REVISED DRAFT

REVISED DRAFT CLEANUP ACTION PLAN
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON
ECOLOGY FACILITY/SITE NO. 95275518

AUGUST 31, 2009

FOR
WASHINGTON STATE DEPARTMENT OF ECOLOGY

GEOENGINEERS

Revised Draft Cleanup Action Plan
Irondale Iron and Steel Plant
File No. 0504-042-00

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List of Acronyms and Abbreviations

ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
bgs	Below ground surface
CAO	Cleanup action objective
CAP	Cleanup action plan
cm	Centimeter
COC	Contaminant of concern
COPC	Contaminant of potential concern
CORP	US Army Corps of Engineers
cPAHs	Carcinogenic polycyclic aromatic hydrocarbons
CSCTM	Conceptual site contaminant transport model
CSEM	Conceptual site exposure model
CSL	Cleanup screening level
CWA	Clean Water Act
DAHP	Washington Department of Archaeology and Historic Preservation
DCA	Disproportionate cost analysis
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
FS	Feasibility study
HPA	Hydraulic project approval
JARPA	Joint Aquatic Resources Permit Application
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MHHW	Mean higher high water

List of Acronyms and Abbreviations (Continued)

MLLW	Mean lower low water
MTCA	Model Toxics Control Act
NWP	Nationwide Permit
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
RCW	Revised Code of Washington
RI	Remedial investigation
RI/FS	Remedial investigation/Feasibility study
SAIC	Science Applications International Corporation
SEPA	State Environmental Policy Act
SHA	Site hazard assessment
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TEE	Terrestrial ecological evaluation
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter
UTS	Universal Treatment Standard
WAC	Washington Administrative Code

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1.0 INTRODUCTION

This document presents the revised draft Cleanup Action Plan (CAP) for upland and aquatic lands at the former Irondale Iron and Steel Plant (Site) in Jefferson County, Washington (Figure 1). The Site is located at 526 Moore Street in the town of Irondale, approximately 5 miles south of Port Townsend. It is located adjacent to Port Townsend Bay and encompasses about 13 acres of upland property and about 1,000 feet of shoreline. This revised draft CAP has been prepared pursuant to the requirements of the Model Toxics Control Act (MTCA) administered by the Washington State Department of Ecology (Ecology) under Chapter 173-340 of the Washington Administrative Code (WAC), and the requirements of the Sediment Management Standards (SMS) administered by Ecology under Chapter 173-204 WAC. The revised draft CAP provides a general description of the proposed site-wide cleanup action and sets forth functional requirements that the cleanup must meet to achieve the cleanup action objectives for the site.

The purpose of the revised draft CAP is to:

- Describe the Site, including a summary of its history and extent of contamination;
- Identify site-specific cleanup levels and points of compliance for each contaminant of concern (COC) and applicable exposure medium;
- Identify applicable state and federal laws for the proposed cleanup action;
- Summarize the cleanup action alternatives evaluated in the Feasibility Study (FS);
- Identify and describe the selected cleanup action alternative for the Site;
- Outline elements of the selected cleanup action for the different media that result in protection of human health and the environment; and
- Discuss environmental covenants and Site use restrictions.

Ecology's Toxic Cleanup Program is managing the Remedial Investigation/Feasibility Study (RI/FS) and the CAP for the Site through its contract with Science Application International Corporation (SAIC). GeoEngineers is working in collaboration with SAIC as a teaming partner on this project under agreement between SAIC and Ecology titled "Hazardous Substances Site Investigation & Remediation for the Toxics Cleanup Program Contract # C0700034; Work Assignment # SAI017." GeoEngineers is responsible for completing the revised draft RI/FS and revised draft Cleanup Action Plan (CAP) for both the upland and aquatic portions of the Site, and SAIC provides technical oversight, sediment sampling and evaluation, and contract management.

2.0 SUMMARY OF SITE CONDITIONS

Various investigation and cleanup activities have been conducted at the Site since 1996. The revised draft RI/FS report prepared in August 2009 describes investigations conducted between 2007 and 2009 at the Site (GeoEngineers, 2009). The purpose of the investigations was to collect, develop, and evaluate sufficient information to allow the selection of an appropriate cleanup action for the Site. Because the Site includes upland areas and aquatic lands, as shown in Figure 2, the media investigated included soil, sediment, groundwater, and surface water. In addition to the 2007 to 2009 investigations, the scope and results of previous investigations were also described in the RI/FS report to provide a comprehensive summary of Site conditions. This section summarizes pertinent environmental conditions at the Site (i.e., nature and extent of contamination) and an overview of the conceptual site model. More detailed descriptions of Site conditions are provided in the revised draft RI/FS report.

2.1 SITE HISTORY

The Site history described in this section was obtained from previous reports, primarily Jefferson County's 2001 Site Hazard Assessment (SHA; Jefferson County, 2001).

Industrial activities took place at the Site from 1881 through 1919. The iron and steel plant produced the first batch of iron in 1881, and the steel production plant was operational beginning in 1909. The Irondale Iron and Steel Plant consisted of a blast furnace and cast house, steel production building (including three open-hearth furnaces and a steel rolling mill), boiler plant, six charcoal kilns (also referred to as beehive kilns), miscellaneous support buildings (raw material warehouses, power house, machine shop, engine shop, and other supporting buildings), a 600-foot wharf and a 6,000-barrel (252,000-gallon) aboveground storage tank (AST) for fuel oil. At its peak in 1910, the steel plant produced more than 700 tons of steel per day and employed 600 workers. The plant was closed in 1911 and was reopened between 1917 and 1919 because of the demand for steel during World War I. The estimated locations of former structures associated with the iron and steel plant are shown in Figure 2.

Since 1919, no other waste-generating industry has used the Site. From the mid-1970s until 1999, the beach area east of the Site was used as log storage for the Port Townsend Paper Company. A review of the Site history and potentially liable parties by Ecology (Ecology, 2007) states that Cotton Engineering and Shipbuilding Corporation, later known as the Cotton Family Limited Partnership, owned the property from 1943 until December 30, 2002, when the property was sold to Jefferson County. Jefferson County bought the property to use as a recreational area and has operated the Site as Irondale Beach Park since that time.

In November 2005, a park visitor notified Ecology about an oily residue on the beach at the Site. After an initial investigation, Ecology determined that there was evidence of contamination along the beach. Ecology and Jefferson County conducted additional sampling to investigate the source of this contamination. Ecology placed the Site on the suspected contaminated site list in March 2006. Irondale Beach Park has been identified as a high-priority cleanup area as part of the Puget Sound Initiative.

In December 2006, Irondale Beach Park was closed pending concerns about potential human health risk. In April 2007, Irondale Beach Park was reopened to the public. However, Jefferson County posted signs warning of possible risk to human health from consumption of intertidal shellfish harvested in the area. As of May 29, 2009, the Washington State Department of Health (DOH) Office of Shellfish and Water Protection has a marine biotoxin advisory for the Irondale Beach Park area; DOH also indicated that the Chimacum Creek Tidelands were not affected by the marine biotoxin advisory (DOH website accessed July 15, 2009). The Chimacum Creek Tidelands are immediately north of the Irondale Beach Park as shown in Figure 1.

The Site is part of the Irondale National Historic District designated by the National Park Service and listed on the National Register of Historic Places. It is our understanding from conversations with Ecology that the only environmental cleanup known to have been conducted at the Site is the removal of oily debris from the bottom of the former AST by Jefferson County. The Jefferson County web page describes this action being completed in January 2006 (Jefferson County, 2009).

2.2 CONCEPTUAL SITE MODELS

A conceptual site contaminant transport model (CSCTM) was developed to describe historical release(s) of hazardous substances at the Site and the subsequent potential migration of those hazardous substances in environmental media. The potential contaminant sources and transport mechanisms are summarized below.

