CDM

Work Plan
Remedial Investigation and Feasibility Study
Maury Island Glacier Pit
Maury Island, Washington

November 5, 2010

Prepared For:

King County Water and Land Resources Division
King Street Center
201 South Jackson Street, M.S. KSC-NR-600
Seattle, Washington 98104-3855

Prepared By:

CDM
14432 SE Eastgate Way, Suite 100
Bellevue, Washington 98007

King County

A Report Prepared For:

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MAURY ISLAND GLACIER PIT
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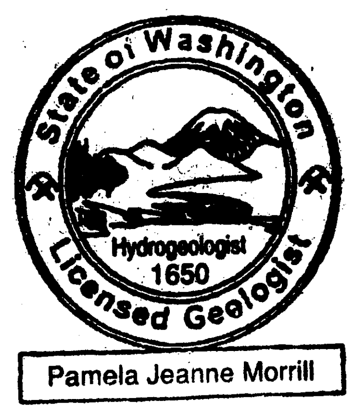
Pamela J. Morrill, LHG
Senior Environmental Scientist



CDM
11811 N.E. 1st Street, Suite 201
Bellevue, Washington 98005
425/453-8383

CDM Project No. 19897-78774-RI/FS

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Section 1
Introduction

1.1 General

This Remedial Investigation (RI) and Feasibility Study (FS) Work Plan (Work Plan) has been prepared on behalf of King County (the County) by Camp Dresser & McKee Inc. (CDM). This Work Plan presents the technical approach for conducting a remedial investigation and feasibility study for Northwest Aggregates' (NWA) Maury Island Sand and Gravel Mine located on Maury Island in King County, Washington. NWA is a wholly owned subsidiary of Glacier Northwest, Inc.

This work is being conducted on a voluntary basis in accordance with the State of Washington Model Toxics Control Act (MTCA), Chapter 173-340 of the Washington Administrative Code (WAC). King County retained CDM to prepare this Work Plan in accordance with our August 20, 2010 proposal. Our services were performed as Work Order No. 1 under contract No. E00196E10.

1.2 Background Information

The NWA Maury Island Sand and Gravel Mine lies within the Tacoma Smelter Plume. The Tacoma Smelter was a 67-acre facility located in the Ruston/North Tacoma area. Beginning in 1890, the Tacoma Smelter was a lead smelter and refinery (EPA, 2010). Asarco purchased the property in 1905. In 1912, the facility was converted to a copper smelter, and refined copper from copper-bearing ores and concentrates shipped in from other locations (EPA, 2010). These copper ores contained high arsenic concentrations (EPA, 2010). Besides copper and arsenic, the ore that Asarco used contained significant concentrations of a variety of metals, including lead, nickel, zinc, cadmium, selenium, antimony, mercury, and silver. Asarco closed the smelter in 1985 (EPA, 2010). Over the years of operation, metals released from the smelter's smokestack, particularly arsenic and lead, were carried by wind and settled over a 100 square-mile area (Ecology, 2001). As a result of this, surface soils within much of the Tacoma smelter fallout area contain arsenic and lead concentrations that are many times greater than natural background concentrations. This is what is referred to as an area-wide contaminant plume.

The Washington Department of Ecology (Ecology) defines any area where a hazardous substance has come to be located as the "site," regardless of property boundaries. For this reason, the NWA Maury Island Sand and Gravel Mine is referred to as the "Property" throughout this Work Plan and the "site" refers to the Tacoma Smelter area-wide contaminant plume.

The soils on Maury Island are among the most significantly impacted within the Tacoma Smelter Plume with average arsenic concentrations greater than 100 milligrams per kilogram (mg/kg), and in some areas greater than 200 mg/kg (Ecology, 2004). On Maury Island, the Property lies within one of the areas most impacted by the Tacoma Smelter Plume (Ecology, 2004).

Ecology is currently drafting a Model Remedy Guidance for the Tacoma Smelter Plume. This document is a soil sampling guidance prepared for property owners and developers who intend to develop or redevelop properties located within the Tacoma Smelter Plume. The guidance only requires testing for arsenic and lead in soil, apparently because these metals are consistently present at the highest concentrations and are the primary contaminants of concern with respect to human health risks.

The Model Remedy Guidance does not address assessment of groundwater, terrestrial ecological concerns, or surface water. In some instances metals impacted soils may cause secondary impacts to groundwater and surface water/sediments as a result of contaminant migration. In undeveloped areas (i.e., forest land) the higher exposure, and therefore the greater population at risk, is the terrestrial ecological environment as opposed to humans.

1.3 Objective of the Remedial Investigation and Feasibility Study

The objective of the RI is to characterize the nature and extent of contamination caused by the Tacoma Smelter Plume. Based on the RI findings, the FS will evaluate remedial alternatives, and ultimately justify a selected remedial alternative that is sufficiently protective of human health and the environment considering the projected long-term Property use as recreational open space.

1.4 Purpose of the Work Plan

The purpose of this Work Plan is to describe the project objectives and organization, functional activities, cleanup alternative evaluation criteria, and quality assurance/quality control (QA/QC) protocols, and provide a health and safety plan (HASP) that will be used to complete the RI. Elements of this plan that were developed to achieve this purpose include the following:

- Summary of previous investigations;
- Presentation of a preliminary conceptual site model;
- Identification of data gaps that require further investigation to enable further understanding of the nature and extent of contamination;
- Scope of field sampling to be performed to meet the objectives of the RI;
- Field investigation procedures, including quality control sampling;
- Quality assurance protocols;
- Ecological and human health risk assessment methodology;
- Methods to be utilized to develop and evaluate cleanup alternatives;

- Summary of the elements to be included in the deliverables;
- Schedule for completing the RI and FS.

1.5 Organization of the Work Plan

This work plan contains the following three documents:

- RI and FS Work Plan.
- Sampling and Analysis Plan (SAP), QA/QC Procedures (**Appendix A**).
- Site Health & Safety Plan (**Appendix B).**

The RI and FS Work Plan is contained within the body of this deliverable. Section 2 presents a description of the Property and vicinity, including the physical setting. Section 3 presents the Property history, description of prior contaminant investigations onsite, data summary, and preliminary identification of potential exposure pathways. Section 4 presents a data evaluation, including development of constituents of potential concern (COPC), and determination of data gaps. Section 5 describes field investigation scope of work, including the sampling scheme, and general sampling methods. ..Section 6 presents the scope of work for the FS. Section 7 describes the deliverables and Section 8 the project schedule. The documents used in preparation of this Work Plan are listed in Section 9.

The SAP, included in **Appendix A**, contains the following elements:

- Description of field exploration and sampling protocols;
- Description of sample handling procedures;
- Description of chemical analyses to be conducted;
- Quality assurance procedures, including quality control sampling and;
- Equipment decontamination and waste control.

The HASP is included in **Appendix B** and includes the following elements:

- Summary of the work to be conducted;
- Evaluation of the physical and chemical hazards;
- Assessment of the means and methods of mitigating such hazards;
- Listing of emergency contact information and;
- Driving directions to the nearest emergency medical facility.

Section 2
Property Location and Description

2.1 Property Location

The Property is located on the southeast side of Maury Island, which is located in the Puget Sound, north of Tacoma, Washington. Maury Island is just off the southeast side of Vashon Island and connected to Vashon Island at its north end by an isthmus. The Property is situated in portions of Sections 28 and 29, Township 22 North, Range 3 East. **Figure 1** shows the Property location.

The Property is bordered on the southeast by the Puget Sound and the north by SW 260th Street (see **Figure 2**). The surrounding land is characteristically forested. King County forested parkland is situated off the northwestern corner of the Property. Small residential lots are located off the south end and northeast corner of the Property. Rural residential small acreage parcels are located to the west.

2.2 Property Description and History

2.2.1 Property Description

The Property is an irregularly-shaped approximately 235 acre property situated on a sea bluff above the Puget Sound. NWA operates a sand and gravel mine within this property. Mining, processing, and reclamation activities are permitted on approximately 193 acres of the Property.

Recent mining operations have been centrally located on the Property. Topographically, the northern, western, and southern portions of the Property are gently rolling. Slope gradients range from roughly 5 to 20 percent in these areas. The elevation decreases and is steeply sloped to the southeast to form the sea bluffs above Puget Sound and the boundary around the mined area. Total elevation change across the Property is approximately 363 feet (AESI, 1998). **Figure 2** shows the Property boundaries with topographic contours projected on an aerial photograph.

Most recently disturbed areas are sparsely vegetated. In older mined and graded areas are thicker stands of grass, scotch broom, blackberries and seedling Pacific Madrone trees. The majority of the upland areas that are undisturbed by mining are covered by mature forest, which includes Pacific Madrone, Douglas Fir, and Maple. Large stands of blackberry bushes cover some areas of the sea bluffs where landslides have occurred in recent history as well as a portion of the upland in the northeast corner of the Property.

2.2.2 Property History

Sand and gravel mining have been conducted at the Property since at least the 1930s and by NWA (or their predecessors) since the 1960s. A series of historical aerial photographs that had previously been obtained by Shannon & Wilson, Inc. were provided to CDM by NWA. Copies of these aerial photographs are included in

Appendix C. Figure 3 outlines some of the more significant features observed on the aerial photographs. Observations noted in these photographs are summarized below.

1936 – The 1936 aerial photograph shows the entire Property and vicinity as having been relatively recently logged. It also shows what is referred to as the "North Pit" on the Property. Located in the northeast quarter of the Property, this former mined area formed a bowl in the topography just off the Puget Sound. This former mine area is evident today by the current topography as shown on **Figure 3.** The photograph also shows a substantial amount of grading that extends off to the north toward the northern property line, which is also outlined on **Figure 3**. Also evident are several slide areas along the bluff.

1960 – The 1960 aerial photograph shows the forest having filled back in and the North Pit mined area as being mostly revegetated. Slide activity is similar to that of the 1936 aerial photograph, and a few newer slides are evident along the bluffs.

1969 – The 1969 aerial photograph shows active mining in the "Southern Pit." A dock is present and two barges by the dock clearly indicate ongoing mining activity. The footprint of Southern Pit is similar to the present footprint shown on **Figure 3.** Two roads led into the Southern Pit. The "Main Access Road" from the north is similar to present. An area along the western side of the road (near the Property entrance) appeared to be cleared out for parking. Extending in a southwesterly-northeasterly direction and following the topography was the "North Slope Access Road." The road followed the topography around the former North Pit. Another, apparently secondary road, extended to the mine area between the two main roads. Slides, resulting from road grading and other disturbances, were observed all along the bluff from the Southern Pit northward along the Puget Sound.

1974 – The Southern Pit was still active in 1974. A large slide had obliterated the southern end of the North Slope Access Road. A new road could be observed extending in a northeast–southwest direction extending from the northeast corner of the Property to the Main Access Road where it meets the northern end of the Southern Pit.

1977 – In 1977 the boundaries of the Southern Pit appeared to have been pushed farther westward. Grading had occurred in and above the area of the 1974 slide.

1980/1985 – In 1980, a fairly substantial amount of additional grading was observed in the area above the 1974 slide and that slide area appeared to have been recently active again. There was a large area to the north of the pit where the trees had been removed starting in the early 1970s and by 1980 the trees were completely removed. The area had scrubby vegetation and a circular road in 1980. By 1985 the road appeared to be overgrown. In 1985, the area of mining appeared to be concentrated on the southern side of the Southern Pit.

1995/2002 – During these years most of the mining appeared to be occurring on the southern and western side of the Southern Pit. Vegetation noted in the central area of the pit suggests a lack of mining activity.

2.3 Physical Setting

Soils, geology, geologic hazards and groundwater existing conditions, impacts and mitigation related to mining were studied by AESI (1998) and are also described in other reports prepared for the Property (ELS, 2006; Terra Associates 1999). The following summarizes the Property physical setting as described in these references.

2.3.1 Geology

The Property is mantled by Vashon age glacial till and outwash. The outwash is interpreted as advance outwash, but may include recessional outwash near the ground surface (ELS, 2006).

Vashon lodgement till mantles approximately one-third of the Property. Till consists of an unsorted and unstratified, but highly compact, mixture of clay, silt, sand, gravel and boulders deposited at the base of the advancing glacier. These sediments appear to be relatively thin and discontinuous where they occur across the upland portions of the property. The till is generally only 3 to 6 feet thick, but at one location the till was found to be greater than 11.5 feet thick (AESI, 1998).

Outwash is exposed over roughly two thirds of the Property and extends throughout the proposed mining depth (ELS, 2006). The Vashon advance outwash deposits are the target mined source for the Maury Island Mine and the predominant stratigraphic unit present on the property (AESI, 1998). Advance outwash sediments were deposited in meltwater streams in front of, and adjacent to, the advancing Vashon ice sheet. Vashon advance outwash deposits typically consist of brown, moist, stratified sandy gravel to gravelly sand becoming fine to medium grained sand with scattered gravels at depth. The upper coarse layer of the advance outwash is 108 to 110 feet thick and is cross-bedded with clasts of silt blocks (AESI, 1998).

Across the upland area, pre-Vashon age deposits occur approximately 290 to 263 feet below existing ground surface (approximate elevations of 8 to 90 feet, respectively) (AESI, 1998). Pre-Vashon age deposits consist of moist to saturated gray to gray brown fine sand and silt with occasional wood fragments.

2.3.2 Soils

Mined areas of the Property lack a soil horizon. On unmodified areas of the Property, soils are relatively young and have not had sufficient time to develop a deep profile. Instead, they exhibit a direct relationship to the underlying parent material. According to soil survey maps (SCS, 1973), three soil types are mapped across the Property. These soil types include: 1) Everett series; 2) Alderwood series; and, 3) Alderwood-Kitsap association, each of which are described below.

Everett Soils (Ev)

Everett soils consist generally of gravelly sandy loam that formed over glacial outwash. The typical soil profile is described as follows:

> **O1 horizon** (1-2 inches thick) – Undecomposed roots, twigs, and moss, abundant roots.
>
> **O2 horizon** (¾ to 1 ½ inches thick) – Decomposed organic matter, abundant roots.
>
> **A1 horizon** (0-1 ½ inches thick) – Black to gray sandy loam with a massive, very friable structure.
>
> **B2 horizon** (10 to 18 inches thick) – Dark brown to yellowish brown gravelly sandy loam with a massive, very friable structure.
>
> **B3 horizon** (8 to 18 inches thick) – Brown to pale brown very gravelly sandy loam with a massive, very friable structure.
>
> **C horizon** (below a depth of 32 inches) – Black/dark grayish brown to brown/gray very gravelly coarse sand with a single grain, loose structure.

Alderwood Soils (Ag)

The Alderwood soils consist of dark brown and grayish-brown gravelly sandy loam developed over a substratum of grayish-brown lodgement till. The typical soil profile is as follows:

> **A1 horizon** (1-3 inches thick) – Very dark brown to dark grayish brown, gravelly sandy loam with a weak, fine granular structure. Friable
>
> **B2 horizon** (9 to 14 inches thick) – Dark brown to brown, gravelly sandy loam with a medium, subangular blocky structure. Slightly hard.
>
> **B3 horizon** (12 to 23 inches thick) – Grayish brown to gray gravelly sandy loam. Contains light olive brown mottling. Hard.
>
> **C horizon** (below a depth of approximately 27 inches) – Grayish brown to gray consolidated till. Contains distinctive light olive brown and yellowish brown mottling.

Alderwood and Kitsap Association (AkF)

Soils within the Alderwood and Kitsap Association contain two or more soil types. Approximately 50 percent of the mapped area is Alderwood gravelly sandy loam and 25 percent is Kitsap silt loam. The remaining percentage of material varies, but may consist of moderately coarse to coarse textured soils. These soils develop in varying parent materials, including clay, silt, sand and gravel, thus the variation. This association typically forms on steep slopes (25 to 70 percent) and is present along the sea bluffs above Puget Sound.

The soil types identified on the Property as extrapolated from the Soil Conservation Service soil survey maps (SCS, 1973) and modified by physical observations (AESI, 1998) are illustrated on **Figure 4**. Mined areas with no remaining soil horizon are identified with an “M.”

2.3.3 Groundwater

The first primary aquifer beneath the Property occurs in the Vashon advance outwash under unconfined conditions and flows from northwest to southeast (ELS, 2006). Groundwater elevations range from 85 feet above mean sea level (ft MSL) in the northwest corner of the Property to 20 ft MSL near the Puget Sound (ELS, 2006).

Because of the high permeability of the outwash sediments and relatively thin, discontinuous covering of near surface till, perched groundwater in the till layer has not been apparent.

Evidence of spring activity has been noted at the contact between the Vashon advance outwash and the underlying less pervious silt and clay of the pre-Vashon unit where exposed near sea level on the east side of the property (AESI, 1998). Some evidence of spring activity was also noted at beach level west of the dock. These seepage zones are considered to be related to groundwater discharge (AESI, 1998).

2.3.4 Surface Water

Because the outwash soils are highly permeable and the till unit, when present, is thin and discontinuous, there are no obviously apparent surface water features on the Property. This includes lakes, ponds, streams, or wetlands. There are also currently no apparent man-made water features, such as stormwater holding ponds or settling ponds. Similarly, historical aerial photographs have shown no obvious signs settling ponds. However, surface water conditions on the Property have not been officially documented during a period of heavy precipitation.

Obviously, even with the most porous soils a certain amount of runoff will occur down steep slopes during periods of heavy rainfall. On the mined out areas where slopes are still poorly vegetated soil erosion will occur to a certain extent along with the stormwater runoff. Soil erosion along the heavily vegetated bluffs will be limited. More importantly, the unstable bluffs are prone to mass wasting.

Section 3
Summary of Prior Environmental Studies

A number of environmental studies related to the Tacoma Smelter Plume have been conducted on the Property by several different consultants since about 1998. The following sections summarize the purpose, scope, and data generated for the soil and groundwater investigations that have been completed to date. A table summarizing the metals data generated during these investigations is included in **Appendix D**. Summary figures prepared by Aspect Consulting that show sample locations and corresponding arsenic concentrations are also included in **Appendix D**.

In Section 3.1 we have used the MTCA Method A soil cleanup levels for unrestricted land use conditions as a basis for comparison. These concentrations are not necessarily the cleanup levels that will be applied to the Property. The Method A cleanup level for arsenic is 20 mg/kg. For lead, cadmium, and mercury, the Method A cleanup levels are 250 mg/kg, 2 mg/kg, and 2 mg/kg, respectively. The Puget Sound area background concentration for arsenic is 7 mg/kg, lead is 24 mg/kg, cadmium 1 mg/kg, and mercury is 0.07 mg/kg (San Juan, 1994).

Various groundwater and surface water standards are discussed with respect to the groundwater data in Section 3.2. Surface water standards are presented in the discussion because groundwater ultimately discharges to the Puget Sound.

3.1 Prior Soil Investigation Summaries

Below is a listing of the soil environmental studies completed for the Property with a brief summary of the purpose of the study, scope or work, and findings.

Associated Earth Sciences, Inc., 1998, *Soils, Geology, Geologic Hazards and Groundwater Report, Existing Conditions, Impacts and Mitigation, Maury Island Pit, King County, Washington.* Prepared for Lone Star Northwest, Inc.

> The purpose of this study was to document existing soils, geology, geologic hazards, and hydrologic conditions. Ten soil samples (EP-2, EP-3, EP-9, EP-11, OBW-1, OBW-2 locations) were collected and analyzed for arsenic, lead and mercury as a part of this study. Four samples were collected from an 8-10 inch depth and the remaining samples were collected from depths of 7 to 220 feet below ground surface (ft bgs). Arsenic concentrations in three of the shallow surface samples were comparable to background. Arsenic in one topsoil sample was present at a concentration of 85 mg/kg. Mercury and lead concentrations in all the samples were low (i.e., background), as were all metals concentrations in all of the samples collected at depth.

Landau Associates. 1999. Letter to Vashon-Maury Island Community Council Re*: Final Sampling Results. NW Aggregates Maury Island Gravel Mine.* January 19, 1999.

The purpose of this study was to assess arsenic concentrations in surface soil samples. Ten soil samples were collected from the 0-2 inch interval (these samples were given the designation "GM"). Arsenic concentrations ranged from 28 to 379 mg/kg in nine samples, and was 9 mg/kg in the tenth sample. Surface detritus was apparently removed before sampling. The only location mentioned as possibly having been disturbed by prior activities (e.g., grading or filling) was GM-9. Samples were sieved by the lab prior to analysis. AGRA collected duplicate samples. Their data was similar, with arsenic concentrations ranging between 6.6 and 477 mg/kg in the ten samples.

Terra Associates, Inc. 1999. *Technical Memorandum, Environmental Soil Sampling, Arsenic, Cadmium and Lead, Lone Star Maury Island Site, King County, Washington*. March 23, 1999.

The purpose of this study was to obtain additional information regarding the distribution of arsenic, cadmium, and lead in soils throughout the Property. The study included collection and analysis of 77 samples, 57 of which were collected from within the top 18 inches (these samples were given the designation "TA"). The samples were collected on a 600-foot grid established across the Property. The set of 57 samples were collected by: 1) sampling the upper 2-inches after removal of branch and leaf litter; 2) using a shovel to advance the hole to 9 inches and collecting the sample; and, 3) using a shovel to advance the hole to 18 inches and collecting another sample. Soils at two of the sample locations were also collected at a depth of 2 ft bgs (arsenic was not detected in either sample).

Of the 19 surface soil samples, 12 exceeded the MTCA Method A arsenic cleanup level, ranging from 47 mg/kg to a high of 220 mg/kg. Of the 19 samples collected at a depth of 9 inches, 11 exceeded the MTCA Method A arsenic cleanup level, ranging from 25 to 270 mg/kg. Of the 19 samples collected at a depth of 18 inches, three exceeded the MTCA Method A arsenic cleanup level, ranging from 43 to 64 mg/kg. In these samples, cadmium concentrations ranged to a maximum of 9.3 mg/kg and lead concentrations ranged to a maximum of 830 mg/kg. Cadmium and lead concentrations were only elevated in soil samples where arsenic concentrations were similarly elevated.

Terra Associates collected the remaining 20 samples from resource materials (i.e., proposed mine materials) from test pits, borings, and grab samples off existing vertical cuts (EP-15 through EP-28, OBW-6, OBW-7, and "G" series samples). Sample depths ranged from 8.5 to 220 ft bgs. Arsenic concentrations were all less than 7 mg/kg. Cadmium and lead concentrations were below detection limits in these samples.

Foster Wheeler Environmental. 1999a. Attachment A to Mitigation Plan, entitled: *Focused Feasibility Study.* In: *Mitigation Report for Contaminated Soils, Northwest Aggregates, Maury Island Sand and Gravel Mining Operation*. June 1999.

> The purpose of this study was to evaluate remedial alternatives, based on the proposed land use as a mining operation. This study estimated that 271,000 cubic yards of surface soils exceed the MTCA Method A arsenic cleanup level of 20 mg/kg. Of that total yardage, approximately 50,520 cubic yards of soil were estimated to exceed 200 mg/kg total arsenic. Of the remedial alternatives evaluated in the FS, excavation and containment on the Property in lined cells was determined to be the preferred alternative.

Foster Wheeler. 1999b. *Mitigation Report for Contaminated Soils, Northwest Aggregates, Maury Island Sand and Gravel Mining Operation*. June 1999.

> This report presents a summary of prior environmental data and the FS described above, as well as confirmation soil sampling, air monitoring, groundwater monitoring, and institutional controls that would be implemented as a part of the proposed remedial alternative.
>
> Additional soil data presented in this report includes three locations ("SS" series samples) where soil samples were collected from the surface, 9 inches and 18 inches, similar to the Terra Associates study summarized above. At two additional locations, soil samples were collected from a depth of 2 ft bgs. Arsenic concentrations were 110 and 140 mg/kg in two surface soil samples and non-detected in the third sample. In the three 9-inch samples, arsenic was reported at 130 mg/kg in one sample and non-detected in two samples. Arsenic was not detected in the 18 inch or 2 ft samples. Cadmium ranged to a maximum of 9.8 mg/kg and lead to a maximum of 840 mg/kg. Cadmium and lead concentrations were only significantly elevated where arsenic concentrations were similarly elevated.

Foster Wheeler. 2000a. *Soil Sampling Report for June 2000*. Prepared for Glacier Northwest, Inc. August 2000.

> The purpose of this investigation was to supplement prior data and better define metals concentrations in selected areas, specifically: 1) the west road where a future grading effort was planned (the samples were given the designation "WRS"); and, 2) near the 180 degree bend in the North Slope access road (ORS-12 and ORS-13). The purpose of the road grading was to improve road drainage. Samples were collected along the east and west access roads. The samples were presumably collected within the top 0-2 or 0-6 inches. Arsenic concentrations in the 12 samples ranged between 19 and 110 mg/kg. The Method A cleanup level was exceeded in 11 of the samples. Cadmium and lead were also analyzed, neither of which were notably elevated in any sample.

What occurred following this sampling is unclear, but it does not appear that grading subsequently occurred.

Foster Wheeler. 2000b. (No Report Available)

Summary tables and summary figures reviewed contain information on 15 soil samples (the samples were given the designation "SF") collected along SW 260th Street by Foster Wheeler in 2000. Similar to those samples documented in the August 2000 report, we assume these were surficial soil samples collected alongside SW 260th Street in preparation of grading, ditch clearing, etc. Arsenic concentrations in these samples ranged between 16.5 and 172 mg/kg. Thirteen of the 15 samples exceeded the Method A cleanup level.

Foster Wheeler. 2001. *Soil Sampling Report for Road Restoration.* Prepared for Glacier Northwest, Inc. October 15, 2001.

The purpose of this investigation was to supplement previous analytical data and quantify metals contamination along the East access road where a road repair project was planned. Twelve samples were collected (ORS-14 through ORS- 25), presumably within the top 2 to 6 inches. Arsenic concentrations ranged between 1.78 and 156 mg/kg. Three samples exceeded the Method A cleanup level. Cadmium and lead were also analyzed and these metals were only elevated when arsenic concentrations were elevated.

Again, what occurred following this sampling is unclear. We similarly presume that subsequent road grading work has modified the ORS series sample locations.

Aspect Consulting, LLC. 2004. *Fill Source Environmental Assessment for Maury Island for STIA Third Runway Project.* Prepared for Glacier Northwest. March 2004.

The purpose of this investigation was to evaluate metals concentrations in mined soils for proposed use in the SeaTac Airport third runway project. In this study Aspect Consulting collected 59 soil samples from a series of test pits and borings. Sample depths ranged between 5 and 280 ft bgs. The samples were analyzed for a variety of metals, including arsenic, cadmium, and lead. Metals concentrations in all samples were low and similar to background.

3.2 Groundwater

There are various water quality standards that can be applied for this Property. The MTCA Method A groundwater cleanup levels for arsenic and lead are both 5 µg/L. There are no Method A standards for copper and zinc. The MTCA human health-based Method B noncarcinogenic standard formula values for copper and zinc are 592 µg/L and 4,800µg/L, respectively.

The MTCA cleanup levels are not entirely consistent with drinking water standards. The State and Federal drinking water primary Maximum Contaminant Levels (MCLs) for arsenic, lead, and copper are 10, 15 and 1,300 µg/L, and the secondary MCL for zinc is 5,000 µg/L.

The marine chronic (most stringent) surface water standards for arsenic, lead, copper and zinc are 36, 8.1, 3.1, and 81 µg/L, respectively.

3.2.1 On-Property Groundwater Quality

Three wells on the Property have been regularly monitored for metals and a variety of other inorganics since February 1999. Monitoring well OBW-7 is located at the northeast (hydraulically upgradient) corner of the Property, OBW-6 is located at the northwest (hydraulically upgradient) corner of the Property, and OBW-9 is located on the southwestern (hydraulically downgradient) side of the Property. Monitoring well locations are shown on **Figure 5.**

The ground surface elevation at OBW-6 is approximately 275 ft MSL and the water level elevation is approximately 57 ft MSL. The ground surface elevation at OBW-7 is approximately 307 ft MSL and the groundwater elevation is approximately 42 ft MSL. The ground surface elevation at OBW-9 is approximately 45 ft MSL and the groundwater elevation is approximately 19 ft MSL. (TerraAssociates, 2003).

CDM obtained water quality data summary tables for these three wells for the period of February 1999 through December 2009 from Aspect, which are included in **Appendix D**. We understand that the wells have dedicated pumps and the metals data are on a totals basis. CDM was not supplied with information on turbidity at the time of sampling, which could be useful in the data evaluation.

Throughout the monitoring period the highest reported arsenic concentrations in OBW-6, OBW-7, and OBW-9 were 3.1 microgram per liter (µg/L), 3.2 µg/L, and 5 µg/L, respectively. The highest lead concentrations in OBW-6, OBW-7, and OBW-9 were 2 µg/L, 2µg/L, and 3 µg/L, respectively. Therefore, even the most stringent standards, MTCA Method A, were not exceeded for either arsenic or lead.

The highest copper concentrations were 21 µg/L in OBW-6, 22 µg/L in OBW-7, and 24 µg/L in OBW-9. The highest zinc concentrations were 120 µg/L in OBW-6, 45 µg/L in OBW-7, and 38 µg/L in OBW-9. The marine chronic surface water standard for zinc was exceed once (out of 34 sampling events) in one well (OBW-6). Copper exceeded its chronic marine surface water standard of 3.1 µg/L standard 6 times in OBW-6 (34 sampling events), 5 times in OBW-7 (33 sampling events), and 6 times in OBW-9 (33 sampling events).

While copper appears to show some propensity in exceeding marine standards, there are several factors that should be considered as follows:

- The marine chronic standard is very low 3.1 µg/L – lower than for all the other metals.

- Copper typically was not detected (21 times in OBW-6 and 18 times each for OBW-7 and OBW-9) with the detection limit typically being 1µg/L.

- In most instances, the reported copper concentrations were only 4 or 5 µg/L, which is within the realm of analytical variation.

- The data are all on the totals basis and therefore there is no way to compare dissolved to totals concentrations, thereby evaluating the possibility of high bias due to suspended solids. We noted that the highest concentrations occurred during two adjacent sampling periods — October 2004 and January 2005 and the next highest concentrations occurred during the very first sampling round (February 1999). One would expect higher turbidity during the first sampling round while the wells may not be yet fully developed. The two consecutive rounds in October 2004 and January 2005 may be consistent with specific quality control issues during field sampling by an individual sampler, but we do not have specific information to substantiate this. At any rate the sporadic occurrence of these higher concentrations leads us to believe that they were likely an artifact of turbidity in the samples, as opposed to being truly higher copper concentrations in groundwater.

Based on these considerations, copper data do not show exceedances of the marine criteria that are necessarily related to the Tacoma Smelter Plume contamination.

Of the other metals analyzed and listed as metals potentially present in Tacoma Smelter Plume fallout, cadmium, mercury, and silver have never been detected. Nickel, antimony, and selenium were only ever detected one to three times in any given well over the past 10 years at concentrations of 1 to 4 µg/L, below any respective groundwater or surface water standards.

3.2.2 Off-Property Groundwater Quality

To further evaluate the possible groundwater impacts from the Tacoma Smelter Plume, CDM conducted a brief research of groundwater data available online for Vashon and Maury Islands. From 2001 through 2004 King County conducted an ambient water quality monitoring program on Vashon-Maury Island and continues to collect long-term water quality data from a number of wells (See **Appendix D** for a well location map and summary of water quality data). The County continues to prepare data summaries annually and posts them on the County's Vashon-Maury Island Watershed website, with the most recent report containing data collected through 2009. Data collected during this 9-year time period from wells on both Vashon and Maury islands show:

- Arsenic, lead and copper levels in the aquifer systems throughout Vashon and Maury Island are consistently below the primary MCL for drinking water (10 μg/L)

- The highest average arsenic concentration for wells monitored by King County on Maury Island is 5.4 and 5.9 μg/L at VAS_W-09a and VAS_W-12 respectively, which slightly exceeds the MTCA Method A groundwater cleanup level of 5 μg/L.

- Historically measured arsenic concentrations in groundwater on Maury and Vashon Island do not appear to be related to anthropogenic sources from Asarco smelter fallout, but more likely the result of two sources: (1) leaching from arsenic contained within native deposits and (2) geochemical reactions within ancestral peat deposits.

- Two arsenic hotspots exist on Vashon Island with concentrations averaging 18.5 and 28.9 μg/L, These elevated arsenic concentration areas appear to correlate with elevated concentrations of phosphorous within localized peat deposits, suggesting that these elevated concentrations may be the result of naturally occurring geochemical processes.

A review of Department of Health records for the three water systems located exclusively on Maury Island shows no exceedances for arsenic, lead and copper from their groundwater sources, some of which include springs. Arsenic data collected from these water systems corroborate with King County data in that arsenic concentrations in groundwater generally range between 1 and 3 μg/L.

3.3 Constituents of Potential Concern (COPC)

3.3.1 Soil

As indicated above, a large number of the soil samples in the studies listed above analyzed cadmium and lead in addition to arsenic. These metals were also correspondingly elevated with respect to what would be expected for naturally occurring background concentrations, but lead more so than cadmium. When arsenic concentrations were low, so were these metals. Mercury was analyzed in a limited number of samples, but was detected in only a small percentage of those and at concentrations well below its Method A cleanup level. Therefore, mercury does not appear to be a COPC.

While additional testing could also find that other metals are also elevated compared to background concentrations, arsenic is typically the driver for remedial actions because of its toxicity to human and terrestrial ecological life. Lead is also typically identified as COPC because of the prevalence in which similarly significant concentrations are present and the relatively acute toxicity of this metal for humans. Metals such as copper and zinc are toxic to aquatic life, but not as much an issue for terrestrial species.

Because these metals were deposited via airborne fallout, and due to their affinity to organic matter and soil cations, they are not highly leachable and typically remain within the upper one to two feet.

Due to the predominance of data that show arsenic, lead, and cadmium concentrations exceeding Method A cleanup levels in surface soils, as well as their relative toxicity, these metals should remain as COPC. There is no current information that would indicate any other metals should be considered as COPC in soil.

3.3.2 Groundwater

After 10 years of on-Property groundwater monitoring, in addition to the water quality data collected by the County and Maury Island drinking water purveyors, no exceedances of drinking water standards for arsenic, cadmium, or lead have been recorded in Maury Island wells and springs. .Copper could be marginally construed as exceeding the marine chronic surface water standard, but this standard appears to be below ambient water quality conditions on the Vashon and Maury Island.[1] Other metals do not exceed either MTCA Method A/B or surface water standards. Therefore, it is highly unlikely that metals associated with the Tacoma Smelter Plume are COPCs in groundwater.

While our preliminary research on groundwater quality indicates that on-Property groundwater has not been impacted by the Tacoma Smelter Plume fallout, these data need to be fully researched, documented and justified within the context of the RI. Otherwise, additional sampling may be required.

3.4 Exposure Pathways

The investigations summarized above have established that only surface soil (upper 2 feet) are known to be impacted by metals. Prior Property investigations have established that leaching has not caused any increase in metals concentrations in subsurface soil.

The following transport mechanisms are, or may be important to the COPC at this Property:

- Transport by dust
- Uptake by plants and/or animals
- Runoff or erosion
- Direct anthropogenic soil movement (e.g., transport of soils on shoes and tires)
- Transport via leaching to groundwater.

[1] Based on King County 2001 - 2004 Ambient Groundwater Monitoring Program, which shows an average concentration of 4.9 ug/L for groundwater throughout Vashon and Maury Island.

To this end, humans may be exposed to site COPCs through both, ingestion and dermal contact. COPC may be inadvertently ingested via ingestion of dust or by placing any object with dirt on it into one's mouth. Direct ingestion may also occur, and is typically a condition called "pica" whereby the subject has a craving and eats generally non-nutritive substances, such as soil. Dermal contact, will readily occur with site COPC by direct contact of soil with exposed skin, and as dust and dirt may be picked up on ones clothing, tools, etc. and then transferred onto the skin.

Exposure to plant and animal life will occur similarly. Although to a certain extent the exposure to plant and animal life is much more direct, considering that soil is the growing medium for plants and that the topsoil is a highly biologically active zone.

Erosion from water runoff could result in transport of contaminated soils. The only locations on the Property where this could be of significance are the bluffs. The upland areas, where most of the soil contamination exists, are flat and not prone to erosion. Within the currently mined area all of the topsoil has been removed and presumably only uncontaminated clean sand and gravel are currently exposed. The bluff areas are, for the most part, densely vegetated. This helps to minimize erosional processes, particularly sheet, rill, and gully erosion. However, as was described in section 2.2.2, the bluffs are prone to mass wasting and several large gullies have opened up over the years, particularly along the bluff to the north of the southern pit during the 1960s and 1970s. Historical road construction and repair along this stretch of the bluff also served to move large quantities of soil.

While these catastrophic failures and grading cause the sudden movement of contaminated soils, they similarly cause the sudden transport of an even larger volume of uncontaminated soils. The end result of this is a freshly exposed face of uncontaminated soils along the bluff wall. At the base of the bluff the relatively small mass of contaminated topsoil, mixed with the large mass of uncontaminated soils, will be essentially lost. In these instances nature will have taken over the course of remediation by dilution.

Furthermore, any potential negative "impact" to the beach/Puget Sound sediments as a result of these mass wasting events, beyond that which the Puget Sound itself was exposed to over the past century of Tacoma Smelter fallout is remote for the following reasons: 1) again, the huge dilution from the intermixing of uncontaminated and contaminated soils, and 2) the low cation exchange capacity of the beach sands which do not promote adsorption of metals.

Data reviewed to date indicate that COPC concentrations in groundwater throughout Maury Island are below maximum contaminant levels for public drinking water supplies and therefore do not appear to present a threat to human exposure via ingestion. Only copper concentrations are apparently sometimes elevated slightly above chronic marine surface water criteria.

Section 4 Evaluation of Contaminant Distribution and Data Gaps

4.1 Contaminant Distribution

4.1.1 Data Set

CDM conducted a statistical evaluation of the arsenic, lead, and cadmium data for soil data at the surface, 9-inch, and 18-inch depths. Existing data were reviewed to remove samples from disturbed areas that would obviously lack contamination due to prior removal of the surface soil layer, such as samples collected from the existing mine area and those suspected to have been collected from a landslide area. Even so, some of the soils data in the statistical evaluation were likely generated from samples collected in disturbed areas. For example, we observed differences between the surface soil data collected by Terra Associates (TA) in 1999 and Foster Wheeler (FW) in 2000 and 2001. TA's arsenic, cadmium and lead data are generally greater than the FW samples. FW's samples also contained no cadmium or lead Method A cleanup level exceedances. There are two plausible reasons for these differences: 1) samples were collected from previously disturbed areas where the surficial layer had already been stripped; and, 2) differences in sampling or analytical protocol. The majority of the differences are likely due to prior disturbance in the area. As a result of keeping these data within the statistical evaluation, overall metals concentrations in undisturbed areas will likely be higher than what is presented here.

The data used in the statistical evaluation are presented in **Appendix E**. When the reported metal concentration was below the method detection limit, a value of one half the detection limit was used in the statistical analysis.

4.1.2 Statistical Findings

The statistical summary, including the sizes of the data sets, average concentrations, standard deviation, median, greatest concentration, upper 95 percent confidence limit, and number and percentage of the samples exceeding the MTCA Method A cleanup levels is presented in **Table 1**.

The average arsenic concentrations were 99 mg/kg, 77 mg/kg, and 14 mg/kg for the surface, 9-inch, and 18-inch depths. The greatest concentrations reported for these depths were 477 mg/kg, 270 mg/kg, and 64 mg/kg, respectively. Compared to the MTCA Method A cleanup level of 20 mg/kg for arsenic, 84 percent of the surface samples exceeded, 57percent of the 9-inch samples exceeded and 16 percent of the 18-inch samples exceeded.

For lead, the average concentrations were 207 mg/kg, 35 mg/kg, and 14 mg/kg for the surface, 9-inch, and 18-inch samples respectively. The greatest concentrations reported for these depths were 840 mg/kg, 120 mg/kg, and 51 mg/kg, respectively.

