVED/TOTAL ARSENIC CONCENTRATION mg/L
SR–01 0.036	SEEP DISSOLVED ARSENIC CONCENTRATION mg/L

NOTE:
DISSOLVED & TOTAL ARSENIC VALUES THAT ARE GRAYED BACK ARE HISTORICAL DATA (MOST RECENT SAMPLING EVENT). WHERE ONLY ONE VALUE IS SHOWN THE VALUE IS DISSOLVED ARSENIC.

Hydrometrics, Inc.®
Consulting Scientists, Engineers & Contractors
Helena, Montana 59601
2727 Airport Road
(406) 443-4150

COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

DISSOLVED & TOTAL ARSENIC
CONCENTRATIONS FOR
SURFACE WATER AND SHALLOW
GROUNDWATER SYSTEM

DRAWING FILE NUMBER
HEL 03099a01.dwg
AUTOCAD REL. 14 DRAWING (DWG)
EXHIBIT
4–7

UPDATE TIME: 12:51AM
008\0030\065\0072\HEL\101599\I:\storage\ 03099a01.dwg

LEGEND

CONCENTRATIONS SHOWN IN COLOR ARE FROM JUNE 1999 SAMPLING DATA

COLOR KEY OF DISSOLVED ARSENIC CONCENTRATIONS

▨	>10 (mg\L)
▨	1.0–10 (mg\L)
▨	0.1–1.0 (mg\L)
▨	0.01–0.1 (mg\L)
▨	<0.005–0.01 (mg\L)

NOTE:
HATCHED BOUNDARIES DASHED WHERE INFERRED AND LEFT OPEN IN AREAS WITHOUT DATA COVERAGE.

● MW-109S <0.005/<0.005	MONITORING WELL DISSOLVED/TOTAL ARSENIC CONCENTRATION mg/L
● HP-14 <0.005	HYDROPUNCH DISSOLVED ARSENIC CONCENTRATION mg/L

NOTE:
DISSOLVED & TOTAL ARSENIC VALUES mg/L THAT ARE GRAYED BACK ARE HISTORICAL DATA.

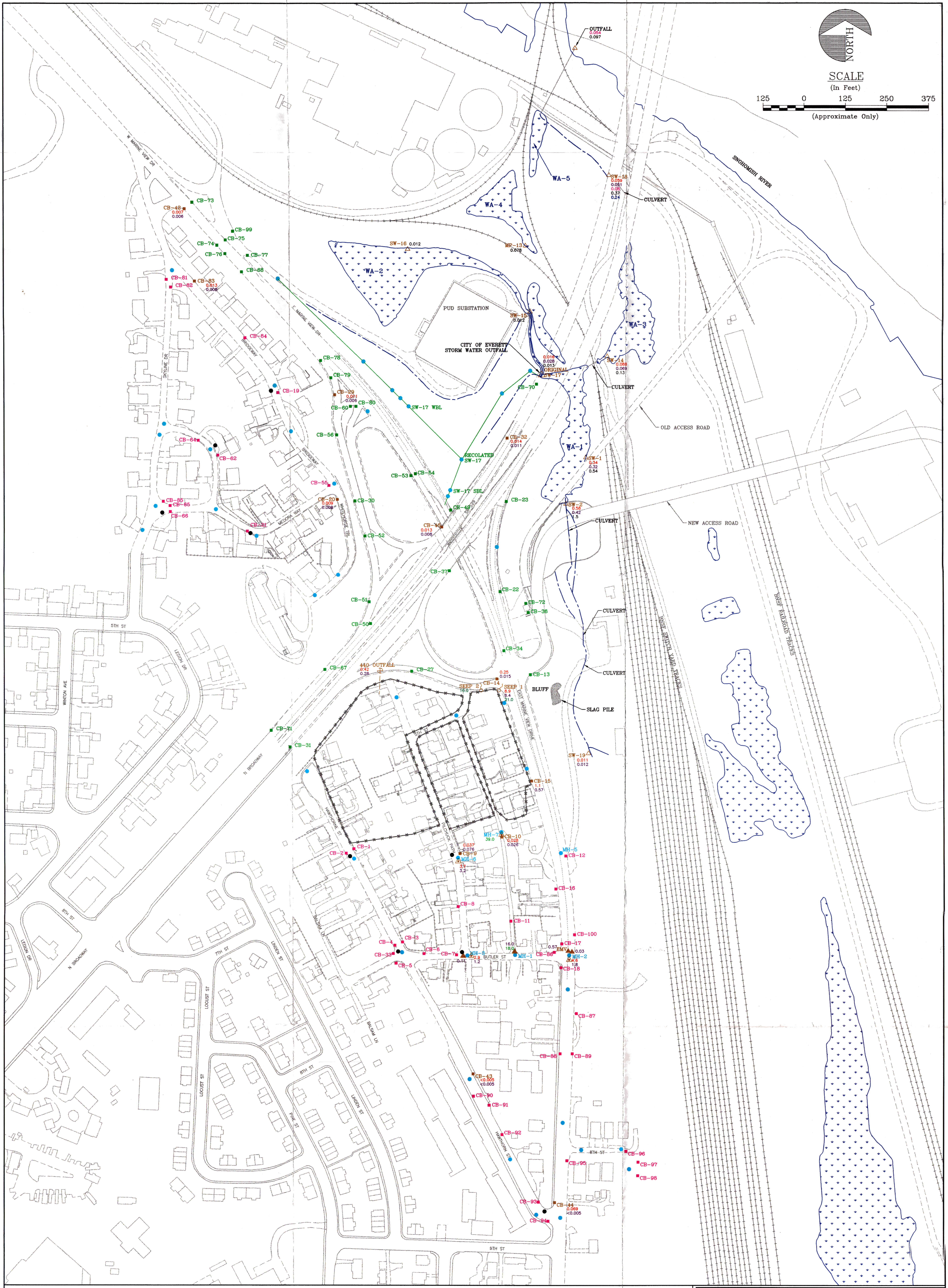
Hydrometrics, Inc.®
Consulting Scientists, Engineers & Contractors
Helena, Montana 59601
2727 Airport Road
(406) 443-4150

COMPREHENSIVE LOWLAND AREA
REMEDIAL INVESTIGATION REPORT
EVERETT, WASHINGTON

DISSOLVED & TOTAL ARSENIC CONCENTRATIONS FOR THE DEEP GROUNDWATER SYSTEM

DRAWING FILE NUMBER
HEL 03099a02.dwg
AUTOCAD REL. 14 DRAWING (DWG)
EXHIBIT
4–8

UPDATE TIME: 1:25PM
008\0030\065\0249\HEL\102799\I:\STORAGE\03099a02.dwg



LEGEND

■	SR-529 OVERPASS CATCH BASIN
●	CATCH BASIN COLLECTION SUMP
■	CITY OF EVERETT STORM WATER/SEWER CATCH BASIN
●	SEWER/STORM WATER MANHOLE
△	SURFACE WATER SAMPLE LOCATION
▲	INLET SAMPLE LOCATION
⚠	OUTLET SAMPLE LOCATION

<0.005	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 1/18/99 TO 1/19/99
<0.005	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 1/28/99
21.0	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 2/5/99
18.0	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 2/22/99
0.054	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 3/19/99
0.012	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 6/17/99
0.24	TOTAL ARSENIC CONCENTRATION (MG/L) FROM 8/3/99

~○	SEEP
‐ ‐ ‐ ⊕	LINE AND OUTFALL CONNECTED TO FOUNDATION AT 440 PILCHUCK
⬭	WET AREA
— ‐ —	DRAINAGE DITCH
‐×‐×‐	FENCED AREA

NOTE:
GRAB SURFACE WATER/STORM WATER SAMPLING LOCATIONS ARE SHOWN IN TAN.

COMPREHENSIVE LOWLAND AREA
RI REPORT
EVERETT, WASHINGTON

GRAB SURFACE WATER AND STORM WATER
SAMPLING RESULTS FOR TOTAL ARSENIC

Hydrometrics, Inc.
Consulting Scientists, Engineers, and Contractors
Ruston, Washington
5219 N. Shirley St., Suite 100 (253) 752-1470

EXHIBIT
4-9

UPDATE TIME: 12:55PM

APPENDIX A
SOIL BORING LOGS

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Soil Boring Log
Hole Name: HP-45

Date Hole Started: 9/23/98 Date Hole Finished: 9/23/98

Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner:
Legal Description:
Descriptive Location:

Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Soil sample/hydropunch
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 30

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?	N		

Static Water Level Below MP: 18.5
Date: 9/22/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): 0

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Collected split spoon samples to 26.5 and then drove hydropunch to 30 feet. Couldn't get flow into hydropunch after repeated attempts. Water level in augers at 18.5 feet. Placed PVC screen and riser within augers to sample. Collected samples for common ions and total and dissolved metals. Pulled PVC casing and abandoned borehole with bentonite grout and bentonite chips.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION
	EVT-9809108	GRAB			0.0 - 0.5'	0.0 - 0.5' **Silt and Sand** light brown to gray, some gravel, gravel is subrounded, up to 1-inch diameter, dry.
	EVT-9809109	SS	12,10,6	1.00	2.0 - 3.5'	0.5 - 7.0' **Sandy Silt** grey to grey green, some gravel, dry.
5	EVT-9809110	SS	2,4,5	0.50	5.0 - 6.5'	
						7.0 - 15.0' **Silty Sand** grey, medium to fine grain, poorly sorted, moist.
10	EVT-9809111	SS	1,2,2	1.30	10.0 - 11.5'	
15	EVT-9809112	SS	1,1,2	1.50	15.0 - 16.5'	15.0 - 17.0' **Peat** with 6-inch grey, fine to medium grain sand horizon.
						17.0 - 26.5' **Sand** grey, very fine to fine grain, well sorted, wet.
20	EVT-9809113	SS	2,4,5	1.50	20.0 - 21.5'	
25	EVT-9809114	SS	7,12,11	1.50	25.0 - 26.5'	
30						

Sheet 1 of 1

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Hydropunch Log

Hole Name: HP-46

Date Hole Started: 2/9/99 Date Hole Finished: 2/9/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description: Former Whsr site near truck scales.
Descriptive Location:

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Hydropunch Water Sample
Target Aquifer:
Hole Diameter (in): 8
Total Depth Drilled (ft): 20

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	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

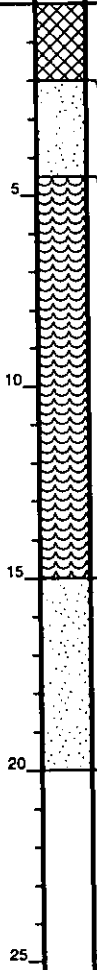
Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council. Borings abandoned with bentonite grout and capped witha 1' concrete cap and ID tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	HP-46-1	GRAB			0.0 - 0.5'
	HP-46-2	SS	12/17/20	1.00	0.5 - 2.0'
	HP-46-3	SS	12/14/1	0.20	2.0 - 3.5'
5	HP-46-4	SS	1/2/1	1.50	5.0 - 6.5' Duplicate sample at 09:17 HP-46-4D. Hydropunch from 5-10, EVT-9902-100 Dup. 101
10	HP-46-5	SS	1/1/1	1.30	10.0 - 11.5'
15	HP-46-6	SS	1/1/1	1.30	15.0 - 16.5'
20	HP-46-7	SS	12/16/20	1.40	20.0 - 21.5' Drive hydropunch to 20-25' EVT-9902-102
25					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 2.0'
SAND and GRAVEl
Gray, medium grained, medium dense, slightly moist to dry, 1/2" a smaller subrounded gravel, and trace brick fragments.
[Fill]

2.0 - 4.5'
SAND
Black with white grains, medium size grains, medium dense, wet, uniform.
[Dredge Fill]

4.5 - 15.0'
SILT
Brown grading to gray, slightly moist, soft plastic, consists primarily of vegetative fibers from 5-10' then becomes more mineral, strong odor of decomposing organic materials.
[Surficial Deposits]

15.0 - 20.0'
SAND
Black with white grains, medium sized grains,loose to medium dense, moist to wet, uniform, trace subrounded 1/4" gravel.
[Alluvium]

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Hydropunch Log

Hole Name: HP-47

Date Hole Started: 2/9/99 Date Hole Finished: 2/10/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description: Former Whsr site near truck scales.
Descriptive Location:

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None

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	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

Purpose of Hole: Collect Hydropunch Water Samples
Target Aquifer:
Hole Diameter (in): 8
Total Depth Drilled (ft): 20

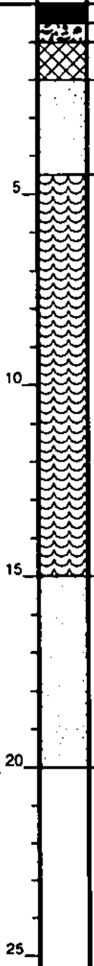
Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council. Borings abandoned with bentonite grout and capped witha 1' concrete cap and ID tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	HP-47-1	GRAB			0.0 - 0.5'
	HP-47-2	SS	45/25/10	1.00	0.5 - 2.0' 3" rounded gravel in cuttings.
	HP-47-3	SS	6/12/14	1.30	2.0 - 3.5' Water at time of drilling]
5	HP-47-4	SS	1/1/1	1.00	5.0 - 6.5' Hydropunch 5-10' sample water EVT-9902-103
10	HP-47-7	SS	1/1/4	1.40	10.0 - 11.5' Duplicate sample HP-47-7D @ 08:02
15	HP-47-5	SS	2/4/6	1.40	15.0 - 16.5'
20	HP-47-6	SS	2/4/7	1.40	20.0 - 21.5' Drive hydropunch 20-25' sample EVT-9902-104.
25					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 0.5'
ASPHALT
2-inches of asphalt.
[Road Pavement]

0.5 - 1.0'
SLAG
Gray, angular, 1/2 to 1/4-inch, dry, hard.
[Slag Fill]

1.0 - 2.0'
SAND & GRAVEL
Sand and Gravel is Gray, medium grained, medium dense, slightly moist to dry, 1/2" and smaller subrounded gravel.
[Fill]

2.0 - 4.5'
SAND
Black with white grains, medium sized grains,loose to medium dense, moist to wet, uniform, trace subrounded 1/4" gravel.
[Dredge Fill]

4.5 - 15.0'
SILT
Brown grading to gray, slightly moist, soft plastic, consists primarily of vegetative fibers from 5-10' then becomes more mineral, strong odor of decomposing organic materials.
[Surficial Deposits]

15.0 - 20.0'
SAND
Black with white grains, medium sized grains,loose to medium dense, moist to wet, uniform, trace subrounded 1/4" gravel.
[Alluvium]

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Hydropunch Log

Hole Name: HP-48

Date Hole Started: 2/10/99 Date Hole Finished: 2/10/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description: Former Whsr site near truck scales.
Descriptive Location:

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None

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	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

Purpose of Hole: Collect Hydropunch Water Samples
Target Aquifer:
Hole Diameter (in): 8
Total Depth Drilled (ft): 20

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council. Borings abandoned with bentonite grout and capped witha 1' concrete cap and ID tag.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	HP-48-1	GRAB			0.0 - 0.5'		0.0 - 0.5' **ASPHALT** 6-inches of asphalt. [Road Pavement]
	HP-48-2	SS	12/14/13	0.50	0.5 - 2.0' Firebrick in cuttings.		0.5 - 2.0' **WOOD & GRAVEL** 1" of wood and firebrick fragments, with angular moist gravel. [Fill]
	HP-48-3	SS	6/8/8	0.70	2.0 - 3.5' Drive hydropunch and sample from 3-8'; EVT-9902-105, dup EVT-9902-106		2.0 - 4.5' **SAND** Black with white grains, medium size grains, medium dense, wet, uniform. [Dredge Fill]
5	HP-48-4	SS	1/2/1	1.40	5.0 - 6.5'		4.5 - 15.0' **SILT** Brown grading to gray, slightly moist, soft plastic, consists primarily of vegetative fibers from 5-10' then becomes more mineral, strong odor of decomposing organic materials. [Surficial Deposits]
10	HP-48-5	SS	1/1/2	1.50	10.0 - 11.5'		
15	HP-48-6	SS	1/1/5	1.20	15.0 - 16.5'		15.0 - 20.0' **SAND** Black with white grains, medium sized grains,loose to medium dense, moist to wet, uniform, trace subrounded 1/4" gravel. [Alluvium]
20		SS	0/0/0	0.00	20.0 - 21.5' No Sample; Drive hydropunch from 20-25' sample EVT-9902-107.		
25							

Sheet 1 of 1

HYDROMETRICS INC.

Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: LB-11

Date Hole Started: 8/25/98 Date Hole Finished: 8/25/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Benson
Legal Description: Benson Property
Descriptive Location: 50' S & 25' W of shed.

Recorded By: JCross
Drilling Company: Hydrometrics (Piper)
Driller: Jeff Cross
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Soil Samples
Target Aquifer:
Hole Diameter (in): 4
Total Depth Drilled (ft): 11.5

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	XRF Analysis	0-0.5, 2-3.5, 5-6.5, and 10-11.

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Piper 2000 mounted on a F-250 pickup using 2 1/4" (ID) hollow stem auger; Sampled witha 2" (oD) split spoon sampler w/o liner under a 140-lb, 30" drop, cathead freefall safety hammer on "A" rod. Borings abandoned with bentonite chips. Cuttings placed in 55 gal. drums for disposal in soil stockpile at smelter footprint. Samples submitted to Hydrometrics, Ruston XRF laboratory for metals analysis.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9808500	SS		0.50	0.0 - 0.5'		0.0 - 2.5' **PEAT** Dark Brown wood/Peat material; All organic material.
	EVT-9808501	SS	1/1/2/3		0.5 - 2.0' Duplicate sample EVT-9808-505 @ 1655		
	EVT-9808502	SS	12/18/20	1.00	2.0 - 3.5'		2.5 - 5.5' **SILT** ML- Greenish gray; fine sand 5%/ silt 90% trace gravels 5%.
5	EVT-9808503	SS	4/6/7		5.0 - 6.5'	5	5.5 - 10.3' **SILT** ML - Greenish gray fine sand 80%/20% silt. moist.
10	EVT-9808504	SS	1/1/1		10.0 - 11.5'	10	10.3 - 11.5' **Clayey SILT** Dark brown clayey SILT; organic material, wood etc., marsh material moldable will rollout, marsh sediment.
15						15	
20						20	
25						25	

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: LB-12

Date Hole Started: 8/26/98 Date Hole Finished: 8/26/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Benson
Legal Description: Benson Property
Descriptive Location: 60' due S of LB-11

Recorded By: JCross
Drilling Company: Hydrometrics (Piper)
Driller: Jeff Cross
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Soil Samples
Target Aquifer:
Hole Diameter (in): 4
Total Depth Drilled (ft): 11.5

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	XRF Analysis	0-0.5, 2-3.5, 5-6.5, and 10-[illegible]1

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: *Drilled with a Piper 2000 mounted on a F-250 pickup using 2 1/4" (ID) hollow stem auger; Sampled witha* 2" (oD) split spoon sampler w/o liner under a 140-lb, 30" drop, cathead freefall safety hammer on "A" rod. Borings abandoned with bentonite chips. Cuttings placed in 55 gal. drums for disposal in soil stockpile at smelter footprint. Samples submitted to Hydrometrics, Ruston XRF laboratory for metals analysis.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9808506	SS	2/6/18/20	0.75	0.0 - 0.5' 3" split spoon.		0.0 - 1.0' **Sandy SILT** MLS - Light brown, fine sandy silt organic material to 1'.
	EVT-9808507	SS			0.5 - 2.0'		1.0 - 2.3' **SILT** ML - Greenish gray slilg with fine silty sand small gravels and brick fragments.
	EVT-9808508	SS	6/7/7	0.50	2.0 - 3.5' 2" split spoon.		2.3 - 3.5' **BRICK** Brick fragments, moist.
5	EVT-9808509	SS	4/4/7	1.00	5.0 - 6.5'		5.0 - 6.5' **Sandy SILT** MLS- Greenish gray fine sandy silt, wet.
10	EVT-9808510	SS	1/1/2	1.00	10.0 - 11.5'		10.0 - 11.5' **Sandy SILT** MLS- Greenish gray fine sandy silt; marsh sediments, organics material, wet.
15							
20							
25							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: LB-13

Date Hole Started: 8/26/98 Date Hole Finished: 8/26/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Benson
Legal Description: Benson Property
Descriptive Location: 25' E of LB-12

Recorded By: JCross
Drilling Company: Hydrometrics (Piper)
Driller: Jeff Cross
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Soil Samples
Target Aquifer:
Hole Diameter (in): 4
Total Depth Drilled (ft): 11.5

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	XRF Analysis	0-0.5, 2-3.5, 5-6.5, and 10-

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Piper 2000 mounted on a F-250 pickup using 2 1/4" (ID) hollow stem auger; Sampled witha 2" (oD) split spoon sampler w/o liner under a 140-lb, 30" drop, cathead freefall safety hammer on "A" rod. Borings abandoned with bentonite chips. Cuttings placed in 55 gal. drums for disposal in soil stockpile at smelter footprint. Samples submitted to Hydrometrics, Ruston XRF laboratory for metals analysis.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9808511	SS	18/20/24/24	0.75	0.0 - 0.5' 3" SS		0.0 - 0.5' **PEAT** PT- Brown organic material. [Native]
	EVT-9808512	SS			0.5 - 2.0' Duplicate sample EVT-9808-516; Sample obtained from 0-2.0		0.5 - 11.3' **Sandy SILT** Greenish gray fine sandy silt with small gravels, moist.
	EVT-9808513	SS	11/14/8	0.75	2.0 - 3.5'		
5	EVT-9808514	SS	2/1/1	0.50	5.0 - 6.5'	5	
10	EVT-9808515	SS	1/1/2	1.00	10.0 - 11.5'	10	11.3 - 11.5' **SILT** OH- Marsh sediments, dark brown organic material.
15						15	
20						20	
25						25	

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log
Hole Name: LB-14

Date Hole Started: 8/26/98 Date Hole Finished: 8/26/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Benson
Legal Description: Benson Property
Descriptive Location: 60' due S of LB-12

Recorded By: JCross
Drilling Company: Hydrometrics (Piper)
Driller: Jeff Cross
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Soil Samples
Target Aquifer:
Hole Diameter (in): 4
Total Depth Drilled (ft): 11.5

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	XRF Analysis	0-0.5, 2-3.5, 5-6.5, and 10-

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Piper 2000 mounted on a F-250 pickup using 2 1/4" (ID) hollow stem auger; Sampled witha 2" (oD) split spoon sampler w/o liner under a 140-lb, 30" drop, cathead freefall safety hammer on "A" rod. Borings abandoned with bentonite chips. Cuttings placed in 55 gal. drums for disposal in soil stockpile at smelter footprint. Samples submitted to Hydrometrics, Ruston XRF laboratory for metals analysis.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9808517	SS	12/18/16/11	0.75	0.0 - 0.5' 3" SS		0.0 - 0.5' **Sandy SILT** MLS- Light brown fine sandy silt, organic material.
	EVT-9808518	SS			0.5 - 2.0'		0.5 - 2.0' **Silty SAND** SM- Silty sand fine grain.
	EVT-9808519	SS	6/4/3	0.50	3.0 - 4.5' 2" SS		2.0 - 3.5' **Sandy SILT** MLS- Light brown sandy silt.
5	EVT-9808520	SS	2/1/2	0.50	5.0 - 6.5'	5	5.0 - 5.5' **Silty SAND** SM- Light brown silty sand.
							5.5 - 6.5' **SAND** SP- Wet light brown, fine to medium sand, some silt.
10	EVT-9808521	SS	1/1/1	1.00	10.0 - 11.5'	10	10.0 - 11.5' **SAND** SP- Lioght brown medium to fine sand, some silt, wet.
15						15	
20						20	
25						25	

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: LB-15

Date Hole Started: 8/26/98 Date Hole Finished: 8/26/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Benson
Legal Description: Benson Property
Descriptive Location: 60' due S of LB-13

Recorded By: JCross
Drilling Company: Hydrometrics (Piper)
Driller: Jeff Cross
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Collect Soil Samples
Target Aquifer:
Hole Diameter (in): 4
Total Depth Drilled (ft): 11.5

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	XRF Analysis	0-0.5, 2-3.5, 5-6.5, and 10-11.

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Piper 2000 mounted on a F-250 pickup using 2 1/4" (ID) hollow stem auger; Sampled witha 2" (oD) split spoon sampler w/o liner under a 140-lb, 30" drop, cathead freefall safety hammer on "A" rod. Borings abandoned with bentonite chips. Cuttings placed in 55 gal. drums for disposal in soil stockpile at smelter footprint. Samples submitted to Hydrometrics, Ruston XRF laboratory for metals analysis.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9808522	SS	18/22/>50	0.75	0.0 - 0.5' 3" SS		0.0 - 1.0' **SILT** Brown, organic material silty sand, compacted at 0.5'.
	EVT-9808523	SS			0.5 - 2.0' Sampled with above SS.		
	EVT-9808524	SS	40/76/48	0.50	2.0 - 3.5' Duplicate sample # EVT-9808-527 @ 1730		1.0 - 3.5' **Sandy SILT** Greenish gray, fine sandy silt, some large gravel.
5	EVT-9808525	SS	18/15/14	0.75	5.0 - 6.5'		5.0 - 10.5' **Silty SAND** Greenish gray silty sand, moist at 6.0.
10	EVT-9808526	SS	1/1/1		10.0 - 11.5'		10.5 - 11.5' **SILT** OH- Marsh sediment, organic material, silty. dark brown to black.
15							
20							
25							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log
Hole Name: LB-19

Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Bentsen
Legal Description: Bentsen Property
Descriptive Location: 20' W of LB-11

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer:
Hole Diameter (in): 8
Total Depth Drilled (ft): 11.5

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?	N		

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-190	GRAB			0.0 - 0.5'		0.0 - 6.0' **Silty SAND** brown to gray , dry, organics to 4', medium dense to soft. [Fill]
	EVT-9809-191	SS	2/10/13	1.00	2.0 - 3.5'		
5	EVT-9809-192	SS	4/3/2	1.00	4.0 - 5.5' 3" split spoon used for recovery.		
	EVT-9809-193	SS	1/1/0	1.00	6.0 - 7.5' Switched back to 2" split spoon; Duplicate sample taken at 11:22, EVT-9809-194		6.0 - 10.0' **Sandy SILT** Gray, loose to soft, moist to slighlty moist, high organics, trace wood. [Till/Fill]
	EVT-9809-195	SS	1/0/0	1.00	8.0 - 9.5'		
10	EVT-9809-196	SS	1/5/7	0.70	10.0 - 11.5' 3" split spoon used.		10.0 - 11.5' **Clayey SILT** Brown, soft, moist, plastic, plastic abdt yellow stained wood fibers. [Till/Fill]
15							
20							
25							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Soil Boring Log

Hole Name: LB-20

Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Bentsen
Legal Description: Bentsen Property
Descriptive Location: 20' S of LB-11

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer:
Hole Diameter (in): 8
Total Depth Drilled (ft): 11.5

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?	N		

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft):
Riser Height (ft):
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-161	SS	2/3/4	1.00	0.0 - 0.5' Piece of slag at surface		0.0 - 4.0' **Sandy SILT** Gray to brown , dry , loose to stiff, medium to coarse grained w/ subrounded gravel. [Till/Fill]
	EVT-9809-162	SS	16/11/8	1.00	2.0 - 3.5'		
5	EVT-9809-163	SS	4/6/4	1.00	4.0 - 5.5'		4.0 - 5.5' **Silty SAND w/ Gravel** Light brown to gray, slightly moist to dry, medium dense, medium grained, 1/2" and smaller subrounded gravel. [Till/Fill]
	EVT-9809-164	SS	1/1/0	1.00	6.0 - 7.5'		5.5 - 10.0' **Sandy SILT** Gray, moist, soft, plastic w/ 2" of wood stained black at 7.3'. sand is medium grained. [Till/Fill]
	EVT-9809-165	SS	1/1/0	0.50	8.0 - 9.5'		
10	EVT-9809-166	SS	1/1/1	0.70	10.0 - 11.5'		10.0 - 11.5' **SILT** Brown, dry, nonplastic, organics.
15							
20							
25							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Hole Name: EV-15A
Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Bentsen
Legal Description: Bentsen Property
Descriptive Location: 5' south of EV-15 B

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8
Total Depth Drilled (ft): 12

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.24'-12'
Surface Casing Used?	Y	Steel Monument	+2.41 to -2.59
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	7'-12'
Sand Pack?	Y	10/20 Silica Sand	5'-12'
Annular Seal?	Y	Bentonite/Cement Grout	2'-5'
Surface Seal?	Y	Concrete	0' - 2'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Static Water Level Below MP: 7.34
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): 2.24

Surface Casing Height (ft): 2.41
Riser Height (ft): 2.24
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Cuttings were placed in 55-gallon drums and labeled. See EV-15B for Lithology.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	1				0.0 - 0.5'		0.0 - 0.0' See EV-15B for Lithology.
5					5 ▼		
10					10		
15					15		
20					20		
25					25		

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-15B

Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Bentsen
Legal Description: Bentsen Property
Descriptive Location: 20 yards south of shed structure.

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Shallow Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 31.5

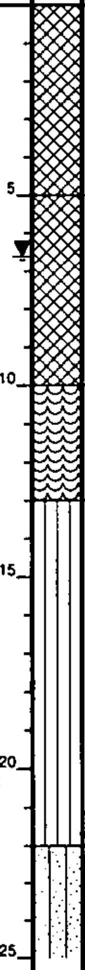
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.44-30
Surface Casing Used?	Y	Steel Monument	+2.69-2.31
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	25'-30'
Sand Pack?	Y	10/20 Silica Sand	21'-30'
Annular Seal?	Y	Bentonite Grout	1'-21'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0-0.5', 2-3.5', 5' intervals ther

Static Water Level Below MP: 9.06
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): 2.44

Surface Casing Height (ft): 2.69
Riser Height (ft): 2.44
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Sampled with a 2" (OD) split spoon under a 30-inch drop, winch release, 140-pound safety hammer. Cuttings placed in a 55-gallon drum and labeled for disposal.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-167	GRAB			0.0 - 0.5'		0.0 - 5.0' **Silty LOAM** Brown, Dry, Loose, abundant vegetative matter, roots, etc.; trace gravel.
		SS	3/5/3	0.00	1.0 - 2.5' No Recovery		
5	EVT-9809-168	SS	1/1/1	0.50	5.0 - 6.5'	▼	5.0 - 10.0' **Sandy SILT** Gray, slightly moist, non-plastic, soft, medium grained sand, trace wood at 6.5-feet.
10	EVT-9809-169	SS	1/1/0	1.50	10.0 - 11.5' Duplicate sample @ 14:47 EVT-9809-170.		10.0 - 13.0' **SILT** Dark brown, slightly moist, plastic, abundant vegetative matter.
							13.0 - 22.0' **SILT** Gray, slighlty moist, soft, plastic, uniform, some vegetative matter; approximately 20 % fine sand.
15	EVT-9809-171	SS	1/1/0	1.50	15.0 - 16.5'		
20	EVT-9809-172	SS	1/1/0	1.50	20.0 - 21.5' Driller says it felt different at 22'		
							22.0 - 28.0' **Sandy SILT** Gray, wet to moist, approximately 40 to 50% coarse to medium sand.
25							



Continued Next Page

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-15B

Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-173	SS	1/1/4	0.50	25.0 - 26.5'		
							28.0 - 31.5' **SAND** Gray, wet, loose to medium-dense, well sorted, and uniform.
30	EVT-9809-174	SS	0/0/5	0.50	30.0 - 31.5'	30	
35						35	
40						40	
45						45	
50						50	
55						55	
60						60	
65						65	

GEOTECH 0030.GPJ HYD-TUC.GDT 3/16/99

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log
Hole Name: EV-16A
Date Hole Started: 9/29/98 Date Hole Finished: 9/29/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Bentsen
Legal Description: Bentsen Property
Descriptive Location: 100 yds S, 30 yds W of Shed

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.47'-12'
Surface Casing Used?	Y	Steel Monument	2.71'-2.29'
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	7'-12'
Sand Pack?	Y	10/20 Silica Sand	5'-12'
Annular Seal?	Y	Bentonite Chips	1'-5'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0-0.5', 2-3.5', 5' intervals

Purpose of Hole: Install Monitor Well
Target Aquifer: Shallow Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 16

Static Water Level Below MP: Dry
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): 2.47

Surface Casing Height (ft): 2.71
Riser Height (ft): 2.47
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Sampled with a 2" (OD) split spoon under a 30-inch drop, winch release, 140-pound safety hammer. Cuttings placed in a 55-gallon drum and labeled for disposal.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION
	EVT-9809-152	GRAB			0.0 - 0.5'	0.0 - 2.0' **Silty LOAM** Brown, dry, loose, some root material, trace subrounded, 1/4" gravel. [Fill]
	EVT-9809-153	SS	2/2/2	1.00	2.0 - 3.5'	2.0 - 12.0' **Sandy SILT** Gray, soft, slightly moist, very plastic, with approximately 20% medium grained sand; 3" of wood at 11.5' with a piece of glass in the silt. [Fill]
5	EVT-9809-154	SS	1/1/1	1.00	5.0 - 6.5'	
10	EVT-9809-155	SS	1/1/1	1.00	10.0 - 11.5' Duplicate sample at 08:52 EVT-9809-156	
	EVT-9809-157	SS	1/1/0	0.50	12.0 - 13.5'	12.0 - 15.5' **SILT** Gray to brown (becomes more gray with depth), high organics (wood fibers), soft plastic, slightly moist to dry.
15	EVT-9809-158	SS	1/1/10	1.50	14.0 - 15.5'	
20						
25						

Sheet 1 of 1

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-17A

Date Hole Started: 9/24/98 Date Hole Finished: 9/24/98

Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Weyerhauser
Legal Description:
Descriptive Location: lowland area adjacent to bluff
Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 12

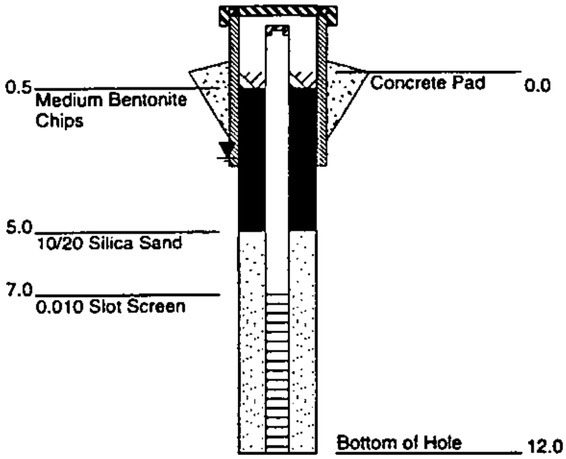
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+3.1-12'
Surface Casing Used?	Y	Steel	+3.5 to -1.5
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	7-12'
Sand Pack?	Y	10-20 silica sand	5-12'
Annular Seal?	Y	Bentonite Chips	0.5-5'
Surface Seal?	Y	Concrete	0-0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	pumping	
Water Samples Taken?	Y	common ions and metals	
Boring Samples Taken?	N		

Static Water Level Below MP: 5.79
Date: 9/25/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): 3.1

Surface Casing Height (ft): 3.6
Riser Height (ft): 3.1
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Six feet east of well EV-17B.

WELL CONSTRUCTION



GRAPHICS

GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Sandy Loam
brown.

1.0 - 4.0'
Fill
Silty Gravel, grey to brown, mixed lithologies with slag fragments, dry.

4.0 - 6.5'
Slag
black, with some brown silty sand, saturated from 6.0-6.5'.

6.5 - 12.0'
Clayey Sand
slightly bluish gray, with minor silt and trace small gravel, overlain by 2-inch peat layer.

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-17B

Date Hole Started: 9/23/98 Date Hole Finished: 9/24/98

Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Weyerhauser
Legal Description:
Descriptive Location: lowland area adjacent to bluff
Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 30

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+1.7-23
Surface Casing Used?	Y	steel	+2.2-2.8
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	18-23'
Sand Pack?	Y	10-20 silica sand	14-23'
Annular Seal?	Y	Bentonite Chips	0.5-14
Surface Seal?	Y	Concrete	0-0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	pumping	
Water Samples Taken?	Y	common ions and metals	
Boring Samples Taken?	Y	split spoon soil samples submitted for XRF metals analysis	

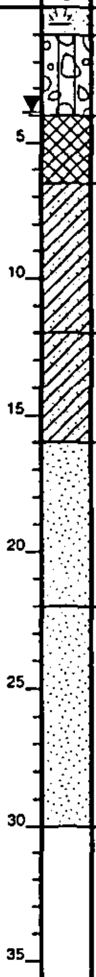
Static Water Level Below MP: 5.57
Date: 9/25/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): 1.7

Surface Casing Height (ft): 2.2
Riser Height (ft): 1.7
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9809115	GRAB			0.0 - 0.5'
	EVT-9809116	SS	17,24,17	1.0'	2.0 - 3.5' 3-inch O.D. split spoon
5	EVT-9809117	SS	17,7,5	1.50	5.0 - 6.5'
10	EVT-9809118	SS	5,2,5	1.00	10.0 - 11.5'
15	EVT-9809119	SS	2,2,4	1.50	15.0 - 16.5'
20	EVT-9809120	SS	7,15,18	1.00	20.0 - 21.5'
25	EVT-9809121	SS	4,12,21	1.00	25.0 - 26.5'
30					no sample due to heaving sands
35					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 1.0'
Sandy Loam
brown.

1.0 - 4.0'
Fill
Silty Gravel, grey to brown, mixed lithologies with slag fragments, dry.

4.0 - 6.5'
Slag
black, with some brown silty sand, saturated from 6.0-6.5'.

6.5 - 12.0'
Clayey Sand
slightly bluish gray, with minor silt and trace small gravel, overlain by 2-inch peat layer, wet.

12.0 - 16.0'
Clayey Sand
As above, transition to brown, well sorted fine to medium sand from 16.0 to 16.5, wet.

16.0 - 22.0'
Sand
brown, fine to medium grain, moderately sorted, thin (3/4-inch) zone of orange (iron) staining, wet.

22.0 - 30.0'
Sand
brown, medium grain, well sorted, wet.

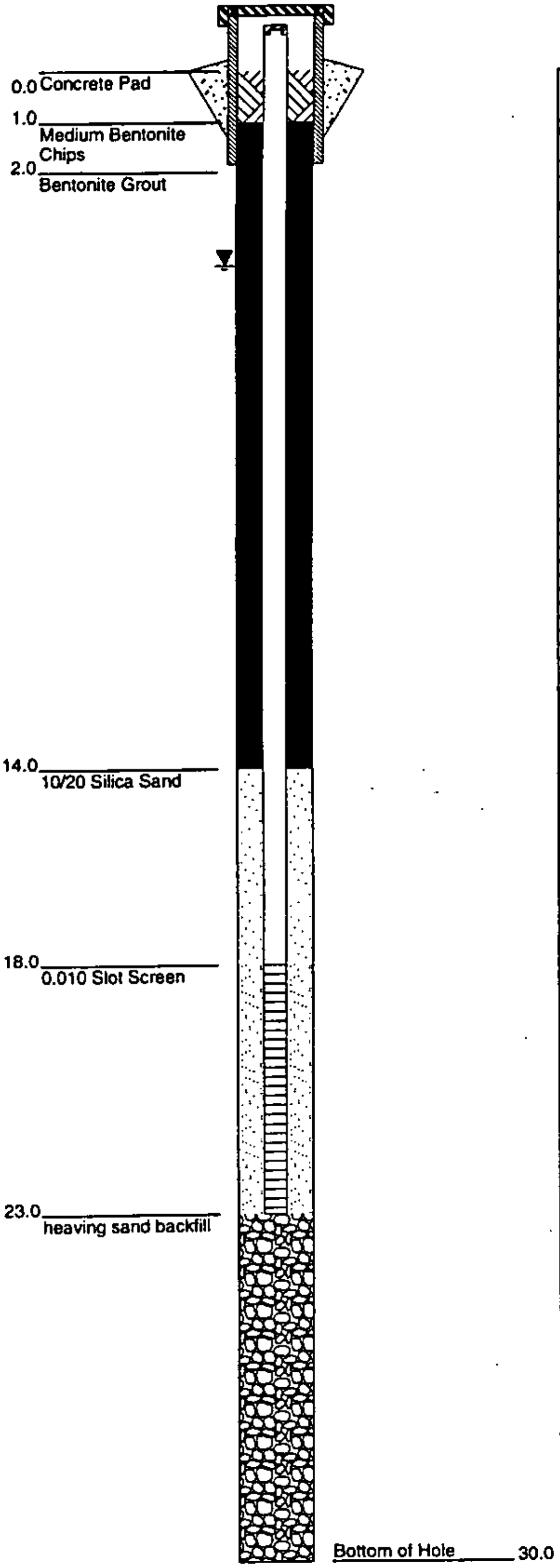
HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-17B

Date Hole Started: 9/23/98 Date Hole Finished: 9/24/98

Well Construction Diagram



Geological Description

0.0 - 1.0'
Sandy Loam
brown.

1.0 - 4.0'
Fill
Silty Gravel, grey to brown, mixed lithologies with slag fragments, dry.

4.0 - 6.5'
Slag
black, with some brown silty sand, saturated from 6.0-6.5'.

6.5 - 12.0'
Clayey Sand
slightly bluish gray, with minor silt and trace small gravel, overlain by 2-inch peat layer, wet.

12.0 - 16.0'
Clayey Sand
As above, transition to brown, well sorted fine to medium sand from 16.0 to 16.5, wet.

16.0 - 22.0'
Sand
brown, fine to medium grain, moderately sorted, thin (3/4-inch) zone of orange (iron) staining, wet.

22.0 - 30.0'
Sand
brown, medium grain, well sorted, wet.

WELL_DIAGRAM 0 J HYD-TUC.GDT 4/8/99

HYDROMETRICS INC.

Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-18

Date Hole Started: 9/24/98 Date Hole Finished: 9/24/98

Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: City of Everett
Legal Description:
Descriptive Location:

Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 55

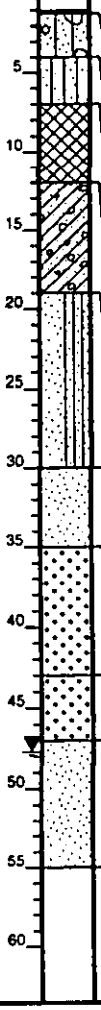
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	0-55'
Surface Casing Used?	Y	steel	0-1.5'
Screen/Perforations?	Y	0.020-inch slot, Sch 40 PVC	45-55'
Sand Pack?	Y	10-20 silica sand	42-55'
Annular Seal?	Y	Bentonite Grout	1-42
Surface Seal?	Y	Concrete	0-0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	pumping	
Water Samples Taken?	Y	common ions and metals	
Boring Samples Taken?	Y	*split spoon soil samples submitted for XRF metals analysis*	

Static Water Level Below MP: 47.37
Date: 9/25/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): -0.34

Surface Casing Height (ft):
Riser Height (ft): -0.34
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks:

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9809122	GRAB			1.0 - 1.3' sample collected below asphalt
	EVT-9809123	SS	4,6,8	1.20	2.0 - 3.5' 3" O.D. split spoon using 300 lb hammer
5	EVT-9809124	SS	5,7,32	1.30	5.0 - 6.5'
10	*EVT-9809125*	*SS*	*3,2,1*	1.00	*10.0 - 11.5' EVT-9809-134* (duplicate)
15	EVT-9809126	SS	20, 50/6"	1.00	15.0 - 16.5'
20	EVT-9809127	SS	30,50/6"	1.00	20.0 - 21.5'
25	EVT-9809128	SS	22,50/6"	1.00	25.0 - 26.5'
30	EVT-9809129	SS	8,14,16	1.50	30.0 - 31.5' drilling easier at 28 feet
35	EVT-9809130	SS	8,15,17	1.00	35.0 - 36.5'
40	EVT-9809131	SS	9,12,14	1.00	40.0 - 41.5'
45	EVT-9809132	SS	20,50/6"	1.50	45.0 - 46.5'
50			15,20,30		50.0 - 51.5' wet, no sample due to heaving sands
55					
60					



GEOLOGICAL DESCRIPTION

1.0 - 1.3'
Road Grade
fine to coarse sand and fine gravel, dry.

1.3 - 4.0'
Fill
Silty gravelly sand - brown to gray, fine grain sand and fine gravel, 10% silt.

4.0 - 7.0'
Fill
Sandy Silt and Gravel - bluish grey, contains fragments of brick and asphalt, dry.

7.0 - 12.0'
Sandy Silt and Gravel
as above, dry, 4 inches of orange silty fine sand overlain by 4 inches of charcoal and ash containing white fragments (bone or shell ?) One piece looks like pipe (?).

12.0 - 19.0'
Sand and Gravel
brown, sand is poorly sorted, gravel is subrounded to 2-inch diameter, dry.

19.0 - 30.0'
Silty Sand
brown, some gravel, moderately dense, slightly damp.

30.0 - 35.0'
Sand
brown, fine grain, well sorted, dry.

35.0 - 43.0'
Sand
brown, medium to coarse grain, moderately to well sorted, dry.

43.0 - 47.0'
Sand
brown, fine to coarse sand, poorly sorted, dry.

47.0 - 55.0'
Sand
brown, medium grain, well sorted, wet.

Sheet 1 of 1

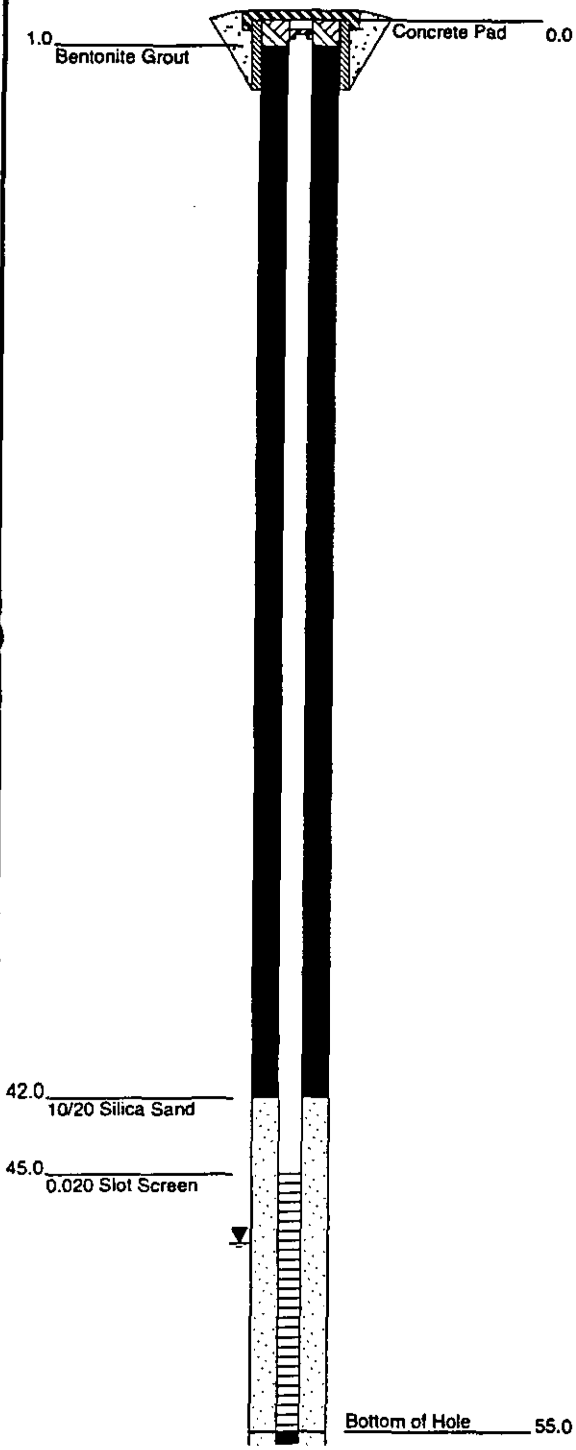
HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-18

Date Hole Started: 9/24/98 Date Hole Finished: 9/24/98

Well Construction Diagram



Geological Description

1.0 - 1.3'
Road Grade
fine to coarse sand and fine gravel, dry.

1.3 - 4.0'
Fill
Silty gravelly sand - brown to gray, fine grain sand and fine gravel, 10% silt.

4.0 - 7.0'
Fill
Sandy Silt and Gravel - bluish grey, contains fragments of brick and asphalt, dry.

7.0 - 12.0'
Sandy Silt and Gravel
as above, dry, 4 inches of orange silty fine sand overlain by 4 inches of charcoal and ash containing white fragments (bone or shell ?) One piece looks like pipe (?).

12.0 - 19.0'
Sand and Gravel
brown, sand is poorly sorted, gravel is subrounded to 2-inch diameter, dry.

19.0 - 30.0'
Silty Sand
brown, some gravel, moderately dense, slightly damp.

30.0 - 35.0'
Sand
brown, fine grain, well sorted, dry.

35.0 - 43.0'
Sand
brown, medium to coarse grain, moderately to well sorted, dry.

43.0 - 47.0'
Sand
brown, fine to coarse sand, poorly sorted, dry.

47.0 - 55.0'
Sand
brown, medium grain, well sorted, wet.

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-19

Date Hole Started: 9/25/98 Date Hole Finished: 9/25/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: City of Everett
Legal Description: Everett Right of Way
Descriptive Location: 10' South of TB-1

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 55

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	0.42'-55.0'
Surface Casing Used?	Y	Flush Monument	0.0'-3.0'
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	50'-5'
Sand Pack?	Y	10/20 Silica Sand	44'-55'
Annular Seal?	Y	Bentonite Grout	1'-44'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Static Water Level Below MP: 47.75
Date: 9/28/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): -0.42

Surface Casing Height (ft): 0.00
Riser Height (ft): -0.42
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Not Sampled See TB-1 for Lithology. Cuttings placed in labeled 55-gallon drums.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
							0.0 - 0.0' See TB-1 log for lithology.
5					5		
10					10		
15					15		
20					20		
25					25		
30					30		
35					35		
40					40		
45					45		
50					▼ 50		
55					55		

GEOTECH 0030.GPJ HYD-TUC.GDT 3/16/99

Sheet 1 of 1

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-20

Date Hole Started: 9/28/98 Date Hole Finished: 9/28/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: City of Everett
Legal Description: Everett Right of Way
Descriptive Location: 2' off Sidwalk on SE corner Mar. view. Dr.

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 55

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.07'-55.0'
Surface Casing Used?	Y	Steel Monument	+2.47-2.53
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	50'-55'
Sand Pack?	Y	10/20 Silica Sand	45'-55'
Annular Seal?	Y	Bentonite Grout	1'-45'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0-0.5', 2-3.5', 5' intervals ther

Static Water Level Below MP: 50.81
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): 2.07

Surface Casing Height (ft): 2.47
Riser Height (ft): 2.07
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Sampled with a 3" (ID) split spoon under a 30-inch drop, winch release, 300-pound, safety hammer under "N" rod. Cuttings placed in a 55-gallon drum and labeled for disposal. Sampled to 50-feet; drilled to 55-feet, did not sample to help prevent heaving sands.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-140	GRAB			0.0 - 0.5'		0.0 - 4.0' **Silty LOAM** Brown, dry, abundant vegetation, loose, trace rounded gravel 1/4" and under. [Fill]
		SS	32/50-1	0.00	2.0 - 4.0' No recovery		
							4.0 - 8.0' **Silty SAND** Brown dry, fine grained, trace 1/4" rounded gravel. [Fill]
5	EVT-9809-141	SS	10/10/9	0.10	5.0 - 6.5'		
							8.0 - 13.0' **SAND** Dark brown, fined grained, loose, slighlty moist to dry, trace organics. [Till/Fill]
10	EVT-9809-142	SS	2/2/2	1.00	10.0 - 11.5'		
							13.0 - 18.0' **Sandy SILT** Red to yellowish brown with some black staining, some oxidation, slightly moist, soft, some 1" subrounded gravels. [Till/Fill]
15	EVT-9809-143	SS	4/2/2	1.00	15.0 - 16.5' Duplicate sample @ 11:12 EVT-9809-144		
							18.0 - 22.0' **SAND** Light brown to gray, slightly moist, sorted, fine grained, medium dense to dense, some 1" subrounded gravels. [Till/Fill]
20	EVT-9809-145	SS	6/14/42	1.00	20.0 - 21.5'		
							22.0 - 55.0' **SAND** Gray, dry to 49', medium to fine grained, medium dense to dense, well sorted. [Alluvium]
25							

Continued Next Page

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-20

Date Hole Started: 9/28/98 Date Hole Finished: 9/28/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-146	SS	12/24/25	1.50	25.0 - 26.5'		
30	EVT-9809-147	SS	8/14/17	1.50	30.0 - 31.5'		
35	EVT-9809-148	SS	4/14/12	1.50	35.0 - 36.5'		
40	EVT-9809-149	SS	10/24/28	1.50	40.0 - 41.5'		
45	EVT-9809-150	SS	10/28/37	1.50	45.0 - 46.5' Water at 49' at time of drilling		
50	EVT-9809-151	SS	14/26/38	1.50	50.0 - 51.5'		
55							
60							
65							

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-21A

Date Hole Started: 2/8/99 Date Hole Finished: 2/8/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description:
Descriptive Location: On acess road for construction of new bridge

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Shallow Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 10

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+5-10.0
Surface Casing Used?	Y	Steel Monument	+5.1-2.9
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	5-10'
Sand Pack?	Y	10/20 Silica Sand	5-10'
Annular Seal?	Y	Bentonite Grout	1-4'
Surface Seal?	Y	Concrete	0-1
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft): 5.1
Riser Height (ft): 5.0
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
							0.0 - 0.0' See log for EV-21B for lithology.
5							
	EV-21A-1	SS	1/3/4	1.30	8.0 - 9.5'		8.0 - 10.0' **SILT** Green to gray, soft, plastic, slightly moist, abundant vegetative fibers. [Surficial Deposits]
10							
15							
20							
25							

GEOTECH 0030.GPJ HYD-TUC.GDT 3/16/99

Sheet 1 of 1

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-21B

Date Hole Started: 2/8/99 Date Hole Finished: 2/8/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description:
Descriptive Location: On acess road for construction of new bridge

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 25

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+5-25.0
Surface Casing Used?	Y	Steel Monument	+5.1-2.9
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	19-24
Sand Pack?	Y	10/20 Silica Sand	19-24'
Annular Seal?	Y	Bentonite Grout	1-15'
Surface Seal?	Y	Concrete	0-1
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft): 5.1
Riser Height (ft): 5.0
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EV-21B-1	GRAB			0.0 - 0.5' Red brick in cuttings.		0.0 - 0.5' **ASPHALT** [Road Pavement]
	EV-21B-2	SS	34/36/17	1.30	0.5 - 2.0'		0.5 - 1.5' **BRICK and SAND** Red, dry, hard; Sand is slightly moist, medium dense to dense, medium to fine grained. [Fill]
	EV-21B-3	SS	17/9/19	1.40	2.0 - 3.5'		2.0 - 8.0' **Silty SAND** Black with white grains, moist to wet, medium to fine grained, medium dense to loose, uniform, some vegetative fibers and strong odors. [Dredge Fill]
5	EV-21B-4	SS	4/5/9	1.20	5.0 - 6.5' Water at time of drilling. Duplicate sample at 11:00, EVT-9902-4D.	5	
							8.0 - 17.0' **SILT** Gray to brown, slightly moist, plastic, soft, abundant vegetative fibers, strong rotting vegetation odor; becomes less organic with depth. [Surficial Deposits]
10	EV-21B-5	SS	1/1/1	1.30	10.0 - 11.5'	10	
15	EV-21B-6	SS	1/0/1	1.30	15.0 - 16.5'	15	
							17.0 - 25.0' **SAND** Black with white grains, set, poorly sorted, fine to coarse grained, some subrounded gravel < 1/4". [Alluvium]
20	EV-21B-7	SS	1/5/16	1.20	20.0 - 21.5'	20	
25						25	

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-22A

Date Hole Started: 9/22/98 Date Hole Finished: 9/22/98

Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: City of Everett
Legal Description:
Descriptive Location: southwest of PUD substation
Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: First Water
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 20

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.15-20
Surface Casing Used?	Y	steel	+2.35-2.65
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	15-20
Sand Pack?	Y	10-20 silica sand	12.5-20
Annular Seal?	Y	Bentonite Chips	1-12.5
Surface Seal?	Y	Concrete	0-0.5
DEVELOPMENT/SAMPLING			
Well Developed?	Y	pumping	
Water Samples Taken?	Y	common ions and metals	
Boring Samples Taken?	Y	split spoon soil samples submitted for XRF metals analysis	

Static Water Level Below MP: 18.89
Date: 9/24/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): 2.15

Surface Casing Height (ft): 2.35
Riser Height (ft): 2.15
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: well was completed with Timco instapack well screen containing 20-40 silica sand

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION
	EVT-9809100	GRAB			0.0 - 0.5'	0.0 - 2.0' **Sand and Silt** light brown, trace gravel, gravel is subrounded up to 1.5 inches in diameter, dry.
	EVT-9809101	SS	8,13,14		2.0 - 3.5' 3" O.D. split spoon with 300 lb hammer	2.0 - 5.0' **Silty Sand** dark brown, more gravel than above, trace of wood and roots, dry.
5	EVT-9809102	SS	6,4,3		5.0 - 6.5'	5.0 - 8.0' **Silty Sand** medium to dark brown, trace gravel.
						8.0 - 15.0' **Sand** black and white (salt and pepper), medium to dark brown at 8 feet, medium to fine grained, well sorted, trace fine gravel, moist.
10	EVT-9809103	SS	1,1,1		10.0 - 11.5'	
15	EVT-9809104	SS	2,4,4		15.0 - 16.5'	15.0 - 17.0' **Sand** grey, fine grain, well sorted, trace of woody organics, wet.
						17.0 - 20.0' **Silt** grey, damp.
20	EVT-9809105	SS	1,1,5		20.0 - 21.5'	
25						

GEOTECH 0030.G D-TUC.GDT 4/8/99

Sheet 1 of 1

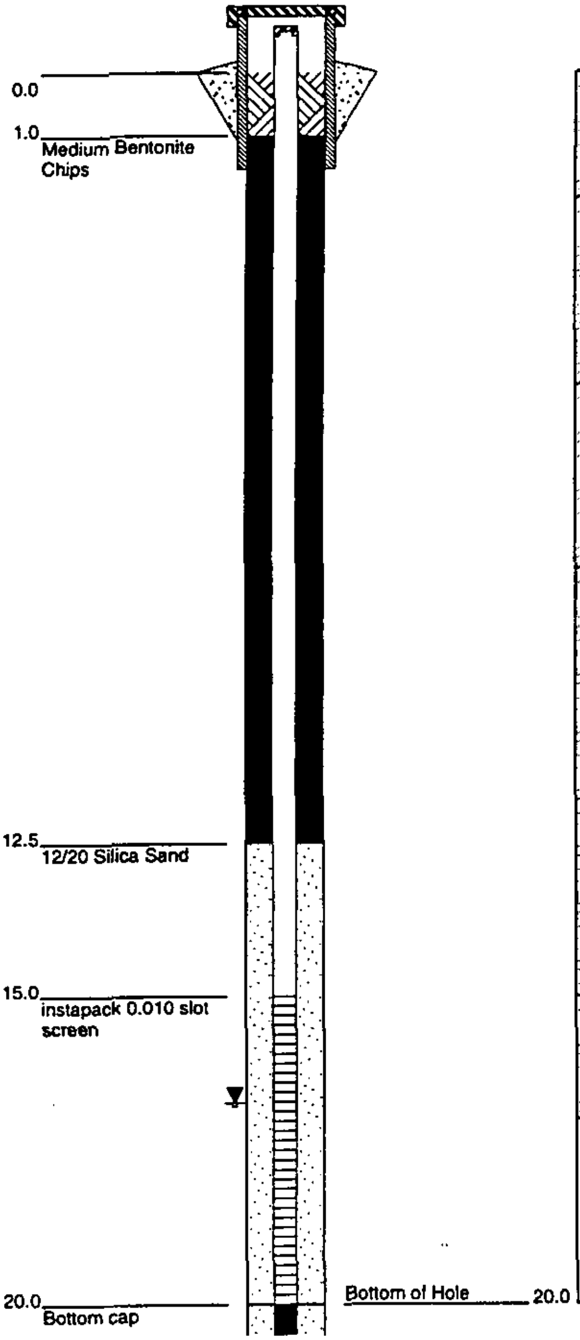
HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-22A

Date Hole Started: 9/22/98 Date Hole Finished: 9/22/98

Well Construction Diagram



Geological Description

0.0 - 2.0'
Sand and Silt
light brown, trace gravel, gravel is subrounded up to 1.5 inches in diameter, dry.

2.0 - 5.0'
Silty Sand
dark brown, more gravel than above, trace of wood and roots, dry.

5.0 - 8.0'
Silty Sand
medium to dark brown, trace gravel.

8.0 - 15.0'
Sand
black and white (salt and pepper), medium to dark brown at 8 feet, medium to fine grained, well sorted, trace fine gravel, moist.

15.0 - 17.0'
Sand
grey, fine grain, well sorted, trace of woody organics, wet.

17.0 - 20.0'
Silt
grey, damp.

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

Monitor Well Log

Hole Name: EV-22B

Date Hole Started: 9/22/98 Date Hole Finished: 9/22/98

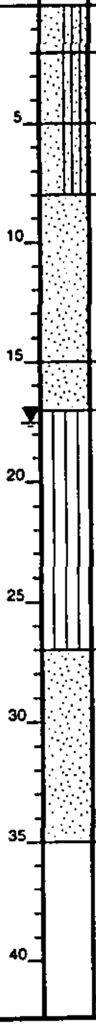
Client: ASARCO
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: City of Everett
Legal Description:
Descriptive Location: southwest of PUD substation
Recorded By: BT
Drilling Company: Hydrometrics
Driller: Jim Neiderkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8-inch
Total Depth Drilled (ft): 35

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+2.5-35
Surface Casing Used?	Y	steel	+2.85-2.15
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	30-35
Sand Pack?	Y	10-20 silica sand	27-35
Annular Seal?	Y	Bentonite Grout	1-27
Surface Seal?	Y	Concrete	0-1
DEVELOPMENT/SAMPLING			
Well Developed?	Y	pumping	
Water Samples Taken?	Y	common ions and metals	
Boring Samples Taken?	Y	split spoon soil samples submitted for XRF metals analysis	

Static Water Level Below MP: 20.02
Date: 9/24/98
MP Description: top of PVC casing
MP Height Above or Below Ground (ft): 2.5
Surface Casing Height (ft): 2.85
Riser Height (ft): 2.5
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: *well was completed with Timco instapack well screen containing 20-40 silica sand*

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
							0.0 - 2.0' **Sand and Silt** light brown, trace gravel, gravel is subrounded up to 1.5 inches in diameter, dry.
							2.0 - 5.0' **Silty Sand** dark brown, more gravel than above, trace of wood and roots, dry.
5							5.0 - 8.0' **Silty Sand** medium to dark brown, trace gravel.
10							8.0 - 15.0' **Sand** black and white (salt and pepper), medium to dark brown at 8 feet, medium to fine grained, well sorted, trace fine gravel, moist.
15							15.0 - 17.0' **Sand** grey, fine grain, well sorted, trace of woody organics, wet.
20							17.0 - 27.0' **Silt** grey, with wood fragments, damp.
25	EVT-9809106	SS	2,2,2		25.0 - 26.5' Split spoon samples were previously collected at well EV-22A to 21 feet.		
							27.0 - 35.0' **Sand** grey, fine grain, trace gravel, wet.
30	EVT-9809107	SS	7,5,5		30.0 - 31.5'		
35							
40							



Sheet 1 of 1

GEOTECH 0030.G[illegible]D-TUC.GDT 4/8/99

HYDROMETRICS INC.
Consulting Scientists and Engineers
Helena, Montana

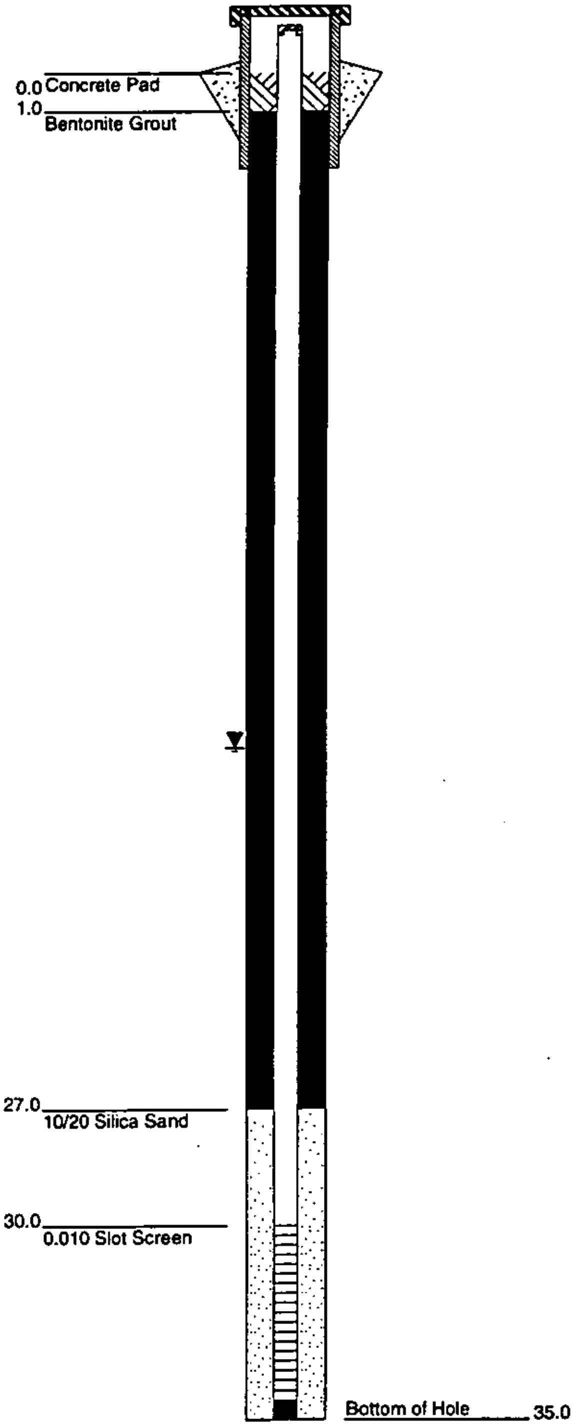
Monitor Well Log

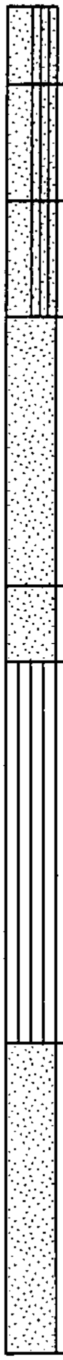
Hole Name: EV-22B

Date Hole Started: 9/22/98 Date Hole Finished: 9/22

Well Construction Diagram

Geological Description





0.0 - 2.0'
Sand and Silt
light brown, trace gravel, gravel is subrounded up to 1.5 inches in diameter, dry.

2.0 - 5.0'
Silty Sand
dark brown, more gravel than above, trace of wood and roots, dry.

5.0 - 8.0'
Silty Sand
medium to dark brown, trace gravel.

8.0 - 15.0'
Sand
black and white (salt and pepper), medium to dark brown at 8 feet, medium to fine grained, well sorted, trace fine gravel, moist.

15.0 - 17.0'
Sand
grey, fine grain, well sorted, trace of woody organics, wet.

17.0 - 27.0'
Silt
grey, with wood fragments, damp.

27.0 - 35.0'
Sand
grey, fine grain, trace gravel, wet.

HYDROMETRICS INC.

Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-23A

Date Hole Started: 9/30/98 Date Hole Finished: 9/30/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Weyerhaeuser
Legal Description: Lowland
Descriptive Location: Under Old Bridge

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Shallow Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 12

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	0.39'-12'
Surface Casing Used?	Y	Flush Monument	0.0'-3.0'
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	7'-12'
Sand Pack?	Y	10/20 Silica Sand	5'-12'
Annular Seal?	Y	Bentonite Chips	1'-5'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	N		

Static Water Level Below MP: 11.14
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): -0.39

Surface Casing Height (ft): 0.00
Riser Height (ft): -0.39
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Cuttings were placed in 55-gallon drums and labeled. See EV-23B for Lithology.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
							0.0 - 0.0' See EV-23B for lithology.
5					5		
10					10	▼	
15					15		
20					20		
25					25		

Sheet 1 of 1

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-23B

Date Hole Started: 9/30/98   Date Hole Finished: 9/30/98

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish   State: Washington
Property Owner: Weyerhaeuser
Legal Description: Lowland
Descriptive Location: Under Old Bridge

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 30

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	0.19'-30'
Surface Casing Used?	Y	Flush Monument	0.0'-3.0'
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	25'-30'
Sand Pack?	Y	10/20 Silica Sand	23'-30'
Annular Seal?	Y	Bentonite Grout	1'-23'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0-0.5', 2-3.5', 5' intervals ther

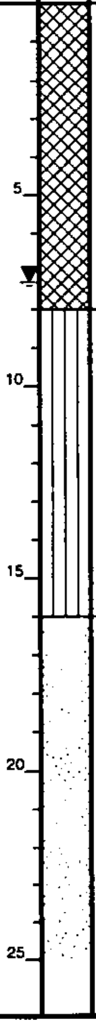
Static Water Level Below MP: 7.09
Date: 9/30/98
MP Description: Top of PVC
MP Height Above or Below Ground (ft): -0.19

Surface Casing Height (ft): 0.00
Riser Height (ft): -0.19
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Sampled with a 2" (OD) split spoon under a 30-inch drop, winch release, 300-pound, safety hammer under "N" rod. Cuttings placed in a 55-gallon drum and labeled for disposal. Sampled to 25' for concern for heaving sands. Sands Heaved to hig to set well. Pulled augers, set teflon plug redrilled wel and set well.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	EVT-9809-175	GRAB			0.0 - 0.5'
	EVT-9809-176	SS	1/2/1	0.20	2.0 - 3.5'
5	EVT-9809-177	SS	1/3/4	0.40	5.0 - 6.5' Duplicate Sample EVT-9809-182 @ 09:20
10	EVT-9809-183	SS	1/1/1	0.20	10.0 - 11.5'
15		SS	1/1/0	0.00	15.0 - 16.5'
	EVT-9809-178	SS	1/2/1	1.00	17.0 - 18.5' Used a 3" (ID) Split Spoon; Duplicate sample EVT-9809-179 @ 09:27
20	EVT-9809-180	SS	1/3/4	0.70	20.0 - 21.5'
25					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 8.0'
Silty SAND
Light brown to black dry to slightly moist, becomes wet at 5', medium to fine grained, some 1/4" subrounded gravel; abundant wood smells like creosote at 5'.
[Fill]

8.0 - 16.0'
SILT
Gray, moist, soft, plastic, abundant organic matter.
[Glacial Till]

16.0 - 30.0'
SAND
Gray, wet to moist, medium grained, loose; Silt at 21.3' plastic.
[Glacial Till]

Continued Next Page

HYDROMETRICS INC.

Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: EV-23B

Date Hole Started: 9/30/98 Date Hole Finished: 9/30/98

(Continued)

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GRAPHICS	GEOLOGICAL DESCRIPTION
	EVT-9809-181	SS	3/3/3	0.50	25.0 - 26.5'		
30					30		
35					35		
40					40		
45					45		
50					50		
55					55		
60					60		
65					65		

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: MW-107D

Date Hole Started: 2/4/99 Date Hole Finished: 2/5/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description: Port of Everett
Descriptive Location: South foot of Sand pile; 100' E of Fence.

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 25

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	5.0'-25'
Surface Casing Used?	Y	Steel Monument	+5.1-2.9
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	20'-25'
Sand Pack?	Y	10/20 Silica Sand	20'-25'
Annular Seal?	Y	Bentonite Grout	1.0'-15.0'
Surface Seal?	Y	Concrete	0-1'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

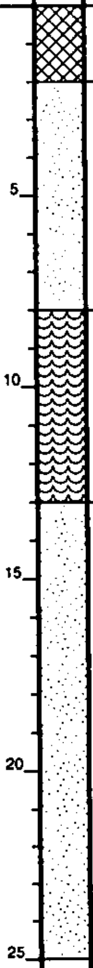
Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft): 5.1
Riser Height (ft): 5.0
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council.

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES
	MW-107D-1	GRAB			0.0 - 0.5'
	MW-107D-2	SS	4/8/12	0.20	0.5 - 2.0'
	MW-107D-3	SS	4/10/12	0.60	2.0 - 3.5' Water ATD 3'.
5	MW-107D-4	SS	1/3/2	0.30	5.0 - 6.5'
10	MW-107D-5	SS	1/0/1	0.70	10.0 - 11.5' Duplicate sample MW-107D-5D @ 14:22
15	MW-107D-6	SS	2/2/3	0.50	15.0 - 16.5' Heaving Sand
20	MW-107D-7	SS	4/8/12	0.80	20.0 - 21.5' Heaving Sand
25					

GRAPHICS



GEOLOGICAL DESCRIPTION

0.0 - 2.0'
Silty SAND
Gray, slightly moist to moist, mediim to fine grained, poorly sorted, medium dense, some wood fibers and 1/4" subrounded gravel.
[Fill]

2.0 - 8.0'
SAND
Black with white grains, medium to coarsegrained, moist to wet, medium dense, subrounded to subangular grains, slight odor may be petroleum based.
[Dredge Fill]

8.0 - 13.0'
SILT
Greenish Gray, soft, plastic, slightly moist, abundant vegetative fibers, strong odor of rotting organics.
[Surficial Deposits]

13.0 - 25.0'
SAND
Black with white, angular, medium to coarse grains with some fines, wet, loose, uniform, trace wood frags.
[Alluvium]

Sheet 1 of 1

GEOTECH 0030.GPJ HYD-TUC.GDT 3/16/99

HYDROMETRICS INC.
Consulting Scientists and Engineers
Tacoma, Washington

Monitor Well Log

Hole Name: MW-109D

Date Hole Started: 2/3/99 Date Hole Finished: 2/4/99

Client: Asarco
Project: Everett Lowland Investigation
County: Snohomish State: Washington
Property Owner: Port of Everett
Legal Description: Former Whsr site near storage shed
Descriptive Location: 100' North of Shed entrance; 10' off access road.

Recorded By: JS
Drilling Company: Hydrometrics (Mobile B-61)
Driller: Jim Niederkorn
Drilling Method: Hollow Stem Auger
Drilling Fluids Used: None
Purpose of Hole: Install Monitor Well
Target Aquifer: Deep Alluvial
Hole Diameter (in): 8
Total Depth Drilled (ft): 25

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	2-inch, flush threaded, Sch 40, PVC	+5.0-25.0
Surface Casing Used?	Y	Steel Monument	+5.1-2.9
Screen/Perforations?	Y	Prepack 0.010-inch slot, Sch 40 PVC	20-25'
Sand Pack?	Y	10/20 Silica Sand	20'-25'
Annular Seal?	Y	Bentonite Grout	2.0-12.0'
Surface Seal?	Y	Concrete	0-2'
DEVELOPMENT/SAMPLING			
Well Developed?	N		
Water Samples Taken?	N		
Boring Samples Taken?	Y	XRF Analysis	0.0, 0.5', 2-3.5', and 5' inte

Static Water Level Below MP:
Date:
MP Description:
MP Height Above or Below Ground (ft):

Surface Casing Height (ft): 5.1
Riser Height (ft): 5.0
Ground Surface Elevation (ft):
MP Elevation (ft):

Remarks: Drilled with a Movile Drill B-61 using 4-1/4" (ID) Hollow Stem Auger; Sampled with a 2" (OD) splid spoon under a 140-lb, 30" drop, winch release safety hammer on "A" rod. Samples submitted to Hydrometrics Ruston XRF lab for metals analysis. Cuttings placed in 55 gallon drums for disposal by the Grandview Residence Council.

GRAPHICS

DEPTH	SAMPLE NUMBER	SAMPLE TYPE	BLOW COUNT	RECOVERY (feet)	DRILLING AND GEOTECHNICAL NOTES	GEOLOGICAL DESCRIPTION
	MW-109D-1	GRAB			0.0 - 0.5'	0.0 - 2.0' **Sandy SILT w/ WOOD** Gray to brown, unsorted, slightly moist, trace gravel with abundant waste. [Fill]
	MW-109D-2	SS	3/3/3	1.50	0.5 - 2.0'	
	MW-109D-3	SS	3/9/8	1.50	2.0 - 3.5'	2.0 - 8.0' **SAND** Black with white grains, medium sized grains, loosely packed, moist to wet, uniform, trace subrounded 1/4" gravel, strong sulfur odor. [Dredge Fill]
5	MW-109D-4	SS	1/2/1	0.50	5.0 - 6.5' Water at time of drilling	
						8.0 - 12.0' **SILT** Gray to brown, soft, moist, plastic, abundant vegetative fibers. [Surficial Deposits]
10	MW-109D-5	SS	1/1/1	1.20	10.0 - 11.5'	
						12.0 - 25.0' **SAND** Black with white grains, medium sized grains,loose to medium dense, moist to wet, uniform, trace subrounded 1/4" gravel. [Alluvium]
15	MW-109D-6	SS	1/3/1	1.00	15.0 - 16.5' Duplicate sample MW-109D-6D @ 1557. Heaving Sand	
20	MW-109D-7	SS	5/6/12	1.00	20.0 - 21.5' Heaving Sand	
25						

APPENDIX B
SOIL/SLAG VALIDATION REPORT

DATA VALIDATION REPORT
EVERETT LOWLAND INVESTIGATION
SOIL DATA
August 1998 through February 1999

Prepared by
Hydrometrics, Inc.
2727 Airport Road
Helena, MT 59601

Prepared: June 1999

TABLE OF CONTENTS

LIST OF APPENDICES

GLOSSARY OF TERMS

CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
EPA	Environmental Protection Agency
FAA	Flame Atomic Absorption
HF Digest	Hydrofluoric Acid Digestion
HGAA	Hydride Generation Atomic Absorption
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
MSA	Method of Standard Additions
PB	Preparation Blank
PRDL	Project Required Detection Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAS	Routine Analytical Services
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOW	Statement of Work
SPLP	Synthetic Precipitation Leaching Procedure
TDS	Total Dissolved Solids
XRF	X-ray Fluorescence

SUMMARY

A total of 165 soil samples were collected for the Everett Lowland Investigation during August through September 1998 (118 samples), and February 1999 (47 samples). These samples have been analyzed in the Hydrometrics' Ruston Laboratory using X-ray fluorescence (XRF) for the following parameters: arsenic, cadmium, chromium, copper, lead, and zinc. The data set has been reviewed using Hydrometrics' in-house 'AutoVal' software. The samples reviewed in this report were analyzed using a fundamental parameters calibration of the XRF instrument. Data quality objectives were met for precision, accuracy, and completeness for the XRF analysis; this information is summarized in Section 9.

Arsenic leachability tests were conducted on slag samples from three sites (LB-16, LB-17, and LB-18) at Asarco's Technical Services Center laboratory in Salt Lake City, Utah. These samples were treated with a modified SPLP procedure at different pH values. The pH values were measured in the final leachates; these were also analyzed for total arsenic by the ICP method 6010. The validation of data for these samples is discussed in Section 10.

The accuracy of the XRF analyses was confirmed by wet chemistry analysis of confirmation samples at a required frequency of at least 1 in 50. A total of seven XRF confirmation samples were analyzed at Asarco's Technical Services Center laboratory. The confirmation sample data validation and a comparison to XRF data has been included in this report as Section 11.

Data validation codes and definitions are listed in Appendix 1, Table 1. Appendix 1 also contains Table 2 (Summary of Flagged Data). The validated sample database is in Appendix 2, supporting documentation is in Appendix 3, and the regression statistics for the confirmation samples are included as Appendix 4.

Quality control violations:

XRF Analyses. Approximately 8 percent (82 out of 990) of all XRF measurements were flagged due to exceedances on 11 of the 90 field duplicate measurements.

- 2 exceedances for arsenic field duplicates resulted in a total of 19 flags.
- 2 exceedances for chromium field duplicates resulted in a total of 14 flags.
- 2 exceedances for copper field duplicates resulted in a total of 11 flags.
- 4 exceedances for lead field duplicates resulted in a total of 32 flags.
- 1 exceedance for zinc field duplicates resulted in a total of 6 flags.

Wet Chemistry Analyses. There were no quality control violations associated with the samples analyzed using traditional wet chemistry techniques.

The Everett Lowland Investigation soil data are considered to be acceptable for project purposes provided that the flagged data are considered with appropriate caution. In using the flagged data, care should be taken to note possible lack of reproducibility indicated by the flags.

DATA VALIDATION REPORT

Prepared by: **Clare Bridge**
Reviewed by: **Linda Tangen**

DATA VALIDATION REPORT

1. INTRODUCTION

- This validation applies to the XRF analysis for 165 soil samples submitted for the Everett Lowland Investigation. In addition to regular samples analyzed by XRF procedures, the total number of samples included 15 field duplicates also analyzed by XRF.

- This validation also applies to the following samples that were analyzed using traditional wet chemistry methods:
    - Seven soil sample splits were submitted as confirmation samples. These samples were analyzed by traditional wet chemistry methods, and were used as a check on the accuracy of the XRF results. The validation of the confirmation samples is discussed in Section 11, along with a comparison to the XRF results.
    - Thirty-four split samples were handled in accordance with a modified version of the EPA's method 1312 (Synthetic Precipitation Leaching Procedure – SPLP). The samples were then analyzed by ICP. The validation of the SPLP results is discussed in Section 10.

- Validation procedures used are generally consistent with:
(Check all that apply)

    _X_ EPA National Functional Guidelines for Inorganic Data Review
    _X_ Work Plan: 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998.
    ___ Other

- Overall level of validation:

    ___ Contract Laboratory Program (CLP)
    _X_ Standard - See Notes.
    ___ Visual
    _X_ XRF Auto-Validation using in house Auto Val program

    Notes: Originally the Everett Lowlands Investigation was undertaken as a CLP project. Subsequently, the CLP requirement was dropped with approval from Ecology. The validation consisted of the following: The frequency and values were checked for both field and laboratory quality control samples. Results were not verified in the raw data. Non-QC sample results were flagged for any quality control exceedances. Data quality objectives for precision, accuracy, and completeness were evaluated as required by the project work plan.

2. DELIVERABLES

- All laboratory document deliverables were present as specified in the CLP-Statement of Work (CLP-SOW), EPA, 1993 and/or the project contract.

  _X_ Yes
  ___ No

- All documentation of field procedures was provided as required.

  _X_ Yes
  ___ No

3. FIELD QUALITY CONTROL SAMPLES

- **Field duplicates**

  Field duplicates have been collected at the proper frequency.

  _X_ Yes
  ___ No

  Field duplicate relative percent differences (RPDs) were within the required control limits (RPD of 35% or less for soil matrix). If the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± 2 times the PRDL for soil matrix.

  ___ Yes
  _X_ No

  The following field duplicate exceedances occurred for the XRF samples validated in this report:

Sample Duplicate Pair	Site	Analyte	Sample Date	Sample Values mg/kg	Duplicate Values mg/kg	# Samples Flagged	RPD or ± Criteria
EVT-9808-500 & -501	LB-11	Chromium	08/25/98	106	168	6	45%
EVT-9808-500 & -501	LB-11	Copper	08/25/98	71	35	6	> ± 20 mg/kg
EVT-9808-500 & -501	LB-11	Lead	08/25/98	120	16	6	> ± 20 mg/kg
EVT-9808-500 & -501	LB-11	Zinc	08/25/98	322	44	6	> ± 20 mg/kg
EVT-9809-125 & -134	EV-19	Arsenic	09/24/98	912	1686	12	60%
EVT-9809-125 & -134	EV-19	Lead	09/24/98	1789	2679	12	40%
EVT-9809-177 & -182	EV-23B	Copper	09/30/98	110	51	5	73%
EVT-9809-177 & -182	EV-23B	Lead	09/30/98	199	134	5	39%
EVT-9809-193 & -194	LB-19	Arsenic	09/29/98	121	261	7	73%
MW-109D-6 & -6D	MW-109D	Chromium	02/03/99	74	51	8	37%
EV-21B-4 & -4D	EV-21B	Lead	02/08/99	42	74	9	> ± 20 mg/kg

Notes: A total of 82 results were flagged because the associated field duplicates were out of control limits. These flags indicate possible lack of reproducibility due to the combined effects of variations in field sampling techniques, sample preparation, and laboratory analytical procedures.

Flagging: J_4/ UJ_4

4. LABORATORY PROCEDURES

- **Laboratory procedures followed**
  _X_ CLP-SOW
  _X_ SW-846
  ___ Standard Methods for Chemical Analysis of Water and Wastes
  _X_ XRF Standard Operating Procedures
  ___ Other

- **Holding times met**
  _X_ Yes
  ___ No

- **Analyses were carried out as requested.**
  _X_ Yes
  ___ No

5. XRF DETECTION LIMITS

The following table lists the XRF laboratory reporting levels.

Analyte	Analysis Method	Reporting Level
Arsenic	XRF	10 ppm
Cadmium	XRF	10 ppm
Chromium	XRF	10 ppm
Copper	XRF	10 ppm
Lead	XRF	10 ppm
Zinc	XRF	10 ppm

- Instrument detection limits (IDLs) were provided by the laboratories.
  _X_ Yes
  ___ No

6. XRF CALIBRATION AND CALIBRATION VERIFICATIONS

- **Instrument calibrations**
  All initial instrument calibrations were performed as specified in the XRF Standard Operating Procedures.
  _X_ Yes
  ___ No
- **Calibration verifications**
  The continuing calibration verification (CCV) standards were analyzed at the required frequency.
  _X_ Yes
  ___ No

The CCV standard percent recovery results were within the required control limits (75-125%).

_X_ Yes -- Source: NIST 2711

___ No

7. XRF LABORATORY DUPLICATES

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes

  ___ No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 35% or less for soil matrix). If the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ±2 times the PRDL for soil matrix.

  _X_ Yes

  ___ No

8. XRF LABORATORY CONTROL SAMPLES

- The reference material used was of the correct matrix and concentration.

  _X_ Yes -- Source: NIST 2711

  ___ No

- Laboratory control samples (LCSs) were prepared in the same way as the associated samples.

  _X_ Yes

  ___ No

- LCSs were prepared and analyzed at the proper frequency

  _X_ Yes

  ___ No

  Notes: The 'Autoval' program listed a missing LCS for all analytes but cadmium. However, with the fundamental parameters calibration, the same standard is used for both the LCS and the CCV. Inspection of the laboratory analysis log revealed that on 8/31/98, the initial standard was labelled a CCV for all analytes but cadmium.

- LCS recoveries were within the required control limits (75-125% for arsenic and lead).

  _X_ Yes

  ___ No

9. XRF DATA QUALITY OBJECTIVES

Accuracy

The accuracy of the data is indicated by the laboratory's ability to recover a known concentration of an analyte. For the data evaluated in this report, accuracy can be measured by percent recovery on laboratory standards, the CCVs and the LCSs. All of the quality control samples were within control limits; mean recoveries are shown in the following table.

Analyte	XRF Mean Recovery on	
	CCVs (n=4)	LCSs (n=2)
Arsenic	95.8%	97.5%
Cadmium	97.6%	97.0%
Chromium	112.3%	110.8%
Copper	98.6%	96.7%
Lead	98.5%	98.7%
Zinc	88.8%	90.2%

Precision

The precision of the data is indicated by the reproducibility of the results as indicated by laboratory and field duplicate samples. All of the laboratory duplicates and 93% (28 out of 30) of the field duplicates were within control limits.

The following table shows the percentage of duplicates that were within control limits broken down by parameter.

Analyte	% of Field Duplicates in Control Limits (n=15)	% of Laboratory Duplicates in Control Limits (n=13)
Arsenic	87%	100%
Cadmium	100%	100% (n=12)*
Chromium	87%	100%
Copper	87%	100%
Lead	80%	100%
Zinc	93%	100%

* With the fundamental parameters calibration, the same standard is used for both the LCS and the CCV. Inspection of the laboratory analysis log revealed that on 8/31/98, the initial standard was labeled a CCV for all analytes but cadmium. The CCV count for cadmium was therefore one less than for the other analytes.

Completeness

All of the laboratory quality control samples were within control limits. Completeness by individual parameter is listed in the following table.

Parameter	# of Samples	# of Samples Not Flagged	% of Samples Not Flagged
Arsenic	165	146	88%
Cadmium	165	165	100%
Chromium	165	151	92%
Copper	165	154	93%
Lead	165	133	81%
Zinc	165	159	96%

Overall completeness expressed as the percent of results not rejected: .... 100%.
Overall completeness expressed as the percent of results without EPA flags:...95%.

10. SPLP ANALYSES

- **Modified SPLP treatment to determine availability of arsenic:**
  At three sites (LB16, LB17, LB18), samples were taken at two depths Total arsenic was measured, and then modified SPLP leaching tests were performed on the six samples. The samples were tested using a de-ionized or distilled water leach; then the samples were leached using a carbonate-buffered alkaline water leach at three different pH values (pH 7, 9, and 11). These samples were not to be crushed. Finally, each of the leach tests for samples from one site (LB-17) was repeated, this time crushing the sample as described in method 1312. In all, six samples were processed using a normal metals digestion, and twenty-eight samples were processed using the modified synthetic precipitation leaching procedure. These twenty-eight samples were then analyzed for pH and for total arsenic using the ICP 6010 method using a reporting limit of 0.1 ppm.

  No QC violations or omissions were found for the SPLP samples. These analyses were not carried out using CLP protocols. Results were therefore not verified in the raw data. The following laboratory QC samples for the ICP analysis of total arsenic were checked and were found to be within control limits.

  - 2 laboratory duplicates (both with a difference less than ± 2 times the PQL);
  - 2 laboratory matrix spikes (105%, 105%);
  - 2 laboratory control samples (105%, 106%);
  - 2 laboratory preparation blanks (both less than the PQL of 0.10 ppm).

11. CONFIRMATION SAMPLES

- **Introduction**
  This validation applies to wet chemistry analysis of arsenic, cadmium, chromium, copper, lead, and zinc for 7 splits of XRF soil samples collected for the Everett Lowlands Investigation during August through September 1998 (5 samples), and February 1999 (2 samples). The purpose of these confirmation samples is to compare analytical results obtained by the XRF instrument with analytical results obtained from traditional wet chemistry soil analysis techniques to see if one set of results is biased with respect to the other. The confirmation samples were analyzed by Asarco's Technical Services Laboratory in Salt Lake City, Utah in laboratory batch 98-258.

  The values of the laboratory quality control samples were checked, but were not verified in the raw data.

- **Detection Limits**
  All analyses were done by the ICP method 6010. The following table lists the laboratory's reporting levels and the instrument detection limits.

Analytes	Digestion	IDL (ppm)	IDL times 50 (ppm)	Reporting Level (mg/kg or ppm)
Arsenic	1g/50ml	0.0048	0.240	1.0
Cadmium	"	0.00024	0.012	1.0
Copper	"	0.0028	0.140	1.0
Chromium	"	0.00049	0.0245	1.0
Lead	"	0.0021	0.105	2.5
Zinc	"	0.0014	0.070	1.0

- **Calibration Verifications**
  The ICV and CCV standards were analyzed at appropriate concentrations (the ICV may be at any value in the calibration range; the CCV is to be midrange, and at a different concentration than the ICV).
  _X_ Yes
  ___ No

  The ICV and CCV standard percent recovery results were within the required control limits (90-110%).
  _X_ Yes
  ___ No

- **Laboratory CRDL Standards**
  The CRDL standards were analyzed at the **frequency** required in the CLP-SOW (EPA, 1995).
  _X_ Yes
  ___ No

  The CRDL standards were analyzed at a **concentration** which demonstrates instrument linearity of response near the reporting level.
  _X_ Yes
  ___ No

- **Laboratory Blanks**
  Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

  The **ICB and CCB** results were within the required control limits.
  _X_ Yes
  ___ No

  Preparation blanks
  Preparation blanks were prepared and analyzed at the required frequency.
  _X_ Yes
  ___ No

  All the analytes in the preparation blank were less than the CRDL (or the PRDL if a project detection limit has been specified).
  _X_ Yes
  ___ No

- **Laboratory Matrix Spikes**
  A matrix spike sample (pre-digestion) was analyzed for each digestion batch and/or matrix, or as required in the CLP-SOW.
  _X_ Yes
  ___ No

  Samples were spiked at appropriate levels.
  _X_ Yes
  ___ No

  Matrix spike recoveries were within the required control limits (75-125%).
  _X_ Yes
  ___ No

- **Laboratory Duplicates**

  Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes
  ___ No

  The laboratory duplicate relative percent differences (RPDs) were within the required control limits (35% or less for soil matrix). If the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PRDL for water matrix, within ± 2 times the PRDL for soil matrix.

  _X_ Yes
  ___ No

- **Laboratory Control Samples**

  LCSs were prepared and analyzed at the proper frequency.

  _X_ Yes
  ___ No

  LCS recoveries were within the required control limits.

  _X_ Yes
  ___ No

- **ICP Quality Control**

  Results on the initial and final **Interference Check Samples (ICSs)** were within control limits.

  _X_ Yes
  ___ No

  Serial dilution samples have been analyzed at the proper frequency and the percent difference criteria have been met (±10%) for analyte concentrations greater than 20 times the CRDL.

  _X_ Yes
  ___ No

- **Data quality objectives**

<u>Accuracy</u> is a measure of the laboratory's ability to recover a known true value of analyte. Here, accuracy has been evaluated by performance on the laboratory control standard (LCS) and on the laboratory matrix spike.

Accuracy As Demonstrated by Laboratory Control Sample Analyses

Parameter	Method	% Recovery	# of LCSs
Arsenic	ICP	92.5%	2
Cadmium	ICP	91%	2
Chromium	ICP	87%	2
Copper	ICP, FAA	96%	2
Lead	ICP	94.5%	2
Zinc	ICP, FAA	104%	2

Accuracy As Demonstrated by Laboratory Matrix Spike Analyses

Parameter	Method	% Recovery	# of Matrix Spikes
Arsenic	ICP	94%	2
Cadmium	ICP	90%	2
Chromium	ICP	89%	2
Copper	ICP, FAA	99%	2
Lead	ICP	99.5%	2
Zinc	ICP, FAA	95%	2

* The sample concentration exceeded the spike concentration by more than a factor of four, so (following accepted laboratory procedures) the spike recovery was not calculated.

<u>Precision</u> is a measure of the reproducibility of results. Precision is evaluated by performance on the laboratory duplicate samples.

Precision As Demonstrated By Laboratory Duplicate Analyses

Parameter	Method	Average % RPD	# of Laboratory Duplicates
Arsenic	ICP	7.4%	2
Cadmium	ICP	NC	2
Chromium	ICP	3.5%	2
Copper	ICP, FAA	0%	2
Lead	ICP	14%	2
Zinc	ICP, FAA	4%	2

<u>Completeness</u>

Completeness expressed as the percent of results not rejected:	100%
Completeness expressed as the percent of results without EPA flags:	100%

- **Data Comparison (XRF Data and HF Digest Data)**
  XRF results have been compared to corresponding wet chemistry results (using a hydrofluoric acid digestion to prepare the soil samples). As required in the project work plan, the following statistical methods were used for the comparison:

  - calculation of the relative percent difference;
  - calculation of recovery rates;
  - regression analysis with 95% confidence bands Miller (1992).

  The source information generated for these comparisons, regression graphs, and an outlier and completeness evaluation, are in Appendix 2.

Relative Percent Difference: .

The data pairs (XRF vs wet chemistry) have been compared using the following criteria: relative percent difference (RPD) values were calculated for samples with concentrations greater than 5 times the PRDL. A control limit of 35% RPD was used for the comparison. If either the XRF or wet chemistry result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the XRF and wet chemistry result should be within ± 2 times the PRDL for soil matrix. These criteria are typically used for the comparison of laboratory duplicates. The RPD/PRDL duplicate criteria are used here to evaluate the agreement of the XRF confirmation sample data pairs relative to generally accepted control limits; however, no data are qualified as a result of the comparison (summarized in the following table).

Parameter	Type of Comparison	# of Data Pairs	# of Data Pairs in Control Limits	% within Control Limits
Arsenic	RPD	1	1	**100%**
	<5xPRDL	6	5	**83%**
	Combined	7	6	**86%**
Cadmium	RPD	0	0	**----**
	<5xPRDL	7	7	**100%**
	Combined	7	7	**100%**
Chromium	RPD	5	1	**20%**
	<5xPRDL	2	1	**50%**
	Combined	7	2	**29%**
Copper	RPD	3	2	**66%**
	<5xPRDL	4	4	**100%**
	Combined	7	6	**86%**
Lead	RPD	3	2	**66%**
	<5xPRDL	4	4	**100%**
	Combined	7	6	**86%**
Zinc	RPD	3	2	**66%**
	<5xPRDL	4	4	**100%**
	Combined	7	6	**86%**

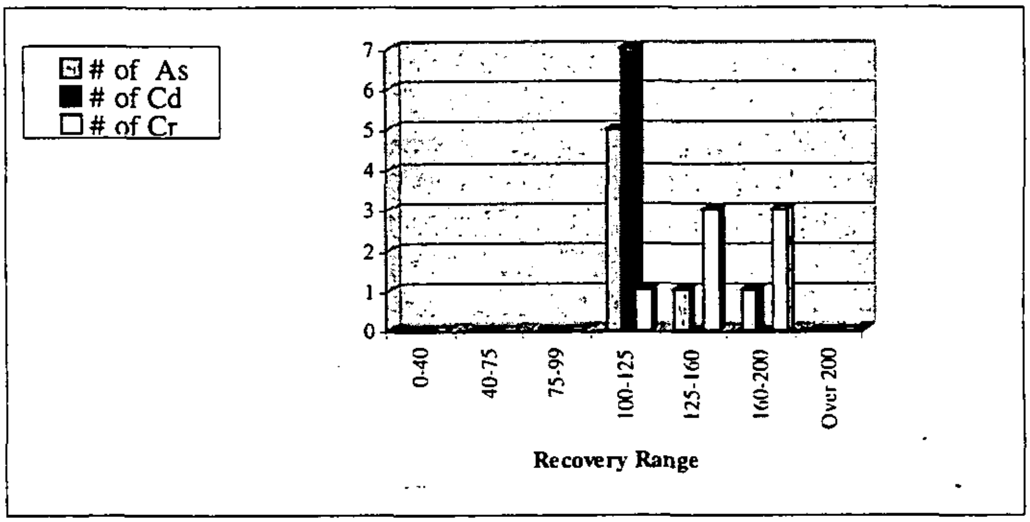
Recovery rate:

Recovery rate (percent) is calculated as (XRF value/HF digest value) x 100. To determine whether one analytical method consistently gives higher or lower concentrations than the other, the frequency of recoveries which are >100% (XRF result higher than wet chemistry result) is compared to those which are <100% (XRF result lower than wet chemistry result).

The following table describes the recoveries for arsenic, cadmium, and chromium:

Analyte	% XRF Results Equal to or Greater than Wet Chemistry	Recovery Ranges
Arsenic	100%	100 to 161%
Cadmium	100%	100%
Chromium	100%	121 to 193%

The following graph presents the recovery rate distribution for arsenic, cadmium, and chromium.



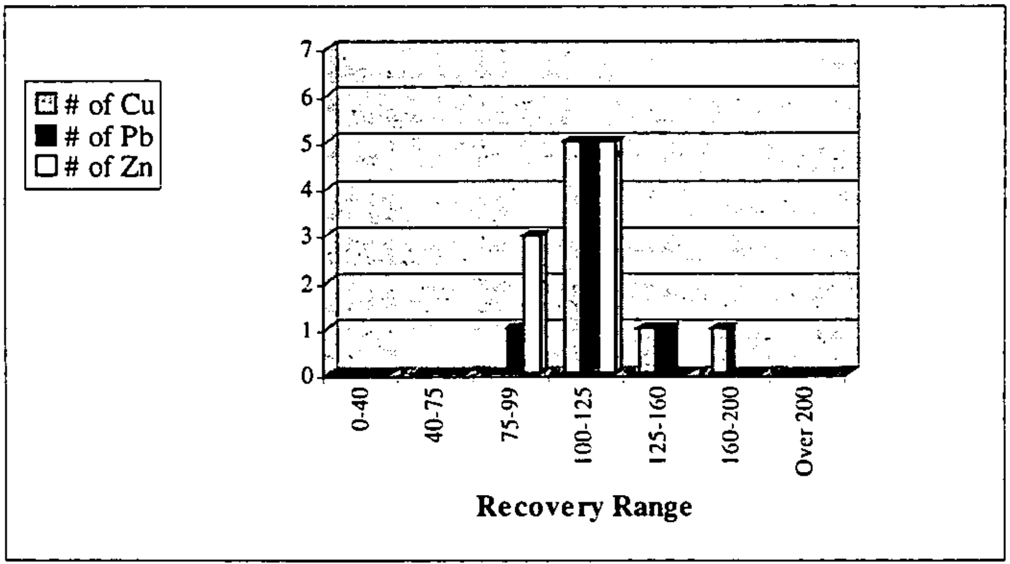
Recovery Range	# of Arsenic Comparisons	% of Arsenic Comparisons	# of Cadmium Comparisons	% of Cadmium Comparisons	# of Chromium Comparisons	% of Chromium Comparisons
0-40						
40-75						
75-99						
100-125	5	71%	7	100%	1	14%
125-160	1	14%			3	43%
160-200	1	14%			3	43%
Over 200						

Shaded area represents "ideal" range.

The following table describes the recoveries for copper, lead, and zinc:

Analyte	% XRF Results Equal to or Greater than Wet Chemistry	Recovery Ranges
Copper	86%	95 to 160%
Lead	86%	83 to 145%
Zinc	43%	46 to 429%

The following graph presents the recovery rate distribution for copper, lead, and zinc.



Recovery Range	# of Copper Comparisons	% of Copper Comparisons	# of Lead Comparisons	% of Lead Comparisons	# of Zinc Comparisons	% of Zinc Comparisons
0-40					0	0
40-75					0	0
75-99			1	14%	3	37.5%
100-125	5	71%	5	71%	5	62.5%
125-160	1	14%	1	14%	0	0
160-200	1	14%			0	0
Over 200					0	0

Shaded area represents "ideal" range.

Regression analysis:

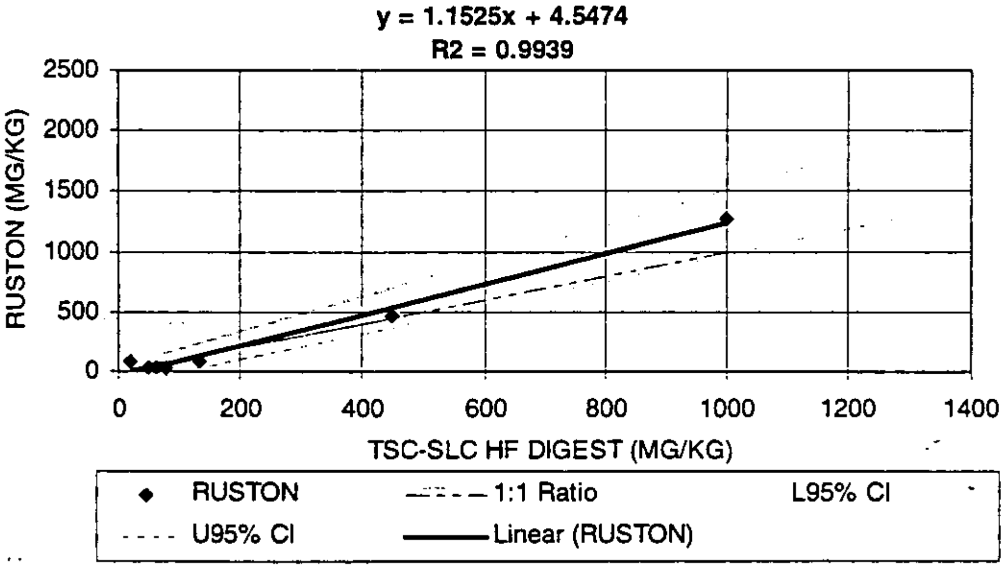
Although the data set consisted of only seven samples, a regression analysis was carried out in accordance with work plan requirements. In considering the results, however, it is important to keep in mind that regression analysis is a statistical method; the greater the number of samples, the better the statistical model will reflect the real world. Generally speaking, unless the site has been well-characterized for the analyte of interest using a matrix-specific calibration which can account for site-specific matrix interferences, results of any regression analysis carried out on sample sets less than ten should not be used alone as a basis for decision-making. They can, however, give valuable information, especially when used in conjunction with the other comparison methods which have been used here (relative percent differences and recovery rates).

> The *R-value* determines the strength of the association between variables. Perfect correlation between variables (i.e. perfect agreement between XRF and wet chemistry concentrations) would be indicated by an *R-value* of 1.0.
>
> The *slope of the regression line* should be near one for methods giving similar results, and may show if a systematic error in calibration plots has occurred during analysis.
>
> The *Y-intercept* should be near zero for methods giving similar results, and may show if a systematic error has been introduced by background interference, whether it be absorption or fluorescence factors.
>
> **Note:** As all cadmium results were below the reporting detection limit for both analysis methods, it was not possible to run a regression line for cadmium.

Arsenic Regression: **R = 0.997**

Slope		y - Intercept	
Upper 95%:	1.26	Upper 95%:	13.75
Value:	1.15	Value:	4.55
Lower 95%:	1.05	Lower 95%:	-4.66

- The R-value is very close to one, showing a high correlation between the two analysis methods.
- The value of the slope is close to one, showing little evidence of systematic error due to calibration.
- The y-intercept is close to zero; and the 95% confidence limits for the y-intercept encompass the ideal value of zero, with a spread biased slightly in the positive direction. This shows that any systematic error introduced by background interference is slight.

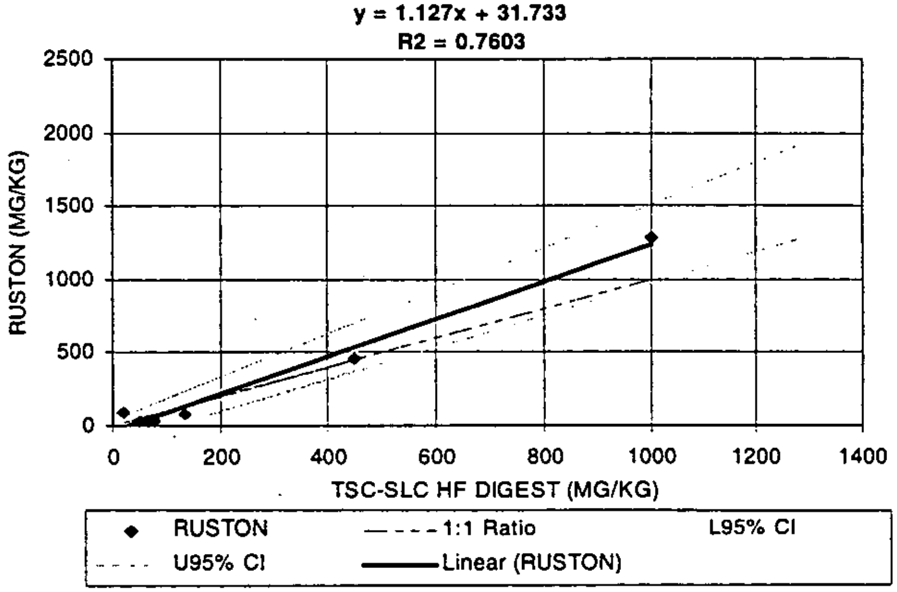


This information and further inspection of the scatter plot of the data (Appendix 2) indicate that arsenic results from the two different analysis methods are in excellent agreement over the concentration range of the samples measured (<10 to 228 mg/kg).

Chromium Regression: **R = 0.872**

Slope		y - Intercept	
Upper 95%:	1.85	Upper 95%:	88.2
Value:	1.13	Value:	31.7
Lower 95%:	0.40	Lower 95%:	-24.7

- The R-value is not very close to one, but still shows some correlation between the two analysis methods.
- The value of the slope is close to one, but with extremely wide 95% confidence bands. This shows evidence of significant random error, probably a combined effect of the following two factors:
    - The sample set contained fewer than ten samples.
    - The analysis was done using a fundamental parameters calibration, which may not have accounted for matrix interferences specific to the site.
- The y-intercept is not close to zero; and although the 95% confidence limits for the y-intercept encompass the ideal value of zero, the spread is very wide and biased in the positive direction. This shows the presence of systematic error and lack of precision introduced by background interference.

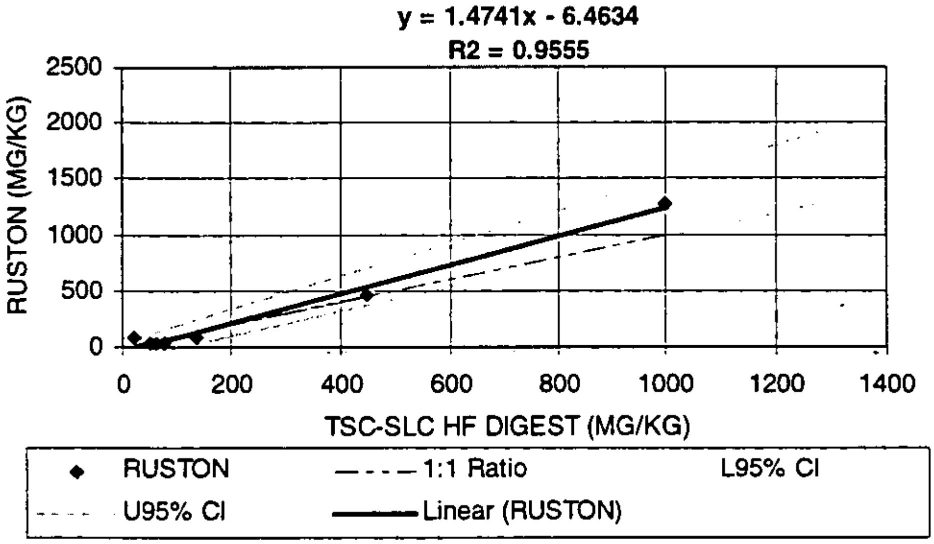


This information, further inspection of the scatter plot of the data (Appendix 2), and consideration of the recovery rates indicate that chromium results from the XRF analysis are biased high with respect to the wet chemistry results.