- While the Irondale Plant operated (1881 to 1919), there were likely spills and releases of fuel oil and lubricating oil to the soil and/or beach, especially in the vicinity of the former fuel AST and associated piping. Iron ore, coke and slag were also likely spilled or dumped in the vicinity of the former wharf used to unload cargo and in the coke warehouse and charcoal kiln areas. Airborne contaminated particles emitted from the kilns and other on-site smoke sources were likely deposited on the ground surfaces. All of these releases represent potential sources of contamination to soil, water and sediment.
- Stormwater and general surface runoff while the Irondale Plant was operating transported contaminants downhill to topographic depressions and the beach. As vegetation became established throughout the Site, after closure of the mill and transition to a park, the volume of stormwater runoff would be reduced.
- Sometime after the Irondale Plant closed, the buildings were demolished and much of the debris was spread around the Site. Log storage activities resulted in regrading and filling of portions of the near-shore areas. These land disturbance activities spread slag, debris and possibly contaminants around the former buildings and near-shore area. These activities also placed clean dredge sand and wood debris over portions of the former ground surface, potentially burying contaminated soil under clean fill.
- Some contaminants (e.g., copper, nickel, carcinogenic polycyclic aromatic hydrocarbons [cPAHs], and total petroleum hydrocarbons [TPH]) in soil leach into groundwater and are transported as dissolved chemicals in groundwater. Groundwater flows toward Port Townsend Bay, where it discharges in the intertidal area potentially contaminating surface water and sediments.
- In the area of the large 6,000-barrel (252,000-gallon) former AST, petroleum hydrocarbons have been released in sufficient quantities to accumulate as free product and migrate toward the Bay. As free product moves laterally and vertically as the groundwater table rises and falls, the free product adheres to soil, enlarging the area of soil contamination (both laterally and vertically).
- Waves along the shoreline erode areas with contaminated soil and groundwater. This erosion releases contaminants to sediments and Port Townsend Bay and distributes debris along the beach.

To provide a framework for interpreting the data presented in the RI, human health and ecological conceptual site exposure models (CSEM) were developed. In particular, the CSEMs were developed to identify complete exposure pathways and potential receptors for the contaminants of potential concern (COPC) detected in various environmental media at the Site. A complete exposure pathway consists of: (1) an identified contaminant source, (2) a release/transport mechanism from the source to locations (exposure points) where potential receptors may come in contact with COPCs, and (3) an exposure route (for example, soil ingestion) where potential receptors may be exposed to COPCs. Exposure pathways deemed to be incomplete (e.g. groundwater ingestion) were not considered further in the RI. The human health and ecological CSEMs are summarized in the following table.

Summary of Conceptual Site Exposure Models	
CSEM Element	**Model Factors**
Contaminant Sources	Petroleum hydrocarbons/PAHs in soil, sediment and groundwater associated with former fuel handling/storage area; smelter process waste (slag); metals in soil from historic dumping and airborne fallout from past Site operations; and building debris in shallow upland soils.
Release Mechanisms and Migration	Leaching of contaminants from soil to groundwater to surface water and sediment; biota uptake of metals from soil (biota then ingested by other ecological receptors); wave erosion along shoreline exposing petroleum contaminated soils or sediments or metals contaminated soil.
Exposure Routes	Ecological: Ingestion for terrestrial and aquatic ecological receptors, direct contact for ecological receptors and plant uptake Human: Direct contact and incidental ingestion
Potential Receptors	Ecological: Plants, soil and sediment biota, wildlife Human: Recreational users, park workers

2.2.1 Potentially Complete Exposure Pathways – Humans

A graphical presentation of the human health CSEM is presented as Figure 3. Current and expected future use of the Site is as a public park. People who could potentially be exposed to COPCs at the Site include site visitors. Because residential exposures and associated risks are typically greater than exposures/risks to site visitors, a hypothetical residential scenario (that is, unrestricted land use) was assumed for the purpose of conservatively assessing potential human health risks in the RI.

Soil

Complete soil-based exposure pathways exist for humans throughout the upland portion of the Site, via incidental soil ingestion, dermal contact with soil and inhalation of particulates. In accordance with WAC 173-340-740, human health exposure to on-site soil is evaluated based on the direct contact with soil exposure pathway (that is, incidental soil ingestion; unrestricted land use).

Groundwater

Dermal contact with groundwater is considered a complete exposure pathway for humans. People may be exposed to groundwater COPCs south of the AST area where groundwater seeps are apparent. Additionally, people may be exposed to groundwater where it discharges to Port Townsend Bay. Because groundwater ingestion at these two locations is expected to be minimal, groundwater ingestion is identified as a "complete but insignificant exposure pathway."

Surface Water

A complete potential pathway exists for human exposure to COPCs in surface water in Port Townsend Bay via consumption of fish. Human exposure to surface water from occasional incidental ingestion of water in the drainage at the northern end of the Site (while wading in the water, for example) was considered as a possible exposure pathway during development of the CSEM. However, potential exposures from occasional incidental ingestion are unlikely to exceed the hypothetical human exposures from fish consumption (bioaccumulation pathway) that form the basis for numerical criteria used in the RI to derive surface water screening levels.

Sediment
Potentially complete exposure pathways exist for human exposure to COPCs in intertidal sediments via incidental ingestion and dermal contact with sediment and ingestion of shellfish.

2.2.2 Potentially Complete Exposure Pathways – Ecological Receptors

A graphical presentation of the ecological conceptual site exposure model is presented as Figure 4. Several complete potential exposure pathways exist for ecological receptors under current and likely future Site use conditions. Ecological receptors that may be exposed to COPCs include plants, soil biota and wildlife (mammals and birds) in the terrestrial environment, and benthic invertebrates and fish in the aquatic environment.

Soil
Potentially complete exposure pathways exist for exposure of terrestrial ecological receptors to COPCs throughout the upland area via direct contact (plants and soil biota), incidental ingestion (wildlife), and consumption of plants or soil biota (wildlife – bioaccumulation pathway).

Groundwater
Potentially complete exposure pathways exist for exposure of terrestrial ecological receptors to COPCs in groundwater via direct contact (plants and soil biota). The depth to groundwater throughout most of the Site is greater than typical rooting or burrowing depths; therefore, these exposure pathways are generally assumed to be insignificant. However, because of the presence of groundwater seeps south of the AST area, plant uptake of COPCs in groundwater is considered a complete exposure pathway. Ecological receptors may also be exposed to COPCs in groundwater indirectly at locations where groundwater discharges to surface water in Port Townsend Bay. Therefore, ecological exposure to groundwater is evaluated via potential surface water exposure.

Surface Water
A complete potential pathway exists for benthic invertebrate and fish exposure to COPCs in surface water.

Sediment
Complete potential pathways exist for exposure of aquatic ecological receptors to COPCs in Port Townsend Bay intertidal sediment via direct contact (benthic invertebrates, fish and shellfish) and consumption of benthic invertebrates and/or fish (wildlife – bioaccumulation pathway).

2.3 SUMMARY OF ENVIRONMENTAL CONDITIONS

The extent and nature of contamination was investigated in the upland and sediment portions of the Site through several phases of study between 2007 and 2009. Figures 5 and 6 show the locations of environmental samples collected prior to and during the recent remedial investigation (RI) activities at the Site. Figure 7 presents the location of terrestrial ecological evaluation samples collected at the site. The results from these studies show that on portions of the Site soil, sediment, and groundwater contain concentrations of arsenic, copper, iron, lead, nickel, zinc, cPAHs and petroleum hydrocarbons that pose a potential risk to human health and the environment. The greatest concentrations of metals are associated with debris and industrial process waste (slag) generally concentrated in areas around the former steel production, power house, stock house and blast furnace buildings. Petroleum hydrocarbon contamination is associated with a former 6000-barrel above ground fuel storage tank located on the southeastern portion of the site.