Compared to the MTCA Method A cleanup level of 250 mg/kg, 33 percent of the surface samples exceeded and none of the 9-inch or 18-inch samples exceeded.

For cadmium, the average concentrations were 1.7 mg/kg, 1.1 mg/kg, and 0.61 mg/kg for the surface, 9-inch, and 18-inch samples respectively. The greatest concentrations reported for these depths were 9.8 mg/kg, 2.9 mg/kg, and 1.5 mg/kg. Compared to the MTCA Method A cleanup level of 2 mg/kg, 19 percent of the surface samples exceeded, 11 percent of the 9-inch samples exceeded and none of the 18-inch samples exceeded.

Based on these data, arsenic concentrations exceed the Method A cleanup level to a depth of 18 inches or more. However, a review of the locations for the three 18-inch samples that exceeded the MTCA Method A cleanup level indicate that impacted soils deeper than 12 inches may only occur in the southern half of the northeast quadrant of the Property.

Lead concentrations exceeding the Method A cleanup level are limited to the surficial layer suggesting that lead is bound up in the organic layer and is not mobilized by infiltrating rain water.

For cadmium, there were no exceedances of the Method A cleanup level in the samples collected from the 18-inch depth. Two of the 18 samples exceeded the cleanup level for the 9-inch depth. Ecology's *Guidance on Sampling and Analysis Methods* (1995) bases the decision on whether an area complies with a cleanup level on the following:

1. The upper 95% confidence limit on the true population mean not exceeding the cleanup level;

2. No sample concentration can exceed twice the cleanup level; and

3. Less than 10% of the samples can exceed the cleanup level.

For cadmium concentrations in the 9-inch samples, the upper 95% confidence limit was 1.5 mg/kg, no sample contained a cadmium concentration greater than twice the 2 mg/kg Method A cleanup level and the percent of samples exceeding the cleanup level was 11%. With a larger data set, cadmium, similar to lead might meet the criteria for being compliant with the cleanup level.

4.1.3 Conclusions

Based on the data reviewed, arsenic remains the primary contaminant of concern for undisturbed soils within the upper 2 feet across the Property. Lead and cadmium are COPCs, but concern for these metals appears to be limited to the surface.

4.2 Data Gaps

In reviewing the cumulative information generated for this Property to date, CDM has identified several data gaps that need to be investigated to complete the RI and proceed to the FS. Briefly, these are as follows:

1) How metals data correlate with the existing environment (i.e., potential effects of soil type, topography, vegetation).

2) Metals concentrations in the surficial organic layer (i.e., forest duff).

3) Current potential exposure to metals along the existing trail system.

4) The sampling density of surficial soils is not sufficient to show small-scale variability (i.e. variation across distances of tens of feet).

5) Potential plant uptake of metals.

6) Impacts of metals on the terrestrial ecological environment.

7) Hydrostratigraphic location (i.e., aquifer and surficial geologic deposits) for the sources of the groundwater quality data collected throughout Maury Island.

8) Potential contaminants or site conditions that influence nature of existing site contamination as associated with historical property use.

9) Seasonal surface water features (i.e., ephemeral creeks, seasonally ponded water).

10) Sample locations are too concentrated along roads and insufficiently scattered across the property to be representative.

11) The subsurface soil sample density appears to be insufficient to show area-wide variability.

The need to address data gaps #1 through #7 are further discussed in the following sections Data gap #8 will be addressed by conducting a Phase 1 environmental site assessment separate from this RI/FS. Should additional potential environmental concern(s) be identified during the Phase 1 ESA additional field investigation will be conducted as appropriate . Data gap #9 will be addressed during a site walk conducted during a storm event as described in Section 5. Data gaps 10 and 11 are address within the sampling scheme outlined in Section 5.

4.2.1 Data Correlation with the Existing Environment

The studies completed to date, for the most part, have not regarded metals concentrations with respect to: 1) the natural environment (i.e., organic layer, soil types, vegetation types, topography); and, 2) historical activities (i.e., mining, grading). Prior to establishing any sampling program, a site needs to be broken up into areas that are similar in their natural development and anthropogenic disturbances. The Model Remedy for the Tacoma Smelter Plume refers to these areas as "decision units."

In many instances sites are relatively homogenous and there may only be one or two decision units. However, the Maury Island mine Property is highly complex in that portions of it have undergone a substantial amount of mining in different areas since the 1930s, other areas were logged in the early part of the 1900's and then allowed to reforest, while yet others have had some form of grading occurring. To further complicate the picture, the Asarco plant operated up until the mid-1980s, so any area that did not have its topsoil stripped after this time was subject to aerial deposition of smelter emissions to some extent.

Figure 5 presents CDM's interpretation of the various decision units for this site. This figure was prepared based on historical site mining and grading activities, topography, and aerial photographs indicating current vegetation type. In all, we have identified four primary decision units: 1) Mine; 2) Forest; 3) Historic Graded; and, 4) Bluff. Each of these decision units have been further divided into sub-units ("sub-decision units"), based on age and other differences as follows:

1) Forest
   a) Western Forest - characterized by Pacific Madrone and Douglas Fir, with understory of salal, bracken fern, sword fern, Oregon Grape, and huckleberries.
   b) Northern Forest - similar to the Western Forest area but geographically separated.
2) Mine
   a) Southern Pit - 1960s through 1980s active mining. Scotch broom and Pacific Madrone are beginning to encroach in this area.
   b) Southern edge of the Southern Pit - Most recently mined area from 1980s through the present. Some Scotch broom is encroaching in this area.
   c) North Pit –Mined approximately in the 1930s and 1940s. Vegetated primarily with Scotch Broom on the northwest slope and northeast slopes, Maple and Pacific Madrone on the southwest slope and the northeast slope.

3) Other Historic Disturbed Areas

a) Logged during the late 1970s to early 1980s with an unknown amount of grading; presently forested but mostly by alder.

b) Grading associated with the North Pit, 1930s; presently forested.

c) Historic rural residence or farm area in the 1930s, and grading in the 1960s. Presently the area is characterized by thick stands of blackberry bushes.

d) Parking and other disturbances along the side of the main road associated with mine from the 1960s through the 1970s; presently forested.

e) Western Edge of the Southern Pit where topsoil was possibly stockpiled. This area is presently heavily vegetated with Scotch Broom and blackberries.

4) Bluff

a) South bluff – Several landslides have occurred along this bluff over the decades. The area is heavily vegetated and there are no trails or roads.

b) Middle bluff – Numerous large landslides occurred along this bluff in the 1930s through 1980s. The area is heavily vegetated, primarily with Scotch Broom and blackberries.

c) North bluff – Landslides have not been prevalent along this bluff but a substantial amount of road grading occurred in 1960s that apparently pushed soils down the slope. The area is heavily vegetated, primarily with Scotch Broom and blackberries, and it also contains a substantial amount of poison oak.

4.2.2 Evaluation of Small Scale Variability

The current data set indicates that the data are spatially random. There are not sufficient data to evaluate "hot spots" greater than 200 feet in diameter. Additional RI data should be developed to determine whether hot spots are large enough be mapped, or whether hot spots are occur randomly on a very small scale basis. The size and distribution of hot spots can greatly influence the practicality of any remedial action.

4.2.3 Forest Duff

Metals, particularly lead and cadmium, become bound in organic matter. Therefore, we expect that metals concentrations in the forest duff, where it exists, to be relatively greater than in the surface soils. To date, all of the sampling has reportedly concentrated on the soils with the organic layer having been removed prior to sampling. CDM finds no credible reason to discard this important part of the soil horizon from the sampling program.

4.2.4 Trails

King County intends to purchase the Property for use as open space. Numerous trails exist throughout the Property and are currently being used by the general public. Besides the current potential exposure, it is expected that the existing trail system layout will be utilized. Metals concentrations within the trail system should be understood to evaluate current/future exposure pathways and for use in development of future remedial alternatives.

4.2.5 Newly Deposited Forest Litter

Plants can uptake metals to varying degrees. Some plants are known to hyperaccumulate metals. For example, Chinese Brake Fern can hyperaccumulate arsenic (Gonzaga, et. al. 2005) and Indian Mustard and Ragweed are known to hyperaccumulate lead (Wikipedia, 2010). On a more local level, Braken fern and Douglas Fir also appear to hyperaccumulate arsenic (AgriLife, 2010; Morel, et. al., 2002).

What we do not currently understand is the current uptake and cycling of metals in the forest litter. For example, to what extent are metals being taken up by the existing foliage onsite and how is it being cycled back onto the Property? The process of using plants to remove metals from soils via hyperaccumulation and then harvesting the resulting metals-laden plants is a form of remediation referred to as "phytoremediation." This may be one form of remediation considered for the Property, but first one needs to understand if metal uptake is occurring and also whether it is being recycled back into the system. This may be an important consideration if portions of the Property are remediated, but are subsequently subject to the fallout of metal-laden leaf litter.

4.2.6 Evaluation of the Terrestrial Ecological Environment

Sections 173-340-7490 through 173-340-7494 of MTCA define the goals and procedures to: 1) determine whether a release of hazardous substances to soil may pose a threat to the terrestrial environment; 2) characterize existing or potential threats to plants or animals exposed to hazardous substances in soils; and, 3) establish Property-specific cleanup standards for protection of terrestrial plants and animals.

The first step in evaluating whether there is a threat to the terrestrial environment is to determine the nature of existing biological conditions at the site and potential terrestrial receptors. The RI will describe existing terrestrial ecological conditions, based on our visual observations while conducting field work. This will include a general description of the vegetation types that are predominant in various areas on the property and observed and anticipated wildlife expected to frequent the area.

4.2.7 Evaluation of Groundwater Quality Data

Further analysis of the Maury Island King County and water purveyor data will be conducted to determine whether the data are conclusive regarding the Tacoma

Smelter Plume's lack of impact to the first aquifer. This analysis will specifically include:

- A determination of hydrostratigraphic completion for the Maury Island wells and spring sources that have water quality information.
- Identifying the surficial geology (e.g. glacial till, outwash) in the vicinity of the Maury Island wells that have water quality information.

If the data are insufficient to draw a conclusion regarding the impacts of the Tacoma Smelter Plume on the groundwater quality, additional on-Property sampling may be conducted.

Section 5
RI Scope of Work

5.1 Objective

This section addresses the methods that will be used to meet the objectives of the RI outlined in Section 1.3. As summarized in Sections 3 and 4, it is well established that arsenic concentrations, as well as cadmium and lead, exceed one or more MTCA cleanup levels in surficial soils throughout the Property. The objective of the current investigation is to fill in remaining data gaps by evaluating:

1) The nature and extent of metals concentrations within the various decision units identified in Section 4. As discussed above, prior assessment work did not account for differences across the Property (the existing environment), including the presence or absence of forest duff, mined areas, areas with fill, etc.

2) The nature and extent of metals concentrations along existing/proposed trails and trail buffer zones, and proposed picnic area.

3) Potential plant uptake of metals that may result in "biocycling" or removal of metals from soils.

The RI should be able to generate data that supplies a certain predictive basis. For example, we know that elevated metals concentrations are generally limited to the upper 12 inches, and likely in limited instances to 18 inches or more. However, it is unclear how soil type, the presence of an organic soil horizon (i.e. forest duff), uptake by vegetation, recent wind deposition, and the impacts of historic mining/grading and other anthropogenic activities affect the varying metals concentrations across the Property.

The scope of RI work outlined in the following sections was developed to meet the objectives described above.

5.2 Sampling Scheme

Figures 6 and **7** show the approximate proposed sample locations. Due to the nature of the site topography, vegetation, and existing trail system, and number of existing sample locations, sample placement did not occur on a grid system. Rather, sample locations were placed generally along the existing trail system at approximately 200- to 300-foot intervals, and then additional sample points were placed throughout the Property to fill large areas that currently have no data.

At each sample point that occurs on a trail, additional sampling will occur approximately 10 to 15 feet off the trail. Therefore, each sample point shown on **Figure 6** that lands on a trail actually consists of two sample points.

Table 2 summarizes the number of existing surface soil samples by decision unit, total acreage of each unit, number of proposed samples by unit, and the sample density by unit. Under the proposed sample layout, there will be a total of approximately 0.9 surface soil samples per acre collected from Decision Unit #1, 1.0 surface soil samples per acre collected from Decision Unit #2, 1.7 surface soil samples per acre from Decision Unit #3, and 0.5 surface soil samples per acre from Decision Unit #4.

The rationale for the sampling proposed for each general area follows:

Sub-decision units 1a, 1b, 3b, and 3d, consist of forested areas. Sub-decision units 1a and 1b are the least disturbed areas on the Property. Sub-decision Units 3b and 3d, while previously disturbed, have generally recovered and have relatively mature forest. The data gained from sampling these areas will provide an understanding of the maximum metals concentrations, and where the metals occur within the soil profile. The data will supplement existing data.

Sub-decision units 2a and 2b, consisting of the most recently mined areas, are assumed to be clean. However, there is very little data throughout these areas. Additional sampling is proposed in order to provide a confirmatory data set. Subsurface soil sampling is proposed only at locations where field screened arsenic concentrations exceed 15 ppm, if any.

Sub-decision units 3a, 3c, and 3e are, or have been, disturbed for one reason or the other over relatively recent years. Arsenic concentrations in surface soils are elevated, but there are virtually no subsurface data in these areas. The uncertainty of what has occurred in these areas, such as the possible stockpiling of surface soils, makes it important to explore subsurface conditions. A backhoe will be required to access suitable sampling locations at sub-decision units 3c and 3e, and to some extent in sub-decision unit 3a, due to heavy vegetation or possible difficult (lodgement till) digging conditions.

Sub-decision unit 2c was mined so long ago that the surface has been impacted by fallout from the smelter plume. Minimal sampling is proposed due to the low accessibility of this area, and subsurface sampling is proposed only to the depth where arsenic concentrations are less than 15 ppm.

Decision Unit 4 (the bluffs) has a low proposed sample density due to relatively lower overall risk and low accessibility of this area. Accessibility is limited not only by brush and steep slopes, but also by poison oak which is particularly prevalent along the northern bluff. The few proposed sampling locations are situated along the existing trail, but otherwise no additional sampling is proposed. Besides the low accessibility, this area is prone to slides and the metals data would therefore likely vary widely with many of the samples containing low arsenic concentrations. As indicated previously, such incidences of slides are not likely to cause an increased risk of harm to the adjoining beach and Puget Sound because of the relatively small amount of contaminated soil that would be mixed in with a much greater volume of clean soils.

5.3 Field Sampling

5.3.1 Soil

Sampling will occur in accordance with the sample layout shown on **Figures 6** and **7** and the methods described in the Sampling and Analysis Plan attached as **Appendix A**. Arsenic and lead concentrations in forest duff and soils will be field screened using an Innov-X System™ X-ray fluorescence (XRF) spectrometer in general accordance with USEPA Method 6200. Cadmium will also be analyzed by XRF, but the detection limit of the XRF is not low enough to provide usable data for the cadmium concentrations present at this Property.

5.3.1.1 Overall Property Sampling Program

The following outlines how field sampling will occur across the Property:

1) At each sample location, describe the vegetation type, topography, presence/thickness of decomposed forest duff and undecomposed vegetation detritus, and indications of anthropogenic disturbance in the sample area on the field form.

2) For sample locations on trails use the XRF to screen arsenic concentrations in forest duff (if present) and surface soil *in situ* (i.e., screen the soil/forest duff directly on the ground with the XRF).

3) For sample locations off trails collect the forest duff (if applicable) and surface soil (0-2inch depth) and screen for arsenic and lead *ex situ* using the XRF (i.e., collect, sieve, and bag a sample and screen the sample using the XRF).

4) For sample locations on roads collect soil (0-2 inch depth) and screen for arsenic and lead *ex situ* using the XRF.

5) At selected locations within Decision Units 1 and 3 (see **Figure 7**) also collect and screen soils at the 9-inch, and 18-inch depths. In Decision Units 2 and 4 samples will be collected at depth only at locations where the arsenic concentration exceeds 15 mg/kg on the XRF.

6) At any location where the arsenic concentration at the 18-inch depth exceeds 15 mg/kg on the XRF, collect a soil sample at the 2-foot depth.

7) The soil samples from 10 percent of the forest duff and 10 percent of the soil XRF screened locations (a minimum of 10 samples each) will be submitted for laboratory analysis of total arsenic, lead, and cadmium.

The decision was made to screen those samples on the trails themselves *in situ* as a balance in the level of effort for the field investigation. Because another sample will be collected off into the forest at each trail sample location, collecting samples on the trails is somewhat duplicative. However, actual data along the trails may be useful during future trail development activities. It will also be useful to identify the variation in metals concentrations in the disturbed (trail) versus relatively undisturbed areas.

5.3.1.2 Evaluation of Small Scale Variability

Evaluation of the small scale variability of arsenic concentrations will occur towards the end of the field investigation. Three locations where the highest arsenic concentrations were identified in forest duff and/or surface soil will be selected for this effort. At each location a 200 ft by 200 ft foot square will be laid out around the sample point where the high arsenic concentration was identified. The 40,000 square foot area will be divided into 50 ft grids. At each grid node (16 total), the XRF will be used to screen arsenic concentrations in the forest duff and surface soil on an *in situ* basis.

5.3.2 Vegetation

Plant uptake of metals will be evaluated by collecting tissue samples of the primary species that represent the Property trees and shrubs. The plant tissue samples will be submitted for analysis of arsenic, cadmium, and lead. For this survey we have selected the following plant species for sampling:

Trees – Douglas Fir, Pacific Madrone, and Alder

Shrubs – Salal, Blackberry, and Bracken Fern

Three or four composite samples of each of these species will be collected from the Property. As the plant tissue samples will be collected from within individual decision units, we expect that there will be some variation in the average concentrations of these decision units. (i.e., low to high).

One sample of each of the plant tissue types will be collected from an area within the Puget Sound unimpacted by the Tacoma Smelter Plume. An attempt will be made to collect these “background” tissue samples from area(s) that have similar geology, climate, and topography.

Further study may be necessary if vegetation sampling shows extreme variability in arsenic uptake within individual species, or if arsenic hyperaccumulation is actually occurring at the property.

5.3.3 Groundwater/Seeps

It is not anticipated that additional groundwater sampling will be required following the data research. However, if there is insufficient data to document no impacts, CDM will explore the presence of the two previously documented seeps on the Property by walking the base of the bluff, followed up by an evaluation of need and specific protocols for sampling.

5.3.4 Surface Water Features

A site reconnaissance will be conducted during a storm event to check for surface water features, such as ephemeral streams, stormwater runoff down gullys, significant ponded water that may last for more than a day or two, wetlands, or other signs of seasonal surface water features. The field work for this RI is expected to occur during the first two weeks of November. Given that the fall rains typically begin in mid to late October, it is anticipated that this reconnaissance can be completed during the period of the soils investigation.

The inspection findings will be documented. Any evidence of seasonal surface water features will be evaluated with respect to the need for sampling.

Section 6 Feasibility Study

6.1 Purpose

The FS will be conducted in accordance with the provisions of MTCA, as described in WAC 173-340-350(8) and with consideration of Ecology's Model Remedy Guidance for the Tacoma Smelter Plume. The purpose of the FS is to develop and evaluate cleanup action alternatives to enable a cleanup action to be selected for the Property. The results of the FS will be documented in the draft FS report. The FS provides the basis for preparation of the draft Cleanup Action Plan (CAP) in accordance with WAC 173-340-380.

6.2 Development of Cleanup Standards and Remediation Levels

Cleanup levels, cleanup standards, and remediation levels will be developed for the Property. A cleanup level is defined by MTCA as "the concentration of a hazardous substance in soil, water air, or sediment that is determined to be protective of human health and the environment under specific exposure conditions" (WAC 173-340-200). Cleanup standards consist of: a) cleanup levels for hazardous substances present at the Property; b) points of compliance (location where cleanup levels must be met); and applicable state and federal laws (ARARS), per WAC 173-340-700(3). A remediation level is defined as the concentration of a hazardous substance above or below which a particular cleanup action component will be used. Remediation levels by definition exceed cleanup levels. Remediation levels are not necessary at all sites, but are expected for this Property.

Cleanup levels, cleanup standards, and remediation levels developed for the Property will be based on protection of human health and the terrestrial ecological environment. Under WAC 173-340-7491 the Property does not qualify for an exclusion from terrestrial ecological evaluation (TEE), and in fact, under the proposed land use for the Property and existing land use in the immediate Property vicinity, a Property-specific TEE would be required under MTCA. It is CDM's understanding that Ecology is currently developing a site-specific TEE for the Tacoma Smelter Plume. The timing of its completion and the applicability of that TEE for the Property are uncertain. However, for purposes of this RI/FS the ecological indicator concentrations listed in Table 749-3 will be used as a basis of comparison. MTCA allows defaulting to these conservative screening level concentrations in lieu of a site-specific TEE.

Cleanup standards and results of the RI will be used to identify the COPCs to be carried forward as COCs for use in the FS and ultimately the selection of the Property remedy for the CAP. The cleanup standards and remediation levels will be established in the FS report.

6.3 Development and Screening of Remedial Alternatives

The objective of the FS process is to develop a reasonable range of cleanup action alternatives for detailed analysis. MTCA allows for an initial screening of cleanup action alternatives, when appropriate, to reduce the number of alternatives carried forward in the detailed analysis. MTCA stipulates that cleanup action alternatives may be eliminated from further consideration in the FS if they consist of one or both of the following:

- Alternatives that, based on a preliminary analysis, so clearly do not meet the minimum of requirements specified in WAC 173-340-360 that a more detailed analysis is not necessary, including those alternatives for which costs are clearly disproportionate.
- Alternatives or components that are not technically possible.

An initial screening of preliminary cleanup alternatives will be conducted to determine those alternatives that must be eliminated from further evaluation in the FS and those that should be carried forward for further evaluation. The rationale for elimination or inclusion will be provided in a table format.

The cleanup action alternatives that pass the initial screening process will be evaluated under the requirements for cleanup actions established by MTCA. As defined in WAC 173-340-360, the selected cleanup action must meet the minimum "threshold" requirements as follows:

- Protect human health and the environment.
- Comply with cleanup standards (WAC 173-340-700 through 173-340-760).
- Comply with applicable local, state and federal laws (WAC 173-340-710).
- Provide for compliance monitoring (WAC 173-340-410 and WAC 173-340-720 through 173-340-760).

In addition, the cleanup action alternatives under consideration will:

- Use permanent solutions to the maximum extent practicable (as defined in WAC 173-340-360[3]). This will be determined by conducting a disproportionate cost analysis in accordance with the procedures and criteria set forth in WAC 173-340-360(3)(e). Specifically, the disproportionate analysis will be conducted on a quantitative basis. Ranking of the alternatives will occur by assembling a list of evaluation criteria, assigning weighted factors, assessing the rank of each criteria for each alternative, and then summing the total cost/benefit for each alternative. The basis for the criteria weighting and alternative rankings will be explained and supported.
- Provide for a reasonable restoration time frame (as defined in WAC 173-340[4]).

- Consider public concerns (WAC 173-340-600).

The FS will evaluate how each of the alternatives meets the MTCA requirements for a cleanup action and will present a recommendation for the preferred cleanup action alternative.

Section 7
Deliverables

7.1 Draft RI Phase I Report

A RI Phase I Report will be prepared as described below, in accordance with the schedule set forth in Section 8. The report is subject to Ecology's review and approval. If Ecology determines that no other sampling or investigations are necessary, upon Ecology's approval, this RI report will be the final RI report for the Property.

The RI report will include:

- Discussion of the site conditions, including the geology, groundwater, surface water, and terrestrial ecological.
- Presentation and evaluation of onsite and offsite groundwater metals data.
- Presentation of historical and current soil data.
- Comparison of the XRF and laboratory data.
- Evaluation of contaminants of concern.
- Evaluation of lateral and vertical extent and concentrations of metals in soil, particularly with respect to the proposed trail system.
- Assessment of COC migration potential and affected media.
- Discussion of data gaps and identification of additional sampling needed, if any, prior to producing a feasibility study report.

The report will include summary tables and figures showing current and historical sample locations, as wells as planned Property features, including proposed trails, roads, parking lots, and picnic grounds. Laboratory reports and field sampling sheets will be included in appendices.

7.2 Draft FS Report

A Draft FS Report will be prepared as described in Section 6, in accordance with the schedule set forth in Section 8. The report is subject to Ecology's review and approval.

7.3 Electronic Data Submittal

Environmental data generated under this work plan will be submitted to Ecology's Environmental Information Management System database, according to Ecology Toxics Cleanup Program Policy #840.
(http://www.ecy.wa.gov/programs/tcp/policies/tcppoly.html

Section 8
Schedule

The estimated schedule to complete the RI and FS is summarized as follows:

Task	Start Day	Duration (days)	Date Completed
Consultant develop RI/FS Work Plan (WP)	0	23	09/15/10
County review WP/Consultant finalizes initial WP	23	5	09/20/10
Ecology review/comment WP	28	14	10/04/10
County review/Consultant finalizes WP	42	4	10/08/10
Ecology WP approval	46	12	10/20/10
Implement WP/Lab analyses	58	43	12/02/10
Consultant develop initial RI report	85	27	12/13/01
County review/Consultant finalizes initial RI	112	7	12/20/10
Ecology reviews/comments on RI	119	25	01/14/11
County/Consultant revises RI	144	10	01/24/10
Ecology RI final review, draft approval	154	14	02/07/10
Consultant develop FS report	113	24	01/07/11
County review/Consultant finalizes FS	137	7	01/14/11
Ecology reviews/comments FS	144	25	02/08/11
County/Consultant revises FS rpt.	169	7	02/15/10
Ecology FS final review, draft approval	176	14	03/01/11
Develop CAP and Update cleanup cost estimate	137	33	02/09/11

Section 9
References

AESI (Associated Earth Sciences, Inc.). 1998. *Soils, Geology, Geologic Hazards and Ground Water Report, Existing Conditions, Impacts, and Mitigations. Maury Island Pit, King County, Washington*. Prepared for Lone Star Northwest, Inc. Revised April 27, 1998.

AgriLife. 2010. Phytoextraction Using Plants to Clean Soils. At : http://agrariabis.wordpress.com/2010/04/30/phytoextraction-using-plants-to-clean-soils/

Aspect Consulting, LLC. 2004. *Fill Source Environmental Assessment for Maury Island for STIA Third Runway Project.* Prepared for Glacier Northwest. March 2004.

Ecology. 2001. Tacoma Smelter Plume Site Questions and Answers. Publication No. 01-09-038. August. At : http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/ts_q_and_a.pdf

Ecology. 2004. Tacoma Smelter Plume (Dirt Alert) Extended Footprint Study, December 2004 Update. At: http://www.ecy.wa.gov/programs/tcp/sites/tacoma_smelter/Extended_footprint_Dec_2004.html#Footprint%20Studies

ELS (Ecological Land Services, Inc.). 2006. *Maury Island Sand and Gravel Mine Reclamation Plan.* Prepared for Northwest Aggregates and Glacier Northwest. February 20.

EPA. 2010. Commencement Bay, Nearshore/Tideflats, Washington. At : http://yosemite.epa.gov/r10/nplpad.nsf/e144fa5b179a8a0388256365007ef6eb/06e1c0cda0d11fc285256594007559fd?OpenDocument

Ferguson, Eric and Ken Johnson. February 2006. *Naturally Occurring Arsenic in Groundwater from Glacial Deposits in King County, Washington.* Presentation to NGWA Naturally Occurring Contaminants Conference.

Foster Wheeler Environmental. 1999a. Attachment A to Mitigation Plan, entitled: *Focused Feasibility Study.* In: *Mitigation Report for Contaminated Soils, Northwest Aggregates, Maury Island Sand and Gravel Mining Operation*. June 1999.

Foster Wheeler. 1999b. *Mitigation Report for Contaminated Soils, Northwest Aggregates, Maury Island Sand and Gravel Mining Operation*. June 1999.

Foster Wheeler. 2000a. *Soil Sampling Report for June 2000*. Prepared for Glacier Northwest, Inc. August 2000.

Foster Wheeler. 2000b. (No Report Available). Summary tables and figures.

Foster Wheeler. 2001. *Soil Sampling Report for Road Restoration.* Prepared for Glacier Northwest, Inc. October 15, 2001.

Gonzaga, Maria I Silva, Jorge A.G. Santos, Lena Q.Ma. 2005. Arsenic chemistry in the rhizosphere of *Pteris vittata* L. and *Nephrolepis exaltata.* L. In : Environmental Pollution 143 (2006) pp. 254-260. At : www.sciencedirect.com.

King County Department of Natural Resources and Parks Water and Land Resources Division. March 2005. *2001-2004 Ambient Groundwater Monitoring Results Report*

King County Department of Natural Resources and Parks Water and Land Resources Division. April 2006. *Vashon-Maury Island 2005 Water Resources Data Report*

King County Department of Natural Resources and Parks Water and Land Resources Division. April 2007. *Vashon-Maury Island 2006 Water Resources Data Report*

King County Department of Natural Resources and Parks Water and Land Resources Division. October 2008. *Vashon-Maury Island 2007 Water Resources Data Report*

King County Department of Natural Resources and Parks Water and Land Resources Division. December 2009. *Vashon-Maury Island 2008 Water Resources Data Report*

King County Department of Natural Resources and Parks Water and Land Resources Division. March 2010. *Vashon-Maury Island 2009 Water Resources Data Report*

Landau, Associates. 1999. Letter, *Final Sampling Results NW Aggregates Maury Island Gravel Mine*. January 19.

Morel, Jean-Louis, Guillaume Echevarria and Nadezhda Goncharova. 2002. Phytormediation of Metal-Contaminated Soils. IV. Earth and Environmental Sciences, Vol 68. Proceedings of the NATO Advanced Study Institute on Phytoremediation of Metal Contaminated Soils. Trest, Czech Republic. August 2002.

Terra Associates, Inc. 1999. *Groundwater Discipline Report*. Geology and Groundwater Sections, Lone Star Pit/Maury Island, King County, Washington. (Appendix A to the Draft Environmental Impact Statement for Maury Island Lone Star Gravel Mine. Jones & Stockes Assoc. Inc., Terra Associates, Inc., and M.R. Sterns Planning and Design. July 1999.) Project No. T-4169. June 3, 1999.

SCS (Soil Conservation Service). 1973. *Soil Survey, King County Area, Washington. United States Department of Agriculture*. Soil Conservation Service.

Washington State Department of Health Division of Environmental Health, Office of Drinking Water. 2010. Sentry Internet Database information pertaining to group A and B public water systems

Wikipedia. 2010. List of Hyperaccumulators. At: http://en.wikipedia.org/wiki/List_of_hyperaccumulators

Distribution

3 Copies 3 CDs	King County Solid Waste Division King Street Center 201 South Jackson Street, M.S. KSC-NR-701 Seattle, Washington 98104-3855 Attention: James Neely
1 Copy 1 CD	Department Ecology Northwest Regional Office 3190 160th Ave. SE Bellevue, Washington 98008-5452 Attention: Bob Warren

Quality Assurance / Technical Review by:

Don Clabaugh, P.E.
Principal Engineer

Tables

Table 1
Stastical Summary
Arsenic, Lead and Cadmium in Surficial Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Analyte	Surface	9-inch Depth	18-inch Depth
Arsenic			
Number of Samples	61	23	19
Average Concentration	99	77	14
Standard Deviation	94	88	17
Median	78	39	8.2
Highest Concentration	477	270	64
Upper 95% Confidence	123	115 [a]	22 [a]
No. Samples Exceeding MTCA	51	13	3
% Samples Exceeding MTCA	84%	57%	16%
MTCA Method A - 20 mg/kg			
Lead			
Number of Samples	36	22	19
Average Concentration	207	35	14
Standard Deviation	254	28	14
Highest Concentration	840	120	51
Median	56	30	8.3
Upper 95% Confidence	293 [a]	48 [a]	21
No. Samples Exceeding MTCA	12	0	0
% Samples Exceeding MTCA	33%	0%	0%
MTCA Method A - 250 mg/kg			
Cadmium			
Number of Samples	36	18	19
Average Concentration	1.7	1.1	0.61
Standard Deviation	2.5	0.74	0.39
Median	0.58	0.95	0.5
Highest Concentration	9.8	2.9	1.5
Upper 95% Confidence	3 [a]	1.5	0.80
No. Samples Exceeding MTCA	7	2	0
% Samples Exceeding MTCA	19%	11%	0%
MTCA Method A - 2 mg/kg			

Notes:
a) Value is approximate since sample population does not appear to be numerically distributed.
mg/kg - milligram per kilogram.
MTCA - Washington Administrative Code Chapter 173-340, Model Toxics Control Act
Cleanup Regulation, Method A suggested soil cleanup level for unrestricted
land uses/industrial properties; promulgated August 15, 2001.

Table 2
Surface Soil Sample Distribution Summary
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Decision Unit	Approx. Acreage in Area	Current No. of Surface Samples	Proposed No. Additional Surface Soil Samples	No. Surface Samples per Acre by Area	No. Subsurface Sample Loc.
1a	60	16	37		10
1b	26	16	11		3
Total DU #1	86	32	48	0.9	13
2a	33	7	23		*
2b	6	2	5		*
2c	13	4	9		3
Total DU #2	52	13	37	1.0	3
3a	18	5	22		3
3b	6	4	8		2
3c	12	11	9		7
3d	5	2	6		2
3e	2	2	6		4
Total DU #3	43	24	51	1.7	18
4a	17	0	0		0
4b	14	1	6		0
4c	11	6	10		0
Total DU # 4	42	7	16	0.5	0
Totals	223 [a]	76	152		34

Notes:

*Depends upon data. If arsenic concentration using XRF is >15 ppm then a deeper sample to be collected.

a) Difference in total site acreage (235 acres) is partly due to not calculating in beach area.

DU - Decision Unit

Figures

Source: GOOGLE EARTH PRO, 2010

N

0 3000
Scale in Feet

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Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure No. 1
Vicinity Map

CDM

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 2
Site Map

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Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 3
Historical Features

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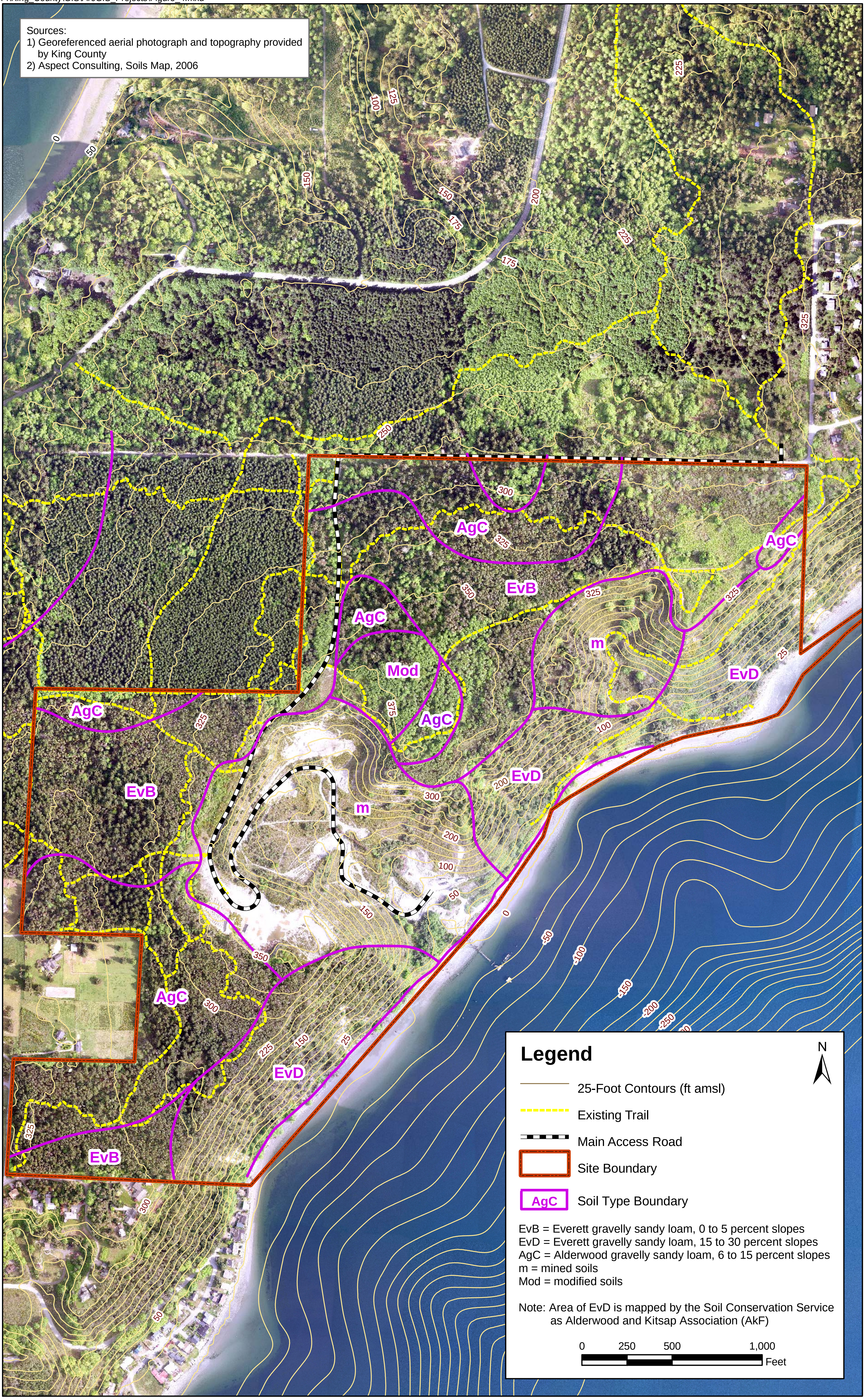

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Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 4
Soils Map

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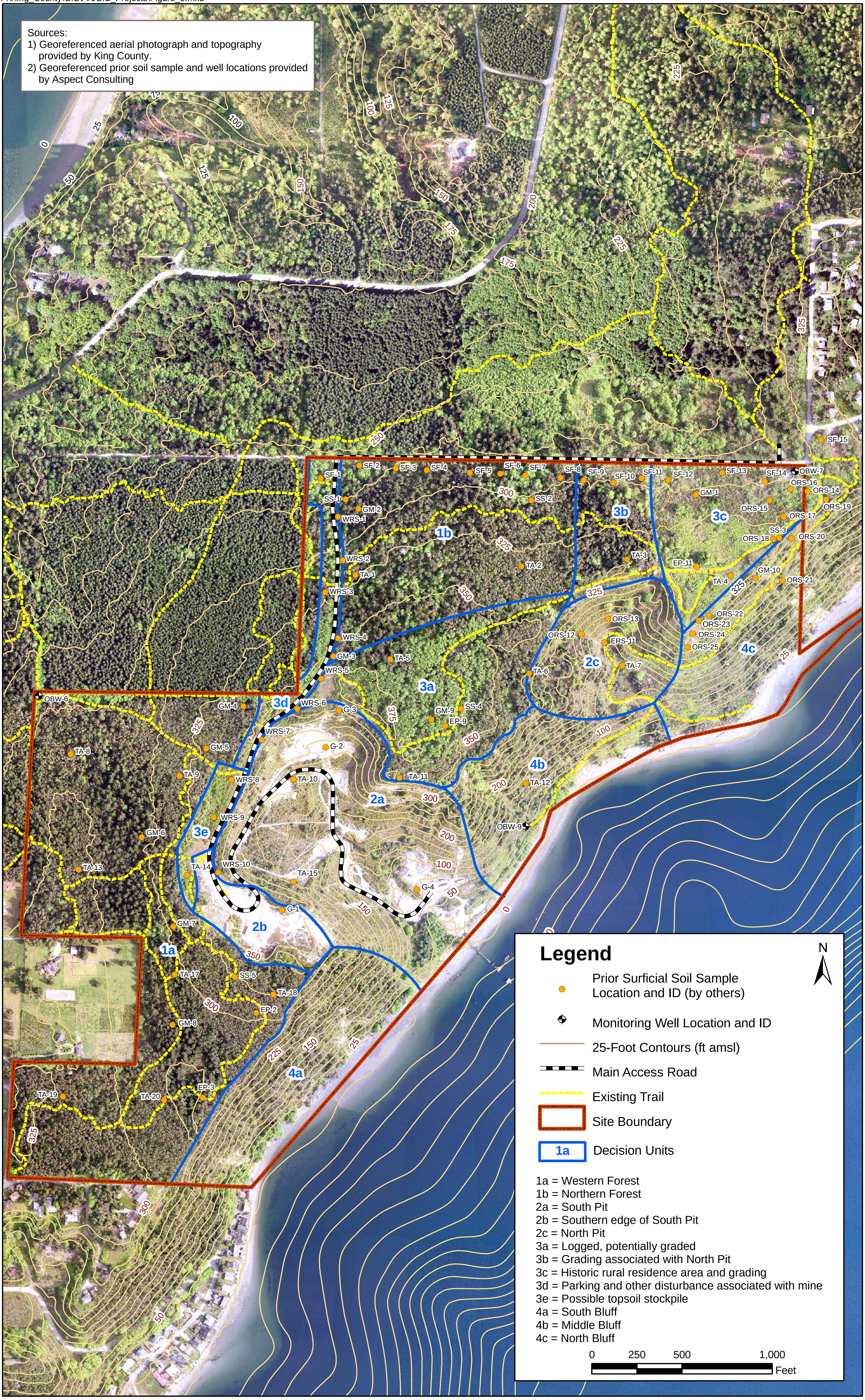