Copper Regression: **R = 0.977**

Slope		y - Intercept	
Upper 95%:	1.84	Upper 95%:	14.5
Value:	1.47	Value:	-6.46
Lower 95%:	1.11	Lower 95%:	-27.4

- The R-value is close to one, showing a high correlation between the two analysis methods.
- The value of the slope is close to one, but with wide 95% confidence bands. This shows evidence of significant random error, probably a combined effect of the following two factors:
  - The sample set contained fewer than ten samples.
  - The analysis was done using a fundamental parameters calibration, which may not have accounted for matrix interferences specific to the site.
- The y-intercept is fairly close to zero; however, the 95% confidence limits for the y-intercept do not encompass the ideal value of zero, and the spread is fairly large and biased in the negative direction. This is evidence of some systematic error and lack of precision introduced by background interference

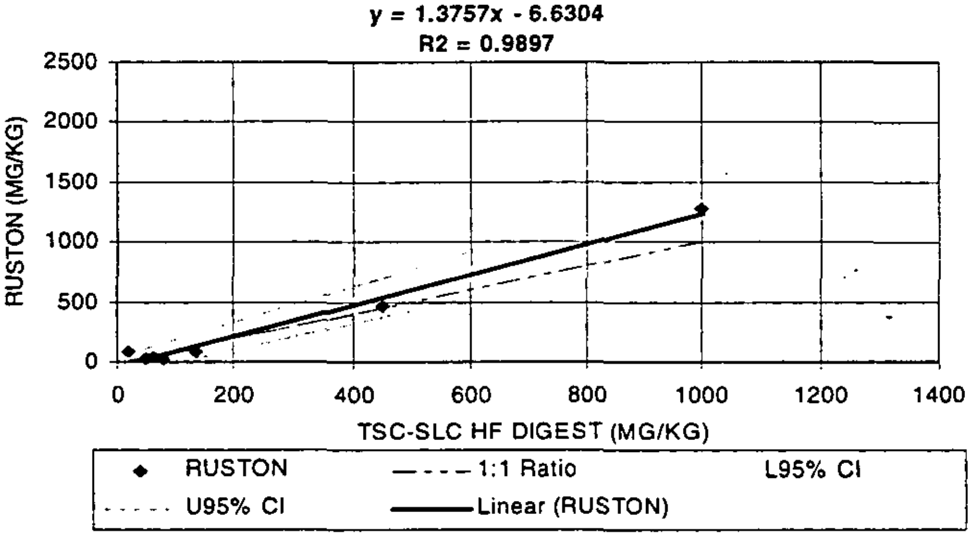


This information and further inspection of the scatter plot of the data (Appendix 2) indicate that copper results from the XRF analysis are generally biased high with respect to the wet chemistry results.

Lead Regression: **R = 0.995**

Slope		y - Intercept	
Upper 95%:	1.54	Upper 95%:	22.4
Value:	1.38	Value:	-6.63
Lower 95%:	1.21	Lower 95%:	-35.7

- The R-value is very close to one, showing a high correlation between the two analysis methods.
- The value of the slope is fairly close to one, but the 95% confidence intervals do not encompass the ideal value of one. This is probably due to systematic error, a combined effect of the following two factors:
  - The sample set contained fewer than ten samples.
  - The analysis was done using a fundamental parameters calibration, which may not have accounted for matrix interferences specific to the site.
- The y-intercept is fairly close to zero; and the 95% confidence limits for the y-intercept encompass the ideal value of zero. The spread, however, is biased in the negative direction. This shows that some systematic error may have been introduced by background interference.

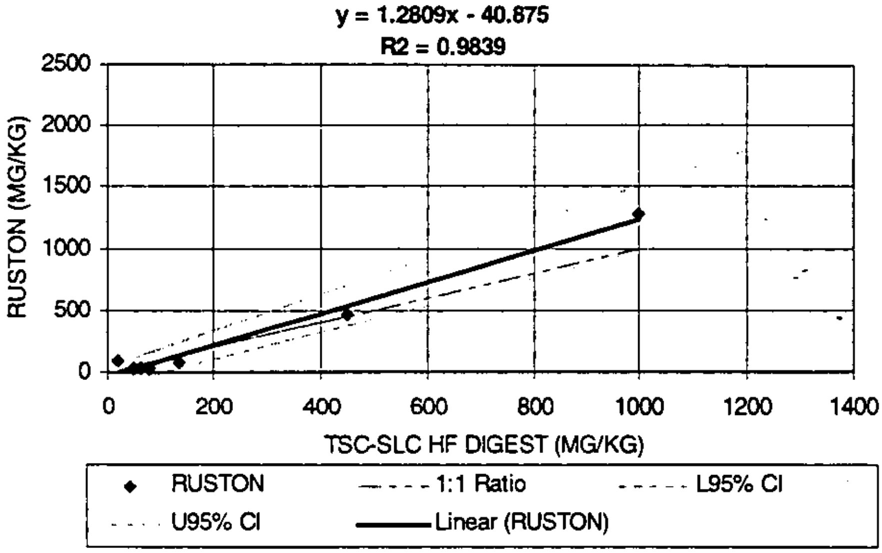


This information and further inspection of the scatter plot of the data (Appendix 2) indicate that lead results from the two different analysis methods are in excellent agreement over the concentration range of the samples measured (<10 to 500 mg/kg).

Zinc Regression: **R = 0.991**

Slope		y - Intercept	
Upper 95%:	1.47	Upper 95%:	38.1
Value:	1.28	Value:	-40.9
Lower 95%:	1.09	Lower 95%:	-120

- The R-value is fairly close to one, showing a strong correlation between the two analysis methods.
- The value of the slope is fairly close to one, but the 95% confidence intervals do not encompass the ideal value of one. This is probably due to systematic error, a combined effect of the following two factors:
  - The sample set contained fewer than ten samples.
  - The analysis was done using a fundamental parameters calibration, which may not have accounted for matrix interferences specific to the site.
- The y-intercept is not close to zero; and although the 95% confidence limits for the y-intercept do encompass the ideal value of zero, the spread is large and is biased in the negative direction. This shows that systematic error at all levels and lack of precision at low levels has been introduced by background interference.



This information and further inspection of the scatter plot of the data (Appendix 2) indicate that although there is a correlation between the zinc results from the two different analysis methods, precision is poor at concentrations below 200 mg/kg.

REFERENCES

Hydrometrics. 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998.

Miller, J. C. and J. N., 1988. Statistics for Analytical Chemistry

Standard Operating Procedure for Spectrace 500 EDXRF Routine Soil Analysis (HL_SOP_53-1/95).

U.S. Environmental Protection Agency, 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.

U.S. Environmental Protection Agency, 1995. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM04.0

U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994.

U.S. Environmental Protection Agency, 1993. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM03.0. (EPA, 1993)

U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994. (EPA, 1994)

APPENDIX 1

Tables

TABLE 1.

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 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates low bias. 4 - Other QC outside control limits. 5 - Quality control sample was omitted. (Not an EPA code.)
UJ	-	The material was analyzed for, but was not detected above the associated value. 1 Blank contamination. Indicates possible high bias and/or false positive. 2 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates low bias. 4 - Other QC outside control limits. 5 - Quality control sample was omitted. (Not an EPA code.)
R	-	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.
A	-	Anomalous data. No apparent explanation for discrepancy in data. (Not an EPA code.)

Table 2. Summary of Flagged Data
Everett Lowlands Investigation, Soil Data
(All values in mg/kg.)

Site	Sample No	Lab No	Date	Parameter	Result	Flagging	Reason for Flag
EV-19B	EVT-9809-122	98R-02598	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	27.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-123	98R-02599	09/24/98	ARSENIC (AS)(TOT)	44.0	J4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	77.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-124	98R-02600	09/24/98	ARSENIC (AS)(TOT)	133.0	J4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	720.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-125	98R-02601	09/24/98	ARSENIC (AS)(TOT)	912.0	J4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	1789.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-126	98R-02602	09/24/98	ARSENIC (AS)(TOT)	588.0	J4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	21.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-127	98R-02603	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	11.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-128	98R-02604	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate RPD=40%
EV-19B	EVT-9809-129	98R-02605	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate RPD=40%
EV-19B	EVT-9809-130	98R-02606	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	13.0	J4	Field duplicate RPD=40%
EV-19B	EVT-9809-131	98R-02607	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate RPD=40%
EV-19B	EVT-9809-132	98R-02608	09/24/98	ARSENIC (AS)(TOT)	< 10.0	UJ4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate RPD=40%
EV-19B	EVT-9809-134	98R-02609	09/24/98	ARSENIC (AS)(TOT)	1686.0	J4	Field duplicate RPD=60%
				LEAD (PB)(TOT)	2679.0	J4	Field duplicate RPD=40%
EV-21A	EV-21A-1	99R-00048	02/08/99	LEAD (PB)(TOT)	15.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-1	99R-00040	02/08/99	LEAD (PB)(TOT)	50.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-2	99R-00041	02/08/99	LEAD (PB)(TOT)	32.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-3	99R-00042	02/08/99	LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate difference >± 20
EV-21B	EV-21B-4	99R-00043	02/08/99	LEAD (PB)(TOT)	43.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-4D	99R-00044	02/08/99	LEAD (PB)(TOT)	74.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-5	99R-00045	02/08/99	LEAD (PB)(TOT)	17.0	J4	Field duplicate difference >± 20
EV-21B	EV-21B-6	99R-00046	02/08/99	LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate difference >± 20
EV-21B	EV-21B-7	99R-00047	02/08/99	LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate difference >± 20
EV-23B	EVT-9809-175	98R-02635	09/30/98	COPPER (CU)(TOT)	105.0	J4	Field duplicate RPD=73%
				LEAD (PB)(TOT)	199.0	J4	Field duplicate RPD=39%
EV-23B	EVT-9809-176	98R-02636	09/30/98	COPPER (CU)(TOT)	143.0	J4	Field duplicate RPD=73%
				LEAD (PB)(TOT)	358.0	J4	Field duplicate RPD=39%

Table 2. Summary of Flagged Data
Everett Lowlands Investigation, Soil Data
(All values in mg/kg.)

Site	Sample No	Lab No	Date	Parameter	Result	Flagging	Reason for Flag
EV-23B	EVT-9809-177	98R-02637	09/30/98	COPPER (CU)(TOT)	110.0	J4	Field duplicate RPD=73%
				LEAD (PB)(TOT)	199.0	J4	Field duplicate RPD=39%
EV-23B	EVT-9809-182	98R-02672	09/30/98	COPPER (CU)(TOT)	51.0	J4	Field duplicate RPD=73%
				LEAD (PB)(TOT)	134.0	J4	Field duplicate RPD=39%
EV-23B	EVT-9809-183	98R-02673	09/30/98	COPPER (CU)(TOT)	52.0	J4	Field duplicate RPD=73%
				LEAD (PB)(TOT)	< 10.0	UJ4	Field duplicate RPD=39%
LB-11	EVT-9808-500	98R-02319	08/25/98	CHROMIUM (CR)(TOT)	88.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	129.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	529.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	1279.0	J4	Field duplicate difference >± 20
LB-11	EVT-9808-501	98R-02320	08/25/98	CHROMIUM (CR)(TOT)	106.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	71.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	120.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	322.0	J4	Field duplicate difference >± 20
LB-11	EVT-9808-502	98R-02322	08/25/98	CHROMIUM (CR)(TOT)	159.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	35.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	56.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	72.0	J4	Field duplicate difference >± 20
LB-11	EVT-9808-503	98R-02323	08/25/98	CHROMIUM (CR)(TOT)	125.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	292.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	2065.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	710.0	J4	Field duplicate difference >± 20
LB-11	EVT-9808-504	98R-02324	08/25/98	CHROMIUM (CR)(TOT)	229.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	64.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	114.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	311.0	J4	Field duplicate difference >± 20
LB-11	EVT-9808-505	98R-02321	08/25/98	CHROMIUM (CR)(TOT)	168.0	J4	Field duplicate RPD=45%
				COPPER (CU)(TOT)	35.0	J4	Field duplicate difference >± 20
				LEAD (PB)(TOT)	16.0	J4	Field duplicate difference >± 20
				ZINC (ZN)(TOT)	44.0	J4	Field duplicate difference >± 20
LB-19	EVT-9809-190	98R-02661	09/29/98	ARSENIC (AS)(TOT)	49.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-191	98R-02662	09/29/98	ARSENIC (AS)(TOT)	34.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-192	98R-02663	09/29/98	ARSENIC (AS)(TOT)	12.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-193	98R-02664	09/29/98	ARSENIC (AS)(TOT)	121.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-194	98R-02665	09/29/98	ARSENIC (AS)(TOT)	261.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-195	98R-02666	09/29/98	ARSENIC (AS)(TOT)	2458.0	J4	Field duplicate RPD=73%
LB-19	EVT-9809-196	98R-02667	09/29/98	ARSENIC (AS)(TOT)	1712.0	J4	Field duplicate RPD=73%
MW-109D	MW-109D-1	99R-00024	02/03/99	CHROMIUM (CR)(TOT)	91.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-2	99R-00025	02/03/99	CHROMIUM (CR)(TOT)	69.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-3	99R-00026	02/03/99	CHROMIUM (CR)(TOT)	71.0	J4	Field duplicate RPD=37%

Table 2. Summary of Flagged Data
Everett Lowlands Investigation, Soil Data
(All values in mg/kg.)

Site	Sample No	Lab No	Date	Parameter	Result	Flagging	Reason for Flag
MW-109D	MW-109D-4	99R-00027	02/03/99	CHROMIUM (CR)(TOT)	59.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-5	99R-00028	02/03/99	CHROMIUM (CR)(TOT)	138.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-6	99R-00029	02/03/99	CHROMIUM (CR)(TOT)	74.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-6D	99R-00030	02/03/99	CHROMIUM (CR)(TOT)	51.0	J4	Field duplicate RPD=37%
MW-109D	MW-109D-7	99R-00031	02/03/99	CHROMIUM (CR)(TOT)	56.0	J4	Field duplicate RPD=37%

APPENDIX 2

Database

Note:

- Lab numbers starting with 98R and 99R are for XRF analyses.
- Lab numbers starting with L99 or 294 are for HF-digest wet chemistry analyses.
- Lab numbers starting with L98 are for SPLP wet chemistry analyses.

TABLE OF CONTENTS BY SITE TYPE

-- SAMPLE TYPE: SOIL --

SITE CODE	1B	1B	1M	1T
SAMPLE DATE	08/28/98	08/28/98	08/28/98	08/28/98
SAMPLE TIME	9:30	9:35	9:40	11:00
LAB	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02412	98R-02413	98R-02414	98R-02399
DEPTH	0-1'	2'	0-1'	0-1'
SAMPLE NUMBER	EVT-9808-1BA	EVT-9808-1BB	EVT-9808-1MA	EVT-9808-1TA
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) TOT	112.0	109.0	262.0	92.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	133.0	113.0	133.0	107.0
COPPER (CU) TOT	248.0	235.0	100.0	77.0
LEAD (PB) TOT	1527.0	1404.0	407.0	408.0
ZINC (ZN) TOT	4063.0	3391.0	456.0	400.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	2B	2M	2M	2M
SAMPLE DATE	08/28/98	08/28/98	08/28/98	08/28/98
SAMPLE TIME	9:45	9:50	9:55	10:00
LAB	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02411	98R-02409	98R-02410	98R-02408
REMARKS			DUPLICATE	
DEPTH	0-1'	0-1'	0-1'	2'
SAMPLE NUMBER	EVT-9808-2BA	EVT-9808-2MA	EVT-9808-2MAD	EVT-9808-2MB
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) TOT	100.0	47.0	46.0	342.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	97.0	134.0	134.0	161.0
COPPER (CU) TOT	84.0	63.0	74.0	123.0
LEAD (PB) TOT	343.0	208.0	233.0	450.0
ZINC (ZN) TOT	693.0	384.0	469.0	480.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	2T	3B	3B	3M
SAMPLE DATE	08/28/98	08/28/98	08/28/98	08/28/98
SAMPLE TIME	11:05	10:05	10:10	10:15
LAB	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02397	98R-02407	98R-02406	98R-02405
DEPTH	0-1'	0-1'	2'	0-1'
SAMPLE NUMBER	EVT-9808-2TA	EVT-9808-3BA	EVT-9808-3BB	EVT-9808-3MA
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) TOT	34.0	220.0	184.0	107.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	150.0	113.0	114.0	133.0
COPPER (CU) TOT	44.0	1359.0	601.0	72.0
LEAD (PB) TOT	117.0	2302.0	1703.0	373.0
ZINC (ZN) TOT	168.0	8001.0	4698.0	510.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	3M	3T	3T	3T	3T
SAMPLE DATE	08/28/98	08/28/98	08/28/98	08/28/98	08/28/98
SAMPLE TIME	10:20	11:10	11:15	11:20	11:25
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02403	98R-02398	98R-02400	98R-02393	98R-02395
REMARKS			DUPLICATE		
DEPTH	2'	0-1'	0-1'	2'	3'
SAMPLE NUMBER	EVT-9808-3MB	EVT-9808-3TA	EVT-9808-3TAD	EVT-9808-3TB	EVT-9808-3TC
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	88.0	30.0	24.0	15.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	122.0	135.0	136.0	133.0	98.0
COPPER (CU) TOT	80.0	45.0	58.0	30.0	32.0
LEAD (PB) TOT	257.0	196.0	209.0	71.0	45.0
ZINC (ZN) TOT	400.0	172.0	169.0	64.0	55.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	4B	4B	4M	4M	4M
SAMPLE DATE	08/28/98	08/28/98	08/28/98	08/28/98	08/28/98
SAMPLE TIME	10:25	10:30	10:35		10:40
LAB	RUSTON	RUSTON	RUSTON	TSC-SLC	RUSTON
LAB NUMBER	98R-02404	98R-02402	98R-02401	294-4140	98R-02394
TYPE				HF DIGEST	
DEPTH	0-1'	2'	0-1'	2'	2'
SAMPLE NUMBER	EVT-9808-4BA	EVT-9808-4BB	EVT-9808-4MA	EVT-9808-4MB	EVT-9808-4MB
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	168.0	154.0	446.0	228.0	266.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	2.9	< 10.0
CHROMIUM (CR) TOT	114.0	140.0	113.0	99.0	150.0
COPPER (CU) TOT	265.0	171.0	96.0	40.0	51.0
LEAD (PB) TOT	1294.0	1114.0	153.0	67.0	79.0
ZINC (ZN) TOT	2385.0	1377.0	196.0	135.0	82.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	4T	4T	EV-15B	EV-15B	EV-15B
SAMPLE DATE	08/28/98	08/28/98	09/29/98	09/29/98	09/29/98
SAMPLE TIME	11:30	11:35	14:30	14:35	14:45
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02396	98R-02392	98R-02653	98R-02654	98R-02655
DEPTH	0-1'	2'	0-0.5'	5-6.5'	10-11.5'
SAMPLE NUMBER	EVT-9808-4TA	EVT-9808-4TB	EVT-9809-167	EVT-9809-168	EVT-9809-169
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	12.0	16.0	29.0	< 10.0	31.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	111.0	130.0	121.0	114.0	137.0
COPPER (CU) TOT	38.0	33.0	75.0	45.0	57.0
LEAD (PB) TOT	90.0	52.0	171.0	< 10.0	< 10.0
ZINC (ZN) TOT	114.0	86.0	453.0	52.0	90.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-15B	EV-16A	EV-16A	EV-16A	EV-16A
SAMPLE DATE	09/29/98	09/29/98	09/29/98	09/29/98	09/29/98
SAMPLE TIME	14:47	8:30	8:35	8:45	8:50
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02656	98R-02640	98R-02641	98R-02642	98R-02643
REMARKS	DUPLICATE				
DEPTH	10-11.5'	0-0.5'	2-3.5'	5-6.5'	10-11.5'
SAMPLE NUMBER	EVT-9809-170	EVT-9809-152	EVT-9809-153	EVT-9809-154	EVT-9809-155
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	32.0	13.0	11.0	< 10.0	782.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	135.0	158.0	137.0	141.0	143.0
COPPER (CU) TOT	69.0	46.0	71.0	37.0	58.0
LEAD (PB) TOT	< 10.0	52.0	17.0	< 10.0	149.0
ZINC (ZN) TOT	85.0	92.0	60.0	60.0	135.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-16A	EV-17B	EV-17B	EV-17B	EV-17B
SAMPLE DATE	09/29/98	09/23/98	09/23/98	09/23/98	09/23/98
SAMPLE TIME	8:52	14:30	14:40	14:45	14:55
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02644	98R-02591	98R-02592	98R-02593	98R-02594
REMARKS	DUPLICATE				
DEPTH	10-11.5'	0-0.5'	2-3.5'	5-6.5'	10-11.5'
SAMPLE NUMBER	EVT-9809-156	EVT-9809-115	EVT-9809-116	EVT-9809-117	EVT-9809-118
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	908.0	163.0	516.0	523.0	79.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	150.0	110.0	104.0	86.0	116.0
COPPER (CU) TOT	66.0	140.0	664.0	1188.0	45.0
LEAD (PB) TOT	147.0	735.0	5638.0	8078.0	428.0
ZINC (ZN) TOT	129.0	1899.0	18395.0	30256.0	1116.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-17B	EV-17B	EV-17B	EV-18B	EV-18B
SAMPLE DATE	09/23/98	09/23/98	09/23/98	09/24/98	09/24/98
SAMPLE TIME	15:10	15:15	15:40	10:55	11:01
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02595	98R-02596	98R-02597	98R-02598	98R-02599
DEPTH	15-16.5'	20-21.5'	25-26.5'	1-1.25'	2-3.5'
SAMPLE NUMBER	EVT-9809-119	EVT-9809-120	EVT-9809-121	EVT-9809-122	EVT-9809-123
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	24.0	< 10.0	18.0	< 10.0 UJ4	44.0 J4
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	117.0	81.0	72.0	111.0	131.0
COPPER (CU) TOT	27.0	22.0	23.0	28.0	25.0
LEAD (PB) TOT	63.0	49.0	23.0	27.0 J4	77.0 J4
ZINC (ZN) TOT	181.0	115.0	73.0	41.0	112.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-18B	EV-18B	EV-18B	EV-18B	EV-18B	EV-18B
SAMPLE DATE	09/24/98	09/24/98	09/24/98	09/24/98	09/24/98	09/24/98
SAMPLE TIME	11:08	11:13	11:20	11:30	11:55	12:10
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02600	98R-02601	98R-02602	98R-02603	98R-02604	98R-02605
DEPTH	5-6.5'	10-11.5'	15-16.5'	20-21.5'	25-26.5'	30-31.5'
SAMPLE NUMBER	EVT-9809-124	EVT-9809-125	EVT-9809-126	EVT-9809-127	EVT-9809-128	EVT-9809-129
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	133.0 J4	912.0 J4	588.0 J4	< 10.0 UJ4	< 10.0 UJ4	< 10.0 UJ4
CADMIUM (CD) TOT	< 10.0	24.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	118.0	118.0	147.0	142.0	195.0	113.0
COPPER (CU) TOT	157.0	224.0	16.0	28.0	31.0	25.0
LEAD (PB) TOT	720.0 J4	1789.0 J4	21.0 J4	11.0 J4	< 10.0 UJ4	< 10.0 UJ4
ZINC (ZN) TOT	948.0	689.0	36.0	22.0	62.0	40.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-18B	EV-18B	EV-18B	EV-18B	EV-20B
SAMPLE DATE	09/24/98	09/24/98	09/24/98	09/24/98	09/26/98
SAMPLE TIME	12:25	12:40	13:00	13:30	10:30
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02606	98R-02607	98R-02608	98R-02609	98R-02668
REMARKS				DUPLICATE	
DEPTH	35-36.5'	40-41.5'	45-46.5'	10-11.5'	0-0.5'
SAMPLE NUMBER	EVT-9809-130	EVT-9809-131	EVT-9809-132	EVT-9809-134	EVT-9809-140
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	< 10.0 UJ4	< 10.0 UJ4	< 10.0 UJ4	1686.0 J4	80.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	27.0	< 10.0
CHROMIUM (CR) TOT	115.0	115.0	132.0	135.0	130.0
COPPER (CU) TOT	24.0	20.0	29.0	309.0	61.0
LEAD (PB) TOT	13.0 J4	< 10.0 UJ4	< 10.0 UJ4	2679.0 J4	290.0
ZINC (ZN) TOT	36.0	39.0	38.0	593.0	247.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-20B	EV-20B	EV-20B	EV-20B	EV-20B
SAMPLE DATE	09/28/98	09/28/98	09/28/98	09/28/98	09/28/98
SAMPLE TIME	10:40	11:00	11:10	11:12	11:20
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02669	98R-02625	98R-02626	98R-02627	98R-02628
DEPTH	5-6.5'	10-11.5'	15-16.5'	15-16.5'	20-21.5'
SAMPLE NUMBER	EVT-9809-141	EVT-9809-142	EVT-9809-143	EVT-9809-144	EVT-9809-145
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	25.0	33.0	2570.0	2236.0	598.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	131.0	106.0	113.0	126.0	118.0
COPPER (CU) TOT	35.0	33.0	409.0	269.0	40.0
LEAD (PB) TOT	75.0	132.0	282.0	261.0	< 10.0
ZINC (ZN) TOT	343.0	109.0	86.0	78.0	42.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:*Less Than Detect. Blank: parameter not tested*
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-21A	EV-21B	EV-21B	EV-21B	EV-21B
SAMPLE DATE	02/08/99	02/08/99	02/08/99	02/08/99	02/08/99
SAMPLE TIME	14:40	10:30	10:35	10:40	10:45
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	99R-00048	99R-00040	99R-00041	99R-00042	99R-00043
SAMPLE NUMBER	EV-21A-1	EV-21B-1	EV-21B-2	EV-21B-3	EV-21B-4
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	18.0	16.0	11.0	< 10.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	141.0	86.0	139.0	88.0	76.0
COPPER (CU) TOT	65.0	42.0	32.0	30.0	31.0
LEAD (PB) TOT	15.0	50.0	32.0	< 10.0	43.0
ZINC (ZN) TOT	87.0	145.0	94.0	39.0	37.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-21B	EV-21B	EV-21B	EV-21B	EV-21B
SAMPLE DATE	02/08/99	02/08/99	02/08/99	02/08/99	02/08/99
SAMPLE TIME		11:00	10:50	10:55	11:10
LAB	TSC-SLC	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	L99-4725	99R-00044	99R-00045	99R-00046	99R-00047
TYPE	HF DIGEST				
SAMPLE NUMBER	EV-21B-4	EV-21B-4D	EV-21B-5	EV-21B-6	EV-21B-7
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	10.0		14.0	< 10.0	20.0
CADMIUM (CD) TOT	<1.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	48.0	68.0	120.0	136.0	66.0
COPPER (CU) TOT	22.0	25.0	62.0	33.0	32.0
LEAD (PB) TOT	39.0	74.0	17.0	< 10.0	< 10.0
ZINC (ZN) TOT	64.0	37.0	90.0	73.0	32.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-22A	EV-22A	EV-22A	EV-22A	EV-22A	EV-22A
SAMPLE DATE	09/22/98	09/22/98	09/22/98	09/22/98	09/22/98	09/22/98
SAMPLE TIME	11:50	12:00	12:20	12:25	12:35	12:45
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02576	98R-02577	98R-02578	98R-02579	98R-02580	98R-02581
DEPTH	0-0.5'	2-3.5'	5-6.5'	10-11.5'	15-16.5'	20-21.5'
SAMPLE NUMBER	EVT-9809-100	EVT-9809-101	EVT-9809-102	EVT-9809-103	EVT-9809-104	EVT-9809-105
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	300.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	115.0	132.0	115.0	59.0	65.0	118.0
COPPER (CU) TOT	25.0	30.0	18.0	32.0	27.0	136.0
LEAD (PB) TOT	11.0	15.0	< 10.0	12.0	< 10.0	1108.0
ZINC (ZN) TOT	47.0	40.0	40.0	35.0	38.0	459.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-22B	EV-22B	EV-23B	EV-23B	EV-23B
SAMPLE DATE	09/22/98	09/22/98	09/30/98	09/30/98	09/30/98
SAMPLE TIME	14:45	15:00	8:55		9:00
LAB	RUSTON	RUSTON	RUSTON	TSC-SLC	RUSTON
LAB NUMBER	98R-02582	98R-02583	98R-02635	294-4142	98R-02636
TYPE				HF DIGEST	
DEPTH	25-26.5'	30-31.5'	0-0.5'	2-3.5'	2-3.5'
SAMPLE NUMBER	EVT-9809-106	EVT-9809-107	EVT-9809-175	EVT-9809-176	EVT-9809-176
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	< 10.0	< 10.0	25.0	27.0	41.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	1.7	< 10.0
CHROMIUM (CR) TOT	132.0	284.0	144.0	72.0	139.0
COPPER (CU) TOT	55.0	23.0	105.0 J4	100.0	143.0 J4
LEAD (PB) TOT	< 10.0	10.0	199.0 J4	293.0	358.0 J4
ZINC (ZN) TOT	71.0	114.0	669.0	450.0	463.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	EV-23B		EV-23B		EV-23B	EV-23B		HP-45
SAMPLE DATE	09/30/98		09/30/98		09/30/98	09/30/98		09/23/98
SAMPLE TIME	9:15		9:20			9:21		7:55
LAB	RUSTON		RUSTON		TSC-SLC	RUSTON		RUSTON
LAB NUMBER	98R-02637		98R-02672		294-4143	98R-02673		98R-02584
REMARKS			DUPLICATE					
TYPE					HF DIGEST			
DEPTH	5-6.5'		5-6.5'		10-11.5'	10-11.5'		0-0.5'
SAMPLE NUMBER	EVT-9809-177		EVT-9809-182		EVT-9809-183	EVT-9809-183		EVT-9809-108
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) TOT	98.0		109.0		28.0	28.0		< 10.0
CADMIUM (CD) TOT	< 10.0		< 10.0		<1.0	< 10.0		< 10.0
CHROMIUM (CR) TOT	143.0		133.0		120.0	145.0		112.0
COPPER (CU) TOT	110.0	J4	51.0	J4	55.0	52.0	J4	30.0
LEAD (PB) TOT	199.0	J4	134.0	J4	12.0	< 10.0	UJ4	17.0
ZINC (ZN) TOT	269.0		207.0		21.0	90.0		44.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-45	HP-45	HP-45	HP-45	HP-45	HP-45
SAMPLE DATE	09/23/98	09/23/98	09/23/98	09/23/98	09/23/98	09/23/98
SAMPLE TIME	07:50	8:05	8:10	8:15	8:23	8:30
LAB	TSC-SLC	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	294-4141	98R-02585	98R-02586	98R-02587	98R-02588	98R-02589
TYPE	HF DIGEST					
DEPTH	2-3.5'	2-3.5'	5-6.5'	10-11.5'	15-16.5'	20-21.5'
SAMPLE NUMBER	EVT-9809-109	EVT-9809-109	EVT-9809-110	EVT-9809-111	EVT-9809-112	EVT-9809-113
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	3.9	< 10.0	< 10.0	23.0	13.0	< 10.0
CADMIUM (CD) TOT	<1.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	77.0	137.0	108.0	102.0	80.0	97.0
COPPER (CU) TOT	18.0	25.0	27.0	55.0	27.0	23.0
LEAD (PB) TOT	7.2	< 10.0	10.0	232.0	14.0	10.0
ZINC (ZN) TOT	50.0	30.0	39.0	322.0	96.0	35.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-45	HP-46	HP-46	HP-46	HP-46
SAMPLE DATE	09/23/98	02/09/99	02/09/99	02/09/99	02/09/99
SAMPLE TIME	*8:43*	*9:00*	*9:05*	*9:10*	*9:15*
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02590	99R-00049	99R-00050	99R-00051	99R-00052
DEPTH	25-26.5'				
SAMPLE NUMBER	EVT-9809-114	HP-46-1	HP-46-2	HP-46-3	HP-46-4
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	< 10.0	< 10.0	531.0	210.0	99.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	125.0	149.0	118.0	74.0	147.0
COPPER (CU) TOT	27.0	33.0	167.0	40.0	83.0
LEAD (PB) TOT	< 10.0	30.0	458.0	38.0	64.0
ZINC (ZN) TOT	41.0	85.0	1119.0	54.0	107.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (*FLD*) or calculated (*CALC*)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-46	HP-46	HP-46	HP-46	HP-47
SAMPLE DATE	02/09/99	02/09/99	02/09/99	02/09/99	02/09/99
SAMPLE TIME	9:17	9:20	9:25	9:30	15:10
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	99R-00053	99R-00054	99R-00055	99R-00056	99R-00057
REMARKS	DUPLICATE				
SAMPLE NUMBER	HP-46-4D	HP-46-5	HP-46-6	HP-46-7	HP-47-1
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	90.0	16.0	< 10.0	< 10.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	118.0	124.0	58.0	66.0	154.0
COPPER (CU) TOT	83.0	48.0	25.0	25.0	29.0
LEAD (PB) TOT	60.0	< 10.0	< 10.0	< 10.0	< 10.0
ZINC (ZN) TOT	104.0	86.0	32.0	35.0	35.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-47	HP-47	HP-47	HP-47	HP-47	HP-47
SAMPLE DATE	02/09/99	02/09/99	02/09/99	02/10/99	02/10/99	02/10/99
SAMPLE TIME	15:15	15:20	15:25	8:05	08:50	8:20
LAB	RUSTON	RUSTON	RUSTON	RUSTON	TSC-SLC	RUSTON
LAB NUMBER	99R-00058	99R-00059	99R-00060	99R-00063	L99-4726	99R-00064
TYPE					HF DIGEST	
SAMPLE NUMBER	HP-47-2	HP-47-3	HP-47-4	HP-47-5	HP-47-5	HP-47-6
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	299.0	25.0	24.0	< 10.0	6.7	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	<1.0	< 10.0
CHROMIUM (CR) TOT	81.0	51.0	133.0	63.0	43.0	73.0
COPPER (CU) TOT	1059.0	25.0	50.0	22.0	18.0	17.0
LEAD (PB) TOT	5619.0	18.0	18.0	< 10.0	5.3	11.0
ZINC (ZN) TOT	23874.0	58.0	78.0	36.0	78.0	40.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-47	HP-47	HP-48	HP-48	HP-48
SAMPLE DATE	02/10/99	02/10/99	02/10/99	02/10/99	02/10/99
SAMPLE TIME	8:00	8:02	10:00	10:05	10:15
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	99R-00061	99R-00062	99R-00065	99R-00066	99R-00067
REMARKS		DUPLICATE			
SAMPLE NUMBER	HP-47-7	HP-47-7D	HP-48-1	HP-48-2	HP-48-3
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	13.0	11.0	59.0	175.0	22.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	138.0	111.0	111.0	51.0	50.0
COPPER (CU) TOT	52.0	44.0	124.0	120.0	20.0
LEAD (PB) TOT	14.0	10.0	294.0	40.0	< 10.0
ZINC (ZN) TOT	95.0	75.0	1064.0	194.0	40.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	HP-48	HP-48	HP-48	LB-11	LB-11	
SAMPLE DATE	02/10/99	02/10/99	02/10/99	08/25/98	08/25/98	
SAMPLE TIME	10:20	11:50	11:55		16:45	
LAB	RUSTON	RUSTON	RUSTON	TSC-SLC	RUSTON	
LAB NUMBER	99R-00068	99R-00069	99R-00070	294-4139	98R-02319	
TYPE				HF DIGEST		
DEPTH				0-0.5'	0-0.5'	
SAMPLE NUMBER	HP-48-4	HP-48-5	HP-48-6	EVT-9808-500	EVT-9808-500	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	22.0	10.0	15.0	38.0	61.0	
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	1.2	< 10.0	
CHROMIUM (CR) TOT	137.0	130.0	101.0	52.0	88.0	J4
COPPER (CU) TOT	65.0	49.0	32.0	85.0	129.0	J4
LEAD (PB) TOT	< 10.0	< 10.0	< 10.0	366.0	529.0	J4
ZINC (ZN) TOT	88.0	59.0	42.0	1000.0	1275.0	J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-11		LB-11		LB-11		LB-11		LB-11	
SAMPLE DATE	08/25/98		08/25/98		08/25/98		08/25/98		08/25/98	
SAMPLE TIME	16:50		17:00		17:05		17:10		16:55	
LAB	RUSTON		RUSTON		RUSTON		RUSTON		RUSTON	
LAB NUMBER	98R-02320		98R-02322		98R-02323		98R-02324		98R-02321	
REMARKS									DUPLICATE	
DEPTH	0.5-2'		2-3.5'		5-6.5'		10-11.5'		0.5-2'	
SAMPLE NUMBER	EVT-9808-501		EVT-9808-502		EVT-9808-503		EVT-9808-504		EVT-9808-505	
-- METALS & MINOR CONSTITUENTS --										
ARSENIC (AS) TOT	26.0		31.0		5966.0		37.0		11.0	
CADMIUM (CD) TOT	< 10.0		< 10.0		34.0		< 10.0		< 10.0	
CHROMIUM (CR) TOT	106.0	J4	159.0	J4	125.0	J4	229.0	J4	168.0	J4
COPPER (CU) TOT	71.0	J4	35.0	J4	292.0	J4	64.0	J4	35.0	J4
LEAD (PB) TOT	120.0	J4	56.0	J4	2065.0	J4	114.0	J4	16.0	J4
ZINC (ZN) TOT	322.0	J4	72.0	J4	710.0	J4	311.0	J4	44.0	J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-12	LB-12	LB-12	LB-12	LB-12
SAMPLE DATE	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98
SAMPLE TIME	10:30	10:35	10:40	10:45	10:50
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02325	98R-02326	98R-02327	98R-02328	98R-02329
DEPTH	0-0.5'	0.5-2'	2-3.5'	5-6.5'	10-11.5'
SAMPLE NUMBER	EVT-9808-506	EVT-9808-507	EVT-9808-508	EVT-9808-509	EVT-9808-510
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	37.0	27.0	< 10.0	< 10.0	12.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	137.0	138.0	143.0	151.0	164.0
COPPER (CU) TOT	107.0	36.0	32.0	29.0	30.0
LEAD (PB) TOT	401.0	89.0	16.0	19.0	15.0
ZINC (ZN) TOT	679.0	192.0	39.0	46.0	57.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-13	LB-13	LB-13	LB-13	LB-13	LB-13
SAMPLE DATE	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98
SAMPLE TIME	13:00	13:05	13:10	13:15	13:20	13:25
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02330	98R-02331	98R-02332	98R-02333	98R-02334	98R-02335
REMARKS						DUPLICATE
DEPTH	0-0.5'	0.5-2'	2-3.5'	5-6.5'	10-11.5'	0.5-2'
SAMPLE NUMBER	EVT-9808-511	EVT-9808-512	EVT-9808-513	EVT-9808-514	EVT-9808-515	EVT-9808-516
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	< 10.0	18.0	< 10.0	< 10.0	20.0	17.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	134.0	131.0	148.0	145.0	152.0	145.0
COPPER (CU) TOT	55.0	30.0	33.0	33.0	37.0	19.0
LEAD (PB) TOT	74.0	22.0	< 10.0	< 10.0	< 10.0	17.0
ZINC (ZN) TOT	145.0	41.0	19.0	33.0	35.0	48.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-14	LB-14	LB-14	LB-14	LB-14
SAMPLE DATE	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98
SAMPLE TIME	15:00	15:05	15:10	15:15	15:20
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02336	98R-02337	98R-02338	98R-02339	98R-02340
DEPTH	0-0.5'	0.5-2'	2-3.5'	5-6.5'	10-11.5'
SAMPLE NUMBER	EVT-9808-517	EVT-9808-518	EVT-9808-519	EVT-9808-520	EVT-9808-521
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	16.0	< 10.0	< 10.0	< 10.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	156.0	123.0	160.0	129.0	159.0
COPPER (CU) TOT	36.0	37.0	26.0	24.0	27.0
LEAD (PB) TOT	31.0	14.0	< 10.0	< 10.0	< 10.0
ZINC (ZN) TOT	148.0	46.0	24.0	45.0	46.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-15	LB-15	LB-15	LB-15	LB-15	LB-15
SAMPLE DATE	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98	08/26/98
SAMPLE TIME	17:05	17:10	17:15	17:20	17:25	17:30
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02341	98R-02342	98R-02343	98R-02344	98R-02345	98R-02346
REMARKS						*DUPLICATE*
DEPTH	0-0.5'	0.5-2'	2-3.5'	5-6.5'	10-11.5'	2-3.5'
SAMPLE NUMBER	EVT-9808-522	EVT-9808-523	EVT-9808-524	EVT-9808-525	EVT-9808-526	EVT-9808-527
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	< 10.0	< 10.0	< 10.0	< 10.0	1071.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	139.0	121.0	128.0	171.0	127.0	129.0
COPPER (CU) TOT	31.0	37.0	33.0	33.0	61.0	37.0
LEAD (PB) TOT	33.0	< 10.0	14.0	12.0	119.0	20.0
ZINC (ZN) TOT	83.0	53.0	42.0	44.0	155.0	52.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; *DIS:Dissolved*; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-16	LB-16	LB-16	LB-16	LB-16	LB-16
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981932-1	L981933-1	L981936-1	L981934-1	L981935-1	L981932-2
TYPE		SPLP/DI	SPLP/PH11	SPLP/PH7	SPLP/PH9	
DEPTH	0-2'	0-2'	0-2'	0-2'	0-2'	5-7'
SAMPLE NUMBER	LB-16A	LB-16A-DI	LB-16A-PH11	LB-16A-PH7	LB-16A-PH9	LB-16B
-- PHYSICAL PARAMETERS --						
PH		9.7	10.6	9.7	9.3	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	550.0	1.4	2.3	1.2	1.3	320.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-16	LB-16	LB-16	LB-16	LB-17
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981933-2	L981936-2	L981934-2	L981935-2	L981932-3
TYPE	SPLP/DI	SPLP/PH11	SPLP/PH7	SPLP/PH9	
DEPTH	5-7'	5-7'	5-7'	5-7'	0-2'
SAMPLE NUMBER	LB-16B-DI	LB-16B-PH11	LB-16B-PH7	LB-16B-PH9	LB-17A
-- PHYSICAL PARAMETERS --					
PH	10.5	11.1	10.5	10.1	
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	0.27	0.25	0.3	0.26	360.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-17	LB-17	LB-17	LB-17	LB-17	LB-17
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981933-3	L981936-3	L981934-3	L981935-3	L981932-4	L981933-4
TYPE	SPLP/DI	SPLP/PH11	SPLP/PH7	SPLP/PH9		SPLP/DI
DEPTH	0-2'	0-2'	0-2'	0-2'	5-7'	5-7'
SAMPLE NUMBER	LB-17A-DI	LB-17A-PH11	LB-17A-PH7	LB-17A-PH9	LB-17B	LB-17B-DI
-- PHYSICAL PARAMETERS --						
PH	8.4	10.4	8.5	9.1		9.2
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.11	0.4	<0.1	<0.1	360.0	<0.1

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-17	LB-17	LB-17	LB-17	LB-17	LB-17
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981933-7	L981936-4	L981936-7	L981934-4	L981934-7	L981935-4
REMARKS	CRUSHED		CRUSHED		CRUSHED	
TYPE	SPLP/DI	SPLP/PH11	SPLP/PH11	SPLP/PH7	SPLP/PH7	SPLP/PH9
DEPTH	5-7'	5-7'	5-7'	5-7'	5-7'	5-7'
SAMPLE NUMBER	LB-17B-DI-CRSH	LB-17B-PH11	B-PH11-CRSH	LB-17B-PH7	LB-17B-PH7-CRSH	LB-17B-PH9
-- PHYSICAL PARAMETERS --						
PH	9.1	11.1	10.9	9.5	9.3	9.3
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	<0.1	0.16	0.27	<0.1	<0.1	<0.1

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-17	LB-18	LB-18	LB-18	LB-18
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981935-7	L981932-5	L981933-5	L981936-5	L981934-5
REMARKS	CRUSHED				
TYPE	SPLP/PH9		SPLP/DI	SPLP/PH11	SPLP/PH7
DEPTH	5-7'	0-2'	0-2'	0-2'	0-2'
SAMPLE NUMBER	LB-17B-PH9-CRSH	LB-18A	LB-18A-DI	LB-18A-PH11	LB-18A-PH7
-- PHYSICAL PARAMETERS --					
PH	9.1		10.0	10.9	10.2
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	<0.1	220.0	0.36	0.61	0.32

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-18	LB-18	LB-18	LB-18	LB-18	LB-18
SAMPLE DATE	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98	08/27/98
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L981935-5	L981932-6	L981933-6	L981936-6	L981934-6	L981935-6
TYPE	SPLP/PH9		SPLP/DI	SPLP/PH11	SPLP/PH7	SPLP/PH9
DEPTH	0-2'	5-7'	5-7'	5-7'	5-7'	5-7'
SAMPLE NUMBER	LB-18A-PH9	LB-18B	LB-18B-DI	LB-18B-PH11	LB-18B-PH7	LB-18B-PH9
-- PHYSICAL PARAMETERS --						
PH	10.2		9.9	11.0	10.1	9.9
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.69	340.0	0.22	0.41	0.41	0.32

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:*Blank; J2,UJ2: Standard; J3:Hold Time; J4,*UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-19	LB-19	LB-19	LB-19	LB-19	LB-19
SAMPLE DATE	09/29/98	09/29/98	09/29/98	09/29/98	09/29/98	09/29/98
SAMPLE TIME	11:02	11:05	11:15	11:20	11:22	11:25
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02661	98R-02662	98R-02663	98R-02664	98R-02665	98R-02666
REMARKS					DUPLICATE	
DEPTH	0-0.5'	2-3.5'	4-5.5'	6-7.5'	6-7.5'	8-9.5'
SAMPLE NUMBER	EVT-9809-190	EVT-9809-191	EVT-9809-192	EVT-9809-193	EVT-9809-194	EVT-9809-195
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	49.0 J4	34.0 J4	12.0 J4	121.0 J4	261.0 J4	2458.0 J4
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	16.0
CHROMIUM (CR) TOT	110.0	126.0	134.0	133.0	126.0	122.0
COPPER (CU) TOT	116.0	24.0	33.0	33.0	40.0	245.0
LEAD (PB) TOT	471.0	33.0	25.0	37.0	49.0	1614.0
ZINC (ZN) TOT	1044.0	82.0	62.0	71.0	90.0	571.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-19	LB-20	LB-20	LB-20	LB-20
SAMPLE DATE	09/29/98	09/29/98	09/29/98	09/29/98	09/29/98
SAMPLE TIME	11:30	11:50	11:55	12:00	12:10
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02667	98R-02647	98R-02648	98R-02649	98R-02650
DEPTH	10-11.5'	0-0.5'	2-3.5'	4-5.5'	6-7.5'
SAMPLE NUMBER	EVT-9809-196	EVT-9809-161	EVT-9809-162	EVT-9809-163	EVT-9809-164
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	1712.0 J4	76.0 J4	19.0	< 10.0 UJ4	968.0
CADMIUM (CD) TOT	15.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	136.0	100.0	154.0	144.0	158.0
COPPER (CU) TOT	140.0	166.0	31.0	30.0	116.0
LEAD (PB) TOT	868.0	928.0	11.0	< 10.0	411.0
ZINC (ZN) TOT	376.0	1728.0	63.0	31.0	434.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	LB-20	LB-20	MW-107D	MW-107D	MW-107D
SAMPLE DATE	09/29/98	09/29/98	02/04/99	02/04/99	02/04/99
SAMPLE TIME	12:15	12:20	14:00	14:05	14:10
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	98R-02651	98R-02652	99R-00032	99R-00033	99R-00034
DEPTH	8-9.5'	10-11.5'			
SAMPLE NUMBER	EVT-9809-165	EVT-9809-166	MW-107D-1	MW-107D-2	MW-107D-3
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	205.0	26.0	< 10.0	207.0	14.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	150.0	139.0	65.0	130.0	53.0
COPPER (CU) TOT	45.0	72.0	25.0	219.0	28.0
LEAD (PB) TOT	87.0	12.0	14.0	742.0	< 10.0
ZINC (ZN) TOT	96.0	84.0	49.0	796.0	21.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	MW-107D	MW-107D	MW-107D	MW-107D	MW-107D
SAMPLE DATE	02/04/99	02/04/99	02/04/99	02/04/99	02/04/99
SAMPLE TIME	14:15	14:20	14:22	14:25	16:00
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	99R-00035	99R-00036	99R-00037	99R-00038	99R-00039
SAMPLE NUMBER	MW-107D-4	MW-107D-5	MW-107D-5D	MW-107D-6	MW-107D-7
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	14.0	15.0	12.0	< 10.0	13.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	70.0	127.0	118.0	60.0	66.0
COPPER (CU) TOT	27.0	50.0	53.0	27.0	24.0
LEAD (PB) TOT	21.0	10.0	< 10.0	10.0	< 10.0
ZINC (ZN) TOT	78.0	92.0	85.0	37.0	42.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	MW-109D	MW-109D	MW-109D	MW-109D	MW-109D	MW-109D
SAMPLE DATE	02/03/99	02/03/99	02/03/99	02/03/99	02/03/99	02/03/99
SAMPLE TIME	15:30	15:35	15:40	15:45	15:50	15:55
LAB	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON	RUSTON
LAB NUMBER	99R-00024	99R-00025	99R-00026	99R-00027	99R-00028	99R-00029
SAMPLE NUMBER	MW-109D-1	MW-109D-2	MW-109D-3	MW-109D-4	MW-109D-5	MW-109D-6
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	13.0	15.0	< 10.0	14.0	17.0	< 10.0
CADMIUM (CD) TOT	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
CHROMIUM (CR) TOT	91.0 J4	69.0 J4	71.0 J4	59.0 J4	138.0 J4	74.0 J4
COPPER (CU) TOT	54.0	72.0	29.0	37.0	48.0	22.0
LEAD (PB) TOT	51.0	243.0	16.0	24.0	12.0	< 10.0
ZINC (ZN) TOT	74.0	100.0	44.0	44.0	89.0	28.0

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SOIL --

SITE CODE	MW-109D		MW-109D	
SAMPLE DATE	02/03/99		02/03/99	
SAMPLE TIME	15:57		16:00	
LAB	RUSTON		RUSTON	
LAB NUMBER	99R-00030		99R-00031	
SAMPLE NUMBER	MW-109D-6D		MW-109D-7	
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) TOT	< 10.0		< 10.0	
CADMIUM (CD) TOT	< 10.0		< 10.0	
CHROMIUM (CR) TOT	51.0	J4	56.0	J4
COPPER (CU) TOT	32.0		18.0	
LEAD (PB) TOT	< 10.0		< 10.0	
ZINC (ZN) TOT	36.0		29.0	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

INDEX

INDEX

+------------------- SAMPLE NUMBER ORDER -------------------+

Page	Sample Number	Lab ##	Date	Site Code
13	EV-21A-1	99R-00048	02/08/99	EV-21A
13	EV-21B-1	99R-00040	02/08/99	EV-21B
13	EV-21B-2	99R-00041	02/08/99	EV-21B
13	EV-21B-3	99R-00042	02/08/99	EV-21B
13	EV-21B-4	99R-00043	02/08/99	EV-21B
14	EV-21B-4	L99-4725	02/08/99	EV-21B
14	EV-21B-4D	99R-00044	02/08/99	EV-21B
14	EV-21B-5	99R-00045	02/08/99	EV-21B
14	EV-21B-6	99R-00046	02/08/99	EV-21B
14	EV-21B-7	99R-00047	02/08/99	EV-21B
1	EVT-9808-1BA	98R-02412	08/28/98	1B
1	EVT-9808-1BB	98R-02413	08/28/98	1B
1	EVT-9808-1MA	98R-02414	08/28/98	1M
1	EVT-9808-1TA	98R-02399	08/28/98	1T
2	EVT-9808-2BA	98R-02411	08/28/98	2B
2	EVT-9808-2MA	98R-02409	08/28/98	2M
2	EVT-9808-2MAD	98R-02410	08/28/98	2M
2	EVT-9808-2MB	98R-02408	08/28/98	2M
3	EVT-9808-2TA	98R-02397	08/28/98	2T
3	EVT-9808-3BA	98R-02407	08/28/98	3B
3	EVT-9808-3BB	98R-02406	08/28/98	3B
3	EVT-9808-3MA	98R-02405	08/28/98	3M
4	EVT-9808-3MB	98R-02403	08/28/98	3M
4	EVT-9808-3TA	98R-02398	08/28/98	3T
4	EVT-9808-3TAD	98R-02400	08/28/98	3T
4	EVT-9808-3TB	98R-02393	08/28/98	3T
4	EVT-9808-3TC	98R-02395	08/28/98	3T
5	EVT-9808-4BA	98R-02404	08/28/98	4B
5	EVT-9808-4BB	98R-02402	08/28/98	4B
5	EVT-9808-4MA	98R-02401	08/28/98	4M
5	EVT-9808-4MB	294-4140	08/28/98	4M
5	EVT-9808-4MB	98R-02394	08/28/98	4M
6	EVT-9808-4TA	98R-02396	08/28/98	4T
6	EVT-9808-4TB	98R-02392	08/28/98	4T
23	EVT-9808-500	294-4139	08/25/98	LB-11
23	EVT-9808-500	98R-02319	08/25/98	LB-11
24	EVT-9808-501	98R-02320	08/25/98	LB-11
24	EVT-9808-502	98R-02322	08/25/98	LB-11
24	EVT-9808-503	98R-02323	08/25/98	LB-11
24	EVT-9808-504	98R-02324	08/25/98	LB-11
24	EVT-9808-505	98R-02321	08/25/98	LB-11
25	EVT-9808-506	98R-02325	08/26/98	LB-12
25	EVT-9808-507	98R-02326	08/26/98	LB-12
25	EVT-9808-508	98R-02327	08/26/98	LB-12
25	EVT-9808-509	98R-02328	08/26/98	LB-12
25	EVT-9808-510	98R-02329	08/26/98	LB-12
26	EVT-9808-511	98R-02330	08/26/98	LB-13
26	EVT-9808-512	98R-02331	08/26/98	LB-13
26	EVT-9808-513	98R-02332	08/26/98	LB-13
26	EVT-9808-514	98R-02333	08/26/98	LB-13
26	EVT-9808-515	98R-02334	08/26/98	LB-13
26	EVT-9808-516	98R-02335	08/26/98	LB-13
27	EVT-9808-517	98R-02336	08/26/98	LB-14
27	EVT-9808-518	98R-02337	08/26/98	LB-14
27	EVT-9808-519	98R-02338	08/26/98	LB-14
27	EVT-9808-520	98R-02339	08/26/98	LB-14
27	EVT-9808-521	98R-02340	08/26/98	LB-14
28	EVT-9808-522	98R-02341	08/26/98	LB-15
28	EVT-9808-523	98R-02342	08/26/98	LB-15
28	EVT-9808-524	98R-02343	08/26/98	LB-15
28	EVT-9808-525	98R-02344	08/26/98	LB-15
28	EVT-9808-526	98R-02345	08/26/98	LB-15
28	EVT-9808-527	98R-02346	08/26/98	LB-15
15	EVT-9809-100	98R-02576	09/22/98	EV-22A
15	EVT-9809-101	98R-02577	09/22/98	EV-22A
15	EVT-9809-102	98R-02578	09/22/98	EV-22A
15	EVT-9809-103	98R-02579	09/22/98	EV-22A
15	EVT-9809-104	98R-02580	09/22/98	EV-22A
15	EVT-9809-105	98R-02581	09/22/98	EV-22A
16	EVT-9809-106	98R-02582	09/22/98	EV-22B

+------------------- LAB NUMBER ORDER -------------------+

Page	Lab ##	Sample Number	Date	Site Code
23	294-4139	EVT-9808-500	08/25/98	LB-11
5	294-4140	EVT-9808-4MB	08/28/98	4M
18	294-4141	EVT-9809-109	09/23/98	HP-45
16	294-4142	EVT-9809-176	09/30/98	EV-23B
17	294-4143	EVT-9809-183	09/30/98	EV-23B
23	98R-02319	EVT-9808-500	08/25/98	LB-11
24	98R-02320	EVT-9808-501	08/25/98	LB-11
24	98R-02321	EVT-9808-505	08/25/98	LB-11
24	98R-02322	EVT-9808-502	08/25/98	LB-11
24	98R-02323	EVT-9808-503	08/25/98	LB-11
24	98R-02324	EVT-9808-504	08/25/98	LB-11
25	98R-02325	EVT-9808-506	08/26/98	LB-12
25	98R-02326	EVT-9808-507	08/26/98	LB-12
25	98R-02327	EVT-9808-508	08/26/98	LB-12
25	98R-02328	EVT-9808-509	08/26/98	LB-12
25	98R-02329	EVT-9808-510	08/26/98	LB-12
26	98R-02330	EVT-9808-511	08/26/98	LB-13
26	98R-02331	EVT-9808-512	08/26/98	LB-13
26	98R-02332	EVT-9808-513	08/26/98	LB-13
26	98R-02333	EVT-9808-514	08/26/98	LB-13
26	98R-02334	EVT-9808-515	08/26/98	LB-13
26	98R-02335	EVT-9808-516	08/26/98	LB-13
27	98R-02336	EVT-9808-517	08/26/98	LB-14
27	98R-02337	EVT-9808-518	08/26/98	LB-14
27	98R-02338	EVT-9808-519	08/26/98	LB-14
27	98R-02339	EVT-9808-520	08/26/98	LB-14
27	98R-02340	EVT-9808-521	08/26/98	LB-14
28	98R-02341	EVT-9808-522	08/26/98	LB-15
28	98R-02342	EVT-9808-523	08/26/98	LB-15
28	98R-02343	EVT-9808-524	08/26/98	LB-15
28	98R-02344	EVT-9808-525	08/26/98	LB-15
28	98R-02345	EVT-9808-526	08/26/98	LB-15
28	98R-02346	EVT-9808-527	08/26/98	LB-15
6	98R-02392	EVT-9808-4TB	08/28/98	4T
4	98R-02393	EVT-9808-3TB	08/28/98	3T
5	98R-02394	EVT-9808-4MB	08/28/98	4M
4	98R-02395	EVT-9808-3TC	08/28/98	3T
6	98R-02396	EVT-9808-4TA	08/28/98	4T
3	98R-02397	EVT-9808-2TA	08/28/98	2T
4	98R-02398	EVT-9808-3TA	08/28/98	3T
1	98R-02399	EVT-9808-1TA	08/28/98	1T
4	98R-02400	EVT-9808-3TAD	08/28/98	3T
5	98R-02401	EVT-9808-4MA	08/28/98	4M
5	98R-02402	EVT-9808-4BB	08/28/98	4B
4	98R-02403	EVT-9808-3MB	08/28/98	3M
5	98R-02404	EVT-9808-4BA	08/28/98	4B
3	98R-02405	EVT-9808-3MA	08/28/98	3M
3	98R-02406	EVT-9808-3BB	08/28/98	3B
3	98R-02407	EVT-9808-3BA	08/28/98	3B
2	98R-02408	EVT-9808-2MB	08/28/98	2M
2	98R-02409	EVT-9808-2MA	08/28/98	2M
2	98R-02410	EVT-9808-2MAD	08/28/98	2M
2	98R-02411	EVT-9808-2BA	08/28/98	2B
1	98R-02412	EVT-9808-1BA	08/28/98	1B
1	98R-02413	EVT-9808-1BB	08/28/98	1B
1	98R-02414	EVT-9808-1MA	08/28/98	1M
15	98R-02576	EVT-9809-100	09/22/98	EV-22A
15	98R-02577	EVT-9809-101	09/22/98	EV-22A
15	98R-02578	EVT-9809-102	09/22/98	EV-22A
15	98R-02579	EVT-9809-103	09/22/98	EV-22A
15	98R-02580	EVT-9809-104	09/22/98	EV-22A
15	98R-02581	EVT-9809-105	09/22/98	EV-22A
16	98R-02582	EVT-9809-106	09/22/98	EV-22B
16	98R-02583	EVT-9809-107	09/22/98	EV-22B
17	98R-02584	EVT-9809-108	09/23/98	HP-45
18	98R-02585	EVT-9809-109	09/23/98	HP-45
18	98R-02586	EVT-9809-110	09/23/98	HP-45
18	98R-02587	EVT-9809-111	09/23/98	HP-45
18	98R-02588	EVT-9809-112	09/23/98	HP-45
18	98R-02589	EVT-9809-113	09/23/98	HP-45

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
16	EVT-9809-107	98R-02583	09/22/98	EV-22B
17	EVT-9809-108	98R-02584	09/23/98	HP-45
18	EVT-9809-109	294-4141	09/23/98	HP-45
18	EVT-9809-109	98R-02585	09/23/98	HP-45
18	EVT-9809-110	98R-02586	09/23/98	HP-45
18	EVT-9809-111	98R-02587	09/23/98	HP-45
18	EVT-9809-112	98R-02588	09/23/98	HP-45
18	EVT-9809-113	98R-02589	09/23/98	HP-45
19	EVT-9809-114	98R-02590	09/23/98	HP-45
8	EVT-9809-115	98R-02591	09/23/98	EV-17B
8	EVT-9809-116	98R-02592	09/23/98	EV-17B
8	EVT-9809-117	98R-02593	09/23/98	EV-17B
8	EVT-9809-118	98R-02594	09/23/98	EV-17B
9	EVT-9809-119	98R-02595	09/23/98	EV-17B
9	EVT-9809-120	98R-02596	09/23/98	EV-17B
9	EVT-9809-121	98R-02597	09/23/98	EV-17B
9	EVT-9809-122	98R-02598	09/24/98	EV-18B
9	EVT-9809-123	98R-02599	09/24/98	EV-18B
10	EVT-9809-124	98R-02600	09/24/98	EV-18B
10	EVT-9809-125	98R-02601	09/24/98	EV-18B
10	EVT-9809-126	98R-02602	09/24/98	EV-18B
10	EVT-9809-127	98R-02603	09/24/98	EV-18B
10	EVT-9809-128	98R-02604	09/24/98	EV-18B
10	EVT-9809-129	98R-02605	09/24/98	EV-18B
11	EVT-9809-130	98R-02606	09/24/98	EV-18B
11	EVT-9809-131	98R-02607	09/24/98	EV-18B
11	EVT-9809-132	98R-02608	09/24/98	EV-18B
11	EVT-9809-134	98R-02609	09/24/98	EV-18B
11	EVT-9809-140	98R-02668	09/28/98	EV-20B
12	EVT-9809-141	98R-02669	09/28/98	EV-20B
12	EVT-9809-142	98R-02625	09/28/98	EV-20B
12	EVT-9809-143	98R-02626	09/28/98	EV-20B
12	EVT-9809-144	98R-02627	09/28/98	EV-20B
12	EVT-9809-145	98R-02628	09/28/98	EV-20B
7	EVT-9809-152	98R-02640	09/29/98	EV-16A
7	EVT-9809-153	98R-02641	09/29/98	EV-16A
7	EVT-9809-154	98R-02642	09/29/98	EV-16A
7	EVT-9809-155	98R-02643	09/29/98	EV-16A
8	EVT-9809-156	98R-02644	09/29/98	EV-16A
36	EVT-9809-161	98R-02647	09/29/98	LB-20
36	EVT-9809-162	98R-02648	09/29/98	LB-20
36	EVT-9809-163	98R-02649	09/29/98	LB-20
36	EVT-9809-164	98R-02650	09/29/98	LB-20
37	EVT-9809-165	98R-02651	09/29/98	LB-20
37	EVT-9809-166	98R-02652	09/29/98	LB-20
6	EVT-9809-167	98R-02653	09/29/98	EV-15B
6	EVT-9809-168	98R-02654	09/29/98	EV-15B
6	EVT-9809-169	98R-02655	09/29/98	EV-15B
7	EVT-9809-170	98R-02656	09/29/98	EV-15B
16	EVT-9809-175	98R-02635	09/30/98	EV-23B
16	EVT-9809-176	294-4142	09/30/98	EV-23B
16	EVT-9809-176	98R-02636	09/30/98	EV-23B
17	EVT-9809-177	98R-02637	09/30/98	EV-23B
17	EVT-9809-182	98R-02672	09/30/98	EV-23B
17	EVT-9809-183	294-4143	09/30/98	EV-23B
17	EVT-9809-183	98R-02673	09/30/98	EV-23B
35	EVT-9809-190	98R-02661	09/29/98	LB-19
35	EVT-9809-191	98R-02662	09/29/98	LB-19
35	EVT-9809-192	98R-02663	09/29/98	LB-19
35	EVT-9809-193	98R-02664	09/29/98	LB-19
35	EVT-9809-194	98R-02665	09/29/98	LB-19
35	EVT-9809-195	98R-02666	09/29/98	LB-19
36	EVT-9809-196	98R-02667	09/29/98	LB-19
19	HP-46-1	99R-00049	02/09/99	HP-46
19	HP-46-2	99R-00050	02/09/99	HP-46
19	HP-46-3	99R-00051	02/09/99	HP-46
19	HP-46-4	99R-00052	02/09/99	HP-46
20	HP-46-4D	99R-00053	02/09/99	HP-46
20	HP-46-5	99R-00054	02/09/99	HP-46
20	HP-46-6	99R-00055	02/09/99	HP-46

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
19	98R-02590	EVT-9809-114	09/23/98	HP-45
8	98R-02591	EVT-9809-115	09/23/98	EV-17B
8	98R-02592	EVT-9809-116	09/23/98	EV-17B
8	98R-02593	EVT-9809-117	09/23/98	EV-17B
8	98R-02594	EVT-9809-118	09/23/98	EV-17B
9	98R-02595	EVT-9809-119	09/23/98	EV-17B
9	98R-02596	EVT-9809-120	09/23/98	EV-17B
9	98R-02597	EVT-9809-121	09/23/98	EV-17B
9	98R-02598	EVT-9809-122	09/24/98	EV-18B
9	98R-02599	EVT-9809-123	09/24/98	EV-18B
10	98R-02600	EVT-9809-124	09/24/98	EV-18B
10	98R-02601	EVT-9809-125	09/24/98	EV-18B
10	98R-02602	EVT-9809-126	09/24/98	EV-18B
10	98R-02603	EVT-9809-127	09/24/98	EV-18B
10	98R-02604	EVT-9809-128	09/24/98	EV-18B
10	98R-02605	EVT-9809-129	09/24/98	EV-18B
11	98R-02606	EVT-9809-130	09/24/98	EV-18B
11	98R-02607	EVT-9809-131	09/24/98	EV-18B
11	98R-02608	EVT-9809-132	09/24/98	EV-18B
11	98R-02609	EVT-9809-134	09/24/98	EV-18B
12	98R-02625	EVT-9809-142	09/28/98	EV-20B
12	98R-02626	EVT-9809-143	09/28/98	EV-20B
12	98R-02627	EVT-9809-144	09/28/98	EV-20B
12	98R-02628	EVT-9809-145	09/28/98	EV-20B
16	98R-02635	EVT-9809-175	09/30/98	EV-23B
16	98R-02636	EVT-9809-176	09/30/98	EV-23B
17	98R-02637	EVT-9809-177	09/30/98	EV-23B
7	98R-02640	EVT-9809-152	09/29/98	EV-16A
7	98R-02641	EVT-9809-153	09/29/98	EV-16A
7	98R-02642	EVT-9809-154	09/29/98	EV-16A
7	98R-02643	EVT-9809-155	09/29/98	EV-16A
8	98R-02644	EVT-9809-156	09/29/98	EV-16A
36	98R-02647	EVT-9809-161	09/29/98	LB-20
36	98R-02648	EVT-9809-162	09/29/98	LB-20
36	98R-02649	EVT-9809-163	09/29/98	LB-20
36	98R-02650	EVT-9809-164	09/29/98	LB-20
37	98R-02651	EVT-9809-165	09/29/98	LB-20
37	98R-02652	EVT-9809-166	09/29/98	LB-20
6	98R-02653	EVT-9809-167	09/29/98	EV-15B
6	98R-02654	EVT-9809-168	09/29/98	EV-15B
6	98R-02655	EVT-9809-169	09/29/98	EV-15B
7	98R-02656	EVT-9809-170	09/29/98	EV-15B
35	98R-02661	EVT-9809-190	09/29/98	LB-19
35	98R-02662	EVT-9809-191	09/29/98	LB-19
35	98R-02663	EVT-9809-192	09/29/98	LB-19
35	98R-02664	EVT-9809-193	09/29/98	LB-19
35	98R-02665	EVT-9809-194	09/29/98	LB-19
35	98R-02666	EVT-9809-195	09/29/98	LB-19
36	98R-02667	EVT-9809-196	09/29/98	LB-19
11	98R-02668	EVT-9809-140	09/28/98	EV-20B
12	98R-02669	EVT-9809-141	09/28/98	EV-20B
17	98R-02672	EVT-9809-182	09/30/98	EV-23B
17	98R-02673	EVT-9809-183	09/30/98	EV-23B
39	99R-00024	MW-109D-1	02/03/99	MW-109D
39	99R-00025	MW-109D-2	02/03/99	MW-109D
39	99R-00026	MW-109D-3	02/03/99	MW-109D
39	99R-00027	MW-109D-4	02/03/99	MW-109D
39	99R-00028	MW-109D-5	02/03/99	MW-109D
39	99R-00029	MW-109D-6	02/03/99	MW-109D
40	99R-00030	MW-109D-6D	02/03/99	MW-109D
40	99R-00031	MW-109D-7	02/03/99	MW-109D
37	99R-00032	MW-107D-1	02/04/99	MW-107D
37	99R-00033	MW-107D-2	02/04/99	MW-107D
37	99R-00034	MW-107D-3	02/04/99	MW-107D
38	99R-00035	MW-107D-4	02/04/99	MW-107D
38	99R-00036	MW-107D-5	02/04/99	MW-107D
38	99R-00037	MW-107D-5D	02/04/99	MW-107D
38	99R-00038	MW-107D-6	02/04/99	MW-107D
38	99R-00039	MW-107D-7	02/04/99	MW-107D
13	99R-00040	EV-21B-1	02/08/99	EV-21B

INDEX

+------------------- SAMPLE NUMBER ORDER -------------------+

Page	Sample Number	Lab ##	Date	Site Code
20	HP-46-7	99R-00056	02/09/99	HP-46
20	HP-47-1	99R-00057	02/09/99	HP-47
21	HP-47-2	99R-00058	02/09/99	HP-47
21	HP-47-3	99R-00059	02/09/99	HP-47
21	HP-47-4	99R-00060	02/09/99	HP-47
21	HP-47-5	99R-00063	02/10/99	HP-47
21	HP-47-5	L99-4726	02/10/99	HP-47
21	HP-47-6	99R-00064	02/10/99	HP-47
22	HP-47-7	99R-00061	02/10/99	HP-47
22	HP-47-7D	99R-00062	02/10/99	HP-47
22	HP-48-1	99R-00065	02/10/99	HP-48
22	HP-48-2	99R-00066	02/10/99	HP-48
22	HP-48-3	99R-00067	02/10/99	HP-48
23	HP-48-4	99R-00068	02/10/99	HP-48
23	HP-48-5	99R-00069	02/10/99	HP-48
23	HP-48-6	99R-00070	02/10/99	HP-48
29	LB-16A	L981932-1	08/27/98	LB-16
29	LB-16A-DI	L981933-1	08/27/98	LB-16
29	LB-16A-PH11	L981936-1	08/27/98	LB-16
29	LB-16A-PH7	L981934-1	08/27/98	LB-16
29	LB-16A-PH9	L981935-1	08/27/98	LB-16
29	LB-16B	L981932-2	08/27/98	LB-16
30	LB-16B-DI	L981933-2	08/27/98	LB-16
30	LB-16B-PH11	L981936-2	08/27/98	LB-16
30	LB-16B-PH7	L981934-2	08/27/98	LB-16
30	LB-16B-PH9	L981935-2	08/27/98	LB-16
30	LB-17A	L981932-3	08/27/98	LB-17
31	LB-17A-DI	L981933-3	08/27/98	LB-17
31	LB-17A-PH11	L981936-3	08/27/98	LB-17
31	LB-17A-PH7	L981934-3	08/27/98	LB-17
31	LB-17A-PH9	L981935-3	08/27/98	LB-17
31	LB-17B	L981932-4	08/27/98	LB-17
31	LB-17B-DI	L981933-4	08/27/98	LB-17
32	LB-17B-DI-CRSH	L981933-7	08/27/98	LB-17
32	LB-17B-PH11	L981936-4	08/27/98	LB-17
32	LB-17B-PH11-CRSH	L981936-7	08/27/98	LB-17
32	LB-17B-PH7	L981934-4	08/27/98	LB-17
32	LB-17B-PH7-CRSH	L981934-7	08/27/98	LB-17
32	LB-17B-PH9	L981935-4	08/27/98	LB-17
33	LB-17B-PH9-CRSH	L981935-7	08/27/98	LB-17
33	LB-18A	L981932-5	08/27/98	LB-18
33	LB-18A-DI	L981933-5	08/27/98	LB-18
33	LB-18A-PH11	L981936-5	08/27/98	LB-18
33	LB-18A-PH7	L981934-5	08/27/98	LB-18
34	LB-18A-PH9	L981935-5	08/27/98	LB-18
34	LB-18B	L981932-6	08/27/98	LB-18
34	LB-18B-DI	L981933-6	08/27/98	LB-18
34	LB-18B-PH11	L981936-6	08/27/98	LB-18
34	LB-18B-PH7	L981934-6	08/27/98	LB-18
34	LB-18B-PH9	L981935-6	08/27/98	LB-18
37	MW-107D-1	99R-00032	02/04/99	MW-107D
37	MW-107D-2	99R-00033	02/04/99	MW-107D
37	*MW-107D-3*	*99R-00034*	*02/04/99*	*MW-107D*
38	MW-107D-4	99R-00035	02/04/99	MW-107D
38	MW-107D-5	99R-00036	02/04/99	MW-107D
38	MW-107D-5D	99R-00037	02/04/99	MW-107D
38	MW-107D-6	99R-00038	02/04/99	MW-107D
38	MW-107D-7	99R-00039	02/04/99	MW-107D
39	MW-109D-1	99R-00024	02/03/99	MW-109D
39	MW-109D-2	99R-00025	02/03/99	MW-109D
39	MW-109D-3	99R-00026	02/03/99	MW-109D
39	MW-109D-4	99R-00027	02/03/99	MW-109D
39	MW-109D-5	99R-00028	02/03/99	MW-109D
39	MW-109D-6	99R-00029	02/03/99	MW-109D
40	MW-109D-6D	99R-00030	02/03/99	MW-109D
40	MW-109D-7	99R-00031	02/03/99	MW-109D

+------------------- LAB NUMBER ORDER -------------------+

Page	Lab ##	Sample Number	Date	Site Code
13	99R-00041	EV-21B-2	02/08/99	EV-21B
13	99R-00042	EV-21B-3	02/08/99	EV-21B
13	99R-00043	EV-21B-4	02/08/99	EV-21B
14	99R-00044	EV-21B-4D	02/08/99	EV-21B
14	99R-00045	EV-21B-5	02/08/99	EV-21B
14	99R-00046	EV-21B-6	02/08/99	EV-21B
14	99R-00047	EV-21B-7	02/08/99	EV-21B
13	99R-00048	EV-21A-1	02/08/99	EV-21A
19	99R-00049	HP-46-1	02/09/99	HP-46
19	99R-00050	HP-46-2	02/09/99	HP-46
19	99R-00051	HP-46-3	02/09/99	HP-46
19	99R-00052	HP-46-4	02/09/99	HP-46
20	99R-00053	HP-46-4D	02/09/99	HP-46
20	99R-00054	HP-46-5	02/09/99	HP-46
20	99R-00055	HP-46-6	02/09/99	HP-46
20	99R-00056	HP-46-7	02/09/99	HP-46
20	99R-00057	HP-47-1	02/09/99	HP-47
21	99R-00058	HP-47-2	02/09/99	HP-47
21	99R-00059	HP-47-3	02/09/99	HP-47
21	99R-00060	HP-47-4	02/09/99	HP-47
22	99R-00061	HP-47-7	02/10/99	HP-47
22	99R-00062	HP-47-7D	02/10/99	HP-47
21	99R-00063	HP-47-5	02/10/99	HP-47
21	99R-00064	HP-47-6	02/10/99	HP-47
22	99R-00065	HP-48-1	02/10/99	HP-48
22	99R-00066	HP-48-2	02/10/99	HP-48
22	99R-00067	HP-48-3	02/10/99	HP-48
23	99R-00068	HP-48-4	02/10/99	HP-48
23	99R-00069	HP-48-5	02/10/99	HP-48
23	99R-00070	HP-48-6	02/10/99	HP-48
29	L981932-1	LB-16A	08/27/98	LB-16
29	L981932-2	LB-16B	08/27/98	LB-16
30	L981932-3	LB-17A	08/27/98	LB-17
31	L981932-4	LB-17B	08/27/98	LB-17
33	L981932-5	LB-18A	08/27/98	LB-18
34	L981932-6	LB-18B	08/27/98	LB-18
29	L981933-1	LB-16A-DI	08/27/98	LB-16
30	L981933-2	LB-16B-DI	08/27/98	LB-16
31	L981933-3	LB-17A-DI	08/27/98	LB-17
31	L981933-4	LB-17B-DI	08/27/98	LB-17
33	L981933-5	LB-18A-DI	08/27/98	LB-18
34	L981933-6	LB-18B-DI	08/27/98	LB-18
32	L981933-7	LB-17B-DI-CRSH	08/27/98	LB-17
29	L981934-1	LB-16A-PH7	08/27/98	LB-16
30	L981934-2	LB-16B-PH7	08/27/98	LB-16
31	L981934-3	LB-17A-PH7	08/27/98	LB-17
32	L981934-4	LB-17B-PH7	08/27/98	LB-17
33	L981934-5	LB-18A-PH7	08/27/98	LB-18
34	L981934-6	LB-18B-PH7	08/27/98	LB-18
32	L981934-7	LB-17B-PH7-CRSH	08/27/98	LB-17
29	L981935-1	LB-16A-PH9	08/27/98	LB-16
30	L981935-2	LB-16B-PH9	08/27/98	LB-16
31	L981935-3	LB-17A-PH9	08/27/98	LB-17
32	L981935-4	LB-17B-PH9	08/27/98	LB-17
34	L981935-5	LB-18A-PH9	08/27/98	LB-18
34	L981935-6	LB-18B-PH9	08/27/98	LB-18
33	L981935-7	LB-17B-PH9-CRSH	08/27/98	LB-17
29	L981936-1	LB-16A-PH11	08/27/98	LB-16
30	L981936-2	LB-16B-PH11	08/27/98	LB-16
31	L981936-3	LB-17A-PH11	08/27/98	LB-17
32	L981936-4	LB-17B-PH11	08/27/98	LB-17
33	L981936-5	LB-18A-PH11	08/27/98	LB-18
34	L981936-6	LB-18B-PH11	08/27/98	LB-18
32	*L981936-7*	*LB-17B-PH11-CRSH*	*08/27/98*	*LB-17*
14	L99-4725	EV-21B-4	02/08/99	EV-21B
21	L99-4726	HP-47-5	02/10/99	HP-47

APPENDIX 3

Supporting Documentation

- ***Calculations**
    - **-% Recoveries**
    - **-Relative Percent Differences (RPDs)**
- ***Procedures for Calculating Accuracy and Precision**
- ***XRF QC Outlier & Completeness Information**

Calculations

- % Recoveries
- Relative Percent Differences (RPDs)

Arsenic **Mean % Recovery: 119%**

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	38	61	161%	|23| > ± 20
EVT-9808-4MB	08/28/98	228	266	117%	15%
EVT-9809-109	09/23/98	< 10	< 10	100%	|0| < ± 20
EVT-9809-176	09/30/98	27	41	152%	|14| < ± 20
EVT-9809-183	09/30/98	28	28	100%	|0| < ± 20
EV-21B-4	02/08/99	10	< 10	100%	|0| < ± 20
HP-47-5	02/10/99	< 10	< 10	100%	|0| < ± 20

Cadmium **Mean % Recovery: 100%**

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	< 10	< 10	100%	|0| < ± 20
EVT-9808-4MB	08/28/98	< 10	< 10	100%	|0| < ± 20
EVT-9809-109	09/23/98	< 10	< 10	100%	|0| < ± 20
EVT-9809-176	09/30/98	< 10	< 10	100%	|0| < ± 20
EVT-9809-183	09/30/98	< 10	< 10	100%	|0| < ± 20
EV-21B-4	02/08/99	< 10	< 10	100%	|0| < ± 20
HP-47-5	02/10/99	< 10	< 10	100%	|0| < ± 20

Chromium **Mean % Recovery: 160%**

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	52	88	169%	51%
EVT-9808-4MB	08/28/98	99	150	152%	41%
EVT-9809-109	09/23/98	77	137	178%	56%
EVT-9809-176	09/30/98	72	139	193%	64%
EVT-9809-183	09/30/98	120	145	121%	19%
EV-21B-4	02/08/99	48	76	158%	|28| > ± 20
HP-47-5	02/10/99	43	63	147%	|20| = ± 20

Copper

Mean % Recovery: 131%

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	85	129	152%	41%
EVT-9808-4MB	08/28/98	40	51	128%	|11| < ± 20
EVT-9809-109	09/23/98	18	25	139%	|7| < ± 20
EVT-9809-176	09/30/98	100	143	143%	35%
EVT-9809-183	09/30/98	55	52	95%	6%
EV-21B-4	02/08/99	22	31	141%	|9| < ± 20
HP-47-5	02/10/99	18	22	122%	|4| < ± 20

Lead

Mean % Recovery: 111%

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	366	529	145%	-36%
EVT-9808-4MB	08/28/98	67	79	118%	-16%
EVT-9809-109	09/23/98	< 10	< 10	100%	|0| < ± 20
EVT-9809-176	09/30/98	293	358	122%	20%
EVT-9809-183	09/30/98	12	< 10	83%	|2| < ± 20
EV-21B-4	02/08/99	39	43	110%	|4| < ± 20
HP-47-5	02/10/99	< 10	< 10	100%	|0| < ± 20

Zinc

Mean % Recovery: 126%

Sample No	Samp Date	HF Digest	XRF	% Recovery	RPD or ± Criteria
EVT-9808-500	08/25/98	1000	1279	128%	24%
EVT-9808-4MB	08/28/98	135	82	61%	49%
EVT-9809-109	09/23/98	50	30	60%	|20| = ± 20
EVT-9809-176	09/30/98	450	463	103%	3%
EVT-9809-183	09/30/98	21	90	429%	|69| < ± 20
EV-21B-4	02/08/99	64	37	58%	|27| < ± 20
HP-47-5	02/10/99	78	36	46%	|42| < ± 20

Procedures
for Calculating
Accuracy and Precision

PROCEDURES FOR CALCULATING ACCURACY
HYDROMETRICS, INC.

1. From the summarized information on the accuracy form, the percent recovery of the blind field standard (BFS) and the recovery of each laboratory spiked sample are calculated separately as:

   - $\% \text{ Recovery of BFS} = \frac{VA}{VK}(100)$; or $\% \text{ Recovery of Spike} = \frac{SSR-SR}{SA}(100)$
   - where:
     VA = analytical result of BFS;
     VK = known (or certified) value of BFS;
     SSR = spiked sample result;
     SR = sample result;
     SA = spike added.
   - Perfect accuracy would be 100 percent recovery.

2. Calculate the sample standard deviation of all recovery data.

$$SD = \left[\frac{\Sigma(Recovery_i - Recovery_{avg})^2}{n-1}\right]^{\frac{1}{2}}$$

   - where recovery_i is the individual recoveries,
   - $\text{recovery}_{avg.}$ is the mean recovery,
   - and n is the number of values.

3. To validate recovery data, the individual recoveries are compared with the average recovery value to identify individual values that lie outside the range of reasonableness. Chauvenet's test is used to identify individual recovery values that lie outside this range.

   To use Chauvenet's test, a screening variable is computed for recovery values that are suspected of lying outside the range of reasonableness.

   Screening Variable = $(\text{Recovery}_i - \text{Recovery}_{avg.})$ /SD

   The screening variable is then compared to Chauvenet's criterion, (Table 1) for the given number of recovery determinations. The suspect recovery value is set aside (set aside values are called "outliers") if the calculated screening variable equals or exceeds Chauvenet's criterion.

   If outliers are identified using Chauvenet's test, a new mean recovery and a new standard deviation is recalculated using the remaining "good" values, Chauvenet's test is then reapplied. This procedure is repeated until all surviving recovery values pass Chauvenet's test. (Usually one application and one recalculation are enough). The final mean recovery and final standard deviation are calculated from the "surviving" recovery values. The final mean recovery value is used to estimate any bias in the data.

TABLE 1. CHAUVENET'S CRITERION FOR REJECTING A SUSPECTED VALUE

Sample Size n	Chauvenet's Criterion*	Sample Size n	Chauvenet's Criterion
3	1.901	17	2.424
4	1.983	18	2.435
5	2.015	19	2.445
6	2.111	20	2.454
7	2.164	21	2.462
8	2.195	22	2.469
9	2.214	23	2.475
10	2.228	24	2.480
11	2.279	25	2.485
12	2.318	26	2.502
13	2.348	27	2.517
14	2.373	28	2.530
15	2.393	29	2.543
16	2.409	30	2.555
		40	2.634

* Based on "t" distribution rather than the traditional "normal" distribution

4. The range of uncertainty in the recovery (R) is then calculated as 90% confidence limits about the mean recovery:

$$\pm R = \pm tSD/(n)^{1/2}$$

- where:
  R is the 90% confidence limit for mean recovery (in percent);
  t is the value of the t distribution for the selected confidence level (90 percent) and (n-1) degrees of freedom (Table 3);
  n is the number of recovery values (samples);
  SD is the sample standard deviation.
- The range of uncertainty is used in conjunction with the mean recovery to determine if data are biased. Adjustments for bias can be made if deemed necessary.

5. Together, the final average recovery value for BFS and laboratory spike and their corresponding uncertainties constitute the QA statements of accuracy for a particular sampling program.

   The completeness of accuracy data is that percentage of the total number of recovery values that remain after outliers are identified and set aside with Chauvenet's test.

PROCEDURES FOR CALCULATING PRECISION

1. From the summarized information on the precision form, the relative percent difference (RPD) of each replicate pair (blind field replicates and laboratory duplicates) are calculated separately as:

$$RPD = \frac{|s-d|}{\frac{(s+d)}{2}} X\,100$$

- where: RPD = Relative Percent Difference
  s = First sample value (original)
  d = Second sample value (duplicate)

- Perfect precision would result in 0% RPD.

2. Any RPD value exceeding the control limits of ± 20% for waters, or ± 35% for soils, is evaluated as a possible outlier using the Dixon's Q method.

Dixon Test for Outlying Observations

This procedure has the advantage that an estimate of the standard deviation is not needed to use it. The procedure is as follows:

a) Rank the RPD data in order of increasing numerical value, i.e.,

$X_1, < X_2, < X_3 < \times \times \times < X_{n-1} < X_n$

b) Decide which RPD value is suspect (always X_n for RPD data).
c) Select the risk for a false rejection (Table 2), usually 10%.
d) Compute one of the following ratios, known as test statistics:

n	Ratio	if X_C is suspect
$3 \leq n \leq 7$	τ_{10}	$(X_n - X_{n-1}) / (X_n - X_1)$
$8 \leq n \leq 10$	τ_{11}	$(X_n - X_{n-1}) / (X_n - X_2)$
$11 \leq n \leq 13$	τ_{21}	$(X_n - X_{n-2}) / (X_n - X_2)$
$14 \leq n \leq 25$	τ_{22}	$(X_n - X_{n-2}) / (X_n - X_3)$

e) Compare the test statistic calculated with the values in Table 2. If the calculated value is greater than the tabulated value, rejection may be made with the tabulated risk.

f) Suspected outliers failing the Dixon test are rejected in an iterative process and are not used in the following precision calculations.

TABLE 2. VALUES FOR USE IN THE DIXON TEST FOR OUTLIERS

Statistic	Number of Observations, n	Risk of False Rejection 0.5%	1%	5%	10%
τ_{10}	3	.994	.988	.941	.886
	4	.926	.889	.765	.679
	5	.821	.780	.642	.557
	6	.740	.698	.560	.482
	7	.680	.637	.507	.434
τ_{11}	8	.725	.683	.554	.479
	9	.677	.635	.512	.441
	10	.639	.597	.477	.409
τ_{21}	11	.713	.679	.576	.517
	12	.675	.642	.546	.490
	13	.649	.615	.521	.467
τ_{22}	14	.674	.641	.546	.492
	15	.647	.616	.525	.472
	16	.624	.595	.507	.454
	17	.505	.577	.490	.438
	18	.589	.561	.475	.424
	19	.575	.547	.462	.412
	20	.562	.535	.450	.401

Original reference: W.J. Dixon, "Processing Outliers." Biometrics, BIOMA, 9 (No. 1): 74-89 (March 1953).

3. Calculate the coefficient of variation (CV) of each duplicate pair (field duplicates and lab duplicates are treated separately).

$$CV_{eachpair} = \frac{SD}{Mean} = \frac{RPD}{\sqrt{2}}$$

4. Calculate the CV for all the pairs (field duplicates and lab duplicates are treated separately).

$$CV_{overall} = [\,\Sigma\,(CV_{each})^2 / k_{pairs}\,]^{1/2}$$

5. Calculate precision, in percent, as:

$$Precision\ (\%) = (\,t * CV_{overall}) / (k_{pairs} - 1)^{1/2}$$

Where: t is the value for the 90% probability level from Table 3.

6. The completeness of precision data is that percentage of the total number of RPD values that remain after outliers are identified and set aside with Dixon's Q test.

TABLE 3. DISTRIBUTION OF t.

Number of Sample	Degrees of Freedom	50	70	80	90	95	98	99
2	1	1.000	1.963	3.078	6.314	12.706	31.821	63.657
3	2	.816	1.386	1.886	2.920	4.303	6.965	9.925
4	3	.765	1.250	1.638	2.353	3.182	4.541	5.841
5	4	.741	1.190	1.533	2.132	2.776	3.747	4.604
6	5	.727	1.156	1.476	2.015	2.571	3.365	4.032
7	6	.718	1.134	1.440	1.943	2.447	3.143	3.707
8	7	.711	1.119	1.415	1.895	3.265	2.998	3.499
9	8	.706	1.108	1.397	1.860	2.306	2.896	3.355
10	9	.703	1.100	1.383	1.833	2.262	2.821	3.250
11	10	.700	1.093	1.372	1.812	2.228	2.764	3.169
12	11	.697	1.088	1.363	1.796	2.201	2.718	3.106
13	12	.695	1.083	1.356	1.782	2.179	2.681	3.055
14	13	.694	1.079	1.350	1.771	2.160	2.650	3.012
15	14	.692	1.076	1.345	1.761	2.145	2.624	2.977
16	15	.691	1.074	1.341	1.753	2.131	2.602	2.947
17	16	.690	1.071	1.337	1.746	2.120	2.583	2.921
18	17	.689	1.069	1.333	1.740	2.110	2.567	2.898
19	18	.688	1.067	1.330	1.734	2.101	2.552	2.878
20	19	.688	1.066	1.328	1.729	2.093	2.539	2.861
21	20	.687	1.064	1.325	1.725	2.086	2.528	2.845
22	21	.686	1.063	1.323	1.721	2.080	2.518	2.831
23	22	.686	1.061	1.321	1.717	2.074	2.508	2.819
24	23	.685	1.060	1.319	1.714	2.069	2.500	2.807
25	24	.685	1.059	1.318	1.711	2.064	2.492	2.797
26	25	.684	1.058	1.316	1.708	2.060	2.485	2.787
27	26	.684	1.058	1.315	1.706	2.056	2.479	2.779
28	27	.684	1.057	1.314	1.703	2.052	2.473	2.771
29	28	.683	1.056	1.313	1.701	2.048	2.467	2.763
30	29	.683	1.055	1.311	1.699	2.045	2.462	2.756
31	30	.683	1.055	1.310	1.697	2.042	2.457	2.750
41	40	.681	1.050	1.303	1.684	2.021	2.432	2.704
61	60	.679	1.046	1.296	1.671	2.000	2.390	2.660
121	120	.677	1.041	1.289	1.658	1.980	2.358	2.617
		.674	1.036	1.282	1.645	1.960	2.326	2.576

XRF

Quality Control Sample

Outlier & Completeness Information

```
                         OUTLIER AND COMPLETENESS EVALUATIO
                           OF LABORATORY CONTROL SAMPLES
                               08/31/98 TO 10/06/98
                               ┌─────────────────┐
                               │  PARAMETER: AS  │
                               └─────────────────┘

  Accuracy Results:
         Total Number of Measurements: 9          Total Number of Outliers: 0
         Number of Valid Measurements (k): 9      Chauvenet's Criterion: 2.214
         90% t value: 1.860                       95% t value: 2.306
         Completeness: 100.0%                     Standard Deviation: 8.23
         10% Precision: 5.10                      5% Precision: 6.33
         Mean Recovery: 97.8%

                                           WITHIN
        ANALYSIS  ANALYSIS   PERCENT   CONTROL  SCREENING
 CODE     DATE      TIME     RECOVERY   LIMITS  VARIABLE   OUTLIER   COMMENTS
-------------------------------------------------------------------------------------------
  AS    08/31/98             -999.0%     N/A    133.273     N/A     Missing LCS for this date.
  AS    09/01/98  11:14:53    100.0%     Yes      0.270     No
  AS    09/03/98  14:53:47     96.1%     Yes      0.193     No
  AS    09/04/98  13:27:05     99.0%     Yes      0.154     No
  AS    09/29/98  08:48:43     86.6%     Yes      1.350     No
  AS    09/30/98  08:25:52     88.5%     Yes      1.119     No
  AS    10/01/98  09:05:13    110.4%     Yes      1.543     No
  AS    10/02/98  08:12:37    106.6%     Yes      1.080     No
  AS    10/05/98  09:29:29     87.6%     Yes      1.234     No
  AS    10/06/98  09:09:03    104.7%     Yes      0.849     No
```

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY CONTROL SAMPLES

02/12/99 TO 02/16/99

PARAMETER: AS

Accuracy Results:

Total Number of Measurements: 2
Number of Valid Measurements (k): 2
90% t value: 6.314
Completeness: 100.0%
10% Precision: 6.38
Mean Recovery: 96.7%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.901
95% t value: 12.706
Standard Deviation: 1.43
5% Precision: 12.83

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
AS	02/12/99	09:16:44	98.0%	Yes	1.000	No	
AS	02/16/99	11:04:36	95.2%	Yes	1.000	No	

```
                                          OF LABORATORY CONTROL SAMPLES
                                              08/31/98 TO 10/06/98

                                              PARAMETER: CD

  Accuracy Results:
          Total Number of Measurements: 10        Total Number of Outliers: 0
          Number of Valid Measurements (k): 10    Chauvenet's Criterion: 2.228
          90% t value: 1.833                      95% t value: 2.262
          Completeness: 100.0%                    Standard Deviation: 4.54
          10% Precision: 2.63                     5% Precision: 3.25
          Mean Recovery: 94.3%

                                          WITHIN
          ANALYSIS  ANALYSIS   PERCENT   CONTROL  SCREENING
   CODE     DATE      TIME     RECOVERY   LIMITS  VARIABLE    OUTLIER   COMMENTS
 ---------------------------------------------------------------------------------------------------------------------------
   CD     08/31/98  12:36:36     97.6%     Yes      0.734       No
   CD     09/01/98  13:14:34     92.8%     Yes      0.314       No
   CD     09/03/98  17:49:28    100.0%     Yes      1.258       No
   CD     09/04/98  14:51:00     95.2%     Yes      0.210       No
   CD     09/29/98  08:56:28     97.6%     Yes      0.734       No
   CD     09/30/98  08:32:44    100.0%     Yes      1.258       No
   CD     10/01/98  09:11:53     88.0%     Yes      1.363       No
   CD     10/02/98  08:19:17     95.2%     Yes      0.210       No
   CD     10/05/98  10:00:12     88.0%     Yes      1.363       No
   CD     10/06/98  09:15:21     88.0%     Yes      1.363       No
```

```
                    OUTLIER AND COMPLETENESS EVALUATION
                      OF LABORATORY CONTROL SAMPLES
                          02/12/99 TO 02/16/99
                         ┌─────────────────┐
                         │  PARAMETER: CD  │
                         └─────────────────┘

  Accuracy Results:
           Total Number of Measurements: 2        Total Number of Outliers: 0
           Number of Valid Measurements (k): 2    Chauvenet's Criterion: 1.901
           90% t value: 6.314                     95% t value: 12.706
           Completeness: 100.0%                   Standard Deviation: 3.57
           10% Precision: 15.95                   5% Precision: 32.09
           Mean Recovery: 103.6%

                                         WITHIN
       ANALYSIS  ANALYSIS   PERCENT    CONTROL  SCREENING
 CODE    DATE      TIME     RECOVERY   LIMITS   VARIABLE   OUTLIER   COMMENTS
 ------------------------------------------------------------------------------------------
  CD   02/12/99  09:27:25    107.1%     Yes       1.000      No
  CD   02/16/99  11:11:47    100.0%     Yes       1.000      No
```

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY CONTROL SAMPLES
08/31/98 TO 10/06/98

PARAMETER: CR

Accuracy Results:

Total Number of Measurements: 9	Total Number of Outliers: 0
Number of Valid Measurements (k): 9	Chauvenet's Criterion: 2.214
90% t value: 1.860	95% t value: 2.306
Completeness: 100.0%	Standard Deviation: 4.40
10% Precision: 2.73	5% Precision: 3.38
Mean Recovery: 108.6%	

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CR	08/31/98		-999.0%	N/A	251.555	N/A	Missing LCS for this date.
CR	09/01/98	09:00:23	113.3%	Yes	1.065	No	
CR	09/03/98	12:18:45	112.5%	Yes	0.897	No	
CR	09/04/98	11:48:59	105.1%	Yes	0.785	No	
CR	09/29/98	09:05:24	108.1%	Yes	0.112	No	
CR	09/30/98	08:18:04	114.0%	Yes	1.234	No	
CR	10/01/98	08:57:24	103.7%	Yes	1.121	No	
CR	10/02/98	08:04:58	112.5%	Yes	0.897	No	
CR	10/05/98	09:21:54	101.4%	Yes	1.626	No	
CR	10/06/98	08:52:17	106.6%	Yes	0.449	No	

```
                     OUTLIER AND COMPLETENESS EVALUATION
                        OF LABORATORY CONTROL SAMPLES
                            02/12/99 TO 02/16/99

                             | PARAMETER: CR |

  Accuracy Results:
          Total Number of Measurements: 2           Total Number of Outliers: 0
          Number of Valid Measurements (k): 2       Chauvenet's Criterion: 1.901
          90% t value: 6.314                        95% t value: 12.706
          Completeness: 100.0%                      Standard Deviation: 4.82
          10% Precision: 21.50                      5% Precision: 43.26
          Mean Recovery: 115.9%

                                        WITHIN
       ANALYSIS  ANALYSIS   PERCENT    CONTROL  SCREENING
 CODE    DATE      TIME     RECOVERY   LIMITS   VARIABLE   OUTLIER   COMMENTS
 ------------------------------------------------------------------------------
  CR   02/12/99  09:05:45    120.7%     Yes      1.000       No
  CR   02/16/99  10:56:14    111.1%     Yes      1.000       No
```

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY CONTROL SAMPLES

08/31/98 TO 10/06/98

PARAMETER: CU

Accuracy Results:

```
        Total Number of Measurements: 9            Total Number of Outliers: 0
        Number of Valid Measurements (k): 9        Chauvenet's Criterion: 2.214
        90% t value: 1.860                         95% t value: 2.306
        Completeness: 100.0%                       Standard Deviation: 4.68
        10% Precision: 2.90                        5% Precision: 3.60
        Mean Recovery: 97.0%
```

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CU	08/31/98		-999.0%	N/A	234.171	N/A	Missing LCS for this date.
CU	09/01/98	11:14:53	97.3%	Yes	0.083	No	
CU	09/03/98	14:53:47	93.8%	Yes	0.666	No	
CU	09/04/98	13:27:05	106.1%	Yes	1.957	No	
CU	09/29/98	08:48:43	101.7%	Yes	1.020	No	
CU	09/30/98	08:25:52	94.7%	Yes	0.479	No	
CU	10/01/98	09:05:13	92.9%	Yes	0.854	No	
CU	10/02/98	08:12:37	98.2%	Yes	0.271	No	
CU	10/05/98	09:29:29	89.4%	Yes	1.603	No	
CU	10/06/98	09:09:03	98.2%	Yes	0.271	No	

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY CONTROL SAMPLES
02/12/99 TO 02/16/99

PARAMETER: CU

```
Accuracy Results:
         Total Number of Measurements: 2          Total Number of Outliers: 0
         Number of Valid Measurements (k): 2      Chauvenet's Criterion: 1.901
         90% t value: 6.314                       95% t value: 12.706
         Completeness: 100.0%                     Standard Deviation: 2.19
         10% Precision: 9.79                      5% Precision: 19.70
         Mean Recovery: 96.1%
```

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CU	02/12/99	09:16:44	93.8%	Yes	1.000	No	
CU	02/16/99	11:04:36	98.2%	Yes	1.000	No	

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY CONTROL SAMPLES

08/31/98 TO 10/06/98

PARAMETER: PB

Accuracy Results:

Total Number of Measurements: 9
Number of Valid Measurements (k): 9
90% t value: 1.860
Completeness: 100.0%
10% Precision: 0.50
Mean Recovery: 98.7%

Total Number of Outliers: 0
Chauvenet's Criterion: 2.214
95% t value: 2.306
Standard Deviation: 0.80
5% Precision: 0.62

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
PB	08/31/98		-999.0%	N/A	1366.91	N/A	Missing LCS for this date.
PB	09/01/98	11:14:53	97.5%	Yes	1.417	No	
PB	09/03/98	14:53:47	98.7%	Yes	0.024	No	
PB	09/04/98	13:27:05	98.5%	Yes	0.238	No	
PB	09/29/98	08:48:43	98.9%	Yes	0.297	No	
PB	09/30/98	08:25:52	100.0%	Yes	1.691	No	
PB	10/01/98	09:05:13	99.4%	Yes	0.941	No	
PB	10/02/98	08:12:37	98.5%	Yes	0.238	No	
PB	10/05/98	09:29:29	99.2%	Yes	0.619	No	
PB	10/06/98	09:09:03	97.4%	Yes	1.631	No	

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY CONTROL SAMPLES
02/12/99 TO 02/16/99

PARAMETER: PB

Accuracy Results:

Total Number of Measurements: 2
Number of Valid Measurements (k): 2
90% t value: 6.314
Completeness: 100.0%
10% Precision: 1.34
Mean Recovery: 98.7%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.901
95% t value: 12.706
Standard Deviation: 0.30
5% Precision: 2.70

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
PB	02/12/99	09:16:44	98.9%	Yes	1.000	No	
PB	02/16/99	11:04:36	98.3%	Yes	1.000	No	

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY CONTROL SAMPLES
08/31/98 TO 10/06/98

PARAMETER: ZN

Accuracy Results:

Total Number of Measurements: 9
Number of Valid Measurements (k): 9
90% t value: 1.860
Completeness: 100.0%
10% Precision: 1.57
Mean Recovery: 89.9%

Total Number of Outliers: 0
Chauvenet's Criterion: 2.214
95% t value: 2.306
Standard Deviation: 2.53
5% Precision: 1.94

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
ZN	08/31/98		-999.0%	N/A	431.075	N/A	Missing LCS for this date.
ZN	09/01/98	11:14:53	91.1%	Yes	0.478	No	
ZN	09/03/98	14:53:47	89.1%	Yes	0.314	No	
ZN	09/04/98	13:27:05	90.5%	Yes	0.251	No	
ZN	09/29/98	08:48:43	91.7%	Yes	0.704	No	
ZN	09/30/98	08:25:52	86.2%	Yes	1.445	No	
ZN	10/01/98	09:05:13	95.1%	Yes	2.061	No	
ZN	10/02/98	08:12:37	90.2%	Yes	0.138	No	
ZN	10/05/98	09:29:29	87.7%	Yes	0.880	No	
ZN	10/06/98	09:09:03	87.4%	Yes	0.993	No	

```
                    OUTLIER AND COMPLETENESS EVALUATION
                     OF LABORATORY CONTROL SAMPLES
                         02/12/99 TO 02/16/99
                         ┌──────────────────┐
                         │  PARAMETER: ZN   │
                         └──────────────────┘

 Accuracy Results:
          Total Number of Measurements: 2         Total Number of Outliers: 0
          Number of Valid Measurements (k): 2     Chauvenet's Criterion: 1.901
          90% t value: 6.314                      95% t value: 12.706
          Completeness: 100.0%                    Standard Deviation: 1.29
          10% Precision: 5.74                     5% Precision: 11.55
          Mean Recovery: 91.0%

                                     WITHIN
       ANALYSIS  ANALYSIS   PERCENT  CONTROL  SCREENING
 CODE    DATE      TIME    RECOVERY  LIMITS   VARIABLE   OUTLIER   COMMENTS
 ______________________________________________________________________________

  ZN   02/12/99  09:16:44     89.7%   Yes       1.000      No
  ZN   02/16/99  11:04:36     92.2%   Yes       1.000      No
```

```
                         OUTLIER AND COMPLETENESS EVALUATION
                              OF CALIBRATION VERIFICATION
                                  08/31/98 TO 10/06/98

                                  PARAMETER: AS

Accuracy Results:
        Total Number of Measurements: 11           Total Number of Outliers: 0
        Number of Valid Measurements (k): 11       Chauvenet's Criterion: 2.279
        90% t value: 1.812                         95% t value: 2.228
        Completeness: 100.0%                       Standard Deviation: 4.56
        10% Precision: 2.49                        5% Precision: 3.07
        Mean Recovery: 94.7%

                                       WITHIN
      ANALYSIS  ANALYSIS   PERCENT    CONTROL  SCREENING
CODE    DATE      TIME     RECOVERY   LIMITS   VARIABLE   OUTLIER   COMMENTS
---------------------------------------------------------------------------------
 AS   08/31/98  14:27:50     96.1%     Yes       0.322       No
 AS   09/01/98  11:27:25     87.6%     Yes       1.555       No
 AS   09/03/98  15:07:04     97.1%     Yes       0.531       No
 AS   09/04/98  13:37:21     96.1%     Yes       0.322       No
 AS   09/29/98  14:55:33     91.4%     Yes       0.721       No
 AS   09/30/98  10:34:40     91.4%     Yes       0.721       No
 AS   10/01/98  13:03:56     88.5%     Yes       1.347       No
 AS   10/01/98  14:16:37     93.3%     Yes       0.304       No
 AS   10/02/98  14:31:00    100.9%     Yes       1.366       No
 AS   10/05/98  10:57:35    102.8%     Yes       1.783       No
 AS   10/06/98  11:12:30     96.1%     Yes       0.322       No
```

OUTLIER AND COMPLETENESS EVALUATION OF CALIBRATION VERIFICATION

02/12/99 TO 02/16/99

PARAMETER: AS

Accuracy Results:

Total Number of Measurements: 4
Number of Valid Measurements (k): 4
90% t value: 2.353
Completeness: 100.0%
10% Precision: 8.20
Mean Recovery: 99.0%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.983
95% t value: 3.182
Standard Deviation: 6.97
5% Precision: 11.08

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
AS	02/12/99	13:20:41	100.9%	Yes	0.273	No	
AS	02/12/99	18:28:54	109.5%	Yes	1.504	No	
AS	02/16/99	13:46:55	91.4%	Yes	1.094	No	
AS	02/16/99	17:07:31	94.2%	Yes	0.684	No	

OUTLIER AND COMPLETENESS EVALUATION OF CALIBRATION VERIFICATION

08/31/98 TO 10/06/98

PARAMETER: CD

Accuracy Results:

Total Number of Measurements: 10	Total Number of Outliers: 0
Number of Valid Measurements (k): 10	Chauvenet's Criterion: 2.228
90% t value: 1.833	95% t value: 2.262
Completeness: 100.0%	Standard Deviation: 4.52
10% Precision: 2.62	5% Precision: 3.23
Mean Recovery: 95.2%	

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CD	08/31/98	12:51:56	92.8%	Yes	0.527	No	
CD	09/01/98	14:24:52	97.6%	Yes	0.527	No	
CD	09/03/98	17:58:17	90.4%	Yes	1.054	No	
CD	09/04/98	14:57:56	104.7%	Yes	2.108	No	
CD	09/29/98	16:40:22	92.8%	Yes	0.527	No	
CD	09/30/98	12:31:17	95.2%	Yes	0.000	No	
CD	10/01/98	15:06:25	100.0%	Yes	1.054	No	
CD	10/02/98	17:21:46	88.0%	Yes	1.581	No	
CD	10/05/98	13:03:07	95.2%	Yes	0.000	No	
CD	10/06/98	13:05:53	95.2%	Yes	0.000	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
02/12/99 TO 02/16/99

PARAMETER: CD

Accuracy Results:

Total Number of Measurements: 4
Number of Valid Measurements (k): 4
90% t value: 2.353
Completeness: 100.0%
10% Precision: 5.77
Mean Recovery: 103.6%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.983
95% t value: 3.182
Standard Deviation: 4.91
5% Precision: 7.81

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CD	02/12/99	15:06:50	100.0%	Yes	0.728	No	
CD	02/16/99	11:20:59	109.5%	Yes	1.213	No	
CD	02/16/99	14:33:45	97.6%	Yes	1.213	No	
CD	02/16/99	18:54:10	107.1%	Yes	0.728	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
08/31/98 TO 10/06/98

PARAMETER: CR

Accuracy Results:

Total Number of Measurements: 12
Number of Valid Measurements (k): 12
90% t value: 1.796
Completeness: 100.0%
10% Precision: 3.69
Mean Recovery: 111.2%

Total Number of Outliers: 0
Chauvenet's Criterion: 2.318
95% t value: 2.201
Standard Deviation: 7.12
5% Precision: 4.52

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CR	08/31/98	17:18:43	108.8%	Yes	0.330	No	
CR	08/31/98	17:37:26	114.0%	Yes	0.399	No	
CR	09/01/98	09:34:06	117.0%	Yes	0.815	No	
CR	09/03/98	12:31:10	121.4%	Yes	1.440	No	
CR	09/03/98	14:14:55	116.2%	Yes	0.711	No	
CR	09/04/98	12:07:31	123.7%	Yes	1.752	No	
CR	09/29/98	18:14:22	100.0%	Yes	1.579	No	
CR	09/30/98	08:43:17	111.1%	Yes	0.017	No	
CR	10/01/98	09:56:31	105.1%	Yes	0.850	No	
CR	10/02/98	12:37:16	108.1%	Yes	0.434	No	
CR	10/05/98	10:09:50	102.2%	Yes	1.266	No	
CR	10/06/98	09:28:33	106.6%	Yes	0.642	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
02/12/99 TO 02/16/99