2.3.1 Sediment

Intertidal Sediment

Intertidal sediment is defined as sediment between mean lower low water (MLLW; see Figure 6) and mean higher high water (MHHW). In the areas east of the former AST and south of the Slag Outcrop, the near-shore surface sediments are generally medium to coarse sand with shell fragments, bricks and occasional slag. Surface sediments farther into the water generally consist of silty fine to medium sand with occasional shells and bricks. The surface sediment closer to the Slag Outcrop consist of coarse slag with sand and shell fragments, while surface sediment at locations SED09 and SED22, which are the southernmost RI sediment sample locations, consists of brick and slag cobbles with medium to coarse sand and shells. Surface sediments north of the former wharf generally consist of fine to medium sand with silt, shell fragments, and slag.

Native sediments were identified throughout one intertidal boring and fill was identified in the other four borings at depths ranging from 4 to 7 feet below ground surface (bgs).

Subtidal Sediment

Subtidal sediment is defined as sediment below MLLW (see Figure 6). Subtidal surface sediments consist primarily of fine sand with silt with some shell debris, organic matter, and a slight to moderate sulfide odor. Sand generally constituted 52 to 72 percent of the subtidal sediment samples.

Summary of Sediment Contaminants

There were no SMS analytes detected at concentrations greater than the SMS criteria in the bioactive zone of 0 to 4 inches bgs. However, benzo(a)pyrene and chrysene were detected at one intertidal sediment location (SED02; at a depth of 4 to 18 inches) at concentrations greater than dry weight sediment screening criteria. Ecology recommends reporting sediment data for nonionic organic chemicals (PAHs, chlorobenzenes, phthalates, and PCBs) as organic carbon normalized and as dry weight (Ecology, 1992). The dry weight comparison was necessary due to the elevated total organic carbon (TOC) concentration of 10.4 percent in sample SED02-070628-4-18. Typical TOC values for Puget Sound marine sediments range from 0.5 to 3 percent (Ecology, 1992). Also, 2,4-dimethylphenol was detected at concentrations greater than SMS criteria at locations SED18 and SED20 (at depths of 5 and 1.5 feet, respectively). 2,4-Dimethylphenol was not detected in other sediment samples collected at the Site. The benzo(a)pyrene, chrysene, and 2,4-dimethylphenol exceedances of sediment screening levels are shown in Figure 8. The location of these exceedances are within the TPH Sediment Remediation Areas shown in Figure 14.

Thirty-four sediment samples were obtained during the RI and analyzed for TPH. The concentrations ranged from not-detected to 15,700 mg/kg (total of diesel- and heavy oil-range petroleum hydrocarbons). The oil identified in these samples was characterized by the analytical laboratory as “extremely” and “very” weathered oil, similar to that detected in soil. Based on chromatographs from the analytical tests, Ecology’s chemist identified the oil as heavy oil-range petroleum hydrocarbons. This description of the oil is consistent with oil identified in the upland and consistent with the historic uses at the Site. In addition, Hart Crowser obtained two sediment samples in 1996, Ecology obtained three sediment samples in 2005, and Jefferson County obtained 36 sediment samples (from 12 locations) in 2007. Note that the locations of the 2005 sediment samples appear to be in the area of TPH contamination identified in the Jefferson County and RI sediment samples; however, the exact location of these samples is not known. The TPH concentrations in the 2005 sediment samples range from 550 to 40,600 mg/kg.

Petroleum hydrocarbon exceedances of the bioassay sediment screening level of 136 mg/kg are shown in Figure 8. The bioassay sediment screening level was derived by SAIC based on bioassays conducted on intertidal sediment samples. TPH-contaminated sediment appears to be located in an approximately 5- to 12-foot-thick interval that extends from the shoreline east of the former AST to approximately 50 feet seaward of the shoreline bank. This location of the contamination is illustrated in Figure 9, which is a cross section through this area, and Figure 12, which shows the lateral boundary of the sediment exceedances and the expected limits of the sediment cleanup action. As illustrated in Figure 12, all of this area is in the intertidal zone (above MLLW) and subject to tidal fluctuations.

2.3.2 Soil

The Site is underlain by a combination of fill and native soil. The fill varies in thickness from zero to approximately 15 feet and is present along all of the near-shore area and beneath former building areas (details of the composition of the fill are outlined below). Most of the upper foot or more of the Site has been disturbed by the prior industrial activities. Native soils underlie the fill and consist of unconsolidated landslide deposits (DNR, 2005). Native soil encountered in explorations consisted of loose gray to brown sand with varying amounts of silt, shell fragments and gravel. Native sediments exposed in the steeper portion of the Site consist of loose sand and silt. A thin layer of topsoil and/or forest duff covers most of the upland portion of the Site.

The fill material encountered beneath the Site is described below; although not all types are present everywhere. Listed in general order from ground surface to deeper, they are:

- Bricks and brick fragments from the former structures. These materials are found around most of the former buildings and the area where the charcoal kilns were located. Brick fragments are also common along the beach below the former kilns and on several of the paths through the park. A layer of charcoal is present near the surface in the former kiln area.
- Loose grey sand with gravel and shell fragments with occasional chips of wood and coke fragments. Along the near-shore area where logs were formerly stored, there is a layer of woody material at the surface of the ground or/and mixed in with the granular material.
- Loose sand with slag and building debris, including some areas that are entirely slag. This fill layer was identified in most of the Site seaward of the steel production buildings and boiler house complex.

General

Metals (arsenic, copper, iron, lead, nickel and zinc), cPAHs, and heavy-oil range petroleum hydrocarbons were detected in Site soil at concentrations greater than preliminary cleanup levels established for the Site (GeoEngineers, 2009). The specific depth intervals and COPCs detected in soils at concentrations greater than preliminary cleanup levels are shown in Figures 8 through 11. Figures 12 and 13 present the limits of upland soil exceeding cleanup levels and the basis for the extent of the upland soil cleanup action.

Petroleum Hydrocarbons and cPAHs

Heavy oil exceedances were limited to the area near the Former AST TPH Area in the upland and extending into the intertidal area. TPH-contaminated soil appears to be located in an approximately 3- to 12-foot-thick interval that extends from near the south side of the former AST to approximately 60 feet seaward of the shoreline bank.

cPAHs were detected at concentrations greater than preliminary cleanup levels near the Former AST TPH Area and at one sample location at the Power House Complex. The exceedances near the former AST are likely associated with heavy oil that was also identified in these samples. cPAH concentrations at these three locations ranged from 54 to 590 micrograms per kilogram (µg/kg).

Metals

Arsenic, copper, iron, nickel, lead and zinc were each detected at concentrations greater than preliminary cleanup levels in at least one soil sample (see Figures 10 and 11). Metals exceedances are located in four general areas of the Site:

- **Steel Production Building:** Metals (arsenic, copper, iron and nickel) were detected at concentrations greater than preliminary cleanup levels in soil samples obtained between 0.5 and 2 feet bgs. Metals concentrations in soil samples obtained from depths of 3 to 5 feet bgs at these locations were less the soil screening levels, indicating that metals contamination at the steel production building may be limited to the top few feet of fill material.
- **Power House Complex:** Metals (arsenic, copper, iron, lead, nickel and zinc) were detected at concentrations greater than preliminary cleanup levels in soil samples obtained between 0.5 and 3 feet bgs. The vertical extent of metals contamination was not defined at two of three sample locations with exceedances; therefore, the excavation alternative evaluated in the FS assumed removal of soil to a depth of 6-feet (the conditional point of compliance for terrestrial ecological receptors).
- **TP08 (seaward of AST) Vicinity:** Metals (arsenic, copper, iron and zinc) were detected at concentrations greater than preliminary cleanup levels in soil samples obtained between 0.5 and 6 feet bgs. The vertical extent of metals contamination was not defined at all locations with exceedances; therefore, the excavation alternative evaluated in the FS assumed removal of soil to a depth of 6-feet (the conditional point of compliance for terrestrial ecological receptors).
- **Slag Outcrop Area:** Metals (arsenic, copper, iron and nickel) were detected at concentrations greater than preliminary cleanup levels in one of two slag samples obtained from the slag outcrop. Because the metals in the slag are not expected to be readily bioavailable (that is, the slag is in a rock-like form that will limit ingestion and dermal contact with metals in the slag), these elevated metals concentrations do not indicate an immediate concern to human health and the environment. Therefore, this area was not identified as in the FS as an area requiring remedial action; however, the slag outcrop area is included as an area associated with shoreline restoration activities.