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 5
Decision Units and Prior Surficial Soil Sample Locations

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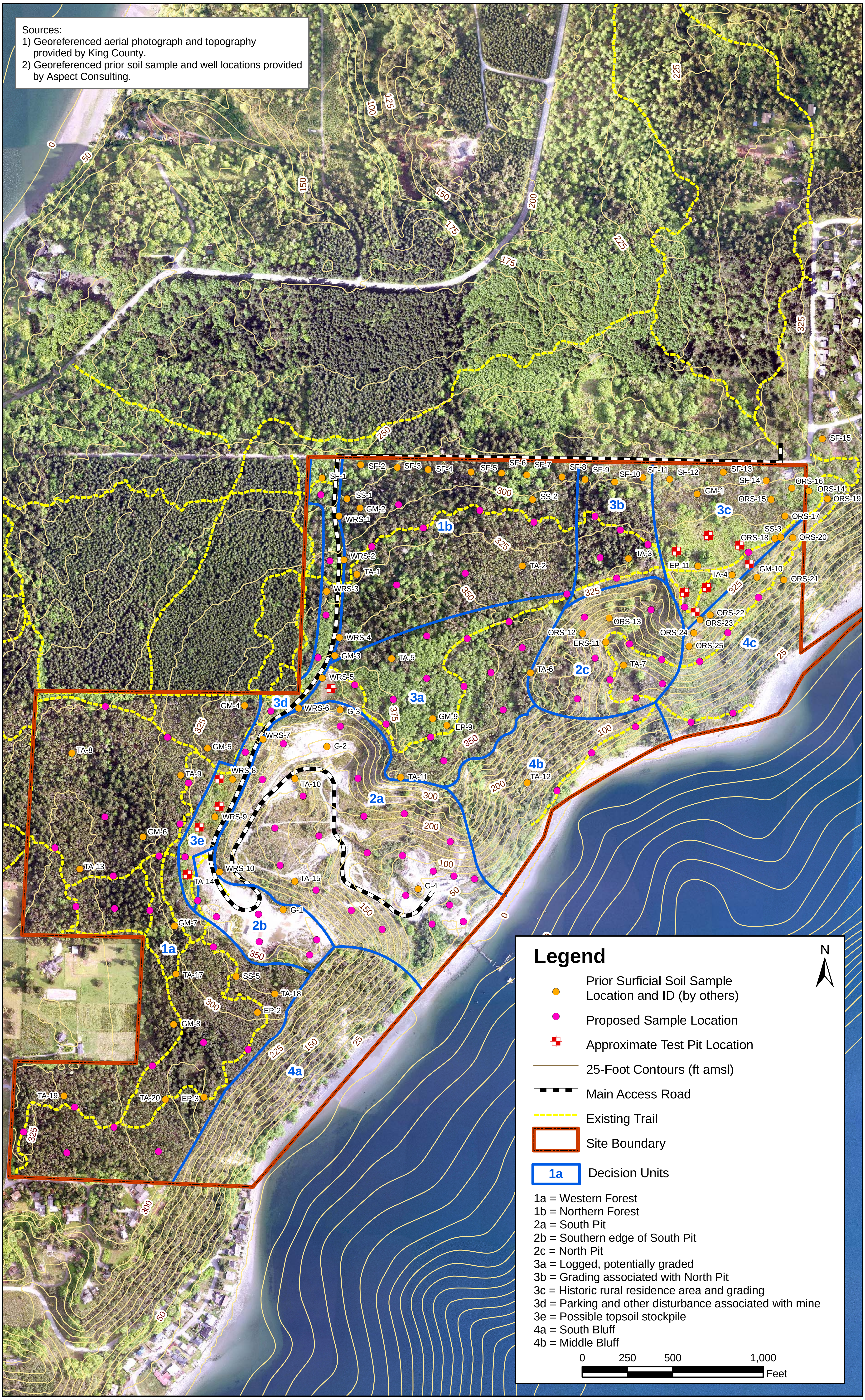

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 6
Proposed Surface Sample Location Map

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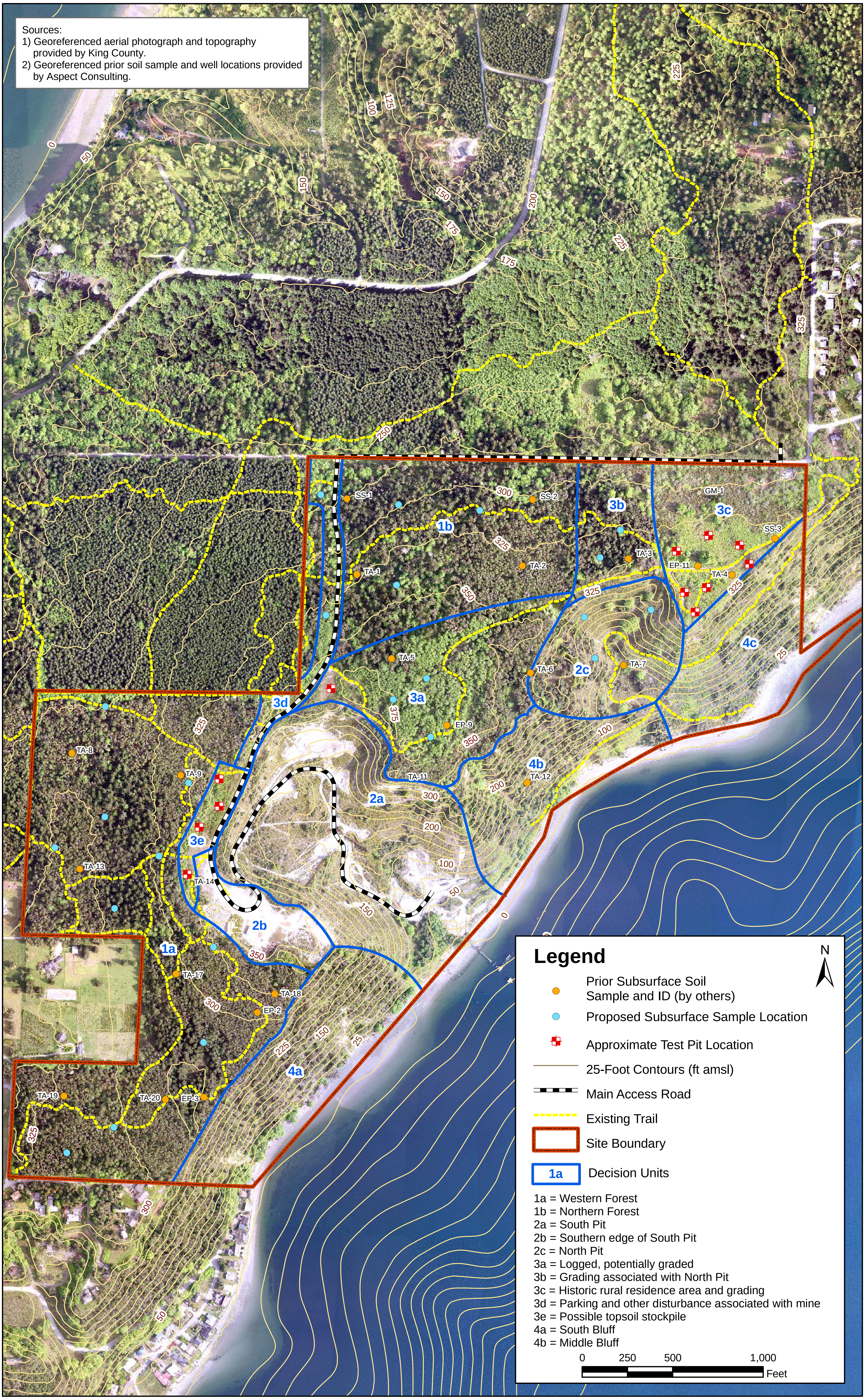

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 7
Proposed Subsurface Sample Location Map

Appendix A
Sampling and Analysis Plan

Appendix A Contents

Figures

Attachments

Section A1
Introduction

This sampling and analysis plan (SAP) has been prepared to describe the methods that will be used to conduct remedial investigation activities at the Glacier Maury Island gravel mine (the Property). This SAP was prepared as an appendix to the Remedial Investigation and Feasibility Study Work Plan, which provides greater detail about the Property description, history, and previous investigations. The Work Plan also describes the purpose and scope of work to be completed.

The objective of this SAP is to ensure that sample collection, handling, and analysis will result in data of known and acceptable quality.

A1.1 Project Personnel and their Responsibilities

Remedial investigation activities will be conducted by Camp Dresser & McKee Inc. (CDM) on behalf of King County. Mr. Lance Peterson is the Project Manager. Ms. Pam Morrill is the technical lead and has responsibility for the day to day management and coordination of the RI field activities. Mr. Jim Neely is King County's designated representative. OnSite Environmental of Redmond Washington is the analytical laboratory for this project. Mr. David Baumeister is OnSite's project manager and will serve as the laboratory's primary contact person and will ensure that the project requirements are met by the laboratory. OnSite will be subcontracting analyses of organic matter to Kuo Testing Labs, Inc. of Othello, Washington.

Section A2
Field Exploration and Sampling Procedures

A2.1 Sample Layout and Survey

A2.1.1 Overall Property Sampling

CDM has established predetermined sampling locations on a georeferenced figure of the Property as shown on **Figures A1** and **A2**. Sample ID's have not been predesignated as we anticipate the need to modify many of the sample locations.

Corresponding northings and eastings (Washington State Plane Coordinate System NAD 1983, north zone) for proposed sample locations will be downloaded into a Trimble® GeoXH™ GPS unit affixed with an external antenna. The GPS unit will then used to find the actual sample locations. There will be occasions that the proposed sample location cannot be accessed (e.g., steep slopes, dense vegetation, poison oak). In those instances, an alternate nearby location will be selected and sampled instead. The alternate sample location will be surveyed with the GPS. In the event that the GPS unit cannot identify any given sample location in the field (i.e., dense forest canopy), the nearest possible location to the sample will be surveyed and the offset of the sample location from the survey location will be noted.

A2.1.2 Evaluation of Small Scale Variability

A 200 ft by 200 ft gridded square area will be used to evaluate small scale variability at a total of three locations. Each area will be subdivided into 50 ft grids. Therefore, each of the three locations where small scale variability is evaluated will have a total of 16 screening locations.

The locations of the three small scale variability study areas have not been predetermined as they will be dependent upon the actual field findings. Once sufficient data has been collected to identify sample locations with the highest arsenic concentrations the grid layout will be projected over these sample points. If the focal sample point can be centered such that the grid layout falls entirely within an individual decision unit, the layout will occur in that manner. Otherwise, the grid system may be adjusted such that the focal point falls entirely within a decision unit and/or the Property boundaries.

A2.2 Soil Arsenic and Lead Screening

A field portable Innov-X Systems™ brand X-Ray Fluorescence (XRF) spectrometer will be used to screen for arsenic and lead throughout this Property. XRF is a proven and rapid screening method for various metals, including arsenic and lead. XRF testing will be conducted in general accordance with EPA Method 6200.

The following outlines the general steps that will be involved in sampling:

1) On the Field Sampling Log (**Attachment A**) describe the vegetation type, topography, presence/thickness of decomposed forest duff and undecomposed vegetation detritus, and indications of anthropogenic disturbance in the sample area.

2) For sample locations directly on trails use the XRF to screen arsenic concentrations in forest duff (if present) and surface soil *in situ*.

3) For sample locations off trails and on roads, collect the forest duff (if applicable) and surface soil (0-2 inch depth) and screen for arsenic and lead *ex situ* using the XRF.

4) At selected locations within Decision Units 1 and 3 (see **Figure A2**) also collect and screen soils at the 9-inch, and 18-inch depths. In Decision Units 2 and 4 samples will be collected at depth only at locations where the arsenic concentration exceeds 15 mg/kg on the XRF.

5) At any location where the arsenic concentration at the 18 inch depth exceeds 15 mg/kg on the XRF, collect a soil sample at the 2-foot depth.

6) The soil samples from 10 percent of the forest duff and 10 percent of the soil XRF screened locations (minimum 10 samples each) will be submitted for laboratory analysis of total arsenic, lead, and cadmium. These laboratory analyzed samples will be collected across the entire spectrum of arsenic concentrations indicated by the XRF.

A2.2.1 Field Sample Collection Methods and XRF Screening

In Situ Screening

In situ XRF screening simply involves operating the machine when in direct contact with the soil. Sample preparation consists of scraping off any vegetation/rocks and leveling the area so that the XRF probe rests level on a flat soil surface. An exception to this will be any areas screened by this method within forested areas where there is forest duff. In this instance, the XRF will be placed directly on top of the forest duff. When this reading has been completed the duff will be scraped aside and the underlying soil layer will then be screened by the same method.

In situ screening will be applied to locations along the trails and for the three small scale variability study areas. *Ex situ* screening as described below will occur at all other locations.

Ex Situ Screening – Hand Collection Methods

1. Using a hand trowel, loosen and remove the forest duff layer over an approximately 3-inch square area. Place this material in a clean, labeled plastic

ziplock plastic bag. Remove any rocks, large sticks, leaves and other undecomposed detritus. Thoroughly mix the material in the ziplock bag.

2. Using a hand trowel, loosen and remove the top 2-inches of soil over an approximately 3-inch square area. Place this material in a disposable sieve with 1.5 millimeter (mm) openings and sieve into a clean, labeled, plastic ziplock bag. Thoroughly mix the material in the ziplock bag.

3. For samples collected at depth, using a bucket hand auger, extend the hole to approximately 2 inches above the desired depth. Clear out the hole by hand and then extend the auger to the desired depth to collect the sample. The sample will be collected from the bottom of the auger head. Using a clean stainless steel spoon or clean gloved hand, discharge approximately 1-inch of soil from the bottom of the auger (the upper portion of the soil is left in the auger and not collected) into a disposable sieve and sieve into a plastic ziplock bag as described above. Repeat as necessary for each subsequent depth interval.

4. After thoroughly mixing the soil sample/forest duff in the plastic bag, measure arsenic and lead concentrations using the XRF (the XRF reading is taken through the plastic bag). A 90 second screening interval will be used for all XRF readings.

Ex Situ Screening – Test Pit Methods

Ex Situ samples will be collected from the test pit sidewalls at the desired depth, and then handled in the same manner described above.

Collection of Samples for Laboratory Analysis

At approximately 10 percent of the forest duff and 10 percent of the soil sample locations (minimum 10 samples of each), confirmation samples will be collected and submitted for laboratory analysis. Samples will be collected across the full range of arsenic concentrations observed, from low to high. The procedure for collecting samples obtained for laboratory analysis is as follows:

1. Place a portion of the sieved fines from the plastic ziplock bag into the XRF cup, seal with Mylar, and take an XRF reading.

2. The XRF cup is placed in a labeled plastic ziplock bag, and stored in a chilled cooler until transport to the laboratory.

3. Submit selected samples under chain-of-custody protocol to an analytical laboratory.

A2.3 Plant Analysis

Plant tissue analyses will be conducted on the following species:

Trees – Douglas Fir, Pacific Madrone, and Alder

Shrubs – Salal, Blackberry (fruit and leaves), and Bracken Fern

Four samples of each of these species will be collected from the Property. In addition, one sample of each will be collected from an area within the Puget Sound unimpacted by the Tacoma Smelter Plume.

<u>Field Sample Collection Methods</u>

1) Each sample will be collected as a composite. Each composite sample will be collected from one general area within a decision unit (see further description below)

2) Samples of mature leaves will be collected from each vegetation type. If necessary, undecomposed leaves can be collected from the forest floor (i.e., Madrone, Alder).

3) Approximately 50 grams of plant tissue will be collected into clean, labeled quart-sized Ziploc bags. The bags will be stapled shut to allow for aeration during sample transit. The samples will be kept in a chilled container or refrigerator until transport to the laboratory.

Due to the varying geographic occurrence of the various vegetative types and lack, or likely spotty presence of metals contamination in some Decision Units (i.e., 2a, 2b, 4) the following composite sampling scheme has been established:

Madrone, Douglas Fir, Salal, Bracken Fern : 1) southern portion of sub-decision unit 1a; 2) the northern portion of sub-decision unit 1a; and 3) sub-decision unit 1b. As the specific types of vegetation exist, samples will also be collected from subdecision unit 2c.

Blackberry: 1) Sub-decision unit 3a;, 2) Sub-decision unit 3c; and 3) Sub-decision unit 3e. If a substantial stand of blackberries exist within decision unit 1a, 1b or 2c a fourth sample will also be collected.

Alder: 1) Sub-decision unit 3a; 2) Sub-decision unit 1a; 3) Sub-decision unit 1b , and 4) Sub-decision unit 3b.

Samples collected from an area unimpacted by the Tacoma Smelter Plume (or Everett Smelter Plume) will be selected. To the extent possible, these samples will be collected from a location on Whidbey Island (i.e., Coupeville area) where the geologic deposits (and soils) and the climate are similar to that of Maury Island

A.2.4 Seep Sampling and Surface Water Sampling

Due to the uncertainty of the need for seep or surface water sampling, the specifics of such sampling areas are not detailed in this work plan. If, and at such time as the need for seep sampling becomes apparent, the presence and conditions of the seeps will be investigated. The details regarding such sampling of surface water and/or seeps will be determined at the time it becomes apparent that there is a need for it.

Section A3
Chemical Analysis

Representative soil and forest duff samples that have been XRF-screened will be submitted to OnSite Environmental, Inc. in Redmond, Washington. The samples will be analyzed for total arsenic, cadmium, and lead by EPA Method 6010B (ICP).

Soil metal concentrations will be reported on a dry weight basis. However, forest duff metal concentrations will be reported both on a dry and wet weight basis. In the past, we have found correlation of metals between the XRF and laboratory data is best on wet weight basis, perhaps because of the typically higher moisture content of this material. Reporting metal concentrations in organic material on a wet weight basis is also considered more appropriate, given that this is the form that will be ingested insects and animals.

Plant tissue samples will be submitted to OnSite also. OnSite will be subcontracting these samples to Kuo Testing Labs, Inc. for analysis of total arsenic, cadmium, and lead. Plant tissue samples will be washed and prepared using the dry ash method and then analyzed by EPA Method 6010B.

Table A1 summarizes the analytical methods, target reporting limits, and holding times for each media and analyte.

Section A4
Quality Assurance Procedures

The overall quality assurance (QA) objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide technically and legally defensible results. This section discusses QA objectives and procedures for this project.

A4.1 Precision

Precision is a measure of reproducibility of measurements of the same characteristic, usually under a given set of conditions.

A4.1.1 Field Precision Objectives

Field precision will be assessed by the collection and analysis of field duplicates and will be expressed as relative percent difference (RPD). Duplicate samples are analyzed to check for matrix variability and analytical method reproducibility. One laboratory duplicate sample will be collected for every 20 samples collected. Soil samples will be co-located (i.e., collected from the same sample bag). A duplicate XRF reading will also be run on the same duplicate lab sample. Duplicate soil samples will be analyzed for the same parameters.

No duplicate plant tissue sampling is proposed.

A4.1.2 Laboratory Precision Objectives

The control limits for accuracy automatically identify the precision of a method. In the analysis of samples in a batch, if the recoveries of the analytes of interest are within control limits, then the precision also is within control. Precision also may be calculated in terms RPD. Precision control limits are outlined in **Table A1.**

Precision will be assessed by comparing the analytical results between laboratory duplicates. The RPD will be calculated for each pair of duplicate analyses using the following equation:

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2}(100\%)$$

Where:

RPD = relative percent different.

X1, X2 = value of sample 1 and sample 2.

RPDs may be compared to the laboratory-established RPD control limits for the analysis. Precision of duplicates depends on sample homogeneity.

A4.2 Accuracy

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system. The accuracy of a measurement system is impacted by errors introduced through the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analytical techniques.

A4.2.1 Field Accuracy Objectives

The achievement of accurate data in the field will be addressed through the adherence to all sample handling, preservation, and holding times.

A4.2.2 Laboratory Accuracy Objectives

Results for method blank and laboratory control samples will be the primary indicators of accuracy. These results will be used to control accuracy by requiring that they meet specific criteria. As spiked samples are analyzed, spike recoveries will be calculated and compared to acceptance limits.

The calculation formula for percent recovery is:

$$R\% = \frac{(C_1 - C_2)(100\%)}{C_3}$$

Where:

R% = Spike amount recovered.

C1 = Concentration of analyte in spiked sample.

C2 = Concentration of analyte in unspiked sample.

C3 = Concentration of spike added.

Acceptance limits as listed in **Table A1** will be based on previously established laboratory performance for similar samples. In this approach, the control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established limits indicate some assignable cause, other than normal measurement error, and possible need for corrective action. Corrective actions may include recalibration of the instrument, reanalysis of the QC sample, reanalysis of the samples in the batch, re-preparation of samples in the batch, or flagging the data as suspect if the problems cannot be resolved. For contaminated samples, recovery of matrix spikes may depend on sample homogeneity, matrix interference, and dilution requirements for quantitation.

A4.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under normal conditions.

A4.3.1 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Field completeness for this project will be greater than 90 percent.

A4.3.2 Laboratory Completeness Objectives

The project laboratory will provide data meeting QC acceptance criteria for a minimum of 90 percent of the samples tested using the SW-846 and other standard methods. At the completion of sample analysis testing, the percent completeness will be calculated by the following equation:

$$C\% = \frac{S}{R}\,(100\%)$$

Where:

C = completeness.

S = number of successful analyses.

R = number of requested analyses.

Successful laboratory analyses can only be accomplished if both the field and laboratory portions of the project are successful. Factors that adversely affect completeness include:

- Receipt of samples in broken containers.
- Receipt of samples in which chain-of-custody or sample integrity is compromised in some way.
- Samples received with insufficient volume to perform initial analyses or repeat analyses, if initial efforts do not meet QC acceptance criteria.
- Samples held in the field or laboratory longer than expected, thereby jeopardizing holding time requirements.
- Samples that have unclear analyses requests.

A4.4 Representativeness

Representativeness qualitatively expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Representativeness expresses the degree to which a sample represents a source material, an environmental media, or a geochemical process. Representativeness is a qualitative parameter, dependent on the proper design of the sampling program and proper choice of extraction and analytical methods.

The characteristic of representativeness cannot be quantified. Subjective factors to be taken into account are as follows:

- Degree of homogeneity of a site.
- Degree of homogeneity of a sample taken from one point in a site.
- Available information on which a sampling plan is based.

A4.4.1 Measures to Ensure Representativeness of Field Data

Calibration checks will be performed on the XRF unit daily in accordance with the manufacturer's specifications. An instrument blank will be analyzed at the beginning, and each time the battery is changed. The instrument blank check will be documented on the daily field sheet. Calibration verification checks will be performed using metal standard reference material certified by the National Institute of Standards and Technology at the beginning and each time the battery is changed. The calibration results will be compared to the specifications provided by the instrument manufacturer and documented on the daily field sheets.

Field duplication and field replication, as defined under precision, also are used to assess representativeness. Two samples that are collected at the same location and at the same time are considered equally representative of this condition, at a given point in space and time. Duplicate XRF sample analyses will be performed on a minimum of 1 in 20 of the field samples analyzed with the XRF Unit. If the precision between the duplicate field sample result is consistently greater than 25 percent, corrective action will be implemented. Corrective action may involve reanalysis, and if necessary, obtaining a new XRF unit.

A4.4.2 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field duplicate samples. Precautions are taken to extract from the sample container an aliquot representative of the whole sample. This includes premixing the sample and discarding foreign material (i.e., stones, twigs, pebbles, etc) from soil samples.

A4.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and new analytical data will be comparable depends on the similarity of sampling and analytical methods.

A4.5.1 Measures to Ensure Comparability of Field Data

Comparability for the RI will be optimized for this work by utilizing similar soil sample depths and the same laboratory analytical methods utilized by others.

A4.5.2 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used as documented in this SAP. Comparability is also dependent on similar QA objectives.

A4.6 Quality Control Samples

A4.6.1 Field Duplicates

Duplicate samples are analyzed to check for matrix variability and analytical method reproducibility. One duplicate sample will be collected for every 20 samples collected. Soil/forest duff samples will be co-located. Duplicate soil/forest duff samples will be analyzed for the same parameters.

Section A5
Sample Containers, Custody Procedures, Shipping, Documentation and Sample Identification

A5.1 Sample Containers

Soil and forest duff samples to be submitted for laboratory analysis will be collected in plastic cups designed for use with the XRF. The tops of the sample cups will be sealed with mylar film. Because of their small size, the sample cups will be placed in plastic ziplock bags and a label placed on the bag. The sample containers will be kept closed and in their shipping packages until used. After sampling, the containers will be placed in coolers, chilled to 4ºC, and shipped to the laboratory.

Plant tissue samples will be submitted to the laboratory within clean, labeled plastic quart-sized ziplock bags. The bags will be stapled shut to allow for aeration.

A5.2 Custody Procedures

A chain-of-custody protocol will be followed to maintain and document sample possession. Each sample will be labeled immediately after collection. Each label will include, at a minimum, the following information:

- Project name and number.
- Initials of the collector.
- Date and time of collection.
- Number that uniquely identifies the sample and its collection location (the sample numbering sequence will not indicate to the laboratory which samples are duplicates).

Samples will be kept in the sampler's custody until the end of each day, when they will be shipped to the laboratory, possible.

Samples will be shipped to the analytical laboratory with chain-of-custody records, establishing the documentation necessary to trace sample possession from the time of collection. The chain-of-custody records will contain, at a minimum, the following information:

- Sample number.
- Signature of collector.
- Date and time of collection.
- Place of collection.
- Sample matrix.

- Signatures of persons involved in the chain of possession.
- Inclusive dates of possession.
- Condition of samples.

The chain-of-custody record also will be used to indicate what analyses are required by checking the appropriate box(es) on the form.

A5.3 Shipping

As described above, samples will be accompanied by a properly completed chain-of-custody form. The original and yellow copies will accompany the shipment, and the pink and gold (if applicable) copies will be retained by the sampler for CDM's project files. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the project laboratory, or to/from a secure storage area.

Soil samples will be properly packaged for shipment and dispatched to the laboratory for analysis, with a separate, signed custody record enclosed in each sample cooler. Shipping containers will be secured with strapping tape and custody seals will be affixed for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations. Samples will either be delivered directly to the analytical laboratory by the sampler, or brought back to CDM's Bellevue office where it will be picked up by a courier for delivery to the laboratory.

Plant tissue samples will be shipped in a box with chain-of-custody seal, and under chain-of-custody protocol as described above. Samples will be shipped via overnight delivery service to the analytical the laboratory on a Monday-Wednesday to ensure prompt delivery.

A5.4 Documentation and Sample Identification

The Daily Field Investigation Form is the basis of CDM's documentation. A copy of this form is included in **Attachment A**. Entries on it describe the day's activities. Field measurements and sample data will be recorded on appropriate forms (see **Attachment A**). Whenever a sample is collected or a measurement is made, a detailed description of the sample location (i.e., vegetation type, soil profile description, topography) and sample description will be recorded. The type of sampling equipment will be noted, a sample description, and sample depth. Sample description forms are included in **Attachment A**.

If an incorrect entry is made, the information will be crossed out with a single line and initialed and dated by the field representative. All entries will be made with non-erasable black ink or permanent black marker.

Samples will be labeled uniquely and sequentially. Each soil and forest duff sample will be prefixed by the sub-decision unit from which it was collected (i.e., 1a, 2c), and the media type (i.e., FD, S), and then a unique number. Plant tissue samples will be similarly numbered, but instead will have an identifier for the plant type. Sample identification examples for each media are as follows:

Forest Duff: 1a-FD-32
Soil: 3c-S-124

Field duplicates will receive a blind and unique sample designation, such as: 1a-FD-0, 3c-S-0

Plant Tissue:

- Douglas Fir: 1a-DF-3
- Alder: 3a-A-1
- Madrone: 1b-M-2
- Blackberry leaves: 3c-B-2
- Salal: 1b-SL-2
- Bracken Fern: 3c-F-2

The plant tissue samples collected from offsite will not have the Decision Unit prefix (i.e., 1a, 2c). It will simply be designated as DF-4, M-4, BL-4 etc. No field duplicates of plant tissue are proposed.

Section A6
Equipment Decontamination and Waste Control

Equipment decontamination and waste control during sampling activities is important to prevent the spread of contaminants, to ensure that no cross contamination occurs during sampling, and to ensure integrity of the samples. Specifically, the main objectives are to:

- Decontaminate sampling equipment and personnel so that work performed does not cause the spread of hazardous constituents off the Property.
- Decontaminate sampling equipment so that hazardous constituents are not introduced into samples through cross contamination.

A6.1 Soil Sampling Equipment

The following decontamination procedures will be used to decontaminate the soil sampling equipment prior to each use.

1. Rinse and clean in potable water.
2. Wash and scrub with nonphosphate-based detergent and potable water.
3. Rinse in distilled water.

Solutions will be renewed as needed. Nylon scrubbers will be used during Steps 1 through 3.

A6.2 Waste Control

Leftover soils generated during sampling activities will be left at the sampling location. Decontamination water will be disposed of onsite at the point of generation (i.e., at the sample location).

Other waste generated during soil sampling (rubber gloves, paper towels, etc.) will be placed in plastic garbage bags and sealed shut. The garbage bags will be placed in a commercial waste collection container at CDM's office for ultimate disposal in a sanitary landfill. Shoes and tires will be washed off with soap and water before leaving the Property and personnel clothing will be laundered daily.

Table

Table A1
Quality Assurance Goals
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Parameter	Analytical Method	Holding Time	Reporting Limit (mg/kg)	Accuracy Percent Recovery	Precision RPD	Completeness
Soil/Forest Duff						
Arsenic	EPA 6010B	6 months	5	75%-125%	20%	90%
Lead	EPA 6010B	6 months	5	75%-125%	20%	90%
Cadmium	EPA 6010B	6 months	0.5	75%-125%	20%	90%
Plant Tissue						
Arsenic	Wash/Dry Ash/EPA 6010B	5 days (for extraction) 6 months (extract)	0.045	95%-105%	5%	90%
Lead	Wash/Dry Ash/EPA 6010B	5 days (for extraction) 6 months (extract)	0.045	95%-105%	5%	90%
Cadmium	Wash/Dry Ash/EPA 6010B	5 days (for extraction) 6 months (extract)	0.045	95%-105%	5%	90%

Notes:
mg/kg - milligram per kilogram.
RPD - relative percent difference.

Figures

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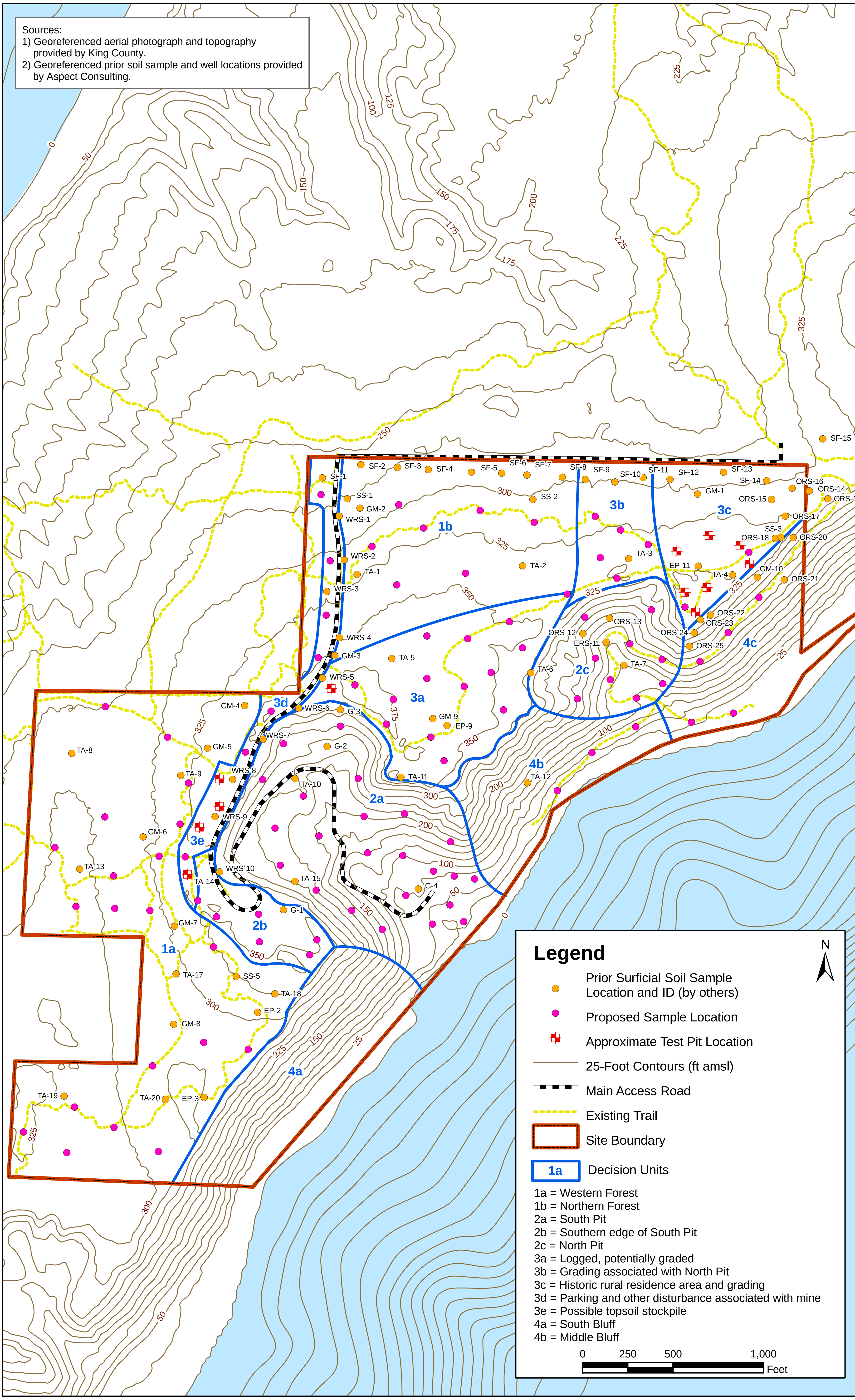

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure A1
Proposed Surface Sample Location Map

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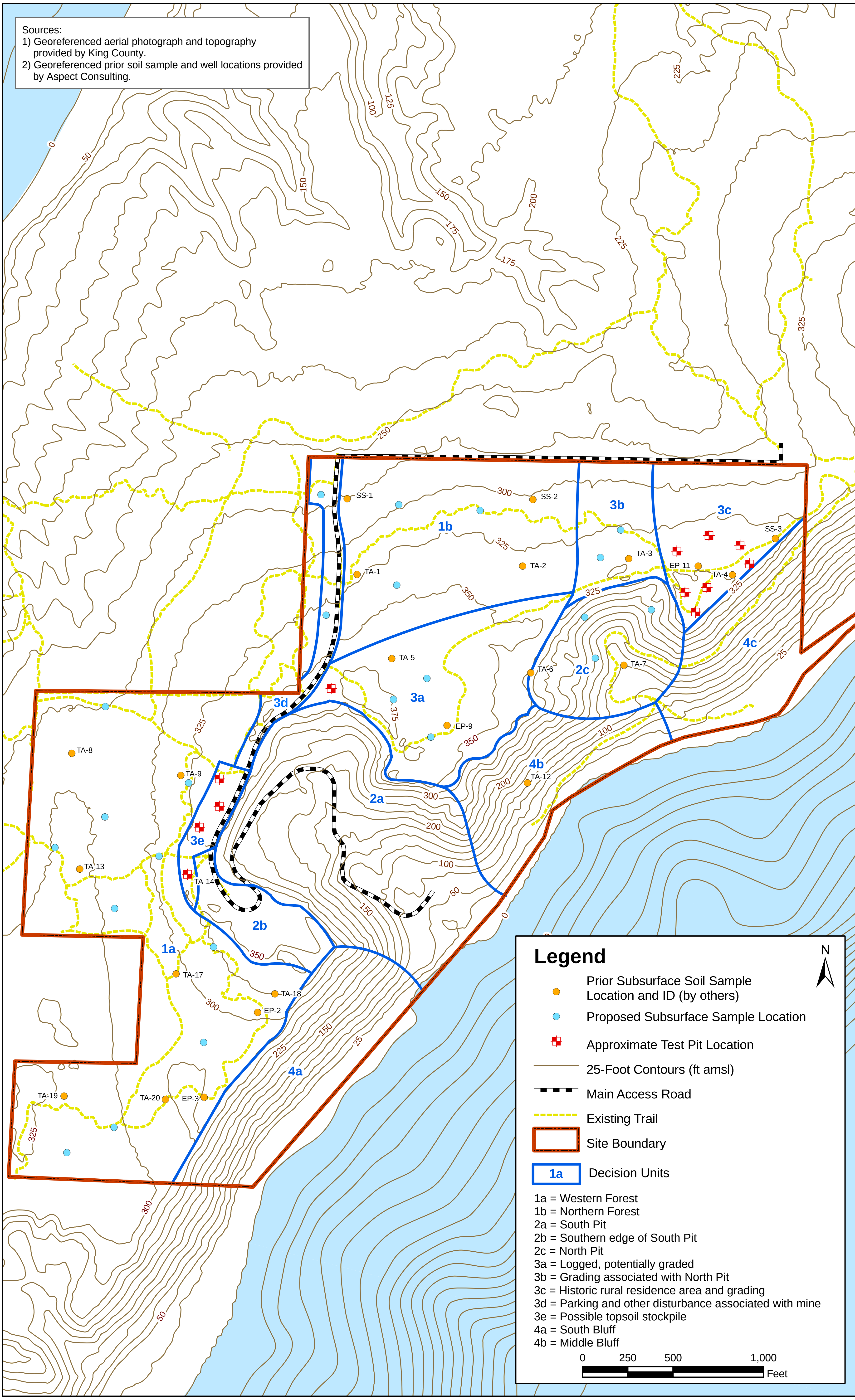

CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure A2
Proposed Subsurface Sample Location Map

Attachment A
Field Forms

CDM

SOIL SAMPLE LOG

Northwest Aggregate Sand and Gravel Mine

Date: ____________________

Project No.: ____________________ Staff: ____________________

Area: ____________________ Sample Collection Method: ____________________

Area Description: ____________________

Notes: ____________________

Depth		Soil Profile Description	Sample Depth (inches)	XRF # / Sample ID / XRF Value (ppm)					
				Field Screen		Sample Cup		Duplicate	
				As	Pb	As	Pb	As	Pb
(inches)	+3								
(Forest Duff)	+2								
	+1								
	0								
(Soil)	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
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	16								
	17								
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	19								
	20								
	21								
	22								
	23								
	24								

CDM

PLANT TISSUE LOG

Northwest Aggregate Sand and Gravel Mine

Date: ____________

Project No.: ____________ Staff: ____________

Sample ID: ____________

Area: ____________

Area Description: ____________

Vegetation Type.: ____________

Collection Method/Notes: ____________

CDM

FIELD INVESTIGATION DAILY REPORT

Sheet ______ of ______

Project ______________________________ Project No. ______________

Location ______________________________ Date ______________

Equipment Rental ______________ Company ______________ To ______________

Equipment Hours ________ F.E. Time from: ________ to: ________ By ______________

Visitors:

Attachments ☐ Continued

Distribution Initial

rev. 2/02

forms\field\field investigation daily report.p65

CDM

CHAIN-OF-CUSTODY

Date ______________ Page ________ of ________

PROJECT INFORMATION

Project Manager: ____________________

Project Name: ____________________

Project Number: ____________________

Site Location: ______________ Sampled By: __________

DISPOSAL INFORMATION

☐ Lab Disposal (return if not indicated)

Disposal Method: ____________________

Disposed by: ____________ Disposal Date: ____________

QC INFORMATION (check one)

☐ SW-846 ☐ CLP ☐ Screening ☐ CDM Std. ☐ Special

Laboratory Number:

ANALYSIS REQUEST

PETROLEUM HYDROCARBONS						ORGANIC COMPOUNDS								PESTS/PCBs					METALS						LEACHING TESTS				OTHER					
TPH-HCID State:	TPH-G State:	TPH-D State:	TPH-418.1 State:	8015M Fuel Hydrocarbon	TPH Special Instructions	8010 Halogenated VOCs	8020 Aromatic VOCs	8020M - BETX only	8240 GC/MS Volatiles	8270 GC/MS Semivolatiles	8310 PAHs	8040 Phenols	DWS - Volatiles and Semivolatiles	8080 OC Pest/PCBs	8080M PCBs only	8140 OP Pesticides	8150 OC Herbicides	DWS - Herb/Pest	Selected Metals: list	Organic Lead (Ca)	TCL Metals (23)	Priority Poll. Metals (13)	DWS - Metals	MFSP - Metals (Wa)	TCLP - Volatiles (ZHE)	TCLP - Semivolatiles	TCLP - Pesticides	TCLP - Metals						NUMBER OF CONTAINERS

SAMPLE ID	DATE	TIME	MATRIX	LAB ID

LAB INFORMATION	SAMPLE RECEIPT	
Lab Name:	Total Number of Containers:	
Lab Address:	Chain-of-Custody Seals: Y/N/NA	
	Intact?: Y/N/NA	
Via:	Received in Good Condition/Cold:	

Turn Around Time: ☐ Standard ☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 1 wk.