PARAMETER: CR

Accuracy Results:

Total Number of Measurements: 4
Number of Valid Measurements (k): 4
90% t value: 2.353
Completeness: 100.0%
10% Precision: 3.61
Mean Recovery: 115.4%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.983
95% t value: 3.182
Standard Deviation: 3.07
5% Precision: 4.89

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CR	02/12/99	11:41:08	120.0%	Yes	1.508	No	
CR	02/12/99	16:48:27	112.5%	Yes	0.905	No	
CR	02/16/99	13:01:38	112.5%	Yes	0.905	No	
CR	02/16/99	15:18:29	116.2%	Yes	0.301	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION

08/31/98 TO 10/06/98

PARAMETER: CU

Accuracy Results:

Total Number of Measurements: 11
Number of Valid Measurements (k): 11
90% t value: 1.812
Completeness: 100.0%
10% Precision: 1.97
Mean Recovery: 99.8%

Total Number of Outliers: 0
Chauvenet's Criterion: 2.279
95% t value: 2.228
Standard Deviation: 3.61
5% Precision: 2.42

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
CU	08/31/98	14:27:50	100.8%	Yes	0.309	No	
CU	09/01/98	11:27:25	100.8%	Yes	0.309	No	
CU	09/03/98	15:07:04	100.0%	Yes	0.066	No	
CU	09/04/98	13:37:21	98.2%	Yes	0.420	No	
CU	09/29/98	14:55:33	97.3%	Yes	0.663	No	
CU	09/30/98	10:34:40	96.4%	Yes	0.906	No	
CU	10/01/98	13:03:56	106.1%	Yes	1.768	No	
CU	10/01/98	14:16:37	100.0%	Yes	0.066	No	
CU	10/02/98	14:31:00	104.3%	Yes	1.282	No	
CU	10/05/98	10:57:35	100.8%	Yes	0.309	No	
CU	10/06/98	11:12:30	92.1%	Yes	2.121	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
02/12/99 TO 02/16/99

PARAMETER: CU

```
Accuracy Results:
          Total Number of Measurements: 4          Total Number of Outliers: 0
          Number of Valid Measurements (k): 4      Chauvenet's Criterion: 1.983
          90% t value: 2.353                       95% t value: 3.182
          Completeness: 100.0%                     Standard Deviation: 4.70
          10% Precision: 5.53                      5% Precision: 7.48
          Mean Recovery: 95.2%

                                        WITHIN
       ANALYSIS  ANALYSIS   PERCENT    CONTROL  SCREENING
CODE     DATE      TIME     RECOVERY   LIMITS   VARIABLE   OUTLIER   COMMENTS
-------------------------------------------------------------------------------------
 CU    02/12/99  13:20:41    100.0%      Yes      1.026       No
 CU    02/12/99  18:28:54     87.7%      Yes      1.585       No
 CU    02/16/99  13:46:55     98.2%      Yes      0.653       No
 CU    02/16/99  17:07:31     94.7%      Yes      0.093       No
```

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
08/31/98 TO 10/06/98

PARAMETER: PB

Accuracy Results:

Total Number of Measurements: 11
Number of Valid Measurements (k): 11
90% t value: 1.812
Completeness: 100.0%
10% Precision: 0.53
Mean Recovery: 98.7%

Total Number of Outliers: 0
Chauvenet's Criterion: 2.279
95% t value: 2.228
Standard Deviation: 0.97
5% Precision: 0.65

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
PB	08/31/98	14:27:50	96.5%	Yes	2.242	No	
PB	09/01/98	11:27:25	98.4%	Yes	0.290	No	
PB	09/03/98	15:07:04	99.3%	Yes	0.597	No	
PB	09/04/98	13:37:21	99.1%	Yes	0.419	No	
PB	09/29/98	14:55:33	100.6%	Yes	2.016	No	
PB	09/30/98	10:34:40	99.3%	Yes	0.686	No	
PB	10/01/98	13:03:56	98.9%	Yes	0.242	No	
PB	10/01/98	14:16:37	98.7%	Yes	0.024	No	
PB	10/02/98	14:31:00	98.1%	Yes	0.556	No	
PB	10/05/98	10:57:35	98.1%	Yes	0.645	No	
PB	10/06/98	11:12:30	98.5%	Yes	0.202	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
02/12/99 TO 02/16/99

PARAMETER: PB

Accuracy Results:

Total Number of Measurements: 4

Number of Valid Measurements (k): 4

90% t value: 2.353

Completeness: 100.0%

10% Precision: 0.70

Mean Recovery: 98.0%

Total Number of Outliers: 0

Chauvenet's Criterion: 1.983

95% t value: 3.182

Standard Deviation: 0.59

5% Precision: 0.94

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
PB	02/12/99	13:20:41	96.9%	Yes	1.673	No	
PB	02/12/99	18:28:54	98.2%	Yes	0.509	No	
PB	02/16/99	13:46:55	98.5%	Yes	0.945	No	
PB	02/16/99	17:07:31	98.1%	Yes	0.218	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
08/31/98 TO 10/06/98

PARAMETER: ZN

Accuracy Results:

Total Number of Measurements: 11	Total Number of Outliers: 1
Number of Valid Measurements (k): 10	Chauvenet's Criterion: 2.228
90% t value: 1.833	95% t value: 2.262
Completeness: 90.9%	Standard Deviation: 1.61
10% Precision: 0.93	5% Precision: 1.15
Mean Recovery: 88.9%	

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
ZN	08/31/98	14:27:50	90.2%	Yes	0.890	No	
ZN	09/01/98	11:27:25	89.1%	Yes	0.178	No	
ZN	09/03/98	15:07:04	86.5%	Yes	1.423	No	
ZN	09/04/98	13:37:21	90.2%	Yes	0.890	No	
ZN	09/29/98	14:55:33	85.7%	Yes	1.957	No	
ZN	09/30/98	10:34:40	88.0%	Yes	0.534	No	
ZN	10/01/98	13:03:56	88.2%	Yes	0.356	No	
ZN	10/01/98	14:16:37	89.7%	Yes	0.533	No	
ZN	10/02/98	14:31:00	83.1%	Yes	2.313	Yes	Rejected in Chauvenet's Test. Screening Variable: 2.313; Chauvenet's Criterion: 2.279; Number of samples: 11; Average: 88.3; Standard Deviation: 2.25.
ZN	10/05/98	10:57:35	90.8%	Yes	1.245	No	
ZN	10/06/98	11:12:30	89.7%	Yes	0.533	No	

OUTLIER AND COMPLETENESS EVALUATION
OF CALIBRATION VERIFICATION
02/12/99 TO 02/16/99

PARAMETER: ZN

Accuracy Results:

Total Number of Measurements: 4
Number of Valid Measurements (k): 4
90% t value: 2.353
Completeness: 100.0%
10% Precision: 3.30
Mean Recovery: 88.4%

Total Number of Outliers: 0
Chauvenet's Criterion: 1.983
95% t value: 3.182
Standard Deviation: 2.80
5% Precision: 4.46

CODE	ANALYSIS DATE	ANALYSIS TIME	PERCENT RECOVERY	WITHIN CONTROL LIMITS	SCREENING VARIABLE	OUTLIER	COMMENTS
ZN	02/12/99	13:20:41	92.5%	Yes	1.478	No	
ZN	02/12/99	18:28:54	89.4%	Yes	0.357	No	
ZN	02/16/99	13:46:55	85.7%	Yes	0.968	No	
ZN	02/16/99	17:07:31	86.0%	Yes	0.866	No	

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: AS

Precision Results:

Total Number of Measurements: 4	Total Number of Outliers: 0
Number of Valid Measurements (k): 4	Dixon Q's Test Value: 0.679
90% t value: 2.353	95% t value: 3.182
Completeness: 100.0%	Standard Deviation: 27.33
10% Precision: 46.18	5% Precision: 62.45
Coefficient of Variation: 34.0%	Mean Percentage RPD: 39.6%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
AS	98R-02343	08/26/98	1715	0.0%	Yes	N/A	UDL
AS	98R-02409	08/28/98	0950	2.2%	Yes	N/A	|1| < 20
AS	98R-02655	09/29/98	1445	3.2%	Yes	N/A	|1| < 20
AS	98R-02331	08/26/98	1305	5.7%	Yes	N/A	|1| < 20
AS	98R-02637	09/30/98	0915	10.6%	Yes	No	10.6%
AS	98R-02643	09/29/98	0850	14.9%	Yes	No	14.9%
AS	98R-02398	08/28/98	1110	22.2%	Yes	N/A	|6| < 20
AS	98R-02601	09/24/98	1113	59.6%	No	No	*OUT* 59.6%
AS	98R-02664	09/29/98	1120	73.3%	No	No	*OUT* 73.3%
AS	98R-02320	08/25/98	1650	81.1%	Yes	N/A	|15| < 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: CD

Precision Results:

Total Number of Measurements: 0
Number of Valid Measurements (k): 0
90% t value: 0.000
Completeness: N/A
10% Precision: -999.00
Coefficient of Variation: 0.0%

Total Number of Outliers: 0
Dixon Q's Test Value: 0.679
95% t value: 0.000
Standard Deviation: 0.00
5% Precision: -999.00
Mean Percentage RPD: 0.0%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CD	98R-02320	08/25/98	1650	0.0%	Yes	N/A	UDL
CD	98R-02331	08/26/98	1305	0.0%	Yes	N/A	UDL
CD	98R-02343	08/26/98	1715	0.0%	Yes	N/A	UDL
CD	98R-02398	08/28/98	1110	0.0%	Yes	N/A	UDL
CD	98R-02409	08/28/98	0950	0.0%	Yes	N/A	UDL
CD	98R-02643	09/29/98	0850	0.0%	Yes	N/A	UDL
CD	98R-02655	09/29/98	1445	0.0%	Yes	N/A	UDL
CD	98R-02664	09/29/98	1120	0.0%	Yes	N/A	UDL
CD	98R-02637	09/30/98	0915	0.0%	Yes	N/A	UDL
CD	98R-02601	09/24/98	1113	11.8%	Yes	N/A	|3| < 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: CD

Precision Results:

Total Number of Measurements: 0
Number of Valid Measurements (k): 0
90% t value: 0.000
Completeness: N/A
10% Precision: -999.00
Coefficient of Variation: 0.0%

Total Number of Outliers: 0
Dixon Q's Test Value: N/A
95% t value: 0.000
Standard Deviation: 0.00
5% Precision: -999.00
Mean Percentage RPD: 0.0%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CD	99R-00029	02/03/99	1555	0.0%	Yes	N/A	UDL
CD	99R-00036	02/04/99	1420	0.0%	Yes	N/A	UDL
CD	99R-00043	02/08/99	1045	0.0%	Yes	N/A	UDL
CD	99R-00052	02/09/99	0915	0.0%	Yes	N/A	UDL
CD	99R-00061	02/10/99	0800	0.0%	Yes	N/A	UDL

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES

08/31/98 TO 10/06/98

PARAMETER: CR

Precision Results:

Total Number of Measurements: 10	Total Number of Outliers: 1
Number of Valid Measurements (k): 9	Dixon Q's Test Value: 0.409
90% t value: 1.860	95% t value: 2.306
Completeness: 90.0%	Standard Deviation: 7.33
10% Precision: 4.60	5% Precision: 5.71
Coefficient of Variation: 7.0%	Mean Percentage RPD: 6.7%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CR	98R-02409	08/28/98	0950	0.0%	Yes	No	0.0%
CR	98R-02398	08/28/98	1110	0.7%	Yes	No	0.7%
CR	98R-02343	08/26/98	1715	0.8%	Yes	No	0.8%
CR	98R-02655	09/29/98	1445	1.5%	Yes	No	1.5%
CR	98R-02643	09/29/98	0850	4.8%	Yes	No	4.8%
CR	98R-02664	09/29/98	1120	5.4%	Yes	No	5.4%
CR	98R-02331	08/26/98	1305	10.1%	Yes	No	10.1%
CR	98R-02601	09/24/98	1113	13.4%	Yes	No	13.4%
CR	98R-02637	09/30/98	0915	23.4%	Yes	No	23.4%
CR	98R-02320	08/25/98	1650	45.3%	No	Yes	*OUT* 45.3%; Rejected in Dixon's Q Test. Screening Variable: 0.491; Dixon's Q Test Value: 0.409; Number of samples: 10

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: CR

Precision Results:

Total Number of Measurements: 5
Number of Valid Measurements (k): 5
90% t value: 2.132
Completeness: 100.0%
10% Precision: 16.78
Coefficient of Variation: 15.7%

Total Number of Outliers: 0
Dixon Q's Test Value: 0.557
95% t value: 2.776
Standard Deviation: 10.29
5% Precision: 21.84
Mean Percentage RPD: 19.8%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CR	99R-00036	02/04/99	1420	7.3%	Yes	No	7.3%
CR	99R-00043	02/08/99	1045	11.1%	Yes	No	11.1%
CR	99R-00061	02/10/99	0800	21.7%	Yes	No	21.7%
CR	99R-00052	02/09/99	0915	21.9%	Yes	No	21.9%
CR	99R-00029	02/03/99	1555	36.8%	No	No	*OUT* 36.8%

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: CU

Precision Results:

Total Number of Measurements: 5
Number of Valid Measurements (k): 4
90% t value: 2.353
Completeness: 80.0%
10% Precision: 20.41
Coefficient of Variation: 15.0%

Total Number of Outliers: 1
Dixon Q's Test Value: 0.557
95% t value: 3.182
Standard Deviation: 7.22
5% Precision: 27.60
Mean Percentage RPD: 20.0%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CU	98R-02343	08/26/98	1715	11.4%	Yes	N/A	|4| < 20
CU	98R-02643	09/29/98	0850	12.9%	Yes	No	12.9%
CU	98R-02409	08/28/98	0950	16.1%	Yes	No	16.1%
CU	98R-02655	09/29/98	1445	19.0%	Yes	No	19.0%
CU	98R-02664	09/29/98	1120	19.2%	Yes	N/A	|7| < 20
CU	98R-02398	08/28/98	1110	25.2%	Yes	N/A	|13| < 20
CU	98R-02601	09/24/98	1113	31.9%	Yes	No	31.9%
CU	98R-02331	08/26/98	1305	44.9%	Yes	N/A	|11| < 20
CU	98R-02320	08/25/98	1650	67.9%	No	N/A	*OUT* |36| > 20
CU	98R-02637	09/30/98	0915	73.3%	No	Yes	*OUT* 73.3%; Rejected in Dixon's Q Test. Screening Variable: 0.669; Dixon's Q Test Value: 0.557; Number of samples: 5

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: CU

Precision Results:

Total Number of Measurements: 1
Number of Valid Measurements (k): 1
90% t value: 0.000
Completeness: 100.0%
10% Precision: ********************
Coefficient of Variation: 0.0%

Total Number of Outliers: 0
Dixon Q's Test Value: 0.557
95% t value: 0.000
Standard Deviation: 0.00
5% Precision: ********************
Mean Percentage RPD: 0.0%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CU	99R-00052	02/09/99	0915	0.0%	Yes	No	0.0%
CU	99R-00036	02/04/99	1420	5.8%	Yes	N/A	|3| < 20
CU	99R-00061	02/10/99	0800	16.7%	Yes	N/A	|8| < 20
CU	99R-00043	02/08/99	1045	21.4%	Yes	N/A	|6| < 20
CU	99R-00029	02/03/99	1555	37.0%	Yes	N/A	|10| < 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: PB

Precision Results:

Total Number of Measurements: 5	Total Number of Outliers: 0
Number of Valid Measurements (k): 5	Dixon Q's Test Value: 0.557
90% t value: 2.132	95% t value: 2.776
Completeness: 100.0%	Standard Deviation: 16.48
10% Precision: 19.29	5% Precision: 25.11
Coefficient of Variation: 18.1%	Mean Percentage RPD: 19.6%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
PB	98R-02655	09/29/98	1445	0.0%	Yes	N/A	UDL
PB	98R-02643	09/29/98	0850	1.4%	Yes	No	1.4%
PB	98R-02398	08/28/98	1110	6.4%	Yes	No	6.4%
PB	98R-02409	08/28/98	0950	11.3%	Yes	No	11.3%
PB	98R-02331	08/26/98	1305	25.6%	Yes	N/A	|5| < 20
PB	98R-02664	09/29/98	1120	27.9%	Yes	N/A	|12| < 20
PB	98R-02343	08/26/98	1715	35.3%	Yes	N/A	|6| < 20
PB	98R-02637	09/30/98	0915	39.0%	No	No	*OUT* 39.0%
PB	98R-02601	09/24/98	1113	39.8%	No	No	*OUT* 39.8%
PB	98R-02320	08/25/98	1650	152.9%	No	N/A	*OUT* |104| > 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

```
                         OUTLIER AND COMPLETENESS EVALUATION
                                OF FIELD DUPLICATES
                                02/12/99 TO 02/16/99
                               ┌─────────────────┐
                               │  PARAMETER: PB  │
                               └─────────────────┘

  Precision Results:
          Total Number of Measurements: 1          Total Number of Outliers: 0
          Number of Valid Measurements (k): 1      Dixon Q's Test Value: 0.557
          90% t value: 0.000                       95% t value: 0.000
          Completeness: 100.0%                     Standard Deviation: 0.00
          10% Precision: *******************       5% Precision: *******************
          Coefficient of Variation: 4.6%           Mean Percentage RPD: 6.5%

                                              RELATIVE    WITHIN
               LAB        SAMPLE    SAMPLE     PERCENT    CONTROL
 CODE        NUMBER        DATE      TIME    DIFFERENCE   LIMITS   OUTLIER  COMMENTS
 ------------------------------------------------------------------------------------------
  PB     99R-00029      02/03/99   1555           0.0%     Yes      N/A     UDL
  PB     99R-00036      02/04/99   1420           0.0%     Yes      N/A     UDL
  PB     99R-00052      02/09/99   0915           6.5%     Yes      No      6.5%
  PB     99R-00061      02/10/99   0800          33.3%     Yes      N/A     |4| < 20
  PB     99R-00043      02/08/99   1045          53.0%     No       N/A     *OUT* |31| > 20
```

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: ZN

Precision Results:

Total Number of Measurements: 7
Number of Valid Measurements (k): 7
90% t value: 1.943
Completeness: 100.0%
10% Precision: 9.29
Coefficient of Variation: 11.7%

Total Number of Outliers: 0
Dixon Q's Test Value: 0.557
95% t value: 2.447
Standard Deviation: 9.12
5% Precision: 11.70
Mean Percentage RPD: 13.8%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
ZN	98R-02398	08/28/98	1110	1.8%	Yes	No	1.8%
ZN	98R-02643	09/29/98	0850	4.5%	Yes	No	4.5%
ZN	98R-02655	09/29/98	1445	5.7%	Yes	No	5.7%
ZN	98R-02601	09/24/98	1113	15.0%	Yes	No	15.0%
ZN	98R-02331	08/26/98	1305	15.7%	Yes	N/A	|7| < 20
ZN	98R-02409	08/28/98	0950	19.9%	Yes	No	19.9%
ZN	98R-02343	08/26/98	1715	21.3%	Yes	N/A	|10| < 20
ZN	98R-02664	09/29/98	1120	23.6%	Yes	No	23.6%
ZN	98R-02637	09/30/98	0915	26.1%	Yes	No	26.1%
ZN	98R-02320	08/25/98	1650	151.9%	No	N/A	*OUT* |278| > 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF FIELD DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: ZN

Precision Results:

Total Number of Measurements: 3
Total Number of Outliers: 0
Number of Valid Measurements (k): 3
Dixon Q's Test Value: 0.557
90% t value: 2.920
95% t value: 4.303
Completeness: 100.0%
Standard Deviation: 8.81
10% Precision: 21.02
5% Precision: 30.98
Coefficient of Variation: 10.2%
Mean Percentage RPD: 11.4%

CODE	LAB NUMBER	SAMPLE DATE	SAMPLE TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
ZN	99R-00043	02/08/99	1045	0.0%	Yes	N/A	|0| < 20
ZN	99R-00052	02/09/99	0915	2.8%	Yes	No	2.8%
ZN	99R-00036	02/04/99	1420	7.9%	Yes	No	7.9%
ZN	99R-00061	02/10/99	0800	23.5%	Yes	No	23.5%
ZN	99R-00029	02/03/99	1555	25.0%	Yes	N/A	|8| < 20

NOTES: || denotes the absolute value of the difference between the orginal and duplicate results.

```
                         OUTLIER AND COMPLETENESS EVALUATIO
                             OF LABORATORY DUPLICATES
                               08/31/98 TO 10/06/98
                               ┌──────────────────┐
                               │  PARAMETER: AS   │
                               └──────────────────┘

  Precision Results:
          Total Number of Measurements: 3          Total Number of Outliers: 0
          Number of Valid Measurements (k): 3      Dixon Q's Test Value: N/A
          90% t value: 2.920                       95% t value: 4.303
          Completeness: 100.0%                     Standard Deviation: 2.33
          10% Precision: 6.67                      5% Precision: 9.83
          Coefficient of Variation: 3.2%           Mean Percentage RPD: 3.9%

                                           RELATIVE   WITHIN
           LAB       ANALYSIS  ANALYSIS    PERCENT   CONTROL
 CODE     NUMBER       DATE      TIME     DIFFERENCE  LIMITS  OUTLIER  COMMENTS
 ─────────────────────────────────────────────────────────────────────────────────
  AS    98R-02332    08/31/98  14:27:50       0.0%      Yes     N/A    UDL
  AS    98R-02585    09/29/98  14:55:33       0.0%      Yes     N/A    UDL
  AS    98R-02604    10/01/98  13:03:56       0.0%      Yes     N/A    UDL
  AS    98R-02414    09/04/98  13:37:21       1.9%      Yes     No     1.9%
  AS    98R-02609    10/01/98  14:16:37       2.7%      Yes     No     2.7%
  AS    98R-02405    09/03/98  15:07:04       7.2%      Yes     No     7.2%
  AS    98R-02346    09/01/98  11:27:25       9.5%      Yes     N/A    |1| < 20
  AS    98R-02648    10/02/98  14:31:00      17.1%      Yes     N/A    |3| < 20
  AS    98R-02653    10/05/98  10:57:35      18.9%      Yes     N/A    |5| < 20
  AS    98R-02599    09/30/98  10:34:40      25.6%      Yes     N/A    |10| < 20
```

```
 NOTES: || denotes the absolute value of the difference between the original and duplicate results.
```

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: AS

Precision Results:

Total Number of Measurements: 1
Total Number of Outliers: 0
Number of Valid Measurements (k): 1
Dixon Q's Test Value: N/A
90% t value: 0.000
95% t value: 0.000
Completeness: 100.0%
Standard Deviation: 0.00
10% Precision: *******************
5% Precision: *******************
Coefficient of Variation: 2.1%
Mean Percentage RPD: 2.9%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
AS	99R-00056	02/16/99	13:46:55	0.0%	Yes	N/A	UDL
AS	99R-00051	02/12/99	18:28:54	2.9%	Yes	No	2.9%
AS	99R-00037	02/12/99	13:20:41	34.5%	Yes	N/A	|5| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATIO.
OF LABORATORY DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: CD

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CD	98R-02332	08/31/98	12:51:56	0.0%	Yes	N/A	UDL
CD	98R-02346	09/01/98	14:24:52	0.0%	Yes	N/A	UDL
CD	98R-02405	09/03/98	17:58:17	0.0%	Yes	N/A	UDL
CD	98R-02414	09/04/98	14:57:56	0.0%	Yes	N/A	UDL
CD	98R-02585	09/29/98	16:40:22	0.0%	Yes	N/A	UDL
CD	98R-02599	09/30/98	12:31:17	0.0%	Yes	N/A	UDL
CD	98R-02648	10/02/98	17:21:46	0.0%	Yes	N/A	UDL
CD	98R-02653	10/05/98	13:03:07	0.0%	Yes	N/A	UDL
CD	98R-02609	10/01/98	15:06:25	3.6%	Yes	N/A	|1| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: CD

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CD	99R-00037	02/12/99	15:06:50	0.0%	Yes	N/A	UDL
CD	99R-00051	02/16/99	11:20:59	0.0%	Yes	N/A	UDL
CD	99R-00056	02/16/99	14:33:45	0.0%	Yes	N/A	UDL

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATIO
OF LABORATORY DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: CR

Precision Results:

Total Number of Measurements: 10	Total Number of Outliers: 0
Number of Valid Measurements (k): 10	Dixon Q's Test Value: N/A
90% t value: 1.833	95% t value: 2.262
Completeness: 100.0%	Standard Deviation: 4.68
10% Precision: 3.54	5% Precision: 4.37
Coefficient of Variation: 5.8%	Mean Percentage RPD: 6.8%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CR	98R-02653	10/05/98	10:09:50	1.6%	Yes	No	1.6%
CR	98R-02402	09/03/98	12:31:10	2.2%	Yes	No	2.2%
CR	98R-02599	09/30/98	08:43:17	3.0%	Yes	No	3.0%
CR	98R-02609	10/01/98	09:56:31	3.8%	Yes	No	3.8%
CR	98R-02332	08/31/98	17:37:26	4.8%	Yes	No	4.8%
CR	98R-02414	09/04/98	12:07:31	5.4%	Yes	No	5.4%
CR	98R-02585	09/29/98	18:14:22	8.4%	Yes	No	8.4%
CR	98R-02648	10/02/98	12:37:16	8.8%	Yes	No	8.8%
CR	98R-02346	09/01/98	09:34:06	13.0%	Yes	No	13.0%
CR	98R-02405	09/03/98	14:14:55	16.6%	Yes	No	16.6%

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY DUPLICATES

02/12/99 TO 02/16/99

PARAMETER: CR

Precision Results:

Total Number of Measurements: 2
Number of Valid Measurements (k): 2
90% t value: 6.314
Completeness: 100.0%
10% Precision: 59.89
Coefficient of Variation: 9.5%

Total Number of Outliers: 0
Dixon Q's Test Value: N/A
95% t value: 12.706
Standard Deviation: 5.65
5% Precision: 120.51
Mean Percentage RPD: 12.2%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CR	99R-00051	02/12/99	16:48:27	6.5%	Yes	No	6.5%
CR	99R-00037	02/12/99	11:41:08	17.8%	Yes	No	17.8%
CR	99R-00056	02/16/99	13:01:38	31.6%	Yes	N/A	|18| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY DUPLICATES

08/31/98 TO 10/06/98

PARAMETER: CU

Precision Results:

Total Number of Measurements: 4	Total Number of Outliers: 0
Number of Valid Measurements (k): 4	Dixon Q's Test Value: N/A
90% t value: 2.353	95% t value: 3.182
Completeness: 100.0%	Standard Deviation: 6.01
10% Precision: 7.81	5% Precision: 10.56
Coefficient of Variation: 5.7%	Mean Percentage RPD: 5.5%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CU	98R-02604	10/01/98	13:03:56	0.0%	Yes	N/A	|0| < 20
CU	98R-02405	09/03/98	15:07:04	1.4%	Yes	No	1.4%
CU	98R-02609	10/01/98	14:16:37	1.6%	Yes	No	1.6%
CU	98R-02414	09/04/98	13:37:21	3.0%	Yes	No	3.0%
CU	98R-02585	09/29/98	14:55:33	3.9%	Yes	N/A	|1| < 20
CU	98R-02648	10/02/98	14:31:00	9.2%	Yes	N/A	|3| < 20
CU	98R-02653	10/05/98	10:57:35	15.8%	Yes	No	15.8%
CU	98R-02346	09/01/98	11:27:25	27.7%	Yes	N/A	|9| < 20
CU	98R-02332	08/31/98	14:27:50	31.6%	Yes	N/A	|9| < 20
CU	98R-02599	09/30/98	10:34:40	43.8%	Yes	N/A	|14| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: CU

```
Precision Results:
          Total Number of Measurements: 1          Total Number of Outliers: 0
          Number of Valid Measurements (k): 1      Dixon Q's Test Value: N/A
          90% t value: 0.000                       95% t value: 0.000
          Completeness: 100.0%                     Standard Deviation: 0.00
          10% Precision: ********************      5% Precision: ********************
          Coefficient of Variation: 11.1%          Mean Percentage RPD: 15.7%
```

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CU	99R-00056	02/16/99	13:46:55	12.8%	Yes	N/A	|3| < 20
CU	99R-00037	02/12/99	13:20:41	15.7%	Yes	No	15.7%
CU	99R-00051	02/12/99	18:28:54	16.1%	Yes	N/A	|7| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY DUPLICATES
08/31/98 TO 10/06/98

PARAMETER: PB

Precision Results:

Total Number of Measurements: 5
Number of Valid Measurements (k): 5
90% t value: 2.132
Completeness: 100.0%
10% Precision: 3.15
Coefficient of Variation: 3.0%

Total Number of Outliers: 0
Dixon Q's Test Value: N/A
95% t value: 2.776
Standard Deviation: 2.38
5% Precision: 4.11
Mean Percentage RPD: 3.4%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
PB	98R-02332	08/31/98	14:27:50	0.0%	Yes	N/A	UDL
PB	98R-02604	10/01/98	13:03:56	0.0%	Yes	N/A	UDL
PB	98R-02405	09/03/98	15:07:04	0.3%	Yes	No	0.3%
PB	98R-02609	10/01/98	14:16:37	0.9%	Yes	No	0.9%
PB	98R-02653	10/05/98	10:57:35	4.6%	Yes	No	4.6%
PB	98R-02414	09/04/98	13:37:21	5.0%	Yes	No	5.0%
PB	98R-02599	09/30/98	10:34:40	6.3%	Yes	No	6.3%
PB	98R-02648	10/02/98	14:31:00	8.7%	Yes	N/A	|1| < 20
PB	98R-02585	09/29/98	14:55:33	9.5%	Yes	N/A	|1| < 20
PB	98R-02346	09/01/98	11:27:25	58.1%	Yes	N/A	|9| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION
OF LABORATORY DUPLICATES
02/12/99 TO 02/16/99

PARAMETER: PB

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
PB	99R-00037	02/12/99	13:20:41	0.0%	Yes	N/A	UDL
PB	99R-00056	02/16/99	13:46:55	0.0%	Yes	N/A	UDL
PB	99R-00051	02/12/99	18:28:54	8.2%	Yes	N/A	|3| < 20

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

```
                    OUTLIER AND COMPLETENESS EVALUATION
                       OF LABORATORY DUPLICATES
                         08/31/98 TO 10/06/98
                         ┌──────────────────┐
                         │  PARAMETER: ZN   │
                         └──────────────────┘

  Precision Results:
          Total Number of Measurements: 7        Total Number of Outliers: 0
          Number of Valid Measurements (k): 7    Dixon Q's Test Value: N/A
          90% t value: 1.943                     95% t value: 2.447
          Completeness: 100.0%                   Standard Deviation: 2.08
          10% Precision: 1.61                    5% Precision: 2.03
          Coefficient of Variation: 2.0%         Mean Percentage RPD: 2.0%

                                           RELATIVE   WITHIN
          LAB       ANALYSIS  ANALYSIS     PERCENT    CONTROL
 CODE    NUMBER       DATE      TIME      DIFFERENCE  LIMITS  OUTLIER  COMMENTS
 ------------------------------------------------------------------------------
  ZN   98R-02346   09/01/98  11:27:25        0.0%      Yes      No     0.0%
  ZN   98R-02653   10/05/98  10:57:35        0.2%      Yes      No     0.2%
  ZN   98R-02414   09/04/98  13:37:21        0.7%      Yes      No     0.7%
  ZN   98R-02609   10/01/98  14:16:37        1.5%      Yes      No     1.5%
  ZN   98R-02604   10/01/98  13:03:56        1.6%      Yes      No     1.6%
  ZN   98R-02405   09/03/98  15:07:04        4.0%      Yes      No     4.0%
  ZN   98R-02332   08/31/98  14:27:50        5.1%      Yes      N/A    |1| < 20
  ZN   98R-02599   09/30/98  10:34:40        6.1%      Yes      No     6.1%
  ZN   98R-02585   09/29/98  14:55:33       18.2%      Yes      N/A    |5| < 20
  ZN   98R-02648   10/02/98  14:31:00       23.0%      Yes      N/A    |13| < 20
```

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

OUTLIER AND COMPLETENESS EVALUATION OF LABORATORY DUPLICATES

02/12/99 TO 02/16/99

PARAMETER: ZN

Precision Results:

Total Number of Measurements: 2	Total Number of Outliers: 0
Number of Valid Measurements (k): 2	Dixon Q's Test Value: N/A
90% t value: 6.314	95% t value: 12.706
Completeness: 100.0%	Standard Deviation: 1.25
10% Precision: 22.21	5% Precision: 44.69
Coefficient of Variation: 3.5%	Mean Percentage RPD: 4.9%

CODE	LAB NUMBER	ANALYSIS DATE	ANALYSIS TIME	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
ZN	99R-00056	02/16/99	13:46:55	2.8%	Yes	N/A	|1| < 20
ZN	99R-00051	02/12/99	18:28:54	3.6%	Yes	No	3.6%
ZN	99R-00037	02/12/99	13:20:41	6.1%	Yes	No	6.1%

NOTES: || denotes the absolute value of the difference between the original and duplicate results.

APPENDIX 4

Linear Regression Graphs and Statistics

OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON
08/20/98 TO 02/12/99

PARAMETER: AS

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
AS	EV-21B-4	02/08/99	L99-4725	99R-00043	10	< 10	0.0%	Yes	N/A	UDL
AS	EVT-9809-183	09/30/98	294-4143	98R-02673	28.0	28	0.0%	Yes	N/A	|0| < 20
AS	EVT-9808-4MB	08/28/98	294-4140	98R-02394	228.0	266	15.4%	Yes	No	15.4%
AS	HP-47-5	02/10/99	L99-4726	99R-00063	6.7	< 10	39.5%	Yes	N/A	UDL
AS	EVT-9809-176	09/30/98	294-4142	98R-02636	27.0	41	41.2%	Yes	N/A	|14| < 20
AS	EVT-9808-500	08/25/98	294-4139	98R-02319	38.0	61	46.5%	No	N/A	*OUT* |23| > 20
AS	EVT-9809-109	09/23/98	294-4141	98R-02585	3.9	< 10	87.8%	Yes	N/A	UDL

ARSENIC (AS) COMPARISON STATISTICAL SUMMA

Regression Statistics	
Multiple R	0.996949742
R Square	0.993908788
Adjusted R Square	0.992690546
Standard Error	7.906729437
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	51004.27529	51004.27529	815.8547109	9.85338E-07
Residual	5	312.5818519	62.51637039		
Total	6	51316.85714			

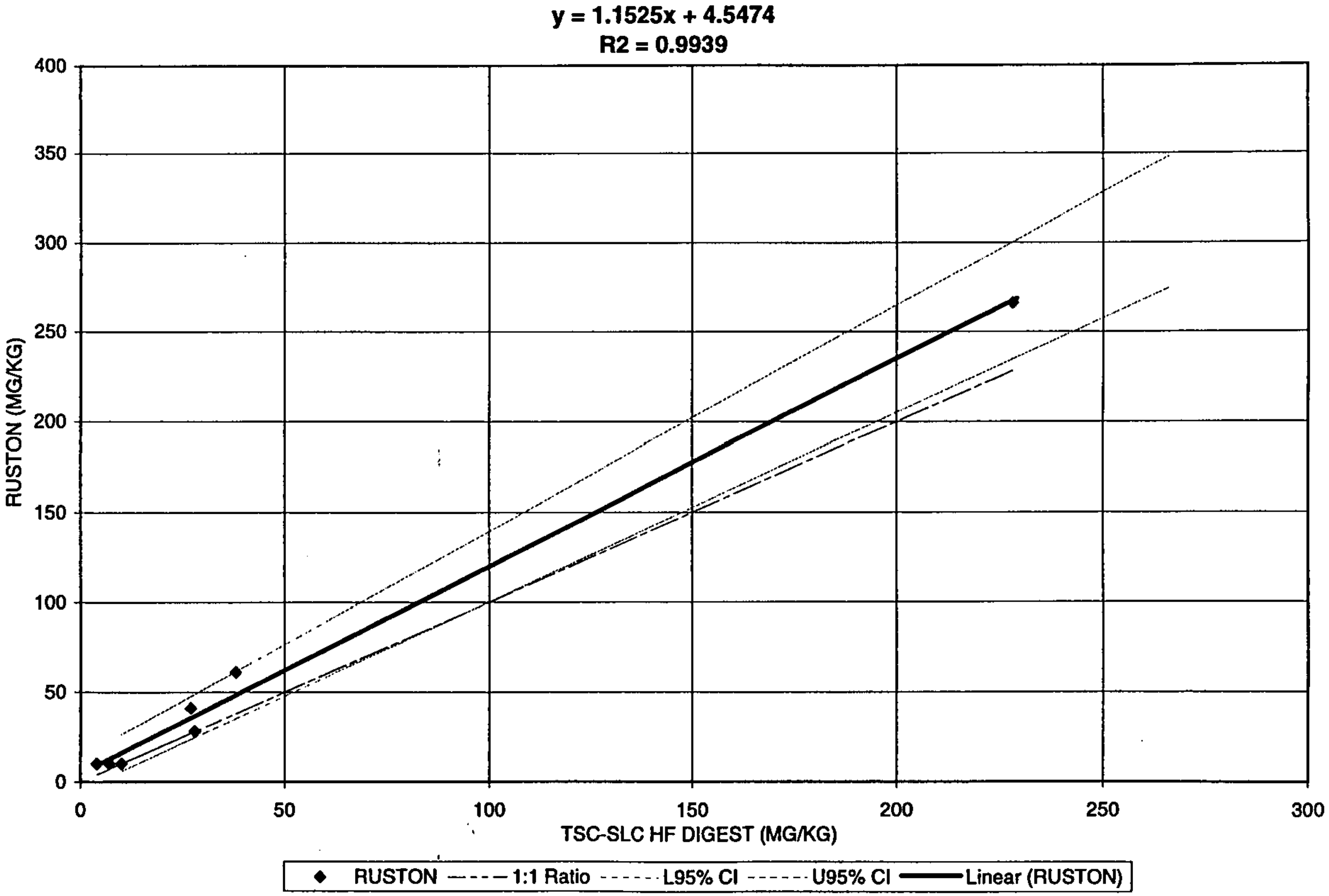
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	4.547403433	3.580135489	1.270176351	0.259918964	-4.655612786	13.75041965
TSC-SLC HF DIGEST	1.152538526	0.040350511	28.56317053	9.85338E-07	1.048814405	1.256262647

t-Test: Paired Two Sample for Means

	TSC-SLC HF DIGEST	*RUSTON*
Mean	48.85714286	60.85714286
Variance	6399.47619	8552.809524
Observations	7	7
Pearson Correlation	0.996949742	
Hypothesized Mean Difference	0	
df	6	
t Stat	-2.239402905	
P(T<=t) one-tail	0.033200783	
t Critical one-tail	1.943180905	
P(T<=t) two-tail	0.066401565	
t Critical two-tail	2.446913641	

Descriptive Statistics	*TSC-SLC HF DIGEST*	*RUSTON*
Mean	48.85714286	60.85714286
Standard Error	30.23592043	34.95468398
Median	27	28
Mode	#N/A	10
Standard Deviation	79.99672612	92.48140096
Sample Variance	6399.47619	8552.809524
Kurtosis	6.447894592	6.034802919
Skewness	2.509563277	2.417545316
Range	224	256
Minimum	4	10
Maximum	228	266
Sum	342	426
Count	7	7
Confidence Level(95.0%)	73.98468614	85.53109303

ARSENIC (AS) REGRESSION CHART



REGRESS.XLS
Using o:\db\ASEVLI\regress\63447745.txt

Hydrometrics, Inc. 4/15/99

OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON
08/20/98 TO 02/12/99

PARAMETER: CD

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CD	EVT-9808-4MB	08/28/98	294-4140	98R-02394	2.9	< 10	110.1%	Yes	N/A	UDL
CD	EVT-9809-176	09/30/98	294-4142	98R-02636	1.7	< 10	141.9%	Yes	N/A	UDL
CD	EVT-9808-500	08/25/98	294-4139	98R-02319	1.2	< 10	157.1%	Yes	N/A	UDL
CD	EV-21B-4	02/08/99	L99-4725	99R-00043	<1.0	< 10	163.6%	Yes	N/A	UDL
CD	EVT-9809-109	09/23/98	294-4141	98R-02585	<1.0	< 10	163.6%	Yes	N/A	UDL
CD	EVT-9809-183	09/30/98	294-4143	98R-02673	<1.0	< 10	163.6%	Yes	N/A	UDL
CD	HP-47-5	02/10/99	L99-4726	99R-00063	<1.0	< 10	163.6%	Yes	N/A	UDL

OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON

08/20/98 TO 02/12/99

PARAMETER: CR

Precision Results: Total Number of Pairs: 5; Total Number of Outliers: 0; Number of Valid Pairs (k): 5; Dixon Q's Test Value: 0.557; 90% t value: 2.132; 95% t value: 2.776; Completeness: 100.0%; Standard Deviation: 0.15; 10% Uncertainty: 36.71; 5% Uncertainty: 47.80; Mean Percentage RPD: 46.2%; Validation Detection Limit (VDL): 10.0; Control limit: 35.0% RPD or for values less than 5 times VDL: the absolute value of the difference between results needs to be within 2 times the VDL.

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CR	EVT-9809-183	09/30/98	294-4143	98R-02673	120.0	145	18.9%	Yes	No	18.9%
CR	HP-47-5	02/10/99	L99-4726	99R-00063	43	63	37.7%	Yes	N/A	|20| < 20
CR	EVT-9808-4MB	08/28/98	294-4140	98R-02394	99.0	150	41.0%	No	No	*OUT* 41.0%
CR	EV-21B-4	02/08/99	L99-4725	99R-00043	48	76	45.2%	No	N/A	*OUT* |28| > 20
CR	EVT-9808-500	08/25/98	294-4139	98R-02319	52.0	88	51.4%	No	No	*OUT* 51.4%
CR	EVT-9809-109	09/23/98	294-4141	98R-02585	77.0	137	56.1%	No	No	*OUT* 56.1%
CR	EVT-9809-176	09/30/98	294-4142	98R-02636	72.0	139	63.5%	No	No	*OUT* 63.5%

CHROMIUM (CR) COMPARISON STATISTICAL SUMMARY

Regression Statistics	
Multiple R	0.871930428
R Square	0.760262671
Adjusted R Square	0.712315205
Standard Error	19.74610828
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	6182.456039	6182.456039	15.85615961	0.010509997
Residual	5	1949.543961	389.9087921		
Total	6	8132			

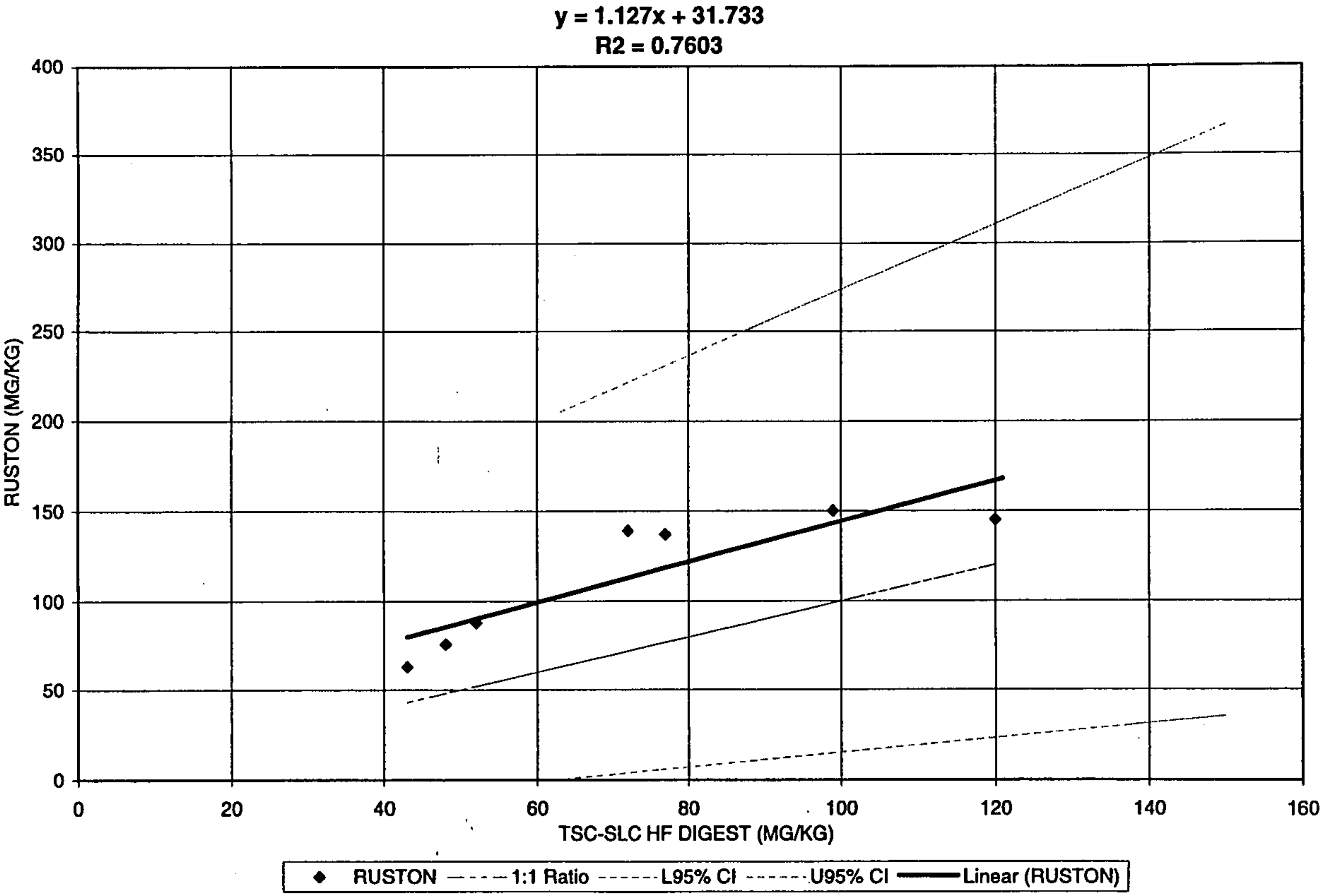
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	31.73253903	21.96666663	1.444576893	0.208189443	-24.73448293	88.19956099
TSC-SLC HF DIGEST	1.12695152	0.283012899	3.981979358	0.010509997	0.399444893	1.854458148

t-Test: Paired Two Sample for Means

	TSC-SLC HF DIGEST	*RUSTON*
Mean	73	114
Variance	811.3333333	1355.333333
Observations	7	7
Pearson Correlation	0.871930428	
Hypothesized Mean Difference	0	
df	6	
t Stat	-5.900305879	
P(T<=t) one-tail	0.00052649	
t Critical one-tail	1.943180905	
P(T<=t) two-tail	0.001052979	
t Critical two-tail	2.446913641	

Descriptive Statistics	*TSC-SLC HF DIGEST*	*RUSTON*
Mean	73	114
Standard Error	10.76590739	13.91470616
Median	72	137
Mode	#N/A	#N/A
Standard Deviation	28.48391359	36.81485208
Sample Variance	811.3333333	1355.333333
Kurtosis	-0.627416448	-2.203852566
Skewness	0.702485337	-0.47165731
Range	77	87
Minimum	43	63
Maximum	120	150
Sum	511	798
Count	7	7
Confidence Level(95.0%)	26.34324564	34.04808432

CHROMIUM (CR) REGRESSION CHART



REGRESS.XLS
Using o:\db\ASEVLI\regress\62589804.txt

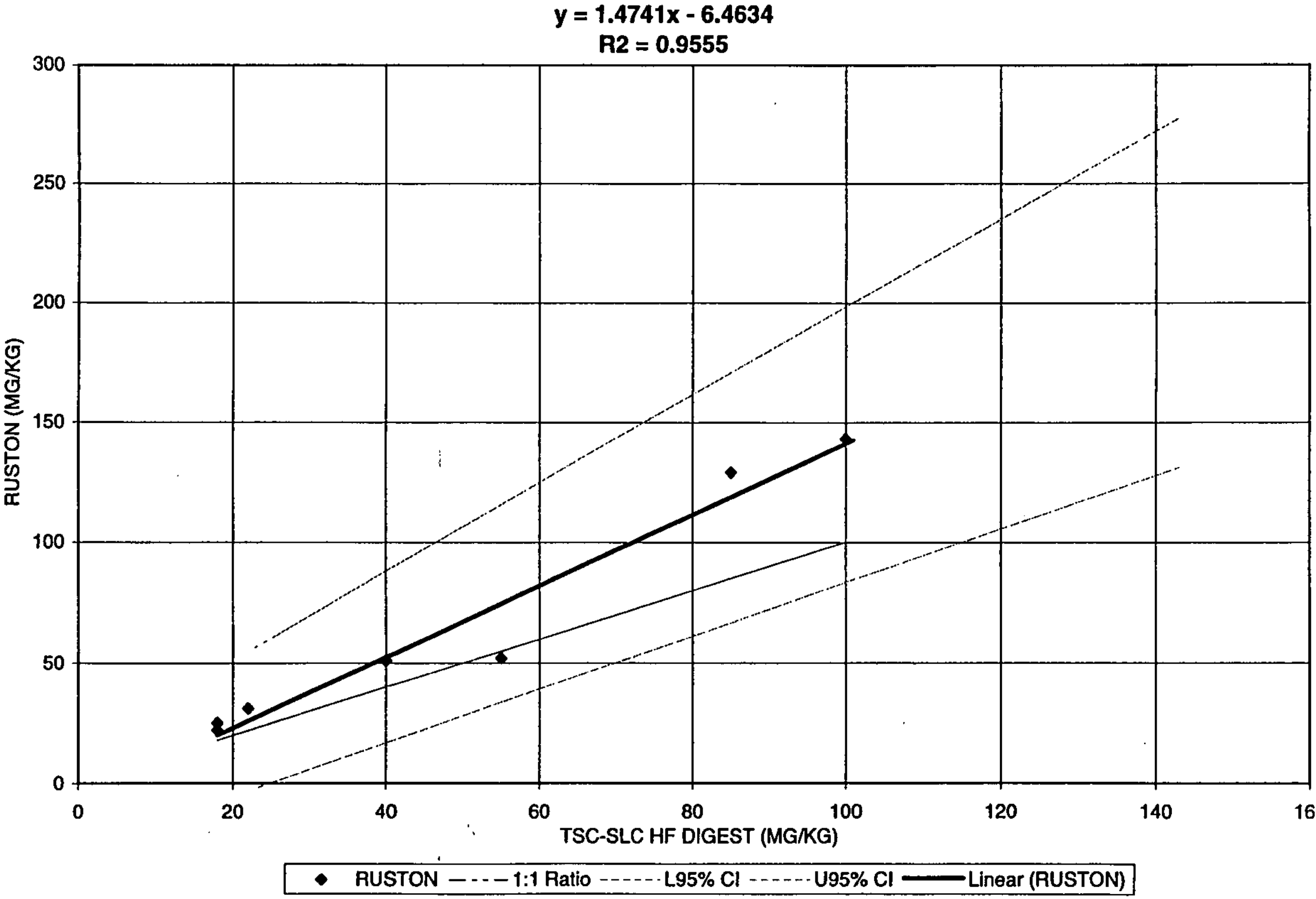
OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON
08/20/98 TO 02/12/99

PARAMETER: CU

Precision Results: Total Number of Pairs: 3; Total Number of Outliers: 0; Number of Valid Pairs (k): 3; Dixon Q's Test Value: 0.886; 90% t value: 2.920; 95% t value: 4.303; Completeness: 100.0%; Standard Deviation: 0.16; 10% Uncertainty: 45.98; 5% Uncertainty: 67.76; Mean Percentage RPD: 27.4%; Validation Detection Limit (VDL): 10.0; Control limit: 35.0% RPD or for values less than 5 times VDL: the absolute value of the difference between results needs to be within 2 times the VDL.

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
CU	EVT-9809-183	09/30/98	294-4143	98R-02673	55.0	52	5.6%	Yes	No	5.6%
CU	HP-47-5	02/10/99	L99-4726	99R-00063	18	22	20.0%	Yes	N/A	|4| < 20
CU	EVT-9808-4MB	08/28/98	294-4140	98R-02394	40.0	51	24.2%	Yes	N/A	|11| < 20
CU	EVT-9809-109	09/23/98	294-4141	98R-02585	18.0	25	32.6%	Yes	N/A	|7| < 20
CU	EV-21B-4	02/08/99	L99-4725	99R-00043	22	31	34.0%	Yes	N/A	|9| < 20
CU	EVT-9809-176	09/30/98	294-4142	98R-02636	100.0	143	35.4%	No	No	*OUT* 35.4%
CU	EVT-9808-500	08/25/98	294-4139	98R-02319	85.0	129	41.1%	No	No	*OUT* 41.1%

COPPER (CU) REGRESSION CHART



REGRESS.XLS
Using o:\db\ASEVLI\regress\62589776.txt

Hydrometrics, Inc. 4/15/99

OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON

08/20/98 TO 02/12/99

PARAMETER: PB

Precision Results: Total Number of Pairs: 3; Total Number of Outliers: 0; Number of Valid Pairs (k): 3; Dixon Q's Test Value: 0.886; 90% t value: 2.920; 95% t value: 4.303; Completeness: 100.0%; Standard Deviation: 0.09; 10% Uncertainty: 37.58; 5% Uncertainty: 55.38; Mean Percentage RPD: 24.3%; Validation Detection Limit (VDL): 10.0; Control limit: 35.0% RPD or for values less than 5 times VDL: the absolute value of the difference between results needs to be within 2 times the VDL.

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
PB	EV-21B-4	02/08/99	L99-4725	99R-00043	39	43	9.8%	Yes	N/A	|4| < 20
PB	EVT-9808-4MB	08/28/98	294-4140	98R-02394	67.00	79	16.4%	Yes	No	16.4%
PB	EVT-9809-183	09/30/98	294-4143	98R-02673	12.00	< 10	18.2%	Yes	N/A	|2| < 20
PB	EVT-9809-176	09/30/98	294-4142	98R-02636	293.00	358	20.0%	Yes	No	20.0%
PB	EVT-9809-109	09/23/98	294-4141	98R-02585	7.200	< 10	32.6%	Yes	N/A	UDL
PB	EVT-9808-500	08/25/98	294-4139	98R-02319	366.00	529	36.4%	No	No	*OUT* 36.4%
PB	HP-47-5	02/10/99	L99-4726	99R-00063	5.3	< 10	61.4%	Yes	N/A	UDL

LEAD (PB) COMPARISON STATISTICAL SUMMARY

Regression Statistics	
Multiple R	0.994811746
R Square	0.98965041
Adjusted R Square	0.987580492
Standard Error	23.29563013
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	259464.2824	259464.2824	478.1109132	3.71363E-06
Residual	5	2713.431917	542.6863834		
Total	6	262177.7143			

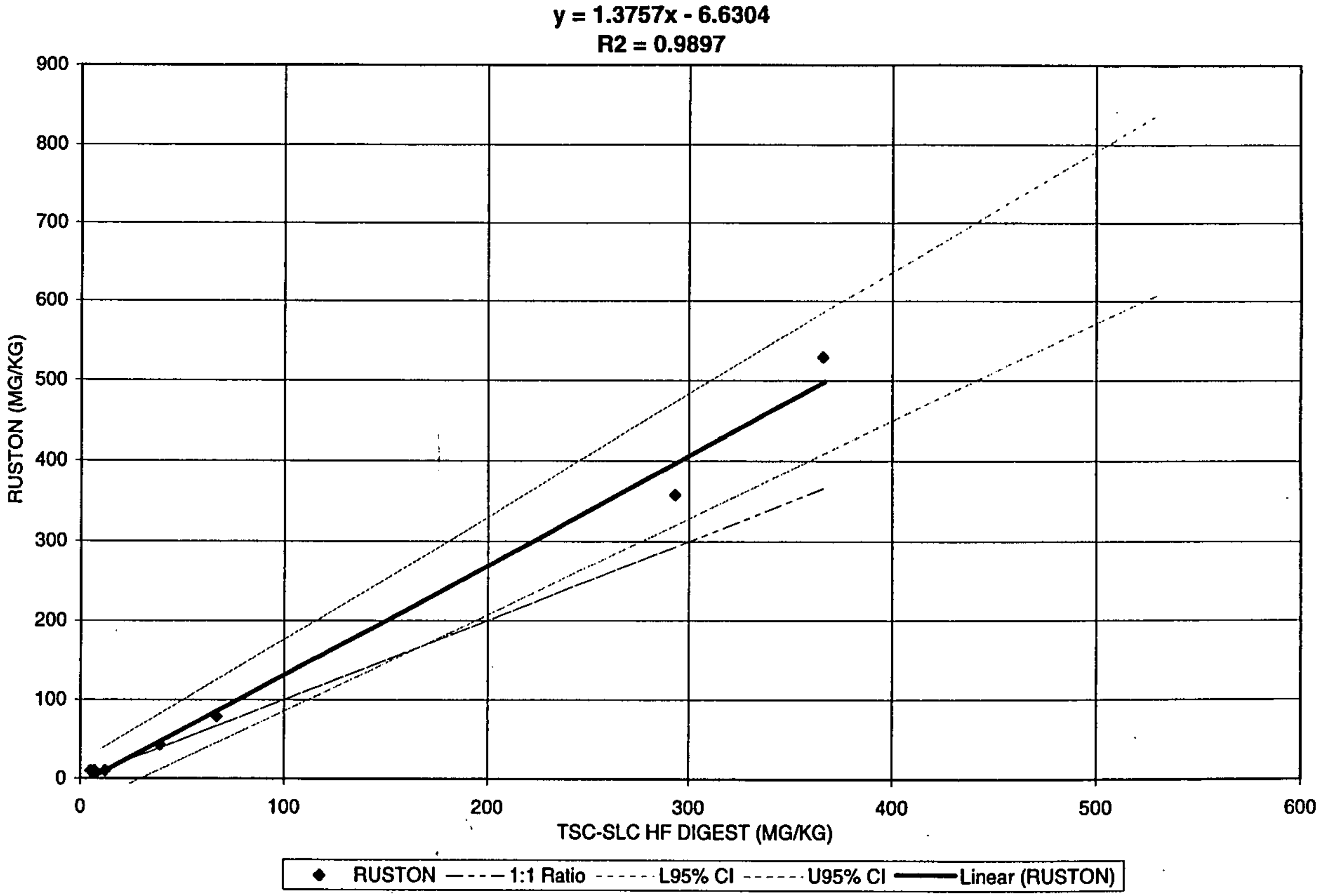
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-6.630351877	11.30551569	-0.586470539	0.583036001	-35.69205766	22.4313539
TSC-SLC HF DIGEST	1.375681195	0.062914894	21.86574749	3.71363E-06	1.213953575	1.537408816

t-Test: Paired Two Sample for Means

	TSC-SLC HF DIGEST	*RUSTON*
Mean	112.7142857	148.4285714
Variance	22850.2381	43696.28571
Observations	7	7
Pearson Correlation	0.994811746	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.558224804	
P(T<=t) one-tail	0.085095687	
t Critical one-tail	1.943180905	
P(T<=t) two-tail	0.170191374	
t Critical two-tail	2.446913641	

Descriptive Statistics	*TSC-SLC HF DIGEST*	*RUSTON*
Mean	112.7142857	148.4285714
Standard Error	57.13422554	79.00839532
Median	39	43
Mode	#N/A	10
Standard Deviation	151.1629521	209.0365655
Sample Variance	22850.2381	43696.28571
Kurtosis	-0.423118009	0.50356769
Skewness	1.226765081	1.401409481
Range	361	519
Minimum	5	10
Maximum	366	529
Sum	789	1039
Count	7	7
Confidence Level(95.0%)	139.8025158	193.3267202

LEAD (PB) REGRESSION CHART



OUTLIER AND COMPLETENESS EVALUATION BETWEEN SAMPLE RECEIVED FROM LABS TSC-SLC (HF DIGEST) AND RUSTON

08/20/98 TO 02/12/99

PARAMETER: ZN

Precision Results: Total Number of Pairs: 3; Total Number of Outliers: 0; Number of Valid Pairs (k): 3; Dixon Q's Test Value: 0.886; 90% t value: 2.920; 95% t value: 4.303; Completeness: 100.0%; Standard Deviation: 0.19; 10% Uncertainty: 46.07; 5% Uncertainty: 67.89; Mean Percentage RPD: 25.4%; Validation Detection Limit (VDL): 10.0; Control limit: 35.0% RPD or for values less than 5 times VDL: the absolute value of the difference between results needs to be within 2 times the VDL.

CODE	SAMPLE NUMBER	SAMPLE DATE	TSC-SLC (HF DIGEST) LAB NO	RUSTON () LAB NO	TSC-SLC (HF DIGEST) RESULTS	RUSTON () RESULTS	RELATIVE PERCENT DIFFERENCE	WITHIN CONTROL LIMITS	OUTLIER	COMMENTS
ZN	EVT-9809-176	09/30/98	294-4142	98R-02636	450.0	463	2.8%	Yes	No	2.8%
ZN	EVT-9808-500	08/25/98	294-4139	98R-02319	1000.0	1279	24.5%	Yes	No	24.5%
ZN	EVT-9808-4MB	08/28/98	294-4140	98R-02394	135.0	82	48.8%	No	No	*OUT* 48.8%
ZN	EVT-9809-109	09/23/98	294-4141	98R-02585	50.0	30	50.0%	Yes	N/A	|20| < 20
ZN	EV-21B-4	02/08/99	L99-4725	99R-00043	64	37	53.5%	No	N/A	*OUT* |27| > 20
ZN	HP-47-5	02/10/99	L99-4726	99R-00063	78	36	73.7%	No	N/A	*OUT* |42| > 20
ZN	EVT-9809-183	09/30/98	294-4143	98R-02673	21.0	90	124.3%	No	N/A	*OUT* |69| > 20

ZINC (ZN) COMPARISON STATISTICAL SUMMARY

Regression Statistics	
Multiple R	0.991932193
R Square	0.983929475
Adjusted R Square	0.980715371
Standard Error	64.32640518
Observations	7

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1266725.425	1266725.425	306.1286129	1.11805E-05
Residual	5	20689.43202	4137.886403		
Total	6	1287414.857			

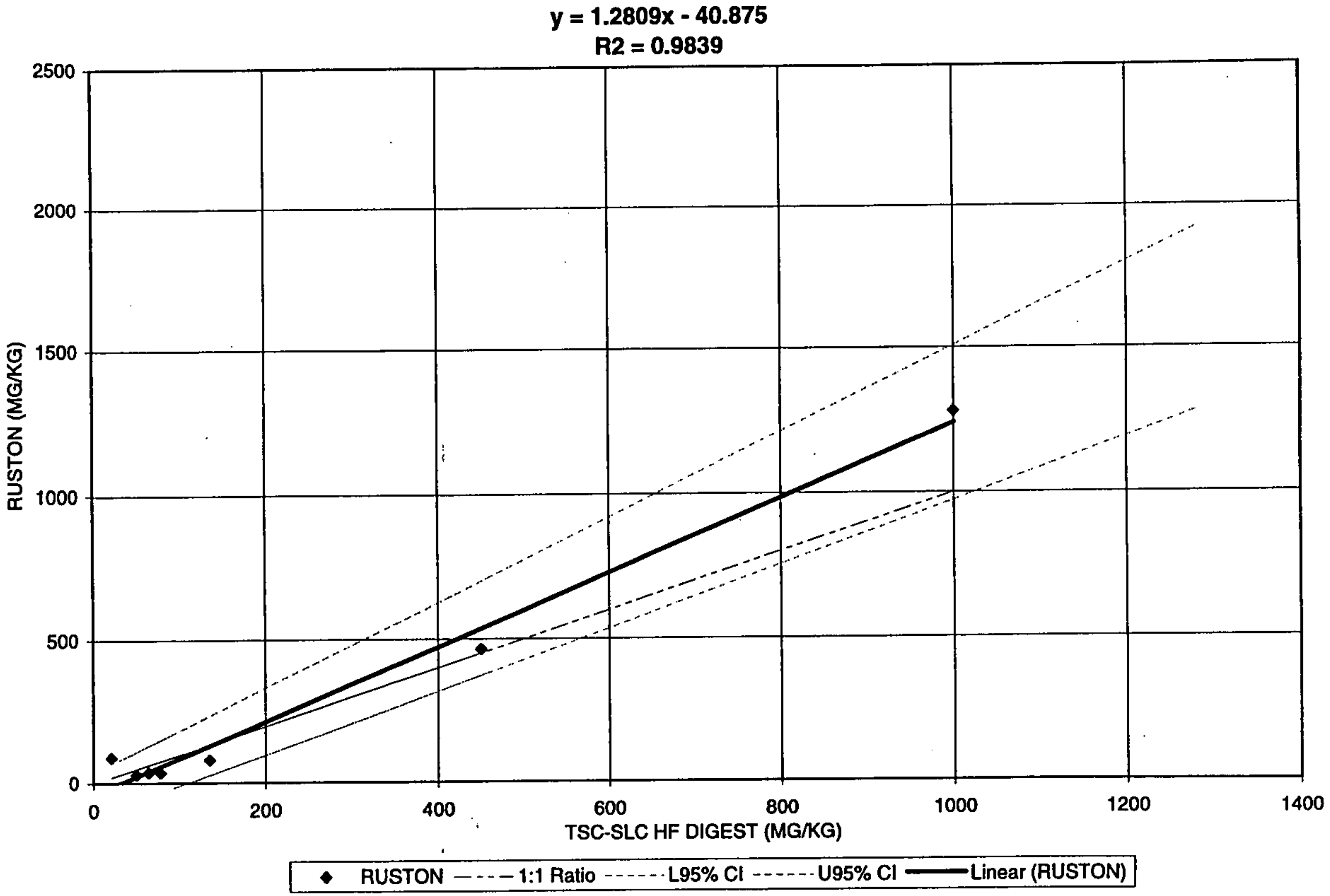
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-40.87502271	30.73670784	-1.329843877	0.241004789	-119.8861165	38.13607103
TSC-SLC HF DIGEST	1.280937241	0.073210924	17.49653145	1.11805E-05	1.092742876	1.469131606

t-Test: Paired Two Sample for Means

	TSC-SLC HF DIGEST	*RUSTON*
Mean	256.8571429	288.1428571
Variance	128669.4762	214569.1429
Observations	7	7
Pearson Correlation	0.991932193	
Hypothesized Mean Difference	0	
df	6	
t Stat	-0.709689899	
P(T<=t) one-tail	0.252264357	
t Critical one-tail	1.943180905	
P(T<=t) two-tail	0.504528714	
t Critical two-tail	2.446913641	

Descriptive Statistics	*TSC-SLC HF DIGEST*	*RUSTON*
Mean	256.8571429	288.1428571
Standard Error	135.5778512	175.079224
Median	78	82
Mode	#N/A	#N/A
Standard Deviation	358.7052776	463.2160866
Sample Variance	128669.4762	214569.1429
Kurtosis	3.449079143	4.540198134
Skewness	1.925829702	2.142325078
Range	979	1249
Minimum	21	30
Maximum	1000	1279
Sum	1798	2017
Count	7	7
Confidence Level(95.0%)	331.7472935	428.4037415

ZINC (ZN) REGRESSION CHART



APPENDIX C
AQUATRACK REPORT

AquaTrack Survey

Everett Smelter Site
Everett, Washington
September, 1998

Jerry R Montgomery, Ph.D.
Sarah E. Montgomery

Hydro Geosciences Inc.

825 South 5th West
PO Box 701290
Salt Lake City, UT 84170-1290
(801) 595-8881 fax (801) 595-8885

TABLE OF CONTENTS

LIST OF FIGURES

EXECUTIVE SUMMARY

Personnel from HGI conducted an AquaTrack survey in conjunction with the lowland investigation in Everett Washington. The overall goal of the survey was to identify subsurface-water flow paths.

The first priority of the survey was to try to locate if there was any connection between a plume identified in the lowland area with water in the upland area. If such a path(s) existed, HGI would identify the path(s) and find out as many characteristics of the path(s) as could be determined from the data. In this regard, HGI was asked to provide information on the following:

1. The location of the source of the subsurface-water in monitoring well EV-8B.
2. The source of metals being found in well EV-8B.
3. The path, or route, of the water from the source to monitoring well EV-8B.

If the data permitted, a secondary consideration was to identify if there was a connection between the shallow and deep water systems, and if possible identify the location of this connection.

The third consideration, if time permitted, to follow the plume to the east across the railroad tracks.

CONCLUSIONS:

Because the interpreters realized the importance of this clean-up project many minor and anomalies and all current paths were included in this report that would have otherwise been ignored. This was done so that all potential problems could be looked at and evaluated, so there would not be any surprises in the future relating to long linear conductors in that area.

The results obtained from the AquaTrack survey are summarized below.

1. Locate the source of the subsurface-water that was found in monitoring well EV-8B.
- As a result of this survey, five and possibly six channels were identified in the area surveyed.
- There are indications from the data, such as the erratic anomaly pattern around the 5th Street water line, that water could be leaking in the area.
- The data suggests that the source of some of the water is still further up gradient from Pilchuck Path.

2. Find out if the source of metals found in monitoring well EV-8B might be originating from the upland area.
- All of the five to six channels connected to monitoring well EV-8B pass through the upland area.
- Channel 4 passes through the area of the former arsenic kitchen.
- Channels 1 and 3 pass through the former arsenic process dust chambers.

- Channels 2 and 5 come from the direction of the former roasters.

3. Identify the path, or route, of the water from the source to monitoring well EV-8B.

- As a result of this survey, five and possibly six channels, were identified in the area surveyed.
- Two channels lead to an area south of the known plume(channels 3 and 4).
- Three channels lead to the area of monitoring well EV-8B(channels 1, 2, and 5).
- A channel may also exist that follows the 5th Street water line to the area of monitoring well EV-8B(channel 6).
- There is an electrical connection between Channel 1 and Channels 3 and 4. This may represent an additional flow path of water that transports some of the water moving down Channels 3 and 4 over to Channel 1.
- The are indications that Channel 5 is partially blocked at the Weyerhaeuser entrance road. This could be due to compaction resulting from heavy truck traffic.

There was insufficient field time to determine the possible connection of the deep and shallow aquifers. These tasks would have required new antenna arrangements and a repeat survey over some of the area. In addition, time did not allow the collection of data relating to the eastern movement of the plume. So, it was concluded that the available time would be better spent in obtaining as much data relating to flow paths, to satisfy the needs of the primary objective.

An attempt was also made to collect data east of the railroad tracks. Because the antenna arrangement had the primary loop to the west, the signal east of monitoring well EV-8B was non-existent. In order to probe east of drill hole EV-8B a new primary loop or antenna would need to be created.

AQUATRACK BACKGROUND

AquaTrack uses electrons as tracers. Because long linear conductors such as water, ore bodies, and utility lines are the best conductors in the ground the electrons will follow them. A moving electron generates a magnetic field. By mapping the magnetic field the electron flow is mapped. The map of current flow thus generates a map of the groundwater, and any other conductors such as utility pipes and ore bodies.

AquaTrack uses electromagnetic energy, injected into the groundwater being investigated, to map water and related geologic structures. More specifically the technology can be used to map, track, and monitor: groundwater, groundwater channels, groundwater structures, subsurface pollution plumes, map interconnected fracture or porous zones, map leaks in earthen dams, map leaks in drain fields, monitor changes in subsurface water flow, monitor changes in ion concentration in groundwater, monitor in situ leaching solution, monitor movement of heap leaching solutions, monitor changes in subsurface redox or reaction fronts, monitor underground chemical reactions, monitor subterranean bioreactions, or other subsurface waters and related geologic structures.

For a more detailed explanation refer to the appendixes at the back of this report.

As part of the continuing investigating effort HGI was retained by Hydrometrics to map potential water channels connecting the upland area with the currently identified water in the lowland area.

EQUIPMENT AND SETUP

The AquaTrack survey requires the establishment of an electrical circuit which includes the water body of interest as part of the circuit. Groundwater is almost always a significantly better conductor than the surrounding soil or rock, due to waters ability as a solvent. The dissolved solids in all ground waters turn the water into an electrolyte.

At least one direct contact with the water is desirable to establish the circuit. (It is possible to conduct a survey without a direct contact with water but the results will not be as reliable as the current could potentially follow another conductor in the ground.) One or more injection electrodes are placed into the water to be mapped. A return electrode placed in a second contact point with the water completes the circuit and the water's path between the electrodes can be mapped. If a second contact is not available, a series of return electrodes are placed outside the area of the survey and the electric current will flow down the water of interest as far as it can. The current will then take the best path (least resistance and generally the shortest) to the return electrodes, completing the

Figure 1: Survey Area.

circuit. Most surveys, including this one, utilize only one direct contact point with the water being surveyed.

Survey Area

The survey area covered the slag outcrop in the lowland area to the railroad tracks, the fenced in area in the upland, and the cloverleafs at the East Marine View drive and Broadway interchange. The area that the survey covered is shown in Figure 1.

Electrode Placement

The first electrode, which was two feet of copper 1/4 inch pipe was placed into monitoring well EV-8B. This electrode location is in the lowland area and is shown as a red "X" in Figure 1. The security fence for the fenced area in the uplands between Hawthorn street and Pilchuck Path was used for the return electrode contact site. This fence was chosen because it was the furthest fence from the electrode in the well and therefore would have biased the survey the least of all the fences in the upland fenced-in area. The fence was also at the edge and not in the middle of the area surveyed, this way the fence would not act as the easiest path for the electricity to follow in the survey area, therefore obscuring the current being carried by the ground water that same area. To make the fence the return electrode the antenna wire was directly connected to the fence with a series of alligator clips.

Copper wires connected both sets of electrodes to the signal transmitter and the power supply, which were located next to monitoring well EV-8B. The antenna wire ran from the well east toward the western edge of the railroad tracks then turned and went north under the new Weyerhaeuser bridge. Then about midway between the new and the old Weyerhaeuser bridges the wire turned west until it went under the old bridge to the base of the hill running along SR-529. The wire was run up the hill to the northwest to the side of SR 529 and then west along the edge of the road following the south edge of SR-529 or Broadway. The wire then went along the edge of Broadway toward to the southwest over the bridge and into the grass area in the clover leaf of the Broadway and East Marine View Drive interchange. In the middle of the grass area, the wire was secured to a tree then strung to the top of the tree. The wire was run over the road to the southwest to a lamp post between two off/on ramps. From this point the wire was continued overhead to a tree on the hill near 5th Street. From the tree the wire was secured on a fire hydrant in the fenced area. The wire then followed the security fence west and was finally connected to a post near the northwest corner at Hawthorne Street. The approximate location of the electrode wires and electrodes are shown in Figure 1.

Grid Location

Due to existing conditions with the house foundations in the fenced area, and the blackberries in the lowland area, survey lines were put wherever it was possible to take readings. Along the available lines, readings were taken on 25 foot spacings. On a few occasions 12.5 foot stations were taken in order to better define a channel center. Figure 4 shows the survey lines.

In the lowland area, survey lines(lines 1, 2, 3, and 4) usually followed roads. A few lines were needed to fill in data gaps, so survey lines were also cut in the blackberries to obtain readings.

In the upland area, survey lines were positioned along roads and, where possible, in backyards. Backyards were used to avoid as many buried utilities as possible. Thus, where there were house foundations and yards, the lines were basically north/south, these lines were SL 6,7,8 ans SL 5th street. The roads used as locations for survey lines were the east and west sides of East Marine View Drive, the west side of the alley between Pilchuck Path and East Marine View Drive(survey line alley), and the west side of Pilchuck Path(survey line Pilchuck). There was also a line starting on the west side of the Weyerhaeuser guard station extending down the side of the hill to the blackberries(survey line 5, and 5 Extra).

INTERPRETERS NOTE

This section has been included for clarification on terms used in this report Survey lines' (SL), are lines of data collection in the survey area. Profiles are the survey lines data after mathematical corrections have been made for objects that influence the data such as power lines and known utilities. Line s a survey line of data stations referring to as a profile or SL. Station refers to a point on a survey line where that data were collected. Channel(s) are paths of current flow that can result from groundwater, utility lines, soil disturbed by past trenching or abandoned structures such as old underground flews, etc.

SURVEY DATA AND CORRECTIONS

At each survey station location, data was taken to calculate the magnitude and direction of the magnetic field produced by HGI's transmitter. This data was recorded and then transferred into a spreadsheet to facilitate subsequent calculations.

The corrections that were made to the data are as follows.

- First, all values were corrected and tied to the base station which was located at Line 1 station 0.75 north. This accounted for drift in the transmitter or receiver.
- Second, all values had the effect of the electrodes removed. This correction is based on the assumption that the fall off is related to the inverse distance from the electrode or pole.

- Third, the effect of the wire position in relation to the station was removed. The effect of the wire is assumed to be straight lines and the standard fields that they create were removed.
- Fourth, with the exception of the water line along 5th Street, corrections were made for known utilities (i.e., power lines, water line on Pilchuck, the alley, and East Marine View Drive). When a known source of magnetic field is paralleled it adds approximately the same amount of field value to each station. This value can be determined by building pseudo profiles running perpendicular to the regular profiles and determining the amount of offset that has been introduced by the known utilities.

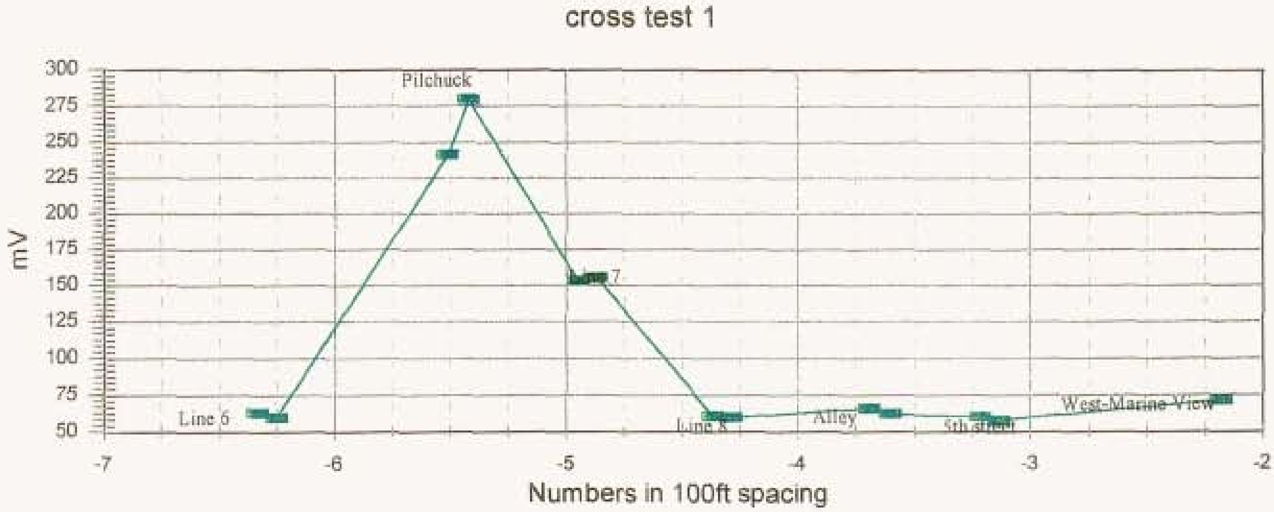


Figure 2 Cross test 1

One of the SL's that showed a pronounced effect from a utility line was SL Pilchuck. Figure 2 demonstrates how the effect of the utility line was removed from the data. Two values from each line were used for the purpose of comparison and averaging. The first thing that becomes apparent is that Line 6, Line 8, the alley Line, the 5th Street Line and West Marine View all have about the same value. Line 7 and Pilchuck are different. A water line runs between Pilchuck and Line 7, and it is closer to the Pilchuck Line. The difference between the average values of the five lines with the same magnitude were subtracted from the Pilchuck Line and Line 7.

Cross test 2 (Figure 3) shows the Pilchuck Line before and after the removal of the water line. The water line on Pilchuck branches off from the 5th Street water line at station -0.75. At that point, the average level of magnetic readings increased by a constant amount. The difference between that increase at station 1 on Pilchuck and the overall average of Lines 6 and 8 were used to determine this correction. The average values of Lines 6 and 8 provide the final correction factor to remove the effects of the water line from the readings taken along Pilchuck. The spike effect of the 5th Street water line has been removed so that the reader can visualize the process.. The same type of process was used to make corrections to SL 7 for the same pipe line.

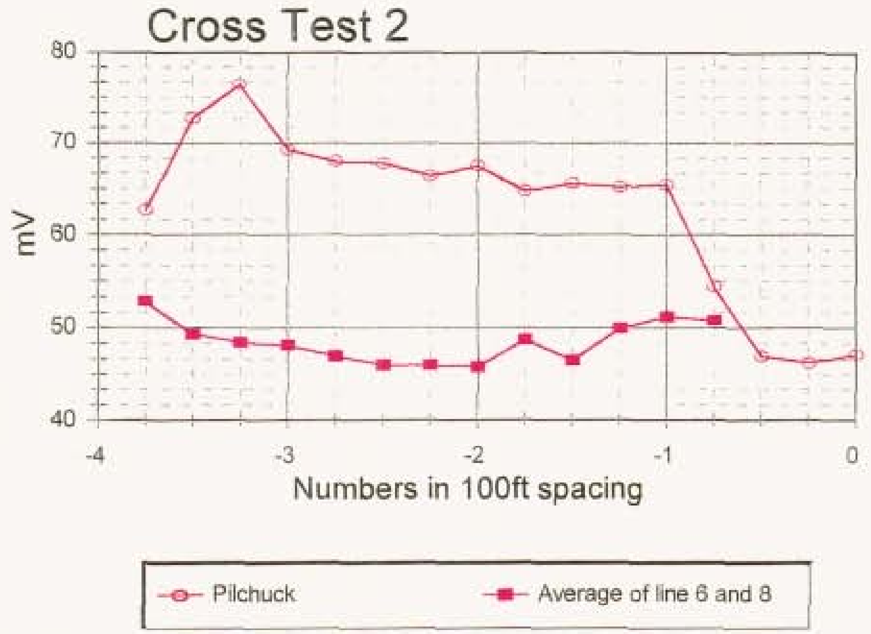


Figure 3 Cross test 2

Subsequently the data for this survey was analyzed two ways. The magnitude of the magnetic field is used to produce a contour map. All data points available are used in this analysis which allows the basic path of the electric current determined. The electric current indicates a potential water flow path.

Analysis of survey lines from data or profiles provide information on the location of the center of the current channel, the channel edge, or shape of the channel, and the center of minor channels in a broad or interconnected flow. Because of the many interferences from cultural effects in a residential area, the only relatively reliable location is the location of the channel centers. The data spacing was generally 25 feet thus the margin of error is half the distance between stations which is about 12.5 feet.

The anomalies from this survey in the upland area are very narrow. This is possibly indicative of several things such as:

- First, very shallow channels.
- Second, very narrow channels.
- Third, some combination of the first two.
- Fourth, possibly picking up interconnecting buried water, sewer or gas lines, old trenches, and subsurface wires.

These possibilities were minimized by trying to limit the survey to back yards whenever possible.

- Fifth, possibly picking up old buried structures that predate the construction of homes.

The overall models seem to be consistent. Channels have been identified by connecting similar anomalies based on size and shape of the curves from one profile to the next. The profiles are built by removal of all the known fields which leaves the basic profile. The horizontal magnetic field highs represent where electrical current or water is flowing. The high amount of noise in this survey area due to culture, for example utility lines, precluded the use of edge location calculations, however the channels are not very wide because they usually show up only on one station.

Near monitoring well EV-8B until East Marine View Drive most of the current is carried in Channel 1. However, in the fenced area there appears to be more current in Channels 3 and 4 than in Channel 1. An allowance might be made for the amount of current being taken by the water line in 5th Street, but even so this does not explain all the differences. The magnitude of the anomalies changes between the west Marine View Profile and, or 5th Street Profile. The 5th Street Profile was run down the front yards of the first two houses but was down the back yards for the rest of the houses. There is possibly an electrical connection between Channel 1 and Channels 3 and 4. This connection could be a water channel or it could be the result of a water pipe or some other conductor carrying current between the various channels.

SURVEY RESULTS

Contours- Channel Location

Electromagnetic theory predicts that the maximum horizontal component of the magnetic field produced by a long conductor will be directly over the conductor. A plot of the maximum horizontal field measurements will therefore produce a contour map that can be used to map the flow of water in the ground. Figure 4 is a plot of the maximum horizontal field mapped for this survey. Data points are marked with a small "+". The contours were produced using all data points available. A standard contouring program, "Surfer" was used. This program utilizes one of the standard contouring methodologies "Kriging" to develop the contour pattern. Unlike hand contours, a computer program can sometimes present misleading plots. This usually happens near the edge of the data where the program makes assumptions on how to fill in spaces without data. Another tendency is to draw circles around high or low data points. Often it is best to connect these circles rather than show them as isolated highs or lows. The

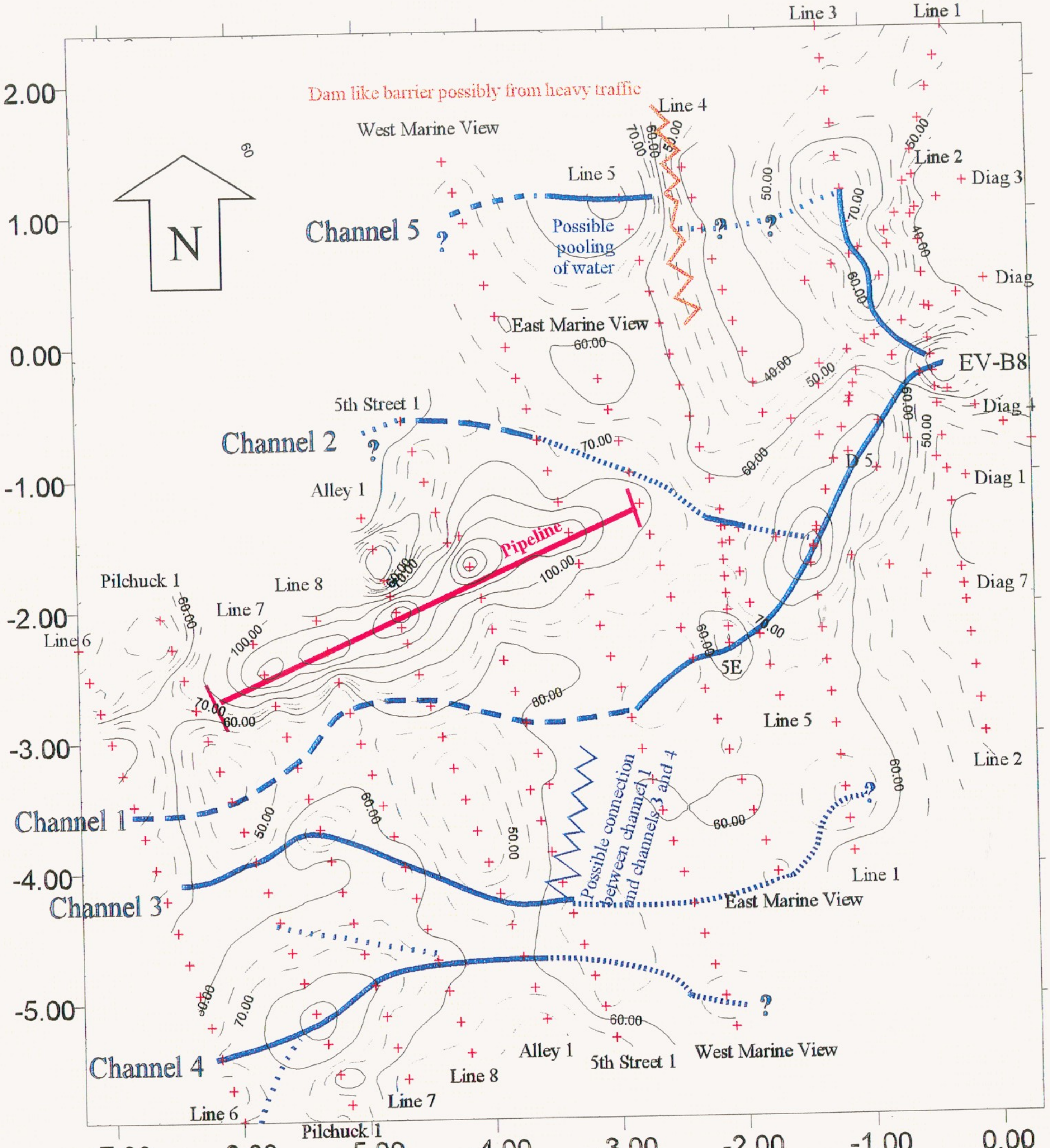


Figure 4 Plot of survey lines, station location and interpretation of current flow paths.

grid on the edge of Figure 4 relates to a 100 foot grid using monitoring well EV-8B as the 0,0 or center of the grid.

In Figure 4, assumed water channels, as indicated by electron flow, are shown in blue. The stronger the anomaly the stronger the line. Dotted or dashed lines are less current flow. This can be the result of wide-line spacing, weaker anomalies on the profiles, or channels that are at the edge of the data. The east end of Channel 3 is a prime example of an anomaly that is at the edge of the data. Another example is the west ends of Channels 2 and 5. Both channels are at the end of survey lines and at the western most extent of the data on the northwest side of the survey area.

On Channel 5 near the north end of Lines 4 and 5, there is a classic anomaly that usually represents water pooled up behind some type of barrier. This can occur naturally or be man made. In this case, it would be possible that a pseudo dam is created by compaction due to vibration from the heavy truck traffic that uses the road between Lines 4 and 5. This is further emphasized by the fact that the anomaly appears to end where the trucks turn into the Weyerhaeuser entrance road at the top of the bluff.

There also appears to be some type of connection between Channel 1 and Channels 3 and 4. This is based on the observation that the eastern portion of Channel 1 is carrying the majority of the current. This is true until the current reaches East Marine View Drive. At that point the majority of the current is pulled off by the water line that runs up 5th Street. The major portion of the remaining current seems to be running up what has been labeled Channels 3 and 4. Channel 1 becomes a minor conduit for current. This anomaly in current flow indicates one of two possibilities:

- First, there is some type of electrical connection between Channel 1 and Channels 3 and 4, and that Channels 3 and 4 are more conductive than Channel 1.
- Second, Channels 3 and 4 on the west side of the survey may, in reality, be Channel 1 on the east side of the survey.

The anomaly associated with the water pipe running down 5th Street is not a simple straight line as one would expect from such a feature. It does not show a consistent width or magnitude of field strength. These are indications that water may be channeling around the pipe. The other indication of this is that the anomaly on line 5 for Channel 2 is stronger than would be expected from the rest of the data relating to Channel 2. However there are a series of explanations that could explain these discrepancies.

- The current coming up the bluff in Channel 2 may be coupling with the water line in 5th Street
- The current in Channel 1 when it reaches East Marine View Drive is shorted over to the water line in 5th Street by a pipe in East Marine View Drive.
- Water could be following the pipe under 5th Street, and this water is responsible for all the electrical interconnections between the channels and the water pipe.
- The value of the anomaly for the 5th Street water line is about 2 to 3 times stronger than any anomaly associated with other pipe lines in the area.

These observations indicate that there is a high likelihood that water is following the 5th Street pipe line.

PROFILE INTERPRETATION

Contour maps of the data provide a significant quantity of information, but contours by themselves are often difficult to interpret. Further refining of the data requires analysis of the data line by line.

Profile or SL data provides information on the center of the water channels, and usually the location of channel edges and a general idea of the shape of the channel. However, in the upland area of this survey, cultural effects, such as power lines fences, etc., distorted the horizontal gradient of the vertical field and in the lowland area the compass directions were not consistent because of the effects of the slag. These two factors distort the math equations used to define channel width and shape. The magnitude of the horizontal anomaly is related to amount of current being carried by the channel or the depth of the channel. These are akin to the uncertainty principle in physics.

The maximum horizontal magnetic field did not appear to be affected and this data is used to locate the center of the channel. The maximum horizontal field in the data also provides some information on depth and width of the channel. The width of the magnetic anomaly seen in the data can provide qualitative information on depth and width of the current channel. The narrower the magnetic anomaly the more shallow and, or possibly the narrower the current channel. The wider the magnetic anomaly can indicate a wider or possibly a deeper, narrow channel. The maximum horizontal field anomalies in this survey are generally narrow being only one station wide. Thus, most of the anomalies seen in this survey generally are indicative of shallow flow in narrow channels. There are exceptions in places where the channels seem to widen a bit and are identified on the individual profiles.

For the most part SL's from this survey run north-south except for the diagonals. The profiles are presented in this report from west to east as far as possible. Profile data is used to define the features that run perpendicular or near perpendicular to the direction of each line or profile. Every attempt has been made to line them up as they would be aligned on the ground.

The station numbering system used by HGI is based on a scale of 100 feet. Thus the distance from station 2 to station 2.75 would be 75 feet. The starting points of each profile was arbitrary but every profile and all stations were eventually tied to a grid that used the position of monitoring well EV-8B as 0NS,0EW. Usually stations south and west of the 0NS0EW, are indicated with negative numbers, and stations that are north or east of the well are positive numbers.The slag in the area made obtaining meaningful compass bearings very unlikely thus the north bearing on the map supplied to HGI by Hydrometrics was used.

Survey line 6 is furthest west and is near the western edge of the fenced area (see Figure 5). A spike at station -0.75 appears to be either a shadow of the 5th Street pipeline or possible part of an extension of Channel 1. The center of Channel 1 is located at about station -1.25. Channel 3 is located at -1.75 and Channel 4 center is about -3.25. Two side Channels to Channel 4 are possibly visible on Line 6. All these channels are only one station wide on this profile which may indicate they are both shallow and narrow.

The survey line along Pilchuck Path also shows Channel 4, but the anomaly is stronger and wider(se Figure 6). This could be a result of current gathering that is occurring at this point to allow some of the current to transfer to the north along the pipeline. The shadow effect seen on Line 6 is the result of two things. First, current focusing toward the contact point on the perimeter fence from the pipe in 5th Street and second, a siphoning off of current from the pipe in Pilchuck Path.

On the Pilchuck Path Profile, Channels 3 and 1 are very weak. Channel 4 and it's side or feeder channels are very strong. This is indicative of several possibilities. The most likely choices are that the channel is shallow and spread out. The whole of the Channel 4 system in this area is a minimum of 200 feet wide, running from the southern most extent of the profile to about station -2.4 on this line. This system is associated with the old arsenic kitchen location and could be a result of the debris left when the kitchens were torn down. The strength of the anomaly at station -2.25 could indicate a point of current gathering due to an increase in ions or ion uptake in the water, or an increase of subsurface soil conductivity resulting from remnants of the old arsenic kitchen, or could be some other unknown factor.

On Profile 7, Channel 4 appears to have a center plus a broader associated channel (see Figure 7). The primary channel center is located at about -2.25. The total extent of the channel runs from about -2.8 to about -1.4. Close and adjacent to Channel 4 is Channel 3. Channel 3 is stronger on this profile than on the previous profile. This could be that some of the current following Channel 3 could be siphoned off to Channel 4 between this and the previous profile. The relative amplitude of the anomalies would support this hypotheses thus indicating possible interconnection along the paths of Channel 3 and 4 through the kitchen area. Channel 1 is almost non-existent on this and the previous profile. This is probably due to the current that was following Channel 1 being passed to Channels 3 and 4 and the 5th Street water line.

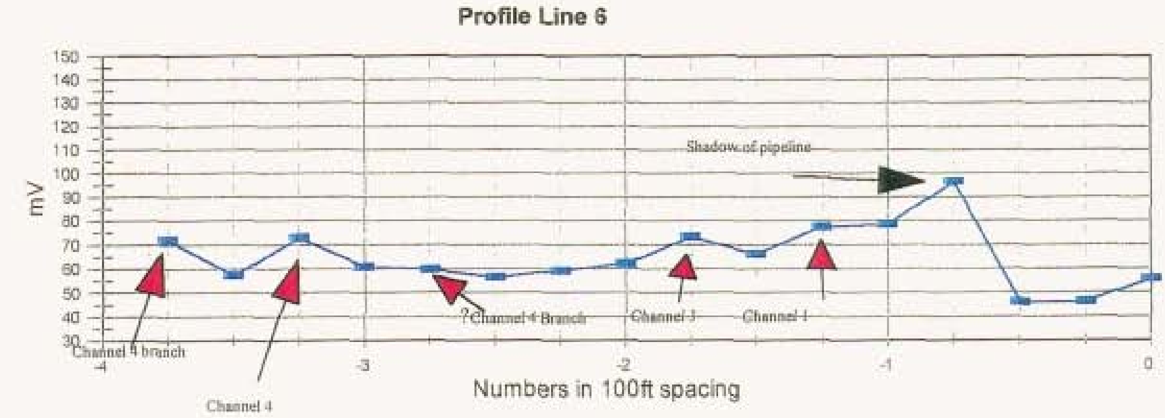


Figure 5. Profile Line 6

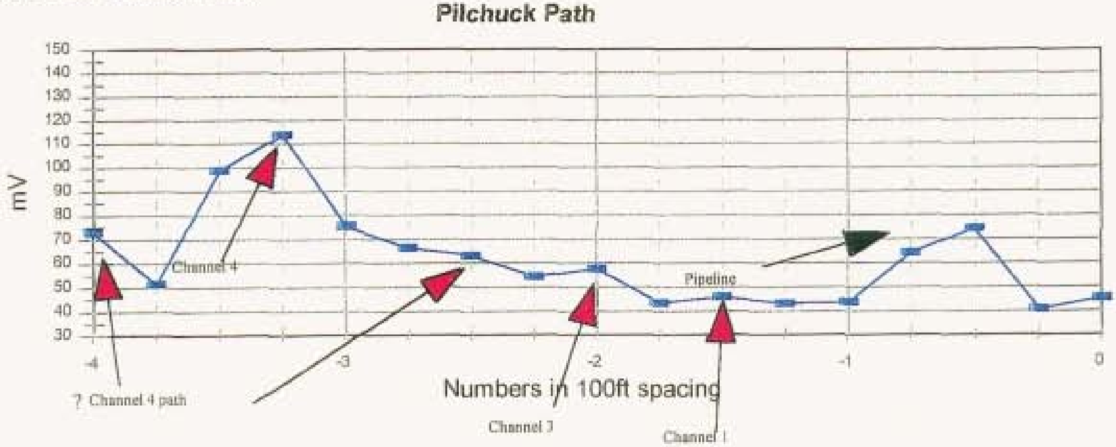


Figure 6. Profile Pilchuck Path

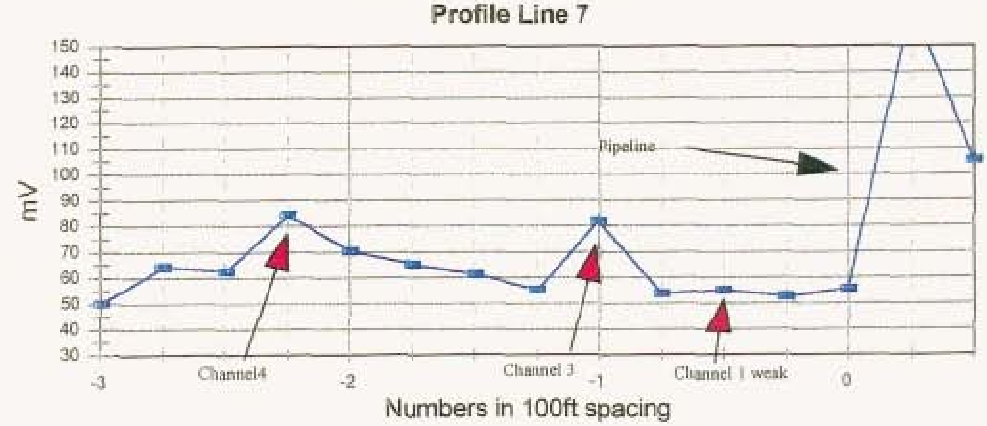


Figure 7. Profile 7

On Profile 8 the magnitude of the center channel anomalies associated with Channels 3 and 4 are approximately the same and Channel 1 appears to be a side effect (see Figure 8). The total effective width of the Channel 3 and 4 system appears to run from about -2.8 to about -0.6.

On the Alley Profile, Channels 3 and 4 have become more entangled, and the system becomes more narrow (see Figure 9). The extent of the combined channels run from about -4.0 or a little more to -2.8. Channel 1 has moved over to where it makes contact with the 5th Street water line. It shows only as a shoulder on the anomaly. This association appears to have accentuated the anomaly at this point. At the north end of the Alley profile, the first effects of Channel 2 can be seen.

The 5th Street line runs perpendicular to 5th Street. Channel 3 and 4 are very similar on this profile compared to the Alley Profile. The maximum has switched, however, the basic anomaly is about the same width and the separation of centers is about the same (see Figure 10). On this profile Channel 1 has moved away from the pipeline and is still quite subdued. This profile only catches the edge of Channel 2 as on the Alley profile.

Between the Alley profile and the 5th Street profile the shoulder has changed from the south to the north side of the water line. This in an indication, that water is moving along the outside of the water line and it is not always equal on the sides. It is possible that this water line is leaking, supplying some of the water.

Other profiles show that a reduction in the magnitude of the anomalies are associated with Channels 3 and 4. For the profile on the west side of East Marine View Drive(West MV), the magnitude of anomalies associated with Channels 3 and 4 are reduced (see Figure 11). Additionally, the anomaly associated with Channel 1 increases markedly. This would indicate that a possible cross connection exists between Channels 3 and 4 and Channel 1 between the 5th Street and West MV profiles. There could be an exchange of water through adjoining channels or other type of electrical connection.

On West MV Profile, Channel 2 is a double channel just north of the water line. These anomalies are about the same magnitude as Channel 1. On this profile, evidence of Channel 5 is seen.

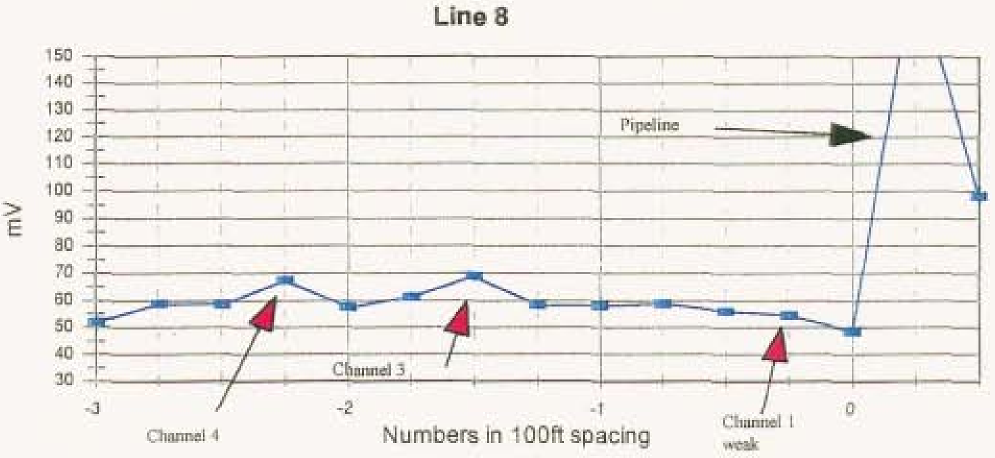


Figure 8. Profile 8.

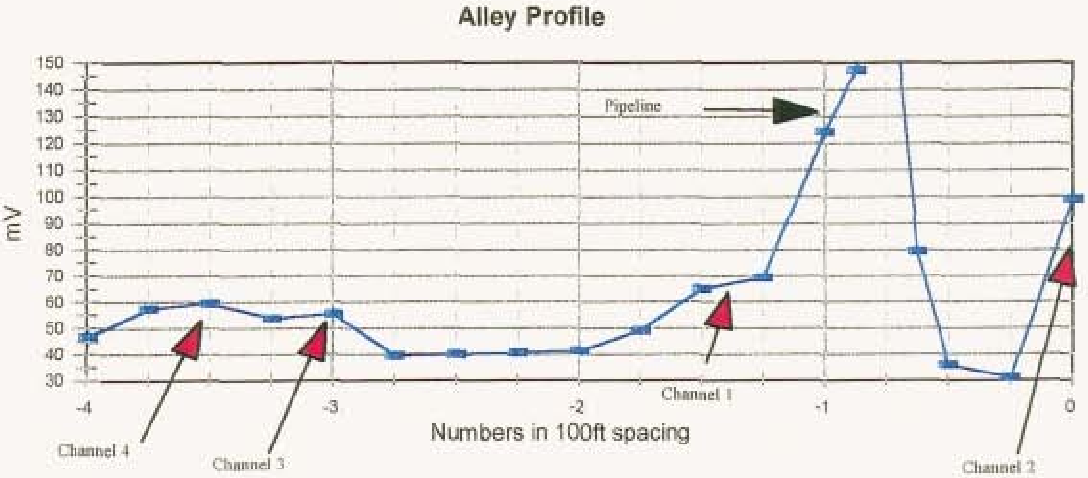


Figure 9. Alley Profile.

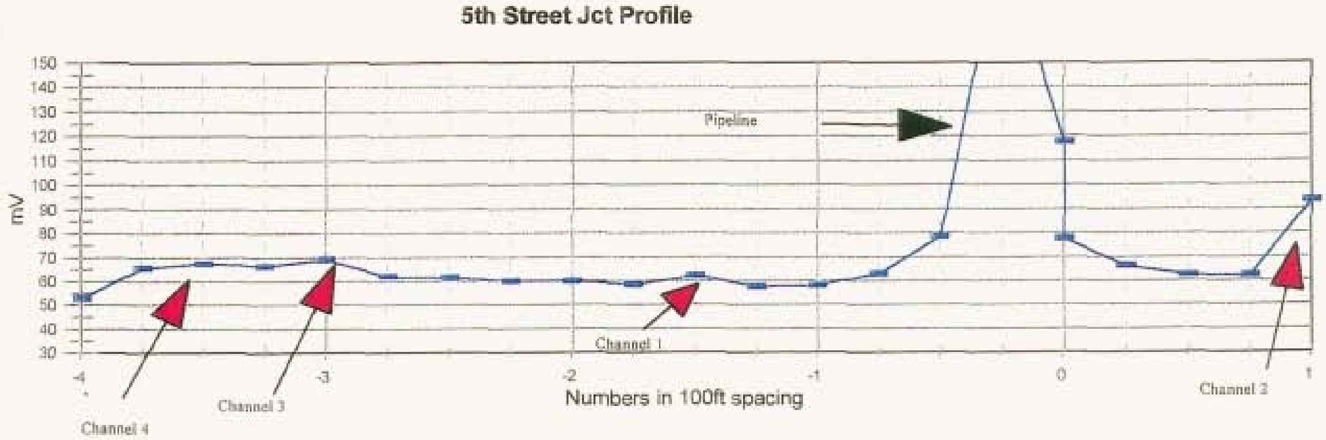


Figure 10. 5th Street Junction Profile.

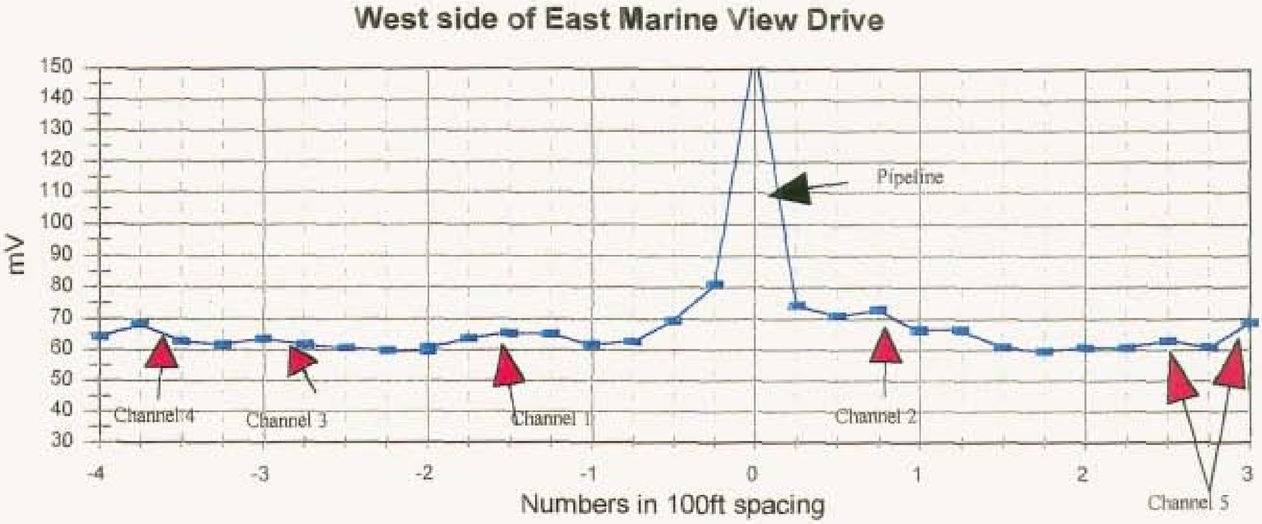


Figure 11. Profile East Marine View Drive, west side.

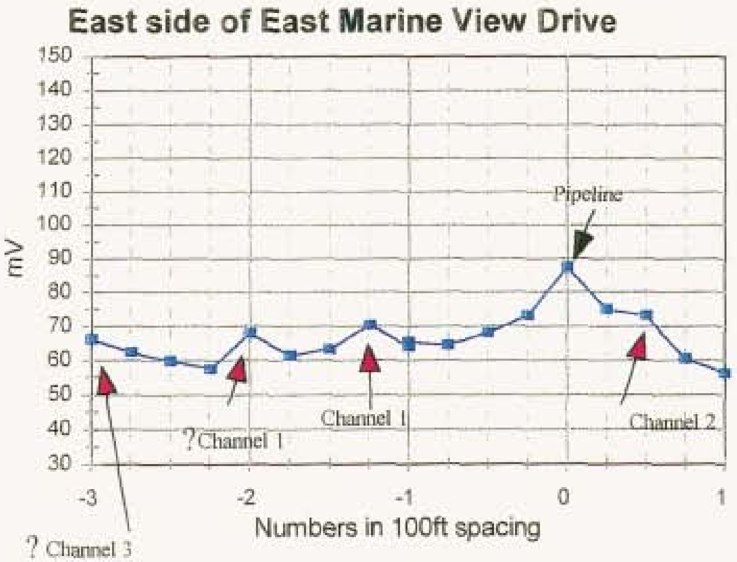


Figure 12 Profile East Marine View Drive, east side.