2.3.3 Groundwater

Static groundwater measurements obtained in the four Site monitoring wells in December 2007 and January 2009 indicate that shallow groundwater occurs about 4 to 6 feet bgs in the near-shore area. These measurements were obtained during both falling and rising tidal cycles, but do not represent conditions during extreme high or low tides. Groundwater levels near Port Townsend Bay may be higher or lower during these tides. Groundwater occurs in both fill material and native sediments.

As expected based on the site topography and confirmed through the groundwater monitoring results, groundwater flows from the upland to the east toward Port Townsend Bay, discharging in the intertidal area. It should be noted that the monitoring well data are not representative of steeper (western) portions of the upland because monitoring wells were not installed in these areas. However, it is reasonable to assume that groundwater flows from these higher elevation areas toward the Bay.

Precipitation is the main source of recharge to groundwater at the Site. Other sources of recharge may include septic drainage fields and stormwater/irrigation runoff related to residences located upgradient of the Site.

There are no groundwater supply wells located on, or within ½ mile of, the Site, and groundwater is not a current source of drinking water. Groundwater beneath the Site satisfies the criteria in MTCA (WAC 173-340-720) for classification as nonpotable groundwater (see GeoEngineers, 2009 for additional details).

Groundwater samples obtained from monitoring wells MW02 through MW05 were analyzed for total and dissolved metals (arsenic, copper, iron, lead, nickel and zinc), petroleum hydrocarbons and PAHs. Petroleum hydrocarbons were detected at concentrations greater than preliminary cleanup levels in MW-02, which is located near the former AST and in the area where high concentrations of petroleum hydrocarbons were identified in soil. Groundwater in MW02 also contained evidence of free product in the form of blebs of oil and heavy sheen on the purge water extracted during sampling. Combined TPH concentrations in samples obtained from MW02 ranged from 1.1 to 3.5 milligrams per liter (mg/L)[1]. The MTCA Method A screening criterion is 0.5 mg/L. TPH was not detected in samples from the other monitoring wells or from the direct-push borings. Dissolved copper and nickel were detected at concentrations greater than preliminary cleanup levels in samples obtained from monitoring wells MW02 and MW03. cPAHs were detected at concentrations greater than the preliminary cleanup level in monitoring well MW02, where elevated petroleum hydrocarbons were also detected.

2.3.4 Surface Water

A surface water drainage exists along the northern boundary of the Site (Figure 2). This drainage enters the Site near the northwestern site boundary and discharges through a metal culvert on the beach near the northern corner of the Site. The length of the portion of the drainage that is located on the Site is about 500 feet. The drainage is about 10 to 20 feet wide and has a dense cover of vegetation. The sources of water contributing to this drainage are not known, although one property owner stated it was "spring fed." The drainage originates in the housing area above the Site.

Two surface water samples, one upstream and one downstream from within the surface water drainage ditch along the north Site boundary, were analyzed for total and dissolved metals. Arsenic and copper were detected at concentrations greater than preliminary cleanup levels. However, the total and dissolved metal concentrations were similar in the downstream sample and the upstream sample; indicating that contamination at the Site is not impacting water in the surface drainage. With the exception of iron, the concentrations of metals identified in the surface water samples are similar to the concentrations identified in the groundwater sample obtained from the closest monitoring well (MW04). Groundwater elevation data suggest that groundwater and surface water in the drainage are hydrologically connected in the vicinity of MW04.

3.0 CLEANUP REQUIREMENTS

The MTCA cleanup regulations provide that a cleanup action must comply with cleanup levels for identified COPCs, points of compliance, and applicable or relevant and appropriate requirements (ARARs) based on federal and state laws (WAC 173-340-710). The Site cleanup levels, points of compliance, and ARARs for the selected cleanup remedy are briefly summarized in the following sections.

[1] Duplicate samples from this well had non-detectable (<0.50 mg/L) TPH.

3.1 CLEANUP ACTION OBJECTIVES

This section presents cleanup action objectives (CAOs), applicable regulatory requirements for the cleanup action, and a screening evaluation of general response actions and remediation technologies that are potentially applicable to the Site.

CAOs consist of chemical- and medium-specific goals for protecting human health and the environment. The CAOs specify the media and contaminants of interest, potential exposure routes and receptors, and proposed cleanup goals. The CAOs for these areas are presented below.

3.1.1 Soil and Groundwater (Uplands)

The objective of the proposed uplands cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by hazardous substances in soil and groundwater in accordance with the MTCA Cleanup Regulation (WAC 173-340) and other applicable regulatory requirements. Specifically, the objective of the uplands cleanup is to mitigate risks associated with the following potential exposure routes and receptors:

- Contact (dermal, incidental ingestion, or inhalation) by visitors, workers (including excavation workers), and other Site users with hazardous substances in soil;
- Contact (incidental ingestion) by terrestrial wildlife with hazardous substances in soil;
- Contact by terrestrial plants and soil biota and/or food-web exposure to hazardous substances in soil;
- Contact (dermal) by visitors, workers (including excavation workers), and other site users with hazardous substances in groundwater,
- Contact by terrestrial plants (via root uptake) to hazardous substances in groundwater; and
- Exposure by aquatic organisms to hazardous substances in soil that erodes, or groundwater that migrates, to the marine environment.

The cleanup goal for the uplands areas is to mitigate these risks by meeting the soil and groundwater cleanup standards identified below in Section 3.2.

3.1.2 Sediment (Marine Area)

The objective of the proposed marine area cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by Site-related hazardous substances in marine sediment in accordance with the MTCA Cleanup Regulation (WAC 173-340), SMS regulations (WAC 173-204) and other applicable regulatory requirements. Specifically, the objective of the Marine Area cleanup is to mitigate risks associated with the following potential exposure routes and receptors:

- Exposure of benthic organisms to Site-related hazardous substances in the biologically active zone of sediment (the upper 10 centimeters (cm) below the mudline);
- Ingestion by aquatic organisms of benthic organisms contaminated by Site-related hazardous substances in sediment;
- Contact (dermal) by Site visitors with hazardous substances in sediment; and

- Ingestion by Site visitors of marine organisms contaminated by Site-related hazardous substances in sediment.

The cleanup goal for the marine area is to mitigate these risks by meeting the sediment groundwater cleanup standards identified below in Section 3.2.

3.2 CLEANUP STANDARDS

Cleanup standards consist of: 1) cleanup levels that are protective of human health and the environment, and 2) the point of compliance at which the cleanup levels must be met. Preliminary site-specific cleanup standards were developed in the RI and adopted during preparation of the FS for the purpose of developing the cleanup action objectives (CAOs) described above for the Site.