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

Special Instructions:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Company:

Appendix B
Health and Safety Plan

HEALTH AND SAFETY PLAN FORM
CDM Health and Safety Program

This document is for the exclusive use of CDM and its subcontractors

CDM (Camp Dresser & McKee)
PROJECT DOCUMENT #:

PROJECT NAME King County - Maury Island RI/FS **PROJECT#** 19897-78774 **REGION** NWR

SITE ADDRESS SW 260th St
Maury Island, WA

CLIENT ORGANIZATION King County
CLIENT CONTACT James Neely
CLIENT CONTACT PHONE # 206-296-4472

( ) **AMENDMENT TO EXISTING APPROVED H&SP?**
( ) **H&SP AMENDMENT NUMBER?**
( ) **DATE OF PREVIOUS H&SP APPROVAL**

OBJECTIVES OF FIELD WORK:
(e.g. collect surface soil samples):

Establish health and safety procedures required to minimize potential hazards to personnel involved in the Remedial Investigation, including activities, such as, in-situ and ex-situ soil sampling (from surface levels down to a depth of 2 feet) and collecting vegetation tissue samples.

SITE TYPE: *Check as many as applicable*

Active	( )	Landfill	( )	Unknown	( )
Inactive	(X)	Uncontrolled	( )	Military	( )
Secure	(X)	Industrial	( )	Other (specify)	
Unsecure	( )	Recovery	( )		
Enclosed space	( )	Well Field	( )		

All requirements described in the **CDM Health and Safety Manual** are incorporated in this health and safety plan by reference.

PERSONNEL AND RESPONSIBILITIES

NAMES OF WORK CREW MEMBERS	Company / Division / Office	Current Training & Medical?	Project or Site Responsibilities	Tasks On Site?
Pam Morrill	ERD/BLV	40-hr OSHA	Work Assignment Manager	1-2-3-4-5-6
Howard Young	ERD/BLV	40-hr Supervisory	Site Health & Safety Coordinator	1-2-3-4-5-6
Kevin Lee	ERD/BLV	40-hr OSHA	Site Engineer	1-2-3-4-5-6
Mark Jusayan	ERD/BLV	40-hr OSHA	Site Engineer	1-2-3-4-5-6
Alexis Lopez	ERD/BLV	40-hr OSHA	Site Geologist	1-2-3-4-5-6
Karen Irby-Smith	ERD/BLV	40-hr OSHA	Site Geologist	1-2-3-4-5-6

BACKGROUND REVIEW: (X) Complete ( ) Incomplete

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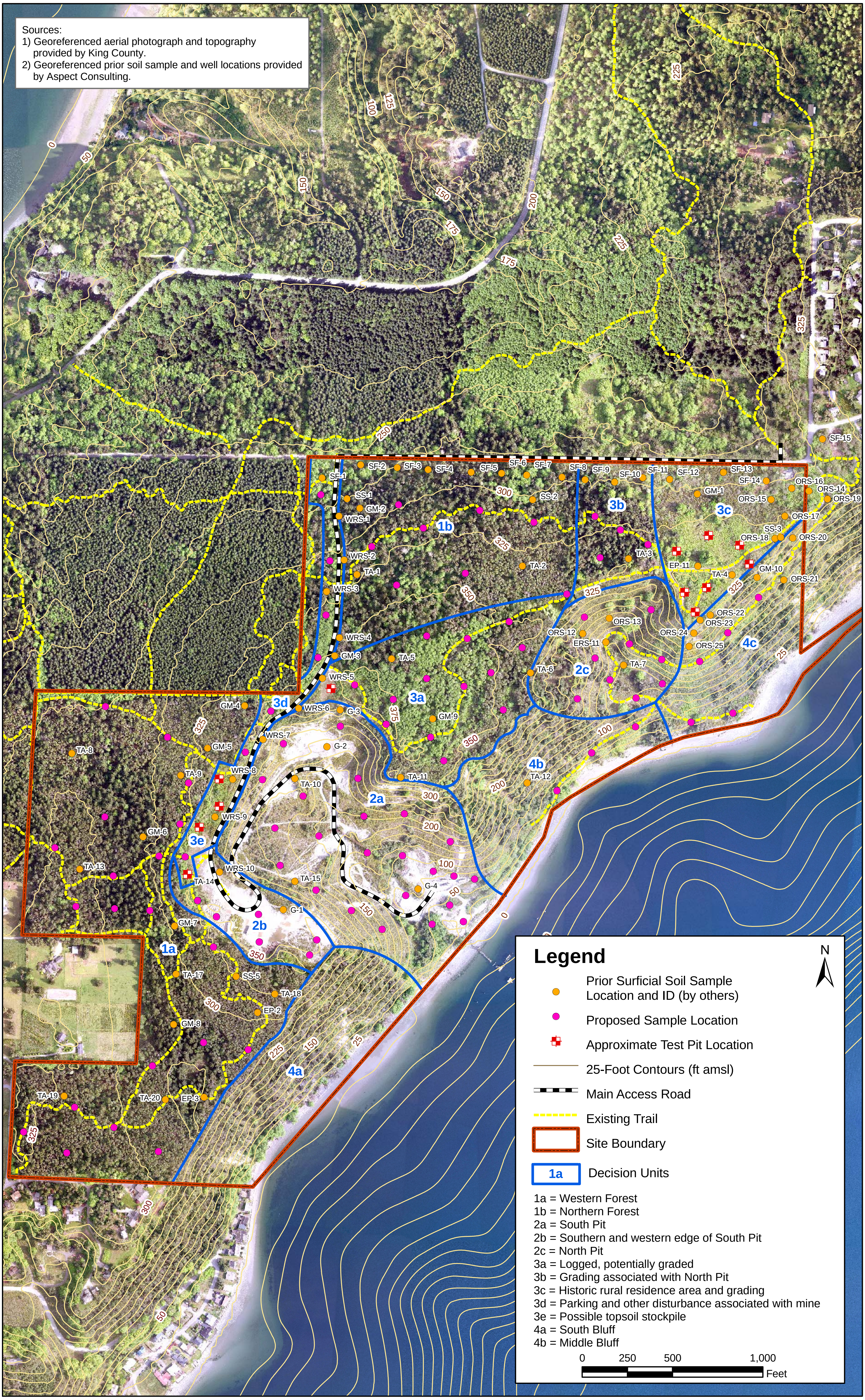


CDM

Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Figure 6
Proposed Surface
Sample Location Map

HEALTH AND SAFETY PLAN FORM **CDM Health and Safety Program**	*This document is for the exclusive use of CDM and its subcontractors*	**CDM** (Camp Dresser & McKee) **PROJECT DOCUMENT #:**

HISTORY: *Summarize conditions that relate to hazard. Include citizen complaints, spills, previous investigations or agency actions, known injuries, etc.*

Sand and gravel mining have been conducted at the site since at least the 1930s. The site lies within the Tacoma Smelter Plume. Lead and later copper refining at the Tacoma Smelter released metals, including arsenic, lead, and cadmium from the smelter's smokestack, which was carried by the wind and settled over a 100 square-mile area. The site lies within one of the areas most impacted by the Tacoma Smelter Plume, on Maury Island. A number of onsite environmental studies related to the Tacoma Smelter Plume have been conducted by several different consultants since 1998.

WASTE TYPES: ( ) Liquid ( ) Solid ( ) Sludge ( ) Gas ( ) Unknown ( ) Other, specify:

WASTE CHARACTERISTICS: *Check as many as applicable.*

( ) Corrosive	( ) Flammable	( ) Radioactive
(X) Toxic	( ) Volatile	( ) Reactive
( ) Inert Gas	( ) Unknown	
( ) Other:		

WORK ZONES:

The exclusion zone shall be a 10-foot radius around sampling sites using hand tools and a 20-foot radius around sampling sites with a backhoe. The contamination reduction zone will be at the perimeter of the exclusion zone. The support zone includes field vehicles.

HAZARDS OF CONCERN: *Check as many as applicable.*

( ) Heat Stress	CDM Guideline	( ) Noise	CDM Guideline
( ) Cold Stress	CDM Guideline	(X) Inorganic Chemicals	
( ) Explosive/Flammable		( ) Organic Chemicals	
( ) Oxygen Deficient		( ) Motorized Traffic	
( ) Radiological		( ) Heavy Machinery	
(X) Biological		(X) Slips & Falls	CDM Guideline
(X) Other:	Vegetation: Poison Oak		
( ) Other:			

FACILITY'S PAST AND PRESENT DISPOSAL METHODS AND PRACTICES:

This plan incorporates CDM's procedure for: *(Click on the relevant topics to download the hazard guideline. Delete irrelevant topics.)*

- Housekeeping
- Manual Material Handling
- Tools and Power Equipment
- Working Around Heavy Equipment
- Hazardous Waste Site Controls
- Hazardous Waste Site Decontamination

HEALTH AND SAFETY PLAN FORM	*This document is for the exclusive*	**CDM** (Camp Dresser & McKee)
CDM Health and Safety Program	*use of CDM and its subcontractors*	**PROJECT DOCUMENT #:**

DESCRIPTION AND FEATURES: *Include principal operations and unusual features (containers, buildings, dikes, power lines, hillslopes, rivers, etc.)*

The site is an irregularly shaped approximately 235 acre property situated on a sea bluff above the Puget Sound. Recent mining operations have been located centrally on the site. Slope gradients generally range from roughly 5 to 20 percent around the north, west, and southern portions of the site. The site is steeply sloped to the East to form the sea bluffs above the Puget Sound and around the mined area. Total elevation change around the site is approximately 363 feet.

Most recent disturbed areas are sparsely vegetated. Older mined and graded areas are vegetated with grass, scotch broom, blackberries and seedling Pacific Madrone trees. There is a significant presence of poison oak along the northern bluff. A majority of upland areas are covered by mature forest, which include Pacific Madrone, Douglas Fir, and Maple.

SURROUNDING POPULATION: (X) Residential ( ) Industrial ( ) Commercial (X) Rural ( ) Urban OTHER:

HAZARDOUS MATERIAL SUMMARY: ***Highlight or bold waste types and estimate amounts by category.***

CHEMICALS: *Amount/Units:*	**SOLIDS:** *Amount/Units:*	**SLUDGES:** *Amount/Units:*	**SOLVENTS:** *Amount/Units:*	**OILS:** *Amount/Units:*	**OTHER:** *Amount/Units:*
Acids	Flyash	Paints	Ketones	Oily Wastes	Laboratory
Pickling Liquors	Mill or Mine Tailings	Pigments	Aromatics	Gasoline	Pharmaceutical
Caustics	Asbestos	Metals Sludges	Hydrocarbons	Diesel Oil	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Alcohols	Lubricants	Radiological
Dyes or Inks	Non-Ferrous Smelter	Distillation Bottoms	Halogenated (chloro, bromo)	Polynuclear Aromatics	Municipal
Cyanides	**Metals: As, Pb, Cd**	Aluminum	Esters	PCBs	Construction
Phenols	Dioxins		Ethers	Heating Oil	Munitions
Halogens					
Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*	Other - *specify*

HEALTH AND SAFETY PLAN FORM
CDM Health and Safety Program

This document is for the exclusive use of CDM and its subcontractors

CDM (Camp Dresser & McKee)
PROJECT DOCUMENT #:

KNOWN CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION	PEL/TLV *ppm or mg/m3 (specify)*	IDLH *ppm or mg/m3 (specify)*	Warning Concentration *(in ppm)*	SYMPTOMS & EFFECTS OF ACUTE EXPOSURE	PHOTO IONIZATION POTENTIAL
Arsenic, inorganic	**477 mg/kg (S)**	10 µg/m3	5 mg/m3	Dust	Nasal ulcers, fever, bronchitis, melanosis, peripheral neuropathy	Dust
Cadmium dust	**9.8 mg/kg (S)**	2 µg/m3	9 mg/m3	Dust	Pulmonary edema, tight chest, chills	Dust
Lead compounds	**840 kg/mg (S)**	50 µg/m3	100 mg/m3	Dust	Fatigue, pallor, colic, insomnia	Dust

NA = Not Available **NE = None Established** **U = Unknown**

Verify your access to an MSDS for each chemical you will use at the site.

S = Soil SW = Surface Water T = Tailings W = Waste TK = Tanks SD = Sediment
A = Air GW = Ground Water SL = Sludge D = Drums L = Lagoons OFF = Off-Site

HEALTH AND SAFETY PLAN FORM
CDM Health and Safety Program

This document is for the exclusive use of CDM and its subcontractors

CDM (Camp Dresser & McKee)
PROJECT DOCUMENT #:

SPECIFIC TASK DESCRIPTIONS	Disturbing the Waste?	TASK - SPECIFIC HAZARDS	HAZARD & SCHEDULE
1 Soil Sampling	**Intrusive**	Exposure to contaminants in soil. Physical exertion from digging. Mechanical hazards from motorized equipment. Working on or near steep slopes. Adverse weather conditions. Contact with poison oak, nettles, blackberry stickers. Stinging/biting Insects	**Medium Hazard** October-November 2010
2 Plant tissue sampling	**Non-intrusive**	Exposure to contaminants in surface soil. Contact with poison oak, blackberry stickers. Stinging/biting insects	**Low Hazard** Oct-10
3	**Pick from the list**		**Pick from the list**
4	**Pick from the list**		**Pick from the list**
5	**Pick from the list**		**Pick from the list**
6	**Pick from the list**		**Pick from the list**

SPECIALIZED TRAINING REQUIRED:

SPECIAL MEDICAL SURVEILLANCE REQUIREMENTS:

Annual medical surveillance in accordance with OSHA HAZWOPER regulations.

OVERALL HAZARD EVALUATION: ( ) High (X) Medium ( ) Low ( ) Unknown *(Where tasks have different hazards, evaluate each.)*

JUSTIFICATION: Physical hazards from working near steep slopes and around heavy equipment. Contaminant hazards low.

FIRE/EXPLOSION POTENTIAL: ( ) High ( ) Medium (X) Low ( ) Unknown

HEALTH AND SAFETY PLAN FORM	*This document is for the exclusive*	**CDM** (Camp Dresser & McKee)
CDM Health and Safety Program	*use of CDM and its subcontractors*	**PROJECT DOCUMENT #:**

PROTECTIVE EQUIPMENT: *Specify by task. Indicate type and/or material, as necessary. Group tasks if possible. Use copies of this sheet if needed.*

BLOCK A

TASKS: **1 - 2** - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - **D - Modified**
(X) Primary ( ) Contingency

Respiratory: (X) Not needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not needed
(X) Safety Glasses:
( ) Face Shield:
( ) Goggles:
(X) Hard Hat:
( ) Other:

Boots: ( ) Not needed
(X) Steel-Toe ( ) Steel Shank
( ) Rubber ( ) Leather
( ) Overboots:

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
( ) Apron:
( ) Tyvek Coverall or
( ) Saranex Coverall
( ) Cloth Coverall:
(X) Other: Work clothes and high-visibilty safety vest

Gloves: ( ) Not needed
(X) Undergloves:
( ) Gloves:
( ) Overgloves:

Other: specify below
(X) Bug Spray
( ) Flotation Device If Over Water
( ) Hearing Protection
(X) Sun Screen

BLOCK B

TASKS: **1 - 2** - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - D - Modified
( ) Primary (X) Contingency

Exit Area

Respiratory: ( ) Not needed
( ) SCBA, Airline:
[illegible]
[illegible]
[illegible] Mask:
Other:

Head and Eye: ( ) Not needed
( ) Safety Glasses:
( ) Face Shield:
( ) Goggles:
( ) Hard Hat:
Other:

[illegible]
[illegible]
[illegible]
( ) Overboots: Latex

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
[illegible]
[illegible] Coverall or
( ) [illegible]x Coverall
( ) [illegible] Coverall:
( ) Other:

Gloves: ( ) Not needed
( ) Undergloves:
( ) Gloves:
( ) Overgloves:

Other: specify below
[illegible]
( ) [illegible] If Over Water
( ) Hearing Protection
( ) Sun Screen

BLOCK C

TASKS: 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - D - Modified
( ) Primary ( ) Contingency

Respiratory: ( ) Not needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not needed
( ) Safety Glasses:
( ) Face Shield:
( ) Goggles:
( ) Hard Hat:
( ) Other:

Boots: ( ) Not needed
( ) Steel-Toe ( ) Steel Shank
( ) Rubber ( ) Leather
( ) Overboots:

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
( ) Apron:
( ) Tyvek Coverall
( ) Saranex Coverall
( ) Cloth Coverall:
( ) Other:

Gloves: ( ) Not needed
( ) Undergloves:
( ) Gloves:
( ) Overgloves:

Other: specify below
( ) Tick Spray
( ) Flotation Device
( ) Hearing Protection
( ) Sun Screen

BLOCK D

TASKS: 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10
LEVEL: A - B - C - D - Modified
( ) Primary ( ) Contingency

Respiratory: ( ) Not needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not needed
( ) Safety Glasses:
( ) Face Shield:
( ) Goggles:
( ) Hard Hat:
( ) Other:

Boots: ( ) Not needed
( ) Steel-Toe ( ) Steel Shank
( ) Rubber ( ) Leather
( ) Overboots:

Prot. Clothing: ( ) Not needed
( ) Encapsulated Suit:
( ) Splash Suit
( ) Apron:
( ) Tyvek Coverall
( ) Saranex Coverall
( ) Cloth Coverall:
( ) Other:

Gloves: ( ) Not needed
( ) Undergloves:
( ) Gloves:
( ) Overgloves:

Other: specify below
( ) Tick Spray
( ) Flotation Device
( ) Hearing Protection
( ) Sun Screen

This health and safety plan form constitutes hazard analysis per 29 CFR 1910.132

HEALTH AND SAFETY PLAN FORM CDM Health and Safety Program		*This document is for the exclusive use of CDM and its subcontractors*		CDM (Camp Dresser & McKee) PROJECT DOCUMENT #:
MONITORING EQUIPMENT:		*Specify by task. Indicate type as necessary. Attach additional sheets if needed.*		
INSTRUMENT	TASK	ACTION GUIDELINES		COMMENTS
Combustible Gas Indicator	1-2-3-4-5-6-7-8	0-10% LEL	*No explosion hazard*	(X) Not Needed
		10-25% LEL	*Potential explosion hazard; notify SHSC*	
		>25% LEL	*Explosion hazard; interrupt task/evacuate*	
		21.0% O2	*Oxygen normal*	
		<21.0% O2	*Oxygen deficient; notify SHSC*	
		<19.5% O2	*Interrupt task/evacuate*	
Radiation Survey Meter	1-2-3-4-5-6-7-8	3 x Background:	*Notify HSM*	(X) Not Needed
		>2mR/hr:	*Establish REZ*	
Photoionization Detector _____eV Lamp Type ____	*Specify:* 1-2-3-4-5-6-7-8			(X) Not Needed
Flame Ionization Detector Type____________	*Specify:* 1-2-3-4-5-6-7-8			(X) Not Needed
Single Gas Type____________ Type____________	*Specify:* 1-2-3-4-5-6-7-8			(X) Not Needed
Respirable Dust Monitor Type____________ Type____________	*Specify:* 1-2-3-4-5-6-7-8			(X) Not Needed
Other **IRRITATION** Type____________	*Specify:* **1, 2**	***If team notice irritation of eyes, nose or throat irritation - EXIT the area***		**Needed**
Other **DUST** Type____________	*Specify:* **1, 2**	***No visible dust is allowed from work activities. EXIT area if visible dust***		**Needed** **Use engineering controls to suppress all dust**

HEALTH AND SAFETY PLAN FORM CDM Health and Safety Program	*This document is for the exclusive use of CDM and its subcontractors*	**CDM** (Camp Dresser & McKee) **PROJECT DOCUMENT #:**

DECONTAMINATION PROCEDURES

ATTACH SITE MAP INDICATING EXCLUSION, DECONTAMINATION, & SUPPORT ZONES AS PAGE TWO

Personnel Decontamination	Sampling Equipment Decontamination	Heavy Equipment Decontamination
Summarize below or attach diagram; Drop equipment, remove hard hat, remove safety glasses, remove gloves, wash hands and face. WASH HANDS AND FACE BEFORE EATING OR DRINKING. Shower as soon as possible. ( ) Not Needed	*Summarize below or attach diagram;* All non-disposable sampling equipment such as spoons will be thoroughly decontaminated between samples with soap, water, and rinsing with distilled water. The four steps of equipment decontamination are: 1.) Scrub with mild solution of Alconox; 2.) rinse with potable water; 3.)spray rinse with distilled water; 4.) air-dry. ( ) Not Needed	*Summarize below or attach diagram;* All heavy equipment shall be brushed or wiped off in the exclusion zone to remove dirt. (X) Not Needed
Containment and Disposal Method PPE waste generated during soil, sampling (rubber gloves, paper towels, etc.) will be placed in plastic garbage bag(s) and sealed shut. The garbage bags will be placed in a County commercial waste collection container for ultimate disposal in accordance with 173-303 WAC and 173-340-820 WAC.	**Containment and Disposal Method** Decontamination water shall be disposed of appropriately onsite.	**Containment and Disposal Method** Decontamination and purge water shall be disposed of appropriately onsite.

HAZARDOUS MATERIALS TO BE BROUGHT ONSITE

Preservatives		*Decontamination*		*Calibration*	
( ) Hydrochloric Acid	( ) Zinc Acetate	(X) Alconox ™	( ) Hexane	( ) 100 ppm isobutylene	( ) Hydrogen Sulfide
( ) Nitric Acid	( ) Ascorbic Acid	( ) Liquinox ™	( ) Isopropanol	( ) Methane	( ) Carbon Monoxide
( ) Sulfuric Acid	( ) Acetic Acid	( ) Acetone	( ) Nitric Acid	( ) Pentane	( ) pH Standards
( ) Sodium Hydroxide	( ) Other:	( ) Methanol	( ) Other:	( ) Hyrogen	( ) Conductivity Std
		( ) Mineral Spirits		( ) Propane	( ) Other:

HEALTH AND SAFETY PLAN FORM	*This document is for the exclusive*	**CDM** (Camp Dresser & McKee)
CDM Health and Safety Program	*use of CDM and its subcontractors*	**PROJECT DOCUMENT #:**

EMERGENCY CONTACTS	
Water Supply	
EPA Release Report #:	800 / 424 - 8802
CDM 24-Hour Emergency #:	PSG 732 / 539 - 8128
Facility Management	
Other (specify)	
CHEMTREC Emergency #:	800 / 424 - 9300

SAFETY NARRATIVE: *Summarize below*

Evacuate site if any unexpected hazardous conditions are encountered. The "buddy system" will be employed for all work being done. Site staff will discuss an evacuation area appropriate for each sample location prior to beginning work at each location. If a work team observes hazards for which they have not been prepared, they will withdraw from the area and call CDM Health and Safety. All workers on the site will have "Stop Work Authority" to immediately stop work if he/she feels that a particular task is being performed unsafely. Stop Work Authority may be exercised by anyone working on the site at anytime without repercussions or retribution.

EMERGENCY CONTACTS	**NAME**	**PHONE**
Health and Safety Manager	Pat Dentler	505 780 - 0381
Site Safety Coordinator	Howard Young	425-519-8300
Client Contact	James Neely	206-296-4472
Other *(specify)*		
Environmental Agency		
State Spill Number	Washington	(800) 258-5990
Fire Department		911
Police Department		911
State Police		911
Health Department		
Poison Control Center	Nationwide	800 / 222 - 1222
Occupational Physician	Dr. Jerry Berke	800 / 350 - 4511

MEDICAL EMERGENCY		**PHONE**
Hospital Name:	Vashon Health Center	206.463.3671
Hospital Address	10030 SW 210th Street, Vashon, WA, 98070	
Name of Contact at Hospital:		
Name of 24-Hour Ambulance:		
Route to Hospital:		

Exit the main entrance of the site heading West on SW 260th St. for 0.4 mi; sharp right turn onto Dockton Rd SW for 3.4 mi, Turn left at SW Quartermaster Dr for 1.1 mi, Turn right at Dugway Rd 0.3 mi, Turn right on Vashon Hwy SW 0.7 mi; turn left at SW 210 St, Clinic is on the first right.

Distance to Hospital: 6.1 Miles

HEALTH AND SAFETY PLAN APPROVALS (H&S Mgr must sign each plan)

Prepared by	[signature]	Date	10/29/10
HSC Signature	[signature]	Date	10/29/10
HSM Signature	FOR PAT DENTLER	Date	Oct 29, 2010

HEALTH AND SAFETY PLAN SIGNATURE FORM

CDM Health and Safety Plan

All site personnel must sign this form indicating receipt of the H&SP. Keep this original on site. It becomes part of the permanent project files. Send a copy to the Health and Safety Manager (HSM).

SITE NAME/NUMBER: King County - Maury Island RI/FS

DIVISION/LOCATION: ______________________

CERTIFICATION:

I understand, and agree to comply with, the provisions of the above referenced H&SP for work activities on this project. I agree to report any injuries, illnesses or exposure incidents to the site Health and Safety Coordinator (SHSC). I agree to inform the SHSC about any drugs (legal and illegal) that I take within three days of site work.

PRINTED NAME	SIGNATURE	DATE

Google maps

Directions to Vashon Health Center Highline Med
10030 Southwest 210th Street, Vashon, WA 98070-6584 - (206) 463-3671
6.1 mi – about **14 mins**

SW 260th St

1.	Head **west** on **SW 260th St** toward **SW 91st Ave** About 1 min	go 0.4 mi total 0.4 mi
2.	Sharp **right** at **Dockton Rd SW** About 6 mins	go 2.8 mi total 3.2 mi
3.	Turn **left** at **SW Point Robinson Rd**	go 79 ft total 3.2 mi
4.	Continue onto **Dockton Rd SW** About 1 min	go 0.6 mi total 3.8 mi
5.	Turn **left** at **SW Quartermaster Dr** About 2 mins	go 1.1 mi total 4.9 mi
6.	Turn **right** at **Dugway Rd**	go 0.3 mi total 5.2 mi
7.	Turn **right** at **Vashon Hwy SW** About 2 mins	go 0.7 mi total 5.9 mi
8.	Turn **left** at **SW 210th St**	go 0.1 mi total 6.0 mi
9.	Take the 1st **right** to stay on **SW 210th St**	go 449 ft total 6.1 mi

Vashon Health Center Highline Med
10030 Southwest 210th Street, Vashon, WA 98070-6584 - (206) 463-3671

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Directions weren't right? Please find your route on maps.google.com and click "Report a problem" at the bottom left.

Appendix C
Historical Aerial Photographs

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

E:\21-1-20059-001\Av_mxd\Fig-C_1936-Air-photo 5-7-04 AJC

0 600 1,200

Scale in Feet

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1936 AERIAL PHOTOGRAPH

FIG. C-1

E:\21-1-20059-001\Av_mxd\Fig-C-2_1960-Air-photo 5-7-04 AJC

0 600 1,200
Scale in Feet

May 2004
21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1960 AERIAL PHOTOGRAPH

FIG. C-2

E:\21-1-20059-001\Av_mxd\Fig-C-3_1969-Air-photo 5-5-04 AJC

0 600 1,200
Scale in Feet

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1969 AERIAL PHOTOGRAPH

FIG. C-3

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1974 AERIAL PHOTOGRAPH

FIG. C-4

E:\21-1-20059-001\Av_mxd\Fig-C-5_1977-Air-photo 5-7-04 AJC

0 600 1,200
Scale in Feet

May 2004
21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1977 AERIAL PHOTOGRAPH

FIG. C-5

E:\21-1-20059-001\Av_mxd\Fig-C-6_1980-Air-photo 5-5-04 AJC

0 600 1,200

Scale in Feet

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1980 AERIAL PHOTOGRAPH

FIG. C-6

E:\21-1-20059-001\Av_mxd\Fig-C-5_1985-Air-photo 5-5-04 AJC

0 600 1,200

Scale in Feet

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1985 AERIAL PHOTOGRAPH

FIG. C-7

E:\21-1-20059-001\Av_mxd\Fig-C-8_1995-Air-photo 5-5-04 AJC

0 600 1,200
Scale in Feet

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
1995 AERIAL PHOTOGRAPH

FIG. C-8

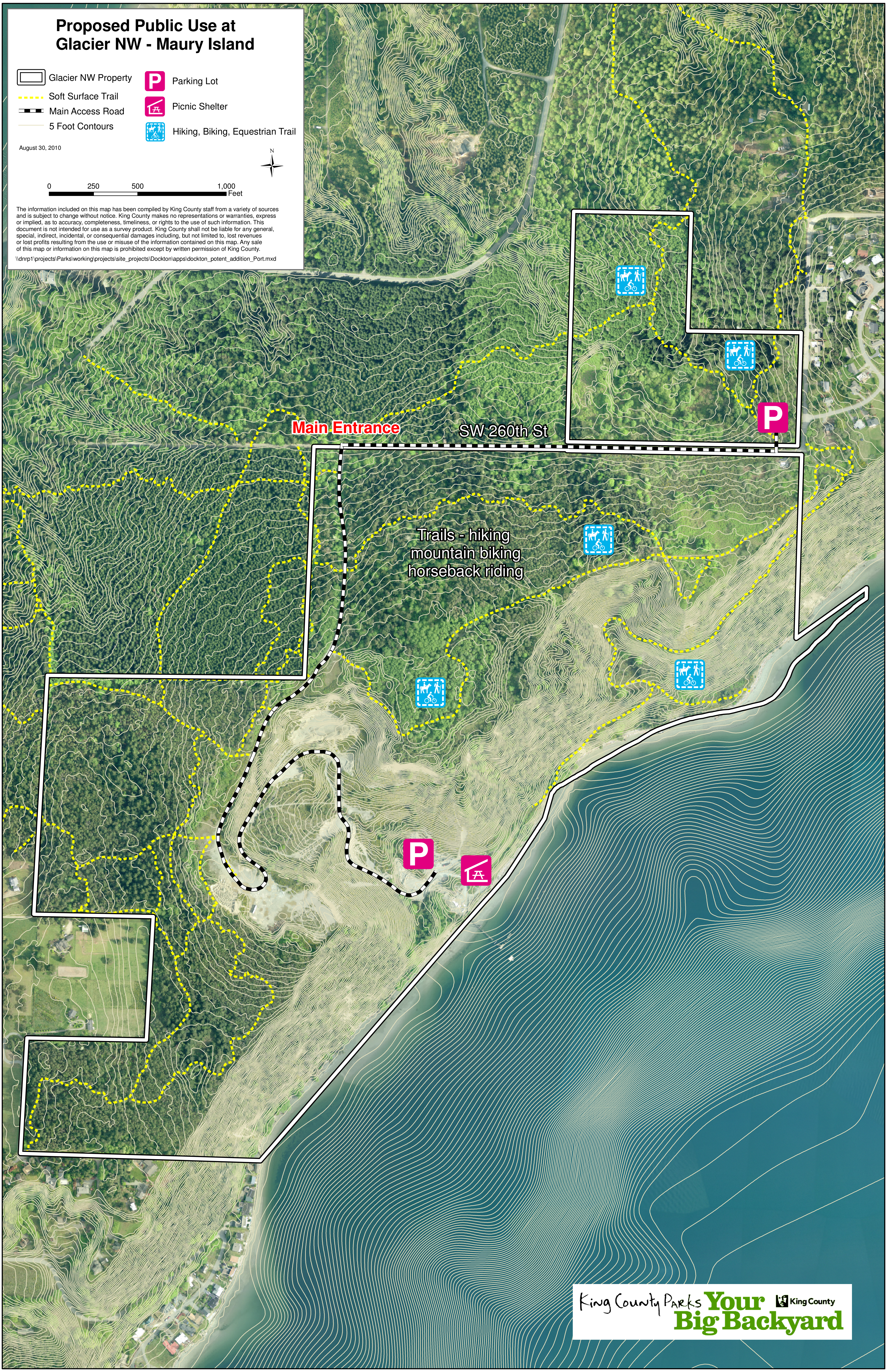
E:\21-1-20059-001\Av_mxd\Fig-C-9_2002-Air-photo 5-5-04 AJC

May 2004

21-1-20059-001

NORTHWEST AGGREGATES
MAURY ISLAND PIT
2002 AERIAL PHOTOGRAPH

FIG. C-9



Proposed Public Use at
Glacier NW - Maury Island
Glacier NW Property
Soft Surface Trail
Main Access Road
5 Foot Contours
Parking Lot
Picnic Shelter
Hiking, Biking, Equestrian Trail
August 30, 2010
N
0
250
500
1,000
Feet
The information included on this map has been compiled by King County staff from a variety of sources and is subject to change without notice. King County makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a survey product. King County shall not be liable for any general, special, indirect, incidental, or consequential damages including, but not limited to, lost revenues or lost profits resulting from the use or misuse of the information contained on this map. Any sale of this map or information on this map is prohibited except by written permission of King County.
\\dnrp1\projects\Parks\working\projects\site_projects\Dockton\apps\dockton_potent_addition_Port.mxd
Main Entrance
SW 260th St
Trails - hiking
mountain biking
horseback riding
P
P
P
King County Parks Your Big Backyard
King County

Appendix D
Existing Soil and Groundwater Data

Table D1
Arsenic, Cadmium, and Lead Data for Site Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
EP-2	0.67 to 0.83	AESI 1998	**85**		18
EP-2	7	AESI 1998	5.7		8.5
EP-3	0.67 to 0.83	AESI 1998	5.8		12
EP-9	0.67 to 0.83	AESI 1998	5.1		9
EP-9	9	AESI 1998	ND		7.1
EP-11	0.67 to 0.83	AESI 1998	4.2		7.6
OBW-1	55	AESI 1998	ND		7.7
OBW-1	190	AESI 1998	ND		6
OBW-2	140	AESI 1998	ND		8.9
OBW-2	220	AESI 1998	ND		5.3
EP-15	9	Terra Associates 1999	4.3	ND	ND
EP-16	10	Terra Associates 1999	4.5	ND	ND
EP-17	8.5	Terra Associates 1999	2.7	ND	ND
EP-18	10	Terra Associates 1999	2.4	ND	ND
EP-19	10	Terra Associates 1999	3.9	ND	ND
EP-20	10	Terra Associates 1999	2.4	ND	ND
EP-21	10	Terra Associates 1999	3.5	ND	ND
EP-22	10	Terra Associates 1999	3.1	ND	ND
EP-23	10	Terra Associates 1999	4.6	ND	ND
EP-24	10	Terra Associates 1999	6.9	ND	ND
EP-25	10	Terra Associates 1999	3.1	ND	ND
EP-26	10	Terra Associates 1999	3.3	ND	ND
EP-27	10	Terra Associates 1999	4	ND	ND
EP-28	10	Terra Associates 1999	2.2	ND	ND
G-1	surface	Terra Associates 1999	ND	ND	ND
G-2	surface	Terra Associates 1999	2.2	ND	ND
G-3	surface	Terra Associates 1999	1.6	ND	ND
G-4	surface	Terra Associates 1999	1.8	ND	ND
GM-1	surface	Landau Associates 1999	**199**		
GM-2	surface	Landau Associates 1999	**379**		
GM-3	surface	Landau Associates 1999	**273**		
GM-4	surface	Landau Associates 1999	**82**		
GM-5	surface	Landau Associates 1999	**30**		
GM-6	surface	Landau Associates 1999	**81**		
GM-7	surface	Landau Associates 1999	**293**		
GM-8	surface	Landau Associates 1999	**477**		
GM-9	surface	Landau Associates 1999	9		
GM-10	surface	Landau Associates 1999	**130**		
OBW-6	95	Terra Associates 1999	ND	ND	ND
OBW-7	270	Terra Associates 1999	2.4	ND	ND
SS-1	surface	Foster Wheeler 1999	**140**	2	**350**
SS-1	0.75	Foster Wheeler 1999	ND	1.6	31
SS-1	1.5	Foster Wheeler 1999	ND	ND	13
SS-2	surface	Foster Wheeler 1999	**110**	**9.8**	**840**
SS-2	0.75	Foster Wheeler 1999	**130**	**2.9**	56