The east side profile of Marine View (East MV) only picks up the edge of Channel 3 and appears to show a split in Channel 1 (see Figure 12). There is the possibility that one of these two channels labeled 1 is really a "T" in the pipeline that runs along East Marine View Drive. Channel 2 is closing in on the pipeline anomaly and as will be seen it crosses it to eventually join up with Channel 1. The pipeline anomaly decreases at this point being only half as strong as it is just across the street. However the anomaly is quite broad on East MV, thus the total power or current flowing on both sides of the street is the same. This indicates a possible deepening of the current flow path.

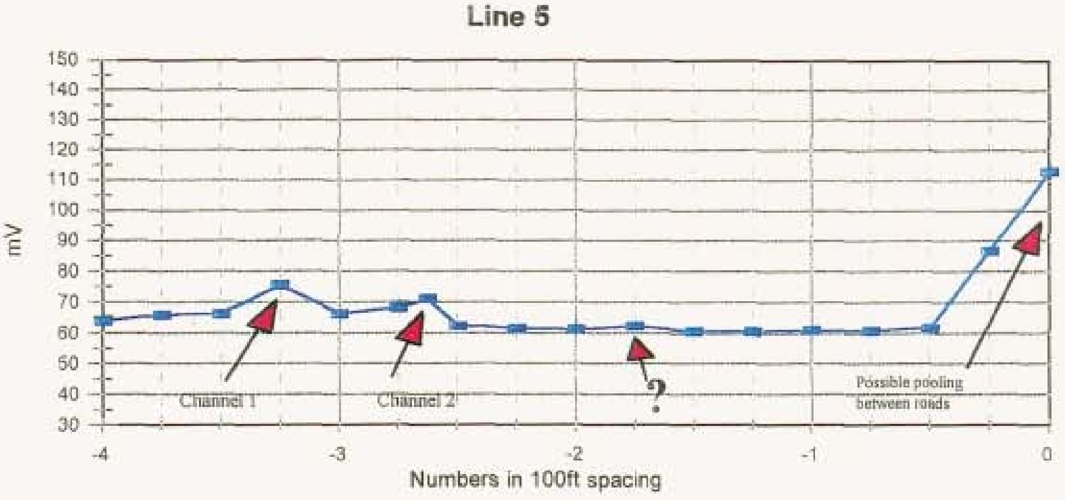


Figure 13. Profile 5. Cut path, east of tree on slag.

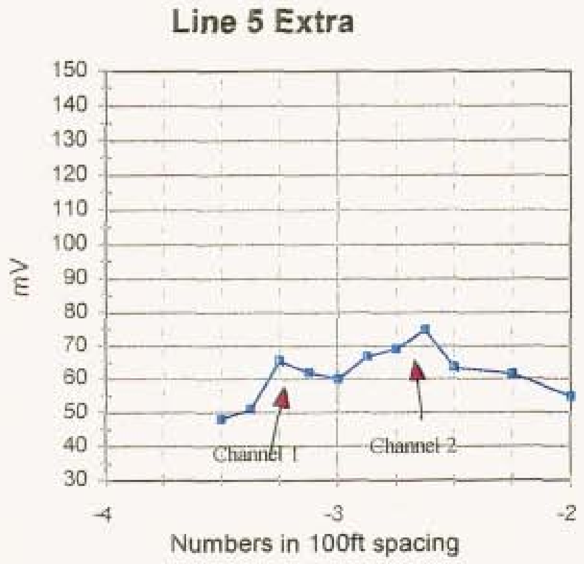


Figure 14. Profile 5 Extra. Cut path, west of tree on slag.

Profile 5 Extra, in Figure 14, is bowed. The basic form of the curve appears in line 5 as flat rather than bowed, see Figure 13. The presence of this artifact in line 5 Extra was not certain and could not be attributed to anything known in the area. Thus, the bow was not removed; however, this artifact makes Channel 2 appear to be stronger than Channel 1 on line 5 Extra. The field data indicates that both anomalies are about equal in strength. The data spacing over these two anomalies is 12.5 feet. Channel 1 is about the same width on both line 5 and 5 Extra.

The width of Channel 1 is estimated to be about 15 to 20 feet wide if it is only 10 feet deep. If the channel depth is 25 feet, the width would be closer to 10 feet.

The parameters for Channel 2 are very similar to those of Channel 1 on both line 5 and 5 Extra. At the bottom of the bluff, Channels 1 and 2 have combined to become a single channel.

The indications are that the single channel is more shallow than the two separate channels. This is suggested by two parameters. The first is that the general width of the anomaly created by the combined anomalies is about the same as each of the separate anomalies. The strength of the two anomalies combined is less than the strength of the anomaly on line 1. This is indicative that the anomalies on line 5 and 5 Extra are deep rather than shallow, and also indicates that they are quite narrow. Channel 5 is very strong near the north end of line 5. The anomaly on line 5 is much stronger than the anomaly on the west side of East Marine View Drive.

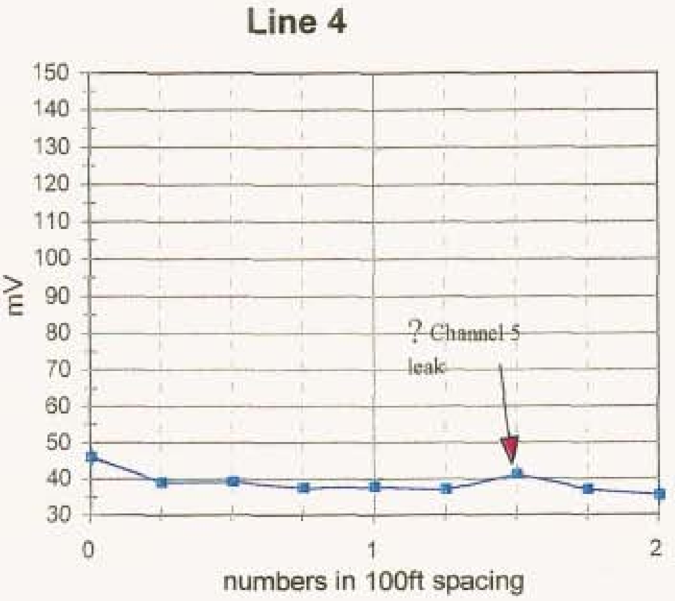


Figure 15 Profile 4.

There is almost no anomaly on Profile 4 (see Figure 15). This is a classical type of anomaly that usually represents water pooled up behind some type of barrier. Such barriers can occur naturally or be the result of man. Because of the location of this anomaly, the most likely explanation is a guess that a pseudo dam was possibly created by compaction due to vibration from the heavy truck traffic that uses the road between lines 4 and 5. Thus all indications are that Channel 5 is partially blocked at the Weyerhaeuser entrance road. This is further emphasized by the fact that the anomaly appears to end where the trucks turn into the Weyerhaeuser road at the top of the bluff. The question mark on line 5 might indicate a weak leak moving around the end of the artificial barrier suggested by the

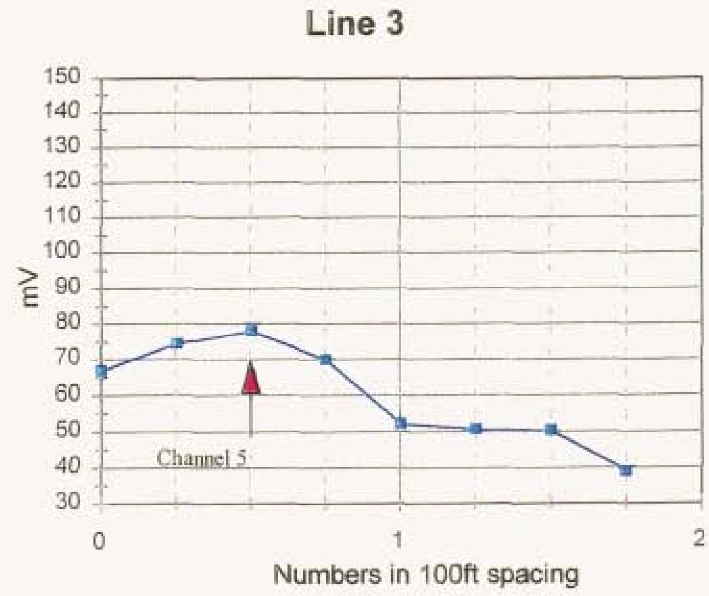


Figure 16 Profile 3.

data between lines 4 and 5(Figures 13 and 4).

On Profile 4, Figure 15, there is a weak anomaly that is probably the result of the strongest leak through the Weyerhaeuser entrance road barrier. This leaking water probably joins the anomaly on line 3 at the base of the bluff which eventually seems to be connected with the water in monitoring well EV-8B.

On Profile 3, Figure 16, there is also a weak anomaly at the survey lines southern most station. This could also be related to the anomaly visible on line 5 indicating water movement around the southern edge of the artificial barrier.

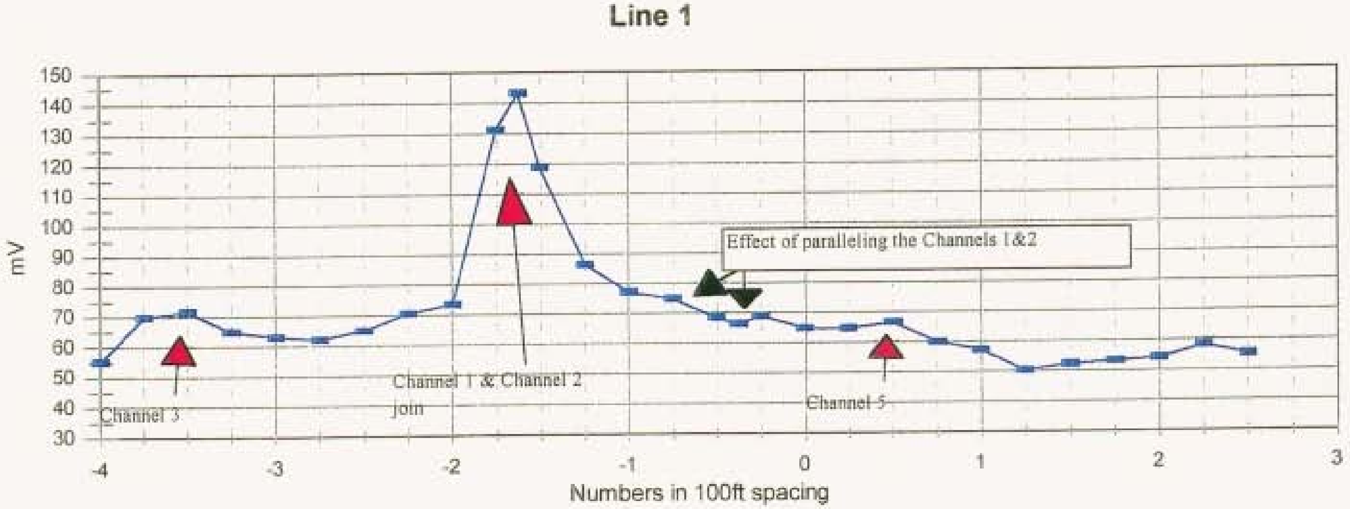


Figure 17 Profile 1.

Profile 1 is at the bottom of the bluff and basically follows the road to the Weyerhaeuser trestle. On the far south end there is an anomaly labeled Channel 3 (see Figure 17). This is the farthest east Channel 3 was detected during this survey. Channels 1 and 2 have combined by the time they reach this profile and parallel it for a short distance. The channel stays on the east side of line 1. Channel 5 also is seen on line 1 and then joins channel 1and 2 somewhere between line 1 and 2.

On Profile 2, Figure 18, the only anomalies visible, are the combined channels which intersect monitoring well EV-8B. Line 2 was not extended far enough south to intersect Channel 3, but the slow rise in the magnetic field on the south end of line 2 could be a result of channels 3and 4.

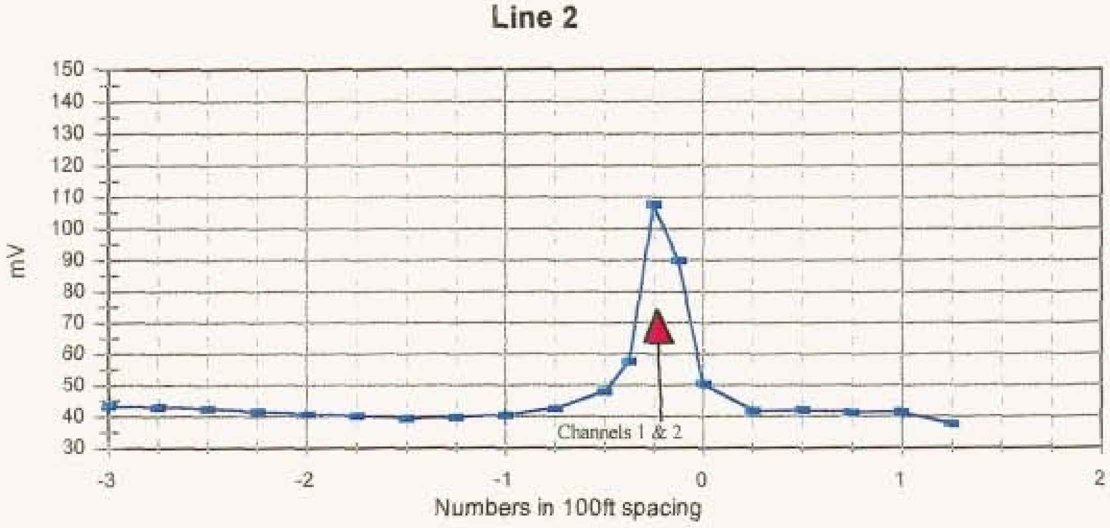


Figure 18 Profile 2.

The diagonals that are in the following figures were short survey lines, and only taken to pinpoint the location of Channel 1 in the low lands. The locations of all stations, and profiles are provided in Figure 25.

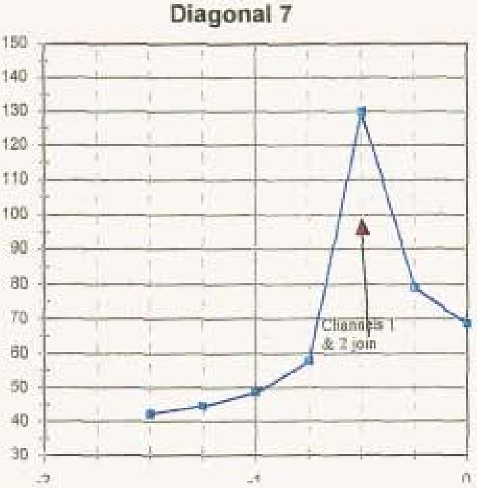


Figure 19 Diagonal survey line 7.

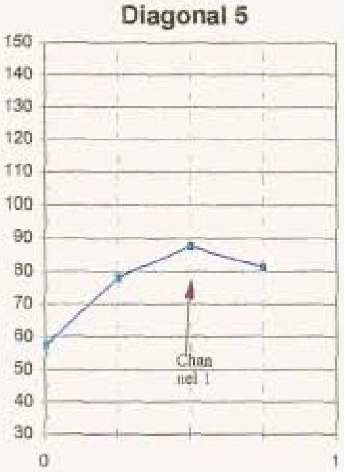


Figure 20 Diagonal survey line 5

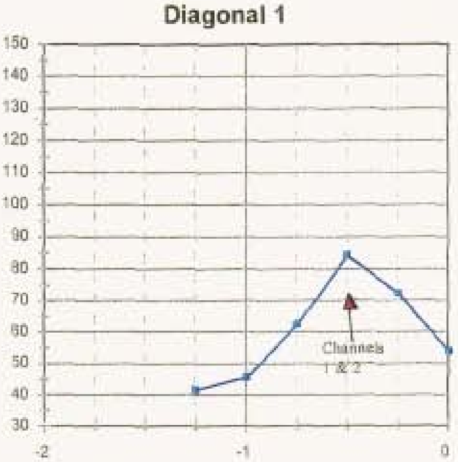


Figure 21 Diagonal survey line 1

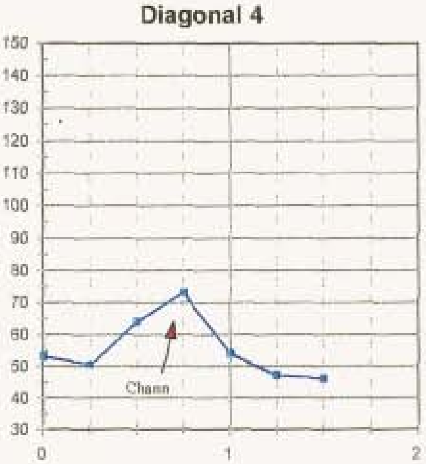


Figure 22 Diagonal survey line 4

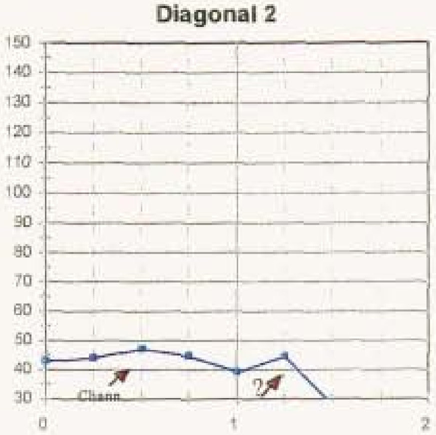


Figure 23 Diagonal survey line 2

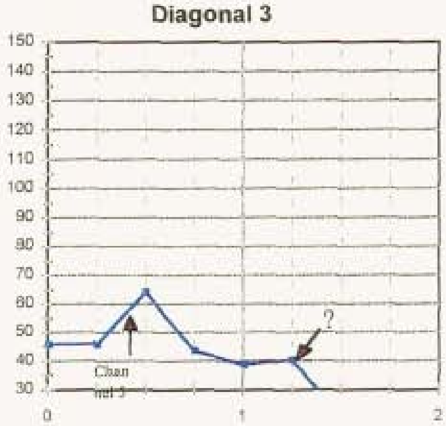


Figure 24 Diagonal survey line 3

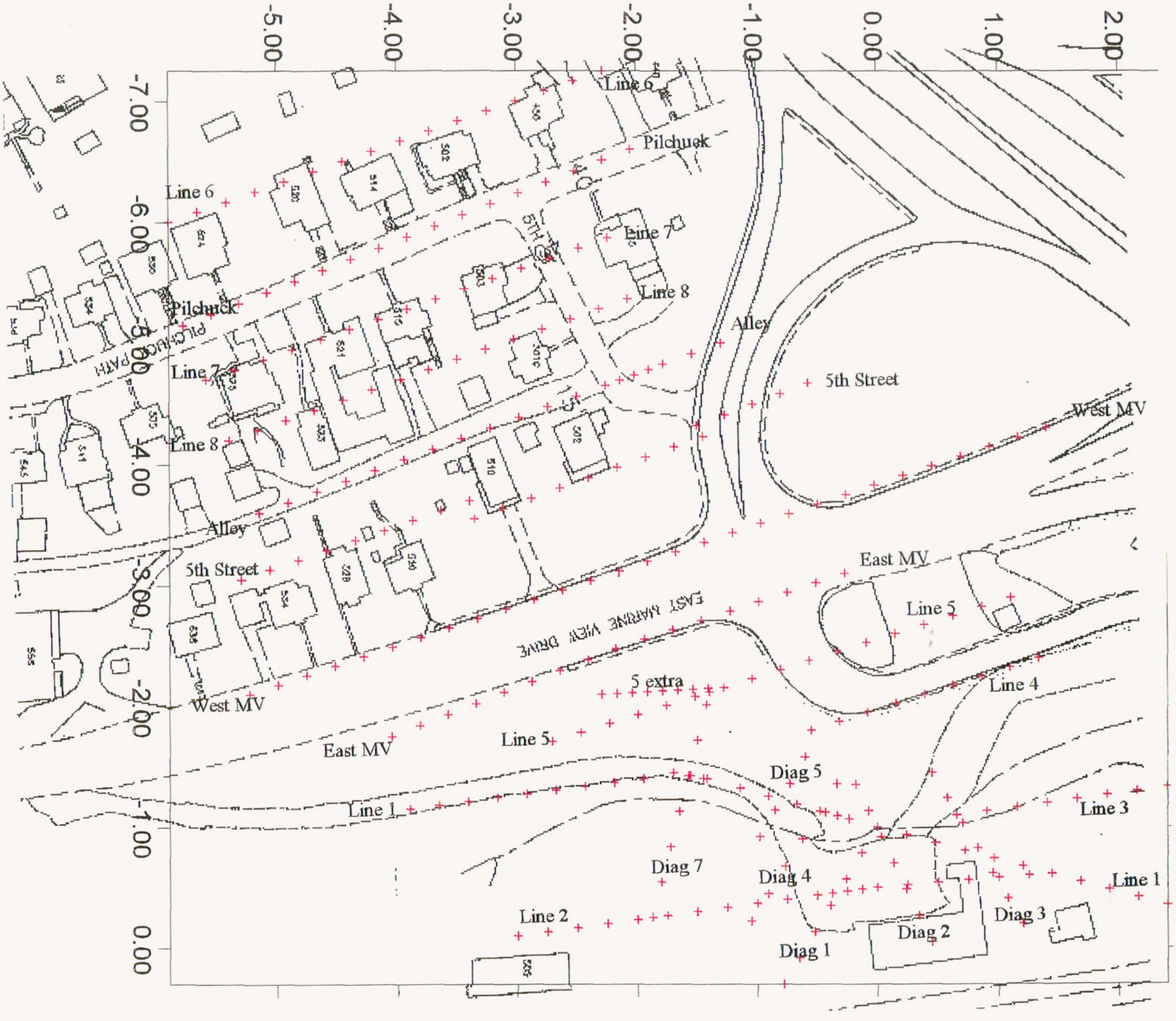


Figure 25. Map of the Everett smelter site, present day, showing stations "+" where data readings were taken.

APPENDIXES

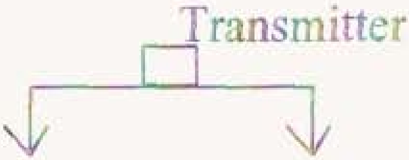
These appendixes are included to provide the reader with an overview of the technology behind AquaTrack. They will assist the reader in understanding the methodology of interpretation. They are not intended to be all inclusive. They are simply intended as an overview to afford appreciation.

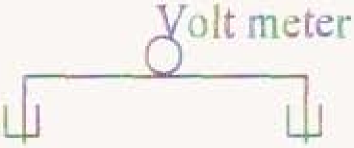
Differences between AquaTrack and conventional groundwater tracking technologies.

Current groundwater mapping technologies fall into one of the following categories: conventional geophysics, tomography, or monitoring wells using logging technologies or tracers.

Conventional geophysics generally involves indirect energizing and measurements which includes: galvanic resistivity, electromagnetic conductivity, conventional electromagnetic surveys, ground penetrating radar, refraction or reflection seismic surveys, and magnetic surveys. Conventional geophysical technologies do not have the capability of resolving separate subsurface anomalies and confirming that they result from a particular plume or groundwater channel. Detecting plumes or even resolving plumes at depths greater than about 100 feet is very difficult.

The disadvantage of resistivity and conductivity surveys are that they are indirect methods and map low resistivity zones. These may or may not be associated with the particular subsurface water in question. The various classical surface electrical resistivity and/or conductivity techniques map resistivity lows or conductivity highs. There is no assurance that the various anomalies are interconnected or just how they relate to the water of interest. There can be two adjacent resistivity anomalies that may or may not be connected because of stratigraphic interference or other problems. Classical resistivity and conductivity technologies energize all subsurface features and average values over a broad area. Thus a particular feature of interest is not isolated and definitively measured. Adjacent features can appear as contiguous features even though they may or may not be connected.





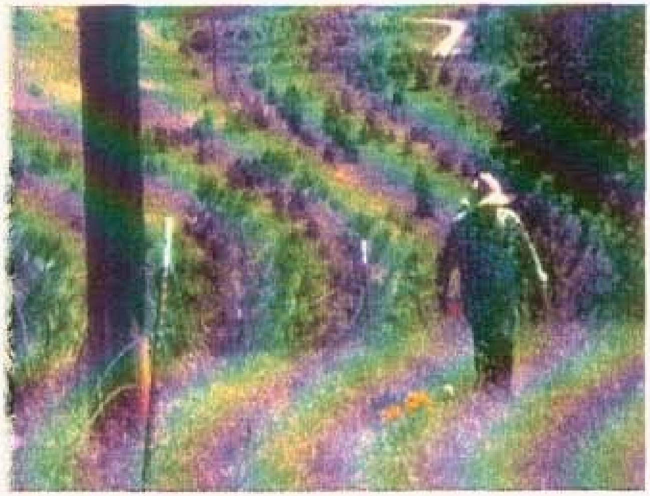
<u>Tomographic type technologies include</u>: electrical resistance tomography, seismic tomography, and radio imaging method. Tomographic technology is a very powerful and sophisticated tool that involves very complicated algorithms to develop models. Resolution is a function of the specific wavelength of the energy source used. The wavelength for seismic tomography is the frequency of the acoustic wave and for electrical resistance tomography, it is the spacing of the electrodes. The draw backs to tomographic technologies are that they are very time consuming and expensive. In addition, resolution of individual features deteriorates as their depth from the surface increases, especially for small or narrow features.

Monitor wells: The drawback to drilling is that you only identify what is at the location of the drill hole. To establish linkage between holes it is necessary to use tracer solutions or a geophysical continuity test. One geophysical technology used to establish connectivity between holes is to place an electrode in one hole at the horizon of interest and then lower another electrode in the second hole to see if there is a response at the horizon of interest in the second hole. This technique establishes connectivity but does not provide a trace of the subsurface path between the drill holes. With monitor wells it is difficult to confidently map a subsurface water system and be certain that all branches or narrow off shoots have been identified. It is possible to miss narrow channels of groundwater. Wells provide inconclusive and at times even misleading results.

Well logging technologies include: thermal logging, gamma logging, neutron logging, acoustic logging, electrical resistivity logging, and electromagnetic induction logging. Well logging technologies have limited range of detection. Generally the detection limits on well logging tool range from a fraction of a meter too just a few meters from the well.

Tracer technologies include: *radioactive or non-radioactive tracer methods.* Tracers are any substance that can be easily and uniquely identified. Tracers are introduced into the medium being investigated and then wells or leaks are monitored at outlying location for the appearance of the tracer. This technology requires monitoring wells and relies on intercepting the tracer to detect leaks. Tracers are a powerful technology, however, it takes time for the tracer to move through an aquifer or subterranean system. The aquifer must be continually monitored and sampled to pick up an indication of the tracer which generally requires sophisticated lab analysis to detect the tracer in the minute quantities that make it through. In some situations it may be objectionable to introduce any additional chemicals into a sensitive system.

AquaTrack mimics tracer technologies in that it uses electrons as its tracer and magnetic sensors to monitor the movement of the tracer. Data reduction can be done on a computer spread sheet, and interpretation involves analyzing profiles and contour maps of the magnetic data.



Technology analogous to AquaTrack

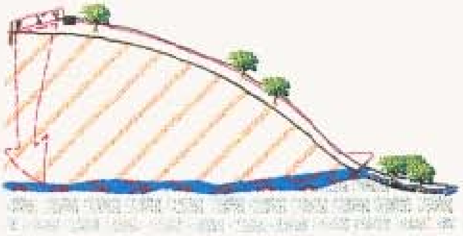
AquaTrack uses the concepts similar to several existing technologies but differs in the execution of the application to tracking water.

The technology is similar to the idea of directly connecting or nearly directly connecting to an ore body as utilized in the Mise-a-la-masse method. Mise-a-la-masse is used to detect mineralization just missed by drilling and in the immediate vicinity of the drill hole.

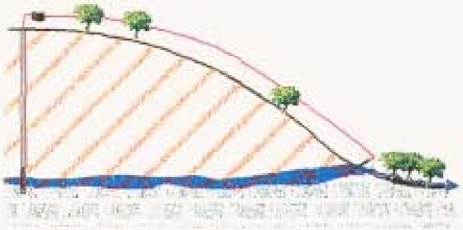
Another similar technology is used by the phone company to detect wires in walls. They attach a signal generator to the wire and energize it. Then a small loop antenna is used to locate the trace of the wire in the wall.

The location of underground pipes and utilities, using Metro Tech tools is also very similar to the technology behind AquaTrack. The closest analogy is a Metro Tech transmitter connected to a pipe and to a grounded electrode. A receiver is used to map the electromagnetic field generated by the current following the pipe. The buried portion of the pipe is located by mapping the magnetic field. When using AquaTrack to track groundwater, underground pipes and wires create noise that must be identified and corrected.

Background



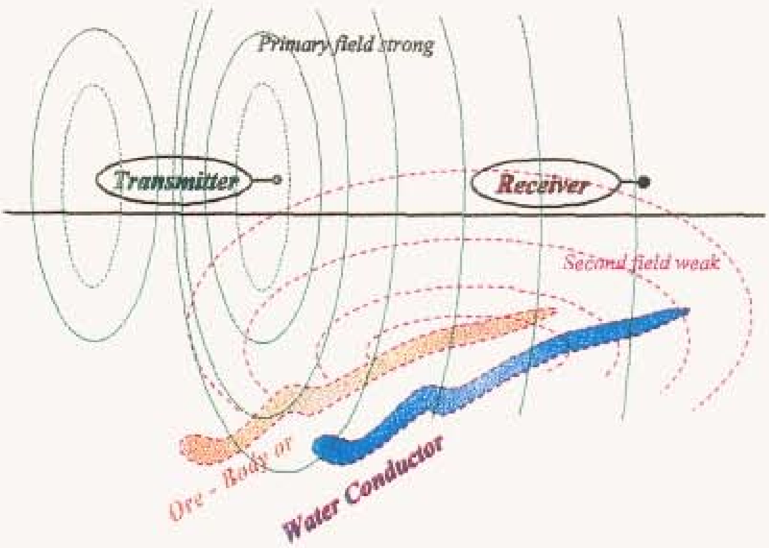
Aqua Track is an electromagnetic method developed to track and monitor ground waters. Some of the capabilities of this system are:



- Mapping subsurface pollution plumes.
- Finding the source of seeps.
- Delineating leaks in earthen dams and drain fields.
- Monitor changing subsurface ion concentrations or reaction fronts.
- Monitor leaching solutions.

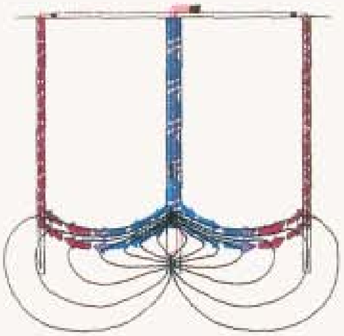
Electromagnetics have long been employed by geophysicists to find minerals and ore deposits. The concept of electromagnetics is straight forward. A fluctuating electrical current in a coil will generate a fluctuating magnetic field. The converse is also true. A fluctuating electric current will be generated in a coil placed in a fluctuating magnetic field. A sub corollary is also true, that any conductor placed in a fluctuating magnetic field will have electric currents circulating in the conductors which in turn will produce their own magnetic field which will oppose the first magnetic field. This secondary magnetic field will be much weaker than the primary magnetic field.

In conventional electromagnetic techniques a transmitter coil is placed on or near the surface. The transmitter coil is energized to create an alternating magnetic field. This alternating magnetic field induces electric current in all the conductors in the area. A second magnetic field is generated by the current flowing in the conductors. The secondary magnetic field interferes with the primary magnetic field and this interference is measured. There are two major problems with this when mapping subsurface water channels. (1) All conductors in the subsurface are energized the same amount and will respond in similar ways and (2) second the secondary magnetic field is usually much weaker and can be hard to resolve from the primary field.



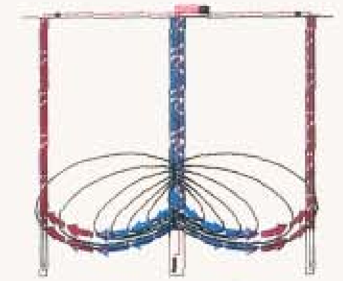
Conventual E.M. surveys

The technology used by Hydro Geosciences Inc. to track groundwater uses electromagnetics, but AquaTrack combines geophysics and tracer technology. By injecting electricity into the solution being investigated the electrons become tracers. As electrons move, they generate a magnetic field. This magnetic field can be measured some distance away from the moving electrons thus direct contact with the electron tracer is unnecessary. AquaTrack creates a primary magnetic field in the conductor of interest and other conductors not of interest generate only a weaker secondary magnetic field. The path followed by these electrons, electric field, maps the groundwater and related structures.



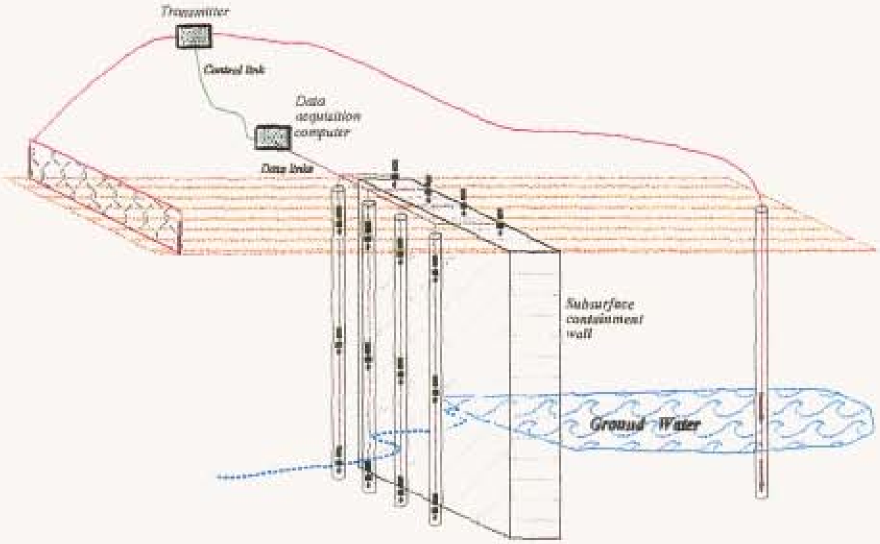
Current Flow bottom & middle electrode

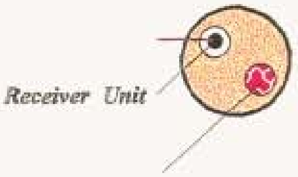
In a drill hole the preferred electrode configuration is to place the return electrode below the energizing electrode. When the return electrode is the upper electrode the current flowing back is closer to the receivers on the surface and thus masks the signal from the groundwater. When the energizing electrode is higher than the return electrode the current in the ground water is closer to the receiver and thus the current following the groundwater creates the stronger signal.



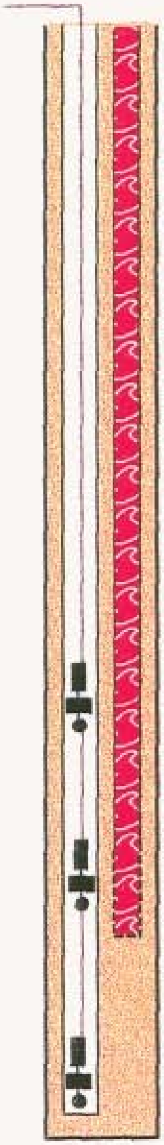
Current Flow top & middle electrode

The principle of electrons acting as traces is utilized so that AquaTrack can actively monitor retainer walls and other subsurface barriers for leaks. This system not only detects leaks in the barrier but identifies the leak location so that it can be repaired with a minimal cost.





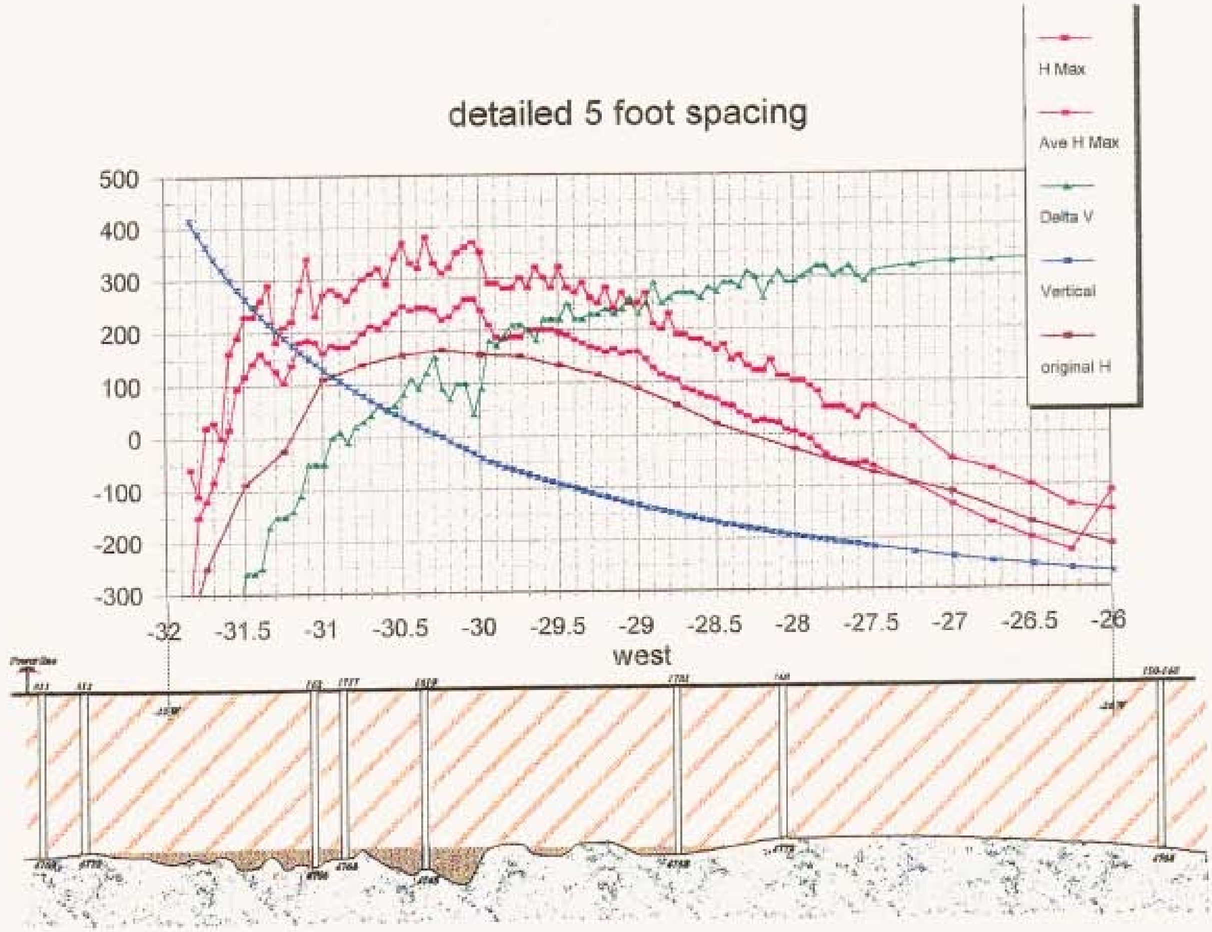
Subsurface Containment Wall



Pure water is not a good conductor, but groundwater is not pure, containing ions from many sources. The more minerals in the water the better a conductor the water will become. Whether the ions come from natural sources, pollution, or from leach solutions. Ground water is a better conductor than everything in the ground except metals. By directly energizing a stream of ground water, the water acts as a subsurface conductor. The magnetic field generated by the electric current flowing in that conductor can be measured on the surface. Since this is a primary field, it is stronger and much easier to track than the secondary fields used by other electromagnetic technologies. Directly energizing requires at least one point of contact with the water in question.

While AquaTrack is based on sound scientific theory, in practice it can be quite difficult. The water being tracked may be only one of several conductors being energized or partially energized. A clay layer in soils often acts as a weak conductor producing a broad superimposed field. Power lines or buried cable will produce their own magnetic fields. The depth of the water from the surface may also vary and will cause variations in the field measurements. Other potential influences include changes in water conductivity due to changing ion concentration or a broadening of the water stream (sheet flow verses channel flow). Even the wire that is used to energize the water stream and connects the return electrode will generate a magnetic field. Although the data obtained by AquaTrack usually allows someone with experience to determine these things, it is always prudent to consider all prior knowledge of a site to confirm observations and as a double check for any data interpretation.

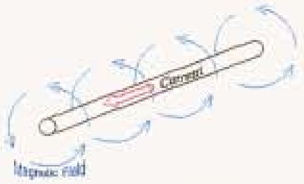
AquaTrack data frequently improves the interpretation of other types of data that has been colleted for the site.



Review of Physical principles involved

The combination and interplay of several electrical phenomena and adaption of several electromagnetic principles, in combinations not previously used, provides the interpretive foundation. The following is an overview of these principals and in some cases' examples of how they are used to interpret AquaTrack data.

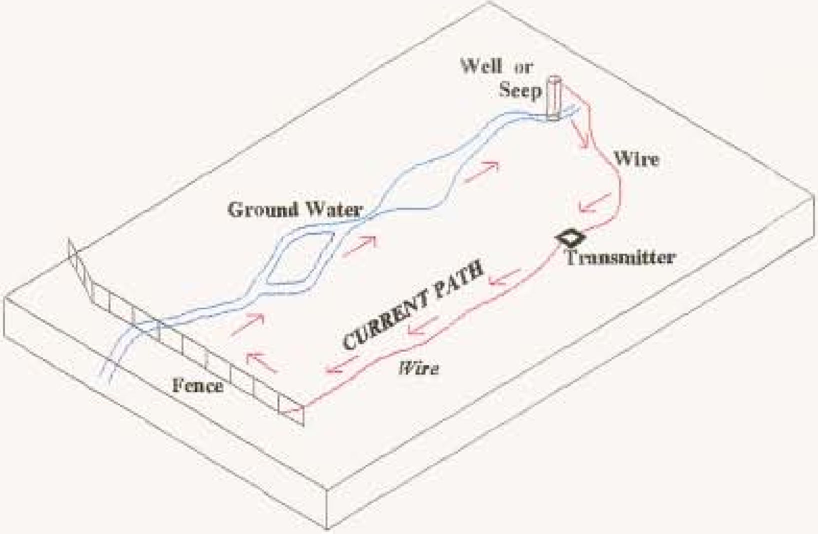
1. Current flowing in a wire generates a magnetic field that wraps around that wire perpendicular to the flow of current.



If the wire is replaced by another conductor, such as water in a subsurface channel, current following that water will create a magnetic field. By mapping the magnetic field generated by the electric current the water channel can be located.

2. Two coils in close proximity are coupled magnetically. A transformer is a special case of two coupled coils. The primary coil is the loop carrying the initial current. The secondary coil has current induced in it by current flowing in the primary coil.

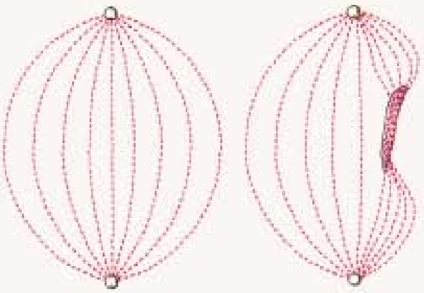
The primary coil of the AquaTrack analogy is created by a large primary loop on and in the ground. The antenna wire forms one part of the primary coil and the subsurface water path forms the other part of the primary coil. The wire portion acts like a single turn coil, but the groundwater portion behaves like a multiple turn coil.



Virtual primary transformer loop or turn created by the antenna wire and groundwater path.

The secondary coil of our hypothetical transformer is the receiver used to map the field of the primary coil. The physical shape of the water portion of the coil will determine whether it exhibits properties of a single wire or simulates multiple windings on a coil. A broad flow will approach the current carrying characteristics of a large number of small wires where a narrow channel, such as in a pipe, will exhibit properties similar to a single wire. The way that the primary and secondary coils couple, and the current generated in the secondary coil is controlled by how many virtual turns, emulated by the groundwater, are inside or outside the position of the secondary coil. Thus theory for transformers and large loops can be used to analyze the resultant magnetic field and infer the shape, location, and path of the channel used by the subsurface water being energized.

3. A good conductor, such as a metallic object, placed in a moderate conductor will gather current from the moderate conductor into the good conductor.



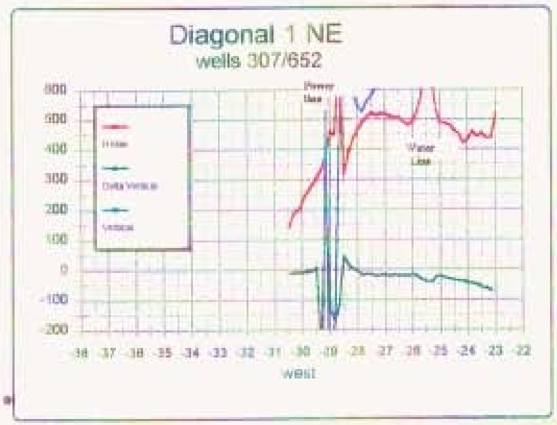
This is demonstrated by the classical physics experiment where two electrodes are placed at opposite ends of a tray of water. The electric field in the tray is first mapped containing only water. Then different types of conductors or insulators are placed in the tray. Objects with greater conductivity than the water warp the electric field in a way that diverts current through the conductor. This is because the entire metal surface is at the same electrical potential. This changes the gradient which focuses the flow of current through the metal. *Conductors gather current.* Insulators whose resistivity is greater than the water divert the current around the object. *Insulators do not gather current.*

Good conductors in the ground will gather electrical current flowing in the ground. This is referred to in the geophysical literature as current gathering. Current flowing in the ground will preferentially follow good conductors in the subsurface. There are three general classes of good conductors in the ground.

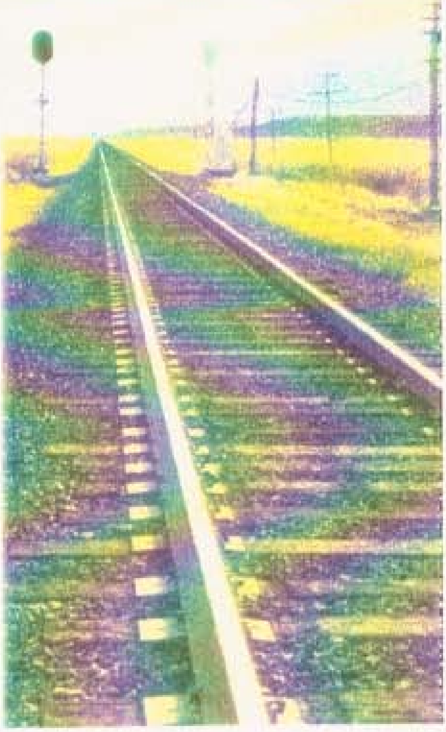
■ First are groundwater channels. When current is directly injected into the conductor of interest, the signature of that conductor will be the strongest because the current will preferentially remain in that conductor. Current will disperse from the conductor at a rate that is a function of the resistivity contrast of groundwater channel and surrounding medium.

■ Second types of conductors are man made. These include:

- communication lines
- over head power wires
- underground metal pipes



- chain link or steel stake fences
- Rails or other elongated conductors.

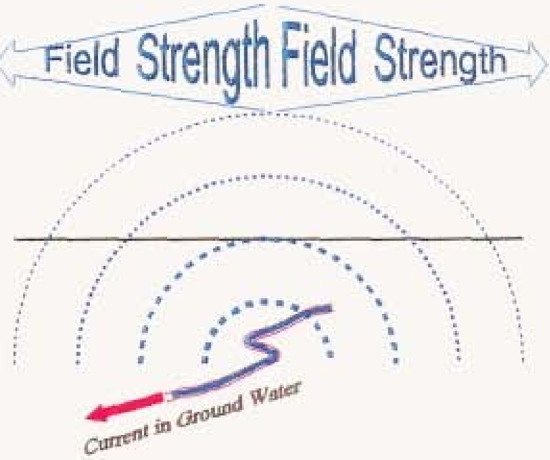


The locations of fences, wires, pipes and conductors are usually known thus they can be accounted when the data is interpreted.

■ Third are mineral deposits such as ore bodies. These are rare and are generally easy to distinguish from other types of conductors.

Application of these principles to AquaTrack

Following are observations of how the magnetic field behaves when using AquaTrack and how this technology is used to map groundwater channels. A loop is formed by the wire and current in the ground. A magnetic field is generated by electrical current following subsurface water. Mapping the components of the magnetic field provides information which can be used to map the electrical ground current, which maps the groundwater.

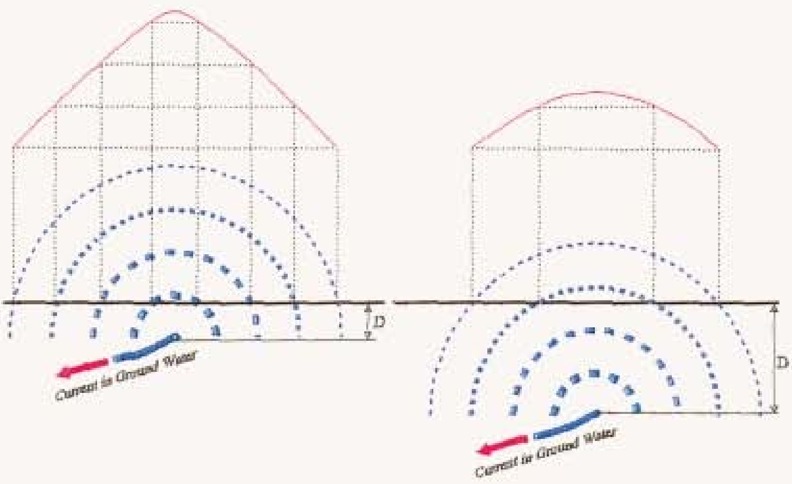


To examine what is happening we will return to our most elementary model which demonstrates the principle of how this technology works. Consider what happens when electric current flows in a wire. A magnetic field is produced that circles the wire. If a conductive stream of water or solution replaces the wire, a magnetic field will form directly above the water's channel. This field will be horizontal and perpendicular to the conducting zone just as it would be for a wire. A curved conductor will behave the same way. The strongest field strength will be measured directly over the conductor. If measured, the magnetic field traces a path on the surface that follows the path of water, in the ground. To create this current flowing in the groundwater, an electrode is placed in the solution to be studied. In the least complicated situation, a single electrode in the groundwater or site of interest would produce the strongest signal from the underground conductor. However, in the real world there are no mono poles and a second electrode is required.

An important part of this technology is that the groundwater or medium of interest is directly energized. This can be done in several ways but ultimately all achieve the same effect. The electromagnetic signal that is measured at any point in the survey is a compilation of the current flowing in the earth and the field created by the wires leading to the electrodes energizing the groundwater.

The magnitude of the magnetic field is related to the size of the loop and the current flowing in the loop. The vertical magnetic field inside a loop will be its maximum and is constant when completely inside the loop. The vertical field decreases when crossing any flow paths that short circuit part of the loop flowing in the ground. The vertical magnetic field will have a relative zero (maximum slope) directly over a water channel. If the water channel is confined, the vertical field will change rapidly over a very short distance. When crossing a wide water channel, the vertical field will start to change, decreasing in strength, before the first edge is crossed. It then stabilizes over the channel and decreases abruptly as the second edge is crossed. Outside the loop, the vertical field will decrease moving away from the loop.

The field intensity can vary according to channel depth.



The horizontal magnetic field inside the loop will be a minimum. The horizontal field is maximum crossing over any conducting strand of the loop. When moving from inside to outside the loop the horizontal field will decrease and continue to decrease outside the loop when moving away from the virtual loop.

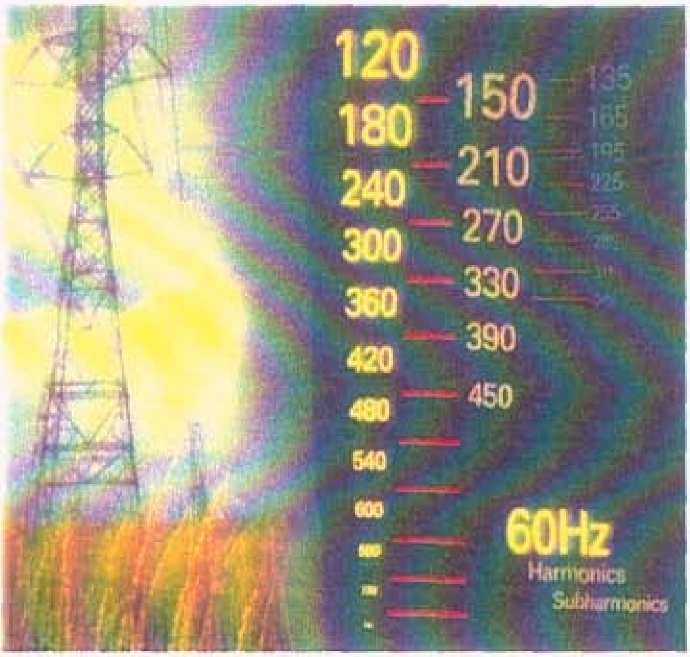
The magnetic field's rate of curvature is proportional to the distance from the water channel carrying the electric current.

The rate that magnetic field falls off along the water channel is proportional to the resistivity contrast between the water channel and the surrounding media

Noise

There are three large sources of electrical noise in the ground that must be accounted for when analyzing AquaTrack field measurements.

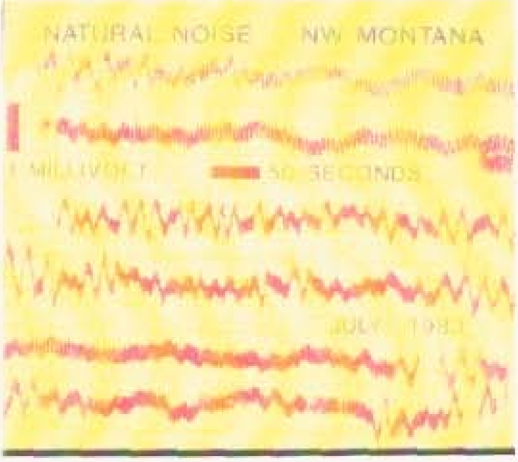
- The first results from power companies which use the earth for their return circuit for all their power distribution. Thus as usage changes during the day the electrical and magnetic field produced by the returned electrical power will shift and change. These effects are

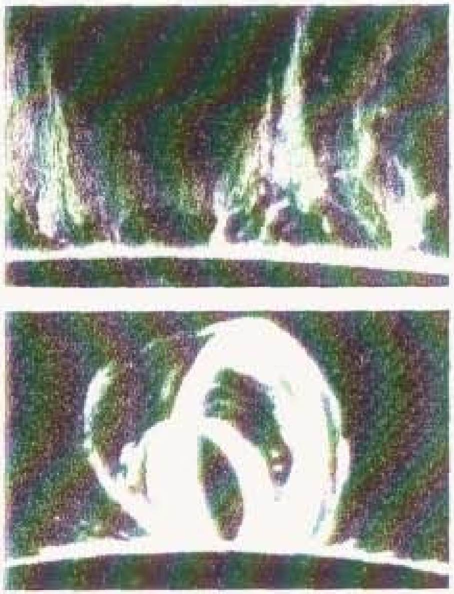


screened by frequency locks between the transmitter and receiver. Corrections are obtained from multiple base station readings used to monitor drifts in the local electromagnetic fields.

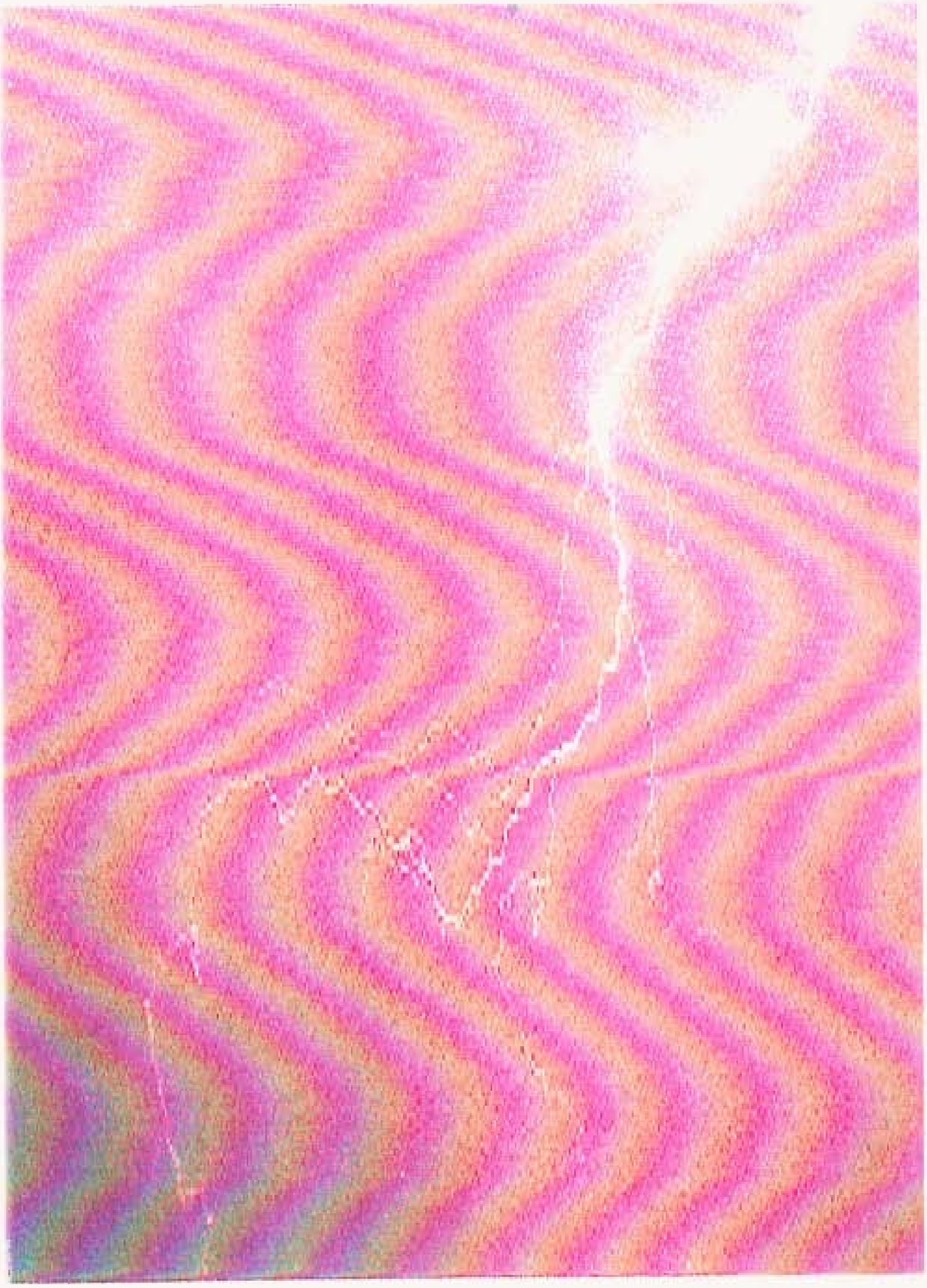
Filters are provided to lock the frequency of the AC current at a precise 400 cycles. 400 cycles is selected to eliminate interference from stray 60 cycle current or any harmonics of 60 cycles. Output voltage is controlled to produce the desired current Both the output voltage and output current are measured and recorded during the survey.

- The second strongest noise source is telluric currents created by the electrical currents that the sun generates in the ionosphere. Multiple readings at a base station help identify and correct for these influences.





- The third electrical noise source is distant thunder storms. The electrical static generated by lightning strikes becomes trapped in a wave guide between the ground and the ionosphere. With distance the currents generated begin to blanket the electromagnetic spectrum usable in this technology. Noise from these sources are corrected using a combination of frequency locks and bases station corrections.



Field procedures

The first step is to provide a path for the current to flow in a large primary loop. The water path to be mapped has to be included as part of this primary loop circuit. This is done by directly connecting an electrode to the water to be mapped. To provide a return path and continuity between the electrodes wire is strung from the primary electrode to the grounded point or points.

At least one of the electrodes must be in contact with the water being tracked. The second electrode can be in contact with the water to establish the flow path between two points. However if the subsurface path is an unknown then it is better if the return electrode does not bias the flow of electricity in the ground. This is best done by using as the second electrode a broad ground plain such as a chain link fence or surface water such as a pond or stream.

A controlled AC transmitter is included in the wire portion of the loop. The current is filtered and controlled to provide a locked frequency between the transmitter and receiver. Output voltage and current are controlled, monitored, and recorded during the survey, and corrections are made for any transmitter drift. All readings are locked to a base station and corrected for diurnal drift.

Data is collected at each station using a special receiver. The receiver consists of a coil and a filtered amplifier. The magnetic signal picked up in the coil is correlated with the transmitter signal and filtered for noise. Magnetic field measurements consist of magnitude and direction of the magnetic field components. The minimum field is detected first because it is more definitive. The field direction is obtained using a compass mounted on the receiver coil. The maximum is measured by rotating the coil 90 degrees and recording the voltage induced in the receiving coil. The coil is again rotated 90 degrees in the vertical to measure the vertical component of the field.

Data Reduction

Analysis of the data is a multifaceted process. Voltage and current of the transmitter are controlled, monitored, and recorded using a portable computer during the survey. These recorded readings are used to correct for any transmitter drift. All readings are locked to a base station and corrected for diurnal drift. Both of these corrections are the same as standard linear correction made to all geophysical data.

- A base station reading is taken as often as possible during the day. The drift measured at the base is assumed to be linear and is simply subtracted from the reading. This compensates for instrument drift and some of the spheric variations.
- The transmitter current is monitored by taking a current readings every minute with a portable computer through

the day. Data gathered at individual stations is normalized to a constant current, usually 1 amp.

The data interpretation can be facilitated and enhanced by various treatments. These are standard mathematical manipulations that are applied equally to all data to remove regional and other effects. For example, First current bleeding from the conductor, groundwater channel, will cause a gradually reduced signal due to lower current flow. This effect can be adjusted by adding a factor based on the stations distance from the current source. Second, the electrodes, or contact points, can act as electric poles and will create a very predictable field. This field can be calculated and removed mathematically from the data.

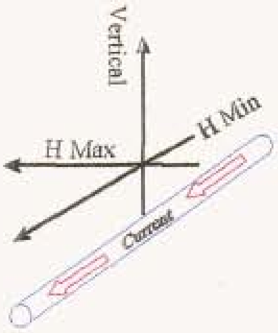
The data can be presented in various forms such as linear or logarithmic. The preferred method is linear but in a few cases where the anomalies are substantial and tend to overwhelm the smaller anomalies, logarithmic is preferred. All data in this report are linear unless specified otherwise.

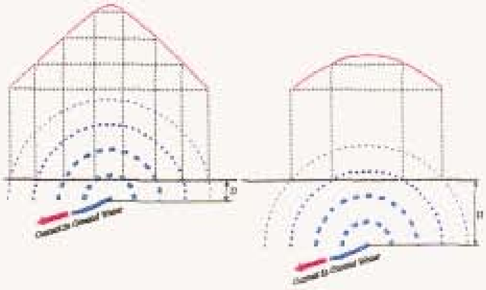
Data Interpretation

General guide lines

In the simplest case, such as a wire like conductor, field strength will be greatest at a point directly over the conductor. If the conductor is straight, field strength measured on a line perpendicular to the conductor will increase until it is directly over the conductor then decrease at the same rate.

The direction of electrical current flowing in the ground, represents the path of the groundwater or channel. Electric current flows in the same direction as the minimum horizontal magnetic field or perpendicular to the maximum horizontal magnetic field. The direction of electric current flow is directly correlatable to the subsurface water channels.





The rate of change of the vertical magnetic field intensity with distance across the anomaly is proportional to the width of the current path or indicates the width of the groundwater channel.

Width of the horizontal magnetic field is proportional to depth and width of the channel.

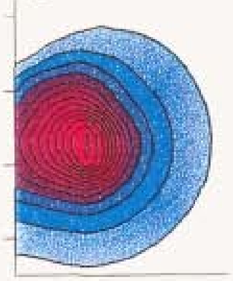
Correlation of vertical and horizontal data can be used to clarify ambiguities of width and depth.

Specific case examples.

The following are examples of how possible features will show up when site data is plotted in a manner similar to that of a contour map:

a. A non perturbed field, where no conductor is energized, would form a contour map composed of concentric circles around the point where the water is energized.

Figure a.



b. Water in a narrow channel will form a V shape in the contours. The shape of the "V" will be sharper the closer to the surface the channel is.

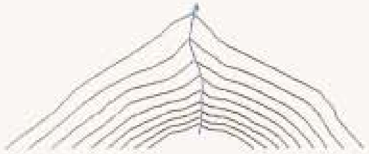


Figure b.

c. A vertical structure such as water flowing along a vertical fault, will also form the "V" contour but with a somewhat lower gradient as fields generated at the lower portions of the fault structure will add to the fields generated closer to the surface.

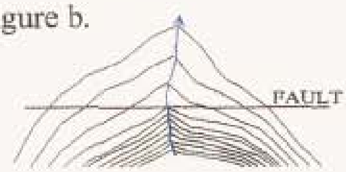
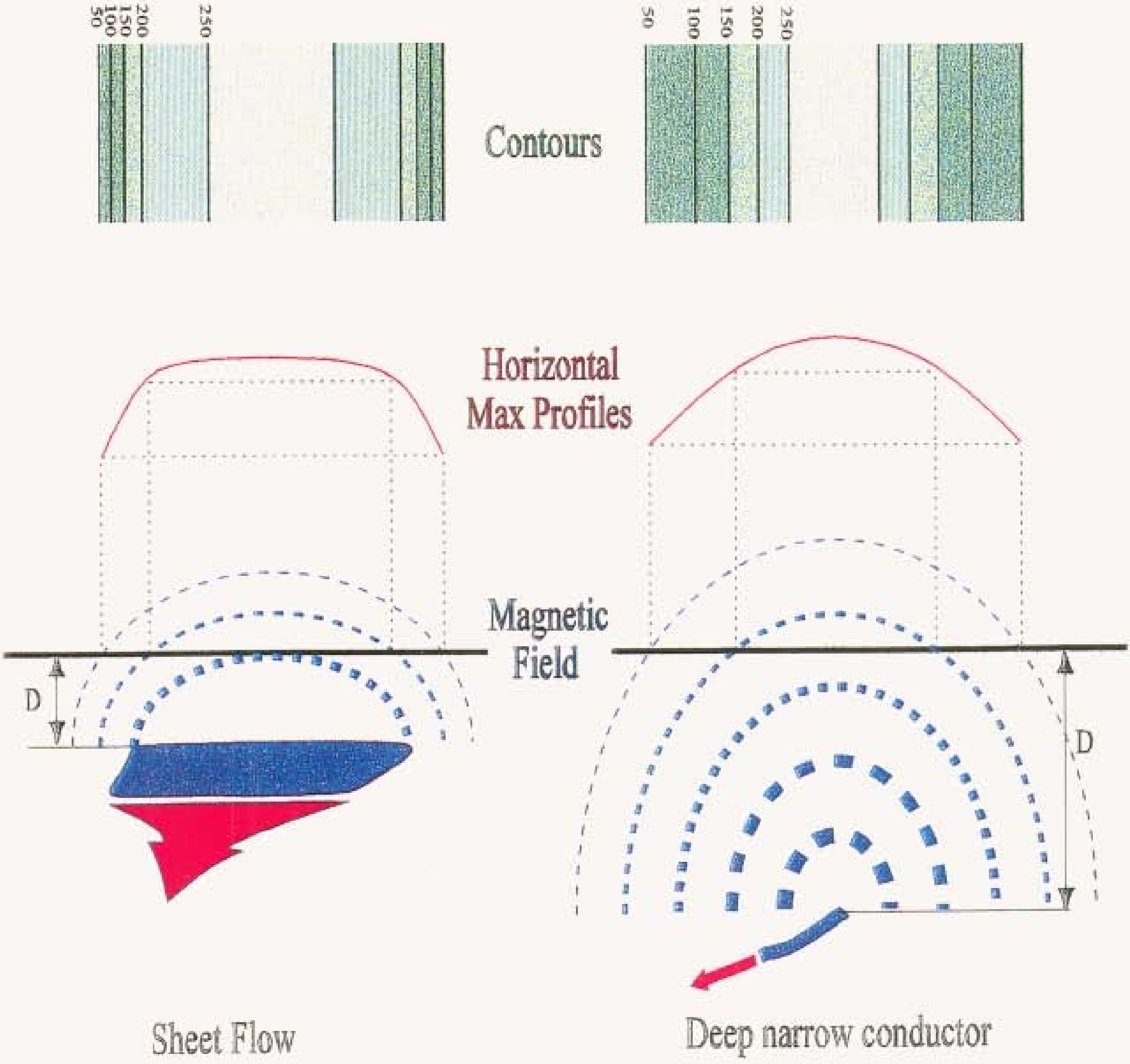


Figure c.

d. A flat conductor or sheet flow of water will produce a flatter signal than a deep narrow conductor. The gradient will increase toward the edge of the water then level off, only to reduce sharply on the other side, making the edge of the sheet flow more pronounced than a deep narrow conductor.

Figure d.


50
100
150
200
250
Contours
50
100
150
200
250
Horizontal Max Profiles
Magnetic Field
D
D
Sheet Flow
Deep narrow conductor

e. Up welling along a conductor will start with lower values due to the depth of the initial flow then increase and narrow in the area of the up welling.

f. Branching in a conductor will show very misleading results in the area of the branch as two or more fields will be measured at one time.

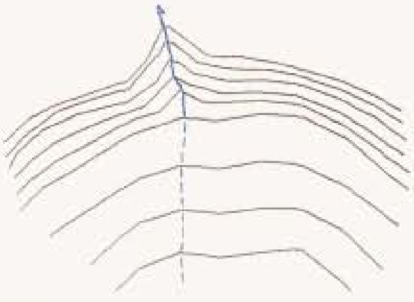


Figure e.

g. If the water becomes less conductive or if the thickness of the water layer thins, this area will change to a lower field strength as less current will be carried. An example would be where relatively fresh water passes through a reaction zone and picks up additional minerals. Measured from the high conductivity side to the low conductivity side, there will appear to be a rapid decrease in conductivity, far more pronounced than could be accounted for by increased distance from the current source. This will look very similar to water flowing along a vertical structure. (see Figure c)

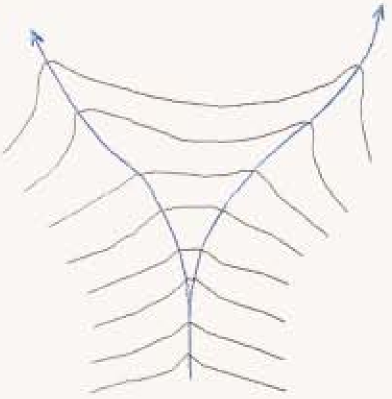


Figure f.

h. Conductors in the surrounding rock or soils, even weakly conductive soils, will cause distortions in the fields measured and may even form secondary fields. These conductors may be a wide variety of things, the most common of which may be power lines, water pipes, or phone lines.

i. An attached clay lens, such as a repository lining, will tend to mask the field of the conductor being tracked and could produce localized high readings in wet areas as they will act as good conductors and concentrate current.

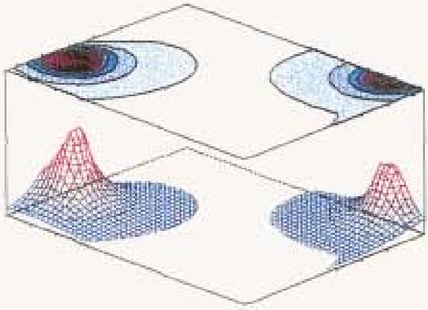


Figure j.

j. Fields in the area of a return electrode show higher values as the current will be collected and concentrated at the electrodes no matter which path it has taken.

k. The rate of change of the vertical magnetic field intensity across the anomaly is proportional to the width of the current path and indicates the width of the groundwater channel.

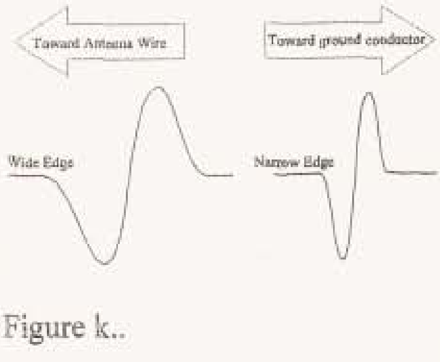


Figure k..

The Amplitude is related to the resistivity contrast between the channel and the soil. The (λ) width is related to how well the channel edge is defined.

l. Width of the horizontal magnetic field is proportional to depth and width of the channel.

m Correlation of vertical and horizontal magnetic field data is used to clarify ambiguities of width and depth.

n. Locale intensity increases in either the magnetic fields can indicate chemical or biological activity. Chemical and biological activity translate into the ability to produce ions.

o. A study conducted over time, weeks or months, will show changes in field values and are plotted by take the difference or ratio of the readings.

p. A study conducted over time, weeks or months, will show changes in field values at the same location due to changes in the flow of water, chemical changes over time (such as oxidation or acid production), or biological activity. Variations from one season to the next would be expected due to variations in seasonal water flows.

q. Comparing changes in the various components of magnetic field over time provide information relating to fluid movement, change in chemical activity, changes of fluid in an aquifer, changes in subsurface biological activity, movement of chemical or bio reaction fronts, leaching progress and activity relating to in situ mining, progress of subsurface chemical or biological remediation, increases or decrease in subsurface flow, changes in salinity, or any change in the groundwater that affects any of its electrical properties.

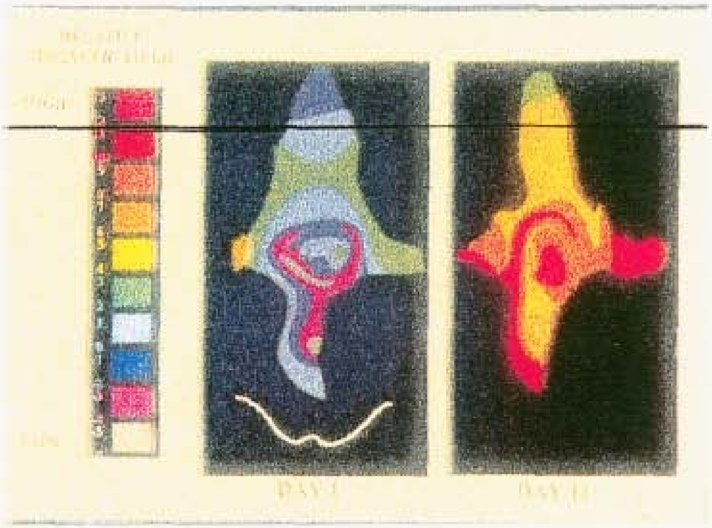


Figure q.

r. The direction as the minimum horizontal magnetic field or a direction perpendicular to the maximum horizontal magnetic field indicates the direction of the current or subsurface solution path. This is visible in vector plots of the minimum field direction.

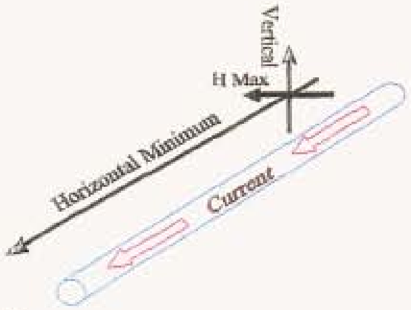


Figure r.

s. As current flows down the groundwater channel, some electrical current leaks into the surrounding medium. The electrical contrast between the channel and host rock can be evaluated by the rate at which the magnetic and electric fields degrade.

t. The dip of the magnetic field is related to depth and dispersion of the ground current.

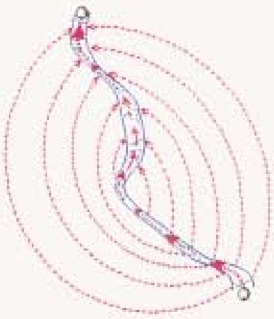


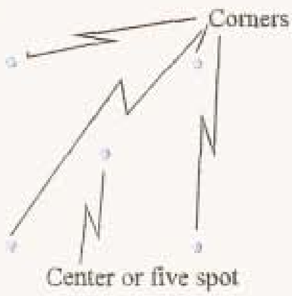
Figure s.

The simple case will rarely exist. Interpretation of the field measurements must therefore include as much information of the site as possible. It is obvious that some field measurements could be interpreted to represent widely different outcomes. Historic data can often be used to eliminate possible explanations. Any known influence on the field must be accounted for and normalized out of the measurements as best as possible. Hydro Geophysics attempts to overcome this by analyzing data as it is being obtained, on the site and confirming the interpretations with observations and with historic data on the site.

All possible explanations for the data obtained need to be considered. For example water will flow along the course of least resistance and most likely will not be straight. Its depth from the surface may also change. The channel the water follows may also expand and contract. As is observed in several cases the path of the water may split following several paths. Other conductors may also exist in the area and may be energized.

It is possible to prejudice the interpretation if care is not taken and the data is not thoroughly analyzed from all possible angles. Hydro geophysics personnel have over 30 years of experience interpreting geophysical data with proven success.

Data Collection and Analysis



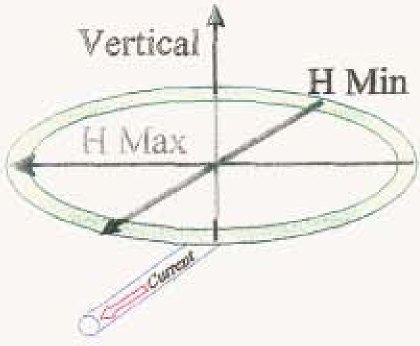
The normal preliminary survey of an area is made by taking magnetic readings at the grid coordinates and at the center of each square or the five spot.

Wells, seeps, springs, or other types of water sources are energized with approximately one amp of current. Variation in current are corrected by normalizing to one amp corrected for current drift. Drift is calculated by monitoring the transmitters output at random intervals.

A second correction is made for diurnal variations by correcting for drift measured at the base station. Base station readings were taken a minimum of three times daily, morning, noon, and evening.

Individual readings at stations affected by known long continuous conductors were collected but were not included in final analysis as they provide misleading readings. These included interference from the wire connecting the electrodes and the fence or row of electrode. Additionally power lines, communication lines, water pipes, and multiple sources in the area. Readings that were not obviously associated with known conductors are not excluded from the final presentation.

The values measured at each station were:



1. Location in northing and easting,
2. Minimum magnetic value and bearing,
3. Maximum magnetic value and bearing,
4. vertical magnetic value,
5. time, and
6. any adjacent cultural feature.

Grided Data and Detailed Profiles

The preliminary or regional data is generally gathered on a north-south/ east-west oriented grid with 100 foot spacing. The primary survey is made by taking measurements at the grid points and at the center of each grid square, or the five spot. The reduced maximum horizontal magnetic field values are contoured to determine general location and orientation of the ground-water channel feeding the energized water source. Readings taken over a grid area provide general information related to water flow and preferential direction of channels. Grid data does not provide detailed information defining channels or the edges of channels. Detailed profiles taken perpendicular to the path of the channel or water, as determined by the grid survey, provides the data needed for improved accuracy for determining the center of the water channel and the location and type of channel edges. Subsequently detailed readings may be taken along selected profiles in locations where the initial data indicated the existence of groundwater channels.

For the best results supplemental readings are taken along selected profiles in locations where initial data indicates the existence of groundwater channels. Detailed or supplemental profiles are located by using the initial grid. Data collected along profiles running north-south or east-west are spaced at 25 foot intervals. Diagonal profiles running north-west to south-east or north-east to south-west are spaced using 23.5 foot intervals These spacing was chosen because it was an even division, 1/4 or 1/6th, of the distance between the corners of the square. Thus the corners and the five spot are re-occupied to assure that the magnetic values for the profiles can be correlate with the regional data.. This permits the comparison and verification of data. These two spacing intervals provide sufficient information to locate subsurface water related features to within about 25 feet.

If more precise information is required in one location for planning or engineering information at 5 foot data spacing can be used. This detailed spacing along a profile will provide details that are relative to approximately 5 feet. These types of profile must be chosen to run perpendicular to the subsurface channel or groundwater flow to provide the greatest accuracy.

APPENDIXES

This appendix is included to provide the reader with a short overview of the technology behind AquaTrack, Patent 5,825,188. It will assist the reader in understanding the methodology of interpretation. It is not intended to be all inclusive. It is simply intended as an overview to afford appreciation.

How does AquaTrack map solutions in the ground?

- Directly energizing the groundwater under investigation.
- This energy provides electrons which move through the water of interest and can be tracked, much easier than if chemical tracers are used.
- Current following the groundwater generates a primary magnetic field.
- Mapping the magnetic field, maps the current flow which, maps groundwater flow and channels.

Innovations AquaTrack uses:

- Electrons injected into water can be followed from the surface but chemical tracers or dyes can not.
- HGI increases the energy in the groundwater thus increasing magnetic signal strength. In the past, gains in interpretive resolution were accomplished by improving data handling techniques or improving filters.
- Older technologies use weak secondary magnetic fields while AquaTrack technology use the strong primary magnetic field.

To confirm that water in a monitoring well flows to a specific seep or well AquaTrack acts like a tracer based technology without the need to add chemical tracers and without waiting for the chemicals to move throughout the system. AquaTrack replaces chemicals with electrons.

AquaTrack increases signal strength by concentrating energy in the aqueous solution being studied.

- AquaTrack is a hybrid technology that combines the best elements from conventional tracer technology with elements from electromagnetic and galvanic technologies.
- The breakthrough came with the concept of direct contact or direct energizing of the groundwater.
- This concentrates the electrical energy in the target which results in a 10 to 100 fold increase in effective signal strength with a concomitant improvement in noise to magnetic signal ratios.
- Interference or false signals from other conductors in the same area are reduced or eliminated.
- Intermediary layers that could insulate or interfere, such as clay lenses or conductive formations, have little effect on the primary field generated enabling AquaTrack to "see" through these layers when others can't.

Examples of similar technology:

- Buried pipes and wire are located using Metro Tech Tools. The Metro Tech transmitter is connected directly to the metal pipe or wire and to a ground electrode. When a current is applied, it will follow the pipe or wire as far as it can, and the pipe or wire is located by measuring the magnetic field with a receiving unit.
- A similar approach is used by the phone company to find wires already placed in a wall. An alternating electric current is applied to the telephone wire, the magnetic field produced is used to locate the wire.

HGI's technologies are essentially the same. AquaTrack just replaces the pipe or wire with water and collects more data than just the high point in the field.

How does AquaTrack differ from conventional Tracer or Geophysical technologies?

- **AquaTrack verses Chemical tracers or dyes**
  - Requires no chemicals and leaves nothing extra in the water.
  - Electric tracer arrives instantly while chemical tracers require extended times to arrive.
  - Provides data on the path of the water, not just connectivity.
  - A collection point or well is not required to detect the arrival of the tracer.
- **AquaTrack verses Conventional EM geophysical surveys**
  - AquaTrack incorporates the water of interest into the primary circuit, conventional EM uses an antenna to produce secondary effects in the target water.
  - AquaTrack measures the primary field produced by the target, while conventional EM measures both the primary field of the antenna and weaker secondary fields produced by the target.
  - AquaTrack screens secondary fields to eliminate interference. In conventional EM the receiver electronically separates all weaker secondary magnetic fields from the stronger primary field, providing data on all conductors in the area.
  - AquaTrack's primary signal is produced only by conductors directly in contact with the circuit, while every conductor in the ground produces a signal for conventional EM.

How does the technology work:

AquaTrack relies on the creation of a large single electric loop, which includes the water being mapped. When this is energized with an AC current, it becomes analogous to a single turn transformer. The theory that applies to such a transformer, applies to this AquaTrack circuit.

To build the AquaTrack circuit, an AC transmitter is connected by wire to two electrodes. The first electrode is placed in direct contact with the water to be tracked. The second electrode provides a path for the current to return. Since the groundwater is a relatively good conductor, compared to rock or soil, the current will follow the water as far as it can to complete the circuit. To track water between two known points, such as a between a monitoring well and a seep, both electrodes can be placed in contact with the water. When only one electrode is in contact with the water, the current must leave the water at some point to find the best path available to the other electrode. For this reason, the second electrode generally consists of multiple electrodes placed to allow the current to find an easy path toward it. An all metal fence that is known or suspected of crossing the underground path of the water becomes a perfect second electrode. For conventional geophysical approaches, no direct contact is made with the feature being studied. The primary circuit is the antenna and the primary field generated produces no information on the study area, just interference that must be corrected for.

By using the water of interest as part of the primary circuit, the magnetic field produced by the water will provide information on the location, depth, and shape of the water channel. For example, a broad flat channel of water will carry current in the same way as a large number of wires connected in parallel. A narrow channel, such as water in a plastic pipe, will produce a magnetic field much like a single wire.

- Shallow channels produce sharper drops in field strength than deeper channels.
- Broad channels produce flatter fields than narrow channels, which will tend to produce peaks.
- Multiple channels produce a series of highs, or peaks, in the data.
- Field strength falls off slower with deep channels than with shallower channels.

APPENDIX D
GROUNDWATER VALIDATION REPORTS

FIRST ROUND OF WELL SAMPLING AND INITIAL FOUR HYDROPUNCH

DATA VALIDATION REPORT

EVERETT LOWLAND INVESTIGATION

GROUNDWATER DATA

October 1998 - March 1999

Prepared by
Hydrometrics, Inc.
2727 Airport Road
Helena, MT 59601

June 1999

TABLE OF CONTENTS

LIST OF APPENDICES

GLOSSARY OF TERMS

CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
FAA	Flame Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
HGAA	Hydride Generation Atomic Absorption
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
MSA	Method of Standard Additions
PB	Preparation Blank
PDL	Project Detection Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOW	Statement of Work
TDS	Total Dissolved Solids

SUMMARY

Groundwater samples collected for the Everett Lowland Investigation from October 1998 through March 1999 have been reviewed in accordance with the EPA's data validation guidelines (EPA, 1994) and the project work plan (Hydrometrics, 1998). It should be noted, however, that the CLP requirements for this project have been dropped on Ecology's approval. Data validation included the evaluation of both laboratory and field quality control samples. Associated sample results were flagged for any QC samples that exceeded quality control limits. Data validation codes used as flags are defined in Table 1 in Appendix 1. A complete listing of flagged data including the reason for each flag is in Table 2 in Appendix 1. The sample database is in Appendix 2.

This report covers data from the following samples:

- One hydropunch sample collected on October 1, 1998. This sample was analyzed at Sound Analytical Services laboratory in Tacoma, Washington.
- Eight hydropunch samples collected on February 9 and 10, 1999. These samples were analyzed at Asarco's Technical Services laboratory in Salt Lake City, Utah.
- Forty-three samples collected at monitoring wells on March 1-5 of 1999. These samples were analyzed at Asarco's Technical Services laboratory.
- Associated quality control samples (nine field duplicates, fifteen field blanks, and one field standard).

Quality control violations resulting in the flagging of data are listed below.

- Nine field SC results were considered suspect after comparison with the laboratory SC and TDS results. For seven samples, the field SC results were considered unusable, and were therefore rejected. For the other two samples, both the field and laboratory SC results were flagged to indicate possible uncertainty in the results. This is discussed further under Interparameter Relationships in Section 10.
- Exceedances on nine of the field duplicate measurements resulted in the flagging of 6 carbonate, 15 total acidity, 4 total suspended solids, 19 sulfate, and 4 dissolved zinc values to indicate the possible lack of reproducibility.
- Detections in ten of the field blanks resulted in the flagging of 4 total suspended solids, 22 sulfate, 2 calcium, 17 dissolved zinc, and 7 total zinc values to indicate a possible high bias at low concentrations.
- Total zinc was detected in the preparation blank for laboratory batch L990256. Two total zinc results were flagged to indicate a possible high bias at low concentrations.
- The laboratory duplicate for batch L990256 was out of control limits for dissolved zinc. Nine dissolved zinc results were flagged to indicate a possible lack of reproducibility.

- Laboratory delays in sample analysis resulted in holding time exceedances for both chloride and sulfate. Holding time flags were attached to 58 sulfate and 19 chloride values to indicate that they may not be representative of the actual sample concentrations.

It should be noted that not all quality control deficiencies are equally serious, and many may have no practical impact on the usefulness of the data. Arsenic, for example, is of particular concern for this project, and no arsenic results have been flagged. Overall project data quality objectives for precision, accuracy, and completeness have been met for the data covered in this report (see discussion in Section 17).

Taken as a whole, this data set provides useful information for the Everett Lowland Investigation providing that the possible lack of reproducibility and possible biases indicated by the flags are taken into account. Overall, 99.3% of the data are considered usable; 93% of the data may be used without qualification; the rest of the data have been flagged with validation codes to assist in their interpretation. (Out of 2304 results, 155 were flagged; seven of these were rejected.)

DATA VALIDATION REPORT

Prepared by: **Clare Bridge**
Reviewed by: **Jenny Vanek**

DATA VALIDATION REPORT

1. INTRODUCTION

- This validation applies to inorganic analytes from 77 groundwater samples collected for the Everett Lowland Investigation from October 1998 through March 1999. The total number of samples included:
  - 9 hydropunch samples (groundwater)
  - 43 groundwater samples from monitoring wells
  - 15 field blanks (8 DI blanks and 7 rinsate blanks)
  - 9 field duplicates
  - 1 field standard.

- Validation procedures used are generally consistent with:

(Check all that apply)

___ EPA CLP National Functional Guidelines for Inorganics Data Review
_X_ Work Plan -- 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998
___ Other

- Overall level of validation:

___ Contract Laboratory Program (CLP)
_X_ Standard
___ Visual

Notes: Originally the Everett Lowlands Investigation was undertaken as a CLP project. Subsequently, the CLP requirement was dropped with Ecology approval. The validation consisted of the following: The frequency and values were checked for both field and laboratory quality control samples. Results were not verified in the raw data. Non-QC sample results were flagged for any field or laboratory quality control exceedances. Data quality objectives for precision, accuracy, and completeness were evaluated as required by the project work plan.

2. DELIVERABLES

- All laboratory document deliverables were present as specified in the CLP-Statement of Work (CLP-SOW), EPA, 1993 and/or the project contract.

_X_ Yes
___No

- All documentation of field procedures was provided as required.

_X_ Yes
___No

Notes: There were a number of inconsistencies in the field notes and in the project site codes. These were resolved during the validation process.

3. FIELD QUALITY CONTROL SAMPLES

The majority of the samples were collected in March 1999. There were two sampling teams on three of the sampling days; these teams submitted separate sets of quality control samples. For flagging purposes, field quality control samples were associated as follows:

March 1, Group 1
EVT-9903-100
EVT-9903-102
EVT-9903-121
EVT-9903-122
EVT-9903-159 (Dup of 122)
EVT-9903-160 (DI)
EVT-9903-161 (Rinsate)

March 1, Group 2
EVT-9903-101
EVT-9903-105
EVT-9903-106
EVT-9903-107
EVT-9903-108
EVT-9903-148 (Dup of 105)
EVT-9903-149 (DI)
EVT-9903-150 (Rinsate)

March 2, Group 1
EVT-9903-103
EVT-9903-104
EVT-9903-116
EVT-9903-117
EVT-9903-118
EVT-9903-123
EVT-9903-124
EVT-9903-125
EVT-9903-128
EVT-9903-129
EVT-9903-162 (Dup of 103)
EVT-9903-163 (DI)
EVT-9903-164 (Rinsate)

March 2, Group 2
EVT-9903-109
EVT-9903-110
EVT-9903-111
EVT-9903-112
EVT-9903-113
EVT-9903-115
EVT-9903-119
EVT-9903-120
EVT-9903-151 (Dup of 110)
EVT-9903-152 (Rinsate)
EVT-9903-153 (DI)

March 3
EVT-9903-126
EVT-9903-127
EVT-9903-130
EVT-9903-131
EVT-9903-165
EVT-9903-166 (Dup of 130)
EVT-9903-167 (DI)
EVT-9903-168 (Rinsate)

March 4
EVT-9903-172 (Standard)

March 5, Group 1
EVT-9903-133
EVT-9903-136
EVT-9903-137
EVT-9903-138
EVT-9903-139
EVT-9903-140
EVT-9903-141
EVT-9903-142
EVT-9903-169 (Dup of 139)
EVT-9903-170 (DI)
EVT-9903-171 (Rinsate)

March 5, Group 2
EVT-9903-135
EVT-9903-144
EVT-9903-145
EVT-9903-146
EVT-9903-147
EVT-9903-154 (Dup of 147)
EVT-9903-155 (DI)
EVT-9903-156 (Rinsate)

Blanks: Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

DI, trip, rinsate, or any other field blanks have been carried out at the proper frequency.
_X_ Yes - For the monitoring well samples.
_X_ No - For the hydropunch samples.

Notes:

- No field quality control samples were submitted with the hydropunch sample collected on October 1, 1998.
- Only one blank was submitted with the hydropunch samples collected on February 9 and 10, 1999.

Reported results on the field blanks are less than the contract required detection limits (CRDL) or the project detection limits (PDL) if these have been specified.
___ Yes
_X_ No

Notes: Blank exceedances and flagging are summarized in the following table:

Blank Type	Sample #	Date	Analyte	Result (ppm)	5 times Result (ppm)	Number of Flags
DI	EVT-9902-108	2/10/99	Sodium	2.0	10.0	0
			Sulfate	1.6	8.0	5
			Zinc(D)	0.009	0.045	6
			Zinc(T)	for Zn (D)	"	2
DI	EVT-9903-150	3/1/99	Sulfate	6.7	33.5	3
Rinsate	EVT-9903-149	3/1/99	TSS	3.1	15.5	2
			Sulfate	4.2	NA	NA
DI	EVT-9903-160	3/1/99	TSS	1.2	6.0	0
			HCO_3	1.0	5.0	0
			Sulfate	3.2	NA	NA

Blank Type	Sample #	Date	Analyte	Result (ppm)	5 times Result (ppm)	Number of Flags
Rinsate	EVT-9903-161	3/1/99	Sulfate	6.8	34.0	2
DI	EVT-9903-153	3/2/99	Sulfate	4.8	24.0	4
Rinsate	EVT-9903-152	3/2/99	Total Alkalinity	1.0	5.0	0
			HCO_3	1.0	5.0	0
			Sulfate	3.7	NA	NA
DI	EVT-9903-163	3/2/99	TSS	1.4	NA	NA
			Total Alkalinity	1.0	5.0	0
			HCO_3	1.0	5.0	0
			Sulfate	2.8	14	5
Rinsate	EVT-9903-164	3/2/99	TSS	2.2	11	2
			Total Alkalinity	1.0	NA	NA
			HCO_3	1.0	NA	NA
			Sulfate	2.0	NA	NA
DI	EVT-9903-167	3/3/99	Total Alkalinity	1.0	5.0	0
			HCO_3	1.0	5.0	0
Rinsate	EVT-9903-168	3/3/99	TDS	11.0	55.0	0
			Sulfate	2.6	13.0	2
DI	EVT-9903-155	3/5/99	TDS	16.0	80.0	0
			Sulfate	9.7	48.5	0
			Zinc (D)	0.006	NA	NA
Rinsate	EVT-9903-156	3/5/99	Total Alkalinity	1.0	5.0	0
			HCO_3	1.0	5.0	0
			Sulfate	4.3	NA	NA
			Zinc (D)	0.007	0.035	3
			Zinc (T)	from (D)	0.035	1
DI	EVT-9903-170	3/5/99	Calcium	1.9	9.5	2
			Sodium	1.1	5.5	0
			Sulfate	3.2	16.0	1
			Zinc (D)	0.009	NA	NA
			Zinc (T)	0.005	NA	NA
Rinsate	EVT-9903-171	3/5/99	Sodium	1.0	NA	NA
			Sulfate	2.0	NA	NA
			Zinc (D)	0.021	0.105	8
			Zinc (T)	from (D)	0.105	4

Notes: When an analyte is detected in a blank, associated results up to 5 times the blank level are flagged to indicate that the results may be biased high due to contamination. Results "associated" with a field blank are generally results for samples collected on the same day as the blank.

Since only one blank was submitted with the February hydropunch samples, the blank was applied to samples collected on both days.

Flagging: UJ_1

- **Field duplicates**

Field duplicates have been collected at the proper frequency.
_X_Yes - The exception is noted below.
___No

Notes: No field quality control was submitted with the hydropunch sample collected on October 1, 1998.

Field duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20% or less for water matrix). If the sample or duplicate result is less than 5 times the PDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PDL for water matrix.
___Yes
_X_No

Site	Date	Sample #/ Dup #	Analyte	Result/ Duplicate (ppm)	Criteria	# of Flags
HP-46D	02/09/99	EVT-9902-100 EVT-9902-101	Total acidity	23/ 49	difference > ± 10 ppm	4
"	"	"	Zinc (Dis)	0.060/ 0.007	difference > ± 0.020 ppm	4
HP-48S	02/10.99	EVT-9902-105 EVT-9902-106	Total acidity	120/ 170	34% RPD	4
"	"	"	Sulfate	3.9/ 2.3	difference > ± 1 ppm	5
EV-19B	03/01/99	EVT-9903-122 EVT-9903-159	TSS	21/ 54	difference > ± 10 ppm	6
EV-7A	03/01/99	EVT-9903-105 EVT-9903-148	Carbonate	17/ 30	55% RPD	6
"	"	"	Sulfate	18/ 26	36% RPD	8
MW-107D2	03/03/99	EVT-9903-130 EVT-9903-166	Sulfate	5.0/ 7.6	difference > ± 1 ppm	6
MW-103D(W)	03/05/99	EVT-9903-139 EVT-9903-169	Total acidity	66/ 52	24% RPD	7

Notes: These flags suggest variability in sample results due to the combined effects of variations in field sampling techniques, sample preparation, and laboratory analytical procedures.

Flagging: J_4/UJ_4

- **Field standards**

  Field standards were sent at the proper frequency
  _X_Yes
  ___No

  Percent recovery on the field standards was within control limits (80-120% for water, within the certified range for soils).
  _X_Yes
  ___No

4. LABORATORY PROCEDURES

- **Laboratory procedures followed**
  _ CLP-SOW
  X SW-846
  _ Methods for Chemical Analysis of Water and Wastes
  _ XRF Standard Operating Procedures
  _ Other

- **Holding times met**
  ___Yes
  _X_No

  Notes: Holding times were exceeded for 58 sulfate results and 19 chloride results. These results were flagged to indicate that they may not be representative of the actual sample concentrations.

  Flagging: J_3/UJ_3

- **Consistency with project requirements**

  Analyses were carried out as requested.
  _X_Yes -- For TSC
  _X_No -- For SAS

  Notes: One hydropunch sample (from HP-45D) was analyzed at Sound Analytical Services (SAS) in Tacoma, Washington. SAS omitted the analysis of laboratory pH and SC; also, no result for total acidity was reported, as the lab noted that they had obtained a negative result. With some exceptions, SAS did not meet the project detection limits.

  Project specified methods were used.
  _X_Yes -- For TSC
  _X_No -- For SAS

  Notes: At SAS, all metals were analyzed using the ICP 6010 method; the laboratory did not use a more sensitive method where necessary in order to achieve project detection limits.

5. DETECTION LIMITS

The following table lists the laboratory's reporting level by analytical method and compares it to the project detection limit (PDL).

Parameter*	**Analysis Method***	**Holding Time**	**SAS Reporting Level (ppm)****	**TSC Reporting Level (ppm)*****	**PDL (ppm)******
Conductivity	120.1	28 days	---	5	---
TDS	160.1	7 days	10	10	10
TSS	160.1	7 days	2	1	10
Calcium	ICP 200.7	6 months	0.5	1	5
Magnesium	ICP 200.7	6 months	0.5	1	5
Sodium	ICP 200.7	6 months	0.5	2	5
Potassium	ICP 200.7	6 months	5	2	5
Alkalinity	310.1	14 days	5	1	1
Acidity*	305.1	14 days	---	5	10
Bicarbonate	310.1	14 days	NA	1	1
Carbonate	310.1	14 days	NA	1	1
Sulfate	375.2	28 days	1.5	2	1
Chloride	325.2	28 days	1.5	1	1
Arsenic	ICP 200.7 ICP-MS 6020	6 months	0.4	0.005	0.005
Cadmium	ICP 200.7 ICP-MS 6020	6 months	0.08	0.002	0.005
Chromium	ICP 200.7 ICP-MS 6020	6 months	0.01	0.005	0.010
Copper*	ICP 200.7 ICP-MS 6020	6 months	0.02	0.010	0.010
Lead	ICP 200.7 ICP-MS 6020	6 months	0.6	0.005	0.005
Zinc	ICP 200.7 ICP-MS 6020	6 months	0.02	0.005	0.020

* The ICP method 200.7 was replaced by the ICP method 6010 when the CLP requirement was removed from the project.

** SAS: Sound Analytical Systems laboratory in Tacoma, Washington.

*** TSC: Asarco's Technical Services Center laboratory in Salt Lake City, Utah.

**** In the project work plan, there were two tables listing parameters, methods, and detection limits for the project: Table 2-3 on page 2-21 of the work plan, and Table 1-2 on page 1-17 in Appendix C of the work plan. These two tables were not consistent with each other. According to the project manager, the laboratories were provided with both tables. Therefore, where there were inconsistencies, the PDL listed here is the least restrictive.

- Reporting detection limits met project detection limits (PDLs).

  ___Yes

  _X_No

  Notes: As shown in the preceding table, reporting detection limits did not meet the project detection limits for sulfate.

- Instrument detection limits (IDLs) were provided by the laboratory.

  ___Yes

  ___No

  _X_NA -- Not required for the project.

6. LABORATORY BLANKS

Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

- **Preparation blanks**

  Preparation blanks were prepared and analyzed at the required frequency.

  _X_Yes

  ___No

  All the analytes in the preparation blank were less than the CRDL (or the PDL if a project detection limit has been specified).

  ___Yes

  _X_No

  Notes: Batch L990256 preparation blank measured 0.006 ppm for total zinc. Associated total zinc results up to 0.030 ppm were flagged to indicate possible high bias due to blank contamination (2 flags).

  Flagging: UJ_1

7. LABORATORY MATRIX SPIKES

- A matrix spike sample (pre-digestion) was analyzed for each digestion batch and/or matrix, or as required in the CLP-SOW.

  _X_Yes

  ___No

- Matrix spike recoveries were within the required control limits (75-125%).

  _X_Yes

  ___No

8. LABORATORY DUPLICATES

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes
  ___No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20% or less for water matrix, 35% or less for soil matrix). For low concentration data, that is if the sample or duplicate result is less than 5 times the PDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PDL for water matrix, and within ± 2 times the PDL for soil matrix.

  ___Yes
  _X_ No

  Notes: For laboratory batch L990256, the laboratory duplicate for dissolved zinc was out of control limits with an RPD of 40%. Nine dissolved zinc results from the same laboratory batch were flagged to indicate a possible lack of reproducibility.

  Flagging: J_4/ UJ_4

9. LABORATORY CONTROL STANDARDS

- The reference material used was of the correct matrix and concentration.

  _X_ Yes
  ___No

- LCSs were prepared and analyzed at the proper frequency

  _X_ Yes
  ___No

- LCS recoveries were within the required control limits (80-120% for water, within the certified range for soils).

  _X_ Yes
  ___No

10. INTERPARAMETER RELATIONSHIPS

- The following relationships have been checked:

  _X_Tot/Dis metals.
  X_Lab pH vs field pH
  X_Lab SC vs field SC
  X_TDS vs SC.
  ___Arsenic speciation/dissolved arsenic.

Tot/Dis metals: If the dissolved metals result is greater than the total metals, the two results are evaluated by the same criteria used for evaluating duplicate samples. For samples where the concentrations are greater than 5 times the PDL, the relative percent difference (RPD) between the dissolved and the total result should be 20% or less; for samples where the concentrations are less than 5 times the PDL, the difference between the dissolved and total results should be within ± the PDL for water matrix.

This relationship was generally in order. The exceptions are listed in the following table (results are in ppm).

Site	Sample #	Analyte	Dissolved	Total	Criteria
EV-4A	EVT-9903-101	Arsenic	0.095	0.039	84% RPD
EV-22B	EVT-9903-127	Arsenic	0.880	0.032	186% RPD

Lab pH vs field pH: These two parameters are compared by calculating the percent difference. This relationship was generally in order. The percent differences were distributed as follows:

Less than 10% difference.................32
From 10 to 15% difference..............8
From 15 to 20% difference..............4
Greater than 20% difference............1

With one exception, field pH values were less than lab pH values. The exception was for EVT-9903-145 collected at MW-108S(W), where the field pH was 6.43, the lab pH was 3.4, and the percent difference was 47%. The increase in the acidity of the sample may be due to iron precipitating out; when the lab analyst checked this sample at the end of May 1999, the pH was near 3, and the sample contained orange particulate matter.

In the reducing environment of groundwater, iron exists as Fe^{+2}. When the water is pumped out of the well and comes in contact with the air, some of the iron is oxidized to Fe^{+3}. In this form, iron reacts with water to form iron hydroxide, which precipitates out as an orange precipitate as shown is this reaction: $2Fe^{+3} + 6H_2O \rightarrow 2Fe(OH)_3\downarrow + 6H^+$. The hydrogen ions produced in this reaction will lower the pH in the sample.

Lab SC vs field SC: These two parameters are compared by calculating the percent difference. The percent differences were distributed as follows:

Less than 10% difference	16
From 10 to 20% difference	16
From 20 to 40% difference	4
Greater than 40% difference	9

The nine samples with percent differences greater than 40% are listed in the following table. Note that for seven of the samples (results shown in boldface), there is an approximate factor of ten difference between the lab and the field SC readings, indicating a possible error in reading the meter.

Site	**Sample #**	**Sample Date & Time**	**Lab pH**	**Field pH**	**% D***	**Lab SC**	**Field SC**	**% D***
EV-15A	EVT-9903-116	3/2, 10:15	6.9	6.47	7%	**2480**	**268**	89%
EV-22A	EVT-9903-126	3/3, 11:00	7.4	7.06	5%	**3680**	**412**	89%
EV-22B	EVT-9903-127	3/3, 11:45	7.9	7.10	11%	**4110**	**510**	88%
MW-102S(W)	EVT-9903-137	3/5, 10:00	**7.0**	**5.90**	**19%**	235	410	75%
MW-103D(W)	EVT-9903-139	3/5, 10:50	7.0	6.33	11%	**2250**	**208**	91%
MW-103S(W)	EVT-9903-138	3/5, 11:20	6.9	6.25	10%	**1835**	**209**	89%
MW-104S(W)	EVT-9903-140	3/5, 12:00	6.8	6.14	11%	**1360**	**146**	89%
MW-105D(W)	EVT-9903-142	3/5, 12:20	7.5	6.88	9%	**1687**	**176**	90%
MW-108S(W)	EVT-9903-145	3/5, 10:00	**3.4**	**6.43**	**47%**	2160	1066	51%

* Percent difference, rounded to nearest percent.

Since the laboratory SC analyses involve measurements of standards as quality control, and since the ratios of TDS to laboratory SC were within the expected ranges, the laboratory SC readings were accepted as reflecting the actual sample values. The field SC results for the seven samples were flagged to indicate that these values are considered unusable, and have therefore been rejected.

Flagging: R

For the samples collected at MW-102S(W) and MW-108S(W), the laboratory SC result was in line with the TDS value. In these two cases, however, there was no clear factor of ten between the field and laboratory SC values; also, considering the field and laboratory pH values for these two samples, the discrepancy between the field and laboratory SC values may reflect real chemical changes occurring in the samples over time. Both the laboratory and field SC results were flagged to indicate the high percent difference and the possible time-dependent uncertainty in the values.

Flagging: J_4

TDS vs SC: The ratio of TDS to SC should lie between 0.55 and 0.75. In natural waters with high sulfate, the ratio may be as high as 0.96. This ratio is intended to be a check on the accuracy of the TDS and SC measurements. (It should be noted that these measurements are less accurate in dilute waters.)

This relationship was generally in order, with all TDS to SC ratios between 0.54 and 0.91. Out of 51 samples where both TDS and lab SC were measured, eight samples (16%) had ratios greater than 0.75.

11. DATA QUALITY OBJECTIVES

- **Project data quality objectives (DQO's) met.**

_X_Yes
___No

Accuracy

The target accuracy for this project is for at least 90 percent of the laboratory spikes and laboratory control samples to be within control limits. This goal was met: one hundred percent of both of these quality control sample types were within control limits.

Precision

The target precision for this project is for at least 90 percent of the field and laboratory duplicates to be within control limits. This goal was met: 95 percent (222 out of 234) of field duplicate measurements and 99 percent (148 out of 149) laboratory duplicate measurements were within control limits.

Completeness

The target completeness for this project is "assessment of at least 90 percent of the sample analyses as 'valid'." A 'valid' result is one that has not been flagged as rejected (R) or anomalous (A).

Overall, this goal was met: 99.7 percent of the results were considered to be valid (2297 out of 2304 results). Considering field SC alone, however, the completeness goal was not met. Of a total of 46 field SC measurements, seven were rejected. Completeness for field SC was 85 percent.

REFERENCES

Hem, J.D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition. US Geological Survey Water Supply Paper 2254.

Hydrometrics. 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998.

U.S. Environmental Protection Agency, 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.

U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983. (EPA, 1983)

U.S. Environmental Protection Agency, 1993. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM03.0

U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994.

APPENDIX 1

TABLES

TABLE 1.

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 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates low bias. 4 - Other QC outside control limits.
UJ	-	The material was analyzed for, but was not detected above the associated value. Subscripts for the "UJ" qualifier: 1 - Blank contamination. Indicates possible high bias and/or false positive. 2 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates low bias. 4 - Other QC outside control limits.
R	-	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.
A	-	Anomalous data. No apparent explanation for discrepancy in data. (Not an EPA code.)