Site-specific cleanup levels for soil that are protective of human health and terrestrial ecological receptors, and cleanup levels for groundwater that are protective of marine surface water, were developed in accordance with MTCA requirements. Under MTCA, the point of compliance is the point or location on a site where the cleanup levels must be attained. The sections below describe the proposed cleanup levels and points of compliance for soil, groundwater, and sediment. A summary of the proposed cleanup levels and points of compliance is presented in the table below.

Overview of Cleanup Levels and Points of Compliance

Constituent	Cleanup Level and Media		
	Soil (mg/kg)	Groundwater (ug/l)[1]	Sediment (mg/kg)
Arsenic	18	Not a groundwater COC	Not a sediment COC
Copper	70	2.4	Not a sediment COC
Iron	58,700	Not a groundwater COC	Not a sediment COC
Lead	120	Not a groundwater COC	Not a sediment COC
Nickel	48	8.2	Not a sediment COC
Zinc	160	Not a groundwater COC	Not a sediment COC
cPAHs	0.137	0.018	Not a sediment COC
Benzo(a)pyrene	Not a soil COC	Not a groundwater COC	1.6
Chrysene	Not a soil COC	Not a groundwater COC	1.4
2,4-Dimethylphenol	Not a soil COC	Not a groundwater COC	0.029
TPH	136	500	136
Point of Compliance based on MTCA	Upper 6 feet (ecological) and Upper 15 feet (human health)[2]	Point of entry to Port Townsend Bay	Biologic active zone and vertical extent of TPH to 136 mg/kg

1 Groundwater cleanup levels are the most conservative (lowest) published numerical values selected from available state and federal surface water criteria as outlined in WAC 173-340-730(3) [see Section 3.2.2 for details].

2 The point of compliance for soil is 6 feet for terrestrial ecological receptors and 15 feet for human health receptors [see Section 3.2.1 for details]. The terrestrial ecological receptor point of compliance is being applied at the TP08 Vicinity, while the human health point of compliance is being applied at the Former AST Area.

3.2.1 Soil

Based on existing and future land use as a Jefferson County Park the Site is considered to be "unrestricted" (a.k.a. residential) with regard to MTCA exposure evaluations. Accordingly, Method B cleanup levels apply to the human health exposure pathway for soil beneath the upland portion of the Site.

The standard point of compliance (upper 15 feet) is considered applicable to prevent exposure by direct contact to Site soil, as defined in WAC 173-340-740(6)(d).

For potential terrestrial ecological exposures, MTCA regulations allow a conditional point of compliance to be established from the ground surface to 6 feet bgs (the biologically active zone according to MTCA default assumptions), provided institutional controls are used to prevent excavation of deeper soil [WAC 173-340-7490(4)(a)]. Accordingly, in areas of the Site where potential ecological exposures are a concern, and where appropriate institutional controls can be implemented, a conditional point of compliance for soil concentrations protective of terrestrial ecological receptors may be proposed throughout the soil column from the ground surface to 6 feet bgs.

Table 1 presents the process of comparing human health and terrestrial ecological screening levels to develop site-specific cleanup levels for soil at the Site.

3.2.2 Groundwater

The highest beneficial use of groundwater beneath the Site is based on the protection of surface water resources (Port Townsend Bay), as specified in WAC 173-340-720. Therefore, groundwater beneath the site is subject to the surface water standards. Because the groundwater cleanup levels are based on protection of marine surface water and not protection of groundwater as drinking water and as provided for in WAC 173-340-720(8)(i), the proposed conditional point of compliance for the groundwater cleanup levels is the point or points where groundwater flows into Port Townsend Bay.

In general, the most conservative (lowest) published numerical values selected from available state and federal surface water criteria as outlined in WAC 173-340-730(3) were selected as the cleanup level.

3.2.3 Sediment

Sediment cleanup levels were developed according to MTCA and SMS requirements and direction provided by Ecology. Two SMS criteria are promulgated by Ecology (WAC 173-204-320). These include the Sediment Quality Standard (SQS), the concentration below which effects to benthos are unlikely, and the cleanup screening level (CSL), the concentration above which more than minor adverse biological effects may be expected. The SQS and CSL values have been developed for a suite of chemicals that includes metals, PAHs and other semivolatile organic compounds (SVOCs), PCBs, and ionizable organic compounds (select phenols, benzyl alcohol, and benzoic acid). The SQS are the most stringent SMS criteria and are used in the FS as sediment cleanup levels for the SMS constituents detected in sediment at the Site.

There is no promulgated SMS criterion for petroleum hydrocarbons in sediment. Therefore, SAIC developed a site specific cleanup level of 136 mg/kg for total petroleum hydrocarbons based on sediment bioassays.

For marine sediments potentially affected by Site-related hazardous substances, the point of compliance for protection of the environment is surface sediments within the biologically active aquatic zone, represented by samples collected across the top 10 cm (i.e., 0 to 4 inches) below the mudline. Since erosion may remove shallow sediment over time, effectively moving the bottom of the biologically active zone deeper compared to current conditions, Ecology determined that the vertical point of compliance in areas with petroleum hydrocarbons should be the vertical extent of sediment with combined TPH concentrations greater than the cleanup level of 136 mg/kg.

3.3 APPLICABLE REGULATORY REQUIREMENTS

In addition to the cleanup standards developed through the MTCA process and presented above, other regulatory requirements must be considered in the selection and implementation of the cleanup action. MTCA requires the cleanup standards to be "at least as stringent as all applicable state and federal laws" [WAC 173-340-700(6)(a)]. Besides establishing minimum requirements for cleanup standards, applicable state and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710. Table 2 presents the ARARs identified as being applicable at this Site.

Additional activities that need to take place prior to implementing the cleanup actions:

- The anticipated cleanup action qualifies for a U.S. Army Corps of Engineers (Corps) Nationwide Permit 38 (NWP 38). Nevertheless, federal consultation under the Endangered Species Act, Section 401 Water Quality Certification, and other substantive requirements must still be met by the cleanup action. Ecology will be responsible for issuing the final approval for the cleanup action, following consultation with other state and local regulators. The Corps will separately be responsible for issuing approval of the project under NWP 38, following Endangered Species Act consultation with the federal Natural Resource Trustees, and also incorporating Ecology's 401 Water Quality Certification.
- Because the proposed project area is part of the Irondale Historic District identified on the National Register of Historic Places, a Cultural Resources Assessment will need to be performed and a Monitoring and Treatment Plan will need to be prepared prior to implementing cleanup actions that cause disturbance to the land. Additionally, a permit from the Washington State Department of Archaeology and Historic Preservation (DAHP) will be needed for the field work portions of the Cultural Resources Assessment. Input will also be requested from local Tribes regarding both the cultural resources assessment and cultural resources monitoring during remedial activities, with cultural resource protocols being developed considering Tribal input.

4.0 ALTERNATIVES CONSIDERED AND BASIS FOR REMEDY SELECTION

This section summarizes the results of developing and evaluating remedial action alternatives performed in the RI/FS.

4.1 REMEDIAL ALTERNATIVES CONSIDERED

A range of potential cleanup action alternatives were evaluated in the RI/FS report (GeoEngineers, 2009). The process of developing remedial alternatives for evaluation involved screening applicable remediation technologies for inclusion in a reasonable set of complete remedial action alternatives. Each remedial action alternative includes a component that addresses each of the Site subunits or contaminant groups. The screening and assembly of remediation technologies resulted in five complete remedial alternatives that were evaluated in the RI/FS. The components of the five remedial alternatives are described in Table 3 and listed below.

- Alternative 1 – Implement Site-wide institutional controls;

- Alternative 2 – Implement upland or marine capping for contaminated areas;
- Alternative 3 – Excavation and disposal of contaminated soil in the AST area, the area associated with sample TP-08, and contaminated intertidal sediment and institutional controls for contaminated upland soil in the Steel Production Building and Power House Complex;
- Alternative 4 – Excavation and disposal of contaminated soil in the AST area, the area associated with sample TP-08, and contaminated intertidal sediment with installation of a geotextile and soil cap for contaminated upland soil in the Steel Production Building and Power House Complex; and
- Alternative 5 – Excavation and disposal of contaminated soil and sediment at the Site.