Table D1
Arsenic, Cadmium, and Lead Data for Site Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
SS-2	1.5	Foster Wheeler 1999	ND	1	11
SS-3	surface	Foster Wheeler 1999	ND	1.2	37
SS-3	0.75	Foster Wheeler 1999	ND	1.1	40
SS-3	1.5	Foster Wheeler 1999	ND	1.2	37
SS-4	2	Foster Wheeler 1999	ND	ND	ND
SS-5	2	Terra Associates 1999	ND	ND	ND
TA-1	surface	Terra Associates 1999	**330**	2	**830**
TA-1	0.75	Terra Associates 1999	**39**	0.84	27
TA-1	1.5	Terra Associates 1999	**43**	0.89	23
TA-2	surface	Terra Associates 1999	**120**	**2.3**	**390**
TA-2	0.75	Terra Associates 1999	**25**	1.2	10
TA-2	1.5	Terra Associates 1999	8.7	ND	ND
TA-3	surface	Terra Associates 1999	**150**	ND	**280**
TA-3	0.75	Terra Associates 1999	**110**	0.91	81
TA-3	1.5	Terra Associates 1999	10	0.62	8.6
TA-4	surface	Terra Associates 1999	**160**	1.5	**450**
TA-4	0.75	Terra Associates 1999	19	0.72	25
TA-4	1.5	Terra Associates 1999	4.2	ND	ND
TA-5	surface	Terra Associates 1999	**47**	0.92	54
TA-5	0.75	Terra Associates 1999	**47**	0.84	59
TA-5	1.5	Terra Associates 1999	**43**	ND	51
TA-6	surface	Terra Associates 1999	**100**	**9.3**	**470**
TA-6	0.75	Terra Associates 1999	**270**	**2.9**	120
TA-6	1.5	Terra Associates 1999	**64**	1.1	30
TA-7	surface	Terra Associates 1999	17	ND	13
TA-7	0.75	Terra Associates 1999	19	ND	18
TA-7	1.5	Terra Associates 1999	13	ND	11
TA-8	surface	Terra Associates 1999	**190**	**3**	**550**
TA-8	0.75	Terra Associates 1999	**67**	0.94	41
TA-8	1.5	Terra Associates 1999	10	ND	7.6
TA-9	surface	Terra Associates 1999	**98**	1.6	**510**
TA-9	0.75	Terra Associates 1999	**110**	0.95	30
TA-9	1.5	Terra Associates 1999	9.2	0.77	7.1
TA-10	surface	Terra Associates 1999	4.3	ND	ND
TA-10	0.75	Terra Associates 1999	ND	ND	ND
TA-10	1.5	Terra Associates 1999	ND	ND	ND
TA-11	surface	Terra Associates 1999	1.9	ND	ND
TA-11	0.75	Terra Associates 1999	ND	ND	ND
TA-11	1.5	Terra Associates 1999	ND	ND	ND
TA-12	surface	Terra Associates 1999	6.1	ND	58
TA-12	0.75	Terra Associates 1999	6.2	ND	ND
TA-12	1.5	Terra Associates 1999	5.7	ND	6
TA-13	surface	Terra Associates 1999	**220**	ND	**470**
TA-13	0.75	Terra Associates 1999	**130**	0.82	45
TA-13	1.5	Terra Associates 1999	8.2	1.5	8.3

Table D1
Arsenic, Cadmium, and Lead Data for Site Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
TA-14	surface	Terra Associates 1999	18	0.91	70
TA-14	0.75	Terra Associates 1999	**130**	1.2	37
TA-14	1.5	Terra Associates 1999	ND	0.92	36
TA-15	surface	Terra Associates 1999	ND	ND	ND
TA-15	0.75	Terra Associates 1999	ND	ND	ND
TA-15	1.5	Terra Associates 1999	ND	ND	ND
TA-17	surface	Terra Associates 1999	**61**	**6**	240
TA-17	0.75	Terra Associates 1999	**260**	1.2	35
TA-17	1.5	Terra Associates 1999	11	ND	ND
TA-18	surface	Terra Associates 1999	11	ND	7.1
TA-18	0.75	Terra Associates 1999	8.2	ND	ND
TA-18	1.5	Terra Associates 1999	5.9	ND	6.1
TA-19	surface	Terra Associates 1999	**100**	**6**	**470**
TA-19	0.75	Terra Associates 1999	**270**	1.4	67
TA-19	1.5	Terra Associates 1999	3.8	ND	ND
TA-20	surface	Terra Associates 1999	**140**	**5.4**	**710**
TA-20	0.75	Terra Associates 1999	11	ND	11
TA-20	1.5	Terra Associates 1999	7.6	0.59	6.6
ERS-11	surface	Foster Wheeler 2000	19	ND	6
ORS-12	surface	Foster Wheeler 2000	**44**	ND	18
ORS-13	surface	Foster Wheeler 2000	**66**	ND	43
SF-1	surface	Foster Wheeler 2000	**24.3**		
SF-2	surface	Foster Wheeler 2000	**38.6**		
SF-3	surface	Foster Wheeler 2000	**47.2**		
SF-4	surface	Foster Wheeler 2000	**81.9**		
SF-5	surface	Foster Wheeler 2000	**172**		
SF-6	surface	Foster Wheeler 2000	**61.2**		
SF-7	surface	Foster Wheeler 2000	19		
SF-8	surface	Foster Wheeler 2000	**89.2**		
SF-9	surface	Foster Wheeler 2000	**53.4**		
SF-10	surface	Foster Wheeler 2000	**82.3**		
SF-11	surface	Foster Wheeler 2000	**77.6**		
SF-12	surface	Foster Wheeler 2000	**94.3**		
SF-13	surface	Foster Wheeler 2000	**69.1**		
SF-14	surface	Foster Wheeler 2000	16.5		
SF-15	surface	Foster Wheeler 2000	**30.3**		
WRS-1	surface	Foster Wheeler 2000	**35**	ND	5
WRS-2	surface	Foster Wheeler 2000	**90**	ND	48
WRS-3	surface	Foster Wheeler 2000	**106**	ND	22
WRS-4	surface	Foster Wheeler 2000	**69**	ND	1
WRS-5	surface	Foster Wheeler 2000	**74**	ND	43
WRS-6	surface	Foster Wheeler 2000	**71**	ND	23
WRS-7	surface	Foster Wheeler 2000	**110**	ND	30
WRS-8	surface	Foster Wheeler 2000	**95**	ND	25
WRS-9	surface	Foster Wheeler 2000	**43**	ND	3

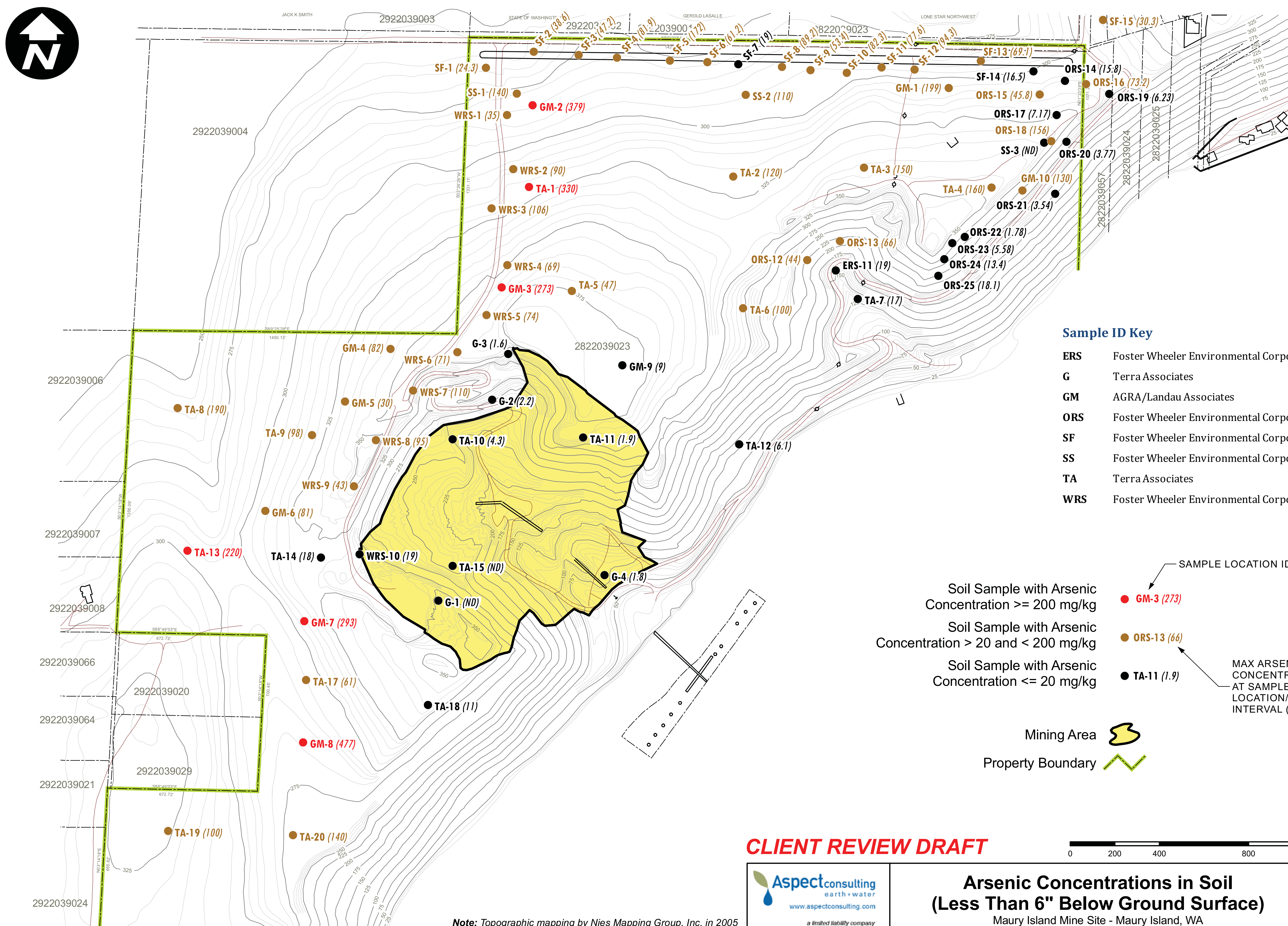
Table D1
Arsenic, Cadmium, and Lead Data for Site Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
WRS-10	surface	Foster Wheeler 2000	19	ND	3
ORS-14	surface	Foster Wheeler 2001	15.8	0.562	24.2
ORS-15	surface	Foster Wheeler 2001	**45.8**	1.84	62.4
ORS-16	surface	Foster Wheeler 2001	**73.2**	1.7	102
ORS-17	surface	Foster Wheeler 2001	7.17	ND	8.97
ORS-18	surface	Foster Wheeler 2001	**156**	0.861	198
ORS-19	surface	Foster Wheeler 2001	6.23	ND	6.1
ORS-20	surface	Foster Wheeler 2001	3.77	ND	2.66
ORS-21	surface	Foster Wheeler 2001	3.54	ND	4.17
ORS-22	surface	Foster Wheeler 2001	1.78	ND	2.01
ORS-23	surface	Foster Wheeler 2001	5.58	ND	6.03
ORS-24	surface	Foster Wheeler 2001	13.4	ND	12.9
ORS-25	surface	Foster Wheeler 2001	18.1	ND	12.6
MI-1	10 to 25	Aspect Consulting 2004	2	0.05	1.84
MI-1	30 to 55	Aspect Consulting 2004	1.8	0.05	1.94
MI-1	60 to 80	Aspect Consulting 2004	1.8	0.05	1.91
MI-1	90 to 110	Aspect Consulting 2004	1.7	0.05	1.61
MI-1	115 to 135	Aspect Consulting 2004	1.6	0.05	1.56
MI-1	145 to 165	Aspect Consulting 2004	1.8	0.05	1.64
MI-2-S-1	8 to 10.5	Aspect Consulting 2004	1.8	0.05	1.83
MI-2-S-2	7.5 to 10	Aspect Consulting 2004	1.8	0.07	1.98
MI-2-S-3	6 to 9	Aspect Consulting 2004	1.7	0.06	2.66
MI-2-S-4	5 to 9	Aspect Consulting 2004	1.7	0.05	3.71
MI-2-S-5	6 to 11	Aspect Consulting 2004	1.7	0.06	1.42
MI-2-S-6	14 to 16	Aspect Consulting 2004	1.9	0.06	2.53
MI-2-S-7	5 to 8	Aspect Consulting 2004	1.8	0.06	3.5
MI-3	20 to 25	Aspect Consulting 2004	2	0.09	1.87
MI-3	30 to 55	Aspect Consulting 2004	1.6	0.06	2
MI-3	60 to 80	Aspect Consulting 2004	1.9	0.05	1.51
MI-3	85 to 110	Aspect Consulting 2004	2	0.07	1.78
MI-3	115 to 135	Aspect Consulting 2004	1.9	0.05	1.59
MI-3	140 to 155	Aspect Consulting 2004	1.8	0.06	1.42
MI-3	170 to 195	Aspect Consulting 2004	1.9	0.06	1.46
MI-3	200 to 220	Aspect Consulting 2004	1.8	0.06	1.45
MI-3	225 to 250	Aspect Consulting 2004	1.7	0.06	1.49
MI-3	260 to 280	Aspect Consulting 2004	2.1	0.06	1.86
MI-4-S-1	13 to 16	Aspect Consulting 2004	1.2	0.08	1.56
MI-4-S-2	6 to 8	Aspect Consulting 2004	2.4	0.07	2.48
MI-4-S-3	6 to 9	Aspect Consulting 2004	2.4	0.08	2.1
MI-4-S-4	11 to 16	Aspect Consulting 2004	1.9	0.06	1.5
MI-4-S-5	10.5 to 13	Aspect Consulting 2004	1.5	0.06	1.31
MI-4-S-6	9 to 13	Aspect Consulting 2004	1.5	0.05	1.41
MI-4-S-7	5 to 8	Aspect Consulting 2004	1.6	0.07	1.5
MI-4-S-8	5 to 8	Aspect Consulting 2004	1.7	0.05	1.61
MI-4-S-9	10 to 13	Aspect Consulting 2004	2.4	0.06	4.4

Table D1
Arsenic, Cadmium, and Lead Data for Site Soils
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
MI-4-S-10	6 to 10	Aspect Consulting 2004	1.6	0.05	2
MI-5	10 to 25	Aspect Consulting 2004	1.4	0.04	1.74
MI-5	30 to 55	Aspect Consulting 2004	1.8	0.07	2.12
MI-5	60 to 80	Aspect Consulting 2004	1.8	0.04	1.8
MI-5	85 to 110	Aspect Consulting 2004	2.1	0.04	1.69
MI-5	115 to 135	Aspect Consulting 2004	1.7	0.04	1.47
MI-5	140 to 165	Aspect Consulting 2004	1.6	0.04	1.38
MI-5	170 to 195	Aspect Consulting 2004	1.8	0.05	1.6
MI-5	200 to 205	Aspect Consulting 2004	1.6	0.04	1.6
MI-5	240 to 250	Aspect Consulting 2004	1.6	0.06	1.47
MI-6	2 to 7	Aspect Consulting 2004	2.4	0.07	2.68
MI-7	11 to 16	Aspect Consulting 2004	2.5	0.05	2.91
MI-8	7 to 12	Aspect Consulting 2004	1.6	0.06	2.13
MI-9	11 to 16	Aspect Consulting 2004	2.2	0.07	3.16
MI-10	12 to 17	Aspect Consulting 2004	1.9	0.06	2.09
MI-11	11 to 16	Aspect Consulting 2004	2.1	0.07	3.6
MI-12	9 to 14	Aspect Consulting 2004	2.2	0.09	2.31
MI-13	5 to 10	Aspect Consulting 2004	2.2	0.07	3.38
MI-14	10 to 15	Aspect Consulting 2004	1.7	0.07	2.52
MI-15	7 to 12	Aspect Consulting 2004	2	0.09	2.83
MI-16	11 to 16	Aspect Consulting 2004	1.9	0.08	2.7
MI-17	9 to 14	Aspect Consulting 2004	1.5	0.07	1.72
MI-18	8 to 13	Aspect Consulting 2004	2.2	0.11	2.96
MI-19	4.5 to 10	Aspect Consulting 2004	2.2	0.08	1.84
MI-20	5 to 10	Aspect Consulting 2004	1.9	0.08	3.12
MI-21	12 to 17	Aspect Consulting 2004	2.1	0.08	1.94
MI-22	14 to 19	Aspect Consulting 2004	2.6	0.07	1.86

Notes:
BOLD values exceed MTCA residential cleanup levels of 20 ppm for Arsenic, 2 ppm for Cadmium, and 250 ppm for Lead.
Data table provided by Aspect Consulting Inc.
mg/kg - milligram per kilogram.
ND - not detected.



Sample ID Key

ERS	Foster Wheeler Environmental Corporation	(2000)
G	Terra Associates	(1999)
GM	AGRA/Landau Associates	(1998)
ORS	Foster Wheeler Environmental Corporation	(2000)
SF	Foster Wheeler Environmental Corporation	(2000)
SS	Foster Wheeler Environmental Corporation	(1999)
TA	Terra Associates	(1999)
WRS	Foster Wheeler Environmental Corporation	(2000)

SAMPLE LOCATION ID (SEE KEY ABOVE)

Soil Sample with Arsenic Concentration >= 200 mg/kg — GM-3 (273)

Soil Sample with Arsenic Concentration > 20 and < 200 mg/kg — ORS-13 (66)

Soil Sample with Arsenic Concentration <= 20 mg/kg — TA-11 (1.9)

MAX ARSENIC CONCENTRATION AT SAMPLE LOCATION/DEPTH INTERVAL (IN MG/KG)

Mining Area

Property Boundary

CLIENT REVIEW DRAFT

0 200 400 800 1,200 1,600 Feet

Note: *Topographic mapping by Nies Mapping Group, Inc. in 2005*

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Arsenic Concentrations in Soil (Less Than 6" Below Ground Surface)

Maury Island Mine Site - Maury Island, WA

DATE: May 2010
DESIGNED BY: OGR
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 050106

FIGURE NO. 1

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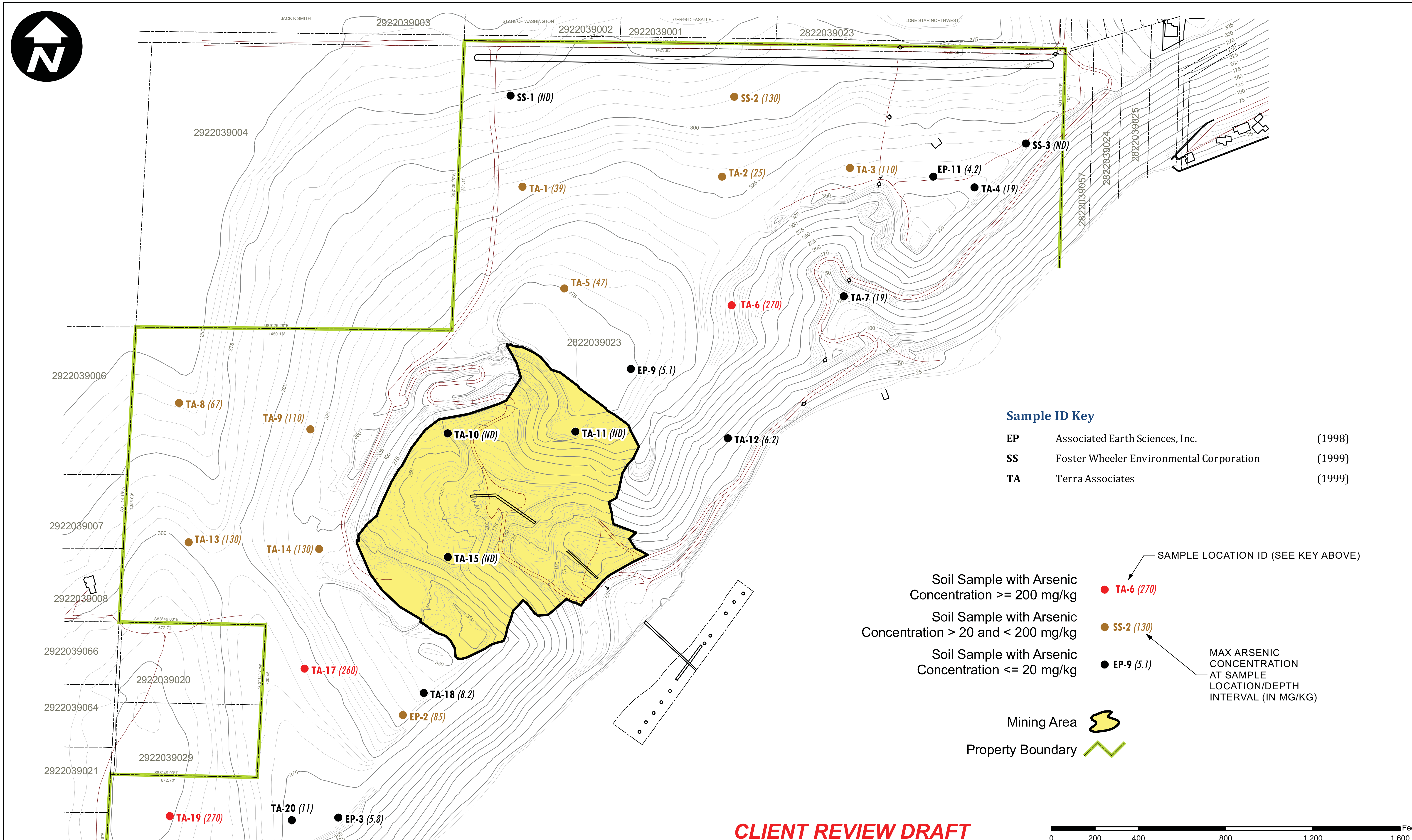

Note: Topographic mapping by Nies Mapping Group, Inc. in 2005

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Arsenic Concentrations in Soil (Between 6" and 1' Below Ground Surface)

Maury Island Mine Site - Maury Island, WA

DATE: May 2010	PROJECT NO. 050106
DESIGNED BY: OGR	
DRAWN BY: PPW	FIGURE NO. 2
REVISED BY: PPW	

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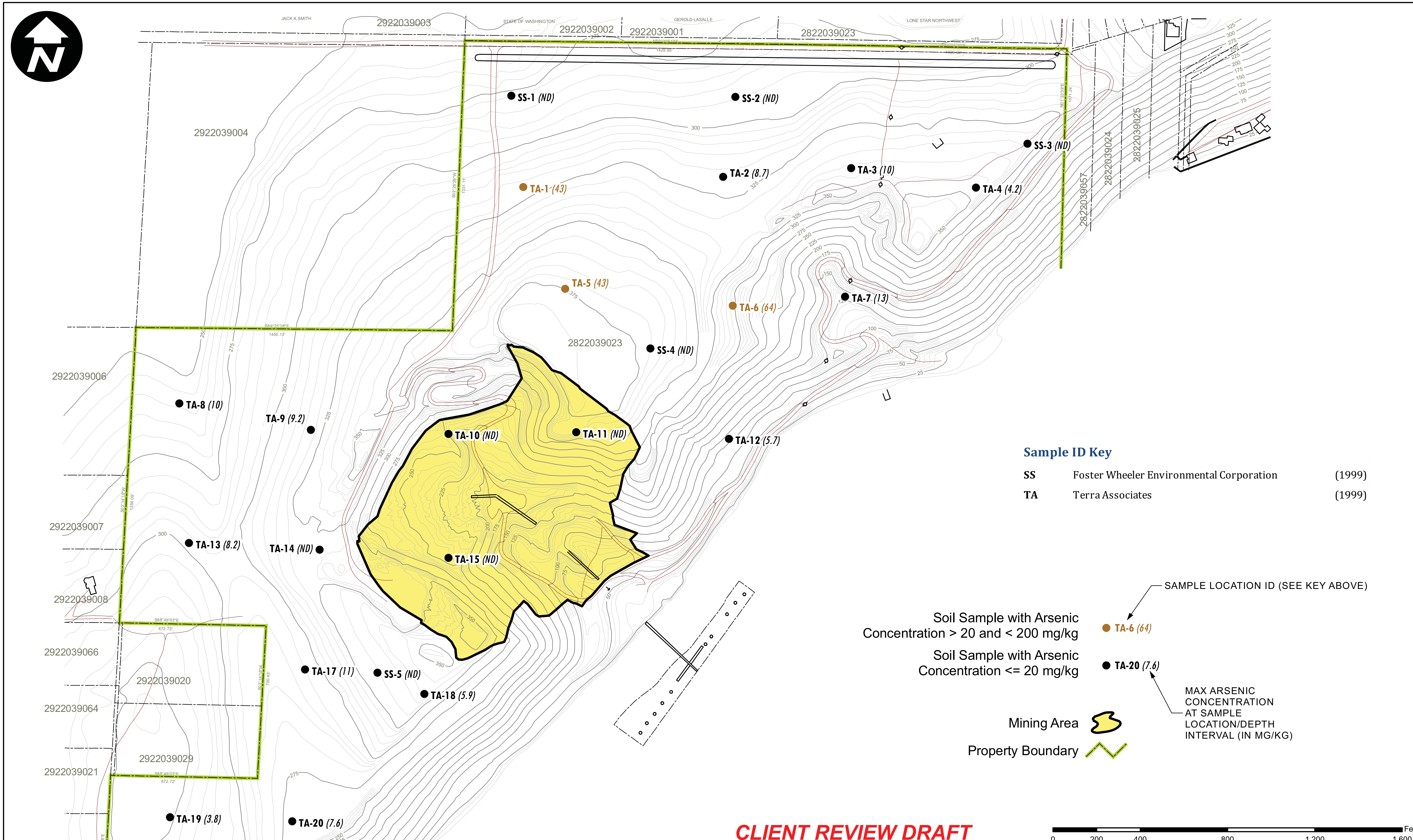

Note: Topographic mapping by Nies Mapping Group, Inc. in 2005

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Arsenic Concentrations in Soil (Between 1' and 2' Below Ground Surface)

Maury Island Mine Site - Maury Island, WA

DATE: May 2010	PROJECT NO. 050106	
DESIGNED BY: OGR		
DRAWN BY: PPW	FIGURE NO. 3	
REVISED BY: PPW		

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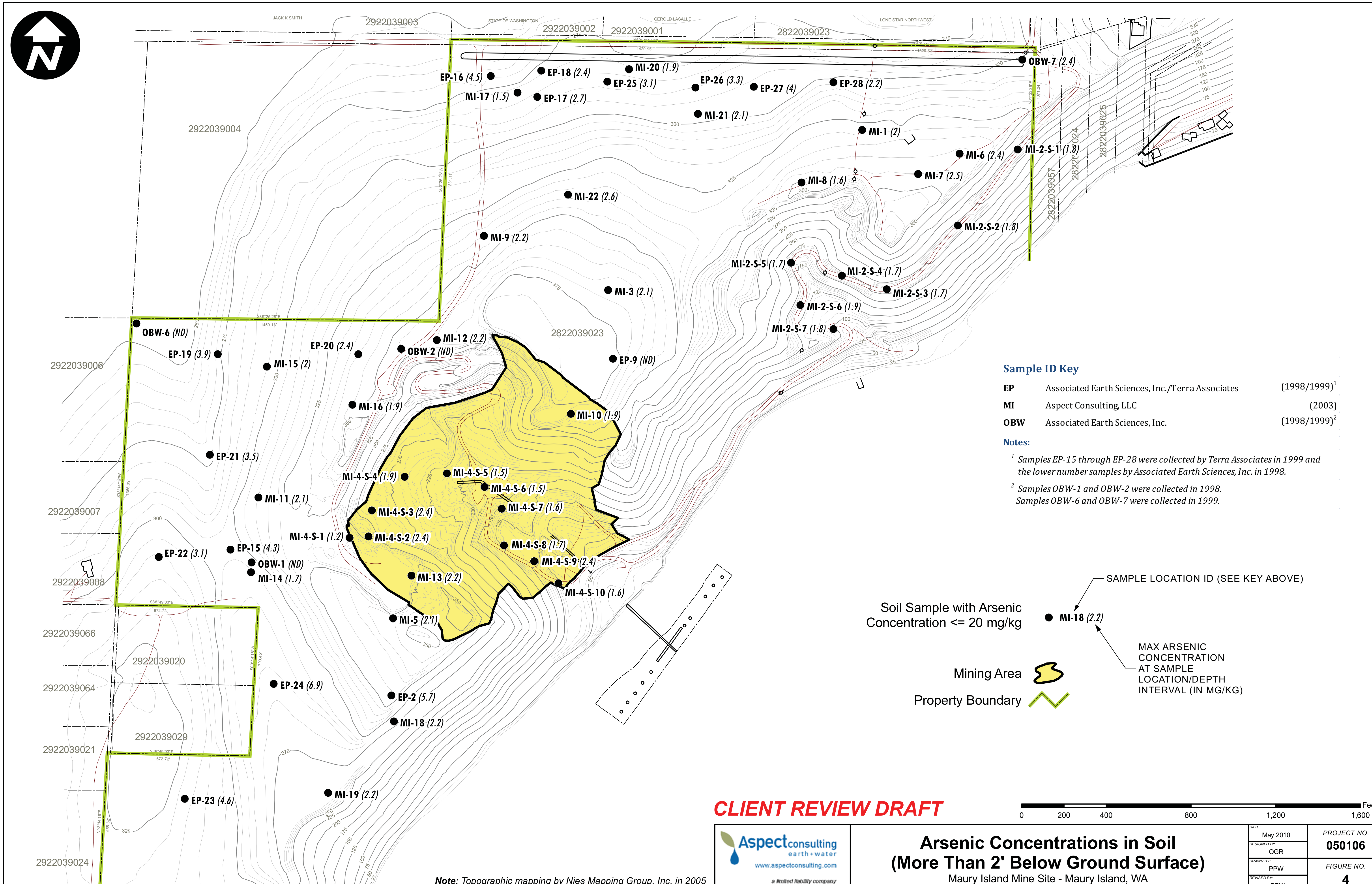

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Arsenic Concentrations in Soil (More Than 2' Below Ground Surface)

Maury Island Mine Site - Maury Island, WA

DATE: May 2010	PROJECT NO. 050106
DESIGNED BY: OGR	
DRAWN BY: PPW	FIGURE NO. 4
REVISED BY: PPW	

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Monitoring Well OBW-6

Water Quality Test Parameter [1][3]	MCL[2] limits	2/19/99	5/18/99	8/31/99	11/18/99	1/19/00	4/18/00	7/13/00	10/11/00	1/24/01	4/25/01	7/24/01	10/31/01	1/22/02	4/19/02	7/17/02	10/24/02	1/15/03	4/17/03	7/15/03	10/16/03	1/14/04	4/22/04	7/26/04	10/14/04	1/25/05	4/21/05	7/20/05	10/20/05	1/19/06	4/12/06	7/19/06	10/24/07	10/23/08	12/9/09
Conventionals																																			
Temperature (C) Field		11.0	12.0	13.2	12.2	7.5	11.2	10.5	9.6	9.7	10.0	10.7	9.2	11.3	9.9	12.1	11.2	11.1	11.2	11.8	11.7	11.2	11.2	11.1	11.1	11.2	11.2	11.2	11.1	10.9	10.8	10.9	11.2	10.2	10.9
pH Field		7.5	7.4	7.4	7.6	7.4	7.5	7.0	7.1	7.2	7.1	7.0	7.3	7.1	7.1	6.5	7.1	7.3	7.4	7.3	7.1	7.0	6.7	6.5	6.7	6.7	6.8	--	7.3	7.2	7.3	7.2	7.4	7.0	7.5
Conductivity (us/cm) Field		140	140	169	181	167	185	188	189	180	186	184	183	165	178	175	100	103	85	93	97	97	99	68	120	141	136	124	149	150	134	145	146	115	--
Turbidity (NTU) Field			3.4	2.0	2.1	2.3	4.3	2.5	5.2	2.8	1.9	2.3	3.7	1.5	1.8	1.4	1.7	1.4	2.1	1.9	2.2	1.3	1.3	2.7	1.7	2.4	2.3	1.9	1.7	1.5	1.9	2.2	--	0.9	1.2
pH	6.5 - 8.5	6.9	7.3	7.4	7.4	7.3	6.8	6.9	7.6	7.3	7.8	7.0	7.2	7.8	7.7	7.4	7.2	7.5	7.7	7.4	7.3	7.4	7.0	7.3	7.8	7.7	7.6	7.5	7.7	7.0	7.4	7.42	7.46	7.3	7.0
Alkalinity		48	46	51	43	41	39	42	14	44	NR	41	32	32	40	40	40	44	80	42	38	42	42	44	80	44	45	48	26	48	50	50	53.8	55	53
Total Organic Carbon		< 1	< 1	< 1	<1	<1	<1	2.4	<1	<2.0	3.7	<1	<1	<1	<1	<1		<1	<1	<1	4.9	<1	<1	12	<1	<1	5.7	<1	<1	<1	<1	2.1	<1	<1	<1
Chloride	250	3.4	4.4	4.9	5.6	5.1	5.9	2.9	4.4	4.02	4.80	5.40	7.3	5.2	5.9	6.4	6.7	4.2	7.7	6.3	9.0	4.2	4.2	6.9	8.8	6.6	1.9	8.2	14.0	12.0	6.7	14.0	10.1	4.4	4.1
Conductivity (us/cm)		130	140	160	160	180	160	170	200	134	200	140	220	110	140	140	150	140	200	170	150	150	160	160	200	200	190	160	200	180	190	180	195	171	160
Color (CU)	15	20	10	15	20	20	20	30	15	20	<5	15	15	<5	5	10	5	10	10	20	5	10	20	15	<5	<5	5	15	<5	<5	<5	<5	10.0	<5	5
Total Cyanide		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0200	<0.005	<0.005	<0.01	<0.005	<0.05
Fluoride	4	0.09	<0.1	0.12	<0.1	<0.1	0.05	0.13	<0.1	<0.01	<0.02	0.31	0.07	0.08	0.07	0.04	0.11	0.10	0.10	<0.02	0.20	0.02	0.08	0.14	<0.02	<0.02	0.11	0.04	0.02	0.11	0.10	<0.02	<0.10	<0.10	<.1
Hardness		49	61	53	58	52	59	46	53	58	120	59	52	53	46	54	47	50	53	53	53	56	57	63	47	73	79	72	69	72	79	70	75.6	68	71
Nitrate as Nitrogen	10	0.95	0.35	0.2	<0.1	0.16	0.25	0.34	0.20	0.513	0.32	0.07	0.05	0.02	0.10	0.07	--	--	--	--	--	0.02	--	--	--	--	--	--	<0.01	0.15	0.33	0.24	0.471	1.82	2.00
Nitrate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.04	0.10	0.06	0.04	0.12	<0.05	0.09	0.36	1.10	0.21	<0.05	<0.05	<0.01	0.15	0.33	0.24	--	--	--
Nitrite		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.002	0.003	0.004	0.002	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	0.95
Total Oil & Grease		<1	<1	<1	<1	<1	NR	NR	<1	<5	<1	<1	<1	1.5	2.5	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	2.7	<1	3	<1	<1	1.1	<1	<4.81	<5	<5
Total Petroleum Hydrocarbons		<1	<1	<1	<1	<1	<0.2	<0.2	<1	<5	<1	<1	<1	<1	1.5	<1	<1	<1	<1	<1	<1	<1	0.1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<4.81	<0.0381	<5
Total Suspended Solids		1	<1	2	1	<1	<1	<1	5	4.0	1.0	<1	2.0	<1	<1	6.0	2.0	<1	1.0	<1	<1	10.0	1.0	2.0	<1	<1	<1	1.0	<1	<1	<1	1.0	<4.0	<4.0	<2
Sulfate	250	13	21	25	23	24	24	13	22	19.1	22	20	20	12	17	21	19	19	18	20	19	18	19	3	21	25	39	31	32	29	30	33	18.8	16	16
Surfactants		0.08	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.22	<0.05	0.09	<0.05	<0.05	0.46	0.16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Turbidity (NTU)		6.1	0.6	4.1	3.5	3.5	4.8	4.1	4.9	4.1	3.1	4.6	4.0	2.0	2.0	3.1	2.7	1.6	4.1	1.3	1.5	1.4	1.8	2.8	2.6	2.0	1.5	1.9	1.6	1.4	1.4	1.6	3.0	2.1	1.6
Total Metals (mg/l)																																			
Aluminum		0.06	0.06	<0.01	<0.01	<0.25	<0.01	0.05	<0.01	<0.25	0.03	0.01	0.02	<0.01	0.71	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.34	0.02	<0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.25	<0.25	<0.40
Antimony		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.02200	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.003	<0.003	<0.002
Arsenic	0.00005	0.002	0.002	0.001	0.002	<0.001	0.001	0.002	0.002	0.0012	0.002	0.002	0.001	0.003	<0.001	<0.001	0.001	0.001	0.0016	0.0015	<0.00005	0.0016	0.0007	<0.001	0.0017	0.0010	0.0018	0.0013	0.0014	0.0018	0.0020	0.00124	0.00091	0.00306	0.00200
Barium	1.0	0.005	0.007	0.008	0.0056	<0.01	0.0042	0.0048	0.0045	<0.01	0.0051	0.0075	0.0067	0.0060	0.0045	0.0043	0.0054	0.0031	0.0074	0.0078	0.0068	0.0068	0.0065	0.0076	0.0098	0.0072	0.0078	0.0073	0.0100	0.0094	0.0097	0.0099	0.0121	0.0154	0.0120
Beryllium		<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.002
Calcium		6.7	7.9	6.9	8	7.6	7.5	6.2	7.6	<0.25	7.2	7.7	7.4	8.0	6.9	10.0	6.8	7.3	7.0	7.3	7.9	8.3	7.8	9.2	1.0	11.0	11.0	11.0	10.0	11.0	12.0	9.7	11.8	9.45	<40
Cadmium	0.01	0.003	<0.002	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00120	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.002
Chromium	0.05	<0.006	<0.006	<0.001	0.004	<0.001	0.003	<0.001	0.021	0.0021	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0044	0.00108	0.003
Copper	1.0	0.016	<0.002	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.0100	<0.001	0.018	<0.001	0.0170	0.0210	0.0020	0.0030	0.0010	0.0030	<0.001	0.004	<0.001	0.00106	<0.005
Iron	0.3	0.77	0.78	0.86	0.92	1.00	0.99	1.30	1.10	1.47	1.00	1.10	1.2	0.82	0.89	0.91	0.90	0.79	0.88	0.89	0.69	0.82	0.84	0.90	1.10	0.90	0.86	0.70	0.61	0.67	0.54	0.621	0.752	0.622	0.430
Mercury	0.002	<0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Magnesium		7.8	9.9	8.7	9.4	8	9.7	7.3	8.4	9.1	8.3	9.6	8.2	8.1	6.9	7.1	7.2	7.8	8.5	8.4	8.0	8.6	9.0	9.8	11.0	11.0	12.0	11.0	11.0	11.0	12.0	11.0	12.4	10.3	11.0
Manganese	0.05	0.03	0.047	0.038	0.051	0.053	0.047	0.052	0.055	0.0643	0.053	0.062	0.056	0.054	0.038	0.037	0.040	0.030	0.041	0.041	0.033	0.031	0.027	0.031	0.043	0.041	0.037	0.032	0.027	0.035	0.030	0.031	0.0344	0.356	0.019
Sodium		6.2	8.7	5.7	7.1	5.9	6.0	4.4	1.1	5.4	<0.05	6.4	5.1	6.4	5.7	6.1	5.2	5.8	7.3	6.9	6	6.9	11	5.9	7.2	7	7.2	6.6	12	6.9	7.4	5.9	6.98	6.8	<50
Nickel		<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00138	0.00254	<0.002
Lead	0.05	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002
Selenium	0.01	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002
Silver	0.05	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.002
Thallium		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.000480	<0.004
Zinc	5.0	0.038	0.037	0.048	0.039	<0.001	0.15	0.032	0.016	0.0188	0.011	<0.001	0.011	0.12	0.004	0.007	0.004	<0.001	0.008	0.015	0.025	<0.001	0.006	0.007	0.039	0.03	0.017	0.011	0.018	0.018	0.020	0.013	0.0143	0.00698	0.01300

Explanation:

[1] Units in mg/L unless otherwise noted. [2] Maximum Contaminate Levels for Groundwater (WAC 173-200).

[3] Beginning 10/24/2007, samples were analyzed by Test America. "<" refers to Test America reporting limit, not instrument detection limit. See attached sample results.

Note that each laboratory has different measuring and reporting limits.