Table 2. Summary of Flagged Data
Everett Lowlands Investigation: Groundwater, October 1998 through March 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
HP-46D	EVT-9902-100	L990256-1	02/09/99	TOTAL ACIDITY AS CACO3	23.0	J4	Field duplicate, difference >± 0.010 ppm
				ZINC (ZN)(DIS)	0.06	J4	Field duplicate, difference >± 0.020 ppm
				ZINC (ZN)(DIS)	0.06	J4	Lab duplicate, 40% RPD
HP-46D (Dup)	EVT-9902-101	L990256-2	02/09/99	TOTAL ACIDITY AS CACO3	49.0	J4	Field duplicate, difference >± 0.010 ppm
				ZINC (ZN)(DIS)	0.007	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.007	J4	Field duplicate, difference >± 0.020 ppm
				ZINC (ZN)(DIS)	0.007	J4	Lab duplicate, 40% RPD
HP-46S	EVT-9902-102	L990256-3	02/09/99	TOTAL ACIDITY AS CACO3	178.0	J4	Field duplicate, difference >± 0.010 ppm
				ZINC (ZN)(DIS)	0.031	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.031	J4	Field duplicate, difference >± 0.020 ppm
				ZINC (ZN)(DIS)	0.031	J4	Lab duplicate, 40% RPD
HP-47S	EVT-9902-103	L990256-4	02/09/99	TOTAL ACIDITY AS CACO3	180.0	J4	Field duplicate, difference >± 0.010 ppm
				SULFATE (SO4)	5.6	UJ1	Field blank, 1.6 ppm
				ZINC (ZN)(DIS)	0.1	J4	Field duplicate, difference >± 0.020 ppm
				ZINC (ZN)(DIS)	0.1	J4	Lab duplicate, 40% RPD
HP-47D	EVT-9902-104	L990256-5	02/10/99	TOTAL ACIDITY AS CACO3	31.0	J4	Field duplicate, 34% RPD
				SULFATE (SO4)	6.3	UJ1	Field blank, 1.6 ppm
				SULFATE (SO4)	6.3	J4	Field duplicate, difference >± 1 ppm
				ZINC (ZN)(DIS)	0.006	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.006	J4	Lab duplicate, 40% RPD
HP-48S	EVT-9902-105	L990256-6	02/10/99	TOTAL ACIDITY AS CACO3	120.0	J4	Field duplicate, 34% RPD
				SULFATE (SO4)	3.9	UJ1	Field blank, 1.6 ppm
				SULFATE (SO4)	3.9	J4	Field duplicate, difference >± 1 ppm
				ZINC (ZN)(DIS)	0.011	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.011	J4	Lab duplicate, 40% RPD
				ZINC (ZN)(TOT)	0.017	UJ1	Field blank, Zn(D) at 0.009 ppm
				ZINC (ZN)(TOT)	0.017	UJ1	Lab preparation blank, 0.006 ppm
HP-48S (Dup)	EVT-9902-106	L990256-7	02/10/99	TOTAL ACIDITY AS CACO3	170.0	J4	Field duplicate, 34% RPD
				SULFATE (SO4)	2.3	UJ1	Field blank, 1.6 ppm
				SULFATE (SO4)	2.3	J4	Field duplicate, difference >± 1 ppm
				ZINC (ZN)(DIS)	0.017	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.017	J4	Lab duplicate, 40% RPD
				ZINC (ZN)(TOT)	0.013	UJ1	Field blank, Zn(D) at 0.009 ppm
				ZINC (ZN)(TOT)	0.013	UJ1	Lab preparation blank, 0.006 ppm
HP-48D	EVT-9902-107	L990256-8	02/10/99	TOTAL ACIDITY AS CACO3	12.0	J4	Field duplicate, 34% RPD
				SULFATE (SO4)	3.4	UJ1	Field blank, 1.6 ppm
				SULFATE (SO4)	3.4	J4	Field duplicate, difference >± 1 ppm
				ZINC (ZN)(DIS)	0.011	UJ1	Field blank, 0.009 ppm
				ZINC (ZN)(DIS)	0.011	J4	Lab duplicate, 40% RPD
DI BLANK	EVT-9902-108	L990256-9	02/10/99	SULFATE (SO4)	1.6	J4	Field duplicate, difference >± 1 ppm
				ZINC (ZN)(DIS)	0.009	J4	Lab duplicate, 40% RPD
EV-3	EVT-9903-100	L990355-1	03/01/99	TOTAL SUSPENDED SOLIDS	120.0	J4	Field duplicate, difference >± 10 ppm
				SULFATE (SO4)	29.0	UJ1	Field blank, 6.8 ppm
				SULFATE (SO4)	29.0	J3	Hold Time, 30 days
EV-4A	EVT-9903-101	L990355-2	03/01/99	CARBONATE AS CO3	<1.0	UJ4	Field duplicate, 55% RPD
				SULFATE (SO4)	54.0	J3	Hold Time, 30 days
				SULFATE (SO4)	54.0	J4	Field duplicate, 36% RPD
EV-4B	EVT-9903-102	L990355-3	03/01/99	SULFATE (SO4)	70.0	J3	Hold Time, 30 days
EV-6A	EVT-9903-103	L990355-4	03/02/99	TOTAL SUSPENDED SOLIDS	6.2	UJ1	Field blank, 2.2 ppm
				SULFATE (SO4)	57.0	J3	Hold Time, 29 days
EV-6B	EVT-9903-104	L990355-5	03/02/99	SULFATE (SO4)	43.0	J3	Hold Time, 29 days

Table 2. Summary of Flagged Data
Everett Lowlands Investigation: Groundwater, October 1998 through March 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
EV-7A	EVT-9903-105	L990355-6	03/01/99	TOTAL SUSPENDED SOLIDS	6.1	UJ1	Field blank, 3.1 ppm
				CARBONATE AS CO3	17.0	J4	Field duplicate, 55% RPD
				SULFATE (SO4)	18.0	UJ1	Field blank, 6.7 ppm
				SULFATE (SO4)	18.0	J3	Hold Time, 30 days
				SULFATE (SO4)	18.0	J4	Field duplicate, 36% RPD
EV-7B	EVT-9903-106	L990355-7	03/01/99	CARBONATE AS CO3	<1.0	UJ4	Field duplicate, 55% RPD
				SULFATE (SO4)	42.0	J3	Hold Time, 30 days
				SULFATE (SO4)	42.0	J4	Field duplicate, 36% RPD
EV-8A	EVT-9903-107	L990355-8	03/01/99	CARBONATE AS CO3	12.0	J4	Field duplicate, 55% RPD
				SULFATE (SO4)	5.6	UJ1	Field blank, 6.7 ppm
				SULFATE (SO4)	5.6	J3	Hold Time, 30 days
				SULFATE (SO4)	5.6	J4	Field duplicate, 36% RPD
EV-8B	EVT-9903-108	L990355-9	03/01/99	CARBONATE AS CO3	<1.0	UJ4	Field duplicate, 55% RPD
				SULFATE (SO4)	56.0	J3	Hold Time, 30 days
				SULFATE (SO4)	56.0	J4	Field duplicate, 36% RPD
EV-9A	EVT-9903-109	L990355-10	03/02/99	SULFATE (SO4)	7.6	UJ1	Field blank, 4.8 ppm
				SULFATE (SO4)	7.6	J3	Hold Time, 29 days
EV-9B	EVT-9903-110	L990355-11	03/02/99	SULFATE (SO4)	34.0	J3	Hold Time, 29 days
WP-1	EVT-9903-111	L990355-12	03/02/99	SULFATE (SO4)	9.3	UJ1	Field blank, 4.8 ppm
				SULFATE (SO4)	9.3	J3	Hold Time, 29 days
MW-3	EVT-9903-112	L990355-13	03/02/99	SULFATE (SO4)	10.0	UJ1	Field blank, 4.8 ppm
				SULFATE (SO4)	10.0	J3	Hold Time, 29 days
MW-4A	EVT-9903-113	L990355-14	03/02/99	SULFATE (SO4)	21.0	UJ1	Field blank, 4.8 ppm
				SULFATE (SO4)	21.0	J3	Hold Time, 29 days
MW-5	EVT-9903-115	L990355-15	03/02/99	SULFATE (SO4)	78.0	J3	Hold Time, 29 days
EV-15A	EVT-9903-116	L990355-16	03/02/99	SC (FLD)(µmhos per cm)	268	R	Ten times factor. Comparison to lab SC and TDS
				SULFATE (SO4)	13.0	UJ1	Field blank, 2.8 ppm
				SULFATE (SO4)	13.0	J3	Hold Time, 29 days
EV-15B	EVT-9903-117	L990355-17	03/02/99	SULFATE (SO4)	14.0	UJ1	Field blank, 2.8 ppm
				SULFATE (SO4)	14.0	J3	Hold Time, 29 days
EV-16A	EVT-9903-118	L990355-18	03/02/99	SULFATE (SO4)	17.0	J3	Hold Time, 29 days
EV-17A	EVT-9903-119	L990355-19	03/02/99	SULFATE (SO4)	26.0	J3	Hold Time, 29 days
EV-17B	EVT-9903-120	L990355-20	03/02/99	SULFATE (SO4)	66.0	J3	Hold Time, 36 days
EV-18B	EVT-9903-121	L990355-21	03/01/99	SULFATE (SO4)	68.0	J3	Hold Time, 30 days
EV-19B	EVT-9903-122	L990355-22	03/01/99	TOTAL SUSPENDED SOLIDS	21.0	J4	Field duplicate, difference >± 10 ppm
				SULFATE (SO4)	32.0	UJ1	Field blank, 6.8 ppm
				SULFATE (SO4)	32.0	J3	Hold Time, 30 days
EV-20B	EVT-9903-123	L990355-23	03/02/99	SULFATE (SO4)	38.0	J3	Hold Time, 29 days
EV-21A	EVT-9903-124	L990355-24	03/02/99	SULFATE (SO4)	35.0	J3	Hold Time, 29 days
EV-21B	EVT-9903-125	L990355-25	03/02/99	SULFATE (SO4)	12.0	UJ1	Field blank, 2.8 ppm
				SULFATE (SO4)	12.0	J3	Hold Time, 29 days
EV-22A	EVT-9903-126	L990355-26	03/03/99	SC (FLD)(µmhos per cm)	412	R	Ten times factor. Comparison to lab SC and TDS

Table 2. Summary of Flagged Data
Everett Lowlands Investigation: Groundwater, October 1998 through March 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
EV-22B	EVT-9903-127	L990355-27	03/03/99	SC (FLD)(µmhos per cm)	510	R	Ten times factor. Comparison to lab SC and TDS
				SULFATE (SO4)	33.0	J4	Field duplicate, 41% RPD
EV-23A	EVT-9903-128	L990355-28	03/02/99	SULFATE (SO4)	5.9	UJ1	Field blank, 2.8 ppm
				SULFATE (SO4)	5.9	J3	Hold Time, 29 days
EV-23B	EVT-9903-129	L990355-29	03/02/99	SULFATE (SO4)	13.0	UJ1	Field blank, 2.8 ppm
				SULFATE (SO4)	13.0	J3	Hold Time, 29 days
MW-107D	EVT-9903-130	L990355-30	03/03/99	SULFATE (SO4)	5.0	UJ1	Field blank, 2.6 ppm
				SULFATE (SO4)	5.0	J4	Field duplicate, 41% RPD
MW-109D	EVT-9903-131	L990355-31	03/03/99	SULFATE (SO4)	24.0	J4	Field duplicate, 41% RPD
MW-5(W)	EVT-9903-133	L990390-2	03/05/99	SULFATE (SO4)	11.0	UJ1	Field blank, 3.2 ppm
				SULFATE (SO4)	11.0	J3	Hold time, 33 days
				CHLORIDE (CL)	18.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.006	UJ1	Field blank, 0.105 ppm
MW-7(W)	EVT-9903-135	L990390-3	03/05/99	SULFATE (SO4)	101.0	J3	Hold time, 33 days
				CHLORIDE (CL)	3.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.012	UJ1	Field blank, 0.007 ppm
MW-8(W)	EVT-9903-136	L990390-4	03/05/99	CALCIUM (CA)	6.7	UJ1	Field blank, 1.9 ppm
				SULFATE (SO4)	19.0	J3	Hold time, 33 days
				CHLORIDE (CL)	92.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.009	UJ1	Field blank, 0.105 ppm
MW-102S(W)	EVT-9903-137	L990390-5	03/05/99	SC (FLD)(µmhos per cm)	410	J4	Comparison to lab SC and TDS
				SC (LAB)(µmhos per cm)	235	J4	Comparison to lab SC and TDS
				TOTAL ACIDITY AS CACO3	17.0	J4	Field duplicate, 24% RPD
				CALCIUM (CA)	5.4	UJ1	Field blank, 1.9 ppm
				SULFATE (SO4)	21.0	J3	Hold time, 33 days
				CHLORIDE (CL)	5.2	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.021	UJ1	Field blank, 0.105 ppm
				ZINC (ZN)(TOT)	0.054	UJ1	Field blank, Zn(D) at 0.105 ppm
MW-103S(W)	EVT-9903-138	L990390-6	03/05/99	SC (FLD)(µmhos per cm)	209	R	Ten times factor. Comparison to lab SC and TDS
				TOTAL ACIDITY AS CACO3	31.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	452.0	J3	Hold time, 33 days
				CHLORIDE (CL)	47.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.009	UJ1	Field blank, 0.105 ppm
				ZINC (ZN)(TOT)	0.008	UJ1	Field blank, Zn(D) at 0.105 ppm
MW-103D(W)	EVT-9903-139	L990390-7	03/05/99	SC (FLD)(µmhos per cm)	208	R	Ten times factor. Comparison to lab SC and TDS
				TOTAL ACIDITY AS CACO3	66.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	218.0	J3	Hold time, 33 days
				CHLORIDE (CL)	388.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.014	UJ1	Field blank, 0.105 ppm
MW-104S(W)	EVT-9903-140	L990390-8	03/05/99	SC (FLD)(µmhos per cm)	146	R	Ten times factor. Comparison to lab SC and TDS
				TOTAL ACIDITY AS CACO3	66.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	398.0	J3	Hold time, 33 days
				CHLORIDE (CL)	26.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.009	UJ1	Field blank, 0.105 ppm
				ZINC (ZN)(TOT)	0.006	UJ1	Field blank, Zn(D) at 0.105 ppm
MW-105S(W)	EVT-9903-141	L990390-9	03/05/99	TOTAL ACIDITY AS CACO3	42.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	36.0	J3	Hold time, 33 days
				CHLORIDE (CL)	4.9	J3	Hold time, 42 days
MW-105D(W)	EVT-9903-142	L990390-10	03/05/99	SC (FLD)(µmhos per cm)	176	R	Ten times factor. Comparison to lab SC and TDS
				TOTAL ACIDITY AS CACO3	56.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	46.0	J3	Hold time, 33 days

Table 2. Summary of Flagged Data
Everett Lowlands Investigation: Groundwater, October 1998 through March 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
MW-105D(W)	EVT-9903-142	L990390-10	03/05/99	CHLORIDE (CL)	220.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.006	UJ1	Field blank, 0.105 ppm
MW-107S2(W)	EVT-9903-144	L990390-11	03/05/99	SULFATE (SO4)	96.0	J3	Hold time, 33 days
				CHLORIDE (CL)	9.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.008	UJ1	Field blank, 0.007 ppm
				ZINC (ZN)(TOT)	0.01	UJ1	Field blank, 0.007 ppm
MW-108S(W)	EVT-9903-145	L990390-12	03/05/99	SC (FLD)(µmhos per cm)	1066	J4	Comparison to lab SC and TDS
				SC (LAB)(µmhos per cm)	2160	J4	Comparison to lab SC and TDS
				SULFATE (SO4)	1142.0	J3	Hold time, 33 days
				CHLORIDE (CL)	28.0	J3	Hold time, 42 days
MW-108D(W)	EVT-9903-146	L990390-13	03/05/99	SULFATE (SO4)	50.0	J3	Hold time, 33 days
				CHLORIDE (CL)	15.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.01	UJ1	Field blank, 0.007 ppm
MW-109S(W)	EVT-9903-147	L990390-14	03/05/99	SULFATE (SO4)	145.0	J3	Hold time, 33 days
				CHLORIDE (CL)	4.8	J3	Hold time, 42 days
EV-7A (Dup)	EVT-9903-148	L990355-32	03/01/99	TOTAL SUSPENDED SOLIDS	6.5	UJ1	Field blank, 3.1 ppm
				CARBONATE AS CO3	30.0	J4	Field duplicate, 55% RPD
				SULFATE (SO4)	26.0	UJ1	Field blank, 6.7 ppm
				SULFATE (SO4)	26.0	J3	Hold Time, 30 days
				SULFATE (SO4)	26.0	J4	Field duplicate, 36% RPD
RINSATE	EVT-9903-149	L990355-33	03/01/99	SULFATE (SO4)	4.2	J3	Hold Time, 30 days
				SULFATE (SO4)	4.2	J4	Field duplicate, 36% RPD
DI BLANK	EVT-9903-150	L990355-34	03/01/99	SULFATE (SO4)	6.7	J3	Hold Time, 30 days
				SULFATE (SO4)	6.7	J4	Field duplicate, 36% RPD
EV-9B (Dup)	EVT-9903-151	L990355-35	03/02/99	SULFATE (SO4)	30.0	J3	Hold Time, 29 days
RINSATE	EVT-9903-152	L990355-36	03/02/99	SULFATE (SO4)	3.7	J3	Hold Time, 29 days
DI BLANK	EVT-9903-153	L990355-37	03/02/99	SULFATE (SO4)	4.8	J3	Hold Time, 29 days
MW-109S(W) (Dup)	EVT-9903-154	L990390-15	03/05/99	SULFATE (SO4)	151.0	J3	Hold time, 33 days
				CHLORIDE (CL)	4.6	J3	Hold time, 42 days
DI BLANK	EVT-9903-155	L990390-1	03/05/99	SULFATE (SO4)	9.7	J3	Hold time, 33 days
				CHLORIDE (CL)	<1.0	UJ3	Hold time, 42 days
RINSATE	EVT-9903-156	L990390-16	03/05/99	SULFATE (SO4)	4.3	J3	Hold time, 33 days
				CHLORIDE (CL)	<1.0	UJ3	Hold time, 42 days
EV-19B (Dup)	EVT-9903-159	L990355-38	03/01/99	TOTAL SUSPENDED SOLIDS	54.0	J4	Field duplicate, difference >± 10 ppm
				SULFATE (SO4)	36.0	J3	Hold Time, 30 days
DI BLANK	EVT-9903-160	L990355-39	03/01/99	TOTAL SUSPENDED SOLIDS	1.2	J4	Field duplicate, difference >± 10 ppm
				SULFATE (SO4)	3.2	J3	Hold Time, 30 days
RINSATE	EVT-9903-161	L990355-40	03/01/99	SULFATE (SO4)	6.8	J3	Hold Time, 30 days
EV-6A (Dup)	EVT-9903-162	L990355-41	03/02/99	TOTAL SUSPENDED SOLIDS	3.9	UJ1	Field blank, 2.2 ppm
				SULFATE (SO4)	54.0	J3	Hold Time, 29 days
DI BLANK	EVT-9903-163	L990355-42	03/02/99	SULFATE (SO4)	2.8	J3	Hold Time, 29 days
RINSATE	EVT-9903-164	L990355-43	03/02/99	SULFATE (SO4)	2.0	J3	Hold Time, 29 days
EV-11	EVT-9903-165	L990355-44	03/03/99	SULFATE (SO4)	15.0	J4	Field duplicate, 41% RPD

Table 2. Summary of Flagged Data
Everett Lowlands Investigation: Groundwater, October 1998 through March 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
MW-107D (Dup)	EVT-9903-166	L990355-45	03/03/99	SULFATE (SO4)	7.6	UJ1	Field blank, 2.6 ppm
				SULFATE (SO4)	7.6	J4	Field duplicate, 41% RPD
RINSATE	EVT-9903-168	L990355-47	03/03/99	SULFATE (SO4)	2.6	J4	Field duplicate, 41% RPD
MW-103D(W) (Dup)	EVT-9903-169	L990390-17	03/05/99	TOTAL ACIDITY AS CACO3	52.0	J4	Field duplicate, 24% RPD
				SULFATE (SO4)	198	J3	Hold time, 33 days
				CHLORIDE (CL)	459.0	J3	Hold time, 42 days
				ZINC (ZN)(DIS)	0.009	UJ1	Field blank, 0.105 ppm
				ZINC (ZN)(TOT)	0.005	UJ1	Field blank, Zn(D) at 0.105 ppm
DI BLANK	EVT-9903-170	L990390-18	03/05/99	SULFATE (SO4)	3.2	J3	Hold time, 33 days
				CHLORIDE (CL)	<1.0	UJ3	Hold time, 42 days
RINSATE	EVT-9903-171	L990390-19	03/05/99	SULFATE (SO4)	2.0	J3	Hold time, 33 days
				CHLORIDE (CL)	<1.0	UJ3	Hold time, 42 days

APPENDIX 2

DATABASE

TABLE OF CONTENTS BY SITE TYPE

ASEVLW - ASARCO, Everett LI Water

ANALYSES SUMMARY REPORT

DataMan Program

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-3		EV-4A		EV-4B	
SAMPLE DATE	03/01/99		03/01/99		03/01/99	
SAMPLE TIME	15:15		12:30		14:15	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-1		L990355-2		L990355-3	
SAMPLE NUMBER	EVT-9903-100		EVT-9903-101		EVT-9903-102	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	46.26		7.47		50.6	
OXYGEN (O) (FLD)	4.88		0.2		2.2	
PH (FLD)	6.23		5.71		6.51	
PH	6.7		6.4		6.9	
SALINITY (G/KG) (FLD)	0.1		0.1		0.3	
SC (UMHOS/CM AT 25 C)	241.0		354.0		756.0	
SC (UMHOS/CM AT 25 C) (FLD)	268.0		325.0		852.0	
TDS (MEASURED AT 180 C)	206.0		265.0		504.0	
TOTAL SUSPENDED SOLIDS	120.0	J4	29.0		954.0	
TURBIDITY (NTU)	3.0		0.0		72.0	
WATER TEMPERATURE (C) (FLD)	12.6		10.9		13.0	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	17.0		36.0		53.0	
MAGNESIUM (MG) DIS	10.0		19.0		51.0	
SODIUM (NA) DIS	13.0		10.0		34.0	
POTASSIUM (K) DIS	3.1		2.6		4.5	
TOTAL ALKALINITY AS CACO3	65.0		116.0		290.0	
TOTAL ACIDITY AS CACO3	9.9		65.0		85.0	
BICARBONATE (HCO3)	79.0		142.0		354.0	
CARBONATE AS CO3	<1.0		<1.0	UJ4	<1.0	
SULFATE (SO4)	29.0	J3	54.0	J3	70.0	J3
		UJ1		J4		
CHLORIDE (CL)	3.5		3.4		22.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		0.095		0.085	
ARSENIC (AS) TOT	<0.005		0.039		0.096	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.006		<0.005		0.013	
COPPER (CU) DIS	0.011		<0.01		<0.01	
COPPER (CU) TOT	0.027		<0.01		0.013	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		0.009	
ZINC (ZN) DIS	0.049		0.059		0.03	
ZINC (ZN) TOT	0.03		0.056		0.058	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-6A	EV-6A	EV-6B	EV-7A
SAMPLE DATE	03/02/99	03/02/99	03/02/99	03/01/99
SAMPLE TIME	15:00	15:10	15:20	14:20
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-4	L990355-41	L990355-5	L990355-6
REMARKS		DUPLICATE		
SAMPLE NUMBER	EVT-9903-103	EVT-9903-162	EVT-9903-104	EVT-9903-105
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	47.1		50.73	1.01
OXYGEN (O) (FLD)	7.43		11.7	0.03
PH (FLD)	6.71		8.04	8.87
PH	7.1	6.8	8.2	8.6
SALINITY (G/KG) (FLD)	0.2		0.2	0.2
SC (UMHOS/CM AT 25 C)	473.0	474.0	553.0	512.0
SC (UMHOS/CM AT 25 C) (FLD)	537.0		623.0	495.0
TDS (MEASURED AT 180 C)	430.0	426.0	355.0	451.0
TOTAL SUSPENDED SOLIDS	6.2 UJ1	3.9 UJ1	398.0	6.1 UJ1
TURBIDITY (NTU)	25.0		180.0	0.0
WATER TEMPERATURE (C) (FLD)	9.1		12.5	9.5
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	58.0	59.0	25.0	87.0
MAGNESIUM (MG) DIS	11.0	11.0	46.0	11.0
SODIUM (NA) DIS	15.0	15.0	23.0	15.0
POTASSIUM (K) DIS	13.0	13.0	6.9	14.0
TOTAL ALKALINITY AS CACO3	187.0	182.0	254.0	272.0
TOTAL ACIDITY AS CACO3	60.0	50.0	15.0	<5.0
BICARBONATE (HCO3)	228.0	222.0	310.0	298.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	17.0 J4
SULFATE (SO4)	57.0 J3	54.0 J3	43.0 J3	18.0 J3 J4,UJ1
CHLORIDE (CL)	6.6	6.6	15.0	7.8
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.26	0.26	0.026	1.7
ARSENIC (AS) TOT	0.24	0.25	0.041	1.7
CADMIUM (CD) DIS	0.015	0.015	<0.002	<0.002
CADMIUM (CD) TOT	0.015	0.015	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	0.028	<0.005
COPPER (CU) DIS	0.43	0.43	<0.01	<0.01
COPPER (CU) TOT	0.51	0.52	0.027	0.016
LEAD (PB) DIS	0.29	0.3	<0.005	0.12
LEAD (PB) TOT	0.33	0.36	0.035	0.17
ZINC (ZN) DIS	18.0	17.0	0.007	0.036
ZINC (ZN) TOT	16.0	17.0	0.15	0.057

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-7A	EV-7B	EV-8A
SAMPLE DATE	03/01/99	03/01/99	03/01/99
SAMPLE TIME	14:40	15:20	16:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-32	L990355-7	L990355-8
REMARKS	DUPLICATE		
SAMPLE NUMBER	EVT-9903-148	EVT-9903-106	EVT-9903-107
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)		6.34	1.49
OXYGEN (O) (FLD)		0.98	0.01
PH (FLD)		6.56	9.03
PH	8.6	7.1	8.9
SALINITY (G/KG) (FLD)		0.1	0.1
SC (UMHOS/CM AT 25 C)	510.0	355.0	413.0
SC (UMHOS/CM AT 25 C) (FLD)		348.0	398.0
TDS (MEASURED AT 180 C)	448.0	271.0	287.0
TOTAL SUSPENDED SOLIDS	6.5 UJ1	35.0	16.0
TURBIDITY (NTU)		0.0	0.0
WATER TEMPERATURE (C) (FLD)		11.2	8.3
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	88.0	27.0	56.0
MAGNESIUM (MG) DIS	11.0	20.0	9.5
SODIUM (NA) DIS	15.0	14.0	17.0
POTASSIUM (K) DIS	15.0	4.1	11.0
TOTAL ALKALINITY AS CACO3	269.0	110.0	225.0
TOTAL ACIDITY AS CACO3	<5.0	19.0	<5.0
BICARBONATE (HCO3)	267.0	134.0	250.0
CARBONATE AS CO3	30.0 J4	<1.0 UJ4	12.0 UJ4
SULFATE (SO4)	26.0 J3 J4,UJ1	42.0 J3 J4	5.6 J3 J4,UJ1
CHLORIDE (CL)	8.4	11.0	2.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	1.7	7.1	1.3
ARSENIC (AS) TOT	1.8	7.0	1.4
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.017	<0.01	<0.01
LEAD (PB) DIS	0.12	<0.005	<0.005
LEAD (PB) TOT	0.18	0.005	0.024
ZINC (ZN) DIS	0.033	<0.005	<0.005
ZINC (ZN) TOT	0.067	0.012	0.051

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-8B		EV-9A		EV-9B		EV-9B	
SAMPLE DATE	03/01/99		03/02/99		03/02/99		03/02/99	
SAMPLE TIME	16:50		10:15		11:15		11:30	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-9		L990355-10		L990355-11		L990355-35	
REMARKS							DUPLICATE	
SAMPLE NUMBER	EVT-9903-108		EVT-9903-109		EVT-9903-110		EVT-9903-151	
-- PHYSICAL PARAMETERS --								
DEPTH TO WATER LEVEL (FEET)	6.2		1.98		5.1			
OXYGEN (O) (FLD)	0.12		0.02		0.48			
PH (FLD)	6.95		7.03		6.16			
PH	7.2		7.7		6.9		6.8	
SALINITY (G/KG) (FLD)	0.1		0.6		0.1			
SC (UMHOS/CM AT 25 C)	455.0		1318.0		404.0		405.0	
SC (UMHOS/CM AT 25 C) (FLD)	446.0		1440.0		400.0			
TDS (MEASURED AT 180 C)	329.0		841.0		298.0		276.0	
TOTAL SUSPENDED SOLIDS	979.0		60.0		5.4		7.6	
TURBIDITY (NTU)	0.0		37.0		10.0			
WATER TEMPERATURE (C) (FLD)	11.8		11.1		11.7			
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS	19.0		122.0		25.0		25.0	
MAGNESIUM (MG) DIS	27.0		31.0		23.0		23.0	
SODIUM (NA) DIS	33.0		117.0		21.0		21.0	
POTASSIUM (K) DIS	5.1		45.0		3.1		2.9	
TOTAL ALKALINITY AS CACO3	152.0		654.0		129.0		135.0	
TOTAL ACIDITY AS CACO3	14.0		58.0		23.0		25.0	
BICARBONATE (HCO3)	185.0		798.0		157.0		165.0	
CARBONATE AS CO3	<1.0	UJ4	<1.0		<1.0		<1.0	
SULFATE (SO4)	56.0	J3 J4	7.6	J3 UJ1	34.0	J3	30.0	J3
CHLORIDE (CL)	13.0		51.0		17.0		16.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	3.5		2.3		0.49		0.46	
ARSENIC (AS) TOT	3.8		2.3		0.46		0.48	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.006		<0.005		0.005		0.013	
COPPER (CU) DIS	<0.01		<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		0.021		<0.01		0.015	
LEAD (PB) DIS	<0.005		0.006		<0.005		<0.005	
LEAD (PB) TOT	<0.005		0.055		<0.005		<0.005	
ZINC (ZN) DIS	<0.005		0.21		<0.005		<0.005	
ZINC (ZN) TOT	0.009		0.3		0.014		0.024	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-11	EV-15A	EV-15B
SAMPLE DATE	03/03/99	03/02/99	03/02/99
SAMPLE TIME	08:45	10:15	10:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-44	L990355-16	L990355-17
SAMPLE NUMBER	EVT-9903-165	EVT-9903-116	EVT-9903-117
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	9.6	3.27	7.55
OXYGEN (O) (FLD)	7.08	1.06	1.02
PH (FLD)	5.81	6.47	6.63
PH	6.2	6.9	7.0
SALINITY (G/KG) (FLD)	0.2	1.2	0.3
SC (UMHOS/CM AT 25 C)	541.0	2480.0	725.0
SC (UMHOS/CM AT 25 C) (FLD)	605.0	268.0 R	830.0
TDS (MEASURED AT 180 C)	412.0	1636.0	493.0
TOTAL SUSPENDED SOLIDS	8.4	1538.0	133.0
TURBIDITY (NTU)	3.0	520.0	120.0
WATER TEMPERATURE (C) (FLD)	9.6	10.6	12.6
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	43.0	248.0	42.0
MAGNESIUM (MG) DIS	10.0	135.0	51.0
SODIUM (NA) DIS	44.0	78.0	36.0
POTASSIUM (K) DIS	4.6	42.0	6.8
TOTAL ALKALINITY AS CACO3	60.0	1380.0	333.0
TOTAL ACIDITY AS CACO3	72.0	330.0	40.0
BICARBONATE (HCO3)	73.0	1684.0	406.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	15.0 J4	13.0 J3 UJ1	14.0 J3 UJ1
CHLORIDES (CL)	85.0	62.0	29.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	47.0	0.04	0.006
ARSENIC (AS) TOT	51.0	0.24	0.006
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	0.027	0.034
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	0.023	0.039
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	0.044	0.006
ZINC (ZN) DIS	0.035	0.006	<0.005
ZINC (ZN) TOT	0.041	0.066	0.047

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-16A		EV-17A		EV-17B	
SAMPLE DATE	03/02/99		03/02/99		03/02/99	
SAMPLE TIME	09:15		12:45		13:25	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-18		L990355-19		L990355-20	
SAMPLE NUMBER	EVT-9903-118		EVT-9903-119		EVT-9903-120	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	4.2		4.08		4.72	
OXYGEN (O) (FLD)	1.18		0.08		0.05	
PH (FLD)	6.36		6.65		6.32	
PH	7.4		6.9		6.6	
SALINITY (G/KG) (FLD)	0.7		0.2		0.2	
SC (UMHOS/CM AT 25 C)	1890.0		500.0		500.0	
SC (UMHOS/CM AT 25 C) (FLD)	1600.0		637.0		510.0	
TDS (MEASURED AT 180 C)	1351.0		376.0		387.0	
TOTAL SUSPENDED SOLIDS	208.0		33.0		26.0	
TURBIDITY (NTU)	20.0		0.0		18.0	
WATER TEMPERATURE (C) (FLD)	9.02		9.1		11.9	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	140.0		67.0		41.0	
MAGNESIUM (MG) DIS	80.0		18.0		30.0	
SODIUM (NA) DIS	168.0		15.0		16.0	
POTASSIUM (K) DIS	23.0		10.0		3.3	
TOTAL ALKALINITY AS CACO3	933.0		237.0		164.0	
TOTAL ACIDITY AS CACO3	295.0		51.0		29.0	
BICARBONATE (HCO3)	1138.0		289.0		200.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	17.0	J3	26.0	J3	66.0	J3
CHLORIDE (CL)	26.0		6.8		8.6	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.063		3.0		0.61	
ARSENIC (AS) TOT	0.099		3.2		0.74	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.015		<0.005		0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.016		0.017		<0.01	
LEAD (PB) DIS	<0.005		0.044		<0.005	
LEAD (PB) TOT	0.014		0.07		0.024	
ZINC (ZN) DIS	<0.005		4.6		0.53	
ZINC (ZN) TOT	0.03		4.6		0.47	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-18B		EV-19B		EV-19B		EV-20B	
SAMPLE DATE	03/01/99		03/01/99		03/01/99		03/02/99	
SAMPLE TIME	16:00		16:45		17:00		14:20	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-21		L990355-22		L990355-38		L990355-23	
REMARKS					DUPLICATE			
SAMPLE NUMBER	EVT-9903-121		EVT-9903-122		EVT-9903-159		EVT-9903-123	
-- PHYSICAL PARAMETERS --								
DEPTH TO WATER LEVEL (FEET)	46.82		47.21				50.05	
OXYGEN (O) (FLD)	5.47		5.16				6.51	
PH (FLD)	6.41		6.5				6.44	
PH	7.1		7.0		7.1		6.9	
SALINITY (G/KG) (FLD)	0.3		0.2				0.2	
SC (UMHOS/CM AT 25 C)	644.0		460.0		461.0		463.0	
SC (UMHOS/CM AT 25 C) (FLD)	730.0		515.0				513.0	
TDS (MEASURED AT 180 C)	431.0		349.0		317.0		335.0	
TOTAL SUSPENDED SOLIDS	1361.0		21.0	J4	54.0	J4	246.0	
TURBIDITY (NTU)	410.0		19.0				4.0	
WATER TEMPERATURE (C) (FLD)	12.8		12.6				12.5	
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS	48.0		32.0		31.0		34.0	
MAGNESIUM (MG) DIS	33.0		29.0		28.0		28.0	
SODIUM (NA) DIS	29.0		14.0		13.0		14.0	
POTASSIUM (K) DIS	5.2		4.9		4.6		4.2	
TOTAL ALKALINITY AS CACO3	140.0		137.0		143.0		97.0	
TOTAL ACIDITY AS CACO3	11.0		15.0		11.0		20.0	
BICARBONATE (HCO3)	171.0		167.0		174.0		118.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0		<1.0	
SULFATE (SO4)	68.0	J3	32.0	J3 UJ1	36.0	J3	38.0	J3
CHLORIDE (CL)	50.0		22.0		24.0		36.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	<0.005		5.2		4.7		11.0	
ARSENIC (AS) TOT	0.011		5.3		4.8		11.0	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.058		0.007		0.008		0.006	
COPPER (CU) DIS	<0.01		<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.047		<0.01		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.011		<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.008		0.006		<0.005		0.007	
ZINC (ZN) TOT	0.073		0.018		0.01		0.01	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-21A		EV-21B		EV-22A	
SAMPLE DATE	03/02/99		03/02/99		03/03/99	
SAMPLE TIME	16:00		16:30		11:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-24		L990355-25		L990355-26	
SAMPLE NUMBER	EVT-9903-124		EVT-9903-125		EVT-9903-126	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	7.25		12.5		13.95	
OXYGEN (O) (FLD)	1.62		0.72		0.25	
PH (FLD)	6.75		6.78		7.06	
PH	7.1		7.9		7.4	
SALINITY (G/KG) (FLD)	0.3		0.3		1.8	
SC (UMHOS/CM AT 25 C)	644.0		646.0		3680.0	
SC (UMHOS/CM AT 25 C) (FLD)	788.0		725.0		412.0	R
TDS (MEASURED AT 180 C)	401.0		433.0		2606.0	
TOTAL SUSPENDED SOLIDS	65.0		24.0		75.0	
TURBIDITY (NTU)	20.0		15.0		35.0	
WATER TEMPERATURE (C) (FLD)	9.0		12.9		10.9	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	46.0		7.6		38.0	
MAGNESIUM (MG) DIS	13.0		18.0		12.0	
SODIUM (NA) DIS	73.0		113.0		814.0	
POTASSIUM (K) DIS	7.2		9.2		9.7	
TOTAL ALKALINITY AS CACO3	258.0		243.0		2132.0	
TOTAL ACIDITY AS CACO3	30.0		10.0		23.0	
BICARBONATE (HCO3)	315.0		296.0		2601.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	35.0	J3	12.0	J3 UJ1	50.0	
CHLORIDE (CL)	25.0		49.0		34.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.006		<0.005		0.015	
ARSENIC (AS) TOT	0.005		<0.005		0.016	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		0.005		0.016	
CHROMIUM (CR) TOT	<0.005		0.01		0.026	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		0.011	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		0.008	
ZINC (ZN) DIS	0.006		<0.005		0.011	
ZINC (ZN) TOT	0.005		0.009		0.012	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-22B	EV-23A	EV-23B
SAMPLE DATE	03/03/99	03/02/99	03/02/99
SAMPLE TIME	11:45	12:20	13:20
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-27	L990355-28	L990355-29
SAMPLE NUMBER	EVT-9903-127	EVT-9903-128	EVT-9903-129
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	19.9	0.87	7.0
OXYGEN (O) (FLD)	0.2	6.01	0.74
PH (FLD)	7.1	6.52	6.96
PH	7.9	6.7	7.1
SALINITY (G/KG) (FLD)	0.9	0.4	0.1
SC (UMHOS/CM AT 25 C)	4110.0	858.0	265.0
SC (UMHOS/CM AT 25 C) (FLD)	510.0 R	1030.0	296.0
TDS (MEASURED AT 180 C)	2675.0	519.0	176.0
TOTAL SUSPENDED SOLIDS	504.0	177.0	165.0
TURBIDITY (NTU)	40.0	50.0	10.0
WATER TEMPERATURE (C) (FLD)	11.0	10.8	11.8
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	36.0	65.0	16.0
MAGNESIUM (MG) DIS	82.0	45.0	12.0
SODIUM (NA) DIS	812.0	34.0	15.0
POTASSIUM (K) DIS	40.0	16.0	3.8
TOTAL ALKALINITY AS CACO3	1688.0	455.0	100.0
TOTAL ACIDITY AS CACO3	42.0	195.0	5.0
BICARBONATE (HCO3)	2059.0	555.0	122.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	33.0 J4	5.9 J3 UJ1	13.0 UJ1 J3
CHLORIDE (CL)	352.0	3.8	7.9
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	0.88	0.064	<0.005
ARSENIC (AS) TOT	0.032	0.071	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	0.009	<0.005	<0.005
CHROMIUM (CR) TOT	0.1	<0.005	0.016
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.091	<0.01	0.024
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.045	<0.005	0.006
ZINC (ZN) DIS	0.009	0.007	<0.005
ZINC (ZN) TOT	0.12	0.015	0.027

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-45D	HP-46D	HP-46D	HP-46S
SAMPLE DATE	10/01/98	02/09/99	02/09/99	02/09/99
SAMPLE TIME		10:40	10:42	13:50
LAB	SAS	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L5893-1	L990256-1	L990256-2	L990256-3
REMARKS			DUPLICATE	
SAMPLE NUMBER	EVT-9809-300	EVT-9902-100	EVT-9902-101	EVT-9902-102
-- PHYSICAL PARAMETERS --				
PH		7.3	7.3	6.7
SC (UMHOS/CM AT 25 C)		377.0	375.0	730.0
TDS (MEASURED AT 180 C)	690.0	252.0	265.0	391.0
TOTAL SUSPENDED SOLIDS	700.0	702.0	624.0	172.0
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	56.0	2.5	2.6	41.0
CALCIUM (CA) TOT	60.0			
MAGNESIUM (MG) DIS	27.0	5.9	5.9	18.0
MAGNESIUM (MG) TOT	30.0			
SODIUM (NA) DIS	170.0	74.0	74.0	70.0
SODIUM (NA) TOT	170.0			
POTASSIUM (K) DIS	18.0	9.0	8.6	9.5
POTASSIUM (K) TOT	18.0			
TOTAL ALKALINITY AS CACO3	620.0	168.0	163.0	204.0
TOTAL ACIDITY AS CACO3		23.0 J4	49.0 J4	178.0 J4
BICARBONATE (HCO3)	756.0	205.0	199.0	249.0
CARBONATE AS CO3	<3.0	<1.0	<1.0	<1.0
SULFATE (SO4)	2.4	11.0	11.0	65.0
CHLORIDE (CL)	13.0	22.0	25.0	63.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.4	0.021	0.02	0.21
ARSENIC (AS) TOT	<0.4	0.032	0.032	0.27
CADMIUM (CD) DIS	<0.08	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.08	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.01	0.011	0.012	<0.005
CHROMIUM (CR) TOT	0.015	0.071	0.07	<0.005
COPPER (CU) DIS	<0.02	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.029	0.11	0.11	0.017
LEAD (PB) DIS	<0.15	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.6	0.022	0.023	0.049
ZINC (ZN) DIS	0.035	0.06 J4	0.007 UJ1 J4	0.031 UJ1 J4
ZINC (ZN) TOT	0.3	0.1	0.1	0.059

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-47D	HP-47S	HP-48D
SAMPLE DATE	02/10/99	02/09/99	02/10/99
SAMPLE TIME	08:50	15:55	12:40
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990256-5	L990256-4	L990256-8
SAMPLE NUMBER	EVT-9902-104	EVT-9902-103	EVT-9902-107
-- PHYSICAL PARAMETERS --			
PH	7.4	6.8	7.5
SC (UMHOS/CM AT 25 C)	444.0	825.0	472.0
TDS (MEASURED AT 180 C)	279.0	446.0	264.0
TOTAL SUSPENDED SOLIDS	963.0	13166.0	602.0
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	3.7	30.0	7.2
MAGNESIUM (MG) DIS	9.8	21.0	22.0
SODIUM (NA) DIS	83.0	71.0	54.0
POTASSIUM (K) DIS	9.5	12.0	7.7
TOTAL ALKALINITY AS CACO3	206.0	337.0	195.0
TOTAL ACIDITY AS CACO3	31.0 J4	180.0 J4	12.0 J4
BICARBONATE (HCO3)	251.0	411.0	238.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	6.3 UJ1 J4	5.6 UJ1	3.4 UJ1 J4
CHLORIDE (CL)	22.0	65.0	36.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	0.051	0.56	0.017
ARSENIC (AS) TOT	0.26	0.64	0.037
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	0.008	<0.005	<0.005
CHROMIUM (CR) TOT	0.2	0.3	0.061
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.2	0.3	0.051
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.036	0.047	0.011
ZINC (ZN) DIS	0.006 UJ1 J4	0.1 J4	0.011 UJ1 J4
ZINC (ZN) TOT	0.33	0.41	0.076

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-48S	HP-48S	MW-3	MW-4A
SAMPLE DATE	02/10/99	02/10/99	03/02/99	03/02/99
SAMPLE TIME	11:30	11:40	14:30	15:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990256-6	L990256-7	L990355-13	L990355-14
REMARKS		DUPLICATE		
SAMPLE NUMBER	EVT-9902-105	EVT-9902-106	EVT-9903-112	EVT-9903-113
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)			0.25	0.5
OXYGEN (O) (FLD)			0.1	0.02
PH (FLD)			6.59	6.43
PH	6.7	6.7	7.0	6.9
SALINITY (G/KG) (FLD)			0.2	0.2
SC (UMHOS/CM AT 25 C)	576.0	576.0	495.0	425.0
SC (UMHOS/CM AT 25 C) (FLD)			542.0	454.0
TDS (MEASURED AT 180 C)	317.0	302.0	335.0	285.0
TOTAL SUSPENDED SOLIDS	72.0	80.0	33.0	94.0
TURBIDITY (NTU)			0.0	36.0
WATER TEMPERATURE (C) (FLD)			8.0	8.2
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	28.0	28.0	60.0	42.0
MAGNESIUM (MG) DIS	19.0	19.0	15.0	17.0
SODIUM (NA) DIS	47.0	47.0	21.0	19.0
POTASSIUM (K) DIS	12.0	12.0	6.0	3.6
TOTAL ALKALINITY AS CACO3	234.0	220.0	240.0	168.0
TOTAL ACIDITY AS CACO3	120.0 J4	170.0 J4	38.0	35.0
BICARBONATE (HCO3)	285.0	268.0	293.0	205.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	3.9 UJ1 J4	2.3 UJ1 J4	10.0 J3 UJ1	21.0 J3 UJ1
CHLORIDE (CL)	41.0	42.0	7.2	16.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.31	0.31	<0.005	<0.005
ARSENIC (AS) TOT	0.35	0.35	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	0.006
ZINC (ZN) DIS	0.011 UJ1 J4	0.017 UJ1 J4	<0.005	<0.005
ZINC (ZN) TOT	0.017 UJ1	0.013 UJ1	0.005	0.013

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-5		MW-5(W)		MW-7(W)	
SAMPLE DATE	03/02/99		03/05/99		03/05/99	
SAMPLE TIME	16:05		12:45		13:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-15		L990390-2		L990390-3	
SAMPLE NUMBER	EVT-9903-115		EVT-9903-133		EVT-9903-135	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	1.42		0.5		30.75	
OXYGEN (O) (FLD)	0.17		0.66		1.53	
PH (FLD)	6.09		6.48		5.97	
PH	6.5		6.9		6.7	
SALINITY (G/KG) (FLD)	0.1		0.4		0.1	
SC (UMHOS/CM AT 25 C)	299.0		1044.0		435.0	
SC (UMHOS/CM AT 25 C) (FLD)	322.0		998.0		472.0	
TDS (MEASURED AT 180 C)	215.0		666.0		316.0	
TOTAL SUSPENDED SOLIDS	7.4		30.0		259.0	
TURBIDITY (NTU)	60.0		14.0		201.0	
WATER TEMPERATURE (C) (FLD)	7.7		10.9		12.1	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	35.0		68.0		25.0	
MAGNESIUM (MG) DIS	5.5		42.0		27.0	
SODIUM (NA) DIS	11.0		106.0		25.0	
POTASSIUM (K) DIS	4.4		14.0		3.3	
TOTAL ALKALINITY AS CACO3	60.0		546.0		100.0	
TOTAL ACIDITY AS CACO3	33.0		128.0		49.0	
BICARBONATE (HCO3)	73.0		666.0		122.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	78.0	J3	11.0	J3 UJ1	101.0	J3
CHLORIDE (CL)	6.0		18.0	J3	3.0	J3
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	<0.005		<0.005		0.014	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		0.003	
CHROMIUM (CR) DIS	<0.005		<0.005		0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		0.017	
COPPER (CU) DIS	<0.01		<0.01		0.014	
COPPER (CU) TOT	<0.01		<0.01		0.035	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.038		0.006	UJ1	0.012	UJ1
ZINC (ZN) TOT	0.042		<0.005		0.07	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-8(W)		MW-102S(W)		MW-103D(W)		MW-103D(W)	
SAMPLE DATE	03/05/99		03/05/99		03/05/99		03/05/99	
SAMPLE TIME	13:15		10:00		10:50		11:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990390-4		L990390-5		L990390-7		L990390-17	
REMARKS							DUPLICATE	
SAMPLE NUMBER	EVT-9903-136		EVT-9903-137		EVT-9903-139		EVT-9903-169	
-- PHYSICAL PARAMETERS --								
DEPTH TO WATER LEVEL (FEET)	7.25		7.5		11.54			
OXYGEN (O) (FLD)	0.75		5.51		3.01			
PH (FLD)	6.43		5.9		6.33			
PH	6.8		7.0		7.0		7.1	
SALINITY (G/KG) (FLD)	0.4		0.1		0.9			
SC (UMHOS/CM AT 25 C)	1197.0		235.0	J4	2250.0		2240.0	
SC (UMHOS/CM AT 25 C) (FLD)	1100.0		410.0	J4	208.0	R		
TDS (MEASURED AT 180 C)	816.0		188.0		1323.0		1310.0	
TOTAL SUSPENDED SOLIDS	6.0		46.0		1.6		7.5	
TURBIDITY (NTU)	11.0		11.0		6.0			
WATER TEMPERATURE (C) (FLD)	14.2		8.1		9.7			
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS	6.7	UJ1	5.4	UJ1	26.0		26.0	
MAGNESIUM (MG) DIS	14.0		1.8		29.0		30.0	
SODIUM (NA) DIS	239.0		48.0		391.0		391.0	
POTASSIUM (K) DIS	15.0		4.0		21.0		20.0	
TOTAL ALKALINITY AS CACO3	512.0		101.0		275.0		276.0	
TOTAL ACIDITY AS CACO3	136.0		17.0	J4	66.0	J4	52.0	J4
BICARBONATE (HCO3)	625.0		123.0		336.0		337.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0		<1.0	
SULFATE (SO4)	19.0	J3	21.0	J3	218.0	J3	198.0	J3
CHLORIDE (CL)	92.0	J3	5.2	J3	388.0	J3	459.0	J3
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	<0.005		<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	<0.005		0.02		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	0.006		<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.006		0.043		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		0.058		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		0.011		<0.005		<0.005	
ZINC (ZN) DIS	0.009	UJ1	0.021	UJ1	0.014	UJ1	0.009	UJ1
ZINC (ZN) TOT	<0.005		0.054	UJ1	<0.005		0.005	UJ1

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-103S(W)		MW-104S(W)		MW-105D(W)	
SAMPLE DATE	03/05/99		03/05/99		03/05/99	
SAMPLE TIME	10:30		11:20		12:20	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990390-6		L990390-8		L990390-10	
SAMPLE NUMBER	EVT-9903-138		EVT-9903-140		EVT-9903-142	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	9.8		6.53		12.2	
OXYGEN (O) (FLD)	2.71		3.51		0.17	
PH (FLD)	6.25		6.14		6.88	
PH	6.9		6.8		7.5	
SALINITY (G/KG) (FLD)	0.9		0.6		0.8	
SC (UMHOS/CM AT 25 C)	1835.0		1360.0		1687.0	
SC (UMHOS/CM AT 25 C) (FLD)	209.0	R	146.0	R	176.0	R
TDS (MEASURED AT 180 C)	1298.0		976.0		1040.0	
TOTAL SUSPENDED SOLIDS	1.6		2.2		5.2	
TURBIDITY (NTU)	4.0		2.0		1.0	
WATER TEMPERATURE (C) (FLD)	8.7		10.7		13.8	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	70.0		59.0		20.0	
MAGNESIUM (MG) DIS	59.0		48.0		18.0	
SODIUM (NA) DIS	289.0		171.0		300.0	
POTASSIUM (K) DIS	28.0		25.0		21.0	
TOTAL ALKALINITY AS CACO3	436.0		234.0		543.0	
TOTAL ACIDITY AS CACO3	31.0	J4	66.0	J4	56.0	J4
BICARBONATE (HCO3)	532.0		285.0		662.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	452.0	J3	398.0	J3	46.0	J3
CHLORIDE (CL)	47.0	J3	26.0	J3	220.0	J3
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	<0.005		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		0.007	
CHROMIUM (CR) TOT	<0.005		<0.005		0.008	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.012		0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.009	UJ1	0.009	UJ1	0.006	UJ1
ZINC (ZN) TOT	0.008	UJ1	0.006	UJ1	<0.005	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-105S(W)	MW-107D	MW-107D	MW-107S2(W)
SAMPLE DATE	03/05/99	03/03/99	03/03/99	03/05/99
SAMPLE TIME	12:00	09:45	09:55	11:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990390-9	L990355-30	L990355-45	L990390-11
REMARKS			DUPLICATE	
SAMPLE NUMBER	EVT-9903-141	EVT-9903-130	EVT-9903-166	EVT-9903-144
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	7.14	7.67		1.65
OXYGEN (O) (FLD)	1.29	0.5		3.48
PH (FLD)	6.57	6.94		6.57
PH	7.0	7.2	7.1	7.0
SALINITY (G/KG) (FLD)	0.2	0.2		0.3
SC (UMHOS/CM AT 25 C)	470.0	606.0	605.0	668.0
SC (UMHOS/CM AT 25 C) (FLD)	548.0	598.0		892.0
TDS (MEASURED AT 180 C)	318.0	370.0	424.0	446.0
TOTAL SUSPENDED SOLIDS	25.0	21.0	28.0	83.0
TURBIDITY (NTU)	1.0	8.0		9.0
WATER TEMPERATURE (C) (FLD)	10.1	12.3		9.5
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	49.0	4.9	5.0	69.0
MAGNESIUM (MG) DIS	6.9	11.0	12.0	18.0
SODIUM (NA) DIS	47.0	118.0	119.0	38.0
POTASSIUM (K) DIS	4.4	10.0	10.0	14.0
TOTAL ALKALINITY AS CACO3	193.0	248.0	257.0	212.0
TOTAL ACIDITY AS CACO3	42.0 J4	39.0	30.0	57.0
BICARBONATE (HCO3)	235.0	303.0	314.0	259.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	36.0 J3	5.0 J4 UJ1	7.6 J4 UJ1	96.0 J3
CHLORIDE (CL)	4.9 J3	29.0	29.0	9.0 J3
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	0.022
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	0.031
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	0.003
CHROMIUM (CR) DIS	<0.005	<0.005	0.005	<0.005
CHROMIUM (CR) TOT	<0.005	0.009	0.009	<0.005
COPPER (CU) DIS	0.032	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.049	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.011	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.11	<0.005	<0.005	0.008 UJ1
ZINC (ZN) TOT	0.14	0.006	0.008	0.01 UJ1

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance; R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-108D(W)		MW-108S(W)		MW-109D	
SAMPLE DATE	03/05/99		03/05/99		03/03/99	
SAMPLE TIME	10:45		11:15		10:30	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990390-13		L990390-12		L990355-31	
SAMPLE NUMBER	EVT-9903-146		EVT-9903-145		EVT-9903-131	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	8.54		8.05		8.3	
OXYGEN (O) (FLD)	0.66		2.05		0.11	
PH (FLD)	6.71		6.43		6.93	
PH	7.2		3.4		8.3	
SALINITY (G/KG) (FLD)	0.1		0.4		0.2	
SC (UMHOS/CM AT 25 C)	419.0		2160.0	J4	830.0	
SC (UMHOS/CM AT 25 C) (FLD)	472.0		1066.0	J4	827.0	
TDS (MEASURED AT 180 C)	285.0		1933.0		554.0	
TOTAL SUSPENDED SOLIDS	45.0		53.0		13.0	
TURBIDITY (NTU)	2.0		41.0		0.0	
WATER TEMPERATURE (C) (FLD)	12.4		11.4		12.5	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	23.0		225.0		11.0	
MAGNESIUM (MG) DIS	24.0		97.0		29.0	
SODIUM (NA) DIS	29.0		50.0		137.0	
POTASSIUM (K) DIS	4.9		24.0		13.0	
TOTAL ALKALINITY AS CACO3	133.0		<1.0		284.0	
TOTAL ACIDITY AS CACO3	14.0		175.0		33.0	
BICARBONATE (HCO3)	162.0		<1.0		346.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	50.0	J3	1142.0	J3	24.0	J4
CHLORIDE (CL)	15.0	J3	28.0	J3	78.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	3.0		<0.005		<0.005	
ARSENIC (AS) TOT	2.9		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		0.007	
CHROMIUM (CR) TOT	<0.005		<0.005		0.012	
COPPER (CU) DIS	<0.01		0.019		<0.01	
COPPER (CU) TOT	<0.01		0.036		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.01	UJ1	0.63		<0.005	
ZINC (ZN) TOT	<0.005		0.6		0.006	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-109S(W)		MW-109S(W)		WP-1	
SAMPLE DATE	03/05/99		03/05/99		03/02/99	
SAMPLE TIME	09:45		10:00		11:50	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990390-14		L990390-15		L990355-12	
REMARKS			DUPLICATE			
SAMPLE NUMBER	EVT-9903-147		EVT-9903-154		EVT-9903-111	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	6.39				4.27	
OXYGEN (O) (FLD)	3.59		3.54		0.72	
PH (FLD)	5.91		5.9		7.2	
PH	6.5		6.5		7.5	
SALINITY (G/KG) (FLD)	0.2		0.2		0.2	
SC (UMHOS/CM AT 25 C)	441.0		440.0		540.0	
SC (UMHOS/CM AT 25 C) (FLD)	530.0		525.0		477.0	
TDS (MEASURED AT 180 C)	317.0		315.0		385.0	
TOTAL SUSPENDED SOLIDS	40.0		40.0		33.0	
TURBIDITY (NTU)	23.0		26.0		9.0	
WATER TEMPERATURE (C) (FLD)	9.0		9.0		10.3	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	54.0		54.0		42.0	
MAGNESIUM (MG) DIS	11.0		11.0		8.5	
SODIUM (NA) DIS	13.0		13.0		51.0	
POTASSIUM (K) DIS	7.3		7.2		22.0	
TOTAL ALKALINITY AS CACO3	46.0		43.0		266.0	
TOTAL ACIDITY AS CACO3	41.0		33.0		20.0	
BICARBONATE (HCO3)	56.0		52.0		325.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	145.0	J3	151.0	J3	9.3	J3 UJ1
CHLORIDE (CL)	4.8	J3	4.6	J3	8.2	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		<0.005		0.98	
ARSENIC (AS) TOT	<0.005		0.005		1.0	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		0.013	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		0.063	
ZINC (ZN) DIS	0.037		0.036		0.015	
ZINC (ZN) TOT	0.033		0.031		0.32	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	BFS	BFS	DI BLANK		DI BLANK		DI BLANK	
SAMPLE DATE	03/04/99	03/04/99	02/10/99		03/01/99		03/01/99	
SAMPLE TIME	11:00		13:10		17:40		17:30	
LAB	TSC-SLC	TRUE VALUE	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990355-48	LOT #426	L990256-9		L990355-34		L990355-39	
REMARKS	STANDARD	STANDARD	BLANK		BLANK		BLANK	
SAMPLE NUMBER	EVT-9903-172	EVT-9903-172	EVT-9902-108		EVT-9903-150		EVT-9903-160	
-- PHYSICAL PARAMETERS --								
PH			5.7		5.5		5.6	
SC (UMHOS/CM AT 25 C)			<10.0		<5.0		<5.0	
TDS (MEASURED AT 180 C)			<10.0		<10.0		<10.0	
TOTAL SUSPENDED SOLIDS			<1.0		<1.0		1.2	J4
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS			<1.0		<1.0		<1.0	
MAGNESIUM (MG) DIS			<1.0		<1.0		<1.0	
SODIUM (NA) DIS			2.0		<2.0		<2.0	
POTASSIUM (K) DIS			<1.0		<2.0		<2.0	
TOTAL ALKALINITY AS CACO3			<1.0		<1.0		1.0	
TOTAL ACIDITY AS CACO3			<5.0		<5.0		<5.0	
BICARBONATE (HCO3)			<1.0		<1.0		1.0	
CARBONATE AS CO3			<1.0		<1.0		<1.0	
SULFATE (SO4)			1.6	J4	6.7	J3 J4	3.2	J3
CHLORIDE (CL)			<1.0		<1.0		<1.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS			<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	0.17	0.181	<0.005		<0.005		<0.005	
CADMIUM (CD) DIS			<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	0.11	0.113	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS			<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.41	0.403	<0.005		<0.005		<0.005	
COPPER (CU) DIS			<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.44	0.425	<0.01		<0.01		<0.01	
LEAD (PB) DIS			<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.75	0.719	<0.005		<0.005		<0.005	
ZINC (ZN) DIS			0.009	J4	<0.005		<0.005	
ZINC (ZN) TOT	0.5	0.544	<0.005		<0.005		<0.005	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	DI BLANK	DI BLANK	DI BLANK	DI BLANK	DI BLANK
SAMPLE DATE	03/02/99	03/02/99	03/03/99	03/05/99	03/05/99
SAMPLE TIME	17:05	16:45	12:00		16:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-37	L990355-42	L990355-46	L990390-1	L990390-18
REMARKS	BLANK	BLANK	BLANK		BLANK
SAMPLE NUMBER	EVT-9903-153	EVT-9903-163	EVT-9903-167	EVT-9903-155	EVT-9903-170
-- PHYSICAL PARAMETERS --					
PH	5.5	5.6	5.6	5.3	5.7
SC (UMHOS/CM AT 25 C)	<5.0	<5.0	<5.0	<10.0	<10.0
TDS (MEASURED AT 180 C)	<10.0	10.0	<10.0	16.0	<10.0
TOTAL SUSPENDED SOLIDS	<1.0	1.4	<1.0	<1.0	<1.0
-- MAJOR CONSTITUENTS --					
CALCIUM (CA) DIS	<1.0	<1.0	<1.0	<1.0	1.9
MAGNESIUM (MG) DIS	<1.0	<1.0	<1.0	<1.0	<1.0
SODIUM (NA) DIS	<2.0	<2.0	<2.0	<1.0	1.1
POTASSIUM (K) DIS	<2.0	<2.0	<2.0	<1.0	<1.0
TOTAL ALKALINITY AS CACO3	<1.0	1.0	1.0	<1.0	<1.0
TOTAL ACIDITY AS CACO3	<5.0	<5.0	<5.0	<5.0	<5.0
BICARBONATE (HCO3)	<1.0	1.0	1.0	<1.0	<1.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	4.8 J3	2.8 J3	<2.0	9.7 J3	3.2 J3
CHLORIDE (CL)	<1.0	<1.0	<1.0	<1.0 UJ3	<1.0 UJ3
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	<0.005	<0.005	<0.005	0.006	0.009
ZINC (ZN) TOT	<0.005	<0.005	<0.005	<0.005	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	RINSATE	RINSATE	RINSATE	RINSATE	RINSATE	RINSATE
SAMPLE DATE	03/01/99	03/01/99	03/02/99	03/02/99	03/03/99	03/05/99
SAMPLE TIME	17:20	17:45	16:45	17:00	12:15	16:20
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990355-33	L990355-40	L990355-36	L990355-43	L990355-47	L990390-16
REMARKS	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK
SAMPLE NUMBER	EVT-9903-149	EVT-9903-161	EVT-9903-152	EVT-9903-164	EVT-9903-168	EVT-9903-156
-- PHYSICAL PARAMETERS --						
PH	5.8	5.5	5.6	5.5	5.5	5.9
SC (UMHOS/CM AT 25 C)	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0
TDS (MEASURED AT 180 C)	<10.0	<10.0	<10.0	<10.0	11.0	<10.0
TOTAL SUSPENDED SOLIDS	3.1	<1.0	<1.0	2.2	<1.0	<1.0
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MAGNESIUM (MG) DIS	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SODIUM (NA) DIS	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0
POTASSIUM (K) DIS	<2.0	<2.0	<2.0	<2.0	<2.0	<1.0
TOTAL ALKALINITY AS CACO3	<1.0	<1.0	1.0	1.0	<1.0	1.0
TOTAL ACIDITY AS CACO3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BICARBONATE (HCO3)	<1.0	<1.0	1.0	1.0	<1.0	1.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	4.2 J3 J4	6.8 J3	3.7 J3	2.0 J3	2.6 J4	4.3 J3
CHLORIDE (CL)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0 UJ3
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	<0.005	<0.005	<0.005	<0.005	<0.005	0.007
ZINC (ZN) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

```
                              -- SAMPLE TYPE: QUALITY CONTROL --

                  SITE CODE       RINSATE
                SAMPLE DATE      03/05/99
                SAMPLE TIME         16:10
                        LAB       TSC-SLC
                 LAB NUMBER    L990390-19
                    REMARKS         BLANK
              SAMPLE NUMBER  EVT-9903-171

  -- PHYSICAL PARAMETERS --
                         PH        5.7
        SC (UMHOS/CM AT 25 C)    <10.0
      TDS (MEASURED AT 180 C)    <10.0
       TOTAL SUSPENDED SOLIDS     <1.0

   -- MAJOR CONSTITUENTS --
            CALCIUM (CA) DIS      <1.0
          MAGNESIUM (MG) DIS      <1.0
             SODIUM (NA) DIS       1.0
           POTASSIUM (K) DIS      <1.0
    TOTAL ALKALINITY AS CACO3     <1.0
      TOTAL ACIDITY AS CACO3      <5.0
          BICARBONATE (HCO3)      <1.0
            CARBONATE AS CO3      <1.0
               SULFATE (SO4)       2.0  J3
               CHLORIDE (CL)      <1.0  UJ3

-- METALS & MINOR CONSTITUENTS --
            ARSENIC (AS) DIS    <0.005
            ARSENIC (AS) TOT    <0.005
            CADMIUM (CD) DIS    <0.002
            CADMIUM (CD) TOT    <0.002
           CHROMIUM (CR) DIS    <0.005
           CHROMIUM (CR) TOT    <0.005
             COPPER (CU) DIS     <0.01
             COPPER (CU) TOT     <0.01
               LEAD (PB) DIS    <0.005
               LEAD (PB) TOT    <0.005
               ZINC (ZN) DIS     0.021
               ZINC (ZN) TOT    <0.005
```

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

INDEX

Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
19	BFS	BLIND FIELD STANDARD	Quality Control		
19	DI BLANK	DI BLANK	Quality Control		
1	EV-3	EV-3	Groundwater		
1	EV-4A	EV-4A	Groundwater		
1	EV-4B	EV-4B	Groundwater		
2	EV-6A	EV-6A	Groundwater		
2	EV-6B	EV-6B	Groundwater		
2	EV-7A	EV-7A	Groundwater		
3	EV-7B	EV-7B	Groundwater		
3	EV-8A	EV-8A	Groundwater		
4	EV-8B	EV-8B	Groundwater		
4	EV-9A	EV-9A	Groundwater		
4	EV-9B	EV-9B	Groundwater		
5	EV-11	EV-11	Groundwater		
5	EV-15A	EV-15A	Groundwater		
5	EV-15B	EV-15B	Groundwater		
6	EV-16A	EV-16A	Groundwater		
6	EV-17A	EV-17A	Groundwater		
6	EV-17B	EV-17B	Groundwater		
7	EV-18B	EV-18B	Groundwater		
7	EV-19B	EV-19B	Groundwater		
7	EV-20B	EV-20B	Groundwater		
8	EV-21A	EV-21A	Groundwater		
8	EV-21B	EV-21B	Groundwater		
8	EV-22A	EV-22A	Groundwater		
9	EV-22B	EV-22B	Groundwater		
9	EV-23A	EV-23A	Groundwater		
9	EV-23B	EV-23B	Groundwater		
10	HP-45D	HP-45 DEEP	Groundwater		
10	HP-46D	HP-46 DEEP	Groundwater		
10	HP-46S	HP-46 SHALLOW	Groundwater		
11	HP-47D	HP-47 DEEP	Groundwater		
11	HP-47S	HP-47 SHALLOW	Groundwater		
11	HP-48D	HP-48 DEEP	Groundwater		
12	HP-48S	HP-48 SHALLOW	Groundwater		
12	MW-3	MW-3	Groundwater		
12	MW-4A	MW-4A	Groundwater		
13	MW-5	MW-5	Groundwater		
13	MW-5(W)	MW-5(W), Weyerhauser well	Groundwater		
13	MW-7(W)	MW-7(W), Weyerhauser well	Groundwater		
14	MW-8(W)	MW-8(W), Weyerhauser well	Groundwater		
14	MW-102S(W)	MW-102S(W), Weyerhauser well	Groundwater		
14	MW-103D(W)	MW-103D(W), Weyerhauser well	Groundwater		
15	MW-103S(W)	MW-103S(W), Weyerhauser well	Groundwater		
15	MW-104S(W)	MW-104S(W), Weyerhauser well	Groundwater		
15	MW-105D(W)	MW-105D(W), Weyerhauser well	Groundwater		
16	MW-105S(W)	MW-105S(W), Weyerhauser well	Groundwater		
16	MW-107D	MW-107D	Groundwater		
16	MW-107S2(W)	MW-107S2(W), Weyerhauser well	Groundwater		
17	MW-108D(W)	MW-108D(W), Weyerhauser well	Groundwater		
17	MW-108S(W)	MW-108S(W), Weyerhauser well	Groundwater		
17	MW-109D	MW-109D	Groundwater		
18	MW-109S(W)	MW-109S(W), Weyerhauser well	Groundwater		
21	RINSATE	RINSATE BLANK	Quality Control		
18	WP-1	WP-1	Groundwater		

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
10	EVT-9809-300	L5893-1	10/01/98	HP-45D
10	EVT-9902-100	L990256-1	02/09/99	HP-46D
10	EVT-9902-101	L990256-2	02/09/99	HP-46D
10	EVT-9902-102	L990256-3	02/09/99	HP-46S
11	EVT-9902-103	L990256-4	02/09/99	HP-47S
11	EVT-9902-104	L990256-5	02/10/99	HP-47D
12	EVT-9902-105	L990256-6	02/10/99	HP-48S
12	EVT-9902-106	L990256-7	02/10/99	HP-48S
11	EVT-9902-107	L990256-8	02/10/99	HP-48D
19	EVT-9902-108	L990256-9	02/10/99	DI BLANK
1	EVT-9903-100	L990355-1	03/01/99	EV-3
1	EVT-9903-101	L990355-2	03/01/99	EV-4A
1	EVT-9903-102	L990355-3	03/01/99	EV-4B
2	EVT-9903-103	L990355-4	03/02/99	EV-6A
2	EVT-9903-104	L990355-5	03/02/99	EV-6B
2	EVT-9903-105	L990355-6	03/01/99	EV-7A
3	EVT-9903-106	L990355-7	03/01/99	EV-7B
3	EVT-9903-107	L990355-8	03/01/99	EV-8A
4	EVT-9903-108	L990355-9	03/01/99	EV-8B
4	EVT-9903-109	L990355-10	03/02/99	EV-9A
4	EVT-9903-110	L990355-11	03/02/99	EV-9B
18	EVT-9903-111	L990355-12	03/02/99	WP-1
12	EVT-9903-112	L990355-13	03/02/99	MW-3
12	EVT-9903-113	L990355-14	03/02/99	MW-4A
13	EVT-9903-115	L990355-15	03/02/99	MW-5
5	EVT-9903-116	L990355-16	03/02/99	EV-15A
5	EVT-9903-117	L990355-17	03/02/99	EV-15B
6	EVT-9903-118	L990355-18	03/02/99	EV-16A
6	EVT-9903-119	L990355-19	03/02/99	EV-17A
6	EVT-9903-120	L990355-20	03/02/99	EV-17B
7	EVT-9903-121	L990355-21	03/01/99	EV-18B
7	EVT-9903-122	L990355-22	03/01/99	EV-19B
7	EVT-9903-123	L990355-23	03/02/99	EV-20B
8	EVT-9903-124	L990355-24	03/02/99	EV-21A
8	EVT-9903-125	L990355-25	03/02/99	EV-21B
8	EVT-9903-126	L990355-26	03/03/99	EV-22A
9	EVT-9903-127	L990355-27	03/03/99	EV-22B
9	EVT-9903-128	L990355-28	03/02/99	EV-23A
9	EVT-9903-129	L990355-29	03/02/99	EV-23B
16	EVT-9903-130	L990355-30	03/03/99	MW-107D
17	EVT-9903-131	L990355-31	03/03/99	MW-109D
13	EVT-9903-133	L990390-2	03/05/99	MW-5(W)
13	EVT-9903-135	L990390-3	03/05/99	MW-7(W)
14	EVT-9903-136	L990390-4	03/05/99	MW-8(W)
14	EVT-9903-137	L990390-5	03/05/99	MW-102S(W)
15	EVT-9903-138	L990390-6	03/05/99	MW-103S(W)
14	EVT-9903-139	L990390-7	03/05/99	MW-103D(W)
15	EVT-9903-140	L990390-8	03/05/99	MW-104S(W)
16	EVT-9903-141	L990390-9	03/05/99	MW-105S(W)
15	EVT-9903-142	L990390-10	03/05/99	MW-105D(W)
16	EVT-9903-144	L990390-11	03/05/99	MW-107S2(W)
17	EVT-9903-145	L990390-12	03/05/99	MW-108S(W)
17	EVT-9903-146	L990390-13	03/05/99	MW-108D(W)
18	EVT-9903-147	L990390-14	03/05/99	MW-109S(W)
3	EVT-9903-148	L990355-32	03/01/99	EV-7A
21	EVT-9903-149	L990355-33	03/01/99	RINSATE
19	EVT-9903-150	L990355-34	03/01/99	DI BLANK
4	EVT-9903-151	L990355-35	03/02/99	EV-9B
21	EVT-9903-152	L990355-36	03/02/99	RINSATE
20	EVT-9903-153	L990355-37	03/02/99	DI BLANK
18	EVT-9903-154	L990390-15	03/05/99	MW-109S(W)
20	EVT-9903-155	L990390-1	03/05/99	DI BLANK
21	EVT-9903-156	L990390-16	03/05/99	RINSATE
7	EVT-9903-159	L990355-38	03/01/99	EV-19B
19	EVT-9903-160	L990355-39	03/01/99	DI BLANK
21	EVT-9903-161	L990355-40	03/01/99	RINSATE
2	EVT-9903-162	L990355-41	03/02/99	EV-6A
20	EVT-9903-163	L990355-42	03/02/99	DI BLANK
21	EVT-9903-164	L990355-43	03/02/99	RINSATE
5	EVT-9903-165	L990355-44	03/03/99	EV-11

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
10	L5893-1	EVT-9809-300	10/01/98	HP-45D
10	L990256-1	EVT-9902-100	02/09/99	HP-46D
10	L990256-2	EVT-9902-101	02/09/99	HP-46D
10	L990256-3	EVT-9902-102	02/09/99	HP-46S
11	L990256-4	EVT-9902-103	02/09/99	HP-47S
11	L990256-5	EVT-9902-104	02/10/99	HP-47D
12	L990256-6	EVT-9902-105	02/10/99	HP-48S
12	L990256-7	EVT-9902-106	02/10/99	HP-48S
11	L990256-8	EVT-9902-107	02/10/99	HP-48D
19	L990256-9	EVT-9902-108	02/10/99	DI BLANK
1	L990355-1	EVT-9903-100	03/01/99	EV-3
4	L990355-10	EVT-9903-109	03/02/99	EV-9A
4	L990355-11	EVT-9903-110	03/02/99	EV-9B
18	L990355-12	EVT-9903-111	03/02/99	WP-1
12	L990355-13	EVT-9903-112	03/02/99	MW-3
12	L990355-14	EVT-9903-113	03/02/99	MW-4A
13	L990355-15	EVT-9903-115	03/02/99	MW-5
5	L990355-16	EVT-9903-116	03/02/99	EV-15A
5	L990355-17	EVT-9903-117	03/02/99	EV-15B
6	L990355-18	EVT-9903-118	03/02/99	EV-16A
6	L990355-19	EVT-9903-119	03/02/99	EV-17A
1	L990355-2	EVT-9903-101	03/01/99	EV-4A
6	L990355-20	EVT-9903-120	03/02/99	EV-17B
7	L990355-21	EVT-9903-121	03/01/99	EV-18B
7	L990355-22	EVT-9903-122	03/01/99	EV-19B
7	L990355-23	EVT-9903-123	03/02/99	EV-20B
8	L990355-24	EVT-9903-124	03/02/99	EV-21A
8	L990355-25	EVT-9903-125	03/02/99	EV-21B
8	L990355-26	EVT-9903-126	03/03/99	EV-22A
9	L990355-27	EVT-9903-127	03/03/99	EV-22B
9	L990355-28	EVT-9903-128	03/02/99	EV-23A
9	L990355-29	EVT-9903-129	03/02/99	EV-23B
1	L990355-3	EVT-9903-102	03/01/99	EV-4B
16	L990355-30	EVT-9903-130	03/03/99	MW-107D
17	L990355-31	EVT-9903-131	03/03/99	MW-109D
3	L990355-32	EVT-9903-148	03/01/99	EV-7A
21	L990355-33	EVT-9903-149	03/01/99	RINSATE
19	L990355-34	EVT-9903-150	03/01/99	DI BLANK
4	L990355-35	EVT-9903-151	03/02/99	EV-9B
21	L990355-36	EVT-9903-152	03/02/99	RINSATE
20	L990355-37	EVT-9903-153	03/02/99	DI BLANK
7	L990355-38	EVT-9903-159	03/01/99	EV-19B
19	L990355-39	EVT-9903-160	03/01/99	DI BLANK
2	L990355-4	EVT-9903-103	03/02/99	EV-6A
21	L990355-40	EVT-9903-161	03/01/99	RINSATE
2	L990355-41	EVT-9903-162	03/02/99	EV-6A
20	L990355-42	EVT-9903-163	03/02/99	DI BLANK
21	L990355-43	EVT-9903-164	03/02/99	RINSATE
5	L990355-44	EVT-9903-165	03/03/99	EV-11
16	L990355-45	EVT-9903-166	03/03/99	MW-107D
20	L990355-46	EVT-9903-167	03/03/99	DI BLANK
21	L990355-47	EVT-9903-168	03/03/99	RINSATE
19	L990355-48	EVT-9903-172	03/04/99	BFS
2	L990355-5	EVT-9903-104	03/02/99	EV-6B
2	L990355-6	EVT-9903-105	03/01/99	EV-7A
3	L990355-7	EVT-9903-106	03/01/99	EV-7B
3	L990355-8	EVT-9903-107	03/01/99	EV-8A
4	L990355-9	EVT-9903-108	03/01/99	EV-8B
20	L990390-1	EVT-9903-155	03/05/99	DI BLANK
15	L990390-10	EVT-9903-142	03/05/99	MW-105D(W)
16	L990390-11	EVT-9903-144	03/05/99	MW-107S2(W)
17	L990390-12	EVT-9903-145	03/05/99	MW-108S(W)
17	L990390-13	EVT-9903-146	03/05/99	MW-108D(W)
18	L990390-14	EVT-9903-147	03/05/99	MW-109S(W)
18	L990390-15	EVT-9903-154	03/05/99	MW-109S(W)
21	L990390-16	EVT-9903-156	03/05/99	RINSATE
14	L990390-17	EVT-9903-169	03/05/99	MW-103D(W)
20	L990390-18	EVT-9903-170	03/05/99	DI BLANK
22	L990390-19	EVT-9903-171	03/05/99	RINSATE
13	L990390-2	EVT-9903-133	03/05/99	MW-5(W)

INDEX

+------------------- SAMPLE NUMBER ORDER -------------------+

Page	Sample Number	Lab ##	Date	Site Code
16	EVT-9903-166	L990355-45	03/03/99	MW-107D
20	EVT-9903-167	L990355-46	03/03/99	DI BLANK
21	EVT-9903-168	L990355-47	03/03/99	RINSATE
14	EVT-9903-169	L990390-17	03/05/99	MW-103D(W)
20	EVT-9903-170	L990390-18	03/05/99	DI BLANK
22	EVT-9903-171	L990390-19	03/05/99	RINSATE
19	EVT-9903-172	L990355-48	03/04/99	BFS
19	EVT-9903-172	LOT #426	03/04/99	BFS

+------------------- LAB NUMBER ORDER -------------------+

Page	Lab ##	Sample Number	Date	Site Code
13	L990390-3	EVT-9903-135	03/05/99	MW-7(W)
14	L990390-4	EVT-9903-136	03/05/99	MW-8(W)
14	L990390-5	EVT-9903-137	03/05/99	MW-102S(W)
15	L990390-6	EVT-9903-138	03/05/99	MW-103S(W)
14	L990390-7	EVT-9903-139	03/05/99	MW-103D(W)
15	L990390-8	EVT-9903-140	03/05/99	MW-104S(W)
16	L990390-9	EVT-9903-141	03/05/99	MW-105S(W)
19	LOT #426	EVT-9903-172	03/04/99	BFS

SECOND ROUND OF WELL SAMPLING AND ADDITIONAL HYDROPUNCH AND SURFACE WATER RESULTS

DATA VALIDATION REPORT

EVERETT LOWLAND INVESTIGATION

GROUNDWATER

and

SUPPLEMENTAL SURFACE WATER DATA

June through August 1999

Prepared by
Hydrometrics, Inc.
2727 Airport Road
Helena, MT 59601

August 1999

TABLE OF CONTENTS

LIST OF APPENDICES

GLOSSARY OF TERMS

CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
FAA	Flame Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
HGAA	Hydride Generation Atomic Absorption
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
MSA	Method of Standard Additions
PB	Preparation Blank
PDL	Project Detection Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOW	Statement of Work
TDS	Total Dissolved Solids

SUMMARY

Groundwater and supplemental surface water samples collected for the Everett Lowland Investigation during June1999 through August 1999 have been reviewed in accordance with the EPA's data validation guidelines (EPA, 1994) and the project work plan (Hydrometrics, 1998). Note that, with approval from Ecology, the CLP requirements for the project have been dropped. Data validation included the evaluation of both laboratory and field quality control samples. Associated sample results were flagged for any QC samples that exceeded quality control limits. Data validation codes used as flags are defined in Table 1 in Appendix 1. A complete listing of flagged data including the reason for each flag is in Table 2 in Appendix 1. The sample database is in Appendix 2.

This report covers data from the following samples:

- 54 groundwater samples;
- 10 surface water samples;
- 19 associated quality control samples (six field duplicates, twelve field blanks, and one field standard).

Quality control violations resulting in the flagging of data are listed below.

- Detections in the field blanks resulted in the flagging of 13 sulfate, 24 dissolved zinc, and 19 total zinc values to indicate a possible high bias at low concentrations.
- Exceedances on the field duplicate measurements resulted in the flagging of 2 carbonate, 15 bicarbonate, and 9 total suspended solids values to indicate the possible lack of reproducibility.
- Low recoveries on laboratory matrix spikes for total zinc resulted in a total of 41 flags to indicate possible low bias.
- Low recoveries on laboratory matrix spikes for dissolved zinc resulted in a total of 41 flags to indicate possible low bias.
- A total of 20 dissolved zinc results were flagged due to low recovery on an ICP-MS laboratory control standard. These flags indicate a possible low bias.
- A total of 20 total zinc results were flagged due to low recovery on an ICP-MS laboratory control standard. These flags indicate a possible low bias.

It should be noted that not all quality control deficiencies are equally serious, and many may have no practical impact on the usefulness of the data. Arsenic, for example, is of particular concern for this project, and no arsenic results have been flagged. Overall project data quality objectives for precision, accuracy, and completeness have been met for the data covered in this report (see discussion in Section 17).

Taken as a whole, this data set provides useful information for the Everett Lowland Investigation providing that the possible lack of reproducibility and possible biases indicated by the flags are taken into account. Overall, 94% of the data may be used without qualification; the rest of the data have been flagged with validation codes to assist in their interpretation. (Out of 2715 results, 169 were flagged.)

DATA VALIDATION REPORT

Prepared by: **Clare Bridge**
Reviewed by: **Linda Tangen**

DATA VALIDATION REPORT

1. INTRODUCTION

- This validation applies to inorganic analytes from 83 samples collected for the Everett Lowland Investigation from June 10 through August 3, 1999. The total number of samples included:
  - 54 groundwater samples -- HP-58 was dry, and there was insufficient water for sample collection at MW-104S(W);
  - 10 surface water samples -- SW-19 was dry;
  - 12 field blanks (6 DI blanks and 6 rinsate blanks);
  - 5 groundwater field duplicates;
  - 1 surface water field duplicate;
  - 1 field standard.
- Validation procedures used are generally consistent with:
  (Check all that apply)

  ___ EPA CLP National Functional Guidelines for Inorganics Data Review
  _X_ Work Plan -- 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998
  ___ Other
- Overall level of validation:

  ___ Contract Laboratory Program (CLP)
  _X_ Standard
  ___ Visual

  Notes: Originally the Everett Lowlands Investigation was undertaken as a CLP project. Subsequently, with Ecology's approval, the CLP requirement was dropped. The validation consisted of the following: The frequency and values were checked for both field and laboratory quality control samples. Results were not verified in the raw data. Non-QC sample results were flagged for any field or laboratory quality control exceedances. Data quality objectives for precision, accuracy, and completeness were evaluated as required by the project work plan.

2. DELIVERABLES

- All laboratory document deliverables were present as specified in the CLP-Statement of Work (CLP-SOW), EPA, 1993 and/or the project contract.

  _X_Yes
  ___No
- All documentation of field procedures was provided as required.

  _X_Yes
  ___No

3. FIELD QUALITY CONTROL SAMPLES

Blanks: Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

DI, trip, rinsate, or any other field blanks have been carried out at the proper frequency.
_X_ Yes - For the samples collected in June.
_X_ No - For the sample collected in August.

Notes: No field quality control samples were submitted with the sample submitted on August 3, 1999.

Reported results on the field blanks are less than the contract required detection limits (CRDL) or the project detection limits (PDL) if these have been specified.
___Yes
_X_ No

Notes: Blank exceedances and flagging are summarized in the following table. In cases where the same analyte was detected in both the rinsate and the DI blank submitted on the same day, only the result used to determine flagging is listed.:

Blank Type	Sample #	Date	Analyte	Result (ppm)	5 times Result (ppm)	Number of Flags
Rinsate	EVT-9906-210	6/10/99	Zinc(D)	0.008	0.040	6
DI	EVT-9906-214	6/11/99	Zinc(D)	0.026	0.130	4
			Zinc(T)	0.006	0.030	3
Rinsate	EVT-9906-215	6/11/99	Zinc(T)	0.006	0.030	
DI	EVT-9906-229	6/14/99	Sodium	1.6	8.0	0
			Sulfate	1.5	7.5	2
Rinsate	EVT-9906-230	6/14/99	Sodium	1.5	7.5	0
DI	EVT-9906-237	6/15/99	Sodium	1.4	7.0	0
			Zinc(T)	0.008	0.040	9
Rinsate	EVT-9906-248	6/15/99	Zinc(T)	0.008	0.040	
			Sulfate	1.4	7.0	0
DI	EVT-9906-260	6/16/99	Sodium	1.0	5.0	0
			Zinc(D)	0.006	0.030	6
Rinsate	EVT-9906-261	6/16/99	Sulfate	2.5	12.5	7
			Zinc(T)	0.008	0.040	7
DI	EVT-9906-283	6/17/99	Sodium	1.1	5.5	0
			Zinc(D)	0.016	0.080	8

Notes: When an analyte is detected in a blank, associated results up to 5 times the blank level are flagged to indicate that the results may be biased high due to contamination. Results "associated" with a field blank are generally results for samples collected on the same day as the blank.

Flagging: UJ_1

- **Field duplicates**

  Field duplicates have been collected at the proper frequency.
  _X_Yes - For the samples collected in June.
  _X_No - For the sample collected in August.

  Notes: No field quality control samples were submitted with the sample submitted on August 3, 1999.

  Field duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20% or less for water matrix). If the sample or duplicate result is less than 5 times the PDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PDL for water matrix.
  ___Yes
  _X_No

Site	Date	Sample #/ Dup #	Analyte	Result/ Duplicate (ppm)	Criteria	# of Flags
EV-8A	6/15/99	EVT-9906-235 EVT-9906-236	TSS	57/ 14	> ± 10 ppm	9
“	“	“	HCO_3	244/ 157	43% RPD	15
			CO_3	<1/ 24	> ± 1 ppm	2

  Notes: These flags suggest variability in sample results due to the combined effects of variations in field sampling techniques, sample preparation, and laboratory analytical procedures.

  Flagging: J_4/UJ_4

- **Field standards**

  Field standards were sent at the proper frequency
  _X_Yes
  ___No

  Percent recovery on the field standards was within control limits (80-120% for water, within the certified range for soils).
  _X_Yes
  ___No

4. LABORATORY PROCEDURES

- **Laboratory procedures followed**
  - _ CLP-SOW
  - X SW-846
  - _ Methods for Chemical Analysis of Water and Wastes
  - _ XRF Standard Operating Procedures
  - _ Other

- **Holding times met**

  _X_ Yes

  ___No

- **Consistency with project requirements**

  Analyses were carried out as requested.

  _X_ Yes

  ___No

  Project specified methods were used.

  _X_ Yes

  ___No

5. DETECTION LIMITS

The following table lists the laboratory's reporting level by analytical method and compares it to the project detection limit (PDL).

Parameter	Analysis Method*	Holding Time	TSC Reporting Level (ppm)**	PDL (ppm)
Conductivity	120.1	28 days	5	---
TDS	160.1	7 days	10	10
TSS	160.1	7 days	1	10
Calcium	ICP 200.7	6 months	1	5
Magnesium	ICP 200.7	6 months	1	5
Sodium	ICP 200.7	6 months	2	5
Potassium	ICP 200.7	6 months	2	5
Alkalinity	310.1	14 days	1	1
Acidity	305.1	14 days	1	10
Bicarbonate	310.1	14 days	1	1
Carbonate	310.1	14 days	1	1
Sulfate	375.2	28 days	1	1
Chloride	325.2	28 days	1	1
Arsenic	ICP 200.7 ICP-MS 6020	6 months	0.005	0.005
Cadmium	ICP 200.7 ICP-MS 6020	6 months	0.002	0.005
Chromium	ICP 200.7 ICP-MS 6020	6 months	0.005	0.010
Copper	ICP 200.7 ICP-MS 6020	6 months	0.010	0.010
Lead	ICP 200.7 ICP-MS 6020	6 months	0.005	0.005
Zinc	ICP 200.7 ICP-MS 6020	6 months	0.005	0.020

* The ICP method 200.7 was replaced by the ICP method 6010 when the CLP requirement was removed from the project.

** TSC: Asarco's Technical Services Center laboratory in Salt Lake City, Utah.

- Reporting detection limits met project detection limits (PDLs).
  _X_Yes
  ___No
- Instrument detection limits (IDLs) were provided by the laboratory.
  ___Yes
  ___No
  _X_NA -- Not required for the project.

6. LABORATORY BLANKS

Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

- **Preparation blanks**

  Preparation blanks were prepared and analyzed at the required frequency.
  _X_Yes
  ___No

  All the analytes in the preparation blank were less than the CRDL (or the PDL if a project detection limit has been specified).
  _X_Yes
  ___No

7. LABORATORY MATRIX SPIKES

- A matrix spike sample (pre-digestion) was analyzed for each digestion batch and/or matrix, or as required in the CLP-SOW.
  _X_Yes
  ___No
- Matrix spike recoveries were within the required control limits (75-125%).
  ___Yes
  _X_No

  Notes: For two laboratory batches, the ICP-MS matrix spike recoveries were low for total zinc and for dissolved zinc. The spike recoveries and subsequent flagging are listed in the following table.

Laboratory Batch	Analyte	Spike Recovery	# of Flags
L991041	Zinc (Dis)	72%	17
L991041	Zinc (Tot)	67%	17
L991058	Zinc (Dis)	69%	24
L991058	Zinc (Tot)	72%	24

8. LABORATORY DUPLICATES

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_Yes
  ___No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20% or less for water matrix, 35% or less for soil matrix). For low concentration data, that is if the sample or duplicate result is less than 5 times the PDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PDL for water matrix, and within ± 2 times the PDL for soil matrix.

  _X_Yes
  ___No

9. LABORATORY CONTROL STANDARDS

- The reference material used was of the correct matrix and concentration.

  _X_Yes
  ___No

- LCSs were prepared and analyzed at the proper frequency

  _X_Yes
  ___No

- LCS recoveries were within the required control limits (80-120% for water).

  ___Yes
  _X_No

  Notes: For laboratory batch L991057, the ICP-MS laboratory control standard recoveries were low for total and for dissolved zinc. The spike recoveries and subsequent flagging are listed in the following table.

Laboratory Batch	Analyte	Spike Recovery	# of Flags
L991057	Zinc (Dis)	70%	20
L991057	Zinc (Tot)	69%	20

10. INTERPARAMETER RELATIONSHIPS

- The following relationships have been checked:

  _X_Tot/Dis metals.
  _X_Lab pH vs field pH
  _X_Lab SC vs field SC
  _X_TDS vs SC.
  _X_Arsenic speciation vs dissolved arsenic.

  Tot/Dis metals: If the dissolved metals result is greater than the total metals, the two results are evaluated by the same criteria used for evaluating duplicate samples. For samples where the concentrations are greater than 5 times the PDL, the relative percent difference (RPD) between the dissolved and the total result should be 20% or less; for samples where the concentrations are less than 5 times the PDL, the difference between the dissolved and total results should be within ± the PDL for water matrix.

This relationship was in order.

Lab pH vs field pH: These two parameters are compared by calculating the percent difference. This relationship was generally in order. The percent differences ranged from 0.4 to 22.4 percent. Out of 69 measurements, 11 showed greater than 10 percent difference between the laboratory and field measurements. The distribution was as follows:

Less than 10% difference	58
From 10 to 15% difference	7
From 15 to 20% difference	3
Greater than 20% difference	1

Lab SC vs field SC: These two parameters are compared by calculating the percent difference. This relationship was generally in order. The percent differences ranged from 0 to 23.8 percent. For the 69 measurements, the percent differences were distributed as follows:

Less than 10% difference	29
From 10 to 15% difference	35
From 16 to 20% difference	4
From 20 to 25% difference	1

TDS vs SC: The ratio of TDS to SC should lie between 0.55 and 0.75. In natural waters with high sulfate, the ratio may be as high as 0.96. This ratio is intended to be a check on the accuracy of the TDS and SC measurements. (It should be noted that these measurements are less accurate in dilute waters.)

This relationship was generally in order, with all TDS to SC ratios between 0.55 and 0.88. Out of 69 samples where both TDS and lab SC were measured, 6 samples (9%) had ratios greater than 0.75.

11. DATA QUALITY OBJECTIVES

- **Project data quality objectives (DQO's) met.**

  _X_ Yes
  ___No

  Accuracy

  The target accuracy for this project is for at least 90 percent of the laboratory spikes and laboratory control samples to be within control limits. This goal was met: 96 percent of the laboratory spikes (95 out of 99) and 99 percent of the laboratory control samples (138 out of 140) were within control limits.

Precision

The target precision for this project is for at least 90 percent of the field and laboratory duplicates to be within control limits. This goal was met: 99 percent (201 out of 204) of field duplicate measurements and 100 percent (153 out of 153) laboratory duplicate measurements were within control limits.

Completeness

The target completeness for this project is "assessment of at least 90 percent of the sample analyses as 'valid'." A 'valid' result is one that has not been flagged as rejected (R) or anomalous (A).

This goal was met: there were no A or R flags. All the data were considered to be useable.

REFERENCES

Hem, J.D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition. US Geological Survey Water Supply Paper 2254.

Hydrometrics. 1998 Supplemental Remedial Investigation for the Lowland Area Everett Smelter Site, Everett, Washington. June 1998.

U.S. Environmental Protection Agency, 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.

U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983. (EPA, 1983)

U.S. Environmental Protection Agency, 1993. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM03.0

U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994.

APPENDIX 1

TABLES

TABLE 1.

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 - Calibration range exceeded or significant deviation from known value. Possible bias.
3 - Holding time not met. Indicates low bias.
4 - Other QC outside control limits.

UJ - The material was analyzed for, but was not detected above the associated value.

Subscripts for the "UJ" qualifier:

1 - Blank contamination. Indicates possible high bias and/or false positive.
2 - Calibration range exceeded or significant deviation from known value. Possible bias.
3 - Holding time not met. Indicates low bias.
4 - Other QC outside control limits.

R - Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.

A - Anomalous data. No apparent explanation for discrepancy in data. (Not an EPA code.)

Table 2. Summary of Flagged Data
Everett Lowland Investigation, Groundwater -- June 1999
(All values in ppm unless otherwise noted.)

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Bias	Reason for Flag
DI BLANK	EVT-9906-208	L991041-9	06/10/99	ZINC (ZN)(DIS)	<0.005	UJ4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	<0.005	UJ4	-33%	Spike recovery 67%
DI BLANK	EVT-9906-214	L991041-15	06/11/99	ZINC (ZN)(DIS)	0.026	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.006	J4	-33%	Spike recovery 67%
DI BLANK	EVT-9906-229	L991057-13	06/14/99	ZINC (ZN)(DIS)	<0.005	UJ2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	<0.005	UJ2	-31%	LCS recovery 69%
DI BLANK	EVT-9906-237	L991057-20	6/15/99	ZINC (ZN)(DIS)	<0.005	UJ2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.008	J2	-31%	LCS recovery 69%
DI BLANK	EVT-9906-260	L991058-23	06/16/99	ZINC (ZN)(DIS)	0.006	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.007	J4	-28%	Spike recovery 72%
EV-3	EVT-9906-225	L991057-9	06/14/99	ZINC (ZN)(DIS)	0.01	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.022	J2	-31%	LCS recovery 69%
EV-4A	EVT-9906-224	L991057-8	06/14/99	ZINC (ZN)(DIS)	0.023	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.039	J2	-31%	LCS recovery 69%
EV-4B	EVT-9906-223	L991057-7	06/14/99	ZINC (ZN)(DIS)	0.036	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.035	J2	-31%	LCS recovery 69%
EV-6A	EVT-9906-220	L991057-4	06/14/99	ZINC (ZN)(DIS)	15.0	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	15.0	J2	-31%	LCS recovery 69%
EV-6B	EVT-9906-221	L991057-5	06/14/99	ZINC (ZN)(DIS)	0.008	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.027	J2	-31%	LCS recovery 69%
EV-6B (Dup)	EVT-9906-222	L991057-6	06/14/99	ZINC (ZN)(DIS)	0.005	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.032	J2	-31%	LCS recovery 69%
EV-7A	EVT-9906-239	L991058-2	06/15/99	BICARBONATE (HCO3)	301.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	0.038	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.031	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.031	J4	-28%	Spike recovery 72%
EV-7B	EVT-9906-238	L991058-1	06/15/99	BICARBONATE (HCO3)	127.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	0.005	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
EV-8A	EVT-9906-235	L991057-18	06/15/99	TOTAL SUSPENDED SOLIDS	57.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	244.0	J4		Field duplicate RPD = 43%
				CARBONATE AS CO3	<1.0	UJ4		Field duplicate difference greater than 1 ppm
				SULFATE (SO4)	5.0	UJ1		Detection in blank (1 ppm)
				ZINC (ZN)(DIS)	0.016	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.022	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.022	J2	-31%	LCS recovery 69%
EV-8A (Dup)	EVT-9906-236	L991057-19	06/15/99	TOTAL SUSPENDED SOLIDS	14.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	157.0	J4		Field duplicate RPD = 43%
				CARBONATE AS CO3	24.0	J4		Field duplicate difference greater than 1 ppm
				SULFATE (SO4)	4.6	UJ1		Detection in blank (1 ppm)
				ZINC (ZN)(DIS)	0.016	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.02	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.02	J2	-31%	LCS recovery 69%
EV-8B	EVT-9906-234	L991057-17	06/15/99	BICARBONATE (HCO3)	179.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	<0.005	UJ2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.009	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.009	J2	-31%	LCS recovery 69%
EV-9A	EVT-9906-242	L991058-5	06/15/99	TOTAL SUSPENDED SOLIDS	43.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	794.0	J4		Field duplicate RPD = 43%
EV-9B	EVT-9906-241	L991058-4	06/15/99	BICARBONATE (HCO3)	179.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%

Table 2. Summary of Flagged Data
Everett Lowland Investigation, Groundwater -- June 1999
(All values in ppm unless otherwise noted.)

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Bias	Reason for Flag
EV-15A	EVT-9906-228	L991057-12	06/14/99	SULFATE (SO4)	6.0	UJ1		Detection in blank (1.5 ppm)
				ZINC (ZN)(DIS)	0.011	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.047	J2	-31%	LCS recovery 69%
EV-15B	EVT-9906-227	L991057-11	06/14/99	SULFATE (SO4)	3.8	UJ1		Detection in blank (1.5 ppm)
				ZINC (ZN)(DIS)	0.006	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.01	J2	-31%	LCS recovery 69%
EV-16A	EVT-9906-226	L991057-10	06/14/99	ZINC (ZN)(DIS)	0.013	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.018	J2	-31%	LCS recovery 69%
EV-17A	EVT-9906-244	L991058-7	06/15/99	TOTAL SUSPENDED SOLIDS	63.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	342.0	J4		Field duplicate RPD = 43%
EV-17B	EVT-9906-243	L991058-6	06/15/99	TOTAL SUSPENDED SOLIDS	22.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	195.0	J4		Field duplicate RPD = 43%
EV-18B	EVT-9906-217	L991057-1	06/14/99	ZINC (ZN)(DIS)	0.009	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.01	J2	-31%	LCS recovery 69%
EV-19B	EVT-9906-218	L991057-2	06/14/99	ZINC (ZN)(DIS)	0.007	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.008	J2	-31%	LCS recovery 69%
EV-20B	EVT-9906-219	L991057-3	06/14/99	ZINC (ZN)(DIS)	0.007	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.009	J2	-31%	LCS recovery 69%
EV-21A	EVT-9906-254	L991058-17	06/16/99	SULFATE (SO4)	6.9	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
EV-21B	EVT-9906-255	L991058-18	06/16/99	SULFATE (SO4)	6.3	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
EV-21B (Dup)	EVT-9906-256	L991058-19	06/16/99	SULFATE (SO4)	7.3	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.01	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.01	J4	-28%	Spike recovery 72%
EV-22A	EVT-9906-263	L991058-26	06/16/99	ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.009	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.009	J4	-28%	Spike recovery 72%
EV-22B	EVT-9906-262	L991058-25	06/16/99	SULFATE (SO4)	11.0	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	0.006	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.006	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.053	J4	-28%	Spike recovery 72%
EV-23A	EVT-9906-233	L991057-16	06/15/99	BICARBONATE (HCO3)	537.0	J4		Field duplicate RPD = 43%
				SULFATE (SO4)	4.6	UJ1		Detection in blank (1.5 ppm)
				ZINC (ZN)(DIS)	0.016	J2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.080	J2	-31%	LCS recovery 69%
EV-23B	EVT-9906-232	L991057-15	06/15/99	BICARBONATE (HCO3)	135.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	<0.005	UJ2	-30%	LCS recovery 70%
				ZINC (ZN)(TOT)	0.013	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.013	J2	-31%	LCS recovery 69%
HP-51	EVT-9906-201	L991041-2	06/10/99	ZINC (ZN)(DIS)	0.016	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.016	J4	-28%	Spike recovery 72%
HP-51	EVT-9906-201	L991041-2	06/10/99	ZINC (ZN)(TOT)	0.016	J4	-33%	Spike recovery 67%
HP-52	EVT-9906-202	L991041-3	06/10/99	ZINC (ZN)(DIS)	0.032	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.032	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.014	J4	-33%	Spike recovery 67%
HP-53	EVT-9906-203	L991041-4	06/10/99	ZINC (ZN)(DIS)	0.005	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.005	J4	-28%	Spike recovery 72%

Table 2. Summary of Flagged Data
Everett Lowland Investigation, Groundwater -- June 1999
(All values in ppm unless otherwise noted.)

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Bias	Reason for Flag
				ZINC (ZN)(TOT)	0.006	J4	-33%	Spike recovery 67%
HP-54	EVT-9906-205	L991041-6	06/10/99	ZINC (ZN)(DIS)	0.007	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.007	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.013	J4	-33%	Spike recovery 67%
HP-55	EVT-9906-204	L991041-5	06/10/99	ZINC (ZN)(DIS)	<0.005	UJ4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	<0.005	UJ4	-33%	Spike recovery 67%
HP-56	EVT-9906-206	L991041-7	06/10/99	ZINC (ZN)(DIS)	<0.005	UJ4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.005	J4	-33%	Spike recovery 67%
HP-56	EVT-9906-207	L991041-8	06/10/99	ZINC (ZN)(DIS)	<0.005	UJ4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	<0.005	UJ4	-33%	Spike recovery 67%
HP-57	EVT-9906-209	L991041-10	06/10/99	ZINC (ZN)(DIS)	0.009	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.009	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.009	J4	-33%	Spike recovery 67%
HP-59	EVT-9906-211	L991041-12	06/11/99	ZINC (ZN)(DIS)	0.006	UJ1		Detection in blank (0.026 ppm)
				ZINC (ZN)(DIS)	0.006	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.007	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(TOT)	0.007	J4	-33%	Spike recovery 67%
HP-59	EVT-9906-212	L991041-13	06/11/99	ZINC (ZN)(DIS)	0.007	UJ1		Detection in blank (0.026 ppm)
				ZINC (ZN)(DIS)	0.007	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.008	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(TOT)	0.008	J4	-33%	Spike recovery 67%
HP-61	EVT-9906-200	L991041-1	06/10/99	ZINC (ZN)(DIS)	0.007	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(DIS)	0.007	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.008	J4	-33%	Spike recovery 67%
HP-62	EVT-9906-213	L991041-14	06/11/99	ZINC (ZN)(DIS)	0.008	UJ1		Detection in blank (0.026 ppm)
				ZINC (ZN)(DIS)	0.008	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.01	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(TOT)	0.01	J4	-33%	Spike recovery 67%
HP-63	EVT-9906-216	L991041-17	06/11/99	ZINC (ZN)(DIS)	0.038	UJ1		Detection in blank (0.026 ppm)
				ZINC (ZN)(DIS)	0.038	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.047	J4	-33%	Spike recovery 67%
MP-13	EVT-9906-279	L991086-12	06/17/99	ZINC (ZN)(DIS)	0.033	UJ1		Detection in blank (0.016 ppm)
MW-3	EVT-9906-245	L991058-8	06/15/99	TOTAL SUSPENDED SOLIDS	28.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	244.0	J4		Field duplicate RPD = 43%
				SULFATE (SO4)	2.8	UJ1		Detection in blank (1.5 ppm)
				ZINC (ZN)(DIS)	0.012	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.005	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.005	J4	-28%	Spike recovery 72%
MW-4A	EVT-9906-246	L991058-9	06/15/99	TOTAL SUSPENDED SOLIDS	22.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	199.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	0.007	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.006	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.006	J4	-28%	Spike recovery 72%
MW-5	EVT-9906-247	L991058-10	06/15/99	TOTAL SUSPENDED SOLIDS	50.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	143.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	0.009	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.01	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.01	J4	-28%	Spike recovery 72%
MW-5(W)	EVT-9906-250	L991058-13	06/16/99	SULFATE (SO4)	7.5	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
MW-5(W)	EVT-9906-250	L991058-13	06/16/99	ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
MW-7(W)	EVT-9906-264	L991058-27	06/16/99	ZINC (ZN)(DIS)	0.007	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.007	J4	-31%	Spike recovery 69%

Table 2. Summary of Flagged Data
Everett Lowland Investigation, Groundwater -- June 1999
(All values in ppm unless otherwise noted.)