4.2 Evaluation Methodology

The five remedial alternatives developed in the FS were evaluated in accordance with the process outlined by MTCA for evaluating cleanup action alternatives. As a first step, the alternatives were evaluated with respect to the threshold requirements that must be met. Cleanup actions performed under MTCA must comply with several basic requirements. Cleanup action alternatives that do not comply with these criteria are not considered suitable cleanup actions under MTCA. As provided in WAC 173-340-360(2)(a), the four threshold requirements for cleanup actions are:

- Protect human health and the environment;
- Comply with cleanup standards;
- Comply with applicable state and federal laws; and
- Provide for compliance monitoring.

For the alternatives that were determined to meet the MTCA threshold criteria, the MTCA disproportionate cost analysis (DCA) process was used to evaluate which of the alternatives that meet MTCA threshold requirements are permanent to the maximum extent practicable. As outlined in WAC 173-340-360(3)(e), MTCA provides a methodology that uses the criteria below to determine whether the costs associated with each cleanup alternative are disproportionate relative to the incremental benefit of the alternative above the next lowest-cost alternative. The comparison of benefits relative to costs may be quantitative, but will often be qualitative. Costs are disproportionate to benefits if the incremental costs of the more permanent alternative exceed the incremental degree of benefits achieved by the other lower-cost alternative [WAC 173-340-360(e)(i)]. Where two or more alternatives are equal in benefits, Ecology selects the less costly alternative [WAC 173-340-360(e)(ii)(c)]. Seven criteria are used in the disproportionate cost analysis as specified in WAC 173-340-360(2) and (3):

- Protectiveness;
- Permanence;
- Cost;
- Long-Term Effectiveness;
- Management of Short-Term Risks;
- Implementability; and
- Consideration of Public Concerns.

Each of the MTCA criteria used in the DCA are described below.

Protectiveness

The overall protectiveness of a cleanup action alternative is evaluated based on several factors. First, the extent to which human health and the environment are protected and the degree to which overall risk at a Site is reduced are considered. Both on-site and off-site reduction in risk resulting from implementing the alternative are considered.

Permanence

MTCA specifies that when selecting a cleanup action alternative, preference shall be given to actions that are "permanent solutions to the maximum extent practicable." Evaluation criteria include the degree to which the alternative permanently reduces the toxicity, mobility or mass of hazardous substances, including the effectiveness of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment processes, and the characteristics and quantity of treatment residuals generated.

Cost

The analysis of cleanup action alternative costs under MTCA includes all costs associated with implementing an alternative, including design, construction, long-term monitoring, and institutional controls. Costs are intended to be comparable among different alternatives to assist in the overall analysis of relative costs and benefits of the alternatives. The costs to implement an alternative include the cost of construction, the net present value of any long-term costs, and agency oversight costs. Long-term costs include operation and maintenance costs, monitoring costs, equipment replacement costs, and the cost of maintaining institutional controls. Unit costs used to develop overall remediation costs for the FS were derived using a combination of published engineering reference manuals (i.e., R.S. Means); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment.

Long-Term Effectiveness

Long-term effectiveness is a parameter that expresses the degree of certainty that the alternative will be successful in maintaining compliance with cleanup standards over the long-term performance of the cleanup action. The MTCA regulations contain a specific preference ranking for different types of technologies that is to be considered as part of the comparative analysis. The ranking places the highest preference on technologies such as reuse/recycling, treatment, immobilization/solidification, and disposal in an engineered, lined, and monitored facility. Lower preference rankings are applied for technologies such as on-site isolation/containment with attendant engineered controls, and institutional controls and monitoring.

Management of Short-term Risks

Evaluation of this criterion considers the relative magnitude and complexity of actions required to maintain protection of human health and the environment during implementation of the cleanup action. Cleanup actions carry short-term risks, such as potential mobilization of contaminants during construction, or safety risks typical of large construction projects. In-water dredging activities carry a risk of temporary water quality degradation and potential sediment recontamination. Some short-term risks can be managed through the use of best practices during project design and construction, while other risks are inherent to project alternatives and can offset the long-term benefits of an alternative.

Implementability

Implementability is an overall metric expressing the relative difficulty and uncertainty of implementing the cleanup action. Evaluation of implementability includes consideration of technical factors such as the availability of mature technologies and experienced contractors to accomplish the cleanup work. It also includes administrative factors associated with permitting and completing the cleanup.

Consideration of Public Concerns

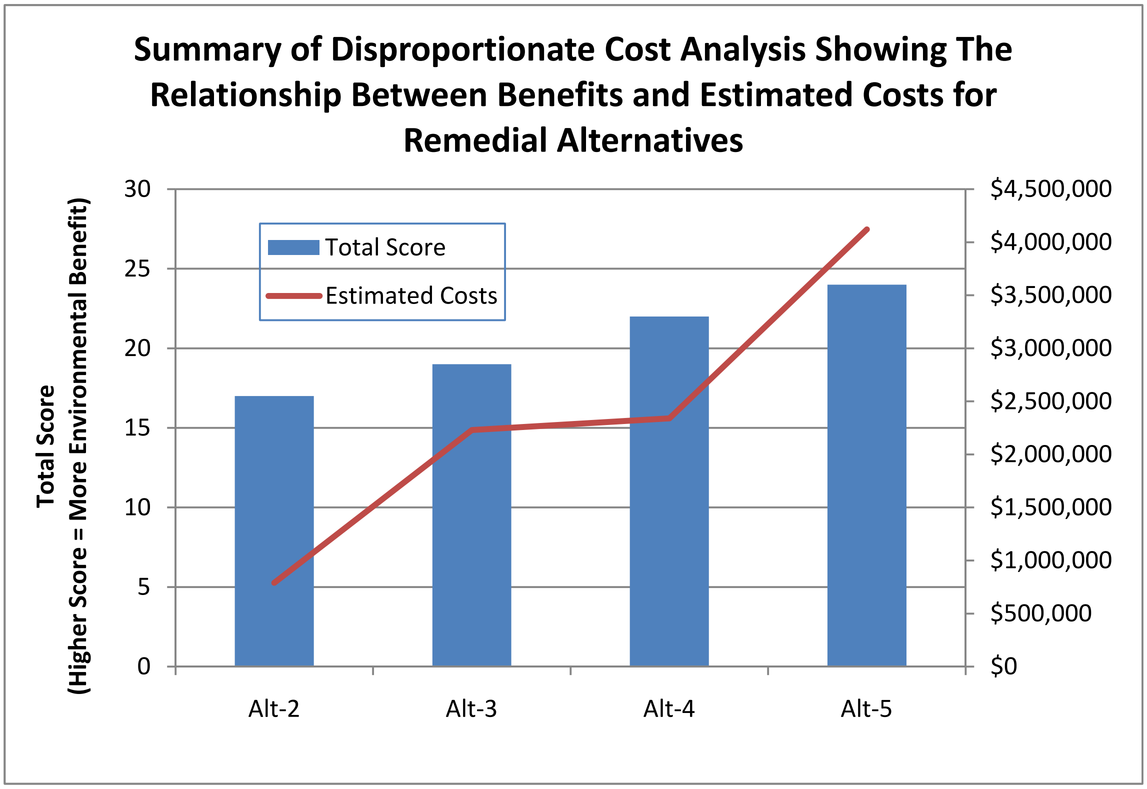
The public involvement process under MTCA is used to identify potential public concerns regarding cleanup action alternatives. The extent to which an alternative addresses those concerns is considered as part of the evaluation process. This includes concerns raised by individuals, community groups, local governments, tribes, federal and state agencies, and other organizations that may have an interest in or knowledge of the Site. In particular, the public concerns for this Site would generally be associated with environmental concerns and performance of the cleanup action, which are addressed under other criteria such as protectiveness and permanence.