NR = Not reported by lab

Table 2
Page 1 of 1
Monitoring Well OBW-7

Water Quality Test Parameter[1][3]	MCL[2] limits	2/19/99	5/18/99	8/31/99	11/18/99	1/19/00	4/18/00	7/13/00	10/11/00	1/24/01	4/25/01	7/24/01	10/31/01	1/22/02	4/19/02	7/17/02	10/24/02	1/15/03	4/17/03	7/15/03	10/16/03	1/14/04	4/22/04	7/26/04	10/14/04	1/25/05	4/21/05	7/20/05	10/20/05	1/19/06	4/12/06	7/19/06	10/24/07	10/23/08	12/9/09
Conventionals																																			
Temperature Field		12.5	15.0	16.6	13.9	9.6	12.7	15.7	15.0	9.9	16.0	14.6	9.9	12.4	11.4	14.7	12.7	12.5	12.7	13.6	13.3	12.6	12.7	12.6	12.5	12.6	12.3	12.9	12.6	12.3	12.4		12.8	11.9	12.4
pH Field		7.1	7.4	7.3	7.5	7.4	7.6	7.3	7.1	7.2	7.0	7.1	7.1	7.0	7.0	6.7	7.1	7.2	7.1	7.0	7.1	7.0	6.9	6.6	6.5	6.6	6.8	--	7.2	7.1	7.1		7.2	7.0	7.1
Conductivity (us/cm) Field		260	250	176	246	274	224	219	234	284	273	255	259	206	282	252	198	205	169	193	192	195	189	123	199	227	220	207	221	226	218		216	217	235
Turbidity (NTU) Field			11.7	1.1	1.2	1.6	1.6	1.7	1.6	2.5	1.5	1.8	1.7	1.9	1.6	1.7	2.2	1.6	2.6	3.8	2.7	2.2	6.7	2.6	2.6	3.1	6.2	3.6	3.2	3.0	3.6		--	3.7	5.5
pH	6.5 - 8.5	7.1	7.6	7.3	7.4	7.4	6.7	7.0	7.4	7.3	7.5	7.2	7.2	7.6	7.5	7.3	7.2	7.4	7.6	7.3	7.2	7.2	7.4	7.4	7.7	7.4	7.5	7.4	7.7	7.1	7.3		7.34	7.3	7.2
Alkalinity		82	86	84	77	78	75	71	30	80	NR	76	68	76	72	76	80	79	44	82	84	79	80	80	100	74	84	86	86	86	86		86.8	92	78
Total Organic Carbon		< 1	< 1	<1	<1	<1	<1	3.3	<1	2.1	<1	<1	<1	<1	3.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3.8	3.3	<1	<1	<1	No	<1	<1	<1
Chloride	250	10.0	9.9	9.6	10.0	8.2	9.5	3.8	8.3	9.3	9.9	11.0	12.0	9.1	12.0	11.0	13.0	12.0	13.0	9.2	12.0	6.6	6.1	9.7	19.0	8.2	1.4	10.0	10.0	13.0	8.3	Access	7.42	10.4	9.4
Conductivity (us/cm)		250	240	260	270	310	290	270	350	272	330	250	440	180	270	270	280	280	400	290	280	280	300	330	310	310	300	190	280	260	280		280	312	280
Color (CU)	15	20	35	5	10	15	10	15	10	5	<5	<5	5	<5	<5	<5	<5	5	<5	15	<5	10	20	10	<5	<5	5	15	<5	5	<5		10.0	<5	10
Total Cyanide		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	<0.005		<0.01	<0.005	<0.05
Fluoride	4	0.07	<0.1	<0.1	<0.1	<0.1	0.02	0.14	<0.1	<0.1	<0.02	<0.02	0.07	0.08	0.13	0.05	0.16	0.06	0.04	<0.02	0.14	<0.02	0.07	0.15	<0.02	<0.02	0.13	0.04	<0.02	0.13	0.10		<0.1	5.56	<0.1
Hardness		100	100	100	100	99	110	92	100	118	120	120	110	110	110	100	100	100	110	120	110	120	120	120	120	120	130	130	120	120	130		111	127	120
Nitrate as Nitrogen	10	5.0	4.6	4.3	5.6	4.2	4.9	3.8	1.8	5.2	5.0	5.3	5.5	5.0	5.9	0.6	--	--	--	--	--	7.2	--	--	--	--	--	4.70	6.40	5.90	5.20		5.50	6.45	6.60
Nitrate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.7	5.0	0.02	6.6	7.8	7.2	7.5	7.2	7.8	7.8	3.8*	4.9	6.4	5.9	--		--	--	--
Nitrite		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.015	0.009	0.015	0.017	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.01	<0.01		<0.01	<0.01	1.200
Total Oil & Grease		<1	<1	<1	<1	<1	<1	<1	<1	<5	<1	1.3	<1	<1	3	<1	4	<1	<1	2.3	<1	<1	<1	<1	<1	1.6	<1	3.4	<1	<1	<1		<4.85	<5	<5
Total Petroleum Hydrocarbons		<1	<1	<1	<1	<1	<0.2	<0.2	<1	<5	<1	<1	<1	<1	1.5	<1	<1	<1	<1	2.3	<1	<1	0.1	<1	<1	<1	<1	<2	<1	<1	<1		<4.85	<0.0381	<5
Total Suspended Solids		2	4	1	<1	<1	<1	<1	1	5	5	<1	1	<1	<1	6	3	<1	1	1	1	<1	1	1	<1	1	<1	<1	<1	<1	3.0		<4.0	<4.0	<2.0
Sulfate	250	21	26	25	24	26	23	14	23	24	25	24	23	13	20	27	25	28	24	22	18	14	14	11	13	19	10	21	18	16	18		31.8	20	19
Surfactants		0.15	0.62	<0.05	<0.05	2.0	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.20	<0.05	0.07	<0.05	<0.05	0.26	0.64	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05
Turbidity (NTU)		6.7	16	1.6	1.8	2.1	1.9	2	2.2	1.73	1.9	2.4	2.4	1.5	2.1	1.3	1.4	1.1	4.3	1.8	2.4	2.3	2.8	1.8	3.4	2.1	1.8	2.5	2.5	2.2	1.9		4.23	3.86	4.3
Total Metals																																			
Aluminum		0.02	0.04	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.25	0.04	0.03	0.02	<0.01	0.97	0.34	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.25	0.06	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	0.04		<0.25	<0.25	<.4
Antimony		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.014	<0.001	<0.001	<0.001	<0.001	<0.001		<0.003	<0.003	<0.002
Arsenic	0.00005	0.002	0.001	0.001	0.002	<0.001	0.001	0.002	<0.001	0.002	<0.001	0.003	0.001	0.003	0.002	0.002	0.001	0.001	0.0023	0.0032	0.001	0.003	0.0013	<0.001	0.0026	0.0021	0.0028	0.0024	0.0019	0.0033	0.0027		0.00196	0.00189	0.00300
Barium	1.0	0.01	0.017	0.011	0.0091	<0.0005	0.0074	0.0084	0.0084	0.011	0.0092	0.01	0.0085	0.0071	0.0081	0.0074	0.016	0.0072	0.0097	0.011	0.0092	0.0099	0.0087	0.0088	0.0100	0.0071	0.0092	0.0093	0.0099	0.0100	0.0098		0.0122	0.0114	0.0130
Beryllium		<0.0002	<0.0002	<0.0002	<0.0002	<0.05	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		<0.001	<0.001	<0.002
Calcium		15	15	15	16	15	17	12	15	18	17	17	16	17	15	15	14	14	16	17	16	17	16	18	18	17	18	18	17	17	19	No	16.0	17.7	<50
Cadmium	0.01	<0.002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	Access	<0.001	<0.001	<0.002
Chromium	0.05	<0.006	<0.006	<0.001	0.001	<0.001	0.003	<0.001	0.026	0.0024	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001		0.00255	0.00241	0.0028
Copper	1.0	0.017	<0.002	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.003	<0.001	<0.001	0.002	0.008	<0.001	0.002	0.004	0.020	0.022	0.002	0.003	0.004	0.001	<0.001		<0.001	0.00109	<0.005
Iron	0.3	0.88	4.8	0.43	0.27	0.27	0.12	0.31	0.28	0.57	0.12	0.27	0.08	0.16	0.16	0.16	0.22	0.26	0.36	0.46	0.28	0.36	0.39	0.21	0.26	0.40	0.49	0.33	0.50	0.41	0.34		0.492	0.536	1.000
Mercury	0.002	<0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002
Magnesium		16	16	16	15	15	17	15	16	18	18	20	17	17	19	16	17	16	17	20	17	19	18	19	19	18	21	21	20	20	21		17.2	19.8	20.0
Manganese	0.05	0.07	0.13	0.057	0.047	0.041	0.042	0.042	0.042	0.0443	0.039	0.033	0.028	0.033	0.025	0.024	0.029	0.019	0.02	0.018	0.014	0.013	0.012	0.0089	0.014	0.012	0.014	0.013	0.019	0.027	0.012		0.0258	0.0197	0.023
Sodium		8.7	9.1	8	9.8	8.6	8.8	7.4	4.1	8.3	<0.05	11	8.5	9.8	9.4	10	8.4	9.1	11	12	9.4	11	13	9.5	10	9.6	10	9.5	10	9.5	10		9.56	10.5	<50
Nickel		<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0015	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.00156	0.00167	0.002
Lead	0.05	0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.006	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.002
Selenium	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.004	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001		<0.001	<0.001	<0.002
Silver	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.001	<0.001	<0.002
Thallium		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	0.0003	<0.004
Zinc	5.0	0.06	0.045	0.037	0.027	<0.001	0.010	0.023	0.016	0.0259	0.01	<0.001	0.014	<0.001	0.005	0.005	0.009	<0.001	0.017	0.024	0.03	0.004	0.013	0.012	0.044	0.037	0.027	0.018	0.02	0.024	0.025		0.0262	0.0228	0.028

Explanation:

(1) Units in mg/L unless otherwise noted. (2) Maximum Contaminate Levels for Groundwater (WAC 173-200).

(3) Beginning 10/24/2007, samples were analyzed by Test America. "<" refers to Test America reporting limit, not instrument detection limit. See attached sample results.

Note that each laboratory has different measuring and reporting limits.

NR = Not reported by lab

Table 3
Page 1 of 1
Monitoring Well OBW-9

Water Quality Test Parameter[(1)(3)]	MCL[(2)] limits	2/19/99	5/18/99	8/31/99	11/18/99	1/19/00	4/18/00	7/13/00	10/11/00	1/24/01	4/25/01	7/24/01	10/31/01	1/22/02	4/19/02	7/17/02
Conventionals																
Temperature Field		12.0	14.0	14.7	12.8	8.6	11.9	13.9	11.2	9.0	12.7	11.8	9.4	11.7	10.2	13.7
pH Field		7.5	7.8	7.9	8.3	8.1	8.2	7.9	7.7	7.8	7.8	7.7	7.9	7.7	7.6	7.3
Conductivity (us/cm) Field		190	190	183	192	216	172	179	190	215	205	200	209	169	234	207
Turbidity (NTU) Field			1.7	2.4	2.4	0.9	1.1	1.1	1.5	1.4	0.6	0.6	0.4	0.3	1.1	0.3
pH	6.5 - 8.5	7.6	7.9	7.5	7.9	7.9	7.4	7.6	8.0	7.9	7.8	7.8	7.9	8.0	8.0	7.9
Alkalinity		94	94	93	92	96	92	93	35	100	NR	91	72	84	84	84
Total Organic Carbon		< 1	< 1	<1	<1	<1	<1	2.7	<1	2.2	<1	6.0	<1	<1	<1	<1
Chloride	250	3.3	3.7	4.0	3.9	2.3	<0.02	2.6	3.0	3.17	4.5	3.4	5.9	3.4	5.4	4.8
Conductivity (us/cm)		190	190	190	200	240	220	220	250	195	200	190	330	170	220	220
Color (CU)	15	10	5	10	15	15	15	15	10	10	<5	5	<5	<5	<5	<5
Total Cyanide		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0100	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride	4	0.13	<0.1	0.16	<0.1	<0.1	<0.02	0.16	<0.1	0.12	<0.02	0.16	0.08	0.10	0.08	0.05
Hardness		80	87	81	84	84	92	73	90	105	95	95	90	96	97	91
Nitrate as Nitrogen	10	<0.25	<0.02	<0.1	<0.1	<0.1	<0.02	<0.02	<0.05	<0.1	0.04	0.08	0.13	0.11	0.10	0.04
Nitrate		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Oil & Grease		<1	<1	<1	<1	<1	<1	NR	<1	<5	<1	1.1	<1	<1	2.5	<1
Total Petroleum Hydrocarbons		<1	<1	<1	<1	<1	<0.2	<0.2	<1	<5	<1	<1	<1	<1	1	<1
Total Suspended Solids		1	<1	<1	1	<1	<1	<1	1	4.0	<1	<1	<1	<1	<1	4.0
Sulfate	250	10	12	12	25	6.6	<0.1	7.2	6.3	4.7	7.8	9.5	17.0	12.0	15.0	17.0
Surfactants		0.13	0.18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.28	<0.05
Turbidity (NTU)		0.78	1.5	1.4	1.6	0.64	1.7	1.2	1.5	<1	0.4	0.84	0.29	0.03	0.47	0.26
Total Metals																
Aluminum		<0.01	0.05	<0.01	<0.01	<0.01	<0.01	0.04	<0.001	<0.25	0.04	0.02	0.03	<0.01	1.1	0.44
Antimony		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.00005	0.004	0.005	0.002	0.004	0.004	<0.001	0.005	0.005	0.0034	0.003	0.003	0.003	0.003	0.001	0.002
Barium	1.0	0.008	0.01	0.012	0.011	0.011	<0.0005	0.012	0.013	0.0165	0.015	0.014	0.012	0.011	0.012	0.012
Beryllium		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium		15	15	15	15	15	16	12	16	17	15	15	16	19	17	18
Cadmium	0.01	<0.002	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	0.05	<0.006	<0.006	<0.001	<0.001	<0.001	<0.001	<0.001	0.019	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005
Copper	1.0	0.006	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0023	<0.001	<0.001	<0.001	<0.001	0.003	0.003
Iron	0.3	0.13	0.29	0.30	0.20	0.17	0.20	0.28	0.30	0.37	0.30	0.20	0.21	0.13	0.15	0.10
Mercury	0.002	<0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Magnesium		10	12	11	11	11	13.0	10.0	12.0	15.2	14.0	14.0	12.0	12.0	13.0	11.0
Manganese	0.05	0.23	0.10	0.077	0.12	0.09	0.09	0.11	0.11	0.11	0.11	0.14	0.17	0.19	0.22	0.23
Sodium		6.8	7.2	6.8	8.1	7.3	7.2	5.2	2.4	7.7	<0.05	9.0	<0.05	7.6	7.0	8.1
Nickel		<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lead	0.05	<0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	0.002	<0.001	<0.001
Selenium	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001
Silver	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thallium		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	5.0	<0.002	0.012	0.015	0.002	<0.001	<0.001	0.008	<0.001	<0.01	<0.001	<0.001	<0.001	<0.001	0.002	0.002

Water Quality Test Parameter[(1)(3)]	10/24/02	1/15/03	4/17/03	7/15/03	10/16/03	1/14/04	4/22/04	7/26/04	10/14/04	5/18/05	7/20/05	10/20/05	1/19/06	4/12/06	7/19/06	10/24/07	10/23/08	12/9/09
Conventionals																		
Temperature Field	11.3	11.3	11.4	11.6	11.6	11.3	11.4	11.6	11.4	11.4	11.4	12.6	11.1	11.1	11.1	11.4	10.3	11.1
pH Field	7.6	7.6	7.5	7.4	7.4	7.3	7.1	6.7	6.9	6.7	--	7.2	7.4	7.4	7.3	7.5	7.3	7.3
Conductivity (us/cm) Field	153	159	130	139	139	116	136	86	142	147	147	221	170	159	156	167	145	166
Turbidity (NTU) Field	0.5	0.3	0.5	0.2	0.7	0.3	0.4	0.7	0.5	1.4	0.8	3.6	1.4	1.7	--	--	1.1	1.1
pH	7.8	7.8	8.0	7.7	7.6	7.6	7.7	7.2	7.9	7.3	7.7	7.7	7.3	7.6	7.63	7.65	7.56	7.46
Alkalinity	92	92	150	90	90	84	100	80	110	90	96	94	94	94	84	91.2	87	86
Total Organic Carbon	<1	<1	<1	<1	1.2	<1	<1	5.0	<1	<1	<1	7.3	<1	<1	<1	<1	<1	<1
Chloride	4.2	4.0	4.9	1.5	7.0	3.0	2.5	4.0	9.4	3.5	3.8	4.3	6.0	3.1	5.4	5.95	3.9	3.5
Conductivity (us/cm)	220	220	310	210	210	210	220	240	230	210	190	240	210	210	480	225	217	200
Color (CU)	<5	5	5	5	5	10	15	10	<5	<5	10	<5	<5	<5	<5	10.0	<5	5
Total Cyanide	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.036	<0.005	<0.005	<0.01	<0.005	<0.05
Fluoride	0.22	0.10	0.09	<0.02	0.15	0.02	0.10	0.08	0.04	0.16	0.08	0.04	0.12	0.13	0.10	<0.100	0.12	<0.1
Hardness	85	89	98	92	87	73	90	92	92	93	100	92	93	94	76	94.0	91	82
Nitrate as Nitrogen	--	--	--	--	--	0.03	--	--	--	--	--	0.012	<0.05	0.110	0.240	0.670	0.284	<.9
Nitrate	0.03	0.14	0.29	0.04	0.12	<0.05	0.06	0.26	0.99	<0.05	<0.05	0.012	<0.05	0.110	0.240	--	--	--
Nitrite	0.002	0.006	0.003	0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.300
Total Oil & Grease	<1	<1	<1	1	<1	<1	<1	<1	<1	<1	2.1	<1	<1	1.2	2	<4.85	<5	<5
Total Petroleum Hydrocarbons	<1	<1	<1	<1	<1	<1	0.1	<1	<1	<1	<2	<1	<1	<1	<1	<4.85	<0.0381	<5
Total Suspended Solids	<1	4.0	2.0	<1	<1	<1	2.0	1.0	<1	<1	<1	<1	1.0	5.0	3.0	<4.0	<4.0	<2
Sulfate	12.0	18.0	12.0	11.0	8.0	9.0	4.9	4.7	7.9	9.0	11.0	9.6	9.6	10.0	13.0	13.2	9.7	12.0
Surfactants	<0.05	<0.05	<0.05	0.05	0.48	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Turbidity (NTU)	0.45	0.34	0.58	0.4	0.48	0.30	0.47	0.94	0.05	0.62	0.31	0.68	0.51	0.54	0.78	1.40	1.66	0.88
Total Metals																		
Aluminum	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.21	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.25	<0.25	<0.40
Antimony	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.003	<0.003	<0.002
Arsenic	0.002	<0.001	0.0026	0.0037	0.0019	0.0039	0.0032	0.0020	0.0037	0.0040	0.0038	0.0024	0.0032	0.0032	0.0026	0.00337	0.00292	0.00360
Barium	0.013	0.015	0.033	0.026	0.022	0.017	0.017	0.015	0.016	0.013	0.014	0.014	0.014	0.015	0.0146	0.0198	0.0156	0.015
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.002
Calcium	15	18	19	18	17	14	17	19	18	18	17	17	17	18	14	17.0	14	<50
Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	<0.001	<0.002
Chromium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.00091	<0.002
Copper	<0.001	<0.001	0.004	0.002	0.005	<0.001	0.004	<0.001	0.024	0.004	0.003	<0.001	0.004	<0.001	0.005	<0.001	0.00138	<0.005
Iron	0.14	0.18	0.21	0.24	0.22	0.11	0.26	0.23	0.25	0.21	0.19	0.30	0.30	0.26	0.42	0.303	0.489	0.280
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Magnesium	11.0	11.0	12.0	12.0	11.0	9.0	11.0	11.0	11.0	12.0	14.0	12.0	12.0	12.0	10.0	13.1	13.2	12.0
Manganese	0.26	0.32	0.37	0.34	0.34	0.29	0.40	0.43	0.45	0.48	0.51	0.54	0.5	0.44	0.34	0.327	0.349	0.220
Sodium	7.4	7.4	10.0	9.2	7.8	6.6	10.0	7.8	8.5	8.9	8.0	8.3	8.1	8.3	6.3	7.53	8.26	<50
Nickel	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.00359	0.00264	<0.002
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002
Selenium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.002
Thallium	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.004
Zinc	<0.001	<0.001	0.005	0.009	0.008	<0.001	<0.001	0.003	0.038	0.009	0.007	0.010	0.014	0.014	0.008	<0.01	0.013	0.007

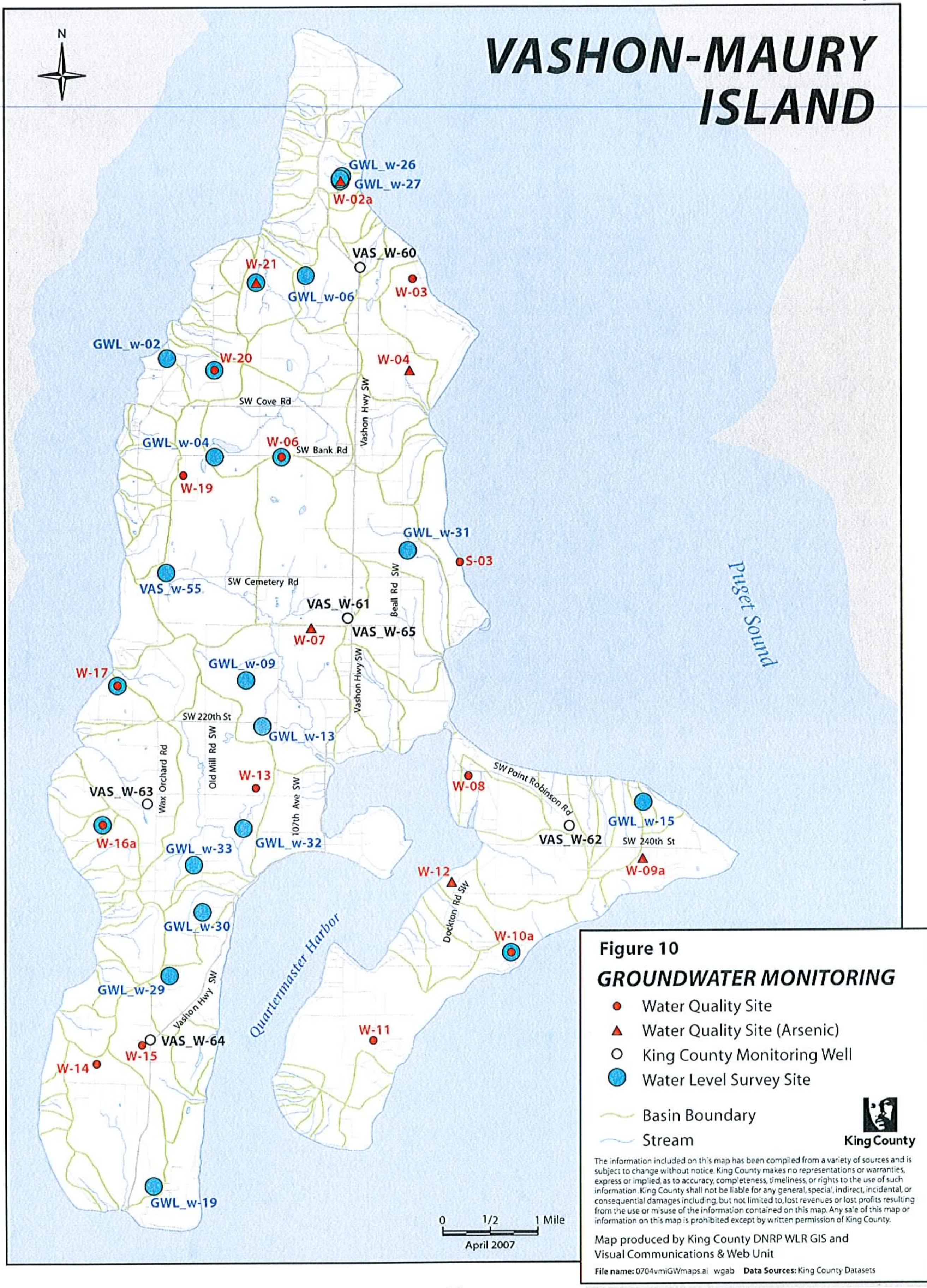
Explanation:

(1) Units in mg/L unless otherwise noted. (2) Maximum Contaminate Levels for Groundwater (WAC 173-200).

(3) Beginning 10/24/2007, samples were analyzed by Test America. "<" refers to Test America reporting limit, not instrument detection limit. See attached sample results.

Note that each laboratory has different measuring and reporting limits.

NR = Not reported by lab


VASHON-MAURY ISLAND
N
GWL_w-26
GWL_w-27
W-02a
VAS_W-60
W-21
GWL_w-06
W-03
GWL_w-02
W-20
W-04
SW Cove Rd
Vashon Hwy SW
GWL_w-04
W-06
SW Bank Rd
W-19
GWL_w-31
S-03
VAS_w-55
SW Cemetery Rd
Beall Rd SW
VAS_W-61
VAS_W-65
W-07
Puget Sound
GWL_w-09
W-17
SW 220th St
GWL_w-13
Wax Orchard Rd
Old Mill Rd SW
107th Ave SW
W-13
VAS_W-63
W-08
SW Point Robinson Rd
GWL_w-15
W-16a
GWL_w-33
GWL_w-32
VAS_W-62
SW 240th St
W-09a
W-12
Dockton Rd SW
GWL_w-30
Quartermaster Harbor
W-10a
GWL_w-29
Vashon Hwy SW
VAS_W-64
W-15
W-14
W-11
GWL_w-19
0 1/2 1 Mile
April 2007
Figure 10
GROUNDWATER MONITORING
Water Quality Site
Water Quality Site (Arsenic)
King County Monitoring Well
Water Level Survey Site
Basin Boundary
Stream
King County
The information included on this map has been compiled from a variety of sources and is subject to change without notice. King County makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. King County shall not be liable for any general, special, indirect, incidental, or consequential damages including, but not limited to, lost revenues or lost profits resulting from the use or misuse of the information contained on this map. Any sale of this map or information on this map is prohibited except by written permission of King County.
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File name: 0704vmiGWmaps.ai wgab Data Sources: King County Datasets

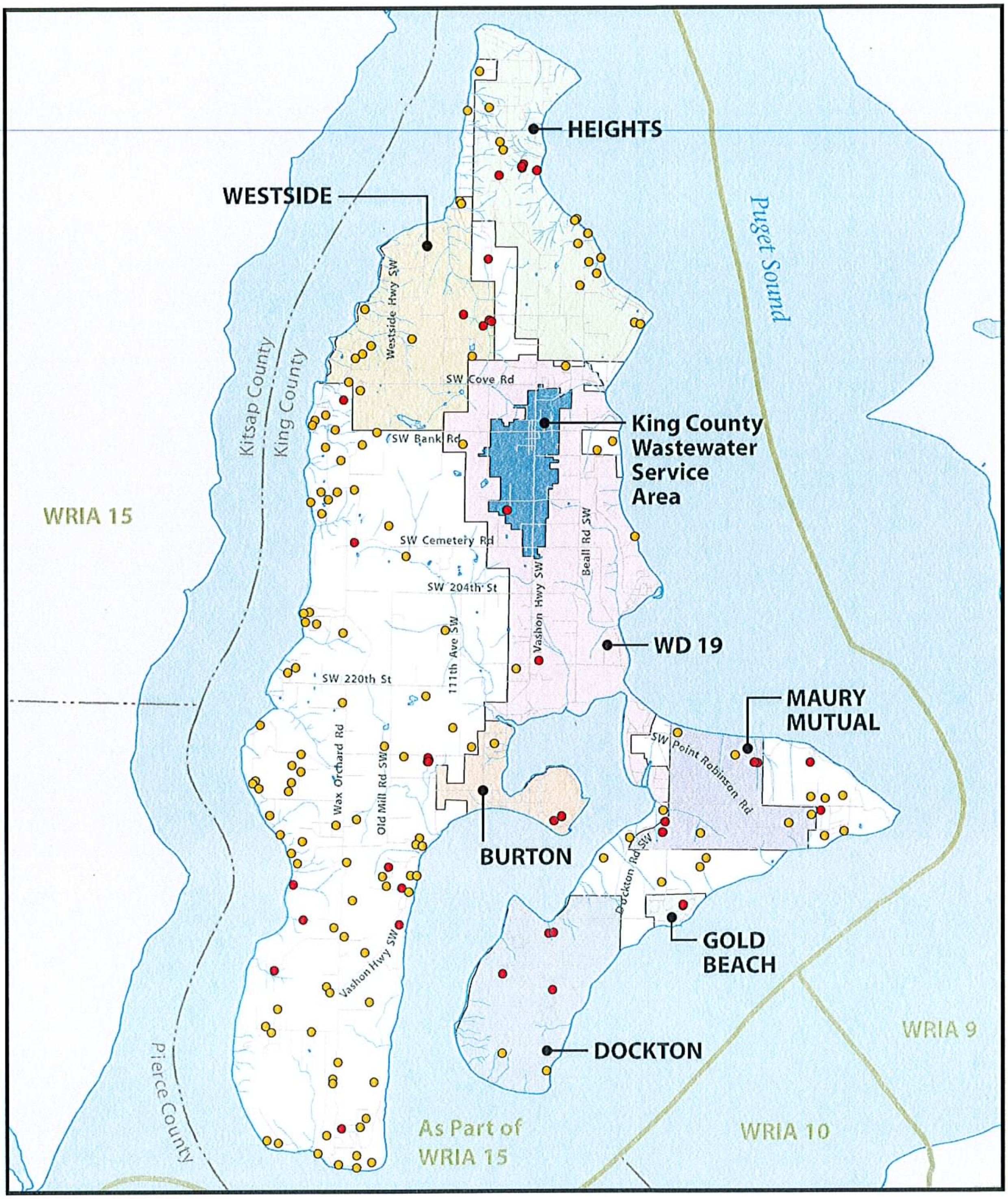

Figure 2
Public Water Systems of Vashon-Maury Island

- Group A Sources
- Group B Sources
- King County Wastewater Service Area
- WRIA Boundary
- Roads

N

0 1 2 Miles

May 2005

King County

Department of Natural Resources and Parks
Water and Land Resources Division

Data Sources:
King County GIS coverages

File name: 0505vmi_fig2.ai wgab

Table 7
Summary of Inorganic Parameters for Vashon-Maury Island Sites (2001 - 2004)
King County Ambient Groundwater
Monitoring Program

Constituent	Average[1] Concentration (mg/L)	Minimum Concentration (mg/L)		Maximum Concentration (mg/L)		Exceedences[2]
Metals						
Arsenic	0.005	0.0005	U	0.0548		21
Barium	0.010	0.0002		0.0346		0
Cadmium	0.00032	0.0001	U	0.002	J	0
Calcium	18.9	0.05		50		NA[4]
Chromium	0.0020	0.0004	U	0.024		0
Copper	0.0049	0.0004	U	0.0788		0
Iron	0.789	0.010	U	24.7		56
Lead	0.0010	0.0002	U	0.014		0
Magnesium	11.3	0.03		23		NA[4]
Manganese	0.105	0.0002	U	1.23		85
Mercury	0.0002	0.0002	U	0.001	U	0
Potassium	3.18	0.63	U	8.4		NA[4]
Selenium	0.0014	0.001	U	0.0015	U	0
Silica	30.7	5.7		67		NA[4]
Silver	0.0013	0.0002	U	0.01	U	0
Sodium	15.0	4.54		58.6		53
Zinc	0.074	0.0005	U	2.47		0
Conventionals						
Alkalinity, Total	107	35.7		296		NA[4]
Chloride	5.08	1.60		14		0
Cyanide	0.005	0.005	U	0.005	U	0
Fluoride	0.11	0.02	U	0.42		0
Nitrate + Nitrite[3]	0.91	0.02	U	6.28		0
Phosphorus, Total	0.111	0.013	J	0.536		NA[4]
Sulfate	11.7	0.10	U	49		0
Total Dissolved Solids	170	81		368		0
Microbiology						
Coliforms, Total	2.17	0	U	45		NA[4]
Coliforms, Fecal	0.41	0	U	2	U	NA[4]

Notes:

[1] The "Average Concentration" is the arithmetic mean of all analytical results for the indicated constituent in the 2001 - 2004 data set for the program wells in the Groundwater Management Area. The detection limit was used for analytical results below the detection limit to calculate the average values.

[2] "Exceedences" is the number of samples in the 2001 - 2004 data set for the Groundwater Management Area where the measured value exceeded the primary or secondary Maximum Contaminant Limit or the guidance concentration for sodium.

[3] Nitrate analyses, which were performed in 2001 before the combined Nitrate+Nitrite analyses began, were used as well as the Nitrate+Nitrite analyses in this table.

[4] Not applicable. Either there is no primary or secondary MCL established or, in the case of coliforms, the MCL applies only to routinely sampled public water supplies.

mg/L - milligrams of constituent per liter of water

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	ANTIMONY mg/l	ARSENIC mg/l	BARIUM mg/l	BERYLLIUM mg/l	CADMIUM mg/l	CALCIUM mg/l	CHROMIUM mg/l	COBALT mg/l	COPPER mg/l	IRON mg/l	LEAD mg/l	MAGNESIUM mg/l	MANGANESE mg/l	MERCURY mg/l
VAS_s-02	11/30/1989	--	0.001	0.008	--	0.002 U	16	0.008	--	0.002 U	0.22	0.001 U	13	0.023	0.0002 U
VAS_s-02	4/16/1990	--	0.001 U	0.008	--	0.002 U	16	0.006 U	--	0.002 U	0.01 U	0.002	14	0.002 U	0.0009
VAS_s-02	10/22/1990	--	0.001	0.008	--	0.002 U	14	0.006 U	--	0.002 U	0.06	0.001	10	0.002 U	0.0005
VAS_s-02	10/22/1990	--	0.001	0.007	--	0.002 U	15	0.006 U	--	0.002 U	0.04	0.002	13	0.002 U	0.001
VAS_s-02	1/23/2001	0.0005 U	0.0011 J	0.00799	0.0002 U	0.0001 U	19.2	0.0016 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	16.6	0.00024 J	0.0002 U
VAS_s-02	11/27/2001	0.0005 U	0.00093 J	0.00832	0.0002 U	0.0001 U	17.8	0.0015 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	15.2	0.00092 J	0.0002 U
VAS_s-02	6/6/2002	0.0005 U	0.00074 J	0.0073	0.0002 U	0.0001 U	18.8	0.0015 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	15.7	0.00128	0.0002 U
VAS_s-02	10/1/2002	0.0005 U	0.00084 J	0.00832	0.0002 U	0.0001 U	18.1	0.00202	0.0002 U	0.00053 J	0.05 U	0.0002 U	15.5	0.00071 J	0.0002 U
VAS_s-02	6/4/2003	0.0005 U	0.00086 J	0.00722	0.0002 U	0.0001 U	17.5	0.0018 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	14.5	0.0013	0.0002 U
VAS_s-03	11/30/1989	--	0.003	0.009	--	0.002 U	11	0.009	--	0.004	0.15	0.002	13	0.022	0.0002 U
VAS_s-03	4/18/1990	--	0.002	0.007	--	0.002 U	10	0.006 U	--	0.002 U	0.01 U	0.001 U	13	0.002 U	0.0002 U
VAS_s-03	4/18/1990	--	0.002	0.007	--	0.002 U	10	0.006 U	--	0.002 U	0.01 U	0.001 U	13	0.002 U	0.0002 U
VAS_s-03	10/24/1990	--	**0.014**	0.017	--	0.002 U	22	0.006 U	--	0.002 U	0.16	0.001	9.2	**0.082**	0.0002 U
VAS_s-03	1/17/2001	0.0005 U	0.0019 J	0.00657	0.0002 U	0.0001 U	11.8	0.00499	0.0002 U	0.00507	0.05 U	0.0002 U	15.4	0.00105	0.0002 U
VAS_s-03	11/27/2001	0.0005 U	0.0018 J	0.00676	0.0002 U	0.0001 U	11.1	0.00413	0.0002 U	0.00701	0.05 U	0.0002 U	14.1	0.0004 J	0.0002 U
VAS_s-03	6/6/2002	0.0005 U	0.0016 J	0.00609	0.0002 U	0.0001 U	11.7	0.00401	0.0002 U	0.00786	0.05 U	0.0002 U	14.4	0.00037 J	0.0002 U
VAS_s-03	10/1/2002	0.0005 U	0.0018 J	0.00656	0.0002 U	0.0001 U	11	0.00478	0.0002 U	0.00755	0.05 U	0.0002 U	14.1	0.00077 J	0.0002 U
VAS_s-03	6/4/2003	0.0005 U	0.002 J	0.0061	0.0002 U	0.0001 U	10.8	0.00449	0.0002 U	0.00907	0.05 U	0.0002 U	13.6	0.00038 J	0.0002 U
VAS_s-03	11/13/2003	0.0005 U	0.0019 J	0.00566	0.0002 U	0.0001 U	10.7	0.0044	0.0002 U	0.00574	0.05 U	0.0002 U	13.2	0.00069 J	0.0002 U
VAS_s-03	6/2/2004	0.0005 U	0.002 J	0.00646	0.0002 U	0.0001 U	10.5	0.00476	0.0002 U	0.00916	0.05 U	0.0002 U	13.2	0.00066 J	0.0002 U
VAS_w-02a	1/16/2001	0.0005 U	0.0071	0.00398	0.0002 U	0.0001 U	19.5	0.00073 J	0.0002 U	0.001 J	0.05 U	0.0002 U	11.6	0.00496	0.0002 U
VAS_w-02a	11/26/2001	0.0005 U	0.00766	0.00411	0.0002 U	0.0001 U	17.8	0.00056 J	0.0002 U	0.00071 J	**0.525**	0.00067 J	11.3	0.00939	0.0002 U
VAS_w-02a	6/5/2002	0.0005 U	0.00706	0.00367	0.0002 U	0.0001 U	19.3	0.0004 U	0.0002 U	0.0004 U	0.061 J	0.0002 U	12.3	0.00682	0.0002 U
VAS_w-02a	6/5/2002	0.0005 U	0.00742	0.00368	0.0002 U	0.0001 U	19.7	0.0004 U	0.0002 U	0.0004 U	0.06 J	0.0002 U	12.1	0.00716	0.0002 U
VAS_w-02a	9/30/2002	0.0005 U	0.00853	0.00404	0.0002 U	0.0001 U	19	0.00058 J	0.0002 U	0.00081 J	0.07 J	0.0002 U	12	0.00634	0.0002 U
VAS_w-02a	6/3/2003	0.0005 U	0.0082	0.00344	0.0002 U	0.0001 U	17.1	0.0012 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	10.7	0.00421	0.0002 U
VAS_w-02a	11/12/2003	0.0005 U	0.00707	0.00356	0.0002 U	0.0001 U	18.3	0.0011 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	11.2	0.00394	0.0002 U
VAS_w-02a	6/1/2004	0.0005 U	0.00755	0.00424	0.0002 U	0.0001 U	18.2	0.0018 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	11.2	0.00344	0.0002 U
VAS_w-03	11/30/1989	--	0.001	0.019	--	0.002 U	21	0.009	--	0.032	0.08	0.012	21	0.005	0.0002 U
VAS_w-03	4/18/1990	--	0.001	0.013	--	0.002 U	19	0.006 U	--	0.002 U	0.01 U	0.003	18	0.002 U	0.0002 U
VAS_w-03	10/24/1990	--	0.01	0.01	--	0.002 U	16	0.006 U	--	0.002 U	**1**	0.002	11	**0.157**	0.0002 U
VAS_w-03	1/22/2001	0.0005 U	0.0013 J	0.0137	0.0002 U	0.0001 U	22.7	0.00078 J	0.0002 U	0.00074 J	0.05 U	0.0002 U	22.2	0.00028 J	0.0002 U
VAS_w-03	11/26/2001	0.0005 U	0.0011 J	0.0132	0.0002 U	0.0001 U	21.2	0.00072 J	0.0002 U	0.00231	0.05 U	0.0002 U	20.5	0.00029 J	0.0002 U
VAS_w-03	6/5/2002	0.0005 U	0.001 J	0.0126	0.0002 U	0.0001 U	22.4	0.00071 J	0.0002 U	0.0038	0.05 U	0.0002 U	21.2	0.00034 J	0.0002 U
VAS_w-03	9/30/2002	0.0005 U	0.0011 J	0.0133	0.0002 U	0.0001 U	21.8	0.0008 J	0.0002 U	0.00059 J	0.05 U	0.0002 U	21.3	0.00022 J	0.0002 U
VAS_w-03	6/3/2003	0.0005 U	0.0011 J	0.0132	0.0002 U	0.0001 U	21.6	0.0008 J	0.0002 U	0.00076 J	0.05 U	0.0002 U	20.7	0.00029 J	0.0002 U
VAS_w-03	11/12/2003	0.0005 U	0.0011 J	0.0123	0.0002 U	0.0001 U	21.4	0.00074 J	0.0002 U	0.00057 J	0.05 U	0.0002 U	19.8	0.00066 J	0.0002 U
VAS_w-03	5/24/2004	0.0005 U	0.0011 J	0.0139	0.0002 U	0.00031 J	22.4	0.00092 J	0.0002 U	0.0011 J	0.05 U	0.0002 U	21.2	0.00037 J	0.0002 U
VAS_w-04	1/16/2001	0.0005 U	**0.0184**	0.0248	--	0.0001 U	20.6	0.0004 U	0.0002 U	0.0012 J	0.089 J	0.0002 U	7.58	0.0498	0.0002 U
VAS_w-04	1/16/2001	0.0005 U	**0.0185**	0.0236	0.0002 U	0.0001 U	20.4	0.0004 U	0.0002 U	0.00825	0.064 J	0.00048 J	7.49	**0.0504**	0.0002 U
VAS_w-04	11/26/2001	0.0005 U	**0.0186**	0.0236	0.0002 U	0.0001 U	21.1	0.0004 U	0.0002 U	0.0029	0.076 J	0.00038 J	7.61	0.0492	0.0002 U
VAS_w-04	11/26/2001	0.0005 U	**0.0188**	0.0241	0.0002 U	0.0001 U	20.4	0.0004 U	0.0002 U	0.00442	0.077 J	0.00038 J	7.38	**0.0514**	0.0002 U
VAS_w-04	6/5/2002	0.0005 U	**0.0178**	0.0227	0.0002 U	0.0001 U	21.3	0.0004 U	0.0002 U	0.00574	0.079 J	0.00079 J	7.54	**0.0507**	0.0002 U
VAS_w-04	9/30/2002	0.0005 U	**0.0186**	0.0245	0.0002 U	0.0001 U	20.8	0.0004 U	0.0002 U	0.00057 J	0.076 J	0.0002 U	7.54	0.0498	0.0002 U
VAS_w-04	6/3/2003	0.0005 U	**0.0188**	0.0221	0.0002 U	0.0001 U	20.3	0.0004 U	0.0002 U	0.001 J	0.062 J	0.00055 J	7.33	0.0493	0.0002 U
VAS_w-04	11/12/2003	0.0005 U	**0.0193**	0.0223	0.0002 U	0.0001 U	21.1	0.0004 U	0.0002 U	0.00604	0.13 J	0.00056 J	7.45	**0.0511**	0.0002 U
VAS_w-04	5/24/2004	0.0005 U	**0.0184**	0.0254	0.0002 U	0.0001 U	21.9	0.0004 U	0.0002 U	0.00548	0.087 J	0.00033 J	7.84	**0.0543**	0.0002 U
VAS_w-06	1/24/2001	0.0005 U	0.0016 J	0.00228	0.0002 U	0.0001 U	10.8	0.0014 J	0.0002 U	0.0135	0.25	0.013	8.46	0.00158	0.0002 U