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Bias	Reason for Flag
				ZINC (ZN)(TOT)	0.042	J4	-28%	Spike recovery 72%
MW-8(W)	EVT-9906-249	L991058-12	06/16/99	SULFATE (SO4)	11.0	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	0.005	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.005	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.013	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.013	J4	-28%	Spike recovery 72%
MW-107D	EVT-9906-257	L991058-20	06/16/99	SULFATE (SO4)	8.3	UJ1		Detection in blank (2.5 ppm)
				ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.009	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.009	J4	-28%	Spike recovery 72%
MW-107S2(W	EVT-9906-251	L991058-14	06/16/99	ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
MW-108D(W)	EVT-9906-258	L991058-21	06/16/99	ZINC (ZN)(DIS)	0.006	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.006	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.012	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.012	J4	-28%	Spike recovery 72%
MW-108S(W)	EVT-9906-252	L991058-15	06/16/99	ZINC (ZN)(DIS)	0.007	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.007	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	<0.005	UJ4	-28%	Spike recovery 72%
MW-109D	EVT-9906-259	L991058-22	06/16/99	ZINC (ZN)(DIS)	0.005	UJ1		Detection in blank (0.006 ppm)
				ZINC (ZN)(DIS)	0.005	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.006	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.006	J4	-28%	Spike recovery 72%
MW-109S(W)	EVT-9906-253	L991058-16	06/16/99	ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.027	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.027	J4	-28%	Spike recovery 72%
OUTFALL	EVT-9906-280	L991086-13	06/17/99	ZINC (ZN)(DIS)	0.013	UJ1		Detection in blank (0.016 ppm)
OUTFALL	EVT-9906-281	L991086-14	06/17/99	ZINC (ZN)(DIS)	0.012	UJ1		Detection in blank (0.016 ppm)
RINSATE	EVT-9906-210	L991041-11	06/10/99	ZINC (ZN)(DIS)	0.008	J4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	<0.005	UJ4	-33%	Spike recovery 67%
RINSATE	EVT-9906-215	L991041-16	06/11/99	ZINC (ZN)(DIS)	<0.005	UJ4	-28%	Spike recovery 72%
				ZINC (ZN)(TOT)	0.006	J4	-33%	Spike recovery 67%
RINSATE	EVT-9906-230	L991057-14	06/14/99	ZINC (ZN)(DIS)	<0.005	UJ2		LCS recovery 70%
				ZINC (ZN)(TOT)	<0.005	UJ2		LCS recovery 69%
RINSATE	EVT-9906-248	L991058-11	06/15/99	ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.008	J4	-28%	Spike recovery 72%
RINSATE	EVT-9906-261	L991058-24	06/16/99	ZINC (ZN)(DIS)	<0.005	UJ4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.008	J4	-28%	Spike recovery 72%
SW-1	EVT-9906-274	L991086-8	06/17/99	ZINC (ZN)(DIS)	0.077	UJ1		Detection in blank (0.016 ppm)
SW-2	EVT-9906-273	L991086-6	06/17/99	ZINC (ZN)(DIS)	0.027	UJ1		Detection in blank (0.016 ppm)
SW-14	EVT-9906-275	L991086-7	06/17/99	ZINC (ZN)(DIS)	0.011	UJ1		Detection in blank (0.016 ppm)
SW-16	EVT-9906-278	L991086-11	06/17/99	ZINC (ZN)(DIS)	0.006	UJ1		Detection in blank (0.016 ppm)
SW-18	EVT-9906-282	L991086-15	06/17/99	ZINC (ZN)(DIS)	0.015	UJ1		Detection in blank (0.016 ppm)
WP-1	EVT-9906-240	L991058-3	06/15/99	TOTAL SUSPENDED SOLIDS	15.0	J4		Field duplicate difference greater than 10 ppm
				BICARBONATE (HCO3)	322.0	J4		Field duplicate RPD = 43%
				ZINC (ZN)(DIS)	0.01	J4	-31%	Spike recovery 69%
				ZINC (ZN)(TOT)	0.011	UJ1		Detection in blank (0.008 ppm)
				ZINC (ZN)(TOT)	0.011	J4	-28%	Spike recovery 72%

APPENDIX 2

DATABASE

TABLE OF CONTENTS BY SITE TYPE

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-3		EV-4A		EV-4B	
SAMPLE DATE	06/14/99		06/14/99		06/14/99	
SAMPLE TIME	15:15		14:30		14:15	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991057-9		L991057-8		L991057-7	
SAMPLE NUMBER	EVT-9906-225		EVT-9906-224		EVT-9906-223	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	46.3		9.81		50.97	
OXYGEN (O) (FLD)	4.54		2.24		0.66	
PH (FLD)	6.31		6.41		6.47	
PH	7.4		7.0		7.0	
SALINITY (G/KG) (FLD)	0.0		0.2		0.2	
SC (UMHOS/CM AT 25 C)	254.0		483.0		763.0	
SC (UMHOS/CM AT 25 C) (FLD)	220.0		468.0		653.0	
TDS (MEASURED AT 180 C)	225.0		332.0		489.0	
TOTAL SUSPENDED SOLIDS	4.2		23.0		<1.0	
TURBIDITY (NTU) (FLD)	7.0		120.0		6.0	
WATER TEMPERATURE (C) (FLD)	13.3		19.2		13.5	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	19.0		47.0		53.0	
MAGNESIUM (MG) DIS	11.0		21.0		48.0	
SODIUM (NA) DIS	15.0		13.0		32.0	
POTASSIUM (K) DIS	3.3		2.4		4.1	
TOTAL ALKALINITY AS CACO3	80.0		206.0		332.0	
TOTAL ACIDITY AS CACO3	10.0		35.0		52.0	
BICARBONATE (HCO3)	98.0		251.0		405.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	21.0		38.0		64.0	
CHLORIDE (CL)	5.4		6.2		29.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		0.63		0.11	
ARSENIC (AS) TOT	<0.005		1.1		0.11	
ARSENIC +3	<0.005		0.26		0.04	
ARSENIC +5	<0.005		0.75		0.12	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.007		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		0.006		<0.005	
ZINC (ZN) DIS	0.01	J2	0.023	J2	0.036	J2
ZINC (ZN) TOT	0.022	J2	0.039	J2	0.035	J2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-6A	EV-6B	EV-6B	EV-7A
SAMPLE DATE	06/14/99	06/14/99	06/14/99	06/15/99
SAMPLE TIME	13:00	12:30	13:15	12:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991057-4	L991057-5	L991057-6	L991058-2
REMARKS			DUPLICATE	
SAMPLE NUMBER	EVT-9906-220	EVT-9906-221	EVT-9906-222	EVT-9906-239
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	47.84	51.2		1.76
OXYGEN (O) (FLD)	0.51	0.1	0.1	0.02
PH (FLD)	6.58	7.95	7.95	8.88
PH	7.0	8.1	8.0	8.2
SALINITY (G/KG) (FLD)	0.1	0.2	0.2	0.1
SC (UMHOS/CM AT 25 C)	501.0	567.0	568.0	465.0
SC (UMHOS/CM AT 25 C) (FLD)	448.0	491.0	490.0	393.0
TDS (MEASURED AT 180 C)	424.0	344.0	348.0	384.0
TOTAL SUSPENDED SOLIDS	13.0	43.0	44.0	<1.0
TURBIDITY (NTU) (FLD)	4.0	23.0	20.0	6.0
WATER TEMPERATURE (C) (FLD)	13.0	12.8	12.8	12.2
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	62.0	23.0	23.0	70.0
MAGNESIUM (MG) DIS	11.0	45.0	44.0	8.2
SODIUM (NA) DIS	14.0	24.0	23.0	13.0
POTASSIUM (K) DIS	12.0	6.8	6.7	13.0
TOTAL ALKALINITY AS CACO3	191.0	220.0	228.0	247.0
TOTAL ACIDITY AS CACO3	58.0	10.0	14.0	<1.0
BICARBONATE (HCO3)	233.0	268.0	278.0	301.0 J4
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	58.0	38.0	37.0	16.0
CHLORIDE (CL)	10.0	22.0	23.0	6.6
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.99	0.021	0.022	2.0
ARSENIC (AS) TOT	0.98	0.025	0.026	2.1
ARSENIC +3	0.42	<0.005	<0.005	1.7
ARSENIC +5	0.56	0.012	0.013	<0.005
CADMIUM (CD) DIS	0.012	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	0.012	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	0.005	0.006	<0.005
COPPER (CU) DIS	0.22	<0.01	<0.01	0.01
COPPER (CU) TOT	0.29	<0.01	<0.01	0.011
LEAD (PB) DIS	0.18	<0.005	<0.005	0.089
LEAD (PB) TOT	0.18	0.006	0.006	0.11
ZINC (ZN) DIS	15.0 J2	0.008 J2	0.005 J2	0.038 J4
ZINC (ZN) TOT	15.0 J2	0.027 J2	0.032 J2	0.031 UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-7B		EV-8A		EV-8A		EV-8B	
SAMPLE DATE	06/15/99		06/15/99		06/15/99		06/15/99	
SAMPLE TIME	12:30		11:30		11:45		11:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-1		L991057-18		L991057-19		L991057-17	
REMARKS					DUPLICATE			
SAMPLE NUMBER	EVT-9906-238		EVT-9906-235		EVT-9906-236		EVT-9906-234	
-- PHYSICAL PARAMETERS --								
DEPTH TO WATER LEVEL (FEET)	5.88		2.21				6.01	
OXYGEN (O) (FLD)	1.04		0.02		0.02		0.03	
PH (FLD)	6.49		9.59		9.6		6.82	
PH	7.6		8.3		8.7		7.7	
SALINITY (G/KG) (FLD)	0.1		0.1		0.1		0.1	
SC (UMHOS/CM AT 25 C)	355.0		356.0		337.0		456.0	
SC (UMHOS/CM AT 25 C) (FLD)	313.0		383.0		383.0		402.0	
TDS (MEASURED AT 180 C)	244.0		247.0		234.0		312.0	
TOTAL SUSPENDED SOLIDS	<1.0		57.0	J4	14.0	J4	<1.0	
TURBIDITY (NTU) (FLD)	2.0		5.0		6.0		6.0	
WATER TEMPERATURE (C) (FLD)	12.1		12.6		12.6		11.8	
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS	25.0		80.0		75.0		18.0	
MAGNESIUM (MG) DIS	18.0		7.0		6.8		26.0	
SODIUM (NA) DIS	14.0		23.0		21.0		34.0	
POTASSIUM (K) DIS	3.5		12.0		12.0		5.1	
TOTAL ALKALINITY AS CACO3	104.0		200.0		169.0		147.0	
TOTAL ACIDITY AS CACO3	6.0		<1.0		<1.0		8.0	
BICARBONATE (HCO3)	127.0	J4	244.0	J4	157.0	J4	179.0	J4
CARBONATE AS CO3	<1.0		<1.0	UJ4	24.0	J4,A	<1.0	
SULFATE (SO4)	32.0		5.0	UJ1	4.6	UJ1	49.0	
CHLORIDE (CL)	13.0		10.0		9.5		16.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	6.9		1.0		0.99		3.5	
ARSENIC (AS) TOT	6.8		1.0		1.1		3.5	
ARSENIC +3	1.8		1.3		1.4		3.4	
ARSENIC +5	5.5		<0.005		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.005	J4	0.016	J2	0.016	J2	<0.005	UJ2
ZINC (ZN) TOT	<0.005	UJ4	0.022	UJ1 J2	0.02	UJ1 J2	0.009	UJ1 J2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-9A		EV-9B		EV-15A	
SAMPLE DATE	06/15/99		06/15/99		06/14/99	
SAMPLE TIME	14:00		13:30		17:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-5		L991058-4		L991057-12	
SAMPLE NUMBER	EVT-9906-242		EVT-9906-241		EVT-9906-228	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	2.81		5.98		3.28	
OXYGEN (O) (FLD)	0.03		0.66		0.26	
PH (FLD)	7.02		6.26		6.36	
PH	7.6		6.8		6.9	
SALINITY (G/KG) (FLD)	0.6		0.1		1.2	
SC (UMHOS/CM AT 25 C)	1339.0		408.0		2440.0	
SC (UMHOS/CM AT 25 C) (FLD)	1470.0		358.0		2600.0	
TDS (MEASURED AT 180 C)	850.0		280.0		1571.0	
TOTAL SUSPENDED SOLIDS	43.0	J4	<1.0		451.0	
TURBIDITY (NTU) (FLD)	7.0		7.0		30.0	
WATER TEMPERATURE (C) (FLD)	12.4		12.1		13.1	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	114.0		23.0		242.0	
MAGNESIUM (MG) DIS	30.0		21.0		132.0	
SODIUM (NA) DIS	106.0		23.0		70.0	
POTASSIUM (K) DIS	45.0		2.8		38.0	
TOTAL ALKALINITY AS CACO3	651.0		147.0		1325.0	
TOTAL ACIDITY AS CACO3	38.0		40.0		335.0	
BICARBONATE (HCO3)	794.0	J4	179.0	J4	1616.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	7.4		33.0		6.0	UJ1
CHLORIDE (CL)	71.0		18.0		95.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	2.2		0.4		0.032	
ARSENIC (AS) TOT	2.2		0.42		0.14	
ARSENIC +3	1.6		0.11		<0.005	
ARSENIC +5	0.091		0.32		0.063	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		0.026	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.01		<0.01		0.023	
LEAD (PB) DIS	0.007		<0.005		<0.005	
LEAD (PB) TOT	0.018		<0.005		0.039	
ZINC (ZN) DIS	0.24		<0.005	UJ4	0.011	J2
ZINC (ZN) TOT	0.28		<0.005	UJ4	0.047	J2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-15B		EV-16A		EV-17A	
SAMPLE DATE	06/14/99		06/14/99		06/15/99	
SAMPLE TIME	16:30		15:45		15:00	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991057-11		L991057-10		L991058-7	
SAMPLE NUMBER	EVT-9906-227		EVT-9906-226		EVT-9906-244	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	8.5		4.03		5.0	
OXYGEN (O) (FLD)	0.05		0.45		0.06	
PH (FLD)	6.57		6.26		6.6	
PH	7.2		6.7		6.9	
SALINITY (G/KG) (FLD)	0.2		0.7		0.2	
SC (UMHOS/CM AT 25 C)	709.0		1430.0		569.0	
SC (UMHOS/CM AT 25 C) (FLD)	608.0		1600.0		627.0	
TDS (MEASURED AT 180 C)	432.0		929.0		462.0	
TOTAL SUSPENDED SOLIDS	3.9		43.0		63.0	J4
TURBIDITY (NTU) (FLD)	5.0		6.0		9.0	
WATER TEMPERATURE (C) (FLD)	13.4		13.0		12.2	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	41.0		118.0		63.0	
MAGNESIUM (MG) DIS	47.0		78.0		18.0	
SODIUM (NA) DIS	35.0		83.0		16.0	
POTASSIUM (K) DIS	5.9		7.3		10.0	
TOTAL ALKALINITY AS CACO3	313.0		699.0		280.0	
TOTAL ACIDITY AS CACO3	36.0		206.0		68.0	
BICARBONATE (HCO3)	382.0		853.0		342.0	J4
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	3.8	UJ1	42.0		22.0	
CHLORIDE (CL)	40.0		59.0		7.8	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		0.085		2.7	
ARSENIC (AS) TOT	<0.005		0.093		3.0	
ARSENIC +3	<0.005		0.014		0.5	
ARSENIC +5	<0.005		0.13		2.7	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		0.017	
COPPER (CU) TOT	<0.01		<0.01		0.028	
LEAD (PB) DIS	<0.005		<0.005		0.045	
LEAD (PB) TOT	<0.005		<0.005		0.064	
ZINC (ZN) DIS	0.006	J2	0.013	J2	4.3	
ZINC (ZN) TOT	0.01	J2	0.018	J2	4.7	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-17B		EV-18B		EV-19B	
SAMPLE DATE	06/15/99		06/14/99		06/14/99	
SAMPLE TIME	14:45		10:00		10:45	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-6		L991057-1		L991057-2	
SAMPLE NUMBER	EVT-9906-243		EVT-9906-217		EVT-9906-218	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	5.25		46.93		47.29	
OXYGEN (O) (FLD)	0.05		4.59		4.5	
PH (FLD)	6.31		6.36		6.55	
PH	6.8		7.5		7.4	
SALINITY (G/KG) (FLD)	0.1		0.2		0.1	
SC (UMHOS/CM AT 25 C)	499.0		638.0		472.0	
SC (UMHOS/CM AT 25 C) (FLD)	462.0		553.0		409.0	
TDS (MEASURED AT 180 C)	365.0		422.0		320.0	
TOTAL SUSPENDED SOLIDS	22.0	J4	24.0		3.6	
TURBIDITY (NTU) (FLD)	14.0		20.0		9.0	
WATER TEMPERATURE (C) (FLD)	12.0		13.3		12.8	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	35.0		46.0		31.0	
MAGNESIUM (MG) DIS	28.0		32.0		28.0	
SODIUM (NA) DIS	19.0		31.0		15.0	
POTASSIUM (K) DIS	2.8		4.8		4.2	
TOTAL ALKALINITY AS CACO3	160.0		131.0		130.0	
TOTAL ACIDITY AS CACO3	46.0		7.0		12.0	
BICARBONATE (HCO3)	195.0	J4	160.0		159.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	72.0		84.0		42.0	
CHLORIDE (CL)	8.7		69.0		42.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.38		<0.005		4.5	
ARSENIC (AS) TOT	0.45		<0.005		4.8	
ARSENIC +3	0.14		<0.005		2.1	
ARSENIC +5	0.33		<0.005		2.9	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		0.007		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.71		0.009	J2	0.007	J2
ZINC (ZN) TOT	0.74		0.01	J2	0.008	J2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-20B	EV-21A	EV-21B	EV-21B
SAMPLE DATE	06/14/99	06/16/99	06/16/99	06/16/99
SAMPLE TIME	11:30	10:00	11:15	11:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991057-3	L991058-17	L991058-18	L991058-19
REMARKS				DUPLICATE
SAMPLE NUMBER	EVT-9906-219	EVT-9906-254	EVT-9906-255	EVT-9906-256
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	50.32	9.72	12.53	
OXYGEN (O) (FLD)	5.34	0.14	0.0	0.0
PH (FLD)	6.3	6.74	6.78	6.77
PH	7.0	7.3	7.3	7.4
SALINITY (G/KG) (FLD)	0.1	0.2	0.2	0.2
SC (UMHOS/CM AT 25 C)	434.0	497.0	614.0	614.0
SC (UMHOS/CM AT 25 C) (FLD)	373.0	497.0	530.0	530.0
TDS (MEASURED AT 180 C)	342.0	326.0	394.0	390.0
TOTAL SUSPENDED SOLIDS	4.5	61.0	2.0	1.9
TURBIDITY (NTU) (FLD)	15.0	1.0	4.0	3.0
WATER TEMPERATURE (C) (FLD)	15.1	14.5	12.2	12.2
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	33.0	38.0	6.1	6.2
MAGNESIUM (MG) DIS	24.0	8.9	15.0	15.0
SODIUM (NA) DIS	16.0	52.0	99.0	103.0
POTASSIUM (K) DIS	3.6	6.2	8.0	8.2
TOTAL ALKALINITY AS CACO3	90.0	230.0	256.0	243.0
TOTAL ACIDITY AS CACO3	27.0	18.0 J4	8.0 J4	17.0 J4
BICARBONATE (HCO3)	110.0	281.0	312.0	296.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	53.0	6.9 UJ1	6.3 UJ1	7.3 UJ1
CHLORIDE (CL)	29.0	20.0	52.0	53.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	13.0	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	12.0	<0.005	<0.005	<0.005
ARSENIC +3	8.2	<0.005	<0.005	<0.005
ARSENIC +5	4.8	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	0.009	0.01
CHROMIUM (CR) TOT	<0.005	<0.005	0.009	0.009
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.007 J2	<0.005 UJ4	<0.005 UJ4	<0.005 UJ4
ZINC (ZN) TOT	0.009 J2	<0.005 UJ4	<0.005 UJ4	0.01 UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-22A	EV-22B	EV-23A
SAMPLE DATE	06/16/99	06/16/99	06/15/99
SAMPLE TIME	14:00	13:45	09:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991058-26	L991058-25	L991057-16
SAMPLE NUMBER	EVT-9906-263	EVT-9906-262	EVT-9906-233
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	14.95	19.52	0.75
OXYGEN (O) (FLD)	0.06	0.26	1.12
PH (FLD)	6.83	7.11	6.23
PH	7.7	7.4	7.1
SALINITY (G/KG) (FLD)	1.6	2.2	0.3
SC (UMHOS/CM AT 25 C)	3230.0	4750.0	845.0
SC (UMHOS/CM AT 25 C) (FLD)	3340.0	4410.0	821.0
TDS (MEASURED AT 180 C)	2249.0	2886.0	532.0
TOTAL SUSPENDED SOLIDS	426.0	361.0	277.0
TURBIDITY (NTU) (FLD)	12.0	82.0	700.0
WATER TEMPERATURE (C) (FLD)	11.1	12.2	14.3
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	26.0	36.0	61.0
MAGNESIUM (MG) DIS	8.7	80.0	42.0
SODIUM (NA) DIS	815.0	899.0	31.0
POTASSIUM (K) DIS	21.0	53.0	16.0
TOTAL ALKALINITY AS CACO3	1953.0	1633.0	440.0
TOTAL ACIDITY AS CACO3	118.0	100.0	148.0
BICARBONATE (HCO3)	2383.0	1992.0	537.0 J4
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	94.0	11.0 UJ1	4.6 UJ1
CHLORIDE (CL)	11.0	737.0	8.8
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005	<0.005	0.051
ARSENIC (AS) TOT	0.011	0.011	0.089
ARSENIC +3	0.005	<0.005	<0.005
ARSENIC +5	<0.005	0.01	0.086
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	0.013	0.01	<0.005
CHROMIUM (CR) TOT	0.022	0.062	0.009
COPPER (CU) DIS	<0.01	<0.005	<0.01
COPPER (CU) TOT	<0.01	0.039	0.014
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	0.018	0.028
ZINC (ZN) DIS	<0.005 UJ4	0.006 UJ1 J4	0.016 J2
ZINC (ZN) TOT	0.009 UJ1 J4	0.053 J4	0.08 J2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	EV-23B		HP-51		HP-52	
SAMPLE DATE	06/15/99		06/10/99		06/10/99	
SAMPLE TIME	09:00		16:45		17:15	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991057-15		L991041-2		L991041-3	
SAMPLE NUMBER	EVT-9906-232		EVT-9906-201		EVT-9906-202	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	5.72		8.25		7.49	
OXYGEN (O) (FLD)	0.03		0.14		0.07	
PH (FLD)	6.78		5.92		6.18	
PH	8.3		6.5		6.7	
SALINITY (G/KG) (FLD)	0.0		0.7		0.5	
SC (UMHOS/CM AT 25 C)	298.0		1519.0		1033.0	
SC (UMHOS/CM AT 25 C) (FLD)	261.0		1610.0		1180.0	
TDS (MEASURED AT 180 C)	210.0		838.0		685.0	
TOTAL SUSPENDED SOLIDS	336.0		6.4		36.0	
TURBIDITY (NTU) (FLD)	8.0		8.0		7.0	
WATER TEMPERATURE (C) (FLD)	11.5		14.1		13.5	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	17.0		6.9		58.0	
MAGNESIUM (MG) DIS	13.0		12.0		31.0	
SODIUM (NA) DIS	18.0		272.0		83.0	
POTASSIUM (K) DIS	3.7		18.0		12.0	
TOTAL ALKALINITY AS CACO3	111.0		52.0		157.0	
TOTAL ACIDITY AS CACO3	8.0		10.0		60.0	
BICARBONATE (HCO3)	135.0	J4	63.0		192.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	18.0		145.0		236.0	
CHLORIDE (CL)	13.0		235.0		126.0	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	<0.005		<0.005		<0.005	
ARSENIC +3	<0.005		<0.005		<0.005	
ARSENIC +5	<0.005		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.007		<0.005		<0.005	
COPPER (CU) DIS	<0.01		<0.01		<0.01	
COPPER (CU) TOT	<0.01		<0.01		<0.01	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	<0.005	UJ2	0.016	UJ1 J4	0.032	UJ1 J4
ZINC (ZN) TOT	0.013	UJ1 J2	0.016	J4	0.014	J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-53	HP-54	HP-55
SAMPLE DATE	06/10/99	06/10/99	06/10/99
SAMPLE TIME	17:35	18:10	17:50
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991041-4	L991041-6	L991041-5
SAMPLE NUMBER	EVT-9906-203	EVT-9906-205	EVT-9906-204
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	7.18	3.15	8.25
OXYGEN (O) (FLD)	0.33	0.35	0.54
PH (FLD)	6.23	7.33	6.92
PH	6.6	7.7	7.4
SALINITY (G/KG) (FLD)	0.3	0.2	0.1
SC (UMHOS/CM AT 25 C)	726.0	594.0	469.0
SC (UMHOS/CM AT 25 C) (FLD)	705.0	524.0	403.0
TDS (MEASURED AT 180 C)	452.0	373.0	275.0
TOTAL SUSPENDED SOLIDS	40.0	27.0	10.0
TURBIDITY (NTU) (FLD)	17.0	16.0	6.0
WATER TEMPERATURE (C) (FLD)	13.0	16.1	12.2
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	36.0	68.0	17.0
MAGNESIUM (MG) DIS	25.0	15.0	4.7
SODIUM (NA) DIS	64.0	29.0	72.0
POTASSIUM (K) DIS	11.0	17.0	6.5
TOTAL ALKALINITY AS CACO3	201.0	280.0	114.0
TOTAL ACIDITY AS CACO3	16.0	12.0	3.0
BICARBONATE (HCO3)	245.0	342.0	139.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	53.0	31.0	23.0
CHLORIDE (CL)	74.0	3.6	44.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	0.024	0.36	<0.005
ARSENIC (AS) TOT	0.023	0.34	<0.005
ARSENIC +3	<0.005	0.22	<0.005
ARSENIC +5	0.033	0.25	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.005 UJ1 J4	0.007 UJ1 J4	<0.005 UJ4
ZINC (ZN) TOT	0.006 J4	0.013 J4	<0.005 UJ4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-56	HP-56	HP-57	HP-58
SAMPLE DATE	06/10/99	06/10/99	06/10/99	06/14/99
SAMPLE TIME	18:45	18:45	19:30	18:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	NO SAMPLE
LAB NUMBER	L991041-7	L991041-8	L991041-10	
REMARKS		DUPLICATE		DRY
SAMPLE NUMBER	EVT-9906-206	EVT-9906-207	EVT-9906-209	EVT-9906-231
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	4.69		7.2	
OXYGEN (O) (FLD)	0.09	0.09	0.52	
PH (FLD)	7.14	7.14	7.11	
PH	7.7	7.6	7.5	
SALINITY (G/KG) (FLD)	0.2	0.2	0.7	
SC (UMHOS/CM AT 25 C)	740.0	737.0	1381.0	
SC (UMHOS/CM AT 25 C) (FLD)	638.0	638.0	1570.0	
TDS (MEASURED AT 180 C)	478.0	473.0	965.0	
TOTAL SUSPENDED SOLIDS	3.5	6.6	41.0	
TURBIDITY (NTU) (FLD)	9.0	10.0	14.0	
WATER TEMPERATURE (C) (FLD)	12.9	12.9	14.6	
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	68.0	70.0	175.0	
MAGNESIUM (MG) DIS	14.0	15.0	67.0	
SODIUM (NA) DIS	58.0	60.0	56.0	
POTASSIUM (K) DIS	28.0	29.0	40.0	
TOTAL ALKALINITY AS CACO3	355.0	351.0	900.0	
TOTAL ACIDITY AS CACO3	6.0	6.0	48.0	
BICARBONATE (HCO3)	433.0	428.0	1098.0	
CARBONATE AS CO3	<1.0	<1.0	<1.0	
SULFATE (SO4)	22.0	24.0	13.0	
CHLORIDE (CL)	12.0	13.0	2.5	
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.007	0.006	0.009	
ARSENIC (AS) TOT	0.006	0.006	0.009	
ARSENIC +3	<0.005	<0.005	<0.005	
ARSENIC +5	0.009	0.007	0.015	
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	
COPPER (CU) DIS	<0.01	<0.01	<0.01	
COPPER (CU) TOT	<0.01	<0.01	<0.01	
LEAD (PB) DIS	<0.005	<0.005	<0.005	
LEAD (PB) TOT	<0.005	<0.005	<0.005	
ZINC (ZN) DIS	<0.005 UJ4	<0.005 UJ4	0.009 UJ1 J4	
ZINC (ZN) TOT	0.005 J4	<0.005 UJ4	0.009 J4	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-59	HP-59	HP-61	HP-62
SAMPLE DATE	06/11/99	06/11/99	06/10/99	06/11/99
SAMPLE TIME	07:45	08:00	16:15	08:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991041-12	L991041-13	L991041-1	L991041-14
REMARKS		DUPLICATE		
SAMPLE NUMBER	EVT-9906-211	EVT-9906-212	EVT-9906-200	EVT-9906-213
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	2.25		7.09	3.24
OXYGEN (O) (FLD)	0.22	0.22	0.06	1.27
PH (FLD)	6.71	6.71	6.75	6.67
PH	7.0	7.2	7.4	7.2
SALINITY (G/KG) (FLD)	0.1	0.1	2.6	0.2
SC (UMHOS/CM AT 25 C)	410.0	414.0	5000.0	549.0
SC (UMHOS/CM AT 25 C) (FLD)	424.0	424.0	5030.0	500.0
TDS (MEASURED AT 180 C)	270.0	260.0	2777.0	344.0
TOTAL SUSPENDED SOLIDS	36.0	34.0	38.0	26.0
TURBIDITY (NTU) (FLD)	12.0	10.0	38.0	60.0
WATER TEMPERATURE (C) (FLD)	12.4	12.4	13.8	13.1
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	18.0	18.0	44.0	69.0
MAGNESIUM (MG) DIS	7.5	7.5	74.0	8.9
SODIUM (NA) DIS	40.0	39.0	813.0	29.0
POTASSIUM (K) DIS	38.0	38.0	38.0	5.4
TOTAL ALKALINITY AS CACO3	202.0	208.0	232.0	157.0
TOTAL ACIDITY AS CACO3	13.0	12.0	<1.0	5.0
BICARBONATE (HCO3)	246.0	254.0	283.0	192.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	3.2	2.8	166.0	61.0
CHLORIDE (CL)	3.9	3.6	1096.0	26.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.009	0.009	0.02	0.005
ARSENIC (AS) TOT	0.008	0.008	0.019	0.005
ARSENIC +3	<0.005	<0.005	0.009	<0.005
ARSENIC +5	0.011	0.012	0.015	0.006
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	0.007	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.006 UJ1 J4	0.007 UJ1 J4	0.007 UJ1 J4	0.008 UJ1 J4
ZINC (ZN) TOT	0.007 UJ1 J4	0.008 UJ1 J4	0.008 J4	0.01 UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	HP-63	MW-3	MW-4A
SAMPLE DATE	06/11/99	06/15/99	06/15/99
SAMPLE TIME	09:15	16:00	16:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991041-17	L991058-8	L991058-9
SAMPLE NUMBER	EVT-9906-216	EVT-9906-245	EVT-9906-246
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	3.11	1.75	0.85
OXYGEN (O) (FLD)	0.24	0.06	0.07
PH (FLD)	6.29	6.56	6.37
PH	6.9	7.0	6.9
SALINITY (G/KG) (FLD)	0.1	0.1	0.1
SC (UMHOS/CM AT 25 C)	522.0	407.0	350.0
SC (UMHOS/CM AT 25 C) (FLD)	467.0	395.0	333.0
TDS (MEASURED AT 180 C)	325.0	230.0	226.0
TOTAL SUSPENDED SOLIDS	12.0	28.0 J4	22.0 J4
TURBIDITY (NTU) (FLD)	44.0	5.0	8.0
WATER TEMPERATURE (C) (FLD)	13.8	14.9	14.6
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	59.0	41.0	32.0
MAGNESIUM (MG) DIS	19.0	9.9	13.0
SODIUM (NA) DIS	15.0	21.0	17.0
POTASSIUM (K) DIS	8.1	6.0	3.6
TOTAL ALKALINITY AS CACO3	251.0	200.0	163.0
TOTAL ACIDITY AS CACO3	28.0	38.0	38.0
BICARBONATE (HCO3)	306.0	244.0 J4	199.0 J4
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	15.0	2.8 UJ1	11.0
CHLORIDE (CL)	5.7	10.0	6.6
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005
ARSENIC +3	<0.005	<0.005	<0.005
ARSENIC +5	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	0.005
LEAD (PB) TOT	0.009	<0.005	<0.005
ZINC (ZN) DIS	0.038 UJ1 J4	0.012 J4	0.007 J4
ZINC (ZN) TOT	0.047 J4	0.005 UJ1 J4	0.006 UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-5		MW-5(W)		MW-7(W)	
SAMPLE DATE	06/15/99		06/16/99		06/16/99	
SAMPLE TIME	17:15		08:00		14:30	
LAB	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-10		L991058-13		L991058-27	
SAMPLE NUMBER	EVT-9906-247		EVT-9906-250		EVT-9906-264	
-- PHYSICAL PARAMETERS --						
DEPTH TO WATER LEVEL (FEET)	3.14		0.75		31.28	
OXYGEN (O) (FLD)	0.11		0.17		2.0	
PH (FLD)	6.15		6.36		6.24	
PH	6.7		6.9		6.8	
SALINITY (G/KG) (FLD)	0.2		0.5		0.1	
SC (UMHOS/CM AT 25 C)	650.0		1073.0		465.0	
SC (UMHOS/CM AT 25 C) (FLD)	604.0		1140.0		380.0	
TDS (MEASURED AT 180 C)	465.0		697.0		318.0	
TOTAL SUSPENDED SOLIDS	50.0	J4	27.0		53.0	
TURBIDITY (NTU) (FLD)	22.0		31.0		32.0	
WATER TEMPERATURE (C) (FLD)	14.2		12.4		11.4	
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	87.0		62.0		25.0	
MAGNESIUM (MG) DIS	12.0		40.0		28.0	
SODIUM (NA) DIS	21.0		107.0		25.0	
POTASSIUM (K) DIS	7.0		15.0		3.4	
TOTAL ALKALINITY AS CACO3	117.0		580.0		100.0	
TOTAL ACIDITY AS CACO3	38.0		126.0		20.0	J4
BICARBONATE (HCO3)	143.0	J4	708.0		122.0	
CARBONATE AS CO3	<1.0		<1.0		<1.0	
SULFATE (SO4)	153.0		7.5	UJ1	53.0	
CHLORIDE (CL)	7.2		14.0		3.9	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	<0.005		<0.005		<0.005	
ARSENIC +3	<0.005		<0.005		<0.005	
ARSENIC +5	<0.005		<0.005		<0.005	
CADMIUM (CD) DIS	<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	<0.005		<0.005		0.035	
COPPER (CU) DIS	<0.01		<0.01		<0.005	
COPPER (CU) TOT	<0.01		<0.01		0.02	
LEAD (PB) DIS	<0.005		<0.005		<0.005	
LEAD (PB) TOT	<0.005		<0.005		<0.005	
ZINC (ZN) DIS	0.009	J4	<0.005	UJ4	0.007	UJ1 J4
ZINC (ZN) TOT	0.01	UJ1 J4	<0.005	UJ4	0.042	J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-8(W)	MW-102S(W)	MW-103D(W)
SAMPLE DATE	06/16/99	06/17/99	06/17/99
SAMPLE TIME	07:30	09:30	10:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991058-12	L991086-1	L991086-2
SAMPLE NUMBER	EVT-9906-249	EVT-9906-266	EVT-9906-267
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	6.15	8.49	10.45
OXYGEN (O) (FLD)	0.17	0.99	0.03
PH (FLD)	6.28	6.53	6.43
PH	6.9	6.9	6.9
SALINITY (G/KG) (FLD)	0.4	0.0	0.6
SC (UMHOS/CM AT 25 C)	961.0	268.0	1435.0
SC (UMHOS/CM AT 25 C) (FLD)	1030.0	242.0	1450.0
TDS (MEASURED AT 180 C)	645.0	236.0	902.0
TOTAL SUSPENDED SOLIDS	28.0	3.9	<1.0
TURBIDITY (NTU) (FLD)	47.0	6.0	1.0
WATER TEMPERATURE (C) (FLD)	11.6	13.1	12.9
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	5.4	5.6	19.0
MAGNESIUM (MG) DIS	12.0	2.0	32.0
SODIUM (NA) DIS	193.0	48.0	229.0
POTASSIUM (K) DIS	13.0	4.2	18.0
TOTAL ALKALINITY AS CACO3	421.0	123.0	420.0
TOTAL ACIDITY AS CACO3	84.0	20.0	86.0
BICARBONATE (HCO3)	514.0	150.0	512.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	11.0 UJ1	16.0	188.0
CHLORIDE (CL)	55.0	6.0	104.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005
ARSENIC +3	<0.005	0.005	<0.005
ARSENIC +5	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	0.005	<0.005	<0.005
CHROMIUM (CR) TOT	0.015	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	0.011	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.005 UJ1 J4	<0.005	<0.005
ZINC (ZN) TOT	0.013 UJ1 J4	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-103S(W)	MW-104S(W)	MW-105D(W)
SAMPLE DATE	06/17/99	06/17/99	06/17/99
SAMPLE TIME	10:15		11:00
LAB	TSC-SLC	NO SAMPLE	TSC-SLC
LAB NUMBER	L991086-3		L991086-4
REMARKS		INSUFF. WATER	
SAMPLE NUMBER	EVT-9906-268	EVT-9906-269	EVT-9906-270
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	11.3	8.02	10.65
OXYGEN (O) (FLD)	3.3		0.01
PH (FLD)	6.58		6.84
PH	7.1		7.3
SALINITY (G/KG) (FLD)	0.6		0.6
SC (UMHOS/CM AT 25 C)	1410.0		1389.0
SC (UMHOS/CM AT 25 C) (FLD)	1400.0		1430.0
TDS (MEASURED AT 180 C)	935.0		858.0
TOTAL SUSPENDED SOLIDS	<1.0		2.1
TURBIDITY (NTU) (FLD)	72.0		3.0
WATER TEMPERATURE (C) (FLD)	13.3		12.9
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	44.0		16.0
MAGNESIUM (MG) DIS	34.0		16.0
SODIUM (NA) DIS	201.0		248.0
POTASSIUM (K) DIS	21.0		17.0
TOTAL ALKALINITY AS CACO3	505.0		470.0
TOTAL ACIDITY AS CACO3	88.0		40.0
BICARBONATE (HCO3)	616.0		573.0
CARBONATE AS CO3	<1.0		<1.0
SULFATE (SO4)	185.0		59.0
CHLORIDE (CL)	49.0		126.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005		<0.005
ARSENIC (AS) TOT	<0.005		<0.005
ARSENIC +3	<0.005		<0.005
ARSENIC +5	<0.005		<0.005
CADMIUM (CD) DIS	<0.002		<0.002
CADMIUM (CD) TOT	<0.002		<0.002
CHROMIUM (CR) DIS	<0.005		0.007
CHROMIUM (CR) TOT	<0.005		0.006
COPPER (CU) DIS	<0.005		<0.01
COPPER (CU) TOT	0.038		<0.01
LEAD (PB) DIS	<0.005		<0.005
LEAD (PB) TOT	<0.005		<0.005
ZINC (ZN) DIS	<0.005		<0.005
ZINC (ZN) TOT	0.01		0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-105S(W)	MW-107D	MW-107S2(W)
SAMPLE DATE	06/17/99	06/16/99	06/16/99
SAMPLE TIME	11:15	12:00	08:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991086-5	L991058-20	L991058-14
SAMPLE NUMBER	EVT-9906-271	EVT-9906-257	EVT-9906-251
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	8.59	9.67	3.05
OXYGEN (O) (FLD)	0.71	0.0	0.1
PH (FLD)	6.64	6.68	6.68
PH	6.4	7.1	7.1
SALINITY (G/KG) (FLD)	0.6	0.2	0.1
SC (UMHOS/CM AT 25 C)	484.0	731.0	448.0
SC (UMHOS/CM AT 25 C) (FLD)	599.0	631.0	414.0
TDS (MEASURED AT 180 C)	306.0	465.0	288.0
TOTAL SUSPENDED SOLIDS	110.0	18.0	23.0
TURBIDITY (NTU) (FLD)	48.0	4.0	1.0
WATER TEMPERATURE (C) (FLD)	13.9	12.0	13.8
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	26.0	6.2	39.0
MAGNESIUM (MG) DIS	3.8	15.0	10.0
SODIUM (NA) DIS	54.0	132.0	29.0
POTASSIUM (K) DIS	4.3	12.0	13.0
TOTAL ALKALINITY AS CACO3	120.0	321.0	206.0
TOTAL ACIDITY AS CACO3	64.0	28.0 J4	22.0 J4
BICARBONATE (HCO3)	146.0	392.0	251.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	70.0	8.3 UJ1	14.0
CHLORIDE (CL)	27.0	45.0	7.5
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005	<0.005	0.04
ARSENIC (AS) TOT	<0.005	<0.005	0.042
ARSENIC +3	<0.005	<0.005	0.023
ARSENIC +5	<0.005	<0.005	0.033
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	0.008	<0.005
CHROMIUM (CR) TOT	<0.005	0.008	<0.005
COPPER (CU) DIS	0.019	<0.005	<0.01
COPPER (CU) TOT	0.029	<0.005	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.012	<0.005	<0.005
ZINC (ZN) DIS	0.2	<0.005 UJ4 J4	<0.005 UJ4
ZINC (ZN) TOT	0.21	0.009 UJ1 J4	<0.005 UJ4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-108D(W)	MW-108S(W)	MW-109D
SAMPLE DATE	06/16/99	06/16/99	06/16/99
SAMPLE TIME	12:30	09:15	13:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991058-21	L991058-15	L991058-22
SAMPLE NUMBER	EVT-9906-258	EVT-9906-252	EVT-9906-259
-- PHYSICAL PARAMETERS --			
DEPTH TO WATER LEVEL (FEET)	8.86	8.37	10.52
OXYGEN (O) (FLD)	0.01	4.15	0.01
PH (FLD)	6.9	6.31	6.82
PH	7.2	7.1	7.2
SALINITY (G/KG) (FLD)	0.1	0.2	0.2
SC (UMHOS/CM AT 25 C)	438.0	727.0	766.0
SC (UMHOS/CM AT 25 C) (FLD)	365.0	620.0	656.0
TDS (MEASURED AT 180 C)	310.0	496.0	488.0
TOTAL SUSPENDED SOLIDS	10.0	23.0	5.7
TURBIDITY (NTU) (FLD)	8.0	5.0	1.0
WATER TEMPERATURE (C) (FLD)	11.7	13.5	12.4
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	21.0	54.0	8.7
MAGNESIUM (MG) DIS	24.0	24.0	22.0
SODIUM (NA) DIS	26.0	25.0	112.0
POTASSIUM (K) DIS	4.5	10.0	11.0
TOTAL ALKALINITY AS CACO3	156.0	149.0	258.0
TOTAL ACIDITY AS CACO3	19.0 J4	18.0 J4	32.0 J4
BICARBONATE (HCO3)	190.0	182.0	315.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	39.0	175.0	21.0
CHLORIDE (CL)	16.0	11.0	77.0
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	3.7	<0.005	<0.005
ARSENIC (AS) TOT	3.8	<0.005	<0.005
ARSENIC +3	3.5	<0.005	<0.005
ARSENIC +5	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	0.011
CHROMIUM (CR) TOT	<0.005	<0.005	0.01
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005
ZINC (ZN) DIS	0.006 UJ1 J4	0.007 UJ1 J4	0.005 UJ1 J4
ZINC (ZN) TOT	0.012 UJ1 J4	<0.005 UJ4	0.006 UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: GROUNDWATER --

SITE CODE	MW-109S(W)		WP-1	
SAMPLE DATE	06/16/99		06/15/99	
SAMPLE TIME	09:45		13:00	
LAB	TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-16		L991058-3	
SAMPLE NUMBER	EVT-9906-253		EVT-9906-240	
-- PHYSICAL PARAMETERS --				
DEPTH TO WATER LEVEL (FEET)	7.57		4.8	
OXYGEN (O) (FLD)	0.8		0.02	
PH (FLD)	6.26		8.75	
PH	6.9		8.1	
SALINITY (G/KG) (FLD)	0.1		0.1	
SC (UMHOS/CM AT 25 C)	445.0		543.0	
SC (UMHOS/CM AT 25 C) (FLD)	396.0		450.0	
TDS (MEASURED AT 180 C)	321.0		358.0	
TOTAL SUSPENDED SOLIDS	408.0		15.0	J4
TURBIDITY (NTU) (FLD)	272.0		5.0	
WATER TEMPERATURE (C) (FLD)	12.1		12.4	
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	49.0		41.0	
MAGNESIUM (MG) DIS	9.0		6.6	
SODIUM (NA) DIS	15.0		51.0	
POTASSIUM (K) DIS	7.1		28.0	
TOTAL ALKALINITY AS CACO3	103.0		268.0	
TOTAL ACIDITY AS CACO3	33.0	J4	2.0	
BICARBONATE (HCO3)	126.0		322.0	J4
CARBONATE AS CO3	<1.0		<1.0	
SULFATE (SO4)	90.0		7.7	
CHLORIDE (CL)	6.8		6.8	
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.005		0.82	
ARSENIC (AS) TOT	0.023		0.89	
ARSENIC +3	<0.005		0.46	
ARSENIC +5	<0.005		0.23	
CADMIUM (CD) DIS	<0.002		<0.002	
CADMIUM (CD) TOT	<0.002		<0.002	
CHROMIUM (CR) DIS	<0.005		<0.005	
CHROMIUM (CR) TOT	0.012		<0.005	
COPPER (CU) DIS	<0.01		<0.01	
COPPER (CU) TOT	0.014		<0.01	
LEAD (PB) DIS	<0.005		<0.005	
LEAD (PB) TOT	0.032		<0.005	
ZINC (ZN) DIS	<0.005	UJ4	0.01	J4
ZINC (ZN) TOT	0.027	UJ1 J4	0.011	UJ1 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	BFS	BFS	DI BLANK		DI BLANK		DI BLANK	
SAMPLE DATE	06/16/99	06/16/99	06/10/99		06/11/99		06/14/99	
SAMPLE TIME			19:15		08:30		17:15	
LAB	TSC-SLC	TRUE VALUE	TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L991058-28	LOT #438	L991041-9		L991041-15		L991057-13	
REMARKS	STANDARD		BLANK		BLANK		BLANK	
OTHER INFO	Lot 438							
SAMPLE NUMBER	EVT-9906-265	EVT-9906-265	EVT-9906-208		EVT-9906-214		EVT-9906-229	
-- PHYSICAL PARAMETERS --								
PH			5.7		5.7		5.6	
SC (UMHOS/CM AT 25 C)			<10.0		<10.0		<10.0	
TDS (MEASURED AT 180 C)			<10.0		<10.0		<10.0	
TOTAL SUSPENDED SOLIDS			<1.0		<1.0		<1.0	
-- MAJOR CONSTITUENTS --								
CALCIUM (CA) DIS			<1.0		<1.0		<1.0	
MAGNESIUM (MG) DIS			<1.0		<1.0		<1.0	
SODIUM (NA) DIS			1.2		<1.0		1.6	
POTASSIUM (K) DIS			<1.0		<1.0		<1.0	
TOTAL ALKALINITY AS CACO3			<1.0		<1.0		<1.0	
TOTAL ACIDITY AS CACO3			<1.0		<1.0		<1.0	
BICARBONATE (HCO3)			<1.0		<1.0		<1.0	
CARBONATE AS CO3			<1.0		<1.0		<1.0	
SULFATE (SO4)			<1.0		<1.0		1.5	
CHLORIDE (CL)			<1.0		<1.0		<1.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS			<0.005		<0.005		<0.005	
ARSENIC (AS) TOT	0.077	0.917	<0.005		<0.005		<0.005	
ARSENIC +3			<0.005		<0.005		<0.005	
ARSENIC +5			<0.005		<0.005		<0.005	
CADMIUM (CD) DIS			<0.002		<0.002		<0.002	
CADMIUM (CD) TOT	0.067	0.75	<0.002		<0.002		<0.002	
CHROMIUM (CR) DIS			<0.005		<0.005		<0.005	
CHROMIUM (CR) TOT	0.57	0.517	<0.005		<0.005		<0.005	
COPPER (CU) DIS			<0.01		<0.01		<0.01	
COPPER (CU) TOT	0.2	0.192	<0.01		<0.01		<0.01	
LEAD (PB) DIS			<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.3	0.292	<0.005		<0.005		<0.005	
ZINC (ZN) DIS			<0.005	UJ4	0.026	J4	<0.005	UJ2
ZINC (ZN) TOT	0.4	0.454	<0.005	UJ4	0.006	J4	<0.005	UJ2

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	DI BLANK	DI BLANK	DI BLANK	RINSATE	RINSATE
SAMPLE DATE	06/15/99	06/16/99	06/17/99	06/10/99	06/11/99
SAMPLE TIME	12:00	13:15	15:30	19:45	08:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991057-20	L991058-23	L991086-16	L991041-11	L991041-16
REMARKS	BLANK	BLANK	BLANK	BLANK	BLANK
SAMPLE NUMBER	EVT-9906-237	EVT-9906-260	EVT-9906-283	EVT-9906-210	EVT-9906-215
-- PHYSICAL PARAMETERS --					
PH	5.7	5.9	5.8	5.9	5.6
SC (UMHOS/CM AT 25 C)	<10.0	<10.0	<10.0	<10.0	<10.0
TDS (MEASURED AT 180 C)	<10.0	<10.0	<10.0	<10.0	<10.0
TOTAL SUSPENDED SOLIDS	<1.0	<1.0	<1.0	<1.0	<1.0
-- MAJOR CONSTITUENTS --					
CALCIUM (CA) DIS	<1.0	<1.0	<1.0	<1.0	<1.0
MAGNESIUM (MG) DIS	<1.0	<1.0	<1.0	<1.0	<1.0
SODIUM (NA) DIS	1.4	1.0	1.1	<1.0	<1.0
POTASSIUM (K) DIS	<1.0	<1.0	<1.0	<1.0	<1.0
TOTAL ALKALINITY AS CACO3	<1.0	<1.0	<1.0	<1.0	<1.0
TOTAL ACIDITY AS CACO3	<1.0	<1.0	<1.0	<1.0	<1.0
BICARBONATE (HCO3)	<1.0	<1.0	<1.0	<1.0	<1.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	1.0	1.6	<1.0	1.6	<1.0
CHLORIDE (CL)	<1.0	<1.0	<1.0	<1.0	<1.0
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
ARSENIC +3	<0.005	<0.005	<0.005	<0.005	<0.005
ARSENIC +5	<0.005	<0.005	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	<0.005 UJ2	0.006 J4	0.016	0.008 J4	<0.005 UJ4
ZINC (ZN) TOT	0.008 J2	0.007 J4	<0.005	<0.005 UJ4	0.006 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	RINSATE	RINSATE	RINSATE	RINSATE
SAMPLE DATE	06/14/99	06/15/99	06/16/99	06/17/99
SAMPLE TIME	17:30	17:00	13:30	15:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991057-14	L991058-11	L991058-24	L991086-17
REMARKS	BLANK	BLANK	BLANK	BLANK
SAMPLE NUMBER	EVT-9906-230	EVT-9906-248	EVT-9906-261	EVT-9906-284
-- PHYSICAL PARAMETERS --				
PH	5.5	5.9	5.8	5.6
SC (UMHOS/CM AT 25 C)	<10.0	<10.0	<10.0	<10.0
TDS (MEASURED AT 180 C)	<10.0	<10.0	<10.0	<10.0
TOTAL SUSPENDED SOLIDS	<1.0	<1.0	<1.0	<1.0
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	<1.0	<1.0	<1.0	<1.0
MAGNESIUM (MG) DIS	<1.0	<1.0	<1.0	<1.0
SODIUM (NA) DIS	1.5	<1.0	<1.0	<1.0
POTASSIUM (K) DIS	<1.0	<1.0	<1.0	<1.0
TOTAL ALKALINITY AS CACO3	<1.0	<1.0	<1.0	<1.0
TOTAL ACIDITY AS CACO3	<1.0	<1.0	<1.0	<1.0
BICARBONATE (HCO3)	<1.0	<1.0	<1.0	<1.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	<1.0	1.4	2.5	<1.0
CHLORIDE (CL)	<1.0	<1.0	<1.0	<1.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005
ARSENIC +3	<0.005	<0.005	<0.005	<0.005
ARSENIC +5	<0.005	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	<0.01	<0.01	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005
ZINC (ZN) DIS	<0.005 UJ2	<0.005 UJ4	<0.005 UJ4	0.009
ZINC (ZN) TOT	<0.005 UJ2	0.008 J4	0.008 J4	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SURFACE WATER --

SITE CODE	MP-13	OUTFALL	OUTFALL	SW-1
SAMPLE DATE	06/17/99	06/17/99	06/17/99	06/17/99
SAMPLE TIME	14:30	14:45	15:00	12:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991086-12	L991086-13	L991086-14	L991086-8
REMARKS			DUPLICATE	
SAMPLE NUMBER	EVT-9906-279	EVT-9906-280	EVT-9906-281	EVT-9906-274
-- PHYSICAL PARAMETERS --				
FLOW (gal/min)		3.69		
OXYGEN (O) (FLD)	1.21	5.57	5.5	4.53
PH (FLD)	6.73	7.53	7.52	7.67
PH	6.8	7.7	7.7	7.7
SALINITY (G/KG) (FLD)	0.2	0.2	0.2	0.5
SC (UMHOS/CM AT 25 C)	602.0	642.0	642.0	1140.0
SC (UMHOS/CM AT 25 C) (FLD)	617.0	545.0	545.0	1180.0
TDS (MEASURED AT 180 C)	397.0	393.0	395.0	792.0
TOTAL SUSPENDED SOLIDS	365.0	31.0	32.0	43.0
TURBIDITY (NTU) (FLD)	161.0	49.0	45.0	7.0
WATER TEMPERATURE (C) (FLD)	19.5	19.7	19.7	23.6
-- MAJOR CONSTITUENTS --				
CALCIUM (CA) DIS	59.0	22.0	21.0	78.0
MAGNESIUM (MG) DIS	14.0	10.0	10.0	37.0
SODIUM (NA) DIS	54.0	88.0	91.0	94.0
POTASSIUM (K) DIS	3.2	8.7	8.9	19.0
TOTAL ALKALINITY AS CACO3	342.0	179.0	170.0	252.0
TOTAL ACIDITY AS CACO3	100.0	6.0	6.0	14.0
BICARBONATE (HCO3)	417.0	218.0	207.0	307.0
CARBONATE AS CO3	<1.0	<1.0	<1.0	<1.0
SULFATE (SO4)	6.7	23.0	21.0	208.0
CHLORIDE (CL)	5.0	85.0	83.0	99.0
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	0.018	0.069	0.066	0.3
ARSENIC (AS) TOT	0.078	0.097	0.1	0.54
ARSENIC +3	<0.005	0.012	0.012	0.23
ARSENIC +5	0.023	0.074	0.066	0.12
CADMIUM (CD) DIS	<0.002	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	<0.005	<0.005	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.017	<0.01	<0.01	0.013
LEAD (PB) DIS	<0.005	<0.005	0.006	<0.005
LEAD (PB) TOT	0.007	<0.005	<0.005	0.024
ZINC (ZN) DIS	0.033 UJ1	0.013 UJ1	0.012 UJ1	0.077 UJ1
ZINC (ZN) TOT	0.067	0.014	0.016	0.23

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SURFACE WATER --

SITE CODE	SW-2	SW-14	SW-15
SAMPLE DATE	06/17/99	06/17/99	06/17/99
SAMPLE TIME	11:45	13:10	14:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L991086-6	L991086-7	L991086-10
SAMPLE NUMBER	EVT-9906-273	EVT-9906-275	EVT-9906-277
-- PHYSICAL PARAMETERS --			
FLOW (gal/min)	0.36		
OXYGEN (O) (FLD)	1.25	1.8	3.5
PH (FLD)	6.98	7.42	7.62
PH	7.4	7.5	7.8
SALINITY (G/KG) (FLD)	0.9	0.2	0.1
SC (UMHOS/CM AT 25 C)	1760.0	562.0	473.0
SC (UMHOS/CM AT 25 C) (FLD)	2030.0	489.0	409.0
TDS (MEASURED AT 180 C)	1184.0	389.0	319.0
TOTAL SUSPENDED SOLIDS	284.0	5.8	3.0
TURBIDITY (NTU) (FLD)	22.0	7.0	2.0
WATER TEMPERATURE (C) (FLD)	17.9	20.5	21.8
-- MAJOR CONSTITUENTS --			
CALCIUM (CA) DIS	103.0	35.0	24.0
MAGNESIUM (MG) DIS	58.0	15.0	10.0
SODIUM (NA) DIS	157.0	61.0	63.0
POTASSIUM (K) DIS	25.0	8.6	6.5
TOTAL ALKALINITY AS CACO3	262.0	221.0	266.0
TOTAL ACIDITY AS CACO3	20.0	12.0	8.0
BICARBONATE (HCO3)	320.0	270.0	325.0
CARBONATE AS CO3	<1.0	<1.0	<1.0
SULFATE (SO4)	363.0	31.0	14.0
CHLORIDE (CL)	195.0	28.0	7.5
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	0.52	0.095	0.01
ARSENIC (AS) TOT	1.5	0.13	0.012
ARSENIC +3	0.5	0.023	0.007
ARSENIC +5	0.19	0.087	0.006
CADMIUM (CD) DIS	<0.002	<0.002	<0.002
CADMIUM (CD) TOT	<0.002	<0.002	<0.002
CHROMIUM (CR) DIS	<0.005	<0.005	<0.005
CHROMIUM (CR) TOT	0.006	<0.005	<0.005
COPPER (CU) DIS	<0.01	<0.01	<0.01
COPPER (CU) TOT	0.042	<0.01	<0.01
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.13	<0.005	<0.005
ZINC (ZN) DIS	0.027 UJ1	0.011 UJ1	<0.005
ZINC (ZN) TOT	0.33	0.009	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: SURFACE WATER --

SITE CODE	SW-16		SW-17	SW-18		SW-18
SAMPLE DATE	06/17/99		06/17/99	06/17/99		08/03/99
SAMPLE TIME	14:15		13:30	15:15		15:35
LAB	TSC-SLC		TSC-SLC	TSC-SLC		CCI
LAB NUMBER	L991086-11		L991086-9	L991086-15		908009-1
SAMPLE NUMBER	EVT-9906-278		EVT-9906-276	EVT-9906-282		EVT-9908-100
-- PHYSICAL PARAMETERS --						
FLOW (gal/min)			0.0	4.0		
OXYGEN (O) (FLD)	3.12		3.75	3.39		
PH (FLD)	7.82		7.69	7.12		
PH	7.6		7.6	7.3		
SALINITY (G/KG) (FLD)	0.1		0.1	0.1		
SC (UMHOS/CM AT 25 C)	478.0		472.0	486.0		
SC (UMHOS/CM AT 25 C) (FLD)	408.0		495.0	425.0		
TDS (MEASURED AT 180 C)	315.0		304.0	313.0		
TOTAL SUSPENDED SOLIDS	5.2		2.4	34.0		
TURBIDITY (NTU) (FLD)	16.0		4.0	14.0		
WATER TEMPERATURE (C) (FLD)	23.1		21.7	18.2		
-- MAJOR CONSTITUENTS --						
CALCIUM (CA) DIS	59.0		25.0	36.0		
MAGNESIUM (MG) DIS	14.0		10.0	11.0		
SODIUM (NA) DIS	54.0		62.0	46.0		
POTASSIUM (K) DIS	3.2		6.5	7.7		
TOTAL ALKALINITY AS CACO3	226.0		229.0	214.0		
TOTAL ACIDITY AS CACO3	9.0		8.0	20.0		
BICARBONATE (HCO3)	276.0		279.0	261.0		
CARBONATE AS CO3	<1.0		<1.0	<1.0		
SULFATE (SO4)	9.0		14.0	13.0		
CHLORIDE (CL)	9.1		7.9	20.0		
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.01		0.012	0.22		0.05
ARSENIC (AS) TOT	0.012		0.013	0.37		0.24
ARSENIC +3	0.008		0.006	0.059		
ARSENIC +5	0.005		0.007	0.2		
CADMIUM (CD) DIS	<0.002		<0.002	<0.002		<0.001
CADMIUM (CD) TOT	<0.002		<0.002	<0.002		<0.001
CHROMIUM (CR) DIS	<0.005		<0.005	<0.005		
CHROMIUM (CR) TOT	<0.005		<0.005	<0.005		
COPPER (CU) DIS	<0.01		<0.01	<0.01		
COPPER (CU) TOT	<0.01		<0.01	<0.01		
LEAD (PB) DIS	<0.005		<0.005	<0.005		<0.003
LEAD (PB) TOT	<0.005		<0.005	<0.005		<0.003
ZINC (ZN) DIS	0.006	UJ1	<0.005	0.015	UJ1	
ZINC (ZN) TOT	0.008		<0.005	0.012		

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

INDEX

Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
20	BFS	BLIND FIELD STANDARD	Quality Control		
20	DI BLANK	DI BLANK	Quality Control		
1	EV-3	EV-3	Groundwater		
1	EV-4A	EV-4A	Groundwater		
1	EV-4B	EV-4B	Groundwater		
2	EV-6A	EV-6A	Groundwater		
2	EV-6B	EV-6B	Groundwater		
2	EV-7A	EV-7A	Groundwater		
3	EV-7B	EV-7B	Groundwater		
3	EV-8A	EV-8A	Groundwater		
3	EV-8B	EV-8B	Groundwater		
4	EV-9A	EV-9A	Groundwater		
4	EV-9B	EV-9B	Groundwater		
4	EV-15A	EV-15A	Groundwater		
5	EV-15B	EV-15B	Groundwater		
5	EV-16A	EV-16A	Groundwater		
5	EV-17A	EV-17A	Groundwater		
6	EV-17B	EV-17B	Groundwater		
6	EV-18B	EV-18B	Groundwater		
6	EV-19B	EV-19B	Groundwater		
7	EV-20B	EV-20B	Groundwater		
7	EV-21A	EV-21A	Groundwater		
7	EV-21B	EV-21B	Groundwater		
8	EV-22A	EV-22A	Groundwater		
8	EV-22B	EV-22B	Groundwater		
8	EV-23A	EV-23A	Groundwater		
9	EV-23B	EV-23B	Groundwater		
9	HP-51	HP-51	Groundwater		
9	HP-52	HP-52	Groundwater		
10	HP-53	HP-53	Groundwater		
10	HP-54	HP-54	Groundwater		
10	HP-55	HP-55	Groundwater		
11	HP-56	HP-56	Groundwater		
11	HP-57	HP-57	Groundwater		
11	HP-58	HP-58	Groundwater		
12	HP-59	HP-59	Groundwater		
12	HP-61	HP-61	Groundwater		
12	HP-62	HP-62	Groundwater		
13	HP-63	HP-63	Groundwater		
23	MP-13	MP-13	Surface Water		
13	MW-3	MW-3	Groundwater		
13	MW-4A	MW-4A	Groundwater		
14	MW-5	MW-5	Groundwater		
14	MW-5(W)	MW-5(W), Weyerhauser well	Groundwater		
14	MW-7(W)	MW-7(W), Weyerhauser well	Groundwater		
15	MW-8(W)	MW-8(W), Weyerhauser well	Groundwater		
15	MW-102S(W)	MW-102S(W), Weyerhauser well	Groundwater		
15	MW-103D(W)	MW-103D(W), Weyerhauser well	Groundwater		
16	MW-103S(W)	MW-103S(W), Weyerhauser well	Groundwater		
16	MW-104S(W)	MW-104S(W), Weyerhauser well	Groundwater		
16	MW-105D(W)	MW-105D(W), Weyerhauser well	Groundwater		
17	MW-105S(W)	MW-105S(W), Weyerhauser well	Groundwater		
17	MW-107D	MW-107D	Groundwater		
17	MW-107S2(W)	MW-107S2(W), Weyerhauser well	Groundwater		
18	MW-108D(W)	MW-108D(W), Weyerhauser well	Groundwater		
18	MW-108S(W)	MW-108S(W), Weyerhauser well	Groundwater		
18	MW-109D	MW-109D	Groundwater		
19	MW-109S(W)	MW-109S(W), Weyerhauser well	Groundwater		
23	OUTFALL	SNOHOMISH RIVER OUTFALL	Surface Water		
21	RINSATE	RINSATE BLANK	Quality Control		
23	SW-1	SW-1	Surface Water		
24	SW-2	SW-2	Surface Water		
24	SW-14	SW-14	Surface Water		
24	SW-15	SW-15	Surface Water		
25	SW-16	SW-16	Surface Water		
25	SW-17	SW-17	Surface Water		
25	SW-18	SW-18	Surface Water		
0	SW-19	SW-19	Surface Water		
19	WP-1	WP-1	Groundwater		

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
12	EVT-9906-200	L991041-1	06/10/99	HP-61
9	EVT-9906-201	L991041-2	06/10/99	HP-51
9	EVT-9906-202	L991041-3	06/10/99	HP-52
10	EVT-9906-203	L991041-4	06/10/99	HP-53
10	EVT-9906-204	L991041-5	06/10/99	HP-55
10	EVT-9906-205	L991041-6	06/10/99	HP-54
11	EVT-9906-206	L991041-7	06/10/99	HP-56
11	EVT-9906-207	L991041-8	06/10/99	HP-56
20	EVT-9906-208	L991041-9	06/10/99	DI BLANK
11	EVT-9906-209	L991041-10	06/10/99	HP-57
21	EVT-9906-210	L991041-11	06/10/99	RINSATE
12	EVT-9906-211	L991041-12	06/11/99	HP-59
12	EVT-9906-212	L991041-13	06/11/99	HP-59
12	EVT-9906-213	L991041-14	06/11/99	HP-62
20	EVT-9906-214	L991041-15	06/11/99	DI BLANK
21	EVT-9906-215	L991041-16	06/11/99	RINSATE
13	EVT-9906-216	L991041-17	06/11/99	HP-63
6	EVT-9906-217	L991057-1	06/14/99	EV-18B
6	EVT-9906-218	L991057-2	06/14/99	EV-19B
7	EVT-9906-219	L991057-3	06/14/99	EV-20B
2	EVT-9906-220	L991057-4	06/14/99	EV-6A
2	EVT-9906-221	L991057-5	06/14/99	EV-6B
2	EVT-9906-222	L991057-6	06/14/99	EV-6B
1	EVT-9906-223	L991057-7	06/14/99	EV-4B
1	EVT-9906-224	L991057-8	06/14/99	EV-4A
1	EVT-9906-225	L991057-9	06/14/99	EV-3
5	EVT-9906-226	L991057-10	06/14/99	EV-16A
5	EVT-9906-227	L991057-11	06/14/99	EV-15B
4	EVT-9906-228	L991057-12	06/14/99	EV-15A
20	EVT-9906-229	L991057-13	06/14/99	DI BLANK
22	EVT-9906-230	L991057-14	06/14/99	RINSATE
11	EVT-9906-231		06/14/99	HP-58
9	EVT-9906-232	L991057-15	06/15/99	EV-23B
8	EVT-9906-233	L991057-16	06/15/99	EV-23A
3	EVT-9906-234	L991057-17	06/15/99	EV-8B
3	EVT-9906-235	L991057-18	06/15/99	EV-8A
3	EVT-9906-236	L991057-19	06/15/99	EV-8A
21	EVT-9906-237	L991057-20	06/15/99	DI BLANK
3	EVT-9906-238	L991058-1	06/15/99	EV-7B
2	EVT-9906-239	L991058-2	06/15/99	EV-7A
19	EVT-9906-240	L991058-3	06/15/99	WP-1
4	EVT-9906-241	L991058-4	06/15/99	EV-9B
4	EVT-9906-242	L991058-5	06/15/99	EV-9A
6	EVT-9906-243	L991058-6	06/15/99	EV-17B
5	EVT-9906-244	L991058-7	06/15/99	EV-17A
13	EVT-9906-245	L991058-8	06/15/99	MW-3
13	EVT-9906-246	L991058-9	06/15/99	MW-4A
14	EVT-9906-247	L991058-10	06/15/99	MW-5
22	EVT-9906-248	L991058-11	06/15/99	RINSATE
15	EVT-9906-249	L991058-12	06/16/99	MW-8(W)
14	EVT-9906-250	L991058-13	06/16/99	MW-5(W)
17	EVT-9906-251	L991058-14	06/16/99	MW-107S2(W)
18	EVT-9906-252	L991058-15	06/16/99	MW-108S(W)
19	EVT-9906-253	L991058-16	06/16/99	MW-109S(W)
7	EVT-9906-254	L991058-17	06/16/99	EV-21A
7	EVT-9906-255	L991058-18	06/16/99	EV-21B
7	EVT-9906-256	L991058-19	06/16/99	EV-21B
17	EVT-9906-257	L991058-20	06/16/99	MW-107D
18	EVT-9906-258	L991058-21	06/16/99	MW-108D(W)
18	EVT-9906-259	L991058-22	06/16/99	MW-109D
21	EVT-9906-260	L991058-23	06/16/99	DI BLANK
22	EVT-9906-261	L991058-24	06/16/99	RINSATE
8	EVT-9906-262	L991058-25	06/16/99	EV-22B
8	EVT-9906-263	L991058-26	06/16/99	EV-22A
14	EVT-9906-264	L991058-27	06/16/99	MW-7(W)
20	EVT-9906-265	L991058-28	06/16/99	BFS
20	EVT-9906-265	LOT #438	06/16/99	BFS
15	EVT-9906-266	L991086-1	06/17/99	MW-102S(W)
15	EVT-9906-267	L991086-2	06/17/99	MW-103D(W)
16	EVT-9906-268	L991086-3	06/17/99	MW-103S(W)

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
11		EVT-9906-231	06/14/99	HP-58
16		EVT-9906-269	06/17/99	MW-104S(W)
0		EVT-9906-272	06/17/99	SW-19
25	908009-1	EVT-9908-100	08/03/99	SW-18
12	L991041-1	EVT-9906-200	06/10/99	HP-61
11	L991041-10	EVT-9906-209	06/10/99	HP-57
21	L991041-11	EVT-9906-210	06/10/99	RINSATE
12	L991041-12	EVT-9906-211	06/11/99	HP-59
12	L991041-13	EVT-9906-212	06/11/99	HP-59
12	L991041-14	EVT-9906-213	06/11/99	HP-62
20	L991041-15	EVT-9906-214	06/11/99	DI BLANK
21	L991041-16	EVT-9906-215	06/11/99	RINSATE
13	L991041-17	EVT-9906-216	06/11/99	HP-63
9	L991041-2	EVT-9906-201	06/10/99	HP-51
9	L991041-3	EVT-9906-202	06/10/99	HP-52
10	L991041-4	EVT-9906-203	06/10/99	HP-53
10	L991041-5	EVT-9906-204	06/10/99	HP-55
10	L991041-6	EVT-9906-205	06/10/99	HP-54
11	L991041-7	EVT-9906-206	06/10/99	HP-56
11	L991041-8	EVT-9906-207	06/10/99	HP-56
20	L991041-9	EVT-9906-208	06/10/99	DI BLANK
6	L991057-1	EVT-9906-217	06/14/99	EV-18B
5	L991057-10	EVT-9906-226	06/14/99	EV-16A
5	L991057-11	EVT-9906-227	06/14/99	EV-15B
4	L991057-12	EVT-9906-228	06/14/99	EV-15A
20	L991057-13	EVT-9906-229	06/14/99	DI BLANK
22	L991057-14	EVT-9906-230	06/14/99	RINSATE
9	L991057-15	EVT-9906-232	06/15/99	EV-23B
8	L991057-16	EVT-9906-233	06/15/99	EV-23A
3	L991057-17	EVT-9906-234	06/15/99	EV-8B
3	L991057-18	EVT-9906-235	06/15/99	EV-8A
3	L991057-19	EVT-9906-236	06/15/99	EV-8A
6	L991057-2	EVT-9906-218	06/14/99	EV-19B
21	L991057-20	EVT-9906-237	06/15/99	DI BLANK
7	L991057-3	EVT-9906-219	06/14/99	EV-20B
2	L991057-4	EVT-9906-220	06/14/99	EV-6A
2	L991057-5	EVT-9906-221	06/14/99	EV-6B
2	L991057-6	EVT-9906-222	06/14/99	EV-6B
1	L991057-7	EVT-9906-223	06/14/99	EV-4B
1	L991057-8	EVT-9906-224	06/14/99	EV-4A
1	L991057-9	EVT-9906-225	06/14/99	EV-3
3	L991058-1	EVT-9906-238	06/15/99	EV-7B
14	L991058-10	EVT-9906-247	06/15/99	MW-5
22	L991058-11	EVT-9906-248	06/15/99	RINSATE
15	L991058-12	EVT-9906-249	06/16/99	MW-8(W)
14	L991058-13	EVT-9906-250	06/16/99	MW-5(W)
17	L991058-14	EVT-9906-251	06/16/99	MW-107S2(W)
18	L991058-15	EVT-9906-252	06/16/99	MW-108S(W)
19	L991058-16	EVT-9906-253	06/16/99	MW-109S(W)
7	L991058-17	EVT-9906-254	06/16/99	EV-21A
7	L991058-18	EVT-9906-255	06/16/99	EV-21B
7	L991058-19	EVT-9906-256	06/16/99	EV-21B
2	L991058-2	EVT-9906-239	06/15/99	EV-7A
17	L991058-20	EVT-9906-257	06/16/99	MW-107D
18	L991058-21	EVT-9906-258	06/16/99	MW-108D(W)
18	L991058-22	EVT-9906-259	06/16/99	MW-109D
21	L991058-23	EVT-9906-260	06/16/99	DI BLANK
22	L991058-24	EVT-9906-261	06/16/99	RINSATE
8	L991058-25	EVT-9906-262	06/16/99	EV-22B
8	L991058-26	EVT-9906-263	06/16/99	EV-22A
14	L991058-27	EVT-9906-264	06/16/99	MW-7(W)
20	L991058-28	EVT-9906-265	06/16/99	BFS
19	L991058-3	EVT-9906-240	06/15/99	WP-1
4	L991058-4	EVT-9906-241	06/15/99	EV-9B
4	L991058-5	EVT-9906-242	06/15/99	EV-9A
6	L991058-6	EVT-9906-243	06/15/99	EV-17B
5	L991058-7	EVT-9906-244	06/15/99	EV-17A
13	L991058-8	EVT-9906-245	06/15/99	MW-3
13	L991058-9	EVT-9906-246	06/15/99	MW-4A
15	L991086-1	EVT-9906-266	06/17/99	MW-102S(W)

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
16	EVT-9906-269		06/17/99	MW-104S(W)
16	EVT-9906-270	L991086-4	06/17/99	MW-105D(W)
17	EVT-9906-271	L991086-5	06/17/99	MW-105S(W)
0	EVT-9906-272		06/17/99	SW-19
24	EVT-9906-273	L991086-6	06/17/99	SW-2
23	EVT-9906-274	L991086-8	06/17/99	SW-1
24	EVT-9906-275	L991086-7	06/17/99	SW-14
25	EVT-9906-276	L991086-9	06/17/99	SW-17
24	EVT-9906-277	L991086-10	06/17/99	SW-15
25	EVT-9906-278	L991086-11	06/17/99	SW-16
23	EVT-9906-279	L991086-12	06/17/99	MP-13
23	EVT-9906-280	L991086-13	06/17/99	OUTFALL
23	EVT-9906-281	L991086-14	06/17/99	OUTFALL
25	EVT-9906-282	L991086-15	06/17/99	SW-18
21	EVT-9906-283	L991086-16	06/17/99	DI BLANK
22	EVT-9906-284	L991086-17	06/17/99	RINSATE
25	EVT-9908-100	908009-1	08/03/99	SW-18

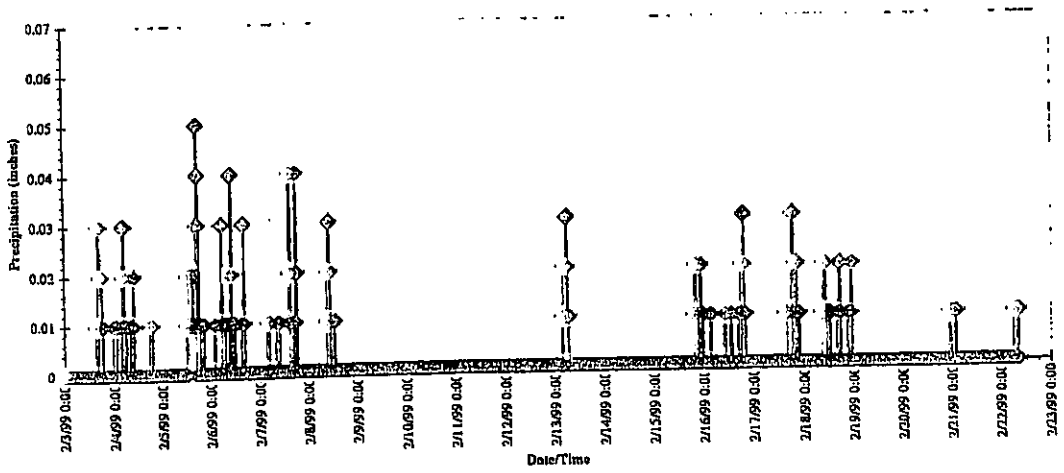
LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
24	L991086-10	EVT-9906-277	06/17/99	SW-15
25	L991086-11	EVT-9906-278	06/17/99	SW-16
23	L991086-12	EVT-9906-279	06/17/99	MP-13
23	L991086-13	EVT-9906-280	06/17/99	OUTFALL
23	L991086-14	EVT-9906-281	06/17/99	OUTFALL
25	L991086-15	EVT-9906-282	06/17/99	SW-18
21	L991086-16	EVT-9906-283	06/17/99	DI BLANK
22	L991086-17	EVT-9906-284	06/17/99	RINSATE
15	L991086-2	EVT-9906-267	06/17/99	MW-103D(W)
16	L991086-3	EVT-9906-268	06/17/99	MW-103S(W)
16	L991086-4	EVT-9906-270	06/17/99	MW-105D(W)
17	L991086-5	EVT-9906-271	06/17/99	MW-105S(W)
24	L991086-6	EVT-9906-273	06/17/99	SW-2
24	L991086-7	EVT-9906-275	06/17/99	SW-14
23	L991086-8	EVT-9906-274	06/17/99	SW-1
25	L991086-9	EVT-9906-276	06/17/99	SW-17
20	LOT #438	EVT-9906-265	06/16/99	BPS

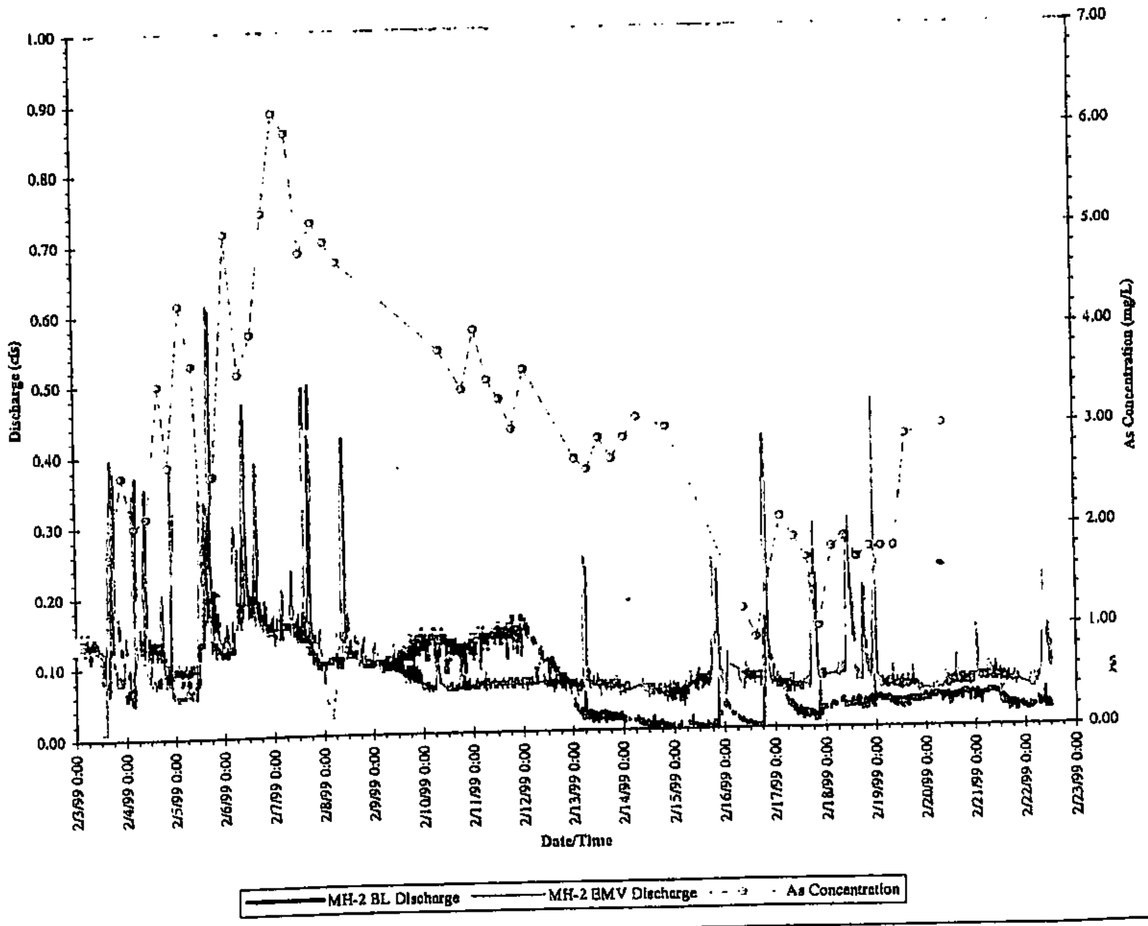
APPENDIX E
DISCHARGE HYDROGRAPHS AND PRECIPITATION TRENDS, STORM WATER GRAB RESULTS, AND COMPOSITE SAMPLING RESULTS

DISCHARGE HYDROGRAPHS AND PRECIPITATION TRENDS

Monitoring Site MH-2:



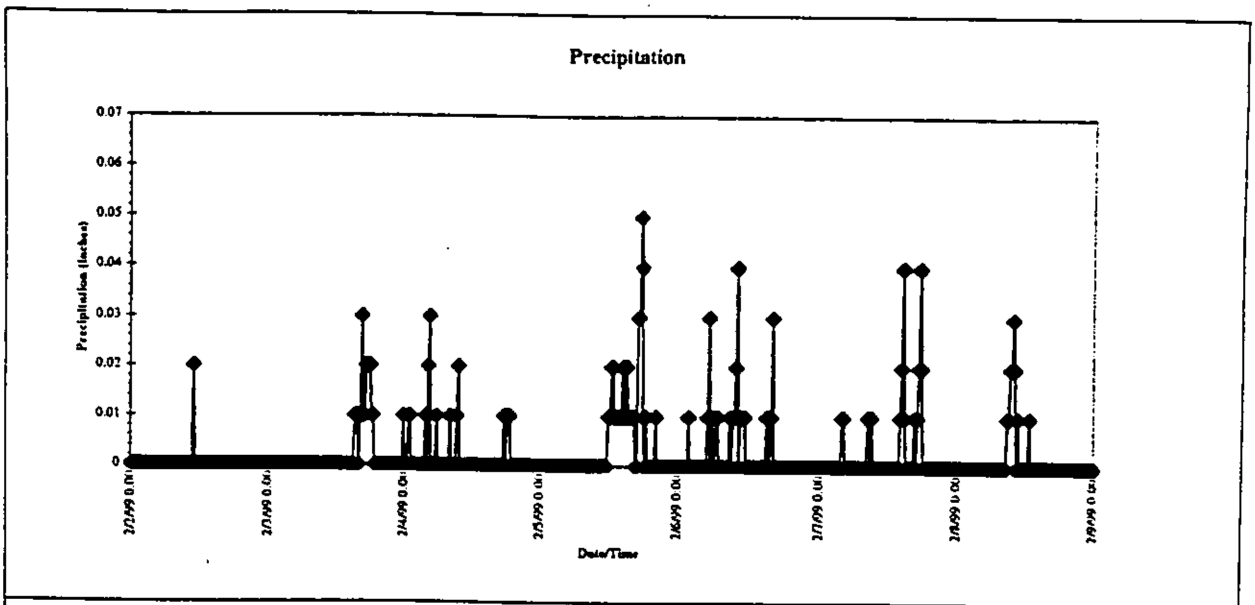
Precipitation



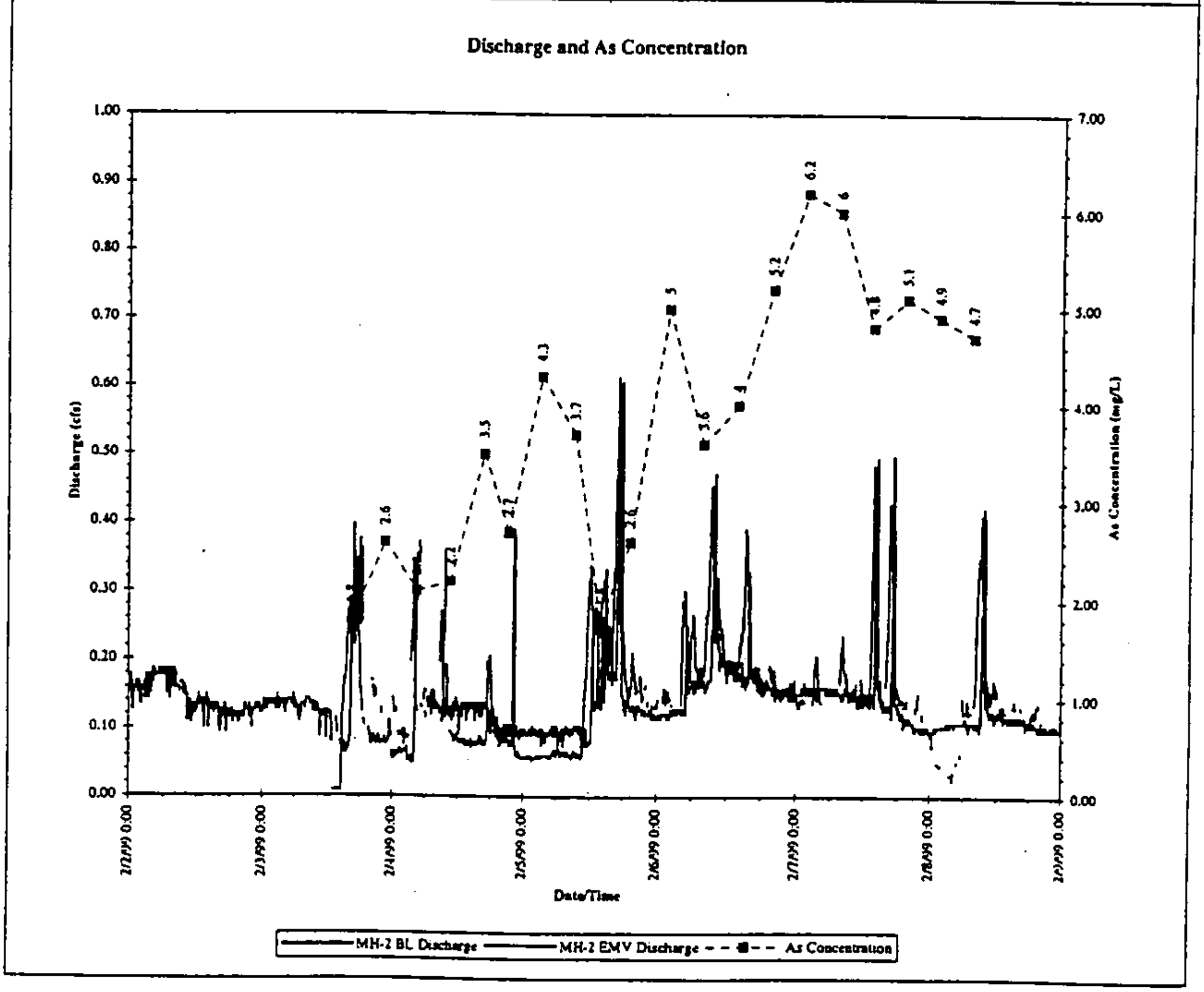
Discharge and As Concentration

Monitoring Site MH-2:

2/2/99 - 2/9/99



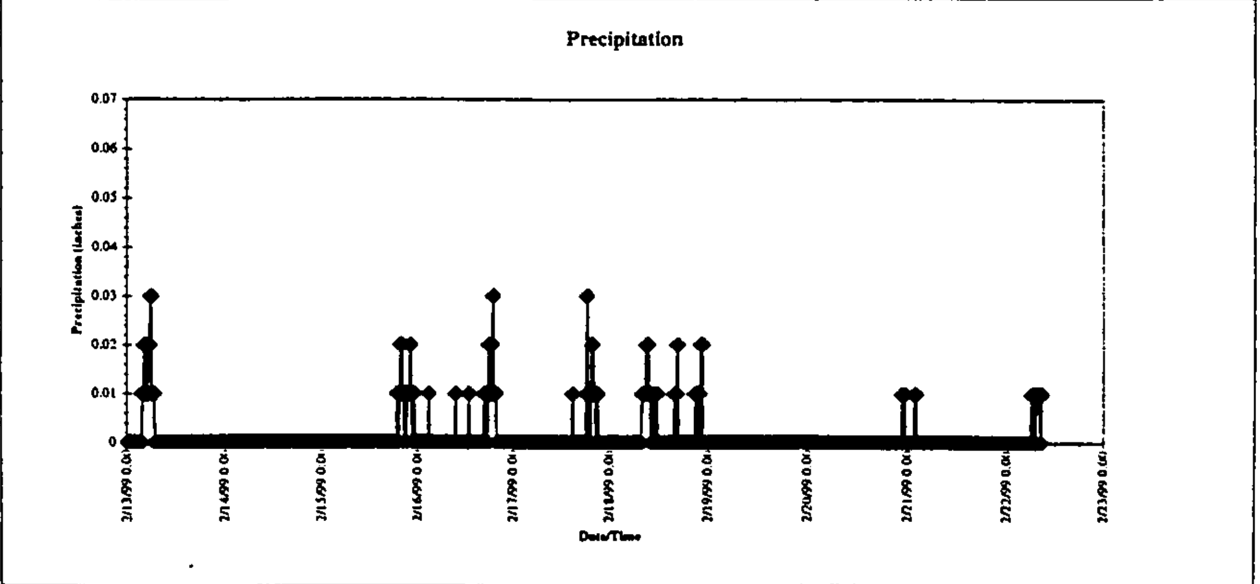
Precipitation

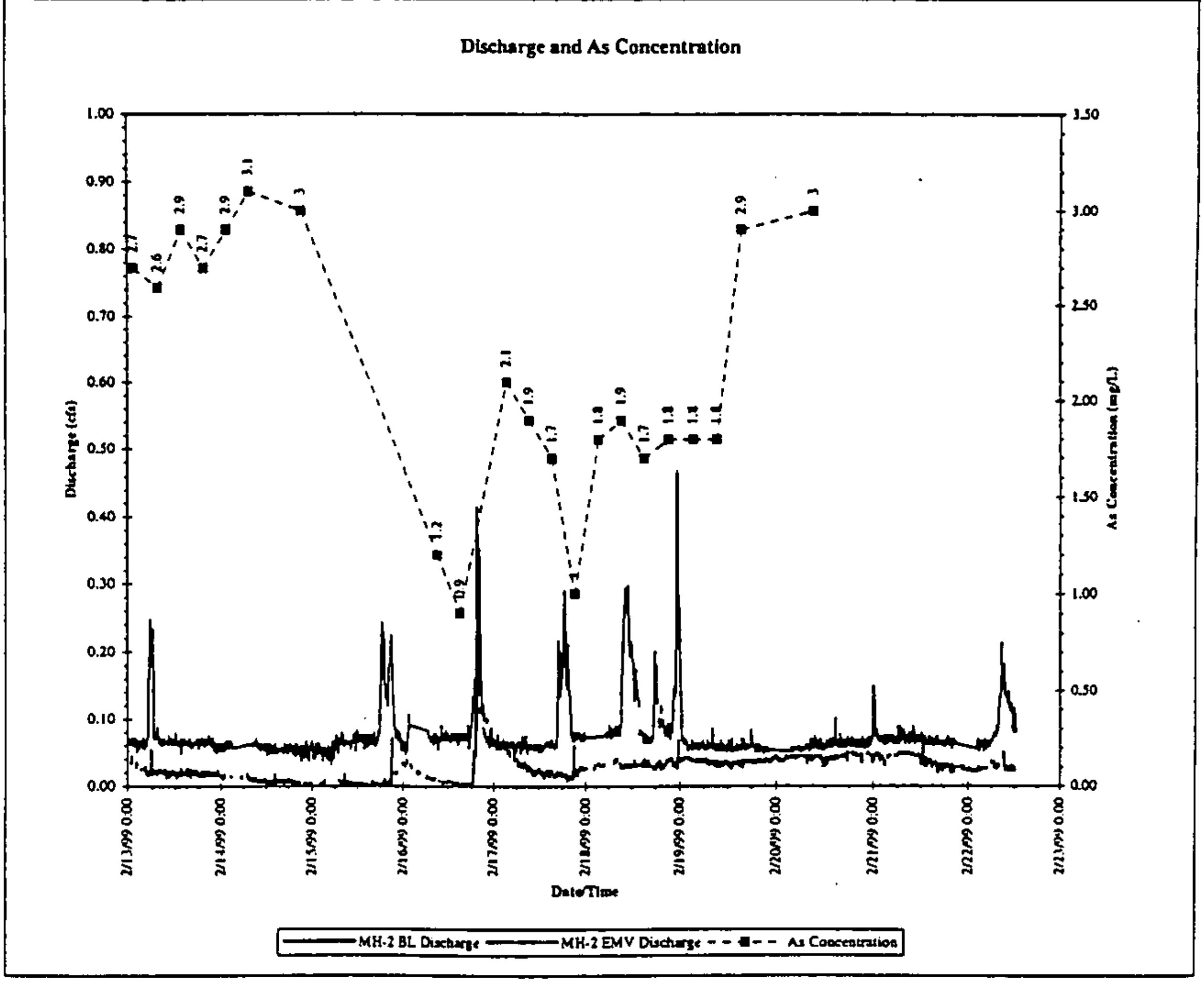


Discharge and As Concentration

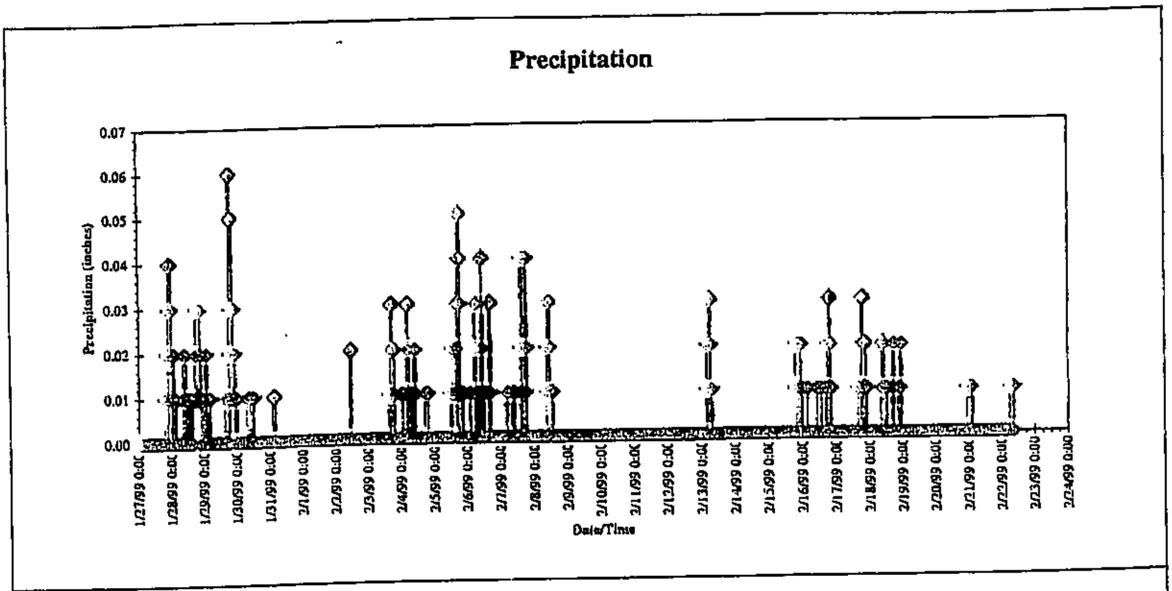
Monitoring Site MH-2:

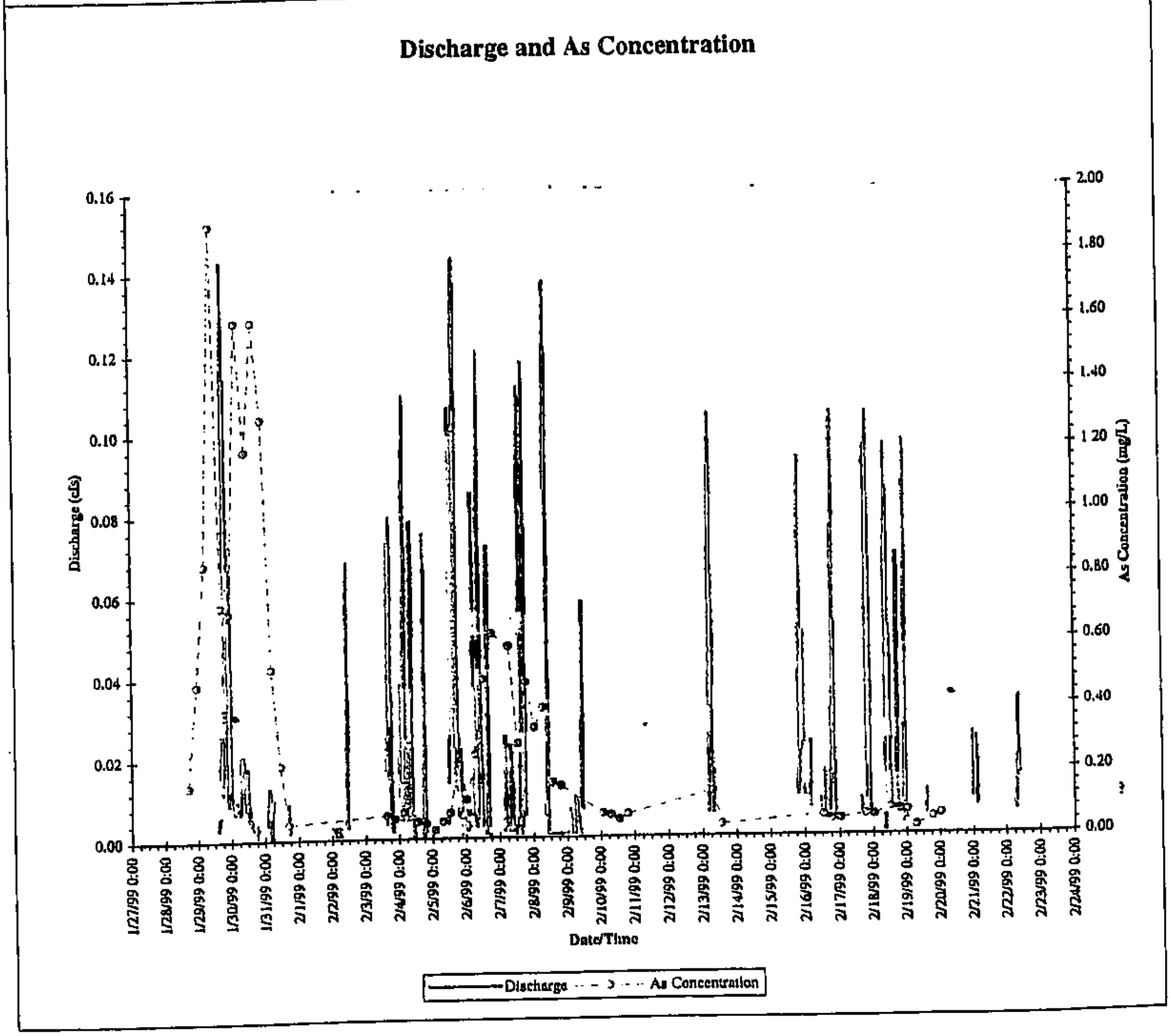
2/13/99 - 2/23/99





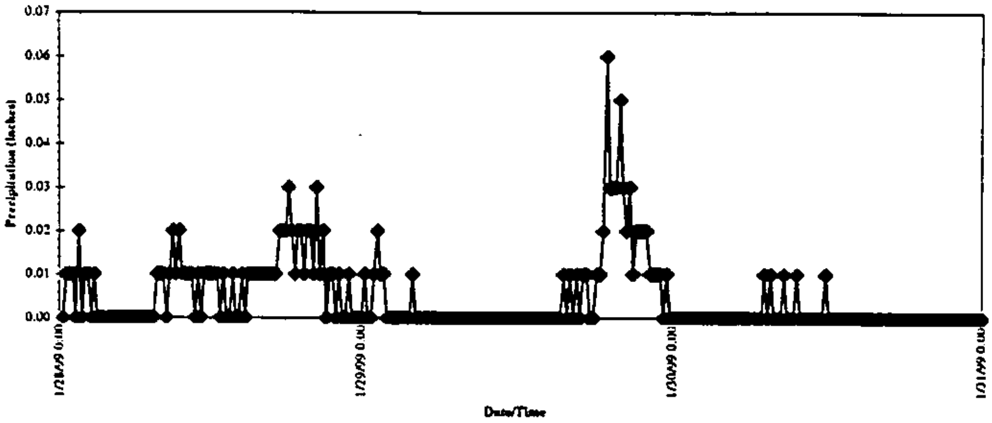
Monitoring Site CB-9:



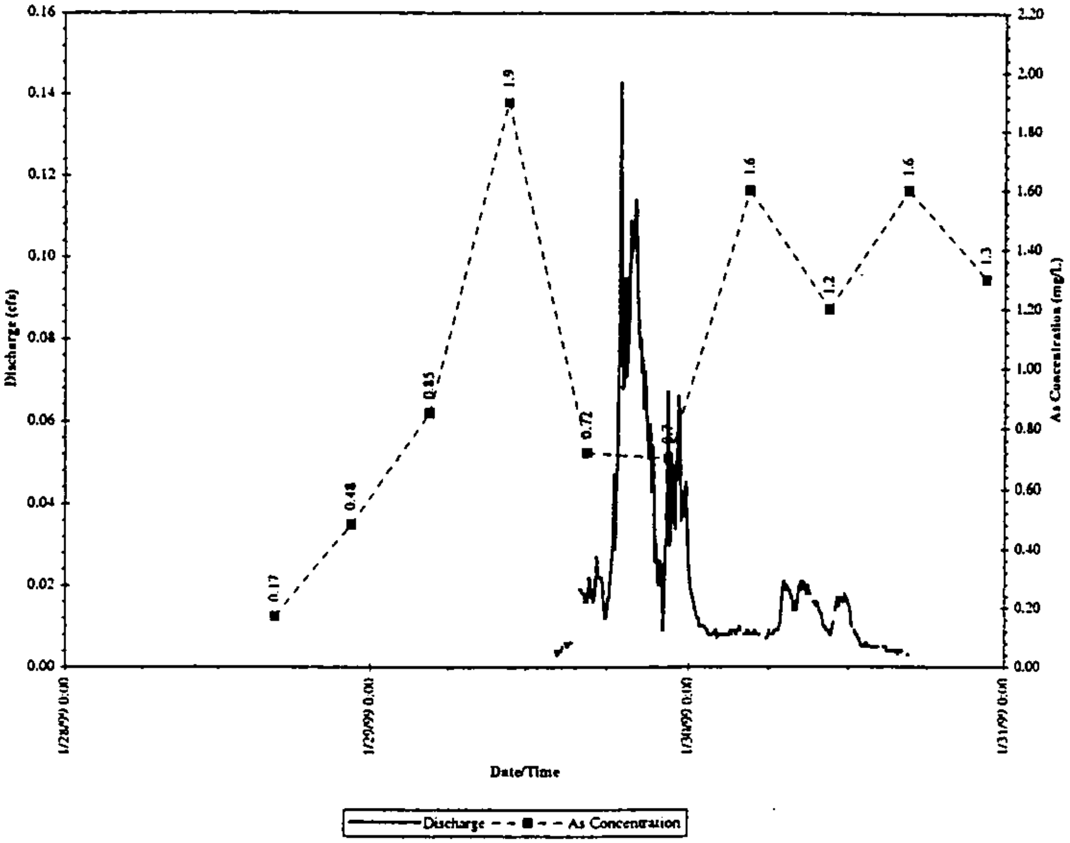


Monitoring Site CB-9:

1/28/99 - 1/31/99



Precipitation

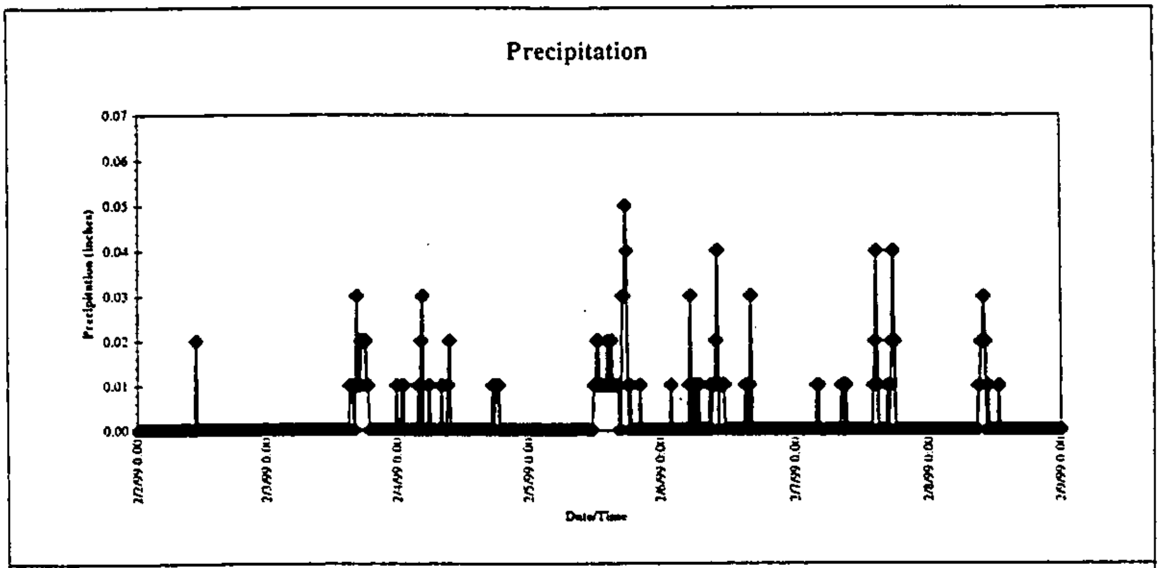


Discharge and As Concentration

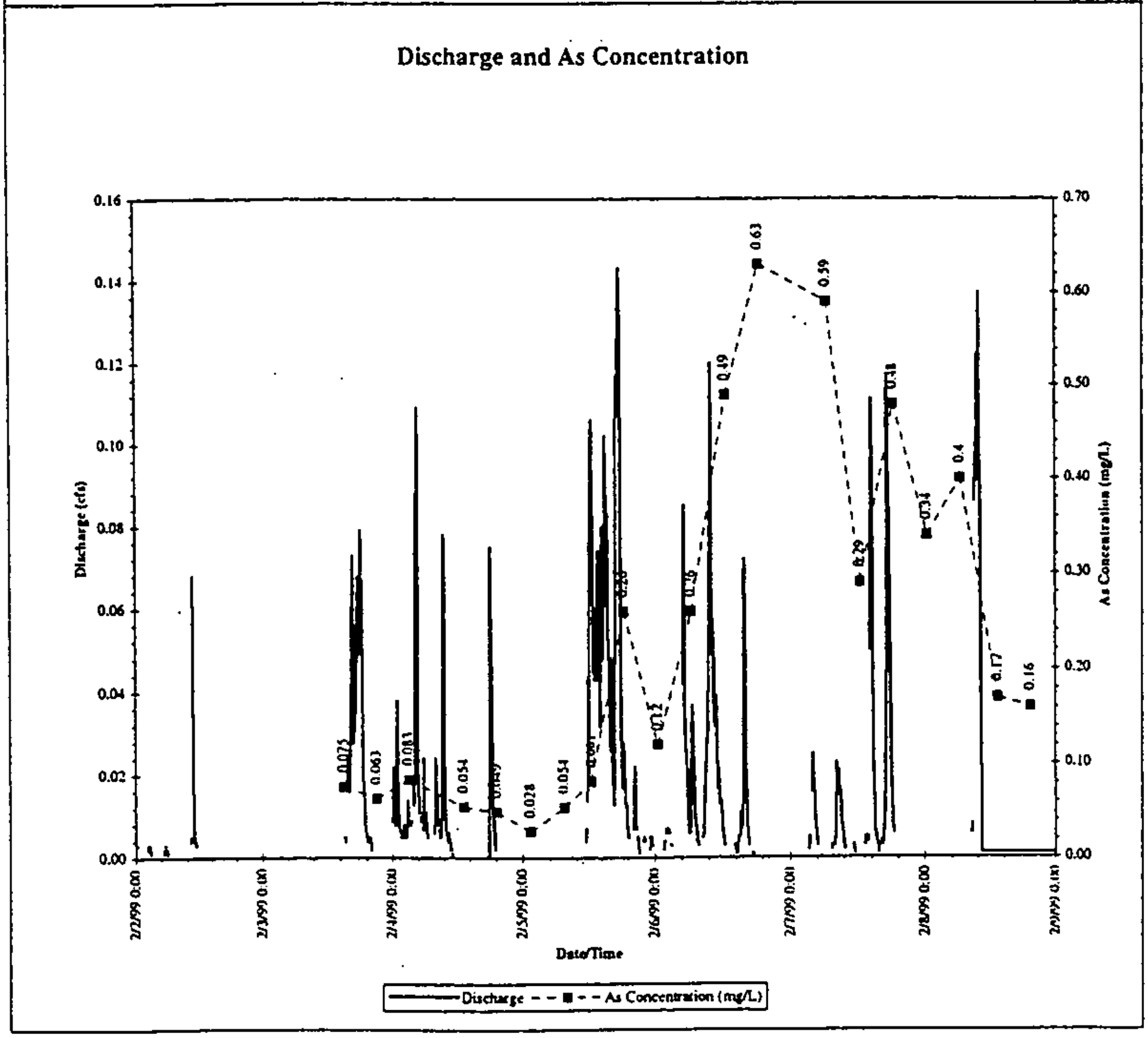
008\0030\0033\hel\050599\k:\data\project\0030\swdata\cb9final.xls

Monitoring Site CB-9:

2/2/99 - 2/9/99



Precipitation



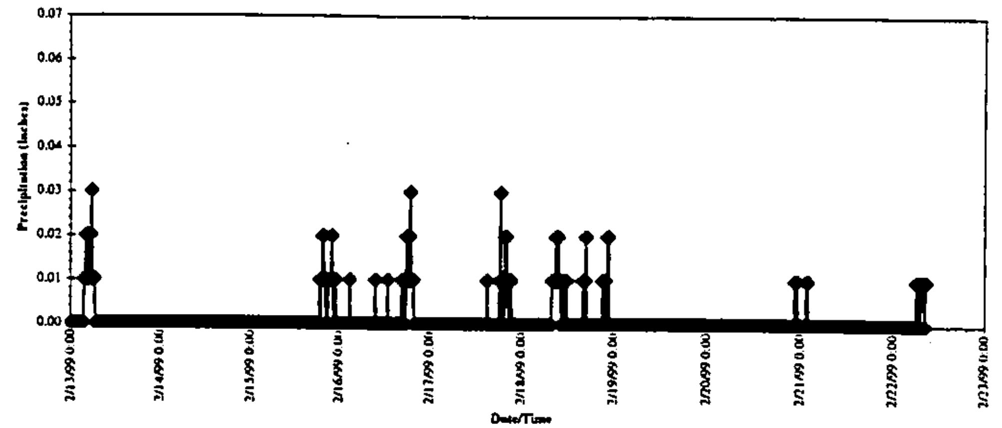
Discharge and As Concentration

008\0030\0033\hel\050599\k:\data\project\0030\swdata\cb9final.xls

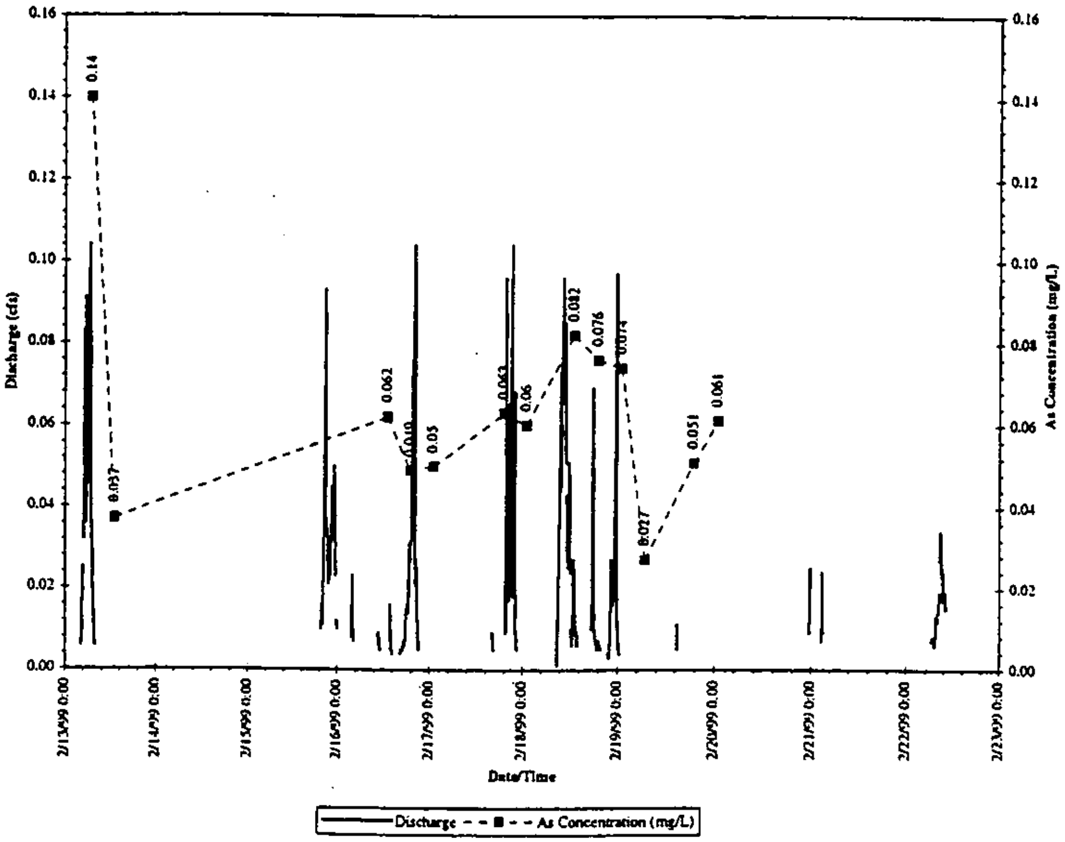
Monitoring Site CB-9:

2/13/99 - 2/23/99

Precipitation

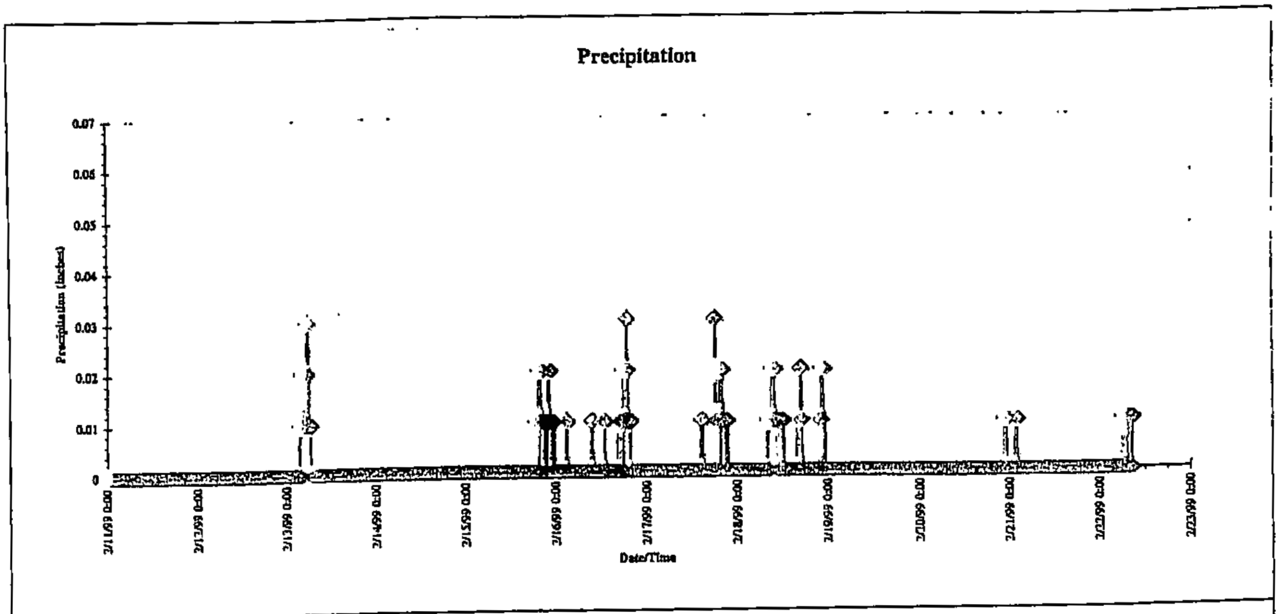


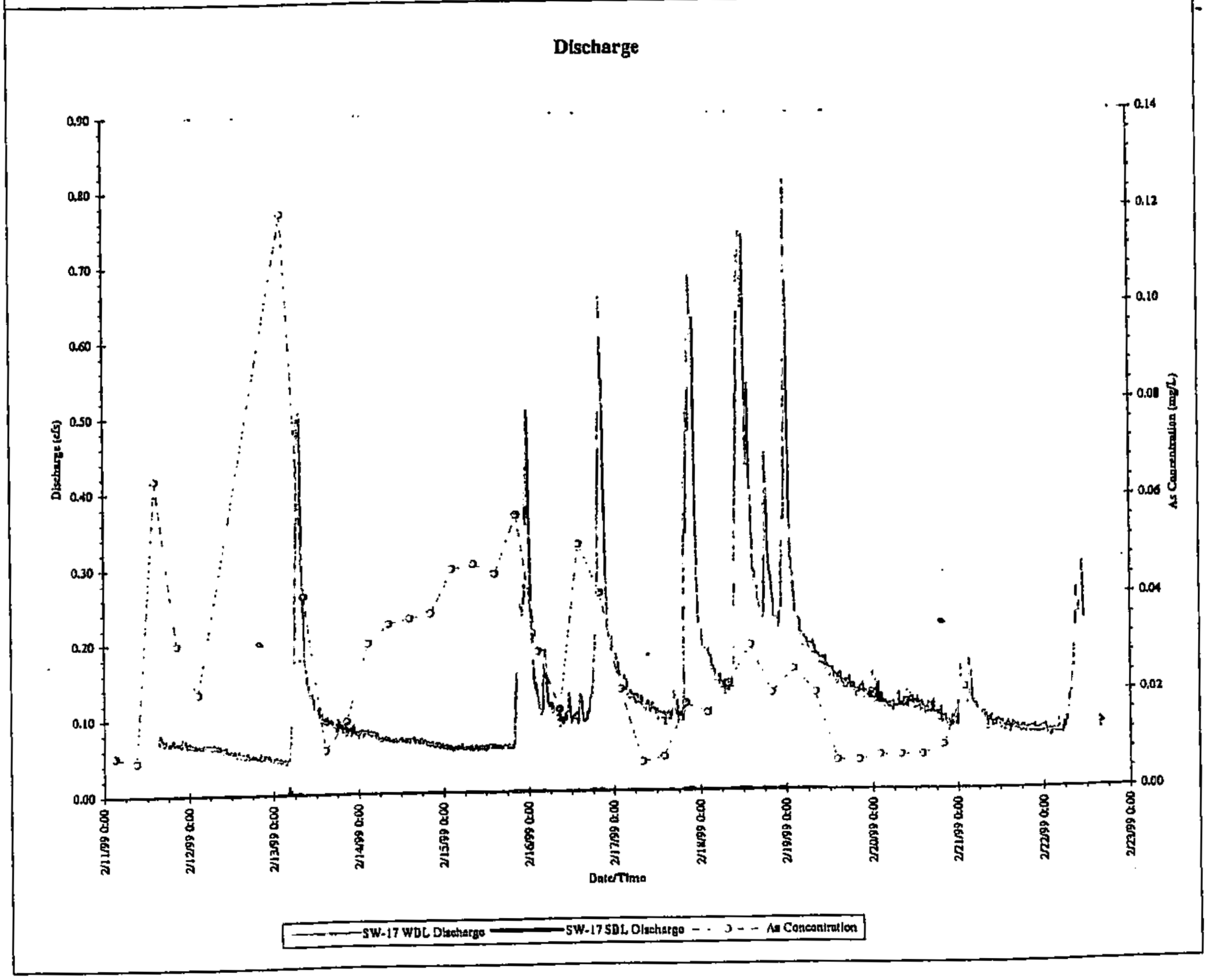
Discharge and As Concentration



008\0030\0033\hel\050599\lc:\data\project\0030\swdata\cb9final.xls

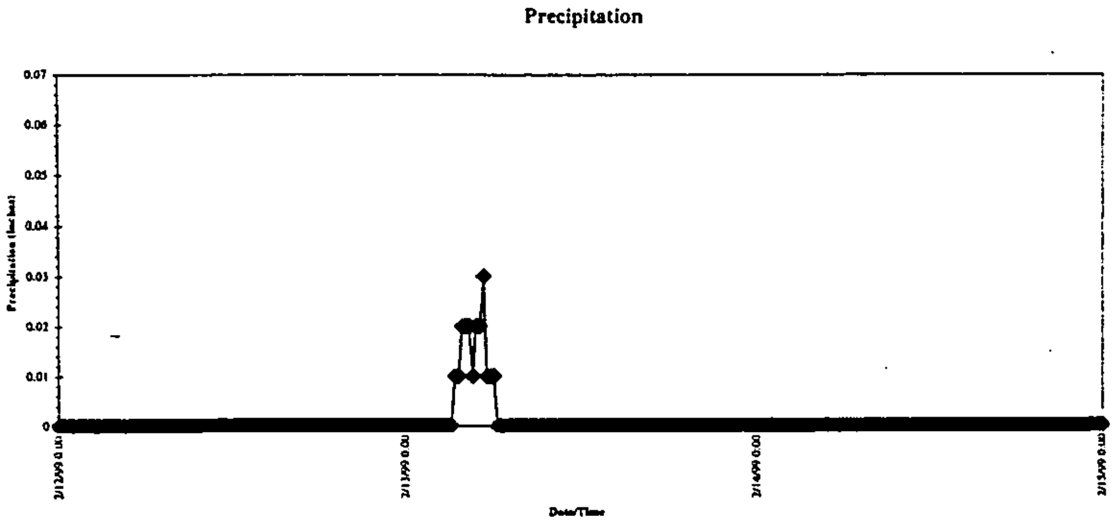
Monitoring Site SW-17:

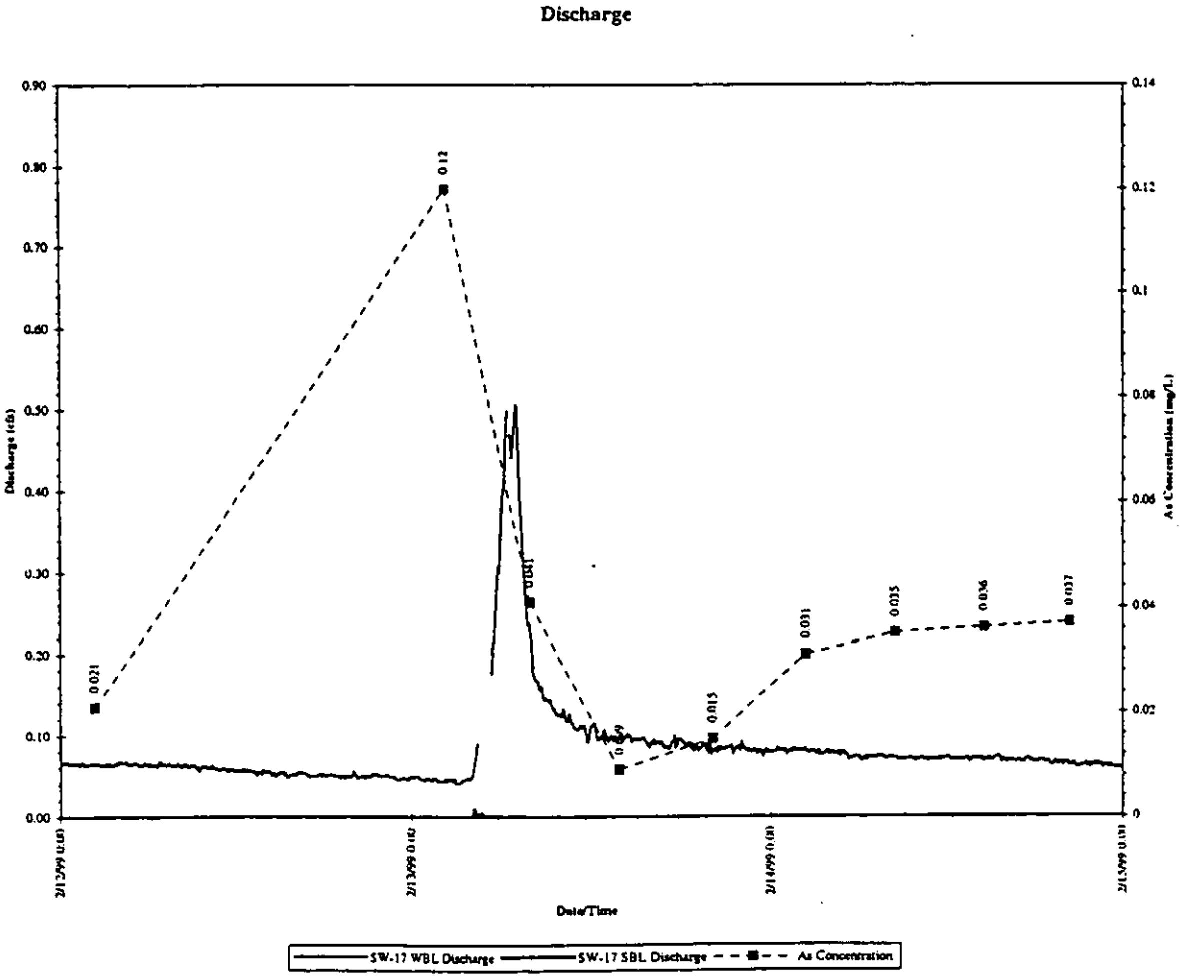




Monitoring Site SW-17:

2/12/99 - 2/15/99



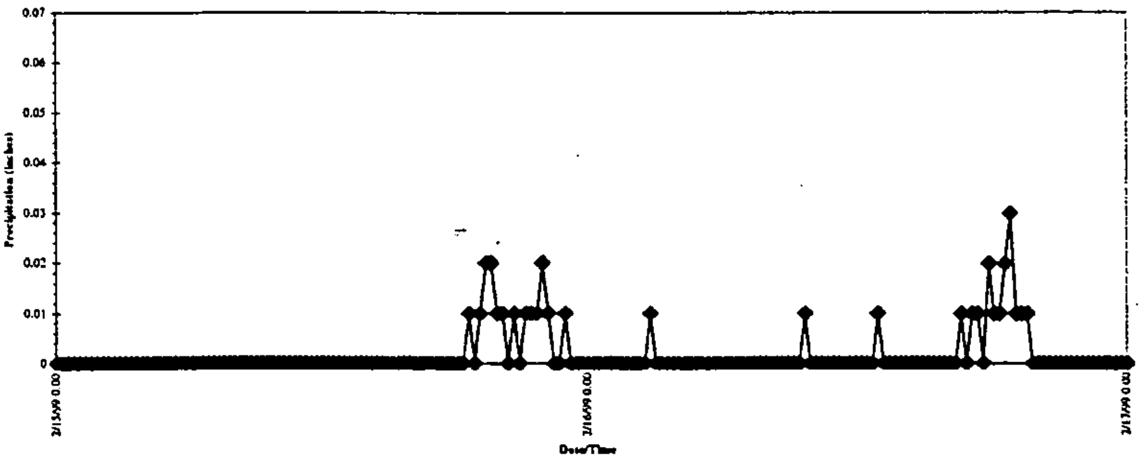


008\0030\0033\hel\050499\k:\data\project\0030\swdata\sw17.xls

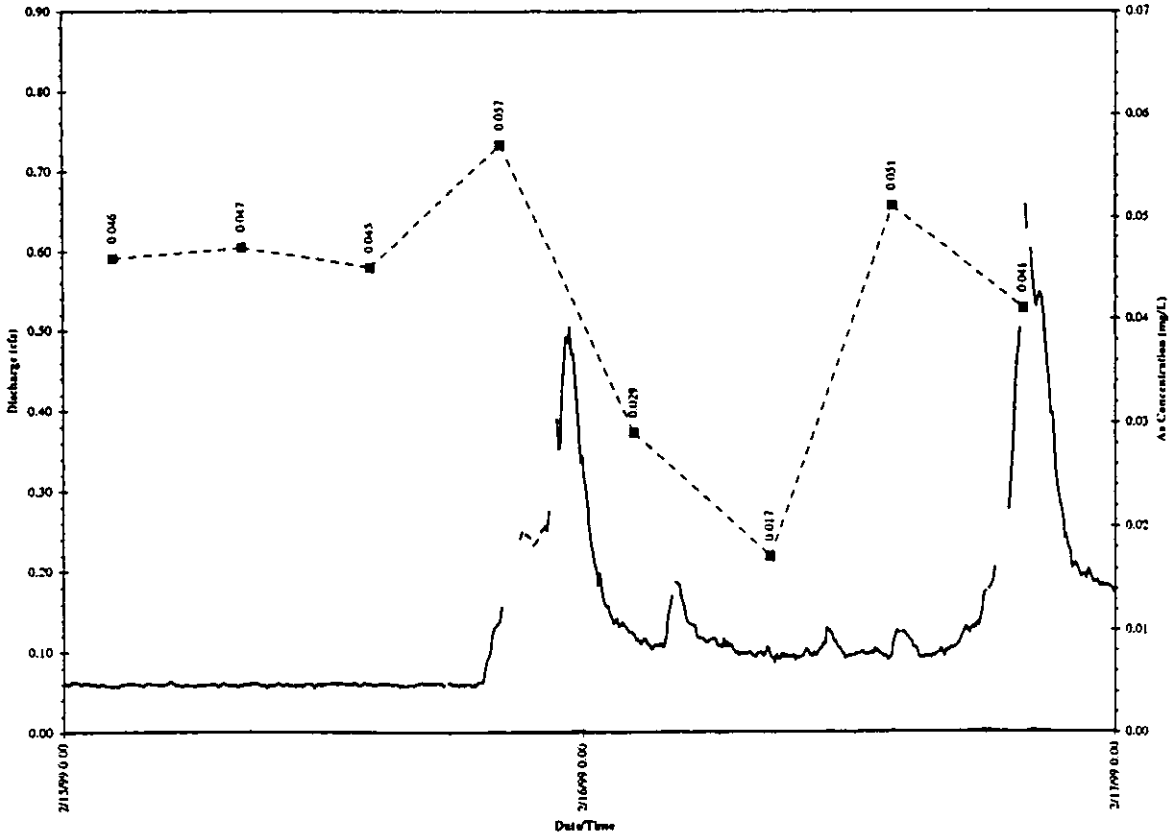
Monitoring Site SW-17:

2/15/99 - 2/17/99

Precipitation

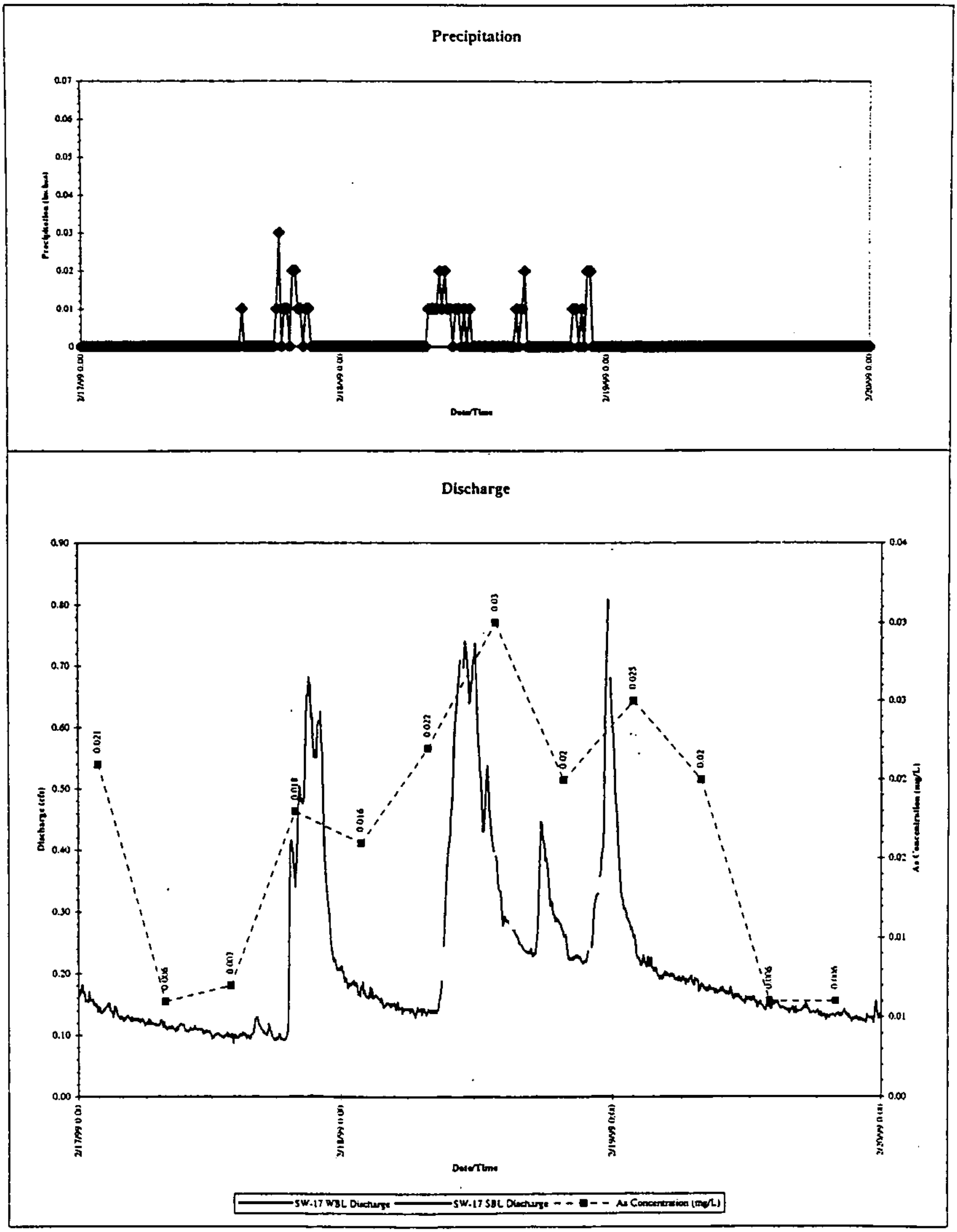


Discharge



Monitoring Site SW-17:

2/17/99 - 2/20/99



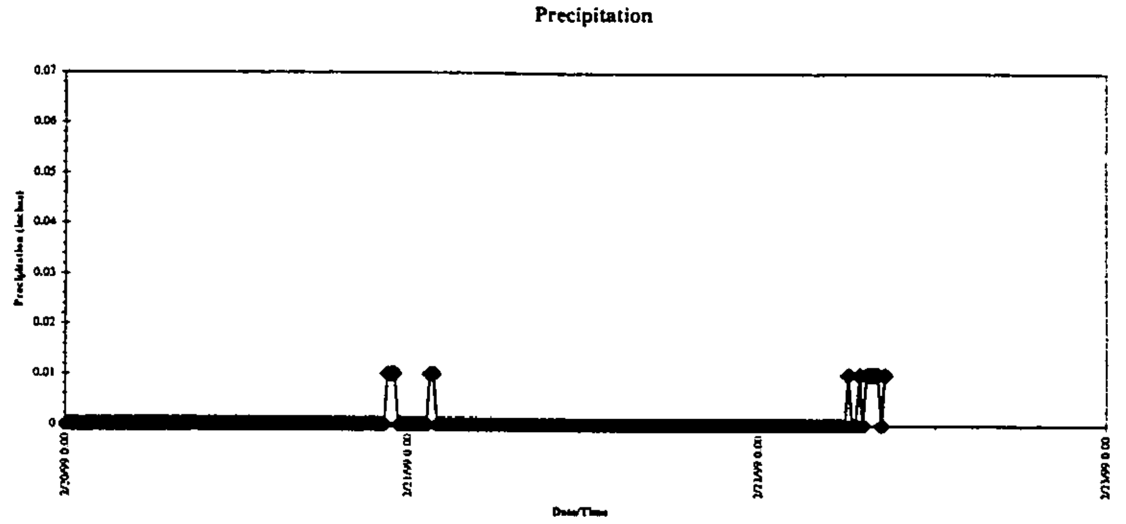
Precipitation

Discharge

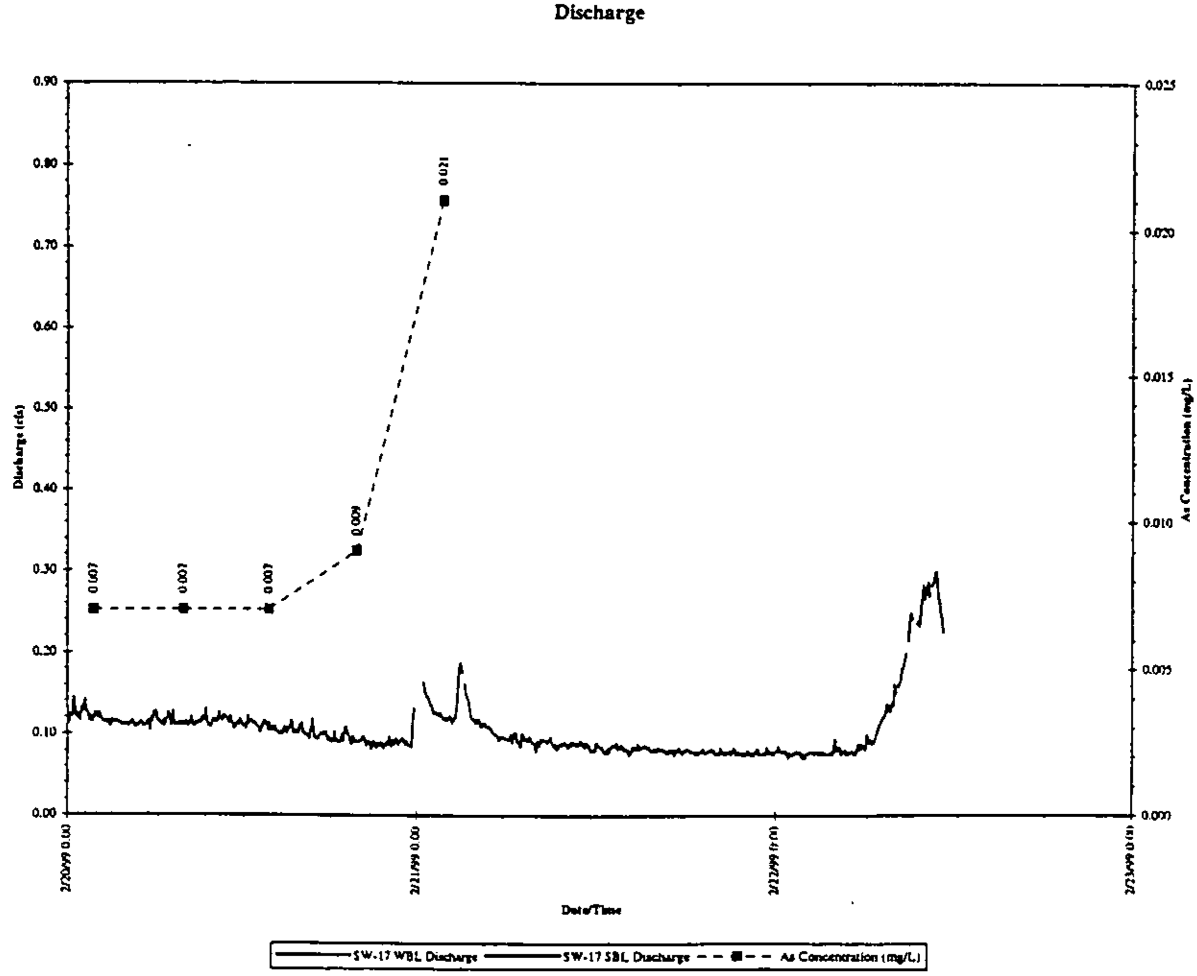
008\0030\0033\hel\050499\k:\data\project\0030\swdata\sw17.xls

Monitoring Site SW-17:

2/20/99 - 2/23/99



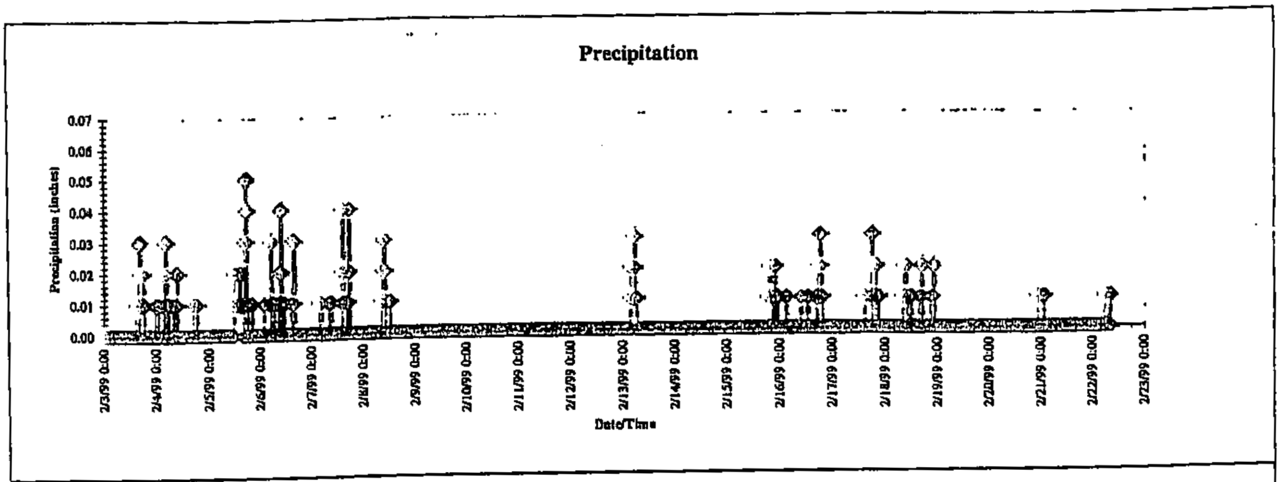
Precipitation

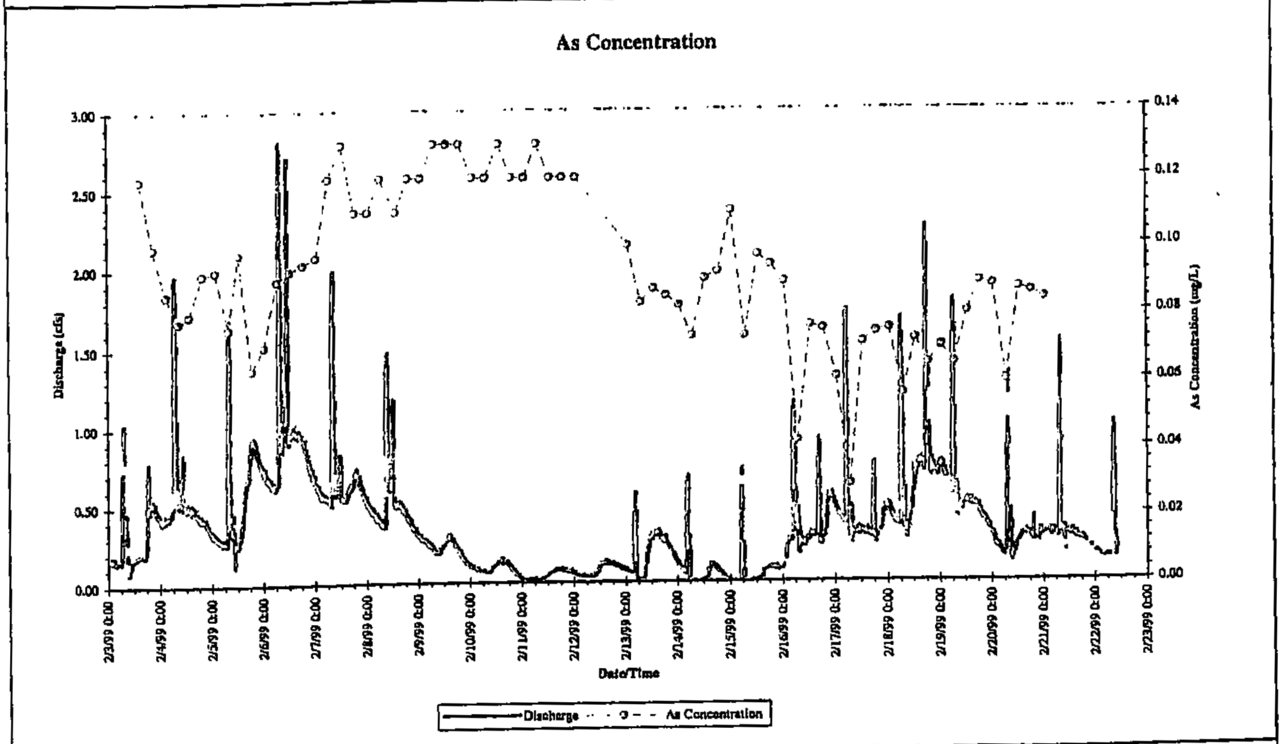


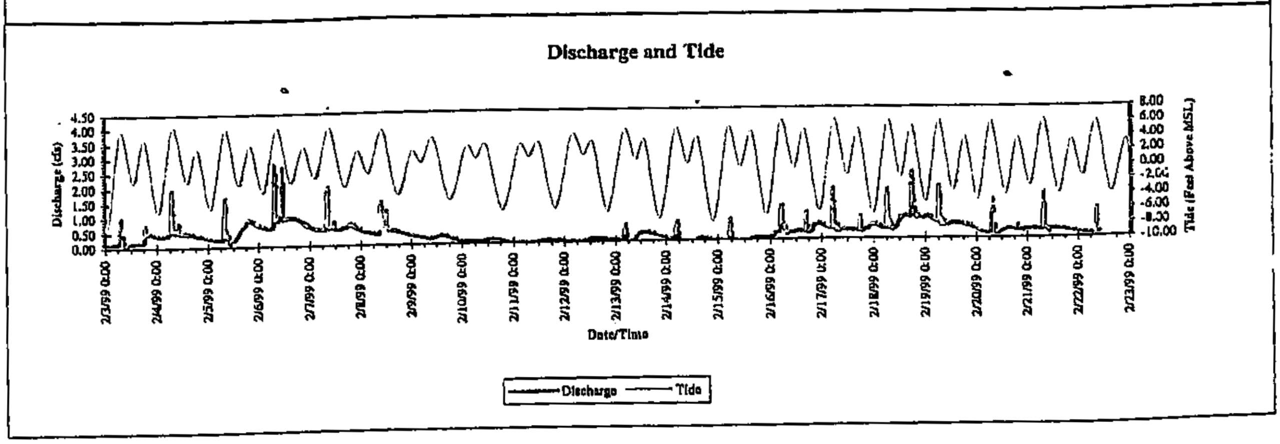
Discharge

008\0030\0033\hel\050499\k:\data\project\0030\swdata\sw17.xls

Monitoring Site SW-18:





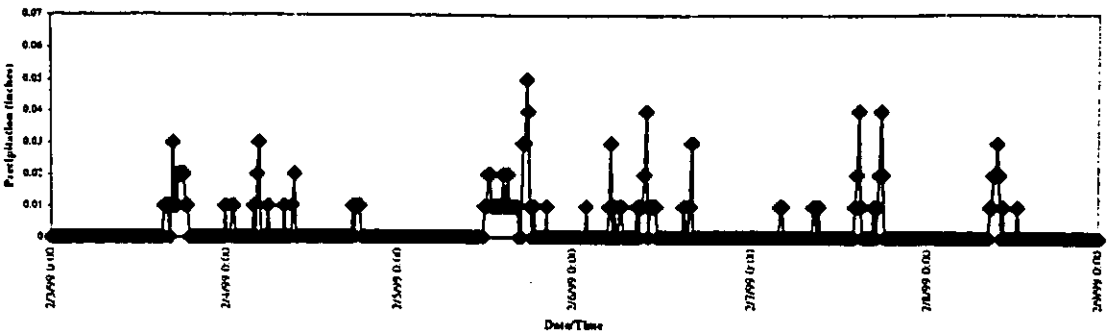


008\0030\0033\hel\050599\k:\data\project\0030\swdata\sw18finl.xls

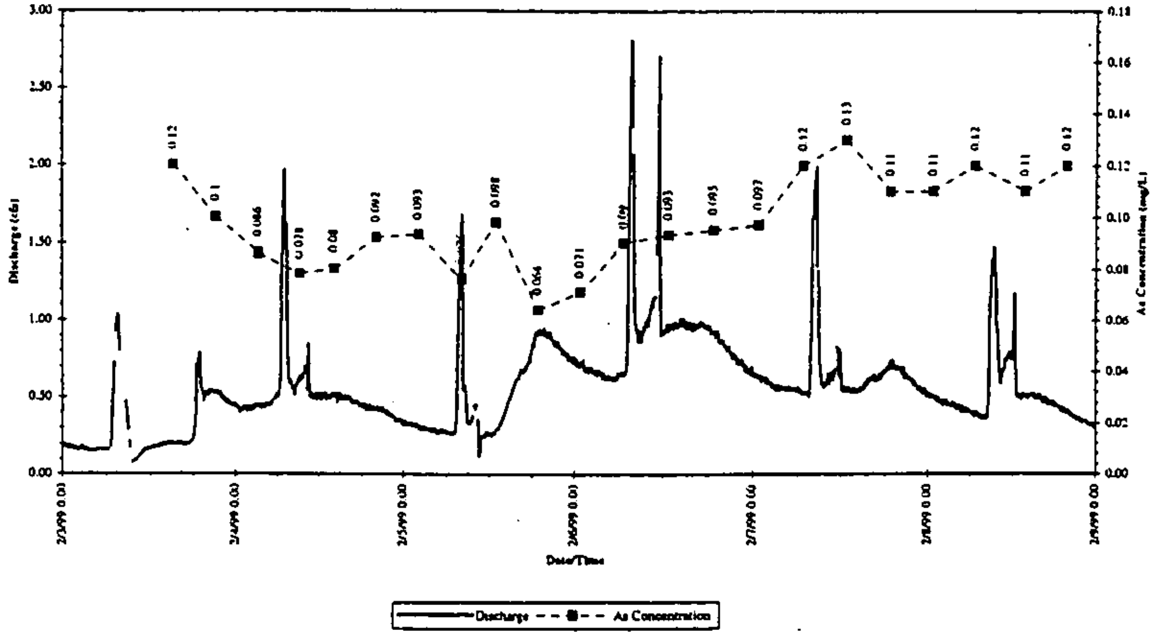
Monitoring Site SW-18:

2/3/99 - 2/9/99

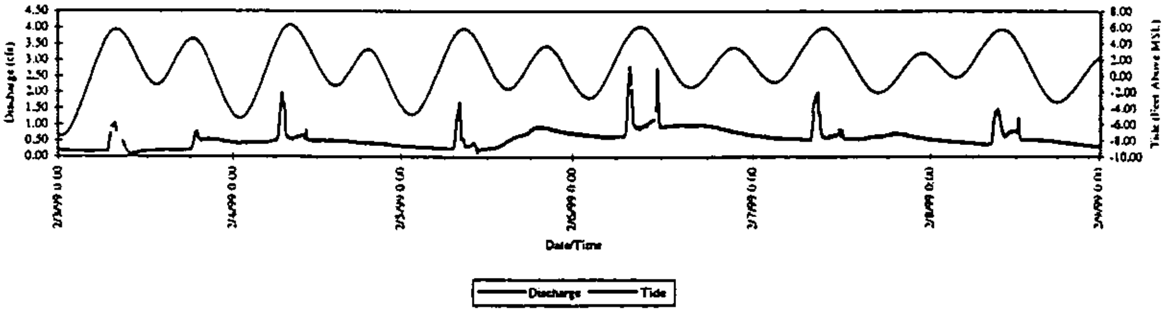
Precipitation



As Concentration



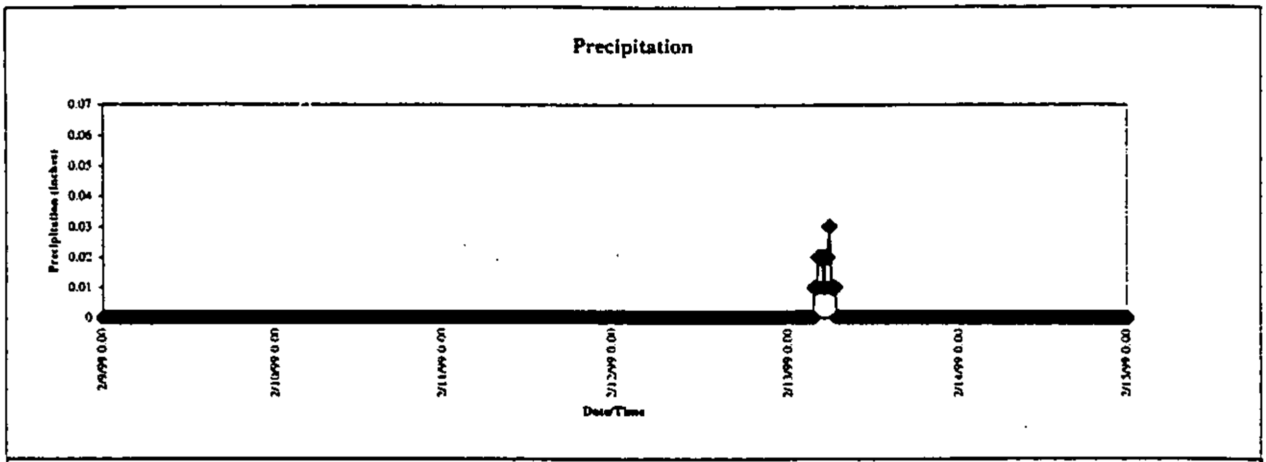
Discharge and Tide



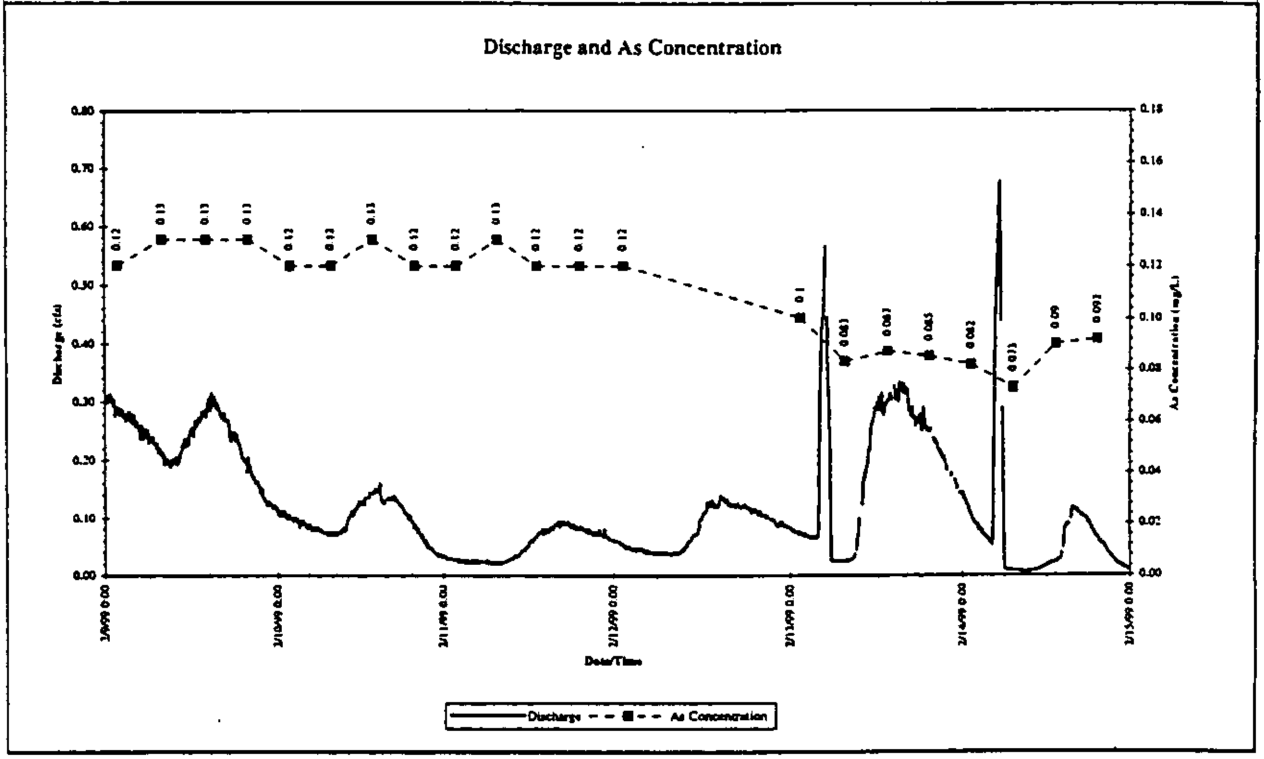
008\0030\0033\hel\050599\k:\data\project\0030\swdata\sw18finl.xls

Monitoring Site SW-18:

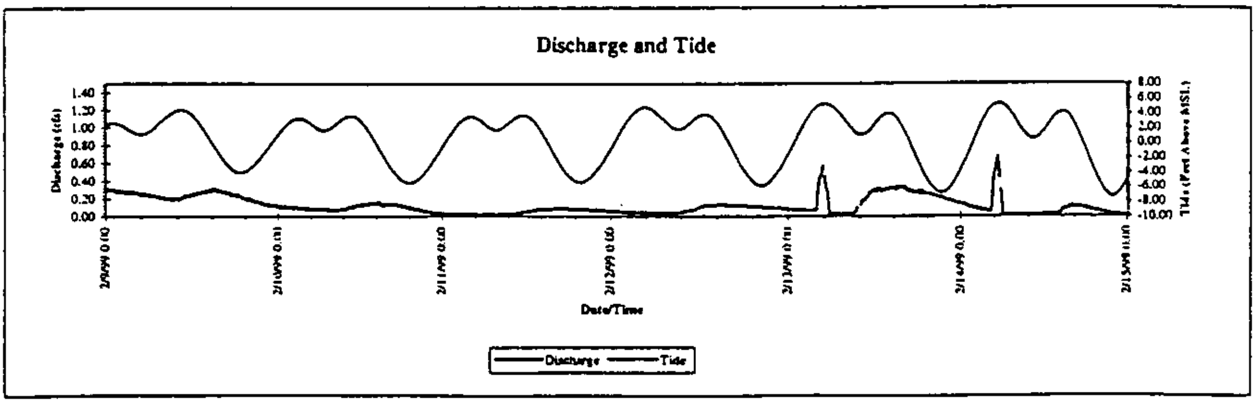
2/9/99 - 2/15/99



Precipitation



Discharge and As Concentration

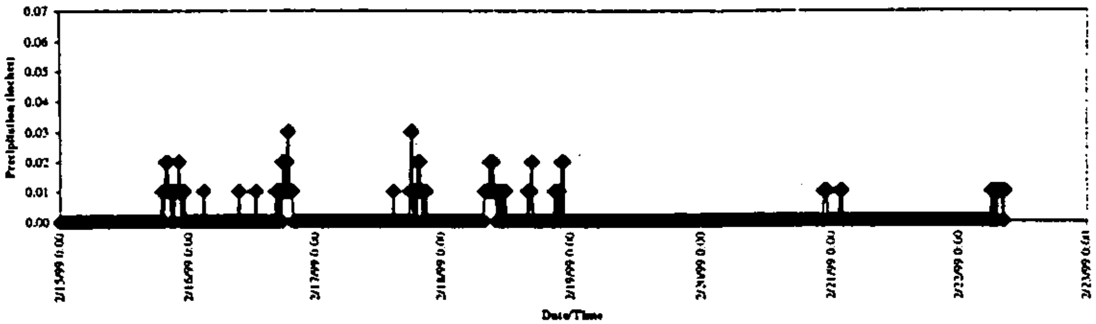


Discharge and Tide

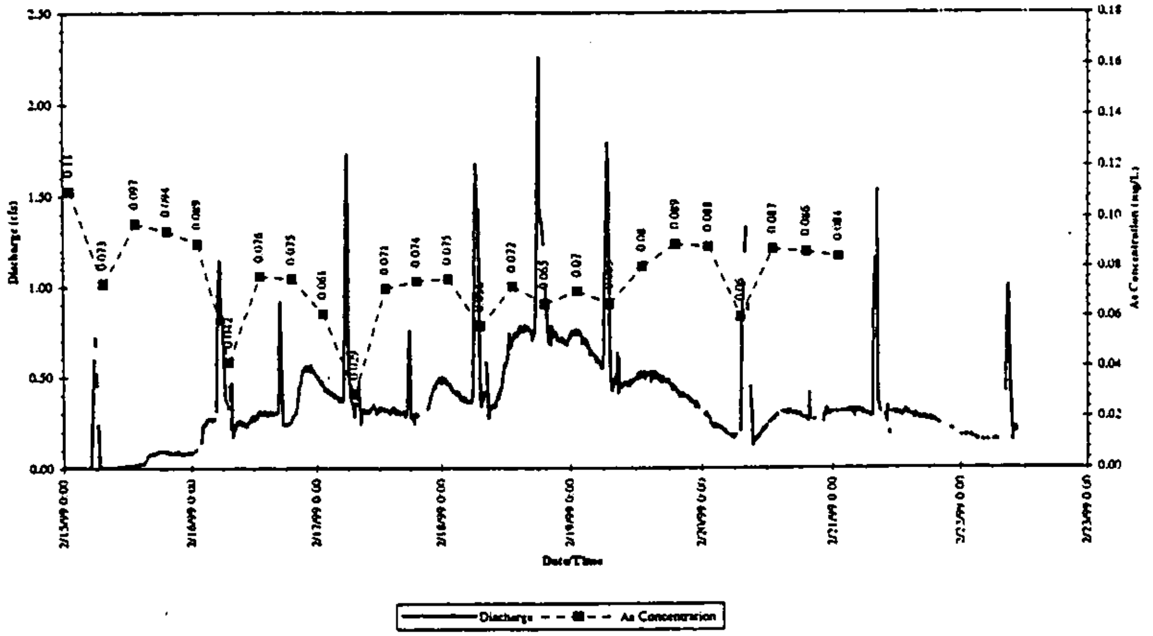
Monitoring Site SW-18:

2/15/99 - 2/23/99

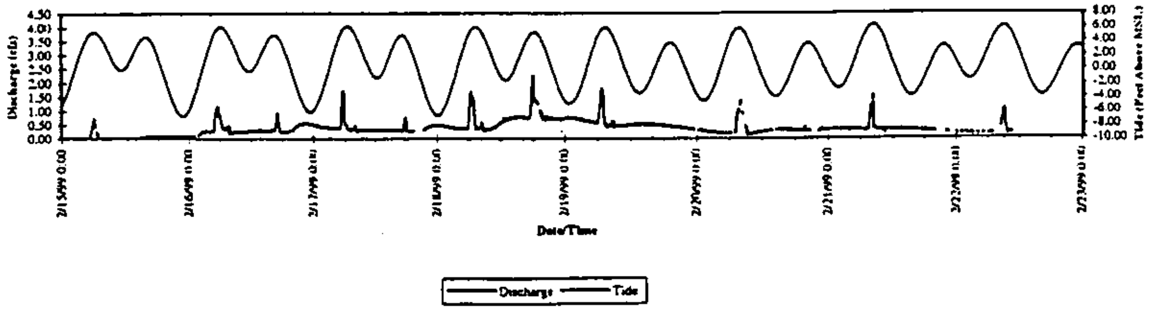
Precipitation



Discharge and As Concentration



Discharge and Tide



STORM WATER GRAB RESULTS

DATA VALIDATION REPORT

INORGANICS ANALYSES

(Arsenic, Cadmium, Lead)

EVERETT STORM WATER INVESTIGATION

January, February, and March 1999 Grab Samples

Prepared by
Hydrometrics, Inc.
2727 Airport Road
Helena, MT 59601

Prepared: March 1999

TABLE OF CONTENTS

LIST OF APPENDICES

GLOSSARY OF TERMS

CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
FAA	Flame Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
HGAA	Hydride Generation Atomic Absorption
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
MSA	Method of Standard Additions
PB	Preparation Blank
PRDL	Project Required Detection Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOW	Statement of Work
TDS	Total Dissolved Solids

SUMMARY

Grab samples collected for the Everett Storm Water Investigation during January of 1999 were analyzed for total and dissolved arsenic, cadmium, and lead at Asarco's Technical Services Laboratory in Salt Lake City, Utah. These data have been reviewed in accordance with the EPA's data validation guidelines (EPA, 1994) and the project work plan (Hydrometrics, 1998). Deviations from prescribed quality control procedures and/or exceedances of quality control limits have been noted, and results have been flagged in the database. All tables are in Appendix 1. Data validation flags are defined in Table 1. A complete listing of flagged data including the reason for each flag is in Table 2. The sample database is in Appendix 2. Samples specified in the work plan were collected during two main January storm water events. Six additional samples were collected including two on February 5, two on February 22, and two on March 19 to further address three areas. These six samples were not specified in the work plan, and therefore, no field quality control samples were collected. The following summarizes data:

- Data quality objectives for precision, accuracy, and completeness have been met for the data covered in this report; these are discussed in Section 11.
- Twenty-five flow measurements were recorded during the two sampling events in January. All of these were flagged 'E' for estimated. Since these flags are not due to quality control violations, the estimated flows are not counted as 'flagged data' in completeness calculations.
- The following quality control violation resulted in the flagging of data:

  The field duplicate collected on January 18 was out of control limits for total lead; the fourteen total lead results from samples collected on that day were flagged to indicate the possible lack of reproducibility.

- Overall numerical frequency requirements for field and laboratory quality control samples were met for the two major storm water sampling events in January. However due to sampling conditions for the January 18/19 sampling event, field procedures specified in the work plan were modified for collecting field blanks and for measuring field parameters. (See Section 3.)
- Two additional grab samples were collected from sites SEEP1 and SEEP2 on February 5, and were submitted to CCI Analytical Laboratories, Inc. in Everett, Washington for the analysis of total arsenic (EVT-9902-SEEP1 &-SEEP2). This sampling was not specified in the project work plan and therefore, no field quality control samples were collected.
- Two additional grab samples were collected on February 22 from two manholes and were analyzed for total arsenic, cadmium, and lead at Asarco's Technical Services Laboratory (EVT-9902-900 & -901). This sampling was not specified in the project work plan and therefore, no field quality control samples were collected.

- Two additional grab samples were collected on March 19 from SW-18 and the Snohomish River outfall. These samples were submitted to CCI Analytical Laboratories, Inc. in Everett, Washington for the analysis of total and dissolved arsenic, cadmium, and lead (EVT-9903-500 & -501). This sampling was not specified in the project work plan and therefore, no field quality control samples were collected.

Taken as a whole, this data set provides useful information for the Everett Storm Water Investigation providing that the possible lack of reproducibility indicated by the flags is taken into account. Overall, 96 percent of the laboratory data may be used without qualification; the rest of the data have been flagged with validation codes to assist in their interpretation.

DATA VALIDATION REPORT

Prepared by: Clare Bridge
Reviewed by: Linda Tangen

DATA VALIDATION REPOR

1. INTRODUCTION

- This validation applies to data from storm water grab samples collected for the Everett Storm Water Investigation during two main sampling events in January and additional sampling in February and March, 1999: twenty-eight samples were submitted from January 18 and 19; thirty-two samples were submitted from January 28 and 29, two samples were submitted on February 5, two samples on February 22, and two samples on March 19. The total number of samples for the two main events in January included four field blanks, four field duplicates, and two blind field standards.

- The six additional samples collected in February and March had no associated field quality control samples. These samples are listed below.

  EVT-9902-SEEP1, collected at the intersection of East Marine Drive and the offramp.
  EVT-9902-SEEP2, collected at the seep 30 feet upgradient from SEEP1.
  EVT-9902-900, collected at MH-7.
  EVT-9902-901, collected at MH-1.
  EVT-9903-500, collected at SW-18.
  EVT-9903-501, collected at the Snohomish River outfall.

- Validation procedures used are generally consistent with (check all that apply):

  _X_ EPA CLP National Functional Guidelines for Inorganics Data Review
  _X_ Work Plan (Hydrometrics, 1998)
  ___ Other

- Overall level of validation:

  ___ Contract Laboratory Program (CLP)
  _X_ Standard
  ___ Visual

  Notes: Field quality control samples were evaluated according to work plan requirements, and associated data were flagged for any exceedances. Blanks and duplicates were considered to be associated with samples collected the same day. Standards were considered to be associated with the same analytical run.

  Laboratory digestion quality control samples (laboratory duplicates, laboratory matrix spikes, laboratory control samples, and laboratory preparation blanks) were all within control limits.

  No field QC samples were collected with the February and March samples, and no lab QC results were included with the laboratory data for the samples collected at SEEP1 and SEEP2. No validation was performed for these two results; they were simply entered into the database.

  Verification of values in the raw data was not required for this project.

2. DELIVERABLES

- All laboratory document deliverables were present as specified in the project contract.
  _X_ Yes
  ___ No

- All documentation of field procedures was provided as required.
  _X_ Yes
  ___ No

3. FIELD QUALITY CONTROL SAMPLES

- **Blanks**: Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

  DI, trip, rinsate, or any other field blanks have been carried out at the proper frequency.
  _X_ Yes -- For the second sampling event.
  _X_ No -- For the first and last sampling events.

  Notes: Concerning blanks, the project work plan requirements are as follows:

  > "Cross-contamination blanks (equipment blanks) will consist of aqueous rinsate blanks collected from the filter apparatus from water sampling equipment prior to collection of a sample. Equipment blanks will be collected at a frequency of 5 percent or 1 per day."

  For the first sampling event, all natural samples were collected on January 18 and January 19. No blanks were submitted for these two days; the two rinsate blanks for the event (EVT-9901-125 and 126) were dated January 20. Typical field procedures were not followed because the rain event was not generating sufficient runoff to allow sample collection, field parameter measurements, and sample filtration to occur at the time of the event. Field parameters were measured, samples were filtered, and filtration blanks were collected in the office on the following day.

  For the sampling event on February 5, no field blank was submitted. The purpose of this sampling event was simply to determine if two locations (SEEP1 and SEEP2) had similar arsenic concentrations. As this effort was not originally part of the work plan and consisted of only two samples, quality control requirements were not followed for the collection of these two samples.

  For the sampling event on February 22, no field blank was submitted. The purpose of this sampling event was simply to determine if an earlier detected concentration at MH-1 came from upgradient MH-7. As this effort was not originally part of the work plan and consisted of only two samples, quality control requirements were not followed for the collection of these two samples.

For the sampling event on March 19, no field blank was submitted. The purpose of this sampling event was simply to determine if an earlier detected concentration at MH-1 came from upgradient MH-7. As this effort was not originally part of the work plan and consisted of only two samples, quality control requirements were not followed for the collection of these two samples.

Reported results on the field blanks are less than the contract required detection limits (CRDL) or the project-required detection limits (PRDL) if project detection limits have been specified.

_X_ Yes
___ No

Notes: When an analyte is detected in a blank, associated results up to 5 times the blank level are flagged to indicate that the results may be biased high due to contamination. Results "associated" with a field blank are generally results for samples collected on the same day as the blank.

- **Field duplicates**

Field duplicates have been collected at the proper frequency.

_X_ Yes - for the 60 samples submitted in January.
___ No

Notes: No duplicate was submitted with the February or March samples (see explanation above under Blanks).

Field duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20 percent or less for water matrix, 35 percent or less for soil matrix). If the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PRDL for water matrix, within ± 2 times the PRDL for soil matrix.

___ Yes
_X_ No

Notes: The sample/field duplicate pair collected at SW-14 on January 18 (EVT-9901-105 & -106) had a difference greater than the PRDL of 0.005 ppm for total lead (0.023 and 0.029 ppm). All total lead results from samples collected January 18 had similar concentrations, and were therefore flagged to indicate a possible lack of reproducibility. In all, 14 total lead results were flagged.

Flags for field duplicate exceedances indicate possible variability in sample results due to the combined effects of variations in field sampling techniques, sample preparation, and laboratory analytical procedures. In this case, it should be pointed out 1)that the laboratory duplicates were within control limits, 2)that field duplicates were created by splitting the original sample, and 3)that the turbidity measured in the original sample was relatively high (150 NTU), and the sample may not have been thoroughly mixed when it was split.

Flagging: J_4/UJ_4

- **Field standards**

  Field standards have been collected at the proper frequency.
  _X_ Yes
  ___ No

  Notes: One blind field standard was submitted with each major shipment of samples.

  Recoveries on the field standards were within control limits (80 to 120 percent recovery for water).
  _X_ Yes
  ___ No

4. LABORATORY PROCEDURES

- **Laboratory procedures followed**

  ___ CLP-SOW
  _X_ SW-846
  ___ Methods for Chemical Analysis of Water and Wastes
  ___ XRF Standard Operating Procedures
  ___ Other

- **Holding times met**

  _X_ Yes
  ___ No

- **Consistency with project requirements**

  Analyses were carried out as requested.
  _X_ Yes
  ___ No

  Project specified methods were used.
  _X_ Yes
  ___ No

5. DETECTION LIMITS

The following table lists the laboratory's reporting level by analytical method and compares it to the project detection limit (PRDL).

Parameter	Analysis Method	Reporting Level (ppm)	PRDL (ppm)
Arsenic	ICP-MS	0.005	0.005
Cadmium	ICP-MS	0.003	0.003
Lead	ICP-MS	0.005	0.005

- Reporting detection limits met project required detection limits (PRDLs).

  _X_ Yes
  ___ No

- Instrument detection limits (IDLs) were provided by the laboratory.

  ___ Yes
  ___ No
  _X_ NA - This was not required for the project.

6. LABORATORY BLANKS

Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

- **Preparation blanks**

  Preparation blanks were prepared and analyzed at the required frequency.

  _X_ Yes
  ___ No

  All the analytes in the preparation blank were less than the CRDL (or the PRDL if a project detection limit has been specified).

  _X_ Yes
  ___ No

7. LABORATORY MATRIX SPIKES

- A matrix spike sample (pre-digestion) was analyzed for each digestion batch and/or matrix, or as required by the laboratory method.

  _X_ Yes
  ___ No

- Matrix spike recoveries were within the required control limits (75-125 percent).

  _X_ Yes
  ___ No

8. LABORATORY DUPLICATES

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes
  ___ No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20 percent or less for water matrix, 35 percent or less for soil matrix). For low concentration data, that is if the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PRDL for water matrix, within ± 2 times the PRDL for soil matrix.

  _X_ Yes
  ___ No

9. LABORATORY CONTROL STANDARDS

- The reference material used was of the correct matrix and concentration.

  _X_ Yes
  ___ No

- LCSs were prepared and analyzed at the proper frequency

  _X_ Yes
  ___ No

- LCS recoveries were within the required control limits (80-120 percent for water, within the certified range for soils).

  _X_ Yes
  ___ No

10. INTERPARAMETER RELATIONSHIPS

- The following relationships have been checked:

  _X_ Tot/Dis metals.
  ___ TDS vs SC.
  ___ Lab SC vs field SC
  ___ Arsenic speciation/dissolved arsenic.

Tot/Dis metals: This relationship was in order with the exception of the measurements of total and dissolved arsenic **at site CB-46** as shown in the following table.

Sample Number	Sample Date	Total Arsenic	Dissolved Arsenic
EVT-9901-117	01-19-99	0.013 ppm	0.19 ppm
EVT-9901-212	01-28-99	0.008 ppm	0.10 ppm

In both cases, the analyst confirmed the results by repeat analyses of both total and dissolved samples. Also, the analyst noted that the presence of undissolved residue in the Totals bottle, thus eliminating the possibility that the bottles had been inadvertently switched in the field.

11. DATA QUALITY OBJECTIVES

- **Project data quality objectives (DQO's) met.**

  X Yes
  ___ No

  Accuracy

  Accuracy for this project is assessed using blind field standards, laboratory-spiked samples, and laboratory reference standards. Target accuracy for this project is acceptance of 90 percent of these QC sample results as valid and within control limits (80 to 120 percent recovery for standards, 75 to 125 percent recovery for spikes).

  Target accuracy was met. All field standard results and all laboratory QC sample results were within control limits.

  Precision

  Precision for this project is assessed using field duplicates and laboratory duplicates. Target precision for this project is acceptance of 90 percent of these QC sample results as valid and within control limits (a relative percent difference of 20 percent or less).

  Target precision was met. All of the laboratory duplicate results and 96 percent of the field duplicate results were within control limits.

  Completeness

  The target completeness for this project is assessment of at least 90 percent of the sample results as "valid".

  Target completeness was met; no data were rejected. Ninety-six percent of the laboratory data may be used without qualification (360 out of 374 laboratory results). The remaining four percent may be used with caution, taking into account the possible lack of reproducibility indicated by the flags on 22 percent of the total lead results (14 out of 64 results were flagged).

REFERENCES

(References appropriate to this project have been checked)

___ Hem, J.D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition. US Geological Survey Water Supply Paper 2254.

X Hydrometrics Project Work Plan. Sampling and Analysis Plan Storm Water and Storm Drain Sediments, Characterization and Controls Work Plan, Everett, Washington. October 1997, revised April 1998.

X U.S. Environmental Protection Agency, 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.

___ U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983. (EPA, 1983)

___ U.S. Environmental Protection Agency, 1993. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM03.0

X U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994.

TABLE 1.

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 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates possible bias. 4 - Other QC outside control limits.
UJ	-	The material was analyzed for, but was not detected above the associated value. Subscripts for the "UJ" qualifier: 1 - Blank contamination. Indicates possible high bias and/or false positive. 2 - Calibration range exceeded or significant deviation from known value. Possible bias. 3 - Holding time not met. Indicates possible bias. 4 - Other QC outside control limits.
R	-	Quality control indicates that the data are unusable (compound may or may not be present). Resampling and/or reanalysis is necessary for verification.
A	-	Anomalous data. No apparent explanation for discrepancy in data. (Not an EPA code.)

TABLE OF CONTENTS BY SITE TYPE

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	BFS	BFS	BFS	BFS	RINSATE
SAMPLE DATE	01/20/99	01/20/99	01/29/99	01/29/99	01/20/99
SAMPLE TIME		14:40		10:00	14:32
LAB	TRUE VALUE	TSC-SLC	TRUE VALUE	TSC-SLC	TSC-SLC
LAB NUMBER		L990142-28		L990208-28	L990142-26
REMARKS	STANDARD	STANDARD	STANDARD	STANDARD	BLANK
SAMPLE NUMBER	EVT-9901-127	EVT-9901-127	EVT-9901-227	EVT-9901-227	EVT-9901-125
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS					<0.005
ARSENIC (AS) TOT	0.0941	0.1	0.0941	0.099	<0.005
CADMIUM (CD) DIS					<0.003
CADMIUM (CD) TOT	0.0765	0.083	0.0765	0.075	<0.003
LEAD (PB) DIS					<0.005
LEAD (PB) TOT	0.0941	0.094	0.0941	0.095	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	RINSATE	RINSATE	RINSATE
SAMPLE DATE	01/20/99	01/28/99	01/28/99
SAMPLE TIME	14:35	12:15	13:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990142-27	L990208-15	L990208-25
REMARKS	BLANK	BLANK	BLANK
SAMPLE NUMBER	EVT-9901-126	EVT-9901-214	EVT-9901-224
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	<0.005	<0.005	<0.005
CADMIUM (CD) DIS	<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003
LEAD (PB) DIS	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	440 OUTFALL		440 OUTFALL		440 OUTFALL	BUTLER-MANHOLE
SAMPLE DATE	01/19/99		01/28/99		01/28/99	01/28/99
SAMPLE TIME	16:20		12:13		12:13	13:15
LAB	TSC-SLC		TSC-SLC		TSC-SLC	TSC-SLC
LAB NUMBER	L990142-25		L990208-26		L990208-27	L990208-31
REMARKS					DUPLICATE	
SAMPLE NUMBER	EVT-9901-124		EVT-9901-225		EVT-9901-226	EVT-9901-230
-- PHYSICAL PARAMETERS --						
FLOW (gal/min)	0.21	E	0.8	E		
OXYGEN (O) (FLD) DIS	9.28		10.94			
PH (FLD)	6.35		5.8			
SC (UMHOS/CM AT 25 C) (FLD)	157.0		110.0			
TURBIDITY (NTU)	1.0		7.0			
WATER TEMPERATURE (C) (FLD)	15.0		16.5			
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.42		0.25		0.25	14.0
ARSENIC (AS) TOT	0.42		0.28		0.27	16.0
CADMIUM (CD) DIS	0.14		0.06		0.06	<0.003
CADMIUM (CD) TOT	0.12		0.063		0.06	0.004
LEAD (PB) DIS	0.008		<0.005		<0.005	<0.005
LEAD (PB) TOT	0.018		0.006		0.006	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	BUTLER-TO-MH3	CB-9		CB-9	CB-10	
SAMPLE DATE	01/28/99	01/18/99		01/28/99	01/19/99	
SAMPLE TIME	12:50	16:22		13:30	14:12	
LAB	TSC-SLC	TSC-SLC		TSC-SLC	TSC-SLC	
LAB NUMBER	L990208-30	L990142-12		L990208-17	L990142-11	
OTHER INFO				Gray-black	Some particles	
SAMPLE NUMBER	EVT-9901-229	EVT-9901-111		EVT-9901-216	EVT-9901-110	
-- PHYSICAL PARAMETERS --						
FLOW (gal/min)		0.45	E		0.44	E
OXYGEN (O) (FLD) DIS		9.3		9.74	9.44	
PH (FLD)		4.67		4.85	4.82	
SC (UMHOS/CM AT 25 C) (FLD)		62.0		54.0	45.0	
TURBIDITY (NTU)		17.0		87.0	9.0	
WATER TEMPERATURE (C) (FLD)		12.1		15.7	11.9	
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS	0.025	0.03		0.007	0.024	
ARSENIC (AS) TOT	0.11	0.037		0.076	0.028	
CADMIUM (CD) DIS	<0.003	<0.003		<0.003	<0.003	
CADMIUM (CD) TOT	<0.003	<0.003		<0.003	<0.003	
✓ LEAD (PB) DIS	<0.005	<0.005		<0.005	<0.005	
LEAD (PB) TOT	<0.005	0.007	J4	0.11	0.005	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-10		CB-14	CB-14	CB-14
SAMPLE DATE	01/28/99		01/19/99	01/19/99	01/18/99
SAMPLE TIME	09:30		16:27	16:27	12:18
LAB	TSC-SLC		TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990208-20		L990142-19	L990142-20	L990208-12
REMARKS				DUPLICATE	
OTHER INFO			Gray		Dark gray
SAMPLE NUMBER	EVT-9901-219		EVT-9901-118	EVT-9901-119	EVT-9901-211
-- PHYSICAL PARAMETERS --					
FLOW (gal/min)	2.4	E			
OXYGEN (O) (FLD) DIS	10.79		9.4		10.6
PH (FLD)	4.79		6.75		6.52
SC (UMHOS/CM AT 25 C) (FLD)	50.0		151.0		99.0
TURBIDITY (NTU)	6.0		325.0		212.0
WATER TEMPERATURE (C) (FLD)	16.3		14.1		14.7
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS	0.015		0.31	0.3	0.008
ARSENIC (AS) TOT	0.026		0.25	0.29	0.015
CADMIUM (CD) DIS	<0.003		<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003		<0.003	<0.003	<0.003
LEAD (PB) DIS	<0.005		<0.005	<0.005	<0.005
LEAD (PB) TOT	0.04		0.041	0.036	0.077

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-15		CB-15		CB-20		CB-20	
SAMPLE DATE	01/19/99		01/28/99		01/18/99		01/28/99	
SAMPLE TIME	16:47		12:37		15:02		10:39	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990142-16		L990208-23		L990142-13		L990208-11	
OTHER INFO	Gray		Light yellow-gr					
SAMPLE NUMBER	EVT-9901-115		EVT-9901-222		EVT-9901-112		EVT-9901-210	
-- PHYSICAL PARAMETERS --								
FLOW (gal/min)	1.73	E	2.4	E	2.59	E	5.5	E
OXYGEN (O) (FLD) DIS	9.46		10.37		9.07		13.0	
PH (FLD)	6.39		5.85		5.96		5.29	
SC (UMHOS/CM AT 25 C) (FLD)	116.0		76.0		89.0		58.0	
TURBIDITY (NTU)	390.0		232.0		2.0		43.0	
WATER TEMPERATURE (C) (FLD)	14.2		16.3		12.2		15.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	1.0		0.49		<0.005		<0.005	
ARSENIC (AS) TOT	1.1		0.57		0.009		0.008	
CADMIUM (CD) DIS	<0.003		<0.003		<0.003		<0.003	
CADMIUM (CD) TOT	<0.003		<0.003		<0.003		<0.003	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.024		0.02		0.005	J4	0.012	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-29	CB-29	CB-32	CB-32
SAMPLE DATE	01/19/99	01/28/99	01/19/99	01/28/99
SAMPLE TIME	15:27	11:12	16:00	10:09
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990142-14	L990208-21	L990142-15	L990208-10
OTHER INFO	Dark gray	Gray	Dark gray	Dark gray
SAMPLE NUMBER	EVT-9901-113	EVT-9901-220	EVT-9901-114	EVT-9901-209
-- PHYSICAL PARAMETERS --				
FLOW (gal/min)	0.33 E	3.2 E	2.27 E	17.3 E
OXYGEN (O) (FLD) DIS	8.66	10.87	8.75	11.5
PH (FLD)	6.32	6.2	7.37	7.03
SC (UMHOS/CM AT 25 C) (FLD)	114.0	78.0	202.0	152.0
TURBIDITY (NTU)	876.0	300.0	999.0	749.0
WATER TEMPERATURE (C) (FLD)	12.7	16.2	13.4	14.6
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.005	<0.005	<0.005	<0.005
ARSENIC (AS) TOT	0.011	0.006	0.014	0.011
CADMIUM (CD) DIS	<0.003	<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.055	0.029	0.063	0.058

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-42		CB-42		CB-43		CB-43	
SAMPLE DATE	01/19/99		01/28/99		01/18/99		01/28/99	
SAMPLE TIME	15:14		11:03		16:10		09:54	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990142-17		L990208-24		L990142-8		L990208-19	
OTHER INFO	Brown-gray		Light gray		Grayish		Light gray	
SAMPLE NUMBER	EVT-9901-116		EVT-9901-223		EVT-9901-107		EVT-9901-218	
-- PHYSICAL PARAMETERS --								
FLOW (gal/min)	1.45	E	4.8	E	0.55	E	2.4	E
OXYGEN (O) (FLD) DIS	9.07		10.27		9.6		10.67	
PH (FLD)	6.25		5.83		5.76		5.31	
SC (UMHOS/CM AT 25 C) (FLD)	114.0		64.0		82.0		50.0	
TURBIDITY (NTU)	278.0		94.0		120.0		76.0	
WATER TEMPERATURE (C) (FLD)	13.8		16.6		11.1		16.5	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	<0.005		<0.005		<0.005		0.006	
ARSENIC (AS) TOT	0.007		0.006		<0.005		<0.005	
CADMIUM (CD) DIS	<0.003		<0.003		<0.003		<0.003	
CADMIUM (CD) TOT	<0.003		<0.003		<0.003		<0.003	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.023		0.011		0.009	J4	0.022	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-44		CB-44		CB-46		CB-46	
SAMPLE DATE	01/18/99		01/28/99		01/19/99		01/28/99	
SAMPLE TIME	16:00		09:45		14:25		10:20	
LAB	TSC-SLC		TSC-SLC		TSC-SLC		TSC-SLC	
LAB NUMBER	L990142-9		L990208-22		L990142-18		L990208-13	
OTHER INFO	Grayish		Light gray		Gray-black		Light gray	
SAMPLE NUMBER	EVT-9901-108		EVT-9901-221		EVT-9901-117		EVT-9901-212	
-- PHYSICAL PARAMETERS --								
FLOW (gal/min)	0.44	E	1.5	E	12.2	E	84.6	E
OXYGEN (O) (FLD) DIS	9.56		11.18		8.72		10.99	
PH (FLD)	6.17		5.66		6.71		6.1	
SC (UMHOS/CM AT 25 C) (FLD)	98.0		58.0		132.0		123.0	
TURBIDITY (NTU)	150.0		127.0		999.0		344.0	
WATER TEMPERATURE (C) (FLD)	11.7		16.2		13.9		15.0	
-- METALS & MINOR CONSTITUENTS --								
ARSENIC (AS) DIS	<0.005		<0.005		0.19		0.1	
ARSENIC (AS) TOT	0.006		<0.005		0.013		0.008	
CADMIUM (CD) DIS	<0.003		<0.003		<0.003		<0.003	
CADMIUM (CD) TOT	<0.003		<0.003		<0.003		<0.003	
LEAD (PB) DIS	<0.005		<0.005		<0.005		<0.005	
LEAD (PB) TOT	0.034	J4	0.026		0.069		0.038	

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-83	CB-83	EAST-TO-MH2	EMVD-TO-MH2
SAMPLE DATE	01/19/99	01/28/99	01/28/99	01/28/99
SAMPLE TIME	17:10	10:55	16:00	15:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990142-10	L990208-9	L990208-32	L990208-29
OTHER INFO	Grayish			
SAMPLE NUMBER	EVT-9901-109	EVT-9901-208	EVT-9901-231	EVT-9901-228
-- PHYSICAL PARAMETERS --				
FLOW (gal/min)	0.04 E	0.3 E		
OXYGEN (O) (FLD) DIS	9.25	12.5		
PH (FLD)	4.8	4.71		
SC (UMHOS/CM AT 25 C) (FLD)	51.0	40.0		
TURBIDITY (NTU)	112.0	57.0		
WATER TEMPERATURE (C) (FLD)	11.0	14.8		
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	<0.005	<0.005	0.005	0.55
ARSENIC (AS) TOT	0.013	0.008	0.032	0.57
CADMIUM (CD) DIS	<0.003	<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.012	0.015	0.13	0.017

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-1	MH-2	MH-2	MH-3
SAMPLE DATE	02/22/99	01/18/99	01/28/99	01/18/99
SAMPLE TIME	14:00	16:40	15:30	17:08
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990389-2	L990142-23	L990208-16	L990142-21
OTHER INFO			Light gray	
SAMPLE NUMBER	EVT-9902-901	EVT-9901-122	EVT-9901-215	EVT-9901-120
-- PHYSICAL PARAMETERS --				
OXYGEN (O) (FLD) DIS		8.21	9.62	9.37
PH (FLD)		6.26	6.28	6.19
SC (UMHOS/CM AT 25 C) (FLD)		213.0	124.0	187.0
TURBIDITY (NTU)		45.0	113.0	11.0
WATER TEMPERATURE (C) (FLD)		13.7	15.8	13.7
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS		3.3	1.5	2.0
ARSENIC (AS) TOT	18.449	4.6	1.8	2.9
CADMIUM (CD) DIS		<0.003	<0.003	0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	0.005
LEAD (PB) DIS		<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005 UJ4	0.014	0.009 J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-3	MH-6	MH-6	MH-6
SAMPLE DATE	01/28/99	01/18/99	01/28/99	01/28/99
SAMPLE TIME	12:45	16:04	12:45	12:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990208-8	L990142-22	L990208-6	L990208-7
REMARKS				DUPLICATE
SAMPLE NUMBER	EVT-9901-207	EVT-9901-121	EVT-9901-205	EVT-9901-206
-- PHYSICAL PARAMETERS --				
OXYGEN (O) (FLD) DIS	9.05	8.76	9.64	
PH (FLD)	6.37	6.0	5.68	
SC (UMHOS/CM AT 25 C) (FLD)	105.0	161.0	157.0	
TURBIDITY (NTU)	19.0	4.0	3.0	
WATER TEMPERATURE (C) (FLD)	16.2	13.7	14.9	
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS	1.0	3.3	2.9	2.8
ARSENIC (AS) TOT	1.2	3.7	3.2	3.2
CADMIUM (CD) DIS	<0.003	0.005	0.006	0.006
CADMIUM (CD) TOT	0.003	0.006	0.006	0.006
LEAD (PB) DIS	<0.005	<0.005	<0.005	<0.005
LEAD (PB) TOT	<0.005	<0.005 UJ4	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-7	SEEP1		SEEP1		SEEP1
SAMPLE DATE	02/22/99	01/19/99		01/28/99		02/05/99
SAMPLE TIME	13:45	16:40		12:25		12:42
LAB	TSC-SLC	TSC-SLC		TSC-SLC		CCI
LAB NUMBER	L990389-1	L990142-24		L990208-18		902033-1
OTHER INFO		Light brown		Light yellow-br		
SAMPLE NUMBER	EVT-9902-900	EVT-9901-123		EVT-9901-217		EVT-9902-SEEP1
-- PHYSICAL PARAMETERS --						
FLOW (gal/min)		1.29	E	2.0	E	
OXYGEN (O) (FLD) DIS		7.71		9.89		
PH (FLD)		6.13		6.27		
SC (UMHOS/CM AT 25 C) (FLD)		251.0		224.0		
TURBIDITY (NTU)		*138.0*		*46.0*		
WATER TEMPERATURE (C) (FLD)		15.1		15.4		
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) DIS		8.5		7.6		
ARSENIC (AS) TOT	38.976	8.9		8.4		21.0
CADMIUM (CD) DIS		0.015		0.014		
CADMIUM (CD) TOT	<0.003	0.014		0.024		
LEAD (PB) DIS		<0.005		<0.005		
LEAD (PB) TOT	<0.005	<0.005		0.037		

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SEEP2	SNOHO OUTFALL	SW-1	SW-1
SAMPLE DATE	02/05/99	03/19/99	01/18/99	01/28/99
SAMPLE TIME	12:46		17:14	12:10
LAB	CCI	CCI	TSC-SLC	TSC-SLC
LAB NUMBER	902033-2	30502103-2	L990142-1	L990208-5
OTHER INFO			Light yellow-br	Light yellow-br
SAMPLE NUMBER	EVT-9902-SEEP2	EVT-9903-S01	EVT-9901-100	EVT-9901-204
-- PHYSICAL PARAMETERS --				
OXYGEN (O) (FLD) DIS			6.47	5.48
PH (FLD)			6.96	6.79
SC (UMHOS/CM AT 25 C) (FLD)			473.0	456.0
TURBIDITY (NTU)			84.0	54.0
WATER TEMPERATURE (C) (FLD)			7.6	14.5
-- METALS & MINOR CONSTITUENTS --				
ARSENIC (AS) DIS		0.025	0.31	0.33
ARSENIC (AS) TOT	16.0	0.054	0.34	0.32
CADMIUM (CD) DIS		<0.003	<0.003	<0.003
CADMIUM (CD) TOT		<0.003	<0.003	<0.003
LEAD (PB) DIS		<0.004	0.015	0.01
LEAD (PB) TOT		0.004	0.025 J4	0.016

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; B:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-2	SW-2	SW-14	SW-14	SW-14
SAMPLE DATE	01/18/99	01/28/99	01/18/99	01/18/99	01/28/99
SAMPLE TIME	17:28	12:20	16:58	16:58	12:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990142-2	L990208-1	L990142-6	L990142-7	L990208-4
REMARKS				DUPLICATE	
OTHER INFO	Light yellow-br	Light yellow-br	Grayish w/parti		Very light gray
SAMPLE NUMBER	EVT-9901-101	EVT-9901-200	EVT-9901-105	EVT-9901-106	EVT-9901-203
-- PHYSICAL PARAMETERS --					
OXYGEN (O) (FLD) DIS	5.64	5.81	8.5		9.51
PH (FLD)	6.75	6.67	6.76		6.67
SC (UMHOS/CM AT 25 C) (FLD)	323.0	360.0	266.0		183.0
TURBIDITY (NTU)	17.0	213.0	150.0		113.0
WATER TEMPERATURE (C) (FLD)	11.7	11.9	11.1		14.0
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS	0.57	0.4	0.061	0.06	0.06
ARSENIC (AS) TOT	0.58	0.42	0.088	0.1	0.069
CADMIUM (CD) DIS	<0.003	<0.003	<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) DIS	0.032	0.017	<0.005	<0.005	<0.005
LEAD (PB) TOT	0.037 J4	0.034	0.029 J4	0.023 J4	0.009

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-18	SW-18	SW-18
SAMPLE DATE	01/18/99	01/28/99	01/18/99	01/28/99	03/19/99
SAMPLE TIME	17:34	14:30	16:48	11:50	
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	CCI
LAB NUMBER	L990142-5	L990208-14	L990142-3	L990208-3	30502103-1
OTHER INFO	Somewhat murky	Very light gray	Somewhat cloudy	Murky	
SAMPLE NUMBER	EVT-9901-104	EVT-9901-213	EVT-9901-102	EVT-9901-202	EVT-9903-500
-- PHYSICAL PARAMETERS --					
OXYGEN (O) (FLD) DIS	8.92	11.14	8.18	9.34	
PH (FLD)	6.78	6.5	6.75	6.37	
SC (UMHOS/CM AT 25 C) (FLD)	252.0	136.0	314.0	240.0	
TURBIDITY (NTU)	55.0	149.0	52.0	83.0	
WATER TEMPERATURE (C) (FLD)	10.5	14.8	10.5	12.9	
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) DIS	0.014	0.032	0.043	0.039	0.054
ARSENIC (AS) TOT	0.016	0.028	0.059	0.051	0.08
CADMIUM (CD) DIS	<0.003	<0.003	<0.003	<0.003	<0.003
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) DIS	<0.005	<0.005	0.005	<0.005	<0.004
LEAD (PB) TOT	0.007 J4	0.016	0.008 J4	0.008	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-19		SW-19
SAMPLE DATE	01/18/99		01/28/99
SAMPLE TIME	17:37		12:30
LAB	TSC-SLC		TSC-SLC
LAB NUMBER	L990142-4		L990208-2
OTHER INFO	Yellow-brown		Yellow-brown
SAMPLE NUMBER	EVT-9901-103		EVT-9901-201
-- PHYSICAL PARAMETERS --			
OXYGEN (O) (FLD) DIS	4.78		5.79
PH (FLD)	5.72		5.64
SC (UMHOS/CM AT 25 C) (FLD)	124.0		145.0
TURBIDITY (NTU)	7.0		7.0
WATER TEMPERATURE (C) (FLD)	10.1		12.1
-- METALS & MINOR CONSTITUENTS --			
ARSENIC (AS) DIS	0.008		0.012
ARSENIC (AS) TOT	0.011		0.012
CADMIUM (CD) DIS	<0.003		<0.003
CADMIUM (CD) TOT	<0.003		<0.003
LEAD (PB) DIS	0.066		0.068
LEAD (PB) TOT	0.064	J4	0.075

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

INDEX

Page	Site Code	Site Name	Site Type	Elevation MP	Well Depth
3	440 OUTFALL	Outfall from 440 Pilchuck	Storm Water		
1	BFS	BLIND FIELD STANDARD	Quality Control		
3	BUTLER-MANHOLE	Manhole by Butler/alley intersection (MH-1)	Storm Water		
4	BUTLER-TO-MH3	Butler flow into MH-3	Storm Water		
4	CB-9	CB-9	Storm Water		
4	CB-10	CB-10	Storm Water		
5	CB-14	CB-14	Storm Water		
6	CB-15	CB-15	Storm Water		
6	CB-20	CB-20	Storm Water		
7	CB-29	CB-29	Storm Water		
7	CB-32	CB-32	Storm Water		
8	CB-42	CB-42	Storm Water		
8	CB-43	CB-43	Storm Water		
9	CB-44	CB-44	Storm Water		
9	CB-46	CB-46	Storm Water		
10	CB-83	CB-83	Storm Water		
10	EAST-TO-MH2	Flow from East line into MH-2	Storm Water		
10	EMVD-TO-MH2	East Marine View Drive flow into MH-2	Storm Water		
11	MH-1	Manhole in Butler from alley	Storm Water		
11	MH-2	MH-2	Storm Water		
11	MH-3	MH-3	Storm Water		
12	MH-6	MH-6	Storm Water		
13	MH-7	Manhole in alley by Taylo	Storm Water		
1	RINSATE	RINSATE	Quality Control		
13	SEEP1	SEEP1 at East Marine View Drive & offramp	Storm Water		
14	SEEP2	SEEP2, 30' upgradient from SEEP1	Storm Water		
14	SNOHO OUTFALL	Snohomish River Outfall	Storm Water		
14	SW-1	SW-1	Storm Water		
15	SW-2	SW-2	Storm Water		
15	SW-14	SW-14	Storm Water		
16	SW-17	SW-17, Three upgradient manholes from outfall	Storm Water		
16	SW-18	SW-18	Storm Water		
17	SW-19	SW-19	Storm Water		

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
14	EVT-9901-100	L990142-1	01/18/99	SW-1
15	EVT-9901-101	L990142-2	01/18/99	SW-2
16	EVT-9901-102	L990142-3	01/18/99	SW-18
17	EVT-9901-103	L990142-4	01/18/99	SW-19
16	EVT-9901-104	L990142-5	01/18/99	SW-17
15	EVT-9901-105	L990142-6	01/18/99	SW-14
15	EVT-9901-106	L990142-7	01/18/99	SW-14
8	EVT-9901-107	L990142-8	01/18/99	CB-43
9	EVT-9901-108	L990142-9	01/18/99	CB-44
10	EVT-9901-109	L990142-10	01/19/99	CB-83
4	EVT-9901-110	L990142-11	01/19/99	CB-10
4	EVT-9901-111	L990142-12	01/18/99	CB-9
6	EVT-9901-112	L990142-13	01/18/99	CB-20
7	EVT-9901-113	L990142-14	01/19/99	CB-29
7	EVT-9901-114	L990142-15	01/19/99	CB-32
6	EVT-9901-115	L990142-16	01/19/99	CB-15
8	EVT-9901-116	L990142-17	01/19/99	CB-42
9	EVT-9901-117	L990142-18	01/19/99	CB-46
5	EVT-9901-118	L990142-19	01/19/99	CB-14
5	EVT-9901-119	L990142-20	01/19/99	CB-14
11	EVT-9901-120	L990142-21	01/18/99	MH-3
12	EVT-9901-121	L990142-22	01/18/99	MH-6
11	EVT-9901-122	L990142-23	01/18/99	MH-2
13	EVT-9901-123	L990142-24	01/19/99	SEEP1
3	EVT-9901-124	L990142-25	01/19/99	440 OUTFALL
1	EVT-9901-125	L990142-26	01/20/99	RINSATE
2	EVT-9901-126	L990142-27	01/20/99	RINSATE
1	EVT-9901-127		01/20/99	BFS
1	EVT-9901-127	L990142-28	01/20/99	BFS
15	EVT-9901-200	L990208-1	01/28/99	SW-2
17	EVT-9901-201	L990208-2	01/28/99	SW-19
16	EVT-9901-202	L990208-3	01/28/99	SW-18
15	EVT-9901-203	L990208-4	01/28/99	SW-14
14	EVT-9901-204	L990208-5	01/28/99	SW-1
12	EVT-9901-205	L990208-6	01/28/99	MH-6
12	EVT-9901-206	L990208-7	01/28/99	MH-6
12	EVT-9901-207	L990208-8	01/28/99	MH-3
10	EVT-9901-208	L990208-9	01/28/99	CB-83
7	EVT-9901-209	L990208-10	01/28/99	CB-32
6	EVT-9901-210	L990208-11	01/28/99	CB-20
5	EVT-9901-211	L990208-12	01/28/99	CB-14
9	EVT-9901-212	L990208-13	01/28/99	CB-46
16	EVT-9901-213	L990208-14	01/28/99	SW-17
2	EVT-9901-214	L990208-15	01/28/99	RINSATE
11	EVT-9901-215	L990208-16	01/28/99	MH-2
4	EVT-9901-216	L990208-17	01/28/99	CB-9
13	EVT-9901-217	L990208-18	01/28/99	SEEP1
8	EVT-9901-218	L990208-19	01/28/99	CB-43
5	EVT-9901-219	L990208-20	01/28/99	CB-10
7	EVT-9901-220	L990208-21	01/28/99	CB-29
9	EVT-9901-221	L990208-22	01/28/99	CB-44
6	EVT-9901-222	L990208-23	01/28/99	CB-15
8	EVT-9901-223	L990208-24	01/28/99	CB-42
2	EVT-9901-224	L990208-25	01/28/99	RINSATE
3	EVT-9901-225	L990208-26	01/28/99	440 OUTFALL
3	EVT-9901-226	L990208-27	01/28/99	440 OUTFALL
1	EVT-9901-227		01/29/99	BFS
1	EVT-9901-227	L990208-28	01/29/99	BFS
10	EVT-9901-228	L990208-29	01/28/99	EMVD-TO-MH2
4	EVT-9901-229	L990208-30	01/28/99	BUTLER-TO-MH3
3	EVT-9901-230	L990208-31	01/28/99	BUTLER-MANHOLE
10	EVT-9901-231	L990208-32	01/28/99	EAST-TO-MH2
13	EVT-9902-900	L990389-1	02/22/99	MH-7
11	EVT-9902-901	L990389-2	02/22/99	MH-1
13	EVT-9902-SEEP1	902033-1	02/05/99	SEEP1
14	EVT-9902-SEEP2	902033-2	02/05/99	SEEP2
16	EVT-9903-500	30502103-1	03/19/99	SW-18
14	EVT-9903-501	30502103-2	03/19/99	SNOHO OUTFALL

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
1		EVT-9901-127	01/20/99	BFS
1		EVT-9901-227	01/29/99	BFS
16	30502103-1	EVT-9903-500	03/19/99	SW-18
14	30502103-2	EVT-9903-501	03/19/99	SNOHO OUTFALL
13	902033-1	EVT-9902-SEEP1	02/05/99	SEEP1
14	902033-2	EVT-9902-SEEP2	02/05/99	SEEP2
14	L990142-1	EVT-9901-100	01/18/99	SW-1
10	L990142-10	EVT-9901-109	01/19/99	CB-83
4	L990142-11	EVT-9901-110	01/19/99	CB-10
4	L990142-12	EVT-9901-111	01/18/99	CB-9
6	L990142-13	EVT-9901-112	01/18/99	CB-20
7	L990142-14	EVT-9901-113	01/19/99	CB-29
7	L990142-15	EVT-9901-114	01/19/99	CB-32
6	L990142-16	EVT-9901-115	01/19/99	CB-15
8	L990142-17	EVT-9901-116	01/19/99	CB-42
9	L990142-18	EVT-9901-117	01/19/99	CB-46
5	L990142-19	EVT-9901-118	01/19/99	CB-14
15	L990142-2	EVT-9901-101	01/18/99	SW-2
5	L990142-20	EVT-9901-119	01/19/99	CB-14
11	L990142-21	EVT-9901-120	01/18/99	MH-3
12	L990142-22	EVT-9901-121	01/18/99	MH-6
11	L990142-23	EVT-9901-122	01/18/99	MH-2
13	L990142-24	EVT-9901-123	01/19/99	SEEP1
3	L990142-25	EVT-9901-124	01/19/99	440 OUTFALL
1	L990142-26	EVT-9901-125	01/20/99	RINSATE
2	L990142-27	EVT-9901-126	01/20/99	RINSATE
1	L990142-28	EVT-9901-127	01/20/99	BFS
16	L990142-3	EVT-9901-102	01/18/99	SW-18
17	L990142-4	EVT-9901-103	01/18/99	SW-19
16	L990142-5	EVT-9901-104	01/18/99	SW-17
15	L990142-6	EVT-9901-105	01/18/99	SW-14
15	L990142-7	EVT-9901-106	01/18/99	SW-14
8	L990142-8	EVT-9901-107	01/18/99	CB-43
9	L990142-9	EVT-9901-108	01/18/99	CB-44
15	L990208-1	EVT-9901-200	01/28/99	SW-2
7	L990208-10	EVT-9901-209	01/28/99	CB-32
6	L990208-11	EVT-9901-210	01/28/99	CB-20
5	L990208-12	EVT-9901-211	01/28/99	CB-14
9	L990208-13	EVT-9901-212	01/28/99	CB-46
16	L990208-14	EVT-9901-213	01/28/99	SW-17
2	L990208-15	EVT-9901-214	01/28/99	RINSATE
11	L990208-16	EVT-9901-215	01/28/99	MH-2
4	L990208-17	EVT-9901-216	01/28/99	CB-9
13	L990208-18	EVT-9901-217	01/28/99	SEEP1
8	L990208-19	EVT-9901-218	01/28/99	CB-43
17	L990208-2	EVT-9901-201	01/28/99	SW-19
5	L990208-20	EVT-9901-219	01/28/99	CB-10
7	L990208-21	EVT-9901-220	01/28/99	CB-29
9	L990208-22	EVT-9901-221	01/28/99	CB-44
6	L990208-23	EVT-9901-222	01/28/99	CB-15
8	L990208-24	EVT-9901-223	01/28/99	CB-42
2	L990208-25	EVT-9901-224	01/28/99	RINSATE
3	L990208-26	EVT-9901-225	01/28/99	440 OUTFALL
3	L990208-27	EVT-9901-226	01/28/99	440 OUTFALL
1	L990208-28	EVT-9901-227	01/29/99	BFS
10	L990208-29	EVT-9901-228	01/28/99	EMVD-TO-MH2
16	L990208-3	EVT-9901-202	01/28/99	SW-18
4	L990208-30	EVT-9901-229	01/28/99	BUTLER-TO-MH3
3	L990208-31	EVT-9901-230	01/28/99	BUTLER-MANHOLE
10	L990208-32	EVT-9901-231	01/28/99	EAST-TO-MH2
15	L990208-4	EVT-9901-203	01/28/99	SW-14
14	L990208-5	EVT-9901-204	01/28/99	SW-1
12	L990208-6	EVT-9901-205	01/28/99	MH-6
12	L990208-7	EVT-9901-206	01/28/99	MH-6
12	L990208-8	EVT-9901-207	01/28/99	MH-3
10	L990208-9	EVT-9901-208	01/28/99	CB-83
13	L990389-1	EVT-9902-900	02/22/99	MH-7
11	L990389-2	EVT-9902-901	02/22/99	MH-1

COMPOSITE SAMPLING RESULTS

DATA VALIDATION REPORT

INORGANICS ANALYSES

(Arsenic, Cadmium, Lead)

EVERETT STORM WATER INVESTIGATION

January and February 1999

Composite Sample Data from Autosamplers

Prepared by
Hydrometrics, Inc.
2727 Airport Road
Helena, MT 59601

Prepared: April 1999

TABLE OF CONTENTS

LIST OF APPENDICES

GLOSSARY OF TERMS

CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
FAA	Flame Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
HGAA	Hydride Generation Atomic Absorption
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
LCS	Laboratory Control Sample
MSA	Method of Standard Additions
PB	Preparation Blank
PRDL	Project Required Detection Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SOW	Statement of Work
TDS	Total Dissolved Solids

SUMMARY

Composite storm water samples collected from autosamplers for the Everett Storm Water Investigation during January and February of 1999 at four sites (CB-9, MH-2, SW-17, and SW-18) were analyzed for total arsenic, cadmium, and lead at Asarco's Technical Services Laboratory in Salt Lake City, Utah. These data have been reviewed in accordance with the EPA's data validation guidelines (EPA, 1994) and the project work plan (Hydrometrics, 1998). Deviations from prescribed quality control procedures and/or exceedances of quality control limits have been noted, and results have been flagged in the database. All tables are in Appendix 1. Data validation flags are defined in Table 1. A complete listing of flagged data including the reason for each flag is in Table 2.

- Data quality objectives for precision, accuracy, and completeness have been met for the data covered in this report; these are discussed in Section 11.
- Laboratory quality control sample requirements were met, both for frequency and values.
- The following quality control violations resulted in the flagging of data:
  Two field duplicates were out of control limits for total lead; the four associated total lead results were flagged to indicate the possible lack of reproducibility.

Taken as a whole, this data set provides useful information for the Everett Storm Water Investigation providing that the possible lack of reproducibility indicated by the flags is taken into account. Overall, 99.5 percent of the laboratory data may be used without qualification (827 out of 831 results); the rest of the data have been flagged with validation codes to assist in their interpretation.

DATA VALIDATION REPORT

Prepared by:	Clare Bridge
Reviewed by:	Jenny Vanek

DATA VALIDATION REPORT

1. INTRODUCTION

- This validation applies to data from instrumented monitoring sites as part of the Everett Storm Water Investigation. Samples were collected from the automated samplers from 1/28/99 to 2/21/99. In all, 22 quality control samples and 255 non-quality control samples were submitted to the laboratory. The quality control samples included eight field blanks, twelve field duplicates, and two blind field standards.

  There were four instrumented sampling sites: CB-9, MH-2, SW-17, and SW-18. The number of samples submitted to the laboratory is summarized in the following table:

Date	CB-9	MH-2	SW-17	SW-18	Total # at Site	Field Duplicates	Field Blanks	Field Standards
1/28/99	1	0	1	0	2	0	0	0
1/29/99	4	0	4	0	8	0	0	0
1/30/99	4	0	4	0	8	0	0	0
1/31/99	4	0	4	0	8	0	0	0
2/1/99	0	0	3	0	3	1	2	0
2/3/99	2	1	1	1	5	0	0	0
2/4/99	3	5	5	5	18	0	0	0
2/5/99	4	5	5	4	18	2	0	0
2/6/99	4	4	4	4	16	0	0	0
2/7/99	4*	4	4	4	16	0	0	0
2/8/99	4	2	4	5	15	1	0	0
2/9/99	0	0	4	4	8	0	0	0
2/10/99	5	2	4	4	15	1	0	0
2/11/99	0	9	5	4	18	1	1	1
2/12/99	0	1	1	1	3	0	0	0
2/13/99	2	4	4	5	15	1	0	0
2/14/99	0	4	4	4	12	1	0	0
2/15/99	0	0	5	4	9	1	1	1
2/16/99	2	2	5	4	13	1	0	0
2/17/99	2	4	4	4	14	0	0	0
2/18/99	3	4	4	4	15	0	0	0
2/19/99	3	3	4	5	15	1	0	0
2/20/99	1	2	4	4	11	1	2	0
2/21/99	0	0	1	1	2	0	2	1
Totals:	52	56	88	71	267	12	8	3
Total non QC = total # collected at sites - field duplicates = 267 - 12 = 255 non-QC samples								

* The bottle leaked during shipment for sample EVT-9902-213 collected at CB-9 at 3:30 on 2/7/99. No laboratory analyses could be performed for this sample.

- Validation procedures used are generally consistent with (check all that apply):

  X EPA CLP National Functional Guidelines for Inorganics Data Review
  X Work Plan (Hydrometrics, 1998)
  ___ Other

- Overall level of validation:

  ___ Contract Laboratory Program (CLP)
  _X_ Standard
  ___ Visual

  Notes: Both field and laboratory quality control samples were evaluated.

  Laboratory digestion quality control samples (laboratory duplicates, laboratory matrix spikes, laboratory control samples, and laboratory preparation blanks) were evaluated according to the EPA's validation guidelines; all were found to be within control limits.

  Verification of values in the raw data was not required for this project.

  The requirements for the field quality control samples referenced in the work plan were established for typical sample collection by field personnel to verify proper sampling techniques. Composite samples collected from autosamplers do not follow typical field collection procedures, and the work plan requirements are not appropriate. However, several field quality control samples were submitted to provide some level of quality assurance. Evaluation of individual field quality control samples is further discussed in Section 3.

2. DELIVERABLES

- All laboratory document deliverables were present as specified in the project contract.

  _X_ Yes
  ___ No

- All documentation of field procedures was provided as required.

  _X_ Yes
  ___ No

3. FIELD QUALITY CONTROL SAMPLES

Samples from the autosamplers were submitted in four shipments. The sample delivery groups and numbers of associated field quality control are summarized in the following table:

Shipment	Sample Dates	Lab Batches	Duplicates	DI Blanks	Standards
First	1/28/99 - 2/1/99	L990217	1	2	0
Second	2/3/99 - 2/11/99	L990289	5	0	1
Third	2/13/99 - 2/21/99	L990388 L990389	4	4	1
Fourth	2/11/99 - 2/15/99	L990476	2	2	1

- **Blanks**: Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

  DI, trip, rinsate, or any other field blanks have been carried out at the proper frequency.
  ___ Yes
  ___ No
  _X_ NA

  Notes: The project work plan required equipment blanks to be collected from filter apparatus prior to the collection of a sample. Equipment blanks are used as controls for possible contamination in the field during the sampling process.

  Because the composite storm water samples were not collected and filtered by field personnel, the equipment blank requirement does not apply. However, field personnel submitted DI blanks as quality control. As shown is the table at the beginning of this section, blanks were submitted with all but the second shipment of samples.

  Reported results on the field blanks are less than the contract required detection limits (CRDL) or the project required detection limits (PRDL) if project detection limits have been specified.
  _X_ Yes
  ___ No

  Notes: When an analyte is detected in a blank, associated results up to 5 times the blank level are flagged to indicate that the results may be biased high due to contamination. Results "associated" with a field blank are generally results for samples collected on the same day as the blank.

- **Field duplicates**

  Field duplicates have been collected at the proper frequency.
  ___ Yes
  ___ No
  _X_ NA

  Notes: The project work plan sets field duplicate frequency at "5 percent or 1 per day, whichever is greater" (work plan, p. C-23). However, as stated in Section 1, these requirements are not applicable to the autosamplers. However, twelve field duplicates were submitted over the four sample shipments.

  Field duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20 percent or less for water matrix, 35 percent or less for soil matrix). If the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PRDL for water matrix, within ± 2 times the PRDL for soil matrix.
  ___ Yes
  _X_ No

Notes: The sample/field duplicate pair collected at SW-17 on February 1 (EVT-9901-328 & -329) had a difference greater than the PRDL of 0.005 ppm for total lead (0.035 and <0.005 ppm). The total lead results for the sample and the duplicate were flagged to indicate a possible lack of reproducibility.

Similarly, the sample/field duplicate pair collected at MH-2 on February 20 (EVT-9902-407 & -408) had a difference greater than the PRDL of 0.005 ppm for total lead (0.033 and 0.015 ppm). The total lead results for the sample and the duplicate were flagged to indicate a possible lack of reproducibility.

Flags for field duplicate exceedances indicate possible variability in sample results due to the combined effects of variations in field sampling techniques, sample preparation, and laboratory analytical procedures.

Flagging: J_4/UJ_4

- **Field standards**

Field standards have been collected at the proper frequency.

_X_ Yes
___ No

Notes: The work plan required one blind field standard to be submitted with each major shipment of samples based on availability. In this case, standards were submitted for all but the first shipment of samples. The ERA standards were sent to the laboratory for the specified dilution.

Recoveries on the field standards were within control limits (80 to 120 percent recovery for water).

_X_ Yes
___ No

4. LABORATORY PROCEDURES

- **Laboratory procedures followed**

___ CLP-SOW
_X_ SW-846
___ Methods for Chemical Analysis of Water and Wastes
___ XRF Standard Operating Procedures
___ Other

- **Holding times met**

_X_ Yes
___ No

- **Consistency with project requirements**

  Analyses were carried out as requested.
  _X_ Yes
  ___ No

  Project specified methods were used.
  _X_ Yes
  ___ No

5. DETECTION LIMITS

The following table lists the laboratory's reporting level by analytical method and compares it to the project detection limit (PRDL).

Parameter	Analysis Method	Reporting Level (ppm)	PRDL (ppm)
Arsenic	ICP-MS	0.005	0.005
Cadmium	ICP-MS	0.003	0.003
Lead	ICP-MS	0.005	0.005

- Reporting detection limits met project required detection limits (PRDLs).
  _X_ Yes
  ___ No

- The laboratory provided instrument detection limits (IDLs).
  ___ Yes
  ___ No
  _X_ NA - This was not required for the project.

6. LABORATORY BLANKS

Please note that the highest blank value associated with any particular analyte is the blank value used for the flagging process.

- **Preparation blanks**

  Preparation blanks were prepared and analyzed at the required frequency.
  _X_ Yes
  ___ No

  All the analytes in the preparation blank were less than the CRDL (or the PRDL if a project detection limit has been specified).
  _X_ Yes
  ___ No

7. LABORATORY MATRIX SPIKES

- A matrix spike sample (pre-digestion) was analyzed for each digestion batch and/or matrix, or as required by the laboratory method.

  _X_ Yes
  ___ No

- Matrix spike recoveries were within the required control limits (75-125 percent).

  _X_ Yes
  ___ No

8. LABORATORY DUPLICATES

- Laboratory duplicate samples were analyzed at the proper frequency.

  _X_ Yes
  ___ No

- The laboratory duplicate relative percent differences (RPDs) were within the required control limits (RPD of 20 percent or less for water matrix, 35 percent or less for soil matrix). For low concentration data, that is if the sample or duplicate result is less than 5 times the PRDL, the RPD criteria are not used. In these cases, the difference between the sample and the duplicate results must be within ± the PRDL for water matrix, within ± 2 times the PRDL for soil matrix.

  _X_ Yes
  ___ No

9. LABORATORY CONTROL STANDARDS

- The reference material used was of the correct matrix and concentration.

  _X_ Yes
  ___ No

- LCSs were prepared and analyzed at the proper frequency

  _X_ Yes
  ___ No

- LCS recoveries were within the required control limits (80-120 percent for water, within the certified range for soils).

  _X_ Yes
  ___ No

10. DATA QUALITY OBJECTIVES

- **Project data quality objectives (DQO's) met.**

  _X_ Yes

  ___ No

Accuracy

Accuracy for this project is assessed using blind field standards, laboratory-spiked samples, and laboratory reference standards. Target accuracy for this project is acceptance of 90 percent of these QC sample results as valid and within control limits (80 to 120 percent recovery for standards, 75 to 125 percent recovery for spikes).

Target accuracy was met. All field standard results and all laboratory QC sample results were within control limits.

Precision

Precision for this project is assessed using field duplicates and laboratory duplicates. Target precision for this project is acceptance of 90 percent of these QC sample results as valid and within control limits (a relative percent difference of 20 percent or less).

Target precision was met. All of the laboratory duplicate results and 94 percent of the field duplicate results were within control limits.

Completeness

The target completeness for this project is assessment of at least 90 percent of the sample results as "valid".

Target completeness was met; no data were rejected. Ninety-nine point five percent of the laboratory data may be used without qualification (827 out of 831 laboratory results). The remaining results may be used with caution, taking into account the possible lack of reproducibility indicated by the flags on these four low-concentration total lead results.

REFERENCES

(References appropriate to this project have been checked)

__ Hem, J.D., 1992. Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition. US Geological Survey Water Supply Paper 2254.

_X_ Hydrometrics Project Work Plan. Sampling and Analysis Plan. Storm Water and Storm Drain Sediments, Characterization and Controls Work Plan, Everett, Washington. October 1997, revised April 1998.

_X_ U.S. Environmental Protection Agency, 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.