4.3 EVALUATION AND COMPARISON OF ALTERNATIVES

The evaluation of remedial alternatives performed in the FS showed that only four of the five alternatives met the MTCA threshold requirements outlined above. Alternative 1, which relies solely on institutional controls to achieve protection from contaminated soil and sediment, was determined to not meet the MTCA threshold requirements.

The remaining four alternatives (Alternatives 2 through 5) were determined to meet the threshold requirements and warranted inclusion in the DCA process. The evaluation of disproportionate cost is based on a comparative analysis of costs against six MTCA evaluation criteria. Relative rankings of each alternative for these criteria are summarized in Table 4. Table 5 summarizes how each alternative scores with respect to each of the DCA criterion and presents the estimated cost for each of the alternatives. The chart below shows how each alternative scores according to the DCA criteria and how the relative benefit corresponds to the relative cost of each alternative.

The evaluation of the level of achievement for how each individual criterion applies to each alternative, using a numeric scoring scale of 1 (lowest) to 5 (highest) is presented in Table 4. Table 5 presents the analysis of these results, including the summation of the resulting scores for each alternative and the determination of disproportionate cost. The conclusions of this evaluation are summarized in the following sections and the graph below.



Protectiveness

Remedial Alternative 5 achieves the highest level of protectiveness of the remaining alternatives as a result of achieving the maximum feasible removal of soil and sediment exceeding cleanup levels. Alternatives 3 and 4 achieve progressively lower levels of protectiveness relative to Alternative 5 based on the method selected to address soil in upland areas away from the shoreline (Power House Complex and Steel Production Building). These three Alternatives share the same proposed remediation scope for the areas with the exposure pathways of greatest risk to human health and the environment; soil and sediment at the Former AST Area, sediment adjacent to the Former AST Area, and the TP-08 Area. Alternative 2 has a lower level of protectiveness as a result of relying on capping of contamination in place rather than removal from the Site.

Protectiveness Scores
• Alternative 5: Score = 5
• Alternative 4: Score = 4
• Alternative 3: Score = 3
• Alternative 2: Score = 2

Permanence

Remedial Alternatives 3 through 5 all achieve a high level of permanence by achieving complete removal of the mass of contamination that poses the greatest risk to human health and the environment; TPH and metals impacted soil and sediment in the Former AST Area, the TP-08 Area, and the intertidal area adjacent to the Former AST Area. The permanence of Remedial Alternatives 3 and 4 are lower than Alternative 5 as a result of maintaining upland contaminant mass on Site associated with the Power House Complex and Steel Production Building and relying on institutional controls or capping methods to prevent exposure. However, Alternative 2 would be expected to have the lowest level of permanence as it utilizes capping

Permanence Scores
• Alternative 5: Score = 5
• Alternative 4: Score = 4
• Alternative 3: Score = 3
• Alternative 2: Score = 2

methods for contaminated marine sediments, which would have a higher possibility of failure due to erosion and other natural processes that could expose contaminants in the future.

Long-Term Effectiveness

Long-Term Effectiveness Scores
• Alternative 5: Score = 5 • Alternative 4: Score = 4 • Alternative 3: Score = 3 • Alternative 2: Score = 2

The long-term effectiveness of the four alternatives that meet the threshold requirements have relative rankings similar to those described above for the Permanence category. The long-term effectiveness relies heavily on using proven technologies to remove contaminant mass. Alternatives that rely primarily (Alternative 2) or partially (Alternatives 3 and 4) on capping and/or institutional controls to protect human health and the environment, while leaving contaminants in place have lower long-term effectiveness as a result of the need to monitor and the potential for the need to revisit the cleanup action in the event of failure. Alternative 5 relies on removal of contaminant mass from the Site to the greatest extent practicable and therefore achieves the highest level of long-term effectiveness.

Management of Short-Term Risks

Management of Short-Term Risk Scores
• Alternative 2: Score = 4 • Alternatives 3, 4, 5: Score = 3

Remedial Alternatives 3 through 5 involve extensive soil removal, including excavation near and within the shoreline and across large areas of open park space currently used by the public. However, the relative difference between the short-term risks associated with these four alternatives is low. The short-term risk associated with Remedial Alternative 2 is lower than the other three Alternatives as a result of the reduced scope of the intrusive earthwork. However, Alternative 2 involves a significant amount of earthwork associated with upland and marine capping, reducing the difference between the Alternatives.

Technical and Administrative Implementability

Technical and Administrative Implementability Scores
• Alternative 2: Score = 4 • Alternatives 3, 4: Score = 3 • Alternative 5: Score = 2

All of the four Remedial Alternatives that meet the threshold requirements are generally implementable using commonly available methods. Alternative 2 rates a higher level of technical implementability due to the limited nature of the associated earthwork but has a reduced level of administrative implementability associated with the development and maintenance of extensive institutional controls. Remedial Alternative 5 has a lower level of technical implementability as a result of including removal of contaminated soil in the Power House Complex and Steel Production Building Area. Including these difficult to access areas of the Site significantly increases the difficulty of Alternative 5. Alternatives 3 and 4 have moderate implementability, with the capping element of Alternative 4 reducing the relative implementability slightly. All of these alternatives have significant earthwork components, particularly the shoreline excavations associated with the former AST area.

Cost

The estimated cost for Remedial Alternatives 2 through 5 are presented below.

- **Remedial Alternative 2** (Capping all Sub-Areas) has an estimated cost of approximately $789,000. This alternative includes the removal of approximately 930 tons of contaminated soil. Tonnage of soil was calculated based on dredging the upper 2 feet of sediment below MHHW over an area of 7,000 square feet (200 feet x 35 feet).

- **Remedial Alternative 3** (Excavation/Removal at the Sediment Remediation Area, Former AST Areas and TP08 Vicinity and Institutional Controls at the Power House Complex and Steel

Production Building) has an estimated cost of approximately $2.23 million. This alternative includes the removal of approximately 11,200 tons of contaminated soil. Tonnage of soil was calculated based on the following excavation dimensions:

- TP08 Vicinity: 180 feet x 80 feet x 6 feet deep
- Former AST Area: 95 feet x 35 feet x 11 feet deep
- Sediment Remediation Areas: 200 feet x 35 feet x 5 feet deep

- **Remedial Alternative 4** (Excavation/Removal at the Sediment Remediation Area, Former AST Areas and TP08 Vicinity and Capping at Power House Complex and Steel Production Building) has an estimated cost of approximately $2.34 million. This alternative includes the removal of approximately 11,200 tons of contaminated soil. The basis for this tonnage is the same as Alternative 3.
- **Remedial Alternative 5** (Excavation/Removal all Sub-Areas) has an estimated cost of approximately $4.12 million. This alternative includes the removal of approximately 21,500 tons of contaminated soil. Tonnage of soil for this alternative includes the TP08 Vicinity, Former AST, and Sediment Remediation area dimensions detailed under Alternative 3 plus the following excavation dimensions:
  - Steel Production Building: 250 feet x 150 feet x 3 feet deep and 70 feet x 70 feet x 3 feet deep
  - Power House Complex: 150 feet x 20 feet x 6 feet deep

4.3.1 Reasonable Restoration Time Frame

The restoration time frame for all of the proposed Remedial Alternatives that meet the threshold requirements is expected to be on the order of two to three years. This time frame includes project design, permitting, contracting, construction, and Site closure activities. Management of institutional controls in the form of restrictive covenants would be required for the contaminated soil left in place under Alternatives 2, 3, and 4. Long-term monitoring may be necessary to ensure compliance with the covenants. These requirements would extend the duration of the associated alternatives.