Data qualifiers are defined in Table D-1.
-- Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	ANTIMONY mg/l	ARSENIC mg/l	BARIUM mg/l	BERYLLIUM mg/l	CADMIUM mg/l	CALCIUM mg/l	CHROMIUM mg/l	COBALT mg/l	COPPER mg/l	IRON mg/l	LEAD mg/l	MAGNESIUM mg/l	MANGANESE mg/l	MERCURY mg/l
VAS_w-06	12/3/2001	0.0005 U	0.001 J	0.0024	0.0002 U	0.0001 U	9.45	0.0012 J	0.0002 U	0.0013 J	0.094 J	0.00036 J	7.24	0.0017	0.0002 U
VAS_w-06	6/11/2002	0.0005 U	0.00095 J	0.00199	0.0002 U	0.0001 U	9.95	0.0014 J	0.0002 U	0.0011 J	0.095 J	0.0002 U	7.46	0.00119	0.0002 U
VAS_w-06	10/14/2002	0.0005 U	0.001 J	0.00219	0.0002 U	0.0001 U	9.45	0.0014 J	0.0002 U	0.0012 J	0.19 J	0.0002 U	7.17	0.00061 J	0.0002 U
VAS_w-06	6/11/2003	0.0005 U	0.00096 J	0.00197	0.0002 U	0.0001 U	9.39	0.0015 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	7.15	0.00751	0.0002 U
VAS_w-06	11/19/2003	0.0005 U	0.00088 J	0.00189	0.0002 U	0.0001 U	9.97	0.0012 J	0.0002 U	0.0004 U	0.05 U	0.0002 U	7.45	0.00044 J	0.0002 U
VAS_w-06	5/27/2004	0.0005 U	0.00093 J	0.0022	0.0002 U	0.0001 U	9.79	0.0017 J	0.0002 U	0.0004 J	0.05 U	0.0002 U	7.67	0.00024 J	0.0002 U
VAS_w-07	11/30/1989	--	**0.012**	0.022	--	0.002 U	21	0.009	--	0.003	**0.73**	0.014	11	**0.087**	0.0002 U
VAS_w-07	4/18/1990	--	**0.013**	0.015	--	0.002 U	18	0.006 U	--	0.002 U	0.15	0.005	7.5	**0.06**	0.0002 U
VAS_w-07	10/24/1990	--	0.002	0.007	--	0.002 U	12	0.006 U	--	0.006	0.07	0.001	14	0.003	0.0005
VAS_w-07	1/17/2001	0.0005 U	**0.0548**	0.0179	0.0002 U	0.0001 U	20.6	0.0011 J	0.00028 J	0.0167	**0.724**	0.00451	9.09	**0.0811**	0.0002 U
VAS_w-07	1/17/2001	0.0005 U	**0.0367**	0.0148	0.0002 U	0.0001 U	20.9	0.0004 U	0.0002 U	0.00406	0.058 J	0.00106	9.03	**0.0707**	0.0002 U
VAS_w-07	11/27/2001	0.0005 U	**0.0388**	0.0187	0.0002 U	0.0001 U	21.7	0.00088 J	0.00033 J	0.00305	**1.07**	0.00082 J	9.46	**0.0842**	0.0002 U
VAS_w-07	11/27/2001	0.0005 U	**0.037**	0.0175	0.0002 U	0.0001 U	20.7	0.00053 J	0.00022 J	0.00219	**0.736**	0.00076 J	8.97	**0.0773**	0.0002 U
VAS_w-07	6/6/2002	0.0005 U	**0.0173**	0.0149	0.0002 U	0.0001 U	22.3	0.0004 U	0.0002 U	0.00045 J	0.2 J	0.00023 J	9.37	**0.0729**	0.0002 U
VAS_w-07	10/1/2002	0.0005 U	**0.0381**	0.0169	0.0002 U	0.0001 U	22	0.00041 J	0.0002 U	0.00078 J	0.16 J	0.00022 J	9.52	**0.0714**	0.0002 U
VAS_w-07	6/4/2003	0.0005 U	**0.0328**	0.0145	0.0002 U	0.0001 U	20.7	0.0004 U	0.0002 U	0.00043 J	0.1 J	0.0002 U	8.67	**0.0708**	0.0002 U
VAS_w-07	11/13/2003	0.0005 U	**0.0469**	0.0149	0.0002 U	0.0001 U	21.3	0.0004 U	0.0002 U	0.00371	0.2 J	0.00048 J	8.74	**0.074**	0.0002 U
VAS_w-07	6/2/2004	0.0005 U	**0.0282**	0.0161	0.0002 U	0.0001 U	21.7	0.0004 U	0.0002 U	0.001 J	0.285	0.00021 J	9.24	**0.0765**	0.0002 U
VAS_w-08	11/30/1989	--	0.004	0.03	--	0.002 U	39	0.019	--	0.004	**0.3**	0.001	18	**0.198**	0.0002 U
VAS_w-08	11/30/1989	--	0.004	0.032	--	0.002 U	40	0.024	--	0.002	**0.32**	0.001	18	**0.208**	0.0002 U
VAS_w-08	4/18/1990	--	0.005	0.031	--	0.002 U	41	0.009	--	0.002 U	**0.34**	0.002	19	**0.2**	0.0002 U
VAS_w-08	10/23/1990	--	0.006	0.018	--	0.002 U	50	0.006 U	--	0.002 U	0.14	0.004	23	0.002 U	0.0002 U
VAS_w-08	1/17/2001	0.0005 U	0.00393	0.0295	0.0002 U	0.0001 U	43.8	0.0004 U	0.0002 U	0.0019 J	0.26	0.0002 U	19.9	**0.193**	0.0002 U
VAS_w-08	4/10/2001	--	0.00288	0.029	--	0.0001 U	41.5	0.0004 U	--	0.00804	**0.391**	0.00208	18.7	**0.181**	0.0002 U
VAS_w-08	11/27/2001	0.0005 U	0.0024 J	0.0301	0.0002 U	0.0001 U	44.1	0.0004 U	0.0002 U	0.0033	**0.507**	0.0006 J	19.7	**0.195**	0.0002 U
VAS_w-08	6/6/2002	0.0005 U	0.00339	0.03	0.0002 U	0.0001 U	47.6	0.0004 U	0.0002 U	0.0014 J	**0.334**	0.00026 J	20.7	**0.2**	0.0002 U
VAS_w-08	10/1/2002	0.0005 U	0.00255	0.0328	0.0002 U	0.0001 U	45.4	0.0004 U	0.0002 U	0.0016 J	**0.31**	0.00022 J	20.6	**0.2**	0.0002 U
VAS_w-08	6/10/2003	0.0005 U	0.0033	0.0307	0.0002 U	0.0001 U	44.7	0.00074 J	0.00034 J	0.00447	**0.967**	0.0012	19.9	**0.215**	0.0002 U
VAS_w-08	11/18/2003	0.0005 U	0.0024 J	0.0279	0.0002 U	0.0001 U	46.5	0.0004 U	0.00022 J	0.0012 J	**0.458**	0.00045 J	19.8	**0.189**	0.0002 U
VAS_w-08	6/2/2004	0.0005 U	0.00324	0.0346	0.0002 U	0.0001 U	47.7	0.0004 U	0.0002 U	0.0018 J	**0.36**	0.00032 J	20.9	**0.223**	0.0002 U
VAS_w-09a	10/2/2002	0.0005 U	0.0072	0.0109	0.0002 U	0.0001 U	16.7	0.0004 U	0.00062 J	0.00066 J	0.22 J	0.00028 J	11.6	**0.131**	0.0002 U
VAS_w-09a	10/2/2002	0.0005 U	0.00733	0.0114	0.0002 U	0.0001 U	16.9	0.0004 U	0.00059 J	0.002	0.252	0.00031 J	12.1	**0.128**	0.0002 U
VAS_w-09a	6/5/2003	0.0005 U	0.00567	0.00993	0.0002 U	0.0001 U	16.1	0.0004 U	0.0002 U	0.0004 U	**0.676**	0.0002 U	11.2	**0.173**	0.0002 U
VAS_w-09a	6/5/2003	0.0005 U	0.00571	0.0104	0.0002 U	0.0001 U	15.9	0.0004 U	0.0002 U	0.0004 U	**0.664**	0.0002 U	11.1	**0.185**	0.0002 U
VAS_w-09a	11/17/2003	0.0005 U	0.00507	0.00936	0.0002 U	0.0001 U	16.4	0.0004 U	0.0002 U	0.0004 U	**0.725**	0.0002 U	11.2	**0.163**	0.0002 U
VAS_w-09a	5/25/2004	0.0005 U	0.00562	0.0103	0.0002 U	0.0001 U	16.4	0.0004 U	0.0002 U	0.0004 U	**0.751**	0.0002 U	11.8	**0.18**	0.0002 U
VAS_w-09a	5/25/2004	0.0005 U	0.00524	0.0105	0.0002 U	0.0001 U	16.6	0.0004 U	0.0002 U	0.0004 U	**0.759**	0.0002 U	12	**0.186**	0.0002 U
VAS_w-09b	1/18/2001	0.0005 U	0.00054 J	0.00286	0.0002 U	0.0001 U	17.2	0.0004 U	0.0002 U	0.0004 U	**0.462**	0.0002 U	16.2	**0.0906**	0.0002 U
VAS_w-09b	4/10/2001	--	0.00086 J	0.00284	--	0.0001 U	16.9	0.0004 U	--	0.0004 U	**1.69**	0.00065 J	15.8	**0.102**	0.0002 U
VAS_w-09b	11/28/2001	0.0005 U	0.0011 J	0.00287	0.0002 U	0.0001 U	17.4	0.0004 U	0.0002 U	0.0004 U	**1.85**	0.00031 J	16.1	**0.087**	0.0002 U
VAS_w-09b	6/10/2002	0.0005 U	0.00069 J	0.00265	0.0002 U	0.0001 U	17.8	0.0004 U	0.0002 U	0.0004 U	**1.13**	0.0002 U	16.1	**0.1**	0.0002 U
VAS_w-09b	10/2/2002	0.0005 U	0.00058 J	0.00311	0.0002 U	0.0001 U	18.4	0.0004 U	0.0002 U	0.0004 U	**0.494**	0.0002 U	17.3	**0.0614**	0.0002 U
VAS_w-10a	1/18/2001	0.0005 U	0.0012 J	0.00603	0.0002 U	0.0001 U	20.7	0.00207	0.0002 U	0.00285	0.05 U	0.00042 J	19.4	0.00086 J	0.0002 U
VAS_w-10a	1/18/2001	0.0005 U	0.0013 J	0.00623	0.0002 U	0.0001 U	20.5	0.00219	0.0002 U	0.0206	0.05 U	0.004	19.1	0.00122	0.0002 U
VAS_w-10a	10/2/2002	0.0005 U	0.0013 J	0.00638	0.0002 U	0.0001 U	20.3	0.00231	0.0002 U	0.0017 J	0.05 U	0.00024 J	18.9	0.0002 U	0.0002 U
VAS_w-10a	6/5/2003	0.0005 U	0.0013 J	0.00461	0.0002 U	0.0001 U	17.2	0.0014 J	0.0002 U	0.00409	0.05 U	0.00021 J	15.7	0.0002 U	0.0002 U
VAS_w-10a	11/17/2003	0.0005 U	0.0012 J	0.00498	0.0002 U	0.0001 U	17.1	0.0015 J	0.0002 U	0.00096 J	0.05 U	0.0002 U	16	0.0002 U	0.0002 U
VAS_w-10a	5/25/2004	0.0005 U	0.0013 J	0.00603	0.0002 U	0.0001 U	19.3	0.00254	0.0002 U	0.00087 J	0.05 U	0.0002 U	17.9	0.0002 U	0.0002 U

Data qualifiers are defined in Table D-1.
-- Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	ANTIMONY mg/l	ARSENIC mg/l	BARIUM mg/l	BERYLLIUM mg/l	CADMIUM mg/l	CALCIUM mg/l	CHROMIUM mg/l	COBALT mg/l	COPPER mg/l	IRON mg/l	LEAD mg/l	MAGNESIUM mg/l	MANGANESE mg/l	MERCURY mg/l
VAS_w-11	1/24/2001	0.0005 U	0.0015 J	0.0113	0.0002 U	0.0001 U	25.2	0.0004 U	0.0002 U	0.00208	0.17 J	0.0002 U	11.1	**0.136**	0.0002 U
VAS_w-11	1/24/2001	0.0005 U	0.0015 J	0.0112	0.0002 U	0.0001 U	25.3	0.0004 U	0.0002 U	0.00205	0.19 J	0.0002 U	11	**0.142**	0.0002 U
VAS_w-11	6/3/2002	0.0005 U	0.0012 J	0.0112	0.0002 U	0.0001 U	24.5	0.0004 U	0.0002 U	0.002	0.17 J	0.0002 U	10.7	**0.146**	0.0002 U
VAS_w-11	10/3/2002	0.0005 U	0.0015 J	0.0128	0.0002 U	0.0001 U	24.2	0.0004 U	0.0002 U	0.00262	0.16 J	0.0002 U	11.3	**0.132**	0.0002 U
VAS_w-11	6/10/2003	0.0005 U	0.0017 J	0.0116	0.0002 U	0.0001 U	23	0.0004 U	0.0002 U	0.0016 J	0.11 J	0.0002 U	10.4	**0.14**	0.0002 U
VAS_w-11	11/18/2003	0.0005 U	0.0014 J	0.011	0.0002 U	0.0001 U	23.8	0.0004 U	0.0002 U	0.00464	**0.325**	0.0002 U	10.8	**0.138**	0.0002 U
VAS_w-11	5/24/2004	0.0005 U	0.0014 J	0.0118	0.0002 U	0.0001 U	23.6	0.0004 U	0.0002 U	0.00694	0.13 J	0.0002 U	11	**0.145**	0.0002 U
VAS_w-12	1/18/2001	0.0005 U	0.00553	0.00914	0.0002 U	0.0001 U	24.3	0.0004 U	0.0002 U	0.0531	0.271	0.0002 U	7.09	**0.0805**	0.0002 U
VAS_w-12	4/10/2001	--	0.00533	0.00929	--	0.0001 U	24.3	0.0004 U	--	0.0335	**0.339**	0.00029 J	7.07	**0.0767**	0.0002 U
VAS_w-12	4/10/2001	--	0.00525	0.00912	--	0.0001 U	24.3	0.0004 U	--	0.0486	**0.486**	0.00077 J	7.06	**0.0786**	0.0002 U
VAS_w-12	11/28/2001	0.0005 U	0.00584	0.00954	0.0002 U	0.0001 U	23.4	0.0004 U	0.0002 U	0.0442	**0.536**	0.0002 U	6.7	**0.085**	0.0002 U
VAS_w-12	6/10/2002	0.0005 U	0.00602	0.00884	0.0002 U	0.0001 U	25.9	0.0004 U	0.0002 U	0.0788	**0.697**	0.0002 U	7.26	**0.0903**	0.0002 U
VAS_w-12	10/2/2002	0.0005 U	0.00594	0.0104	0.0002 U	0.0001 U	25.2	0.0004 U	0.0002 U	0.013	0.2 J	0.0002 U	7.37	**0.0825**	0.0002 U
VAS_w-12	6/5/2003	0.0005 U	0.00559	0.00855	0.0002 U	0.0001 U	24.8	0.0004 U	0.0002 U	0.0174	0.15 J	0.00022 J	7.07	**0.0788**	0.0002 U
VAS_w-12	11/17/2003	0.0005 U	0.00745	0.00943	0.0002 U	0.0001 U	24	0.00278	0.0002 U	0.0661	**1.22**	0.00284	7.01	**0.093**	0.0002 U
VAS_w-12	11/17/2003	0.0005 U	0.00766	0.00852	0.0002 U	0.0001 U	25.4	0.0013 J	0.0002 U	0.0461	**0.774**	0.00136	7.15	**0.0822**	0.0002 U
VAS_w-12	5/24/2004	0.0005 U	0.00554	0.00952	0.0002 U	0.0001 U	24.6	0.0004 U	0.0002 U	0.00544	0.12 J	0.0002 U	7.16	**0.0869**	0.0002 U
VAS_w-13	1/17/2001	0.0005 U	0.0012 J	0.00603	0.0002 U	0.0001 U	16.9	0.00233	0.0002 U	0.00473	0.05 U	0.0017	15.2	0.00078 J	0.0002 U
VAS_w-13	12/4/2001	0.0005 U	0.0012 J	0.00551	0.0002 U	0.0001 U	16.1	0.00212	0.0002 U	0.00046 J	0.05 U	0.00036 J	14	0.00119	0.0002 U
VAS_w-13	6/11/2002	0.0005 U	0.001 J	0.0045	0.0002 U	0.0001 U	15.8	0.0017 J	0.0002 U	0.00096 J	0.15 J	0.00153	14.1	0.00522	0.0002 U
VAS_w-13	6/11/2002	0.0005 U	0.00099 J	0.0044	0.0002 U	0.0001 U	16.2	0.0015 J	0.0002 U	0.0011 J	0.15 J	0.00149	13.9	0.00618	0.0002 U
VAS_w-13	10/14/2002	0.0005 U	0.0012 J	0.00512	0.0002 U	0.0001 U	14.7	0.00234	0.0002 U	0.00093 J	0.064 J	0.00025 J	12.7	0.0023	0.0002 U
VAS_w-13	6/4/2003	0.0005 U	0.0011 J	0.0047	0.0002 U	0.0001 U	15.3	0.0023	0.0002 U	0.00068 J	0.064 J	0.0002 J	13.3	0.00217	0.0002 U
VAS_w-13	11/13/2003	0.0005 U	0.0012 J	0.00453	0.0002 U	0.0001 U	14.8	0.00249	0.0002 U	0.00085 J	0.11 J	0.00042 J	12.6	0.00336	0.0002 U
VAS_w-13	6/2/2004	0.0005 U	0.0012 J	0.00511	0.0002 U	0.0001 U	14.5	0.00251	0.0002 U	0.0006 J	0.05 U	0.0002 U	13	0.00105	0.0002 U
VAS_w-14	1/22/2001	0.0005 U	0.0015 J	0.00364	0.0002 U	0.0001 U	12.5	0.00096 J	0.0002 U	0.00045 J	0.16 J	0.0002 U	9.51	0.00121	0.0002 U
VAS_w-14	11/29/2001	0.0005 U	0.0015 J	0.00413	0.0002 U	0.0001 U	11.6	0.0012 J	0.0002 U	0.00083 J	**0.717**	0.00077 J	8.75	0.00122	0.0002 U
VAS_w-14	6/3/2002	0.0005 U	0.0012 J	0.00392	0.0002 U	0.0001 U	12	0.0015 J	0.0002 U	0.00097 J	**0.481**	0.00167	9.35	0.0273	0.0002 U
VAS_w-14	10/3/2002	0.0005 U	0.0013 J	0.0041	0.0002 U	0.0001 U	12	0.0017 J	0.0002 U	0.0008 J	**0.325**	0.00079 J	9.22	0.00251	0.0002 U
VAS_w-14	6/10/2003	0.0005 U	0.0015 J	0.00388	0.0002 U	0.0001 U	11.8	0.0013 J	0.0002 U	0.00053 J	0.11 J	0.0005 J	8.88	0.00133	0.0002 U
VAS_w-14	11/18/2003	0.0005 U	0.0013 J	0.00358	0.0002 U	0.0001 U	12.1	0.0012 J	0.0002 U	0.0004 U	0.19 J	0.0005 J	8.97	0.00103	0.0002 U
VAS_w-14	6/1/2004	0.0005 U	0.0013 J	0.0043	0.0002 U	0.0001 U	12.6	0.00209	0.0002 U	0.0016 J	0.19 J	0.00069 J	9.61	0.00309	0.0002 U
VAS_w-15	1/22/2001	0.0005 U	0.0018 J	0.00123	0.0002 U	0.0001 U	12	0.0004 U	0.0002 U	0.00464	0.065 J	0.00044 J	8.38	**0.168**	0.0002 U
VAS_w-15	1/22/2001	0.0005 U	0.0016 J	0.00127	0.0002 U	0.0001 U	11.8	0.0004 U	0.0002 U	0.00282	0.057 J	0.00046 J	8.21	**0.178**	0.0002 U
VAS_w-15	11/29/2001	0.0005 U	0.0014 J	0.00125	0.0002 U	0.0001 U	11	0.0004 U	0.0002 U	0.00052 J	0.05 U	0.0002 U	7.62	**0.177**	0.0002 U
VAS_w-15	6/10/2002	0.0005 U	0.0014 J	0.00122	0.0002 U	0.0001 U	11.8	0.0004 U	0.0002 U	0.0011 J	0.05 U	0.0002 U	8	**0.175**	0.0002 U
VAS_w-15	10/3/2002	0.0005 U	0.0014 J	0.00126	0.0002 U	0.0001 U	11.7	0.0004 U	0.0002 U	0.00048 J	0.061 J	0.0002 U	8.2	**0.192**	0.0002 U
VAS_w-15	6/5/2003	0.0005 U	0.0015 J	0.00127	0.0002 U	0.0001 U	11.5	0.0004 U	0.0002 U	0.00084 J	0.22 J	0.00031 J	7.88	**0.197**	0.0002 U
VAS_w-15	11/17/2003	0.0005 U	0.0013 J	0.00114	0.0002 U	0.0001 U	11.7	0.0004 U	0.0002 U	0.0006 J	0.21 J	0.00079 J	7.94	**0.171**	0.0002 U
VAS_w-15	6/1/2004	0.0005 U	0.0013 J	0.0002 U	0.0002 U	0.0001 U	0.05 U	0.0004 U	0.0002 U	0.00077 J	0.05 U	0.0002 U	0.03 U	0.00041 J	0.0002 U
VAS_w-15	6/1/2004	0.0005 U	0.0013 J	0.0002 U	0.0002 U	0.0001 U	0.05 U	0.0004 U	0.0002 U	0.00074 J	0.05 U	0.0002 U	0.03 U	0.0004 J	0.0002 U
VAS_w-16a	1/24/2001	0.0005 U	0.0005 U	0.00401	0.0002 U	0.0001 U	9.91	0.00201	0.0002 U	0.00473	0.086 J	0.0002 U	8.14	0.00085 J	0.0002 U
VAS_w-16a	11/29/2001	0.0005 U	0.00052 J	0.00385	0.0002 U	0.0001 U	8.91	0.0019 J	0.0002 U	0.00697	0.13 J	0.00025 J	7.23	0.00161	0.0002 U
VAS_w-16a	6/10/2002	0.0005 U	0.00057 J	0.00372	0.0002 U	0.0001 U	9.69	0.0022	0.0002 U	0.00541	**0.673**	0.00281	7.65	0.00966	0.0002 U
VAS_w-16a	10/3/2002	0.0005 U	0.0005 U	0.00408	0.0002 U	0.0001 U	9.76	0.00239	0.0002 U	0.0026	0.066 J	0.00033 J	8.01	0.00168	0.0002 U
VAS_w-16a	6/10/2003	0.0005 U	0.00057 J	0.00363	0.0002 U	0.0001 U	8.86	0.00233	0.0002 U	0.002	0.097 J	0.00048 J	7.22	0.00163	0.0002 U
VAS_w-16a	11/18/2003	0.0005 U	0.0005 U	0.00351	0.0002 U	0.0001 U	8.69	0.00222	0.0002 U	0.0011 J	0.1 J	0.0002 U	6.93	0.00076 J	0.0002 U
VAS_w-16a	5/27/2004	0.0005 U	0.00052 J	0.00397	0.0002 U	0.0001 U	8.71	0.00243	0.0002 U	0.0015 J	0.05 U	0.00021 J	7.24	0.00055 J	0.0002 U

Data qualifiers are defined in Table D-1.
-- Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	ANTIMONY mg/l	ARSENIC mg/l	BARIUM mg/l	BERYLLIUM mg/l	CADMIUM mg/l	CALCIUM mg/l	CHROMIUM mg/l	COBALT mg/l	COPPER mg/l	IRON mg/l	LEAD mg/l	MAGNESIUM mg/l	MANGANESE mg/l	MERCURY mg/l
VAS_w-17	1/22/2001	0.0005 U	0.00064 J	0.00279	0.0002 U	0.0001 U	10.7	0.0011 J	0.0002 U	0.00325	0.12 J	0.00178	7.07	0.00345	0.0002 U
VAS_w-17	11/29/2001	0.0005 U	0.0005 J	0.00291	0.0002 U	0.0001 U	10.3	0.0011 J	0.0002 U	0.00222	0.1 J	0.00086 J	6.71	0.00241	0.0002 U
VAS_w-17	6/3/2002	0.0005 U	0.0005 U	0.00264	0.0002 U	0.0001 U	11.1	0.00095 J	0.0002 U	0.00249	0.079 J	0.00118	7.07	0.00469	0.0002 U
VAS_w-17	10/7/2002	0.0005 U	0.00055 J	0.00317	0.0002 U	0.0001 U	11.1	0.0013 J	0.0002 U	0.004	**2.59**	0.00236	7.24	0.0485	0.0002 U
VAS_w-17	6/11/2003	0.0005 U	0.0005 U	0.0028	0.0002 U	0.0001 U	10.6	0.0012 J	0.0002 U	0.0013 J	0.088 J	0.00073 J	6.9	0.00292	0.0002 U
VAS_w-17	11/19/2003	0.0005 U	0.0005 U	0.00266	0.0002 U	0.0001 U	10.2	0.0011 J	0.0002 U	0.00073 J	0.05 U	0.00047 J	6.52	0.00052 J	0.0002 U
VAS_w-17	5/27/2004	0.0005 U	0.0005 U	0.00314	0.0002 U	0.0001 U	11	0.0013 J	0.0002 U	0.00245	0.05 U	0.00063 J	7.18	0.00228	0.0002 U
VAS_w-18	2/28/2001	--	0.00259	0.0106	--	0.0001 U	38.2	0.0012 U	--	0.00073 U	**9.57**	0.00092 U	11.1	**0.975**	0.0002 U
VAS_w-18	2/28/2001	--	0.00277	0.0105	--	0.0001 U	39	0.0012 U	--	0.00069 U	**9.76**	0.00109	11.3	**0.967**	0.0002 U
VAS_w-18	12/3/2001	0.0005 U	0.00314	0.0124	0.0002 U	0.0001 U	36.4	0.0014 J	0.0002 U	0.00829	**9.52**	0.00365	10.4	**1.13**	0.0002 U
VAS_w-18	6/11/2002	0.0005 U	0.00806	0.019	0.0002 U	0.0001 U	41.1	0.0019 J	0.0002 U	0.00791	**24.7**	0.00679	11.2	**1.23**	0.0002 U
VAS_w-18	10/7/2002	0.0005 U	0.00303	0.0115	0.0002 U	0.0001 U	41.4	0.0016 J	0.0002 U	0.0123	**10.2**	0.00139	11.8	**0.994**	0.0002 U
VAS_w-18	6/11/2003	0.0005 U	0.00299	0.0106	0.0002 U	0.0001 U	38.6	0.0013 J	0.0002 U	0.0013 J	**9.01**	0.00063 J	10.8	**1.1**	0.0002 U
VAS_w-18	6/11/2003	0.0005 U	0.0045	0.0123	0.0002 U	0.0001 U	38.5	0.0015 J	0.0002 U	0.00466	**12.7**	0.00171	10.7	**1.1**	0.0002 U
VAS_w-18	11/19/2003	0.0005 U	0.00301	0.0103	0.0002 U	0.0001 U	40	0.0013 J	0.0002 U	0.00626	**9.41**	0.00603	11	**1.1**	0.0002 U
VAS_w-18	5/26/2004	0.0005 U	0.00293	0.0116	0.0002 U	0.0001 U	38.4	0.0014 J	0.0002 U	0.0004 U	**8.93**	0.00023 J	11.1	**1.15**	0.0002 U
VAS_w-19	11/30/1989	--	0.003	0.008	--	0.002 U	8.7	0.006 U	--	0.002 U	**0.42**	0.001	10	**0.107**	0.0002 U
VAS_w-19	4/20/1990	--	0.004	0.006	--	0.002 U	7.8	0.006 U	--	0.002 U	**0.34**	0.001	8.2	**0.092**	0.0002 U
VAS_w-19	10/26/1990	--	0.003	0.006	--	0.002 U	10	0.006 U	--	0.002 U	**0.46**	0.004	9.6	**0.105**	0.0003
VAS_w-19	10/26/1990	--	0.003	0.006	--	0.002 U	9.8	0.006 U	--	0.002 U	**0.42**	0.005	9.7	**0.104**	0.0006
VAS_w-19	1/23/2001	0.0005 U	0.002 J	0.00536	0.0002 U	0.0001 U	8.76	0.0004 U	0.0002 U	0.0044	**0.392**	0.00104	9.64	**0.0915**	0.0002 U
VAS_w-19	1/23/2001	0.0005 U	0.002 J	0.00552	0.0002 U	0.0001 U	9.01	0.0004 U	0.0002 U	0.00734	**0.357**	0.00064 J	9.92	**0.0939**	0.0002 U
VAS_w-19	6/3/2002	0.0005 U	0.0018 J	0.00527	0.0002 U	0.0001 U	8.93	0.0004 U	0.0002 U	0.0004 U	**0.374**	0.0002 U	9.56	**0.101**	0.0002 U
VAS_w-19	10/7/2002	0.0005 U	0.002 J	0.00591	0.0002 U	0.0001 U	9.23	0.0004 U	0.0002 U	0.0004 U	**0.362**	0.0002 U	10.1	**0.0995**	0.0002 U
VAS_w-19	6/11/2003	0.0005 U	0.0019 J	0.00549	0.0002 U	0.0001 U	8.44	0.0004 U	0.0002 U	0.0004 U	0.282	0.0002 U	8.99	**0.1**	0.0002 U
VAS_w-19	11/19/2003	0.0005 U	0.0019 J	0.0053	0.0002 U	0.0001 U	8.74	0.0004 U	0.0002 U	0.0004 U	**0.309**	0.0002 U	9.34	**0.0948**	0.0002 U
VAS_w-19	5/26/2004	0.0005 U	0.002 J	0.00574	0.0002 U	0.0001 U	9.08	0.0004 U	0.0002 U	0.0004 U	**0.303**	0.00032 J	9.89	**0.104**	0.0002 U
VAS_w-20	1/23/2001	0.0005 U	0.00072 J	0.00347	0.0002 U	0.0001 U	10.2	0.00289	0.0002 U	0.00207	0.21 J	0.00118	6.99	0.00315	0.0002 U
VAS_w-20	4/10/2001	--	0.0006 J	0.00332	--	0.0001 U	9.5	0.00267	--	0.00244	0.079 J	0.00065 J	6.46	0.00214	0.0002 U
VAS_w-20	12/3/2001	0.0005 U	0.00064 J	0.00353	0.0002 U	0.0001 U	8.84	0.00309	0.0002 U	0.00391	0.05 U	0.0002 U	5.88	0.00151	0.0002 U
VAS_w-20	6/11/2002	0.0005 U	0.00063 J	0.00349	0.0002 U	0.0001 U	10.2	0.00252	0.0002 U	0.0042	0.05 U	0.00044 J	6.63	0.00168	0.0002 U
VAS_w-20	10/7/2002	0.0005 U	0.00064 J	0.00324	0.0002 U	0.0001 U	10.3	0.00323	0.0002 U	0.00442	0.05 U	0.00029 J	6.83	0.00096 J	0.0002 U
VAS_w-20	6/4/2003	0.0005 U	0.00069 J	0.00342	0.0002 U	0.0001 U	9.84	0.00272	0.0002 U	0.00436	0.05 U	0.00024 J	6.46	0.00144	0.0002 U
VAS_w-20	11/13/2003	0.0005 U	0.00061 J	0.0032	0.0002 U	0.0001 U	10.3	0.00252	0.0002 U	0.00278	0.05 U	0.00028 J	6.58	0.00129	0.0002 U
VAS_w-20	11/13/2003	0.0005 U	0.00061 J	0.00331	0.0002 U	0.0001 U	10.5	0.0025	0.0002 U	0.00302	0.05 U	0.00032 J	6.63	0.00144	0.0002 U
VAS_w-20	5/27/2004	0.0005 U	0.0006 J	0.00315	0.0002 U	0.0001 U	9.78	0.00307	0.0002 U	0.00511	0.05 U	0.0002 U	6.49	0.00109	0.0002 U
VAS_w-21	1/16/2001	0.0005 U	0.00389	0.0094	0.0002 U	0.0001 U	19.9	0.0004 U	0.0002 U	0.0197	0.267	0.00085 J	9.6	0.021	0.0002 U
VAS_w-21	11/26/2001	0.0005 U	0.00376	0.00871	0.0002 U	0.0001 U	19.7	0.0004 U	0.0002 U	0.00092 J	0.24 J	0.0002 U	9.31	0.019	0.0002 U
VAS_w-21	6/5/2002	0.0005 U	0.00398	0.00925	0.0002 U	0.0001 U	21.7	0.0004 U	0.0002 U	0.00074 J	0.17 J	0.0002 U	10	0.0223	0.0002 U
VAS_w-21	9/30/2002	0.0005 U	0.00437	0.0101	0.0002 U	0.0001 U	21.7	0.0004 U	0.0002 U	0.0013 J	0.22 J	0.0002 U	10.2	0.0208	0.0002 U
VAS_w-21	9/30/2002	0.0005 U	0.00395	0.00999	0.0002 U	0.0001 U	21.4	0.0004 U	0.0002 U	0.0017 J	0.2 J	0.0002 U	10.2	0.0191	0.0002 U
VAS_w-21	6/3/2003	0.0005 U	0.00389	0.00953	0.0002 U	0.0001 U	21	0.0004 U	0.0002 U	0.0012 J	0.258	0.0002 U	9.93	0.018	0.0002 U
VAS_w-21	11/12/2003	0.0005 U	0.00443	0.00923	0.0002 U	0.0001 U	21.5	0.0004 U	0.0002 U	0.0093	0.23 J	0.0002 U	9.86	0.0203	0.0002 U
VAS_w-21	6/2/2004	0.0005 U	0.00441	0.01	0.0002 U	0.0001 U	21.8	0.0004 U	0.0002 U	0.00244	0.1 J	0.0002 U	10.3	0.0216	0.0002 U

Data qualifiers are defined in Table D-1.
-- Sample not analyzed
Results in bold typeface exceed the MCL.