__ U.S. Environmental Protection Agency, 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Revised March 1983. (EPA, 1983)

__ U.S. Environmental Protection Agency, 1993. USEPA Contract Laboratory Program Statement of Work for Inorganics Analysis . Document Number ILM03.0

_X_ U.S. Environmental Protection Agency, 1994. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February 1994.

TABLE 1.

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 - Calibration range exceeded or significant deviation from known value. Possible bias.
3 - Holding time not met. Indicates possible bias.
4 - Other QC outside control limits.

UJ - The material was analyzed for, but was not detected above the associated value.

Subscripts for the "UJ" qualifier:

1 - Blank contamination. Indicates possible high bias and/or false positive.
2 - Calibration range exceeded or significant deviation from known value. Possible bias.
3 - Holding time not met. Indicates possible bias.
4 - Other QC 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 - Anomalous data. No apparent explanation for discrepancy in data. (Not an EPA code.)

Table 2. Summary of Flagged Data
Everett Stormwater Investigation
Autosampler Data, January - February 1999

Site	Sample No	Lab No	Date	Parameter	Result	Flag	Reason for Flag
MH-2	EVT-9902-407	L990339-47	02/20/99	LEAD (PB)(TOT)	0.033	J4	Field duplicate difference >± 0.005 ppm
MH-2	EVT-9902-408	L990339-48	02/20/99	LEAD (PB)(TOT)	0.015	J4	Field duplicate difference >± 0.005 ppm
SW-17	EVT-9901-328	L990217-28	02/01/99	LEAD (PB)(TOT)	0.035	J4	Field duplicate difference >± 0.005 ppm
SW-17	EVT-9901-329	L990217-29	02/01/99	LEAD (PB)(TOT)	<0.005	UJ4	Field duplicate difference >± 0.005 ppm

APPENDIX 2

DATABASE

TABLE OF CONTENTS BY SITE TYPE

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	BFS	BFS	BFS	BFS	BFS	BFS
SAMPLE DATE	02/11/99	02/11/99	02/15/99	02/15/99	02/21/99	02/21/99
SAMPLE TIME		11:00		13:05		17:15
LAB	TRUE VALUE	TSC-SLC	TRUE VALUE	TSC-SLC	TRUE VALUE	TSC-SLC
LAB NUMBER	ERA #436	L990289121	ERA #437	L990476-33	ERA #436	L990339-53
REMARKS	STANDARD		STANDARD	STANDARD	STANDARD	STANDARD
OTHER INFO					Lot #436	
SAMPLE NUMBER	EVT-9902-320	EVT-9902-320	EVT-9903-833	EVT-9903-833	EVT-9902-413	EVT-9902-413
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.181	0.17	0.2	0.21	0.181	0.21
CADMIUM (CD) TOT	0.113	0.1	0.12	0.12	0.113	0.12
LEAD (PB) TOT	0.719	0.7	0.66	0.62	0.719	0.75

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	DI BLANK	DI BLANK	DI BLANK	DI BLANK	DI BLANK	DI BLANK
SAMPLE DATE	02/01/99	02/01/99	02/11/99	02/15/99	02/20/99	02/20/99
SAMPLE TIME	15:30	16:00	08:00	11:00	13:15	14:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-30	L990217-31	L990476-31	L990476-32	L990339-49	L990339-50
REMARKS	BLANK	BLANK	BLANK	BLANK	BLANK	BLANK
SAMPLE NUMBER	EVT-9901-330	EVT-9901-331	EVT-9903-831	EVT-9903-832	EVT-9902-409	EVT-9902-410
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: QUALITY CONTROL --

SITE CODE	DI BLANK	DI BLANK
SAMPLE DATE	02/21/99	02/21/99
SAMPLE TIME	15:15	16:15
LAB	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-51	L990339-52
REMARKS	BLANK	BLANK
SAMPLE NUMBER	EVT-9902-411	EVT-9902-412
-- METALS & MINOR CONSTITUENTS --		
ARSENIC (AS) TOT	<0.005	<0.005
CADMIUM (CD) TOT	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	01/28/99	01/29/99	01/29/99	01/29/99	01/29/99	01/30/99
SAMPLE TIME	19:30	01:30	07:30	13:30	19:30	01:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-1	L990217-2	L990217-3	L990217-4	L990217-5	L990217-6
SAMPLE NUMBER	EVT-9901-300	EVT-9901-301	EVT-9901-302	EVT-9901-303	EVT-9901-304	EVT-9901-305
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.17	0.48	0.85	1.9	0.72	0.7
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.026	0.012	<0.005	<0.005	0.017	0.012

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	01/30/99	01/30/99	01/30/99	01/31/99	01/31/99	01/31/99
SAMPLE TIME	07:30	13:30	19:30	01:30	07:30	13:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-7	L990217-8	L990217-9	L990217-10	L990217-11	L990217-12
SAMPLE NUMBER	EVT-9901-306	EVT-9901-307	EVT-9901-308	EVT-9901-309	EVT-9901-310	EVT-9901-311
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	1.6	1.2	1.6	1.3	0.53	0.23
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	0.019	0.014	0.006	0.008	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	01/31/99	02/03/99	02/03/99	02/04/99	02/04/99	02/04/99
SAMPLE TIME	19:30	18:00	24:00	06:00	16:20	22:20
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-13	L990289-1	L990289-2	L990289-3	L990289-4	L990289-5
SAMPLE NUMBER	EVT-9901-312	EVT-9902-200	EVT-9902-201	EVT-9902-202	EVT-9902-203	EVT-9902-204
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.05	0.075	0.063	0.083	0.054	0.049
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.013	0.007	0.01	0.014	0.005	0.007

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	02/05/99	02/05/99	02/05/99	02/05/99	02/06/99	02/06/99
SAMPLE TIME	04:20	10:20	15:30	21:30	03:30	09:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-6	L990289-7	L990289-8	L990289-9	L990289-10	L990289-11
SAMPLE NUMBER	EVT-9902-205	EVT-9902-206	EVT-9902-207	EVT-9902-208	EVT-9902-209	EVT-9902-210
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.028	0.054	0.081	0.26	0.12	0.26
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	0.021	0.011	0.005	0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	02/06/99	02/06/99	02/07/99	02/07/99	02/07/99	02/07/99
SAMPLE TIME	15:30	21:30	03:30	09:30	15:30	21:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-12	L990289-13	L990289-14	L990289-15	L990289-16	L990289-17
REMARKS			NO SAMPLE			
OTHER INFO			Bottle Leaked			
SAMPLE NUMBER	EVT-9902-211	EVT-9902-212	EVT-9902-213	EVT-9902-214	EVT-9902-215	EVT-9902-216
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.49	0.63		0.59	0.29	0.48
CADMIUM (CD) TOT	<0.003	<0.003		<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	0.009		0.006	0.011	0.041

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	02/08/99	02/08/99	02/08/99	02/08/99	02/10/99	02/10/99
SAMPLE TIME	03:30	09:30	16:15	22:15	04:15	10:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-18	L990289-19	L990289-20	L990289-21	L990289-22	L990289-23
SAMPLE NUMBER	EVT-9902-217	EVT-9902-218	EVT-9902-219	EVT-9902-220	EVT-9902-221	EVT-9902-222
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.34	0.4	0.17	0.16	0.073	0.068
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	<0.005	0.023	0.006	0.011	0.009

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	02/10/99	02/10/99	02/10/99	02/13/99	02/13/99	02/16/99
SAMPLE TIME	16:15	16:25	22:15	10:00	16:00	15:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-24	L990289-25	L990289-26	L990338-1	L990338-2	L990338-3
REMARKS		DUPLICATE				
SAMPLE NUMBER	EVT-9902-223	EVT-9902-224	EVT-9902-225	EVT-9902-321	EVT-9902-322	EVT-9902-323
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.054	0.052	0.071	0.14	0.037	0.062
CADMIUM (CD) TOT	0.003	0.003	0.004	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.067	0.062	0.047	0.11	0.022	0.031

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	CB-9	CB-9
SAMPLE DATE	02/16/99	02/17/99	02/17/99	02/18/99	02/18/99	02/18/99
SAMPLE TIME	21:45	03:45	21:45	03:45	15:45	21:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990338-4	L990338-5	L990338-6	L990338-7	L990338-8	L990338-9
SAMPLE NUMBER	EVT-9902-324	EVT-9902-325	EVT-9902-326	EVT-9902-327	EVT-9902-328	EVT-9902-329
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.049	0.05	0.063	0.06	0.082	0.076
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.026	0.009	0.04	0.023	0.046	0.02

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	CB-9	CB-9	CB-9	CB-9	MH-2
SAMPLE DATE	02/19/99	02/19/99	02/19/99	02/20/99	02/03/99
SAMPLE TIME	03:45	09:45	21:45	03:45	19:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	*L990338-10*	*L990338-11*	*L990338-12*	*L990338-13*	L990289-92
SAMPLE NUMBER	EVT-9902-330	EVT-9902-331	EVT-9902-332	EVT-9902-333	EVT-9902-291
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	0.074	0.027	0.051	0.061	1.8
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.034	0.01	0.064	0.027	0.028

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/04/99	02/04/99	02/04/99	02/04/99	02/04/99	02/05/99
SAMPLE TIME	01:30	07:30	13:30	19:30	24:00	06:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-93	L990289-94	L990289-95	L990289-96	L990289-97	L990289-98
SAMPLE NUMBER	EVT-9902-292	EVT-9902-293	EVT-9902-294	EVT-9902-295	EVT-9902-296	EVT-9902-297
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	2.6	2.1	2.2	3.5	2.7	4.3
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.011	0.01	0.015	0.02	0.028	0.024

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/05/99	02/05/99	02/05/99	02/05/99	02/06/99	02/06/99
SAMPLE TIME	12:00	12:15	16:45	22:15	04:45	10:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-99	L990289100	L990289101	L990289102	L990289103	L990289104
REMARKS		DUPLICATE				
SAMPLE NUMBER	EVT-9902-298	EVT-9902-299	EVT-9902-300	EVT-9902-301	EVT-9902-302	EVT-9902-303
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	3.7	3.6	1.8	2.6	5.0	3.6
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.023	0.019	0.025	0.021	<0.005	0.01

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/06/99	02/06/99	02/07/99	02/07/99	02/07/99	02/07/99
SAMPLE TIME	16:45	22:45	04:45	10:45	16:45	22:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289105	L990289106	L990289107	L990289108	L990289109	L990289110
SAMPLE NUMBER	EVT-9902-304	EVT-9902-305	EVT-9902-306	EVT-9902-307	EVT-9902-308	EVT-9902-309
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	4.0	5.2	6.2	6.0	4.8	5.1
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	0.004
LEAD (PB) TOT	0.03	0.02	0.015	0.022	0.024	0.01

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/08/99	02/08/99	02/10/99	02/10/99	02/11/99	02/11/99
SAMPLE TIME	04:45	10:45	12:00	23:00	05:00	06:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289111	L990289112	L990289113	L990289114	L990289115	L990289116
SAMPLE NUMBER	EVT-9902-310	EVT-9902-311	EVT-9902-312	EVT-9902-313	EVT-9902-314	EVT-9902-315
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	4.9	4.7	3.8	3.4	4.0	<0.005
CADMIUM (CD) TOT	0.004	0.005	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.013	0.018	0.006	0.008	0.007	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/11/99	02/11/99	02/11/99	02/11/99	02/11/99	02/11/99
SAMPLE TIME	07:00	08:00	09:00	10:00	05:00	16:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289117	L990289118	L990289119	L990289120	L990476-23	L990476-24
SAMPLE NUMBER	EVT-9902-316	EVT-9902-317	EVT-9902-318	EVT-9902-319	EVT-9903-823	EVT-9903-824
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	<0.005	<0.005	<0.005	<0.005	3.5	3.3
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	0.004	0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	0.018	0.011

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/11/99	02/12/99	02/13/99	02/13/99	02/13/99	02/13/99
SAMPLE TIME	22:30	04:30	04:30	10:30	16:30	22:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-25	L990476-26	L990339-29	L990339-30	L990339-31	L990339-32
SAMPLE NUMBER	EVT-9903-825	EVT-9903-826	EVT-9902-389	EVT-9902-390	EVT-9902-391	EVT-9902-392
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	3.0	3.6	2.7	2.6	2.9	2.7
CADMIUM (CD) TOT	0.003	0.003	0.003	0.003	0.003	0.004
LEAD (PB) TOT	0.027	0.006	0.013	0.014	0.012	0.014

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/14/99	02/14/99	02/14/99	02/14/99	02/16/99	02/16/99
SAMPLE TIME	04:30	10:30	24:00	23:55	12:00	18:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-33	L990476-27	L990476-28	L990476-29	L990339-34	L990339-35
REMARKS				DUPLICATE		
SAMPLE NUMBER	EVT-9902-393	EVT-9903-827	EVT-9903-828	EVT-9903-829	EVT-9902-394	EVT-9902-395
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	2.9	3.1	3.0	2.9	1.2	0.9
CADMIUM (CD) TOT	0.006	0.009	0.003	0.003	<0.003	<0.003
LEAD (PB) TOT	0.025	0.049	0.024	0.023	0.027	0.026

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2
SAMPLE DATE	02/17/99	02/17/99	02/17/99	02/17/99	02/18/99	02/18/99
SAMPLE TIME	06:00	12:00	18:00	24:00	06:00	12:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-36	L990339-37	L990339-38	L990339-39	L990339-40	L990339-41
SAMPLE NUMBER	EVT-9902-396	EVT-9902-397	EVT-9902-398	EVT-9902-399	EVT-9902-400	EVT-9902-401
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	2.1	1.9	1.7	1.0	1.8	1.9
CADMIUM (CD) TOT	<0.003	<0.003	0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.008	0.011	0.038	0.034	0.029	0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	MH-2	MH-2	MH-2	MH-2	MH-2	
SAMPLE DATE	02/18/99	02/18/99	02/19/99	02/19/99	02/19/99	02/20/99	
SAMPLE TIME	18:00	24:00	06:00	12:00	18:00	12:00	
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	
LAB NUMBER	L990339-42	L990339-43	L990339-44	L990339-45	L990339-46	L990339-47	
SAMPLE NUMBER	EVT-9902-402	EVT-9902-403	EVT-9902-404	EVT-9902-405	EVT-9902-406	EVT-9902-407	
-- METALS & MINOR CONSTITUENTS --							
ARSENIC (AS) TOT	1.7	1.8	1.8	1.8	2.9	3.0	
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	
LEAD (PB) TOT	0.019	0.006	0.009	0.019	0.009	0.033	J4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	MH-2	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/20/99	01/28/99	01/29/99	01/29/99	01/29/99
SAMPLE TIME	12:15	20:30	03:30	09:30	15:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-48	L990217-15	L990217-16	L990217-17	L990217-18
REMARKS	DUPLICATE				
SAMPLE NUMBER	EVT-9902-408	EVT-9901-315	EVT-9901-316	EVT-9901-317	EVT-9901-318
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	2.8	0.024	0.032	0.066	0.096
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.015 J4	0.015	0.036	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	01/29/99	01/30/99	01/30/99	01/30/99	01/30/99	01/31/99
SAMPLE TIME	21:30	03:30	09:30	15:30	21:30	03:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-19	L990217-20	L990217-21	L990217-22	L990217-23	L990217-24
SAMPLE NUMBER	EVT-9901-319	EVT-9901-320	EVT-9901-321	EVT-9901-322	EVT-9901-323	EVT-9901-324
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.079	0.056	0.14	0.1	0.19	0.21
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.024	0.005	<0.005	0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	01/31/99	01/31/99	01/31/99	02/01/99	02/01/99	02/01/99
SAMPLE TIME	09:30	15:30	21:30	01:30	03:30	09:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990217-25	L990217-26	L990217-27	L990217-14	L990217-28	L990217-29
REMARKS						DUPLICATE
SAMPLE NUMBER	EVT-9901-325	EVT-9901-326	EVT-9901-327	EVT-9901-313	EVT-9901-328	EVT-9901-329
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.21	0.14	0.09	0.048	0.1	0.091
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	0.005	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	0.012	0.035 J4	<0.005 UJ4

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/03/99	02/04/99	02/04/99	02/04/99	02/04/99	02/04/99
SAMPLE TIME	19:00	01:00	07:00	13:00	17:30	23:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-59	L990289-60	L990289-61	L990289-62	L990289-63	L990289-64
SAMPLE NUMBER	EVT-9902-258	EVT-9902-259	EVT-9902-260	EVT-9902-261	EVT-9902-262	EVT-9902-263
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.022	0.049	0.044	0.025	0.014	0.015
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.017	<0.005	0.006	0.008	<0.005	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; B:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/05/99	02/05/99	02/05/99	02/05/99	02/05/99	02/06/99
SAMPLE TIME	05:30	11:30	16:15	16:30	22:15	04:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	*L990289-65*	*L990289-66*	*L990289-67*	*L990289-68*	*L990289-69*	*L990289-70*
REMARKS				DUPLICATE		
SAMPLE NUMBER	EVT-9902-264	EVT-9902-265	EVT-9902-266	EVT-9902-267	EVT-9902-268	EVT-9902-269
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.03	0.009	0.06	0.057	0.05	0.062
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.005	<0.005	0.02	0.02	0.016	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; *J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;*
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/06/99	02/06/99	02/06/99	02/07/99	02/07/99	02/07/99
SAMPLE TIME	10:15	16:15	22:15	04:15	10:15	16:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-71	L990289-72	L990289-73	L990289-74	L990289-75	L990289-76
SAMPLE NUMBER	EVT-9902-270	EVT-9902-271	EVT-9902-272	EVT-9902-273	EVT-9902-274	EVT-9902-275
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.055	0.053	0.07	0.12	0.11	0.15
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	0.01	0.005	<0.005	0.007	0.011

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/07/99	02/08/99	02/08/99	02/08/99	02/08/99	02/09/99
SAMPLE TIME	22:15	04:15	10:15	17:30	23:30	05:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-77	L990289-78	L990289-79	L990289-80	L990289-81	L990289-82
SAMPLE NUMBER	EVT-9902-276	EVT-9902-277	EVT-9902-278	EVT-9902-279	EVT-9902-280	EVT-9902-281
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.074	0.13	0.12	0.08	0.085	0.1
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.023	<0.005	<0.005	0.012	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/09/99	02/09/99	02/09/99	02/10/99	02/10/99	02/10/99
SAMPLE TIME	11:30	17:30	23:30	05:30	11:30	18:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-83	L990289-84	L990289-85	L990289-86	L990289-87	L990289-88
SAMPLE NUMBER	EVT-9902-282	EVT-9902-283	EVT-9902-284	EVT-9902-285	EVT-9902-286	EVT-9902-287
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.077	0.02	0.013	0.079	0.12	0.011
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/10/99	02/11/99	02/11/99	02/11/99	02/11/99	02/11/99
SAMPLE TIME	24:00	06:00	06:15	12:00	17:15	23:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-89	L990289-90	L990289-91	L990476-11	L990476-12	L990476-13
REMARKS			DUPLICATE			
SAMPLE NUMBER	EVT-9902-288	EVT-9902-289	EVT-9902-290	EVT-9903-811	EVT-9903-812	EVT-9903-813
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.009	0.008	0.008	0.007	0.065	0.031
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	0.072	0.03

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/12/99	02/13/99	02/13/99	02/13/99	02/13/99	02/14/99
SAMPLE TIME	05:15	05:15	11:15	17:15	23:15	05:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-14	L990338-14	L990338-15	L990338-16	L990338-17	L990338-18
SAMPLE NUMBER	EVT-9903-814	EVT-9902-334	EVT-9902-335	EVT-9902-336	EVT-9902-337	EVT-9902-338
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.021	0.12	0.041	0.009	0.015	0.031
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.016	0.014	0.019	<0.005	<0.005	0.007

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/14/99	02/14/99	02/14/99	02/15/99	02/15/99	02/15/99
SAMPLE TIME	11:15	17:15	23:15	05:15	11:15	11:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-15	L990476-16	L990476-17	L990476-18	L990476-19	L990476-20
REMARKS						DUPLICATE
SAMPLE NUMBER	EVT-9903-815	EVT-9903-816	EVT-9903-817	EVT-9903-818	EVT-9903-819	EVT-9903-820
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.035	0.036	0.037	0.046	0.047	0.044
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/15/99	02/15/99	02/16/99	02/16/99	02/16/99	02/16/99
SAMPLE TIME	17:15	23:15	05:15	11:15	11:30	16:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-21	L990476-22	L990338-19	L990338-20	L990338-21	L990338-22
REMARKS					DUPLICATE	
SAMPLE NUMBER	EVT-9903-821	EVT-9903-822	EVT-9902-339	EVT-9902-340	EVT-9902-341	EVT-9902-342
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.045	0.057	0.029	0.017	0.016	0.051
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	0.011	0.011	<0.005	<0.005	0.022

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/16/99	02/17/99	02/17/99	02/17/99	02/17/99	02/18/99
SAMPLE TIME	22:45	04:45	10:45	16:45	22:45	04:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990338-23	L990338-24	L990338-25	L990338-26	L990338-27	L990338-28
SAMPLE NUMBER	EVT-9902-343	EVT-9902-344	EVT-9902-345	EVT-9902-346	EVT-9902-347	EVT-9902-348
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.041	0.021	0.006	0.007	0.018	0.016
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.024	<0.005	<0.005	<0.005	0.012	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/18/99	02/18/99	02/18/99	02/19/99	02/19/99	02/19/99
SAMPLE TIME	10:45	16:45	22:45	04:45	10:45	16:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990338-29	L990338-30	L990338-31	L990338-32	L990338-33	L990338-34
SAMPLE NUMBER	EVT-9902-349	EVT-9902-350	EVT-9902-351	EVT-9902-352	EVT-9902-353	EVT-9902-354
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.022	0.03	0.02	0.025	0.02	0.006
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.008	0.012	0.007	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-17	SW-17	SW-17	SW-17	SW-17	SW-17
SAMPLE DATE	02/19/99	02/20/99	02/20/99	02/20/99	02/20/99	02/21/99
SAMPLE TIME	22:45	04:45	10:45	16:45	22:45	04:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990338-35	L990338-36	L990338-37	L990338-38	L990338-39	L990338-40
SAMPLE NUMBER	EVT-9902-355	EVT-9902-356	EVT-9902-357	EVT-9902-358	EVT-9902-359	EVT-9902-360
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.006	0.007	0.007	0.007	0.009	0.021
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	<0.005	<0.005	<0.005	0.007

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/03/99	02/04/99	02/04/99	02/04/99	02/04/99	02/04/99
SAMPLE TIME	18:15	00:15	6:15	12:15	17:00	23:00
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-27	L990289-28	L990289-29	L990289-30	L990289-31	L990289-32
SAMPLE NUMBER	EVT-9902-226	EVT-9902-227	EVT-9902-228	EVT-9902-229	EVT-9902-230	EVT-9902-231
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.12	0.1	0.086	0.078	0.08	0.092
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.006	0.007	0.008	0.005	0.006	0.007

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/05/99	02/05/99	02/05/99	02/05/99	02/06/99	02/06/99
SAMPLE TIME	05:00	11:00	15:45	21:45	03:45	09:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-33	L990289-34	L990289-35	L990289-36	L990289-37	L990289-38
SAMPLE NUMBER	EVT-9902-232	EVT-9902-233	EVT-9902-234	EVT-9902-235	EVT-9902-236	EVT-9902-237
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.093	0.076	0.098	0.064	0.071	0.09
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	<0.005	0.006	0.008	0.006	0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/06/99	02/06/99	02/07/99	02/07/99	02/07/99	02/07/99
SAMPLE TIME	15:45	21:45	03:45	09:45	15:45	21:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-39	L990289-40	L990289-41	L990289-42	L990289-43	L990289-44
SAMPLE NUMBER	EVT-9902-238	EVT-9902-239	EVT-9902-240	EVT-9902-241	EVT-9902-242	EVT-9902-243
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.093	0.095	0.097	0.12	0.13	0.11
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.006	0.008	0.006	0.006	0.006	0.006

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/08/99	02/08/99	02/08/99	02/08/99	02/08/99	02/09/99
SAMPLE TIME	03:45	09:45	16:45	17:00	22:45	04:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-45	L990289-46	L990289-47	L990289-48	L990289-49	L990289-50
REMARKS				DUPLICATE		
SAMPLE NUMBER	EVT-9902-244	EVT-9902-245	EVT-9902-246	EVT-9902-247	EVT-9902-248	EVT-9902-249
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.11	0.12	0.11	0.11	0.12	0.12
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	0.007	0.009	0.011	0.009	0.007

NOTES: All results in mg/L (Water) or mg/kg *(Soil) unless noted and are* laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/09/99	02/09/99	02/09/99	02/10/99	02/10/99	02/10/99
SAMPLE TIME	10:45	16:45	22:45	04:45	10:45	16:45
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-51	L990289-52	L990289-53	L990289-54	L990289-55	L990289-56
SAMPLE NUMBER	EVT-9902-250	EVT-9902-251	EVT-9902-252	EVT-9902-253	EVT-9902-254	EVT-9902-255
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.13	0.13	0.13	0.12	0.12	0.13
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	0.01	0.009	0.008	0.007	0.007

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/10/99	02/11/99	02/11/99	02/11/99	02/11/99	02/12/99
SAMPLE TIME	22:45	04:45	10:30	16:15	22:15	04:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990289-57	L990289-58	L990476-1	L990476-2	L990476-3	L990476-4
SAMPLE NUMBER	EVT-9902-256	EVT-9902-257	EVT-9903-800	EVT-9903-801	EVT-9903-802	EVT-9903-803
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.12	0.12	0.13	0.12	0.12	0.12
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	0.008	0.007	0.007	0.19	0.008

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/13/99	02/13/99	02/13/99	02/13/99	02/13/99	02/14/99
SAMPLE TIME	04:15	04:30	10:15	16:15	22:15	04:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-1	L990339-2	L990339-3	L990339-4	L990339-5	L990339-6
REMARKS		DUPLICATE				
SAMPLE NUMBER	EVT-9902-361	EVT-9902-362	EVT-9902-363	EVT-9902-364	EVT-9902-365	EVT-9902-366
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.1	0.095	0.083	0.087	0.085	0.082
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.007	0.005	0.11	<0.005	<0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/14/99	02/14/99	02/14/99	02/15/99	02/15/99	02/15/99
SAMPLE TIME	10:15	16:15	22:15	04:15	10:15	16:15
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-5	L990476-6	L990476-7	L990476-8	L990476-9	L990476-10
SAMPLE NUMBER	EVT-9903-805	EVT-9903-806	EVT-9903-807	EVT-9903-808	EVT-9903-809	EVT-9903-810
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.073	0.09	0.092	0.11	0.073	0.097
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	0.65	0.008	0.007	<0.005	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/15/99	02/16/99	02/16/99	02/16/99	02/16/99	02/17/99
SAMPLE TIME	22:15	04:15	10:15	16:10	22:10	04:10
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990476-30	L990339-7	L990339-8	L990339-9	L990339-10	L990339-11
SAMPLE NUMBER	EVT-9903-830	EVT-9902-367	EVT-9902-368	EVT-9902-369	EVT-9902-370	EVT-9902-371
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.094	0.089	0.042	0.076	0.075	0.061
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.005	0.007	<0.005	0.032	<0.005	0.012

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/17/99	02/17/99	02/17/99	02/18/99	02/18/99	02/18/99
SAMPLE TIME	10:10	16:10	22:10	04:10	10:10	16:10
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-12	L990339-13	L990339-14	L990339-15	L990339-16	L990339-17
SAMPLE NUMBER	EVT-9902-372	EVT-9902-373	EVT-9902-374	EVT-9902-375	EVT-9902-376	EVT-9902-377
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.029	0.071	0.074	0.075	0.056	0.072
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.15	<0.005	0.043	<0.005	<0.005	0.05

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/18/99	02/19/99	02/19/99	02/19/99	02/19/99	02/19/99
SAMPLE TIME	22:10	04:10	10:10	16:10	22:10	22:30
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-18	L990339-19	L990339-20	L990339-21	L990339-22	L990339-23
REMARKS						DUPLICATE
SAMPLE NUMBER	EVT-9902-378	EVT-9902-379	EVT-9902-380	EVT-9902-381	EVT-9902-382	EVT-9902-383
-- METALS & MINOR CONSTITUENTS --						
ARSENIC (AS) TOT	0.065	0.07	0.065	0.08	0.089	0.086
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	0.006	0.006	0.006	0.007	0.005	<0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

-- SAMPLE TYPE: STORM WATER --

SITE CODE	SW-18	SW-18	SW-18	SW-18	SW-18
SAMPLE DATE	02/20/99	02/20/99	02/20/99	02/20/99	02/21/99
SAMPLE TIME	04:10	10:10	16:10	22:10	04:10
LAB	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC	TSC-SLC
LAB NUMBER	L990339-24	L990339-25	L990339-26	L990339-27	L990339-28
SAMPLE NUMBER	EVT-9902-384	EVT-9902-385	EVT-9902-386	EVT-9902-387	EVT-9902-388
-- METALS & MINOR CONSTITUENTS --					
ARSENIC (AS) TOT	0.088	0.06	0.087	0.086	0.084
CADMIUM (CD) TOT	<0.003	<0.003	<0.003	<0.003	<0.003
LEAD (PB) TOT	<0.005	<0.005	0.005	0.005	0.005

NOTES: All results in mg/L (Water) or mg/kg (Soil) unless noted and are laboratory (LAB) unless field (FLD) or calculated (CALC)
TOT:Total; DIS:Dissolved; TRC:Total Recoverable; E:Estimated; <:Less Than Detect. Blank: parameter not tested
Validation Flags: A:Anomalous; UJ1:Blank; J2,UJ2: Standard; J3:Hold Time; J4,UJ4:Duplicate, Spike, or Split Exceedance;
R:Rejected.

INDEX

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
4	EVT-9901-300	L990217-1	01/28/99	CB-9
4	EVT-9901-301	L990217-2	01/29/99	CB-9
4	EVT-9901-302	L990217-3	01/29/99	CB-9
4	EVT-9901-303	L990217-4	01/29/99	CB-9
4	EVT-9901-304	L990217-5	01/29/99	CB-9
4	EVT-9901-305	L990217-6	01/30/99	CB-9
5	EVT-9901-306	L990217-7	01/30/99	CB-9
5	EVT-9901-307	L990217-8	01/30/99	CB-9
5	EVT-9901-308	L990217-9	01/30/99	CB-9
5	EVT-9901-309	L990217-10	01/31/99	CB-9
5	EVT-9901-310	L990217-11	01/31/99	CB-9
5	EVT-9901-311	L990217-12	01/31/99	CB-9
6	EVT-9901-312	L990217-13	01/31/99	CB-9
24	EVT-9901-313	L990217-14	02/01/99	SW-17
22	EVT-9901-315	L990217-15	01/28/99	SW-17
22	EVT-9901-316	L990217-16	01/29/99	SW-17
22	EVT-9901-317	L990217-17	01/29/99	SW-17
22	EVT-9901-318	L990217-18	01/29/99	SW-17
23	EVT-9901-319	L990217-19	01/29/99	SW-17
23	EVT-9901-320	L990217-20	01/30/99	SW-17
23	EVT-9901-321	L990217-21	01/30/99	SW-17
23	EVT-9901-322	L990217-22	01/30/99	SW-17
23	EVT-9901-323	L990217-23	01/30/99	SW-17
23	EVT-9901-324	L990217-24	01/31/99	SW-17
24	EVT-9901-325	L990217-25	01/31/99	SW-17
24	EVT-9901-326	L990217-26	01/31/99	SW-17
24	EVT-9901-327	L990217-27	01/31/99	SW-17
24	EVT-9901-328	L990217-28	02/01/99	SW-17
24	EVT-9901-329	L990217-29	02/01/99	SW-17
2	EVT-9901-330	L990217-30	02/01/99	DI BLANK
2	EVT-9901-331	L990217-31	02/01/99	DI BLANK
6	EVT-9902-200	L990289-1	02/03/99	CB-9
6	EVT-9902-201	L990289-2	02/03/99	CB-9
6	EVT-9902-202	L990289-3	02/04/99	CB-9
6	EVT-9902-203	L990289-4	02/04/99	CB-9
6	EVT-9902-204	L990289-5	02/04/99	CB-9
7	EVT-9902-205	L990289-6	02/05/99	CB-9
7	EVT-9902-206	L990289-7	02/05/99	CB-9
7	EVT-9902-207	L990289-8	02/05/99	CB-9
7	EVT-9902-208	L990289-9	02/05/99	CB-9
7	EVT-9902-209	L990289-10	02/06/99	CB-9
7	EVT-9902-210	L990289-11	02/06/99	CB-9
8	EVT-9902-211	L990289-12	02/06/99	CB-9
8	EVT-9902-212	L990289-13	02/06/99	CB-9
8	EVT-9902-213	L990289-14	02/07/99	CB-9
8	EVT-9902-214	L990289-15	02/07/99	CB-9
8	EVT-9902-215	L990289-16	02/07/99	CB-9
8	EVT-9902-216	L990289-17	02/07/99	CB-9
9	EVT-9902-217	L990289-18	02/08/99	CB-9
9	EVT-9902-218	L990289-19	02/08/99	CB-9
9	EVT-9902-219	L990289-20	02/08/99	CB-9
9	EVT-9902-220	L990289-21	02/08/99	CB-9
9	EVT-9902-221	L990289-22	02/10/99	CB-9
9	EVT-9902-222	L990289-23	02/10/99	CB-9
10	EVT-9902-223	L990289-24	02/10/99	CB-9
10	EVT-9902-224	L990289-25	02/10/99	CB-9
10	EVT-9902-225	L990289-26	02/10/99	CB-9
37	EVT-9902-226	L990289-27	02/03/99	SW-18
37	EVT-9902-227	L990289-28	02/04/99	SW-18
37	EVT-9902-228	L990289-29	02/04/99	SW-18
37	EVT-9902-229	L990289-10	02/04/99	SW-18
37	EVT-9902-230	L990289-31	02/04/99	SW-18
37	EVT-9902-231	L990289-32	02/04/99	SW-18
38	EVT-9902-232	L990289-33	02/05/99	SW-18
38	EVT-9902-233	L990289-34	02/05/99	SW-18
38	EVT-9902-234	L990289-35	02/05/99	SW-18
38	EVT-9902-235	L990289-36	02/05/99	SW-18
38	EVT-9902-236	L990289-37	02/06/99	SW-18
38	EVT-9902-237	L990289-38	02/06/99	SW-18
39	EVT-9902-238	L990289-39	02/06/99	SW-18

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
1	ERA #436	EVT-9902-320	02/11/99	BFS
1	ERA #436	EVT-9902-413	02/21/99	BFS
1	ERA #437	EVT-9903-833	02/15/99	BFS
4	L990217-1	EVT-9901-300	01/28/99	CB-9
5	L990217-10	EVT-9901-309	01/31/99	CB-9
5	L990217-11	EVT-9901-310	01/31/99	CB-9
5	L990217-12	EVT-9901-311	01/31/99	CB-9
6	L990217-13	EVT-9901-312	01/31/99	CB-9
24	L990217-14	EVT-9901-313	02/01/99	SW-17
22	L990217-15	EVT-9901-315	01/28/99	SW-17
22	L990217-16	EVT-9901-316	01/29/99	SW-17
22	L990217-17	EVT-9901-317	01/29/99	SW-17
22	L990217-18	EVT-9901-318	01/29/99	SW-17
23	L990217-19	EVT-9901-319	01/29/99	SW-17
4	L990217-2	EVT-9901-301	01/29/99	CB-9
23	L990217-20	EVT-9901-320	01/30/99	SW-17
23	L990217-21	EVT-9901-321	01/30/99	SW-17
23	L990217-22	EVT-9901-322	01/30/99	SW-17
23	L990217-23	EVT-9901-323	01/30/99	SW-17
23	L990217-24	EVT-9901-324	01/31/99	SW-17
24	L990217-25	EVT-9901-325	01/31/99	SW-17
24	L990217-26	EVT-9901-326	01/31/99	SW-17
24	L990217-27	EVT-9901-327	01/31/99	SW-17
24	L990217-28	EVT-9901-328	02/01/99	SW-17
24	L990217-29	EVT-9901-329	02/01/99	SW-17
4	L990217-3	EVT-9901-302	01/29/99	CB-9
2	L990217-30	EVT-9901-330	02/01/99	DI BLANK
2	L990217-31	EVT-9901-331	02/01/99	DI BLANK
4	L990217-4	EVT-9901-303	01/29/99	CB-9
4	L990217-5	EVT-9901-304	01/29/99	CB-9
4	L990217-6	EVT-9901-305	01/30/99	CB-9
5	L990217-7	EVT-9901-306	01/30/99	CB-9
5	L990217-8	EVT-9901-307	01/30/99	CB-9
5	L990217-9	EVT-9901-308	01/30/99	CB-9
6	L990289-1	EVT-9902-200	02/03/99	CB-9
7	L990289-10	EVT-9902-209	02/06/99	CB-9
7	L990289-11	EVT-9902-210	02/06/99	CB-9
8	L990289-12	EVT-9902-211	02/06/99	CB-9
8	L990289-13	EVT-9902-212	02/06/99	CB-9
8	L990289-14	EVT-9902-213	02/07/99	CB-9
8	L990289-15	EVT-9902-214	02/07/99	CB-9
8	L990289-16	EVT-9902-215	02/07/99	CB-9
8	L990289-17	EVT-9902-216	02/07/99	CB-9
9	L990289-18	EVT-9902-217	02/08/99	CB-9
9	L990289-19	EVT-9902-218	02/08/99	CB-9
6	L990289-2	EVT-9902-201	02/03/99	CB-9
9	L990289-20	EVT-9902-219	02/08/99	CB-9
9	L990289-21	EVT-9902-220	02/08/99	CB-9
9	L990289-22	EVT-9902-221	02/10/99	CB-9
9	L990289-23	EVT-9902-222	02/10/99	CB-9
10	L990289-24	EVT-9902-223	02/10/99	CB-9
10	L990289-25	EVT-9902-224	02/10/99	CB-9
10	L990289-26	EVT-9902-225	02/10/99	CB-9
37	L990289-27	EVT-9902-226	02/03/99	SW-18
37	L990289-28	EVT-9902-227	02/04/99	SW-18
37	L990289-29	EVT-9902-228	02/04/99	SW-18
6	L990289-3	EVT-9902-202	02/04/99	CB-9
37	L990289-30	EVT-9902-229	02/04/99	SW-18
37	L990289-31	EVT-9902-230	02/04/99	SW-18
37	L990289-32	EVT-9902-231	02/04/99	SW-18
38	L990289-33	EVT-9902-232	02/05/99	SW-18
38	L990289-34	EVT-9902-233	02/05/99	SW-18
38	L990289-35	EVT-9902-234	02/05/99	SW-18
38	L990289-36	EVT-9902-235	02/05/99	SW-18
38	L990289-37	EVT-9902-236	02/06/99	SW-18
38	L990289-38	EVT-9902-237	02/06/99	SW-18
39	L990289-39	EVT-9902-238	02/06/99	SW-18
6	L990289-4	EVT-9902-203	02/04/99	CB-9
39	L990289-40	EVT-9902-239	02/06/99	SW-18
39	L990289-41	EVT-9902-240	02/07/99	SW-18

INDEX

+------------------ SAMPLE NUMBER ORDER ------------------+

Page	Sample Number	Lab ##	Date	Site Code
39	EVT-9902-239	L990289-40	02/06/99	SW-18
39	EVT-9902-240	L990289-41	02/07/99	SW-18
39	EVT-9902-241	L990289-42	02/07/99	SW-18
39	EVT-9902-242	L990289-43	02/07/99	SW-18
39	EVT-9902-243	L990289-44	02/07/99	SW-18
40	EVT-9902-244	L990289-45	02/08/99	SW-18
40	EVT-9902-245	L990289-46	02/08/99	SW-18
40	EVT-9902-246	L990289-47	02/08/99	SW-18
40	EVT-9902-247	L990289-48	02/08/99	SW-18
40	EVT-9902-248	L990289-49	02/08/99	SW-18
40	EVT-9902-249	L990289-50	02/09/99	SW-18
41	EVT-9902-250	L990289-51	02/09/99	SW-18
41	EVT-9902-251	L990289-52	02/09/99	SW-18
41	EVT-9902-252	L990289-53	02/09/99	SW-18
41	EVT-9902-253	L990289-54	02/10/99	SW-18
41	EVT-9902-254	L990289-55	02/10/99	SW-18
41	EVT-9902-255	L990289-56	02/10/99	SW-18
42	EVT-9902-256	L990289-57	02/10/99	SW-18
42	EVT-9902-257	L990289-58	02/11/99	SW-18
25	EVT-9902-258	L990289-59	02/03/99	SW-17
25	EVT-9902-259	L990289-60	02/04/99	SW-17
25	EVT-9902-260	L990289-61	02/04/99	SW-17
25	EVT-9902-261	L990289-62	02/04/99	SW-17
25	EVT-9902-262	L990289-63	02/04/99	SW-17
25	EVT-9902-263	L990289-64	02/04/99	SW-17
26	EVT-9902-264	L990289-65	02/05/99	SW-17
26	EVT-9902-265	L990289-66	02/05/99	SW-17
26	EVT-9902-266	L990289-67	02/05/99	SW-17
26	EVT-9902-267	L990289-68	02/05/99	SW-17
26	EVT-9902-268	L990289-69	02/05/99	SW-17
26	EVT-9902-269	L990289-70	02/06/99	SW-17
27	EVT-9902-270	L990289-71	02/06/99	SW-17
27	EVT-9902-271	L990289-72	02/06/99	SW-17
27	EVT-9902-272	L990289-73	02/06/99	SW-17
27	EVT-9902-273	L990289-74	02/07/99	SW-17
27	EVT-9902-274	L990289-75	02/07/99	SW-17
27	EVT-9902-275	L990289-76	02/07/99	SW-17
28	EVT-9902-276	L990289-77	02/07/99	SW-17
28	EVT-9902-277	L990289-78	02/08/99	SW-17
28	EVT-9902-278	L990289-79	02/08/99	SW-17
28	EVT-9902-279	L990289-80	02/08/99	SW-17
28	EVT-9902-280	L990289-81	02/08/99	SW-17
28	EVT-9902-281	L990289-82	02/09/99	SW-17
29	EVT-9902-282	L990289-83	02/09/99	SW-17
29	EVT-9902-283	L990289-84	02/09/99	SW-17
29	EVT-9902-284	L990289-85	02/09/99	SW-17
29	EVT-9902-285	L990289-86	02/10/99	SW-17
29	EVT-9902-286	L990289-87	02/10/99	SW-17
29	EVT-9902-287	L990289-88	02/10/99	SW-17
30	EVT-9902-288	L990289-89	02/10/99	SW-17
30	EVT-9902-289	L990289-90	02/11/99	SW-17
30	EVT-9902-290	L990289-91	02/11/99	SW-17
12	EVT-9902-291	L990289-92	02/03/99	MH-2
13	EVT-9902-292	L990289-93	02/04/99	MH-2
13	EVT-9902-293	L990289-94	02/04/99	MH-2
13	EVT-9902-294	L990289-95	02/04/99	MH-2
13	EVT-9902-295	L990289-96	02/04/99	MH-2
13	EVT-9902-296	L990289-97	02/04/99	MH-2
13	EVT-9902-297	L990289-98	02/05/99	MH-2
14	EVT-9902-298	L990289-99	02/05/99	MH-2
14	EVT-9902-299	L990289100	02/05/99	MH-2
14	EVT-9902-300	L990289101	02/05/99	MH-2
14	EVT-9902-301	L990289102	02/05/99	MH-2
14	EVT-9902-302	L990289103	02/06/99	MH-2
14	EVT-9902-303	L990289104	02/06/99	MH-2
15	EVT-9902-304	L990289105	02/06/99	MH-2
15	EVT-9902-305	L990289106	02/06/99	MH-2
15	EVT-9902-306	L990289107	02/07/99	MH-2
15	EVT-9902-307	L990289108	02/07/99	MH-2
15	EVT-9902-308	L990289109	02/07/99	MH-2

+------------------- LAB NUMBER ORDER ------------------+

Page	Lab ##	Sample Number	Date	Site Code
39	L990289-42	EVT-9902-241	02/07/99	SW-18
39	L990289-43	EVT-9902-242	02/07/99	SW-18
39	L990289-44	EVT-9902-243	02/07/99	SW-18
40	L990289-45	EVT-9902-244	02/08/99	SW-18
40	L990289-46	EVT-9902-245	02/08/99	SW-18
40	L990289-47	EVT-9902-246	02/08/99	SW-18
40	L990289-48	EVT-9902-247	02/08/99	SW-18
40	L990289-49	EVT-9902-248	02/08/99	SW-18
6	L990289-5	EVT-9902-204	02/04/99	CB-9
40	L990289-50	EVT-9902-249	02/09/99	SW-18
41	L990289-51	EVT-9902-250	02/09/99	SW-18
41	L990289-52	EVT-9902-251	02/09/99	SW-18
41	L990289-53	EVT-9902-252	02/09/99	SW-18
41	L990289-54	EVT-9902-253	02/10/99	SW-18
41	L990289-55	EVT-9902-254	02/10/99	SW-18
41	L990289-56	EVT-9902-255	02/10/99	SW-18
42	L990289-57	EVT-9902-256	02/10/99	SW-18
42	L990289-58	EVT-9902-257	02/11/99	SW-18
25	L990289-59	EVT-9902-258	02/03/99	SW-17
7	L990289-6	EVT-9902-205	02/05/99	CB-9
25	L990289-60	EVT-9902-259	02/04/99	SW-17
25	L990289-61	EVT-9902-260	02/04/99	SW-17
25	L990289-62	EVT-9902-261	02/04/99	SW-17
25	L990289-63	EVT-9902-262	02/04/99	SW-17
25	L990289-64	EVT-9902-263	02/04/99	SW-17
26	L990289-65	EVT-9902-264	02/05/99	SW-17
26	L990289-66	EVT-9902-265	02/05/99	SW-17
26	L990289-67	EVT-9902-266	02/05/99	SW-17
26	L990289-68	EVT-9902-267	02/05/99	SW-17
26	L990289-69	EVT-9902-268	02/05/99	SW-17
7	L990289-7	EVT-9902-206	02/05/99	CB-9
26	L990289-70	EVT-9902-269	02/06/99	SW-17
27	L990289-71	EVT-9902-270	02/06/99	SW-17
27	L990289-72	EVT-9902-271	02/06/99	SW-17
27	L990289-73	EVT-9902-272	02/06/99	SW-17
27	L990289-74	EVT-9902-273	02/07/99	SW-17
27	L990289-75	EVT-9902-274	02/07/99	SW-17
27	L990289-76	EVT-9902-275	02/07/99	SW-17
28	L990289-77	EVT-9902-276	02/07/99	SW-17
28	L990289-78	EVT-9902-277	02/08/99	SW-17
28	L990289-79	EVT-9902-278	02/08/99	SW-17
7	L990289-8	EVT-9902-207	02/05/99	CB-9
28	L990289-80	EVT-9902-279	02/08/99	SW-17
28	L990289-81	EVT-9902-280	02/08/99	SW-17
28	L990289-82	EVT-9902-281	02/09/99	SW-17
29	L990289-83	EVT-9902-282	02/09/99	SW-17
29	L990289-84	EVT-9902-283	02/09/99	SW-17
29	L990289-85	EVT-9902-284	02/09/99	SW-17
29	L990289-86	EVT-9902-285	02/10/99	SW-17
29	L990289-87	EVT-9902-286	02/10/99	SW-17
29	L990289-88	EVT-9902-287	02/10/99	SW-17
30	L990289-89	EVT-9902-288	02/10/99	SW-17
7	L990289-9	EVT-9902-208	02/05/99	CB-9
30	L990289-90	EVT-9902-289	02/11/99	SW-17
30	L990289-91	EVT-9902-290	02/11/99	SW-17
12	L990289-92	EVT-9902-291	02/03/99	MH-2
13	L990289-93	EVT-9902-292	02/04/99	MH-2
13	L990289-94	EVT-9902-293	02/04/99	MH-2
13	L990289-95	EVT-9902-294	02/04/99	MH-2
13	L990289-96	EVT-9902-295	02/04/99	MH-2
13	L990289-97	EVT-9902-296	02/04/99	MH-2
13	L990289-98	EVT-9902-297	02/05/99	MH-2
14	L990289-99	EVT-9902-298	02/05/99	MH-2
14	L990289100	EVT-9902-299	02/05/99	MH-2
14	L990289101	EVT-9902-300	02/05/99	MH-2
14	L990289102	EVT-9902-301	02/05/99	MH-2
14	L990289103	EVT-9902-302	02/06/99	MH-2
14	L990289104	EVT-9902-303	02/06/99	MH-2
15	L990289105	EVT-9902-304	02/06/99	MH-2
15	L990289106	EVT-9902-305	02/06/99	MH-2

INDEX

SAMPLE NUMBER ORDER

Page	Sample Number	Lab ##	Date	Site Code
15	EVT-9902-309	L990289110	02/07/99	MH-2
16	EVT-9902-310	L990289111	02/08/99	MH-2
16	EVT-9902-311	L990289112	02/08/99	MH-2
16	EVT-9902-312	L990289113	02/10/99	MH-2
16	EVT-9902-313	L990289114	02/10/99	MH-2
16	EVT-9902-314	L990289115	02/11/99	MH-2
16	EVT-9902-315	L990289116	02/11/99	MH-2
17	EVT-9902-316	L990289117	02/11/99	MH-2
17	EVT-9902-317	L990289118	02/11/99	MH-2
17	EVT-9902-318	L990289119	02/11/99	MH-2
17	EVT-9902-319	L990289120	02/11/99	MH-2
1	EVT-9902-320	ERA #436	02/11/99	BFS
1	EVT-9902-320	L990289121	02/11/99	BFS
10	EVT-9902-321	L990338-1	02/13/99	CB-9
10	EVT-9902-322	L990338-2	02/13/99	CB-9
10	EVT-9902-323	L990338-3	02/16/99	CB-9
11	EVT-9902-324	L990338-4	02/16/99	CB-9
11	EVT-9902-325	L990338-5	02/17/99	CB-9
11	EVT-9902-326	L990338-6	02/17/99	CB-9
11	EVT-9902-327	L990338-7	02/18/99	CB-9
11	EVT-9902-328	L990338-8	02/18/99	CB-9
11	EVT-9902-329	L990338-9	02/18/99	CB-9
12	EVT-9902-330	L990338-10	02/19/99	CB-9
12	EVT-9902-331	L990338-11	02/19/99	CB-9
12	EVT-9902-332	L990338-12	02/19/99	CB-9
12	EVT-9902-333	L990338-13	02/20/99	CB-9
31	EVT-9902-334	L990338-14	02/13/99	SW-17
31	EVT-9902-335	L990338-15	02/13/99	SW-17
31	EVT-9902-336	L990338-16	02/13/99	SW-17
31	EVT-9902-337	L990338-17	02/13/99	SW-17
31	EVT-9902-338	L990338-18	02/14/99	SW-17
33	EVT-9902-339	L990338-19	02/16/99	SW-17
33	EVT-9902-340	L990338-20	02/16/99	SW-17
33	EVT-9902-341	L990338-21	02/16/99	SW-17
33	EVT-9902-342	L990338-22	02/16/99	SW-17
34	EVT-9902-343	L990338-23	02/16/99	SW-17
34	EVT-9902-344	L990338-24	02/17/99	SW-17
34	EVT-9902-345	L990338-25	02/17/99	SW-17
34	EVT-9902-346	L990338-26	02/17/99	SW-17
34	EVT-9902-347	L990338-27	02/17/99	SW-17
34	EVT-9902-348	L990338-28	02/18/99	SW-17
35	EVT-9902-349	L990338-29	02/18/99	SW-17
35	EVT-9902-350	L990338-30	02/18/99	SW-17
35	EVT-9902-351	L990338-31	02/18/99	SW-17
35	EVT-9902-352	L990338-32	02/19/99	SW-17
35	EVT-9902-353	L990338-33	02/19/99	SW-17
35	EVT-9902-354	L990338-34	02/19/99	SW-17
36	EVT-9902-355	L990338-35	02/19/99	SW-17
36	EVT-9902-356	L990338-36	02/20/99	SW-17
36	EVT-9902-357	L990338-37	02/20/99	SW-17
36	EVT-9902-358	L990338-38	02/20/99	SW-17
36	EVT-9902-359	L990338-39	02/20/99	SW-17
36	EVT-9902-360	L990338-40	02/21/99	SW-17
43	EVT-9902-361	L990339-1	02/13/99	SW-18
43	EVT-9902-362	L990339-2	02/13/99	SW-18
43	EVT-9902-363	L990339-3	02/13/99	SW-18
43	EVT-9902-364	L990339-4	02/13/99	SW-18
43	EVT-9902-365	L990339-5	02/13/99	SW-18
43	EVT-9902-366	L990339-6	02/14/99	SW-18
45	EVT-9902-367	L990339-7	02/16/99	SW-18
45	EVT-9902-368	L990339-8	02/16/99	SW-18
45	EVT-9902-369	L990339-9	02/16/99	SW-18
45	EVT-9902-370	L990339-10	02/16/99	SW-18
45	EVT-9902-371	L990339-11	02/17/99	SW-18
46	EVT-9902-372	L990339-12	02/17/99	SW-18
46	EVT-9902-373	L990339-13	02/17/99	SW-18
46	EVT-9902-374	L990339-14	02/17/99	SW-18
46	EVT-9902-375	L990339-15	02/18/99	SW-18
46	EVT-9902-376	L990339-16	02/18/99	SW-18
46	EVT-9902-377	L990339-17	02/18/99	SW-18

LAB NUMBER ORDER

Page	Lab ##	Sample Number	Date	Site Code
15	L990289107	EVT-9902-306	02/07/99	MH-2
15	L990289108	EVT-9902-307	02/07/99	MH-2
15	L990289109	EVT-9902-308	02/07/99	MH-2
15	L990289110	EVT-9902-309	02/07/99	MH-2
16	L990289111	EVT-9902-310	02/08/99	MH-2
16	L990289112	EVT-9902-311	02/08/99	MH-2
16	L990289113	EVT-9902-312	02/10/99	MH-2
16	L990289114	EVT-9902-313	02/10/99	MH-2
16	L990289115	EVT-9902-314	02/11/99	MH-2
16	L990289116	EVT-9902-315	02/11/99	MH-2
17	L990289117	EVT-9902-316	02/11/99	MH-2
17	L990289118	EVT-9902-317	02/11/99	MH-2
17	L990289119	EVT-9902-318	02/11/99	MH-2
17	L990289120	EVT-9902-319	02/11/99	MH-2
1	L990289121	EVT-9902-320	02/11/99	BFS
10	L990338-1	EVT-9902-321	02/13/99	CB-9
12	L990338-10	EVT-9902-330	02/19/99	CB-9
12	L990338-11	EVT-9902-331	02/19/99	CB-9
12	L990338-12	EVT-9902-332	02/19/99	CB-9
12	L990338-13	EVT-9902-333	02/20/99	CB-9
31	L990338-14	EVT-9902-334	02/13/99	SW-17
31	L990338-15	EVT-9902-335	02/13/99	SW-17
31	L990338-16	EVT-9902-336	02/13/99	SW-17
31	L990338-17	EVT-9902-337	02/13/99	SW-17
31	L990338-18	EVT-9902-338	02/14/99	SW-17
33	L990338-19	EVT-9902-339	02/16/99	SW-17
10	L990338-2	EVT-9902-322	02/13/99	CB-9
33	L990338-20	EVT-9902-340	02/16/99	SW-17
33	L990338-21	EVT-9902-341	02/16/99	SW-17
33	L990338-22	EVT-9902-342	02/16/99	SW-17
34	L990338-23	EVT-9902-343	02/16/99	SW-17
34	L990338-24	EVT-9902-344	02/17/99	SW-17
34	L990338-25	EVT-9902-345	02/17/99	SW-17
34	L990338-26	EVT-9902-346	02/17/99	SW-17
34	L990338-27	EVT-9902-347	02/17/99	SW-17
34	L990338-28	EVT-9902-348	02/18/99	SW-17
35	L990338-29	EVT-9902-349	02/18/99	SW-17
10	L990338-3	EVT-9902-323	02/16/99	CB-9
35	L990338-30	EVT-9902-350	02/18/99	SW-17
35	L990338-31	EVT-9902-351	02/18/99	SW-17
35	L990338-32	EVT-9902-352	02/19/99	SW-17
35	L990338-33	EVT-9902-353	02/19/99	SW-17
35	L990338-34	EVT-9902-354	02/19/99	SW-17
36	L990338-35	EVT-9902-355	02/19/99	SW-17
36	L990338-36	EVT-9902-356	02/20/99	SW-17
36	L990338-37	EVT-9902-357	02/20/99	SW-17
36	L990338-38	EVT-9902-358	02/20/99	SW-17
36	L990338-39	EVT-9902-359	02/20/99	SW-17
11	L990338-4	EVT-9902-324	02/16/99	CB-9
36	L990338-40	EVT-9902-360	02/21/99	SW-17
11	L990338-5	EVT-9902-325	02/17/99	CB-9
11	L990338-6	EVT-9902-326	02/17/99	CB-9
11	L990338-7	EVT-9902-327	02/18/99	CB-9
11	L990338-8	EVT-9902-328	02/18/99	CB-9
11	L990338-9	EVT-9902-329	02/18/99	CB-9
43	L990339-1	EVT-9902-361	02/13/99	SW-18
45	L990339-10	EVT-9902-370	02/16/99	SW-18
45	L990339-11	EVT-9902-371	02/17/99	SW-18
46	L990339-12	EVT-9902-372	02/17/99	SW-18
46	L990339-13	EVT-9902-373	02/17/99	SW-18
46	L990339-14	EVT-9902-374	02/17/99	SW-18
46	L990339-15	EVT-9902-375	02/18/99	SW-18
46	L990339-16	EVT-9902-376	02/18/99	SW-18
46	L990339-17	EVT-9902-377	02/18/99	SW-18
47	L990339-18	EVT-9902-378	02/18/99	SW-18
47	L990339-19	EVT-9902-379	02/19/99	SW-18
43	L990339-2	EVT-9902-362	02/13/99	SW-18
47	L990339-20	EVT-9902-380	02/19/99	SW-18
47	L990339-21	EVT-9902-381	02/19/99	SW-18
47	L990339-22	EVT-9902-382	02/19/99	SW-18

INDEX

INDEX

+------------------- SAMPLE NUMBER ORDER -------------------+

Page	Sample Number	Lab ##	Date	Site Code
1	EVT-9903-833	L990476-33	02/15/99	BFS

+------------------- LAB NUMBER ORDER -------------------+

Page	Lab ##	Sample Number	Date	Site Code
44	L990476-9	EVT-9903-809	02/15/99	SW-18

Appendix F

APPENDIX F
WASTEWATER INFLUENT, EFFLUENT, AND BIOSOLID INFORMATION

REVIEW OF ARSENIC DATA FOR WASTEWATER AND BIOSOLIDS

EVERETT WATER POLLUTION CONTROL FACILITY
EVERETT, WASHINGTON

OCTOBER 16, 1998

Prepared for:

TOXICS CLEANUP PROGRAM
DEPARTMENT OF ECOLOGY
Bellevue, Washington

Prepared by:

ASARCO INCORPORATED
Ruston, Washington

Introduction

In comments on the Draft Storm Water and Storm Drain Sediment Characterization and Controls Work Plan (ASARCO, 1998), the Washington Department of Ecology (Ecology) expressed concern with the levels of arsenic in biosolids and effluent from the Everett Water Pollution Control Facility (WPCF) and requested that ASARCO work with the City of Everett to define the relationship between arsenic input and the biosolids and effluent output. In response ASARCO contacted Everett representatives (Dan Thompson and Gene Bennett) and discussed these concerns by telephone and in an April 27, 1998 meeting. Everett representatives provided ASARCO with copies of the City of Everett's 1995, 1996, and 1997 Residual Solids Monitoring Reports prepared in compliance with NPDES permit WA-002449-0. Everett representatives also provided a disk with an Excel spreadsheet containing influent and effluent water quality data for arsenic for samples taken between January 1995 and April 1998. Recently, Everett representatives provided copies of laboratory results of biosolids samples taken in 1993, 1994 and March and May of 1998.

The influent to the aeration pond is located on the northwest side of the pond. Wastewater flows from the influent south from Zone I to Zone II, east into Zone III, then north into Zone IV, and is treated aerobically as it flows from one end of the pond to the other. A sketch of the pond is presented in Figure 1. Wastewater is biologically treated through aerobic decomposition in the aeration pond. Effluent from the aeration pond is discharged at Outfall 015, located on the northeast side of the pond. Wastewater is also withdrawn from the aeration pond and treated in a trickling filter/secondary clarifier. Waste secondary solids from the trickling filter/secondary clarifier are returned to the aeration pond. Effluent from the trickling filter/secondary clarifier is discharged to Outfall 015a. Everett's NPDES Permit No. WA-002449-0 requires Everett to take flow measurements and samples of influent wastewater and treated effluent. The City of Everett analyzes samples for antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, zinc, cyanide, oil and grease, phenols, and conventional parameters. The flow and water quality of samples from the trickling filter/secondary clarifier, which is discharged at Outfall 015a, varies on a daily basis from that the aeration pond effluent, which discharges at Outfall 015, but on an annual basis they are comparable. Therefore, for this evaluation, only the data from the aeration pond were examined in detail.

During the treatment process, biosolids accumulate in the aeration pond. The City of Everett takes quarterly composite biosolids samples from nine areas of the aeration pond in accordance with NPDES Permit No. WA-002449-0. Area 1 is located in Zone I. Areas 2 through 4 are located in Zone II. Areas 5 through 7 are located in Zone III. Areas 8 and 9 are located in Zone IV. Sampling locations for 1996 are presented in Figure 1. Samples are analyzed for total volatile solids, total solids, pH, silver, arsenic, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, selenium, and zinc. Samples are also analyzed annually for PCB's and routinely for vector attraction and pathogen parameters. Although the NPDES permit does not identify arsenic as a monitoring parameter, the City of Everett analyzes the samples for arsenic to help classify biosolids for land application. These biosolids samples are obtained from five locations within each area being sampled. Grab samples are taken from cores that extend from the top of the biosolids blanket to the pond bottom at each of the five locations within an area. Grab samples are composited to make up a five liter sample for each area. Additional compositing is performed in the laboratory for the purpose of vector attraction evaluation.

During the quarter prior to land application of the biosolids, the City of Everett also obtains one composite sample made up of samples from all nine areas. Results of that sample are used to characterize biosolids for land application or recycling projects (personal communication, October 2, 1998).

The influent, effluent, and biosolids data summarized above were reviewed. The focus of the review was on total arsenic in biosolids samples and the existence of any seasonal or long term trends, however, other metals in biosolids samples and arsenic in wastewater were also examined.

Wastewater

Average monthly concentrations of arsenic in influent wastewater from 1995 through April 1998 were calculated from data supplied by Everett (analytical results of weekly 24-hour composite samples). Average monthly concentrations of arsenic were plotted over time, and compared to monthly precipitation recorded at Everett Junior College to examine possible seasonal variations in influent quality (see Figure 2). There appears to be a relationship between average monthly concentration of arsenic in influent and monthly precipitation. A correlation factor was calculated using the statistical correlation function supplied with the Excel program and comparing average monthly concentrations of arsenic to monthly rainfall. The correlation factor between average monthly arsenic influent concentration and monthly precipitation is 0.715. The average concentration of arsenic in influent samples for each year reviewed is presented below:

ARSENIC CONCENTRATION	1995	1996	1997	1998*
MONTHLY AVE RANGE (ug/L)	1.8 to 13.5	1.3 to 13.6	1.3 to 10.5	1.6 to 12.1
ANNUAL AVERAGE (ug/L)	5.5	5.6	4.2	5.1

* January through April

The City of Everett calculates daily loading by multiplying the average daily flow by the concentration of the weekly 24-hour composite sample. Monthly averages of daily loading of arsenic in influent wastewater from 1995 through April 1998 were calculated from data supplied by the City of Everett (calculations of daily loadings from weekly samples). Monthly averages were also plotted over time and compared to monthly precipitation to examine possible seasonal variations in influent quality. A graph of this data is presented in Figure 3. There appears to be a weak relationship between daily loading of arsenic averaged on a monthly basis and monthly precipitation. The correlation factor between average monthly arsenic concentration and monthly precipitation was calculated to be 0.574. The average loading of arsenic in influent samples for each year reviewed is presented below:

ARSENIC LOADING	1995	1996	1997	1998*
MONTHLY AVE RANGE (lb/day)	0.21 to 3.29	0.16 to 6.43	0.20 to 2.03	0.22 to 3.37
ANNUAL AVERAGE (lb/day)	1.08	1.52	0.78	1.30

* January through April

Average monthly concentrations of arsenic in treated effluent from the pond from 1995 through April 1998 were calculated from data supplied by Everett (analytical results of weekly 24-hour composite samples). Average monthly concentrations of arsenic were plotted over time and compared to monthly precipitation. A graph of this data is presented in Figure 4. There appears to be a weak relationship between average monthly concentration of arsenic and monthly precipitation. The correlation factor between average monthly arsenic concentration and monthly precipitation was calculated to be 0.412. The average concentration of arsenic in effluent samples for each year reviewed is presented below:

ARSENIC CONCENTRATION	1995	1996	1997	1998*
MONTHLY AVE RANGE (ug/L)	2.3 to 13.8	1.6 to 9.9	2.4 to 8.3	2.4 to 5.3
ANNUAL AVERAGE (ug/L)	4.8	4.5	4.2	3.8

* January through April

Monthly averages of daily loading of arsenic in wastewater effluent from 1995 through April 1998 were calculated from data supplied by the City of Everett (calculations of daily loading from weekly samples). Monthly averages were plotted over time and compared to monthly precipitation. A graph of this data is presented in Figure 5. There appears to be a weak relationship between daily loading of arsenic averaged on a monthly basis and monthly precipitation. The correlation factor between monthly averages of daily loading and monthly rainfall was calculated to be 0.535. The average loading of arsenic in effluent samples for each year reviewed is presented below:

ARSENIC LOADING	1995	1996	1997	1998*
MONTHLY AVE RANGE (lb/day)	0.16 to 1.98	0.15 to 1.19	0.17 to 0.99	0.22 to 0.63
ANNUAL AVERAGE (lb/day)	0.43	0.42	0.36	0.38

* January through April

Biosolids

Application of biosolids is regulated under WAC 173-308. Table 1 of that regulation sets the maximum allowable concentration (ceiling limit) of pollutants in biosolids that are applied to the land. The ceiling limit for arsenic is 75 mg/Kg on a dry weight basis. Table 3 of that regulation sets a lower pollutant concentration threshold which, when achieved, relieves the person who prepares biosolids and the person who applies biosolids, from certain requirements related to recordkeeping, reporting, and labeling. The concentration limit for arsenic is 41 mg/Kg. Biosolids that meet the pollutant concentration limits in Table 3, the Class A pathogen reduction requirements, and the vector attraction reduction requirements, are defined as "exceptional quality biosolids." Biosolids that exceed the pollutant concentration limits in Table 3 may be applied to the land if the concentration is less than the ceiling limit and if the cumulative pollutant loading rates and the annual pollutant loading rates (Tables 2 and 4) are met. Tables 1 through 4 are presented in Appendix A.

Average quarterly concentrations of arsenic in biosolids samples from 1993 through May 1998 were plotted over time for each Zone. Graphs of this data are presented in Figures 6 through 9. Average quarterly arsenic concentrations in biosolids for the overall pond (combination of all zones) were also plotted over time. The graph of this data is presented in Figure 10. The graph of average quarterly concentrations of arsenic in biosolids samples was supplemented by interpolating between quarterly data points for each month. Correlation factors were calculated using the statistical correlation function supplied with the Excel program and comparing average monthly concentrations of arsenic to monthly rainfall. Short term fluctuations were observed and peaks in overall quarterly arsenic concentrations were observed to occur during or immediately after low rainfall. No clear relationship was observed, however, between the average concentration of arsenic in biosolids samples and precipitation.

Generally, concentrations of arsenic are lowest in samples from Zone 1 and highest in samples from Zone 4. The highest concentrations of arsenic in biosolids were observed in samples taken in June 1995. Average quarterly concentrations of arsenic in biosolids consistently fall below the ceiling limit (Table 1) in every Zone. Average quarterly concentrations of arsenic in biosolids have exceeded the Table 3 values occasionally in Zones 3 and several times in Zone 4. Concentrations of arsenic have exceeded the Table 3 value only once between 1993 and April 1998 in the composite sample taken for land application characterization purposes.

A portion of the accumulated biosolids have been removed from Areas 3 through 9 (Zones 2 through 4) of the aeration pond approximately every two years. Removal activities occurred from July to October 1992, from September 1994 to January 1995, from August to December 1996, and from May to July 1998. No relationships were observed between biosolids removal activities and arsenic levels in effluent or biosolids.

Average concentrations of arsenic in biosolids for each year are presented below:

ZONE	1993	1994	1995	1996	1997	1998*
	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
1	24.0	24.7	24.6	21.9	25.8	26.0
2	27.5	28.0	28.0	26.2	25.2	26.0
3	35.8	35.4	34.1	34.4	34.2	32.7
4	38.0	40.8	43.9	39.3	40.6	42.9

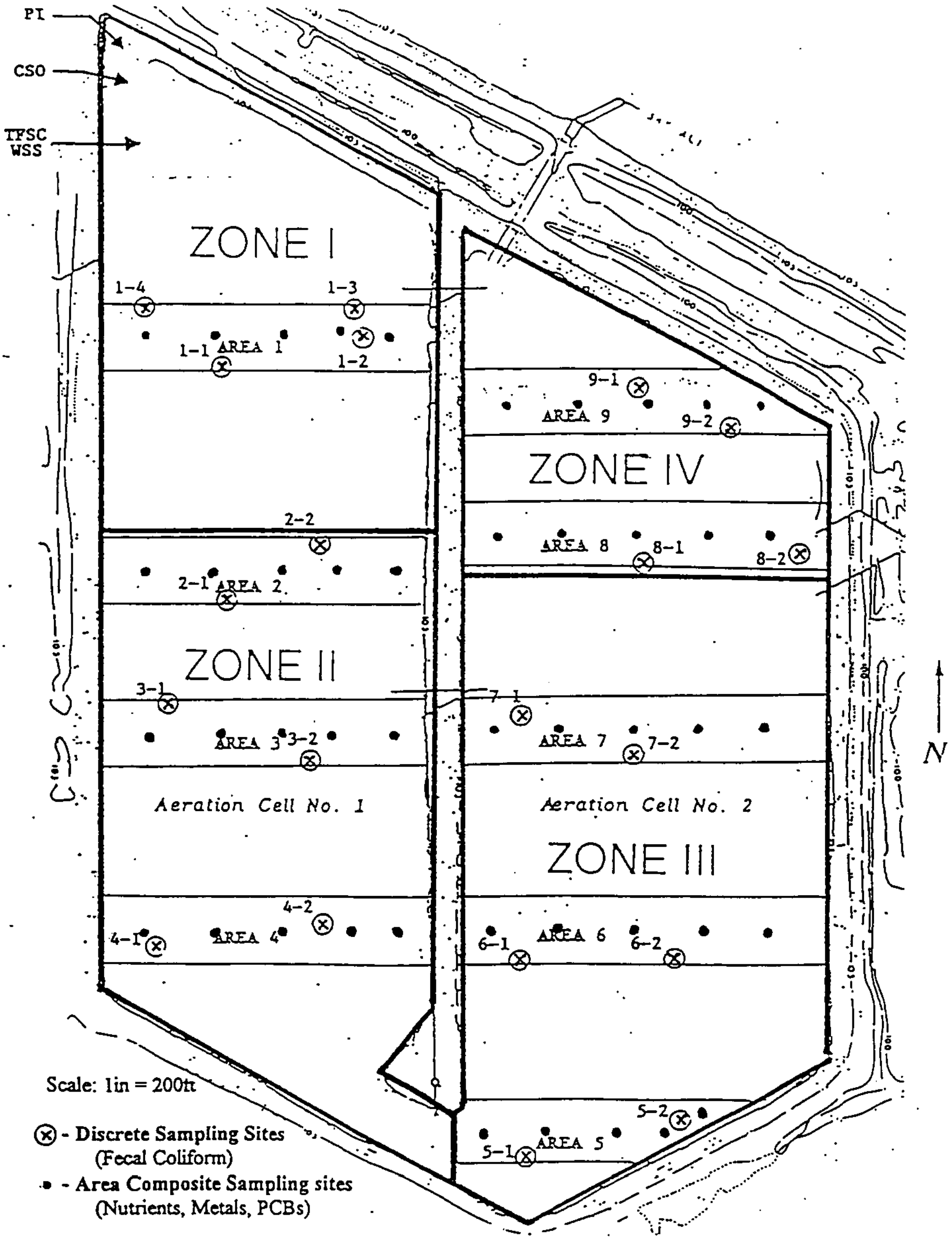
* March and May only

Summary and Conclusions

Arsenic concentrations and loadings were evaluated for wastewater influent and pond effluent from 1995 through April 1998. Arsenic concentrations were also evaluated for accumulated biosolids from 1993 through May of 1998. Short term variations in arsenic levels in wastewater influent, pond effluent and accumulated biosolids were observed. Average monthly arsenic concentrations and loading in influent were observed to vary with monthly rainfall. A weaker relationship between average monthly arsenic concentrations in pond effluent and rainfall was also observed.

Linear regression analysis was used to evaluate possible trends in arsenic levels in wastewater influent, effluent and biosolids. Trend lines are shown on Figures 2 through 9. The slopes of the trend lines were relatively flat and do not indicate any clear increasing or decreasing concentration trends with time.

Average quarterly arsenic concentrations in biosolids are consistently below the ceiling concentration of 75 mg/Kg established in WAC 173-308 Table 1 for the time period evaluated. Average quarterly arsenic concentrations in biosolids occasionally exceed the concentration limit (41 mg/Kg) established to help define exceptional quality biosolids (Table 3). However, other factors affect whether or not biosolids may be defined as exceptional quality biosolids, including the results of the composite land application characterization sample. These factors include pathogen reduction requirements, vector attraction requirements, and concentrations of other metals. Everett representatives indicated that pathogen reduction requirements and vector attraction requirements are consistently met (personal communication, October 2, 1998). The data also indicate that average quarterly cadmium and zinc concentrations occasionally exceed the concentration limit and average quarterly lead concentrations routinely exceed the concentration limit for exceptional quality biosolids (Table 3).



1996 Aeration Pond Sampling Locations

From "1996 Residual Solids Monitoring Report; NPDES Permit WA-002449-0, City of Everett, WA"

Figure 1

Average Monthly Arsenic Concentration and Monthly Precipitation
Aeration Pond Influent
Everett Water Pollution Control Facility

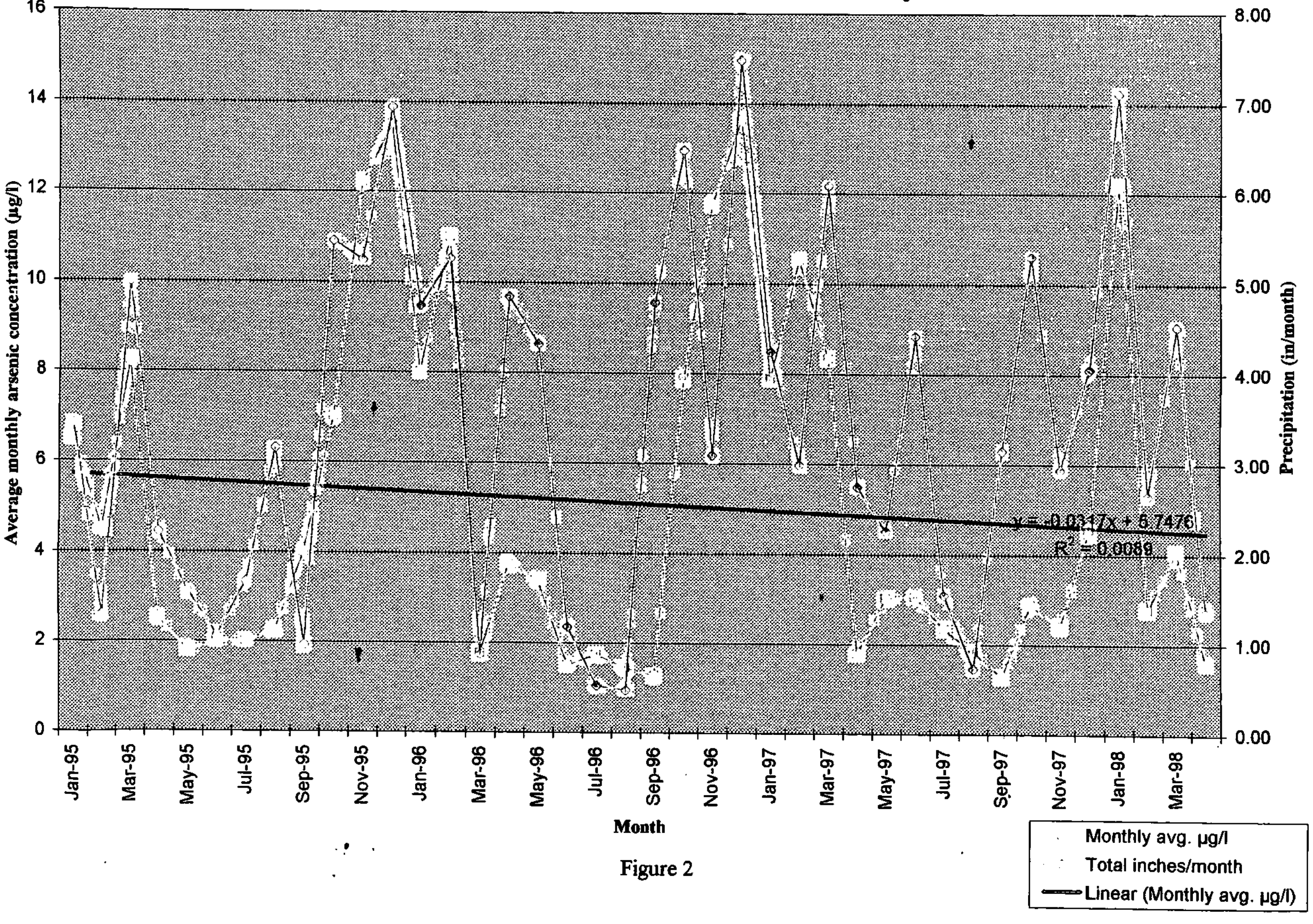


Figure 2

Average Monthly Arsenic Loading and Monthly Precipitation
Aeration Pond Influent
Everett Water Pollution Control Facility

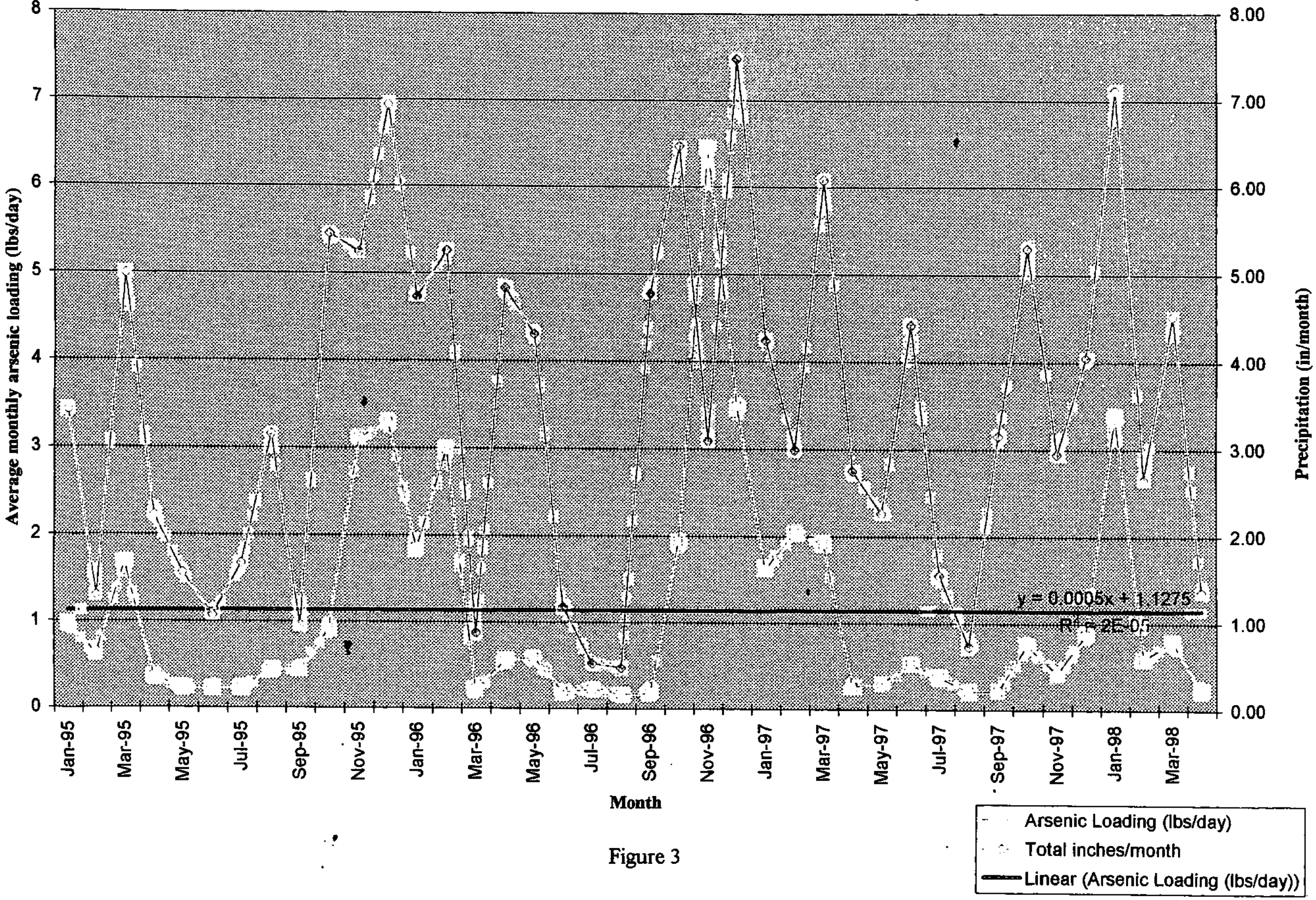


Figure 3

Average Monthly Arsenic Concentration and Monthly Precipitation
Aeration Pond Effluent
Everett Water Pollution Control Facility

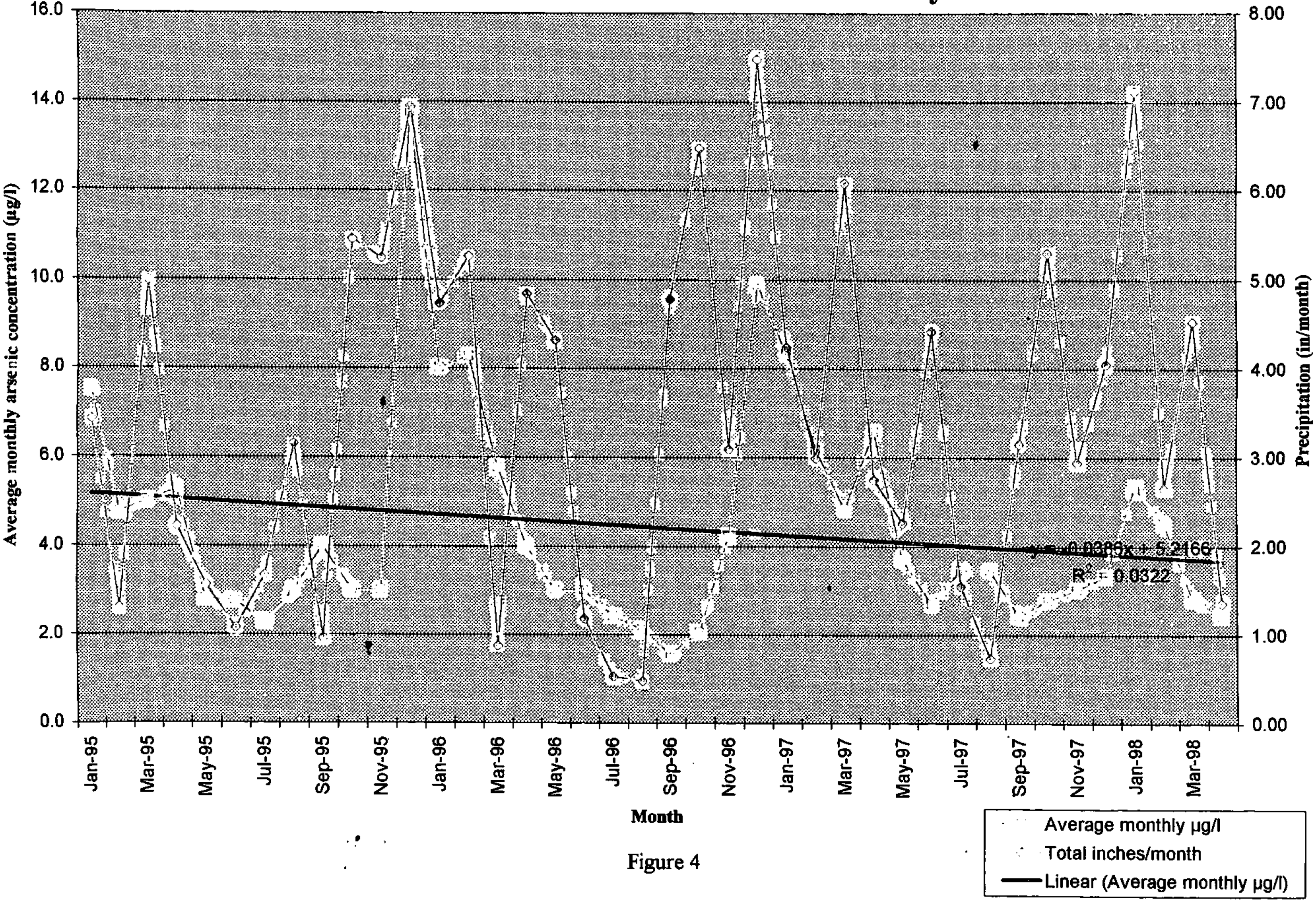


Figure 4

Average Monthly Arsenic Loading and Monthly Precipitation
Aeration Pond Effluent
Everett Water Pollution Control Facility

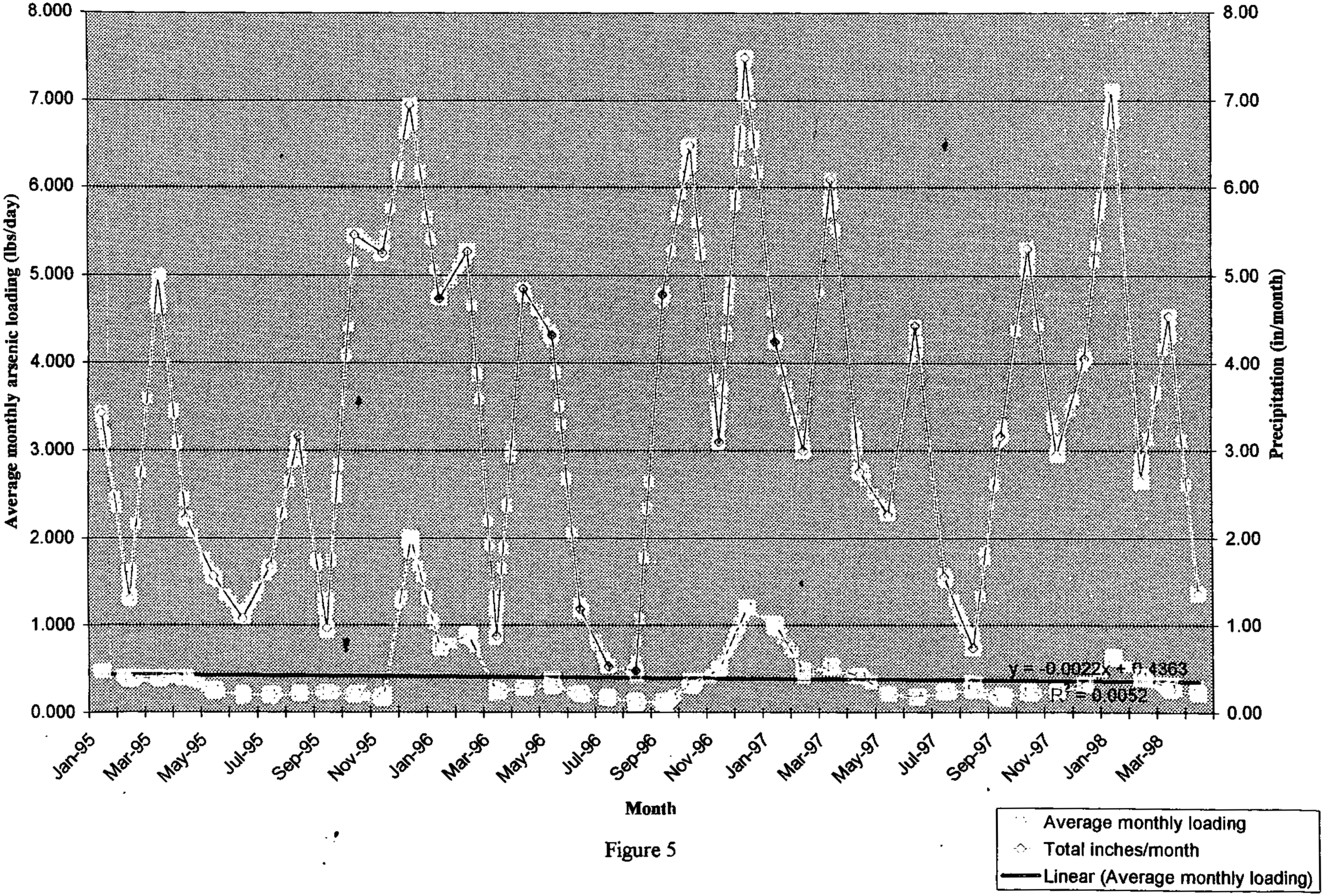


Figure 5

Zone 1 Average Quarterly Arsenic Concentrations
Aeration Pond Biosolids
Everett Water Pollution Control Facility

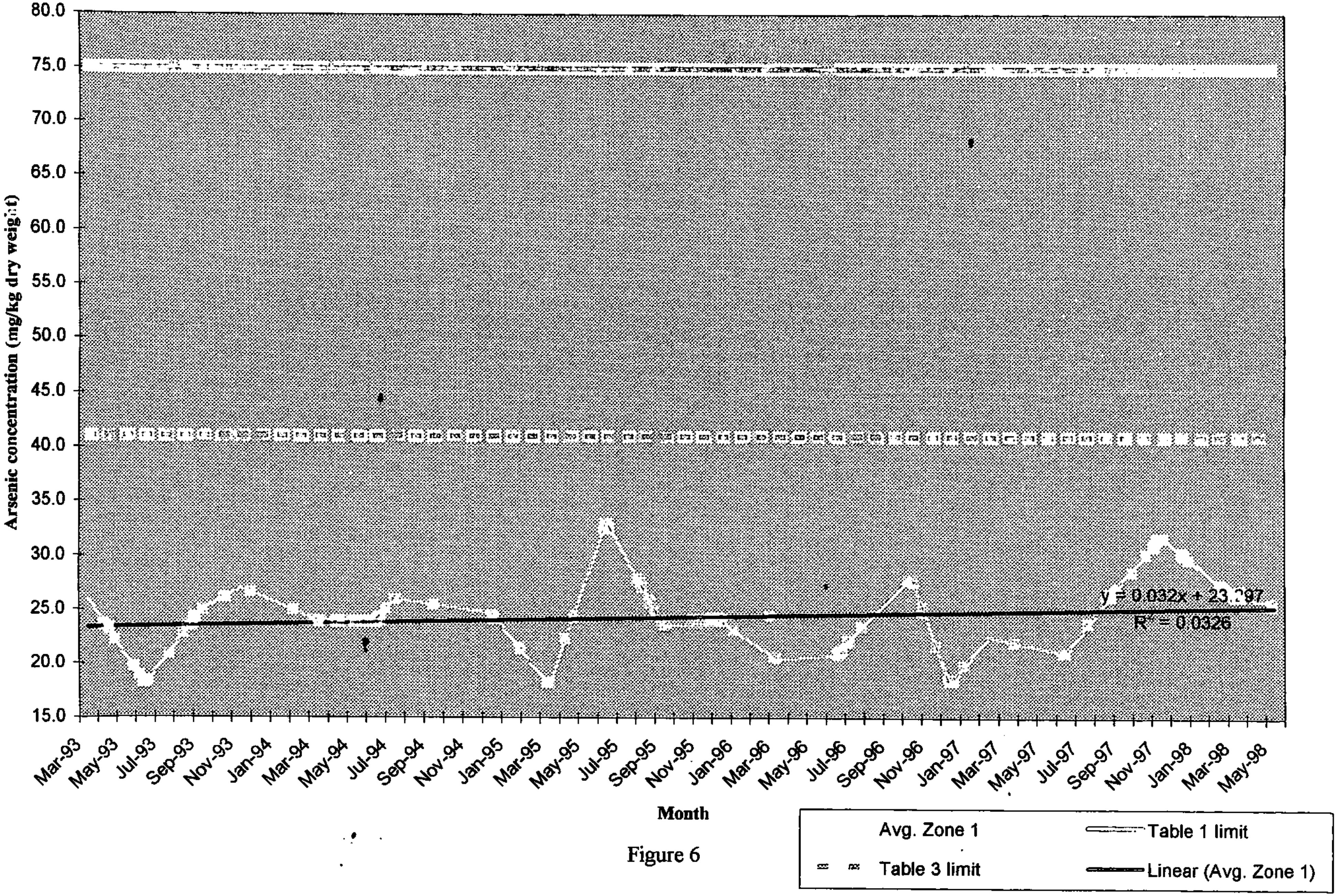


Figure 6

Zone 2 Average Quarterly Arsenic Concentrations
Aeration Pond Biosolids
Everett Water Pollution Control Facility

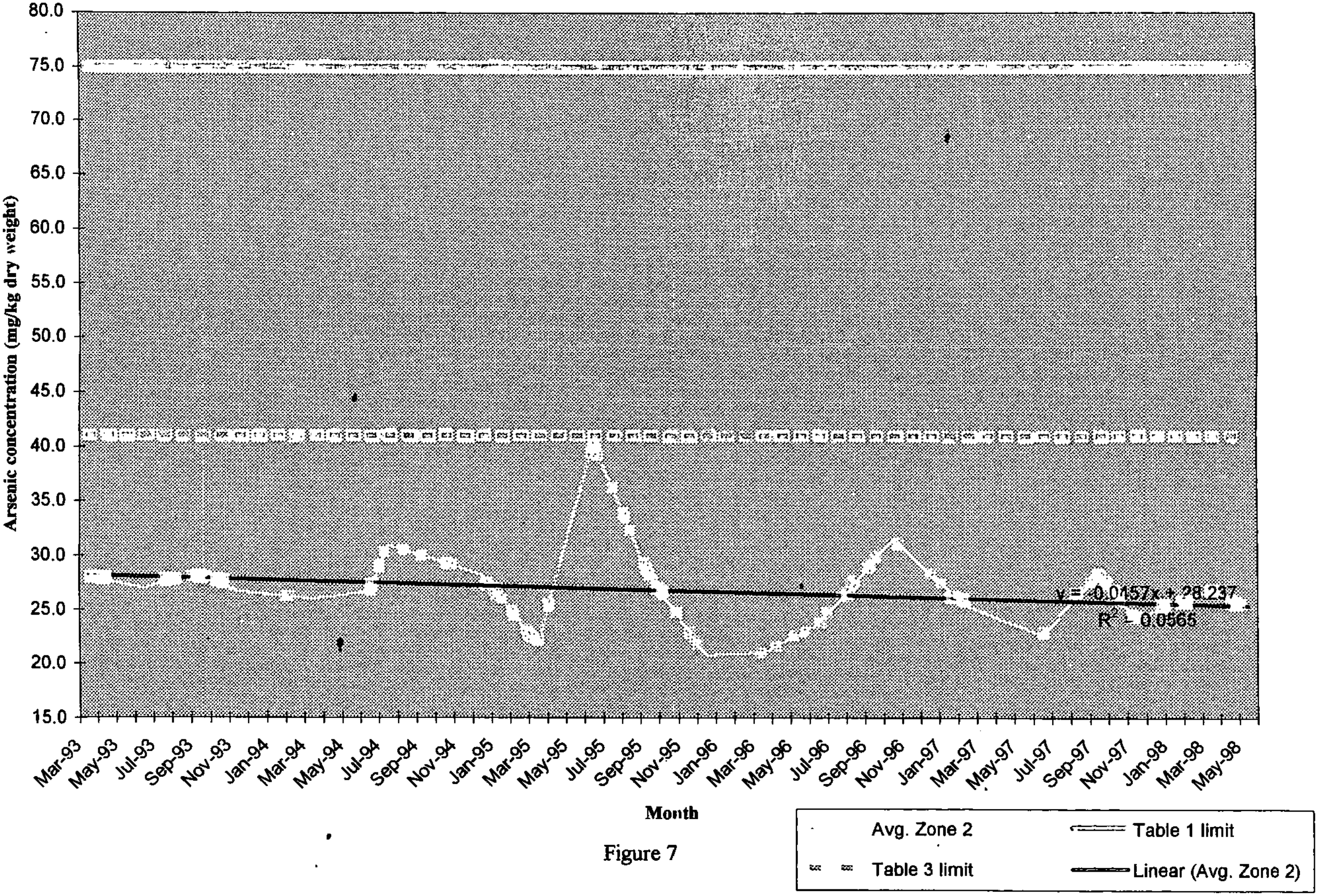


Figure 7

Zone 3 Average Quarterly Arsenic Concentrations
Aeration Pond Biosolids
Everett Water Pollution Control Facility

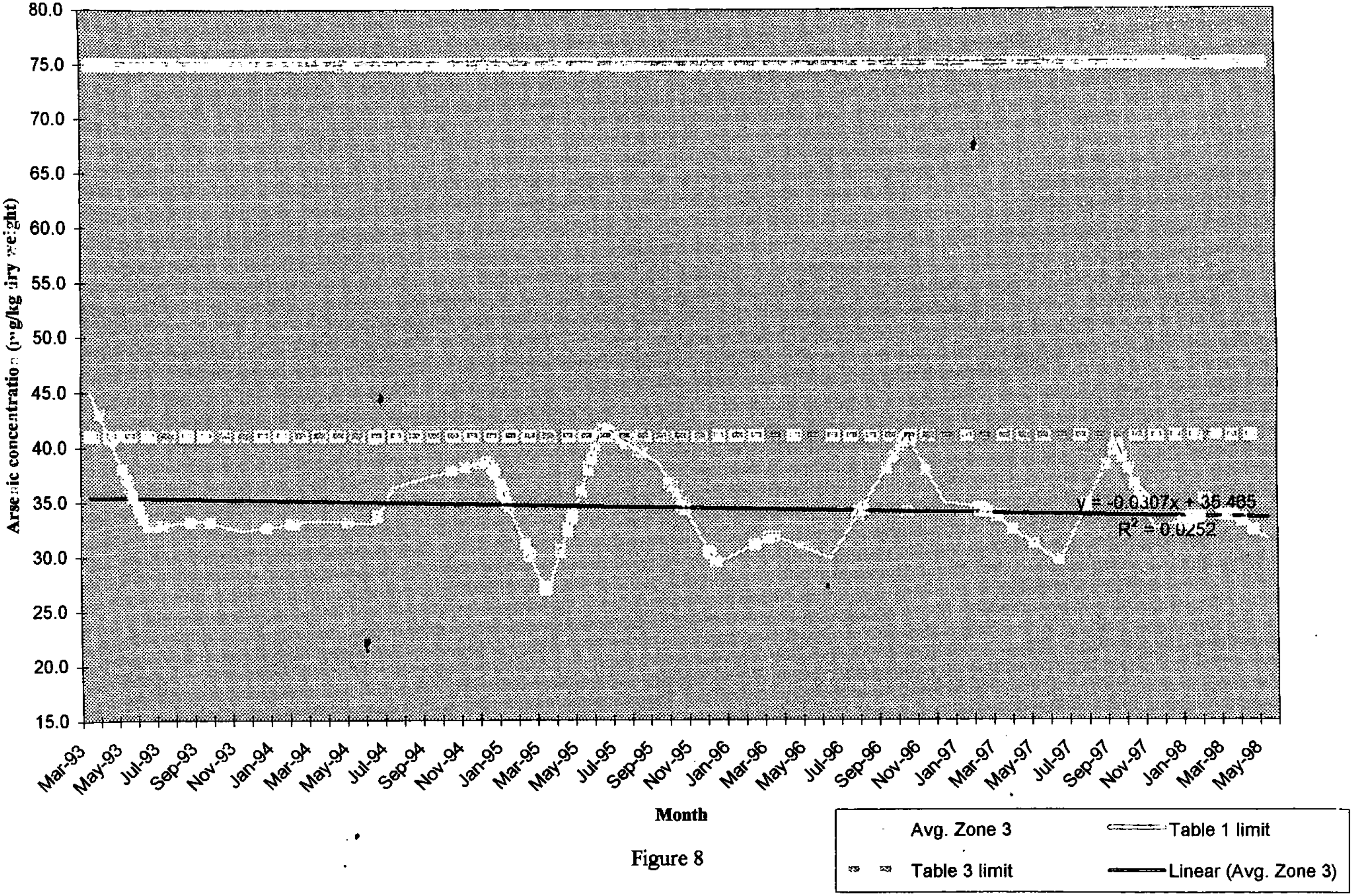


Figure 8

Zone 4 Average Quarterly Arsenic Concentrations
Aeration Pond Biosolids
Everett Water Pollution Control Facility

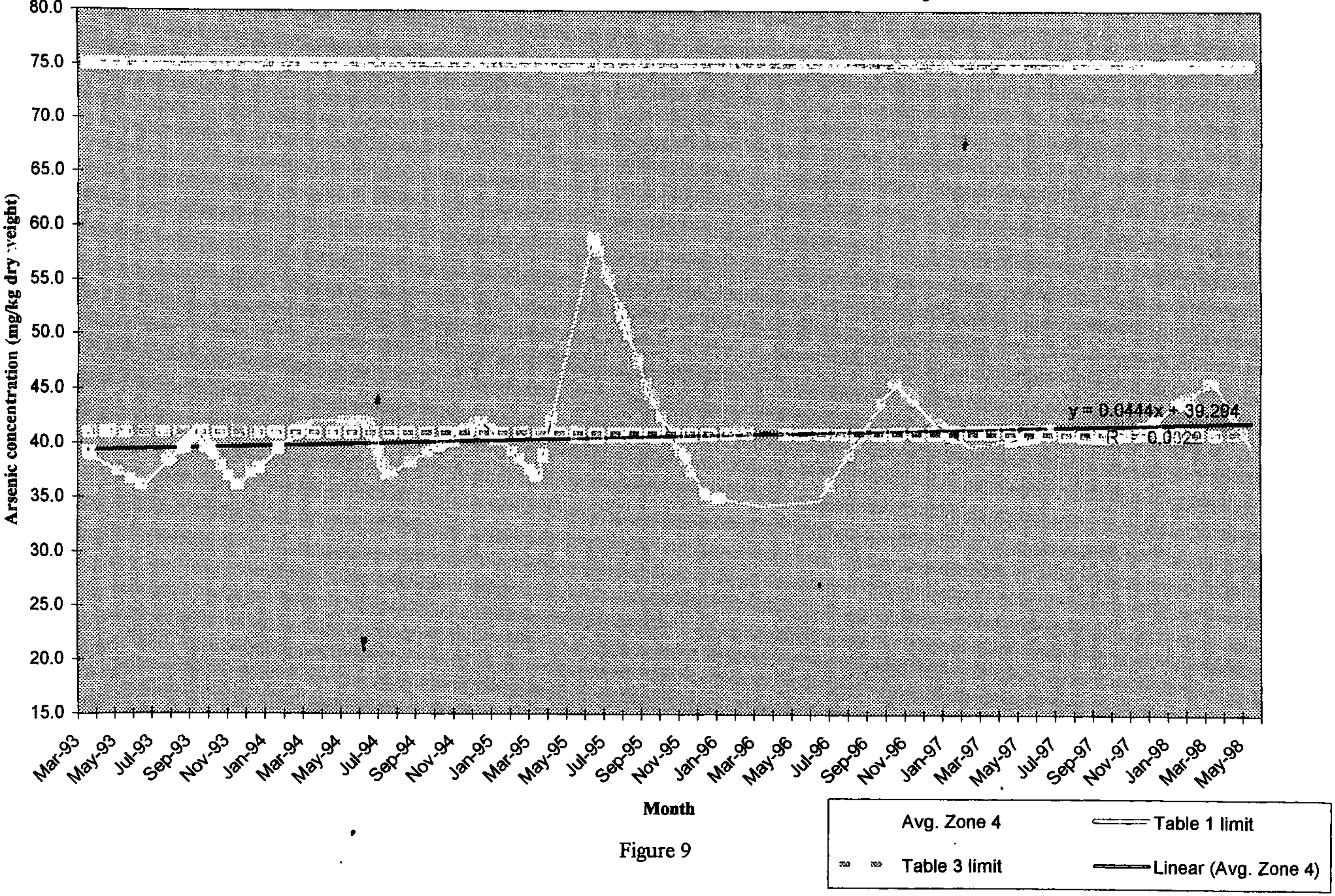


Figure 9

Overall Average Quarterly Arsenic Concentrations and Monthly Precipitation
Aeration Pond Biosolids
Everett Water Pollution Control Facility

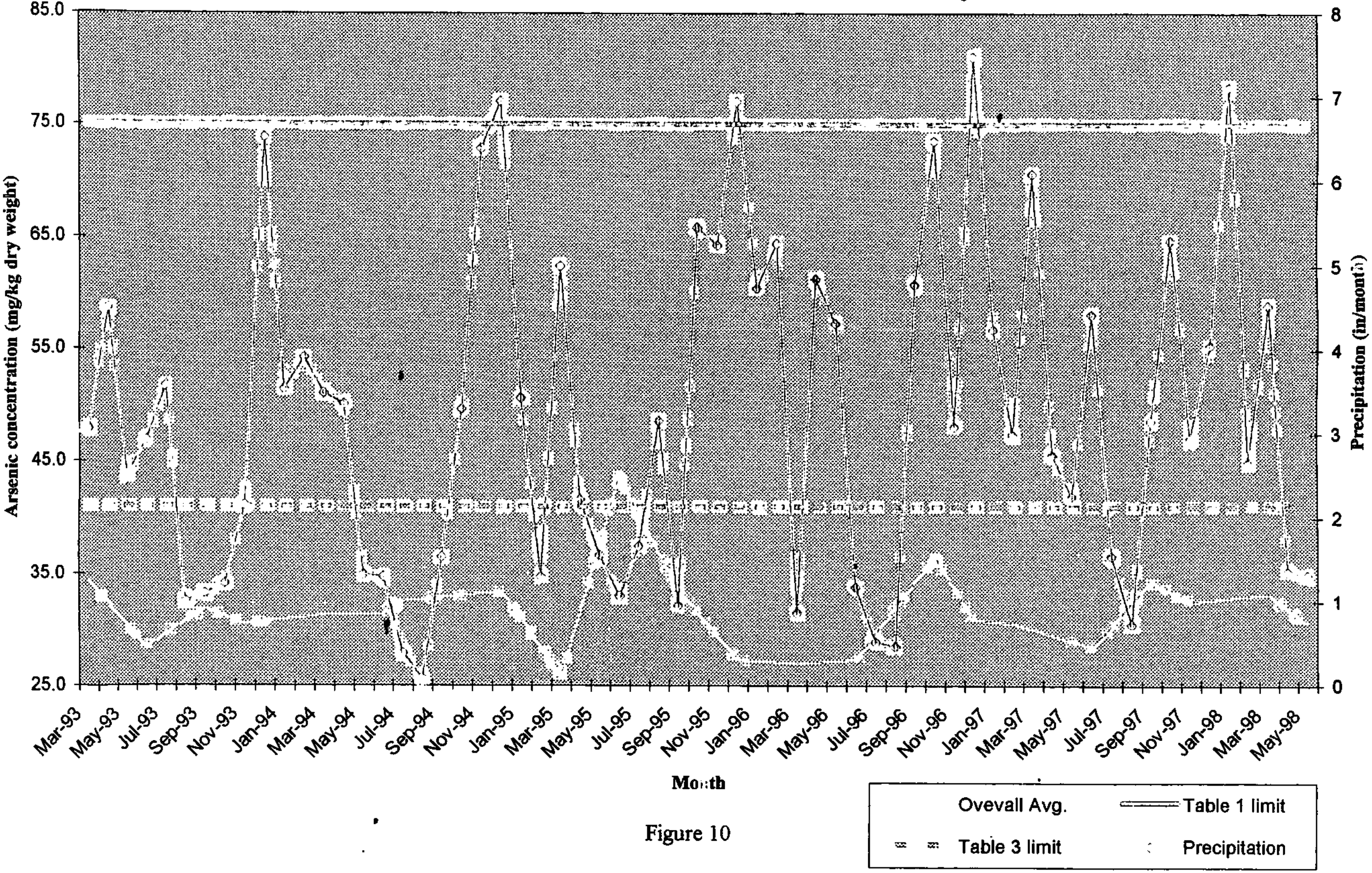


Figure 10

Appendix A

Tables 1 through 4
WAC 173-308

TABLE 1 – CEILING CONCENTRATION LIMITS

POLLUTANT	CEILING CONCENTRATION *
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

*** Milligrams per kilogram – dry weight basis**

TABLE 2 – CUMULATIVE POLLUTANT LOADING RATES

POLLUTANT	CUMULATIVE POLLUTANT LOADING RATE*
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

*** Kilograms per hectare – dry weight basis**

TABLE 3 – POLLUTANT CONCENTRATION LIMITS

POLLUTANT	LIMIT*
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

*** Monthly average concentration in milligrams per kilogram – dry weight basis**

TABLE 4 – ANNUAL POLLUTANT LOADING RATES

POLLUTANT	ANNUAL POLLUTANT LOADING RATE*
Arsenic	2.0
Cadmium	1.9
Copper	75
Lead	15
Mercury	0.85
Nickel	21
Selenium	5.0
Zinc	140

*** Kilograms per hectare per 365 day period**

[Statutory Authority: RCW 70.95J.020 and 70.95.255. 98–05–101 (Order 97–30), § 173–308–160, filed 2/18/98, effective 3/21/98.]