Table D-4
Metals

Well ID	Sample Date	MOLYBDENUM mg/l	NICKEL mg/l	POTASSIUM mg/l	SELENIUM mg/l	SILICA mg/l	SILVER mg/l	SODIUM mg/l	THALLIUM mg/l	VANADIUM mg/l	ZINC mg/l
VAS_s-02	11/30/1989	--	--	1 U	0.001 U	14	0.01 U	9.4	--	--	0.026
VAS_s-02	4/16/1990	--	--	0.96	0.001 U	30	0.01 U	8.6	--	--	0.05
VAS_s-02	10/22/1990	--	--	1.2	0.001 U	18	0.01 U	6.5	--	--	0.02
VAS_s-02	10/22/1990	--	--	0.63	0.001 U	24	0.01 U	8.7	--	--	0.02 U
VAS_s-02	1/23/2001	0.0005 U	0.0013 J	2 U	0.0015 U	30	0.0002 U	9.07	0.0002 U	0.00491	0.00088 J
VAS_s-02	11/27/2001	0.0005 U	0.00152	2 U	0.0015 U	5.7	0.0002 U	8.48	0.0002 U	0.00471	0.00078 J
VAS_s-02	6/6/2002	0.0005 U	0.0013 J	2 U	0.0015 U	13	0.0002 U	8.79	0.0002 U	0.0042	0.0024 J
VAS_s-02	10/1/2002	0.0005 U	0.00161	2 U	0.0015 U	21	0.0002 U	9.16	0.0002 U	0.00507	0.0013 J
VAS_s-02	6/4/2003	0.0005 U	0.0013 J	2 U	0.0015 U	31.8	0.0002 U	8.45	0.0002 U	0.00519	0.00078 J
VAS_s-03	11/30/1989	--	--	2.3	0.001 U	20	0.01 U	8.8	--	--	0.036
VAS_s-03	4/18/1990	--	--	1.5	0.001 U	32	0.01 U	6.6	--	--	0.04
VAS_s-03	4/18/1990	--	--	1.5	0.001 U	32	0.01 U	6.4	--	--	0.04
VAS_s-03	10/24/1990	--	--	5	0.001 U	28	0.01 U	**30**	--	--	0.83
VAS_s-03	1/17/2001	0.0005 U	0.00191	3.2 J	0.0015 U	42	0.0002 U	7.16	0.0002 U	0.00617	0.0079
VAS_s-03	11/27/2001	0.0005 U	0.00193	2.5 J	0.0015 U	5.7	0.0002 U	6.59	0.0002 U	0.00547	0.0115
VAS_s-03	6/6/2002	0.0005 U	0.00177	2.1 J	0.0015 U	42	0.0002 U	6.87	0.0002 U	0.00553	0.0138
VAS_s-03	10/1/2002	0.0005 U	0.00204	2.4 J	0.0015 U	24	0.0002 U	6.73	0.0002 U	0.00632	0.012
VAS_s-03	6/4/2003	0.0005 U	0.00185	2.3 J	0.0015 U	43.3	0.0002 U	6.62	0.0002 U	0.00676	0.0164
VAS_s-03	11/13/2003	0.0005 U	0.0018	2.5 J	0.0015 U	41.1	0.0002 U	6.6	0.0002 U	0.00642	0.00933
VAS_s-03	6/2/2004	0.0005 U	0.00209	2.7 J	0.0015 U	42.5	0.0002 U	6.44	0.0002 U	0.00676	0.0144
VAS_w-02a	1/16/2001	0.00078 J	0.00059 J	3.2 J	0.0015 U	30	0.0002 U	6.23	0.0002 U	0.00275	0.00665
VAS_w-02a	11/26/2001	0.00083 J	0.00081 J	3 J	0.0015 U	31	0.0002 U	6.22	0.0002 U	0.00285	0.0186
VAS_w-02a	6/5/2002	0.001 J	0.00081 J	3 J	0.0015 U	29	0.0002 U	6.97	0.0002 U	0.00261	0.00609
VAS_w-02a	6/5/2002	0.00099 J	0.00068 J	2.9 J	0.0015 U	30	0.0002 U	6.74	0.0002 U	0.00255	0.00558
VAS_w-02a	9/30/2002	0.0012 J	0.00092 J	3.3 J	0.0015 U	23	0.0002 U	6.76	0.0002 U	0.00312	0.00727
VAS_w-02a	6/3/2003	0.00084 J	0.00061 J	3 J	0.0015 U	30.2	0.0002 U	6.24	0.0002 U	0.00306	0.00271
VAS_w-02a	11/12/2003	0.00059 J	0.00061 J	3.2 J	0.0015 U	42.5	0.0002 U	6.39	0.0002 U	0.00315	0.0037
VAS_w-02a	6/1/2004	0.00068 J	0.00064 J	3.3 J	0.0015 U	33.9	0.0002 U	6.22	0.0002 U	0.00322	0.0015 J
VAS_w-03	11/30/1989	--	--	6.3	0.001 U	26	0.01 U	**39**	--	--	0.056
VAS_w-03	4/18/1990	--	--	4.5	0.001 U	20	0.01 U	**28**	--	--	0.03
VAS_w-03	10/24/1990	--	--	1.5	0.001 U	24	0.01 U	7.7	--	--	0.07
VAS_w-03	1/22/2001	0.00706	0.00039 J	2 U	0.0015 U	26	0.0002 U	**30.8**	0.0002 U	0.00534	0.00496
VAS_w-03	11/26/2001	0.00697	0.00062 J	5.8 J	0.0015 U	27	0.0002 U	**29**	0.0002 U	0.00475	0.00481
VAS_w-03	6/5/2002	0.00661	0.00048 J	5.8 J	0.0015 U	27	0.0002 U	**30.1**	0.0002 U	0.00458	0.00373
VAS_w-03	9/30/2002	0.00699	0.0006 J	6.1 J	0.0015 U	22	0.0002 U	**30.2**	0.0002 U	0.00509	0.0023 J
VAS_w-03	6/3/2003	0.00703	0.00039 J	5.8 J	0.0015 U	27.2	0.0002 U	**29.6**	0.0002 U	0.00552	0.00345
VAS_w-03	11/12/2003	0.00674	0.00052 J	5.9 J	0.0015 U	26.5	0.0002 U	**29**	0.0002 U	0.00535	0.0044
VAS_w-03	5/24/2004	0.00738	0.00048 J	6.4 J	0.0015 U	26.6	0.0002 U	**29.2**	0.0002 U	0.00544	0.00326
VAS_w-04	1/16/2001	0.00587	0.00068 J	7.3 J	0.0015 U	38	0.0002 U	**58.1**	0.0002 U	0.00033 J	0.0111
VAS_w-04	1/16/2001	0.0059	0.00078 J	8.4 J	0.0015 U	40	0.0002 U	**57.1**	0.0002 U	0.00035 J	0.00912
VAS_w-04	11/26/2001	0.00582	0.00079 J	7.6 J	0.0015 U	43	0.0002 U	**58.6**	0.0002 U	0.0003 U	0.0144
VAS_w-04	11/26/2001	0.00604	0.0009 J	7.5 J	0.0015 U	43	0.0002 U	**56.7**	0.0002 U	0.00032 J	0.016
VAS_w-04	6/5/2002	0.00556	0.00079 J	7.3 J	0.0015 U	43	0.0002 U	**58.1**	0.0002 U	0.0003 U	0.017
VAS_w-04	9/30/2002	0.00591	0.00099 J	7.9 J	0.0015 U	23	0.0002 U	**58.5**	0.0002 U	0.00034 J	0.00718
VAS_w-04	6/3/2003	0.00573	0.00078 J	7.6 J	0.0015 U	41.2	0.0002 U	**58.3**	0.0002 U	0.00035 J	0.0148
VAS_w-04	11/12/2003	0.00561	0.00082 J	7.7 J	0.0015 U	41.9	0.0002 U	**57.9**	0.0002 U	0.00037 J	0.014
VAS_w-04	5/24/2004	0.00624	0.00085 J	8.2 J	0.0015 U	39.9	0.0002 U	**58**	0.0002 U	0.0004 J	0.0114
VAS_w-06	1/24/2001	0.0005 U	0.0004 J	2 U	0.0015 U	25	0.0002 U	5.13	0.0002 U	0.00379	0.00737

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-- Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	MOLYBDENUM mg/l	NICKEL mg/l	POTASSIUM mg/l	SELENIUM mg/l	SILICA mg/l	SILVER mg/l	SODIUM mg/l	THALLIUM mg/l	VANADIUM mg/l	ZINC mg/l
VAS_w-06	12/3/2001	0.0005 U	0.00043 J	2 U	0.0015 U	30	0.0002 U	4.68	0.0002 U	--	0.00374
VAS_w-06	6/11/2002	0.0005 U	0.00043 J	2 U	0.0015 U	23	0.0002 U	4.92	0.0002 U	0.00274	0.0029
VAS_w-06	10/14/2002	0.0005 U	0.00054 J	2 U	0.0015 U	9.5	0.0002 U	4.82	0.0002 U	0.00317	0.00344
VAS_w-06	6/11/2003	0.0005 U	0.00046 J	2 U	0.0015 U	27.9	0.0002 U	4.8	0.0002 U	0.0031	0.00433
VAS_w-06	11/19/2003	0.0005 U	0.00041 J	2 U	0.0015 U	26.8	0.0002 U	4.99	0.0002 U	0.00297	0.00362
VAS_w-06	5/27/2004	0.0005 U	0.00041 J	2 U	0.0015 U	26.1	0.0002 U	4.93	0.0002 U	0.00314	0.00254
VAS_w-07	11/30/1989	--	--	6	0.001 U	30	0.01 U	**43**	--	--	0.226
VAS_w-07	4/18/1990	--	--	3.7	0.001 U	28	0.01 U	**25**	--	--	0.11
VAS_w-07	10/24/1990	--	--	1.8	0.001 U	30	0.01 U	7	--	--	0.02
VAS_w-07	1/17/2001	0.00542	0.00235	5.7 J	0.0015 U	37	0.0002 U	**21.7**	0.0002 U	0.0011 J	2.47
VAS_w-07	1/17/2001	0.00584	0.00041 J	5.9 J	0.0015 U	37	0.0002 U	**22.7**	0.0002 U	0.0003 U	0.0261
VAS_w-07	11/27/2001	0.00512	0.00257	4.9 J	0.0015 U	41	0.0002 U	**22.6**	0.0002 U	0.0011 J	1.45
VAS_w-07	11/27/2001	0.00524	0.00201	4.8 J	0.0015 U	38	0.0002 U	**21.6**	0.0002 U	0.00072 J	1.18
VAS_w-07	6/6/2002	0.00518	0.00092 J	4.9 J	0.0015 U	37	0.0002 U	**22.9**	0.0002 U	0.0003 U	0.0968
VAS_w-07	10/1/2002	0.00574	0.0009 J	5.4 J	0.0015 U	24	0.0002 U	**23.8**	0.0002 U	0.0003 J	0.0296
VAS_w-07	6/4/2003	0.00541	0.00053 J	4.7 J	0.0015 U	38.3	0.0002 U	**21.1**	0.0002 U	0.0003 U	0.0258
VAS_w-07	11/13/2003	0.00538	0.00093 J	5 J	0.0015 U	37.3	0.0002 U	**21.4**	0.0002 U	0.00041 J	0.982
VAS_w-07	6/2/2004	0.00585	0.00065 J	5.4 J	0.0015 U	38.3	0.0002 U	**21**	0.0002 U	0.00036 J	0.0134
VAS_w-08	11/30/1989	--	--	7.6	0.001 U	34	0.01 U	**39**	--	--	0.028
VAS_w-08	11/30/1989	--	--	7.8	0.001 U	34	0.01 U	**39**	--	--	0.024
VAS_w-08	4/18/1990	--	--	6.3	0.001 U	32	0.01 U	**45**	--	--	0.07
VAS_w-08	10/23/1990	--	--	3.7	0.001 U	25	0.01 U	8.2	--	--	0.02 U
VAS_w-08	1/17/2001	0.00952	0.0006 J	8 J	0.0015 U	41	0.0002 U	**40.4**	0.0002 U	0.0003 U	0.00623
VAS_w-08	4/10/2001	--	--	7.3 J	0.0015 U	50	0.0002 U	**36.2**	--	--	0.0136
VAS_w-08	11/27/2001	0.00974	0.0012 J	7.3 J	0.0015 U	43	0.0002 U	**37.6**	0.0002 U	0.0003 U	0.0118
VAS_w-08	6/6/2002	0.00998	0.0011 J	7.3 J	0.0015 U	40	0.0002 U	**42.9**	0.0002 U	0.0003 U	0.00437
VAS_w-08	10/1/2002	0.00981	0.0013 J	8.1 J	0.0015 U	25	0.0002 U	**41.2**	0.0002 U	0.0003 U	0.00818
VAS_w-08	6/10/2003	0.0097	0.00178	7.5 J	0.0015 U	40.1	0.0002 U	**40.3**	0.0002 U	0.00071 J	0.0181
VAS_w-08	11/18/2003	0.00909	0.00096 J	7.7 J	0.0015 U	41.6	0.0002 U	**39.1**	0.0002 U	0.0003 U	0.0176
VAS_w-08	6/2/2004	0.011	0.00083 J	8.3 J	0.0015 U	41	0.0002 U	**42**	0.0002 U	0.0003 U	0.00996
VAS_w-09a	10/2/2002	0.0012 J	0.00643	2.1 J	0.0015 U	24	0.0002 U	7.95	0.0002 U	0.00325	0.0611
VAS_w-09a	10/2/2002	0.0012 J	0.00638	2.2 J	0.0015 U	23	0.0002 U	8.35	0.0002 U	0.00319	0.0589
VAS_w-09a	6/5/2003	0.001 J	0.00036 J	2 U	0.0015 U	38.5	0.0002 U	7.53	0.0002 U	0.0003 U	0.0075
VAS_w-09a	6/5/2003	0.0011 J	0.00035 J	2 U	0.0015 U	37.1	0.0002 U	7.55	0.0002 U	0.0003 U	0.0074
VAS_w-09a	11/17/2003	0.001 J	0.00039 J	2.1 J	0.0015 U	35.8	0.0002 U	7.64	0.0002 U	0.0003 U	0.01
VAS_w-09a	5/25/2004	0.0011 J	0.00035 J	2.4 J	0.0015 U	35.4	0.0002 U	7.81	0.0002 U	0.0003 U	0.00906
VAS_w-09a	5/25/2004	0.0012 J	0.00032 J	2.4 J	0.0015 U	35.4	0.0002 U	7.98	0.0002 U	0.0003 U	0.0099
VAS_w-09b	1/18/2001	0.0006 J	0.0004 J	2.7 J	0.0015 U	20	0.0002 U	8.41	0.0002 U	0.0003 U	0.00469
VAS_w-09b	4/10/2001	--	--	2.4 J	0.0015 U	23	0.0002 U	8.05	--	--	0.117
VAS_w-09b	11/28/2001	0.00052 J	0.00047 J	2.5 J	0.0015 U	20	0.0002 U	8.39	0.0002 U	0.00046 J	0.055
VAS_w-09b	6/10/2002	0.00058 J	0.00047 J	2.1 J	0.0015 U	19	0.0002 U	8.31	0.0002 U	0.0003 U	0.0435
VAS_w-09b	10/2/2002	0.0005 U	0.00062 J	2.3 J	0.0015 U	17	0.0002 U	9.01	0.0002 U	0.00036 J	0.0113
VAS_w-10a	1/18/2001	0.0005 U	0.0029	2.3 J	0.0015 U	36	0.0002 U	17	0.0002 U	0.0029	0.0032
VAS_w-10a	1/18/2001	0.0005 U	0.00322	2.7 J	0.0015 U	36	0.0002 U	16.9	0.0002 U	0.003	0.0136
VAS_w-10a	10/2/2002	0.0005 U	0.0032	2.6 J	0.0015 U	25	0.0002 U	18.2	0.0002 U	0.00299	0.0435
VAS_w-10a	6/5/2003	0.0005 U	0.00269	2 U	0.0015 U	37.3	0.0002 U	11.7	0.0002 U	0.00314	0.0135
VAS_w-10a	11/17/2003	0.0005 U	0.00264	2.2 J	0.0015 U	38.2	0.0002 U	13.2	0.0002 U	0.00315	0.00293
VAS_w-10a	5/25/2004	0.0005 U	0.00322	2.4 J	0.0015 U	36.4	0.0002 U	15.8	0.0002 U	0.00313	0.0021 J

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Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	MOLYBDENUM mg/l	NICKEL mg/l	POTASSIUM mg/l	SELENIUM mg/l	SILICA mg/l	SILVER mg/l	SODIUM mg/l	THALLIUM mg/l	VANADIUM mg/l	ZINC mg/l
VAS_w-11	1/24/2001	0.00082 J	0.00038 J	3.4 J	0.0015 U	41	0.0002 U	9.36	0.0002 U	0.0003 U	0.00352
VAS_w-11	1/24/2001	0.0008 J	0.00035 J	3.7 J	0.0015 U	43	0.0002 U	9.45	0.0002 U	0.0003 U	0.00331
VAS_w-11	6/3/2002	0.00076 J	0.0005 J	2.9 J	0.0015 U	42	0.0002 U	8.89	0.0002 U	0.0003 U	0.0024 J
VAS_w-11	10/3/2002	0.00097 J	0.00065 J	3.4 J	0.0015 U	20	0.0002 U	10.3	0.0002 U	0.0003 U	0.0016 J
VAS_w-11	6/10/2003	0.001 J	0.00041 J	2.8 J	0.0015 U	45.2	0.0002 U	9.79	0.0002 U	0.0003 U	0.0023 J
VAS_w-11	11/18/2003	0.00088 J	0.00043 J	3.5 J	0.0015 U	43.3	0.0002 U	9.98	0.0002 U	0.0003 U	0.0055
VAS_w-11	5/24/2004	0.00094 J	0.0013 J	3.4 J	0.0015 U	41.2	0.0002 U	9.45	0.0002 U	0.0003 U	0.00308
VAS_w-12	1/18/2001	0.00329	0.0003 U	3.6 J	0.0015 U	26	0.0002 U	**26.1**	0.0002 U	0.0003 U	0.0208
VAS_w-12	4/10/2001	–	–	3 J	0.0015 U	30	0.0002 U	**25.5**	–	–	0.00998
VAS_w-12	4/10/2001	–	–	3.1 J	0.0015 U	30	0.0002 U	**25.4**	–	–	0.0133
VAS_w-12	11/28/2001	0.00338	0.00045 J	3.2 J	0.0015 U	28	0.0002 U	**24.7**	0.0002 U	0.0003 U	0.0141
VAS_w-12	6/10/2002	0.00303	0.00046 J	2.9 J	0.0015 U	7.8	0.0002 U	**26.5**	0.0002 U	0.0003 U	0.0643
VAS_w-12	10/2/2002	0.00337	0.00064 J	3.5 J	0.0015 U	21	0.0002 U	**27.3**	0.0002 U	0.0003 U	0.0021 J
VAS_w-12	6/5/2003	0.00314	0.00032 J	3.2 J	0.0015 U	28.5	0.0002 U	**26**	0.0002 U	0.0003 U	0.00364
VAS_w-12	11/17/2003	0.00341	0.00188	3.5 J	0.0015 U	28	0.0002 U	**25.3**	0.0002 U	0.0003 U	0.163
VAS_w-12	11/17/2003	0.00304	0.0011 J	3.4 J	0.0015 U	27.9	0.0002 U	**26.5**	0.0002 U	0.0003 U	0.161
VAS_w-12	5/24/2004	0.00347	0.00036 J	3.4 J	0.0015 U	27.6	0.0002 U	**25.6**	0.0002 U	0.0003 U	0.0018 J
VAS_w-13	1/17/2001	0.0005 U	0.0014 J	2.9 J	0.0015 U	30	0.0002 U	6.73	0.0002 U	0.00463	0.00319
VAS_w-13	12/4/2001	0.0005 U	0.0013 J	2 U	0.0015 U	35	0.0002 U	6.55	0.0002 U	0.00434	0.00073 J
VAS_w-13	6/11/2002	0.0005 U	0.0011 J	2 U	0.0015 U	25	0.0002 U	6.89	0.0002 U	0.00371	0.0162
VAS_w-13	6/11/2002	0.0005 U	0.001 J	2 U	0.0015 U	25	0.0002 U	6.55	0.0002 U	0.00355	0.0155
VAS_w-13	10/14/2002	0.0005 U	0.0013 J	2 U	0.0015 U	11	0.0002 U	6.22	0.0002 U	0.00461	0.00482
VAS_w-13	6/4/2003	0.0005 U	0.0012 J	2 U	0.0015 U	31.5	0.0002 U	6.45	0.0002 U	0.00476	0.00739
VAS_w-13	11/13/2003	0.0005 U	0.0012 J	2 U	0.0015 U	29.9	0.0002 U	6.29	0.0002 U	0.00484	0.00533
VAS_w-13	6/2/2004	0.0005 U	0.0012 J	2.2 J	0.0015 U	31.5	0.0002 U	6.21	0.0002 U	0.00496	0.00828
VAS_w-14	1/22/2001	0.0005 U	0.0003 U	2 U	0.0015 U	29	0.0002 U	6.34	0.0002 U	0.00276	0.115
VAS_w-14	11/29/2001	0.0005 U	0.0003 U	2 U	0.0015 U	28	0.0002 U	6.07	0.0002 U	0.00292	0.224
VAS_w-14	6/3/2002	0.0005 U	0.00032 J	2 U	0.0015 U	28	0.0002 U	6.16	0.0002 U	0.00261	0.344
VAS_w-14	10/3/2002	0.0005 U	0.00039 J	2 U	0.0015 U	20	0.0002 U	6.27	0.0002 U	0.00308	0.245
VAS_w-14	6/10/2003	0.0005 U	0.0003 U	2 U	0.0015 U	32.7	0.0002 U	6.02	0.0002 U	0.00294	0.098
VAS_w-14	11/18/2003	0.0005 U	0.0003 U	2 U	0.0015 U	31.1	0.0002 U	6.1	0.0002 U	0.00281	0.0845
VAS_w-14	6/1/2004	0.0005 U	0.0003 J	2 U	0.0015 U	30.3	0.0002 U	6.29	0.0002 U	0.00311	0.294
VAS_w-15	1/22/2001	0.0005 U	0.00045 J	2 U	0.0015 U	29	0.0002 U	5.79	0.0002 U	0.00077 J	0.0642
VAS_w-15	1/22/2001	0.0005 U	0.00043 J	2 U	0.0015 U	30	0.0002 U	5.68	0.0002 U	0.0008 J	0.0527
VAS_w-15	11/29/2001	0.0005 U	0.00042 J	2 U	0.0015 U	32	0.0002 U	5.42	0.0002 U	0.00072 J	0.0454
VAS_w-15	6/10/2002	0.0005 U	0.00043 J	2 U	0.0015 U	24	0.0002 U	5.68	0.0002 U	0.00068 J	0.0356
VAS_w-15	10/3/2002	0.0005 U	0.00052 J	2 U	0.0015 U	19	0.0002 U	5.82	0.0002 U	0.00082 J	0.0504
VAS_w-15	6/5/2003	0.0005 U	0.00042 J	2 U	0.0015 U	32.7	0.0002 U	5.59	0.0002 U	0.00092 J	0.0521
VAS_w-15	11/17/2003	0.0005 U	0.0006 J	2 U	0.0015 U	32.2	0.0002 U	5.64	0.0002 U	0.001 J	0.317
VAS_w-15	6/1/2004	0.0005 U	0.0003 U	2 U	0.0015 U	31	0.0002 U	**33.3**	0.0002 U	0.00074 J	0.00489
VAS_w-15	6/1/2004	0.0005 U	0.0003 U	2 U	0.0015 U	31.1	0.0002 U	**33.8**	0.0002 U	0.00076 J	0.00516
VAS_w-16a	1/24/2001	0.0005 U	0.00068 J	2 U	0.0015 U	26	0.0002 U	7.28	0.0002 U	0.00347	0.0194
VAS_w-16a	11/29/2001	0.0005 U	0.0007 J	2 U	0.0015 U	27	0.0002 U	6.65	0.0002 U	0.00321	0.022
VAS_w-16a	6/10/2002	0.0005 U	0.00078 J	2 U	0.0015 U	28	0.0002 U	6.87	0.0002 U	0.00345	0.0511
VAS_w-16a	10/3/2002	0.0005 U	0.00088 J	2 U	0.0015 U	17	0.0002 U	7.58	0.0002 U	0.00336	0.0243
VAS_w-16a	6/10/2003	0.0005 U	0.00074 J	2 U	0.0015 U	27.7	0.0002 U	6.77	0.0002 U	0.00373	0.0185
VAS_w-16a	11/18/2003	0.0005 U	0.00067 J	2 U	0.0015 U	27.9	0.0002 U	6.63	0.0002 U	0.00365	0.00869
VAS_w-16a	5/27/2004	0.0005 U	0.00072 J	2 U	0.0015 U	27.3	0.0002 U	6.63	0.0002 U	0.00377	0.0123

Data qualifiers are defined in Table D-1.
– Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix D
Vashon-Maury Island
2001-2004 Monitoring Data
Table D-4
Metals

Well ID	Sample Date	MOLYBDENUM mg/l		NICKEL mg/l		POTASSIUM mg/l		SELENIUM mg/l		SILICA mg/l	SILVER mg/l		SODIUM mg/l	THALLIUM mg/l		VANADIUM mg/l		ZINC mg/l	
VAS_w-17	1/22/2001	0.0005	U	0.0012	J	2	U	0.0015	U	30	0.0002	U	6.58	0.0002	U	0.00157		0.0362	
VAS_w-17	11/29/2001	0.0005	U	0.0013	J	2	U	0.0015	U	31	0.0002	U	6.42	0.0002	U	0.0014	J	0.028	
VAS_w-17	6/3/2002	0.0005	U	0.0012	J	2	U	0.0015	U	30	0.0002	U	6.64	0.0002	U	0.0013	J	0.0248	
VAS_w-17	10/7/2002	0.0005	U	0.00156		2	U	0.0015	U	26	0.0002	U	6.87	0.0002	U	0.00172		0.172	
VAS_w-17	6/11/2003	0.0005	U	0.0013	J	2	U	0.0015	U	32	0.0002	U	6.48	0.0002	U	0.00162		0.0117	
VAS_w-17	11/19/2003	0.0005	U	0.0012	J	2	U	0.0015	U	30.8	0.0002	U	6.24	0.0002	U	0.00161		0.00387	
VAS_w-17	5/27/2004	0.0005	U	0.0014	J	2	U	0.0015	U	31.5	0.0002	U	6.65	0.0002	U	0.00171		0.0102	
VAS_w-18	2/28/2001	--		--		2	U	0.0015	U	33	0.0002	U	7.09	--		--		0.0691	
VAS_w-18	2/28/2001	--		--		2	U	0.0015	U	32	0.0002	U	7.21	--		--		0.0714	
VAS_w-18	12/3/2001	0.0005	U	0.0011	J	2.2	J	0.0015	U	67	0.0002	U	6.65	0.0002	U	--		0.0825	
VAS_w-18	6/11/2002	0.0005	U	0.00098	J	2	U	0.0015	U	49	0.0002	U	7.02	0.0002	U	0.00192		0.369	
VAS_w-18	10/7/2002	0.0005	U	0.0012	J	2.1	J	0.0015	U	51	0.0002	U	7.49	0.0002	U	0.0012	J	0.0368	
VAS_w-18	6/11/2003	0.0005	U	0.00065	J	2	U	0.0015	U	55	0.0002	U	6.86	0.0002	U	0.0012	J	0.0339	
VAS_w-18	6/11/2003	0.0005	U	0.00064	J	2	U	0.0015	U	54.3	0.0002	U	6.76	0.0002	U	0.0014	J	0.0766	
VAS_w-18	11/19/2003	0.0005	U	0.00077	J	2	U	0.0015	U	51.8	0.0002	U	7.02	0.0002	U	0.0011	J	0.0272	
VAS_w-18	5/26/2004	0.0005	U	0.00055	J	2	U	0.0015	U	51.4	0.0002	U	6.89	0.0002	U	0.0012	J	0.0313	
VAS_w-19	11/30/1989	--		--		2		0.001	U	28	0.01	U	5	--		--		0.074	
VAS_w-19	4/20/1990	--		--		1.1		0.001	U	22	0.01	U	5.2	--		--		0.09	
VAS_w-19	10/26/1990	--		--		0.86		0.001	U	21	0.01	U	5.6	--		--		0.07	
VAS_w-19	10/26/1990	--		--		0.85		0.001	U	21	0.01	U	5.4	--		--		0.07	
VAS_w-19	1/23/2001	0.0005	U	0.00081	J	2	U	0.0015	U	26	0.0002	U	4.76	0.0002	U	0.00167		0.0168	
VAS_w-19	1/23/2001	0.0005	U	0.00085	J	2	U	0.0015	U	28	0.0002	U	4.87	0.0002	U	0.0017		0.0185	
VAS_w-19	6/3/2002	0.0005	U	0.00083	J	2	U	0.0015	U	29	0.0002	U	4.77	0.0002	U	0.0014	J	0.0431	
VAS_w-19	10/7/2002	0.0005	U	0.001	J	2	U	0.0015	U	25	0.0002	U	5.04	0.0002	U	0.00172		0.0939	
VAS_w-19	6/11/2003	0.0005	U	0.00087	J	2	U	0.0015	U	30.1	0.0002	U	4.54	0.0002	U	0.00174		0.0831	
VAS_w-19	11/19/2003	0.0005	U	0.00094	J	2	U	0.0015	U	29.1	0.0002	U	4.85	0.0002	U	0.00176		0.128	
VAS_w-19	5/26/2004	0.0005	U	0.0009	J	2	U	0.0015	U	27.9	0.0002	U	4.93	0.0002	U	0.00173		0.108	
VAS_w-20	1/23/2001	0.0005	U	0.00038	J	2	U	0.0015	U	24	0.0002	U	5.26	0.0002	U	0.0026		0.0785	
VAS_w-20	4/10/2001	--		--		2	U	0.0015	U	28	0.0002	U	4.96	--		--		0.0745	
VAS_w-20	12/3/2001	0.0005	U	0.00043	J	2	U	0.0015	U	27	0.0002	U	4.74	0.0002	U	--		0.0604	
VAS_w-20	6/11/2002	0.0005	U	0.0005	J	2	U	0.0015	U	27	0.0002	U	5.21	0.0002	U	0.00224		0.0714	
VAS_w-20	10/7/2002	0.0005	U	0.0005	J	2	U	0.0015	U	22	0.0002	U	5.41	0.0002	U	0.00254		0.0669	
VAS_w-20	6/4/2003	0.0005	U	0.00045	J	2	U	0.0015	U	24.7	0.0002	U	5.09	0.0002	U	0.00263		0.0508	
VAS_w-20	11/13/2003	0.0005	U	0.00043	J	2	U	0.0015	U	24.9	0.0002	U	5.4	0.0002	U	0.00252		0.0219	
VAS_w-20	11/13/2003	0.0005	U	0.00044	J	2	U	0.0015	U	25.1	0.0002	U	5.36	0.0002	U	0.00255		0.0254	
VAS_w-20	5/27/2004	0.0005	U	0.00042	J	2	U	0.0015	U	25.1	0.0002	U	5.23	0.0002	U	0.00256		0.0589	
VAS_w-21	1/16/2001	0.00058	J	0.0014	J	3.3	J	0.0015	U	32	0.0002	U	7.02	0.0002	U	0.0003	U	0.0101	
VAS_w-21	11/26/2001	0.00056	J	0.00042	J	2.7	J	0.0015	U	34	0.0002	U	7.2	0.0002	U	0.0003	U	0.00081	J
VAS_w-21	6/5/2002	0.00053	J	0.00043	J	2.4	J	0.0015	U	34	0.0002	U	7.25	0.0002	U	0.00036	J	0.001	J
VAS_w-21	9/30/2002	0.0006	J	0.00062	J	2.7	J	0.0015	U	21	0.0002	U	7.26	0.0002	U	0.00062	J	0.00059	J
VAS_w-21	9/30/2002	0.00056	J	0.00056	J	2.8	J	0.0015	U	24	0.0002	U	7.3	0.0002	U	0.00043	J	0.0005	U
VAS_w-21	6/3/2003	0.0005	J	0.00052	J	2.8	J	0.0015	U	34.2	0.0002	U	7.21	0.0002	U	0.0003	U	0.0016	J
VAS_w-21	11/12/2003	0.00052	J	0.00037	J	2.9	J	0.0015	U	33.3	0.0002	U	6.95	0.0002	U	0.00055	J	0.00069	J
VAS_w-21	6/2/2004	0.00061	J	0.00033	J	3	J	0.0015	U	34.2	0.0002	U	7.07	0.0002	U	0.00041	J	0.0012	J

Data qualifiers are defined in Table D-1.
-- Sample not analyzed
Results in bold typeface exceed the MCL.

Appendix E
Soil Data Used in Statistical Analyses

Table E1
Arsenic, Cadmium, and Lead Data for Site Soils - Surface
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
GM-1	surface	Landau Associates 1999	**199**		
GM-2	surface	Landau Associates 1999	**379**		
GM-3	surface	Landau Associates 1999	**273**		
GM-4	surface	Landau Associates 1999	**82**		
GM-5	surface	Landau Associates 1999	**30**		
GM-6	surface	Landau Associates 1999	**81**		
GM-7	surface	Landau Associates 1999	**293**		
GM-8	surface	Landau Associates 1999	**477**		
GM-9	surface	Landau Associates 1999	9		
GM-10	surface	Landau Associates 1999	**130**		
SS-1	surface	Foster Wheeler 1999	**140**	2	**350**
SS-2	surface	Foster Wheeler 1999	**110**	**9.8**	**840**
SS-3	surface	Foster Wheeler 1999	4	1.2	37
TA-1	surface	**Terra Associates 1999**	**330**	2	**830**
TA-2	surface	**Terra Associates 1999**	**120**	**2.3**	**390**
TA-3	surface	**Terra Associates 1999**	**150**	0.4	**280**
TA-4	surface	**Terra Associates 1999**	**160**	1.5	**450**
TA-5	surface	**Terra Associates 1999**	**47**	0.92	54
TA-6	surface	**Terra Associates 1999**	**100**	**9.3**	**470**
TA-7	surface	**Terra Associates 1999**	17	0.29	13
TA-8	surface	**Terra Associates 1999**	**190**	**3**	**550**
TA-9	surface	**Terra Associates 1999**	**98**	1.6	**510**
TA-12	surface	**Terra Associates 1999**	6.1	0.27	58
TA-13	surface	**Terra Associates 1999**	**220**	0.6	**470**
TA-14	surface	**Terra Associates 1999**	18	0.91	70
TA-17	surface	**Terra Associates 1999**	**61**	**6**	240
TA-18	surface	**Terra Associates 1999**	11	0.3	7.1
TA-19	surface	**Terra Associates 1999**	**100**	**6**	**470**
TA-20	surface	**Terra Associates 1999**	**140**	**5.4**	**710**
ERS-11	surface	Foster Wheeler 2000	19	0.5	6
ORS-12	surface	Foster Wheeler 2000	**44**	0.5	18
ORS-13	surface	Foster Wheeler 2000	**66**	0.5	43
SF-1	surface	Foster Wheeler 2000	**24.3**		
SF-2	surface	Foster Wheeler 2000	**38.6**		
SF-3	surface	Foster Wheeler 2000	**47.2**		
SF-4	surface	Foster Wheeler 2000	**81.9**		
SF-5	surface	Foster Wheeler 2000	**172**		
SF-6	surface	Foster Wheeler 2000	**61.2**		
SF-7	surface	Foster Wheeler 2000	19		
SF-8	surface	Foster Wheeler 2000	**89.2**		
SF-9	surface	Foster Wheeler 2000	**53.4**		
SF-10	surface	Foster Wheeler 2000	**82.3**		
SF-11	surface	Foster Wheeler 2000	**77.6**		
SF-12	surface	Foster Wheeler 2000	**94.3**		

Table E1
Arsenic, Cadmium, and Lead Data for Site Soils - Surface
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
SF-13	surface	Foster Wheeler 2000	**69.1**		
SF-14	surface	Foster Wheeler 2000	16.5		
SF-15	surface	Foster Wheeler 2000	**30.3**		
WRS-1	surface	**Foster Wheeler 2000**	**35**	0.05	5
WRS-2	surface	**Foster Wheeler 2000**	**90**	0.05	48
WRS-3	surface	**Foster Wheeler 2000**	**106**	0.05	22
WRS-4	surface	**Foster Wheeler 2000**	**69**	0.05	1
WRS-5	surface	**Foster Wheeler 2000**	**74**	0.05	43
WRS-6	surface	**Foster Wheeler 2000**	**71**	0.05	23
WRS-7	surface	**Foster Wheeler 2000**	**110**	0.05	30
WRS-8	surface	**Foster Wheeler 2000**	**95**	0.05	25
WRS-9	surface	**Foster Wheeler 2000**	**43**	0.05	3
ORS-14	surface	**Foster Wheeler 2001**	15.8	0.562	24.2
ORS-15	surface	**Foster Wheeler 2001**	**45.8**	1.84	62.4
ORS-16	surface	**Foster Wheeler 2001**	**73.2**	1.7	102
ORS-17	surface	**Foster Wheeler 2001**	7.17	0.05	8.97
ORS-18	surface	**Foster Wheeler 2001**	**156**	0.861	198

Notes:
One half the detection limit was used when metal was not detected.
BOLD values exceed MTCA residential cleanup levels of 20 ppm for Arsenic, 2 ppm for Cadmium, and 250 ppm for Lead.
mg/kg - milligram per kilogram.

Table E2
Arsenic, Cadmium, and Lead Data for Site Soils - 0.75 and 0.67-0.83 feet bgs
Northwest Aggregates Sand and Gravel Mine
Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
EP-2	0.67 to 0.83	AESI 1998	**85**		18
EP-3	0.67 to 0.83	AESI 1998	5.8		12
EP-9	0.67 to 0.83	AESI 1998	5.1		9
EP-11	0.67 to 0.83	AESI 1998	4.2		7.6
SS-1	0.75	Foster Wheeler 1999	4	1.6	31
SS-2	0.75	Foster Wheeler 1999	**130**	**2.9**	56
SS-3	0.75	Foster Wheeler 1999	4	1.1	40
TA-1	0.75	Terra Associates 1999	**39**	0.84	27
TA-2	0.75	Terra Associates 1999	**25**	1.2	10
TA-3	0.75	Terra Associates 1999	**110**	0.91	81
TA-4	0.75	Terra Associates 1999	19	0.72	25
TA-5	0.75	Terra Associates 1999	**47**	0.84	59
TA-6	0.75	Terra Associates 1999	**270**	**2.9**	120
TA-7	0.75	Terra Associates 1999	19	0.28	18
TA-8	0.75	Terra Associates 1999	**67**	0.94	41
TA-9	0.75	Terra Associates 1999	**110**	0.95	30
TA-12	0.75	Terra Associates 1999	6.2	0.27	2.7
TA-13	0.75	Terra Associates 1999	**130**	0.82	45
TA-14	0.75	Terra Associates 1999	**130**	1.2	37
TA-17	0.75	Terra Associates 1999	**260**	1.2	35
TA-18	0.75	Terra Associates 1999	8.2	0.29	2.9
TA-19	0.75	Terra Associates 1999	**270**	1.4	67
TA-20	0.75	Terra Associates 1999	11	0.3	11

Notes:
One half the detection limit was used when metal was not detected.
BOLD values exceed MTCA residential cleanup levels of 20 ppm for Arsenic, 2 ppm for Cadmium, and 250 ppm for Lead.
bgs - below ground surface.
mg/kg - milligram per kilogram.

Table E3

Arsenic, Cadmium, and Lead Data for Site Soils - 1.5 feet bgs

Northwest Aggregates Sand and Gravel Mine

Maury Island, Washington

Sample Location	Sample Depth Interval in feet	Data Source	Arsenic Concentration in mg/kg	Cadmium Concentration in mg/kg	Lead Concentration in mg/kg
SS-1	1.5	Foster Wheeler 1999	4	0.5	13
SS-2	1.5	Foster Wheeler 1999	4	1	11
SS-3	1.5	Foster Wheeler 1999	4	1.2	37
TA-1	1.5	Terra Associates 1999	**43**	0.89	23
TA-2	1.5	Terra Associates 1999	8.7	0.28	2.8
TA-3	1.5	Terra Associates 1999	10	0.62	8.6
TA-4	1.5	Terra Associates 1999	4.2	0.27	2.7
TA-5	1.5	Terra Associates 1999	**43**	0.32	51
TA-6	1.5	Terra Associates 1999	**64**	1.1	30
TA-7	1.5	Terra Associates 1999	13	0.27	11
TA-8	1.5	Terra Associates 1999	10	0.27	7.6
TA-9	1.5	Terra Associates 1999	9.2	0.77	7.1
TA-12	1.5	Terra Associates 1999	5.7	0.26	6
TA-13	1.5	Terra Associates 1999	8.2	1.5	8.3
TA-14	1.5	Terra Associates 1999	2	0.92	36
TA-17	1.5	Terra Associates 1999	11	0.26	2.6
TA-18	1.5	Terra Associates 1999	5.9	0.29	6.1
TA-19	1.5	Terra Associates 1999	3.8	0.3	3
TA-20	1.5	Terra Associates 1999	7.6	0.59	6.6

Notes:

One half the detection limit was used when metal was not detected.

BOLD values exceed MTCA residential cleanup levels of 20 ppm for Arsenic, 2 ppm for Cadmium, and 250 ppm for Lead.

bgs - below ground surface.

mg/kg - milligram per kilogram.