4.3.2 Consideration of Public Concerns

Consideration of Public Concerns Scores
• Alternatives 3, 4, 5: Score = 4 • Alternative 2: Score = 3

The remedial alternatives proposed for the Site are generally expected to be acceptable to the public. The alternatives that achieve the greatest level of protection and certainty rely on the greatest level of soil removal and result in the most intrusive Site activities. Each of the alternatives that involve significant removal of contaminated soil scored a 4 for this criterion (i.e., low to moderate public concern). Alternative 2, which relies predominantly on capping, would be expected to have a lower level of acceptance by the public and therefore, was scored lower than the other alternatives, with a score of 3.

As summarized in Table 5, Alternative 5 ranks the highest of the four alternatives that meet threshold requirements. However, the estimated costs associated with Alternative 5 ($4.12 million) is nearly double the cost of the next highest ranking alternative, Alternative 4 ($2.34 million), and therefore the cost of Alternative 5 is considered substantial and disproportionately higher than the estimated cost of Alternative 4 relative to the incremental environmental benefit. The cost of Alternative 4 is not significantly higher than the estimated cost of the next highest ranking alternative, Alternative 3 ($2.23 million) and therefore the increased cost of Alternative 4 is not disproportionate to the increase of the environmental benefit associated with capping of the Power House Complex and Steel Production Building (Alternative 4) versus the use of only institutional controls (Alternative 3). Consequently, Alternative 4 is preferred over the other alternatives.

5.0 SELECTED SITE CLEANUP ACTION

Based on the comparative analysis performed in the FS and summarized in Section 4.3 above, the preferred Remedial Alternative for the Site is Alternative 4. This alternative reduces immediate risk to potential human and ecological receptors through:

1. Complete removal of contaminated sediment below the mean higher high water (MHHW);
2. Complete removal of TPH and metals contaminated soil at the former AST area and the area in the vicinity of sample location TP-08;
3. Installation of a permeable geotextile and soil cap to prevent direct exposure to contaminated soil in the Power House Complex and Steel Production Building areas; and
4. Perform site restoration tasks including restoring excavation areas to original conditions; planting soil cap areas for use as public park space; and remove slag material in the slag outcrop area along the shoreline to allow restoration of the shoreline.

Remedial Alternative 4 utilizes a combination of upland soil excavation, marine sediment removal, and upland soil capping to achieve cleanup goals at the Site. The soil removal actions proposed under Remedial Alternative 4 include areas associated with the former AST and the TP-08 Area. Soil that exceeds cleanup levels in the vicinity of these areas would be excavated to the extent practicable. The contaminated soil in the vicinity of the Power House Complex and Steel Production Building would be addressed by construction of a permeable geotextile and soil cap to prevent direct exposure to the contaminated soil. The contaminated sediment will be addressed by excavating or dredging to the extent required to achieve cleanup goals in conjunction with the excavation activities at the former AST area. Specifically, Remedial Alternative 4 includes the following components:

- Excavate approximately 8,750 tons of soil from various areas across the Site. Excavation dimensions are presented in Section 4.3 (under the Cost heading). Tonnage estimate included an assumption of 20 percent expansion above in-place volume and 1.6 tons per cubic yard of soil. The areas of proposed soil excavation include:
  - Excavate to the extent feasible, soil down to approximately 11 feet bgs in the former AST area with TPH concentrations above cleanup levels.
  - Excavate to the extent feasible, soil down to approximately six feet bgs in the vicinity of TP-08 Area with metals concentrations above cleanup levels.
- Excavate or dredge approximately 2,500 tons of sediment from the impacted shoreline area adjacent to the former AST area. Excavation dimensions are presented in Section 4.3 (under the Cost heading). Tonnage estimate included an assumption of 20 percent expansion above in-place volume and 1.6 tons per cubic yard of sediment. The sediment impacted with TPH above the ecological-based cleanup level will be removed to the extent practicable.
- Cap contaminated soil in the Power House Complex and the Steel Production Building with a multi-component cap consisting of a permeable geotextile covered with clean soil.
- Transport contaminated soil and sediment to appropriate disposal facilities.

- Backfill upland excavations with clean imported fill and restore original Site topography, features, and surfaces.
- Backfill shoreline removal areas with clean imported fill of grain size appropriate for the marine environment, using a habitat substrate surface material.
- Install a monitoring well network and monitor groundwater quarterly for at least one year.

The following sections provide further description of the components of Remedial Alternative 4.

5.1 Soil and Sediment Removal

Soil exceeding the final cleanup levels for TPH, cPAHs, and metals would be removed to varying depths, as described above and shown in Figure 14. The upland soil removal associated with the proposed cleanup action is expected to be performed using commonly available land-based excavation techniques. The construction methods would be specified during the design of the cleanup action or by the selected cleanup contractor. The shoreline excavation of contaminated sediment could be performed as an extension of the upland excavations, using land-based machinery. However, this would likely require shoring the outer edge of the removal area using sheet-pile wall or similar methods to allow the excavation to be performed to the depth required and to allow for dewatering of the excavation. Based on conceptual level remedial design performed for the FS and this CAP, the soil and sediment removal components of the cleanup action are likely to include the following:

- Excavation of upland soil as shown in Figure 14 results in approximately 8,750 tons of contaminated soil excavated. Excavation of upland soil in the location of the former AST may require demolition of portions of the AST concrete walls and base to achieve complete removal of contaminated soil. However, due to the historic nature of the structures at the Site, any excavation activities that impact existing building foundations and structures will require coordination with the Washington Department of Archeology and Historic Preservation (DAHP). Demolition of the AST would be completed to the extent required to achieve contaminant removal and to ensure remaining components are structurally sound.
- Excavation or dredging of TPH-impacted sediment adjacent to the former AST location would be completed to the extent practicable. The sediment removal would result in generating approximately 2,500 tons of contaminated sediment requiring disposal. The shoreline sediment removal would likely be performed as an extension of the upland soil removal at the former AST location described above, using land-based equipment. The outer, seaward, edge of the sediment removal would likely require installation of a sheet-pile wall to meet shoring needs and to serve as a cut-off wall to allow removal in a dryer environment. Alternatively, all or a portion of the sediment removal may be performed using common water-based dredging equipment. However, the presence of hydrocarbons in sediment to be removed will require significant water quality best management practices during dredging and water-based hauling.
- In conjunction with the sediment/shoreline soil removal component of the cleanup action alternative, slag material present at the slag outcrop area along the shoreline will be removed to the extent needed to place a proper thickness of beach habitat substrate over any remaining slag without adjusting the existing grade.

5.2 Soil Disposal

Excavated soil would be characterized for disposal as required by MTCA and Washington State Dangerous Waste regulations and the selected disposal facility. The contaminated soil is expected to fall into two categories: non-dangerous waste suitable for disposal at a Subtitle D landfill, or dangerous waste requiring either disposal at a Subtitle C (hazardous/dangerous waste) facility or treatment prior to disposal at a Subtitle D facility.

For soil to be categorized as non-dangerous waste and suitable for disposal at a Subtitle D landfill, it would be necessary to demonstrate that Site contaminants are not present at concentrations greater than ten times the Universal Treatment Standards (UTS), as defined in 40 CFR 268.48. This requirement includes the results of toxicity characteristic leaching procedure (TCLP) testing for metals. Based on the results of previous TCLP analyses performed on soil with high total metals concentrations, it is expected that the volume of soil that fails TCLP will be minimal and costs associated with potential treatment are not considered in the estimated cost of this Alternative.

5.3 UPLAND SOIL CAP

The proposed cleanup action involves leaving COCs in place in soil in the Steel Production Building area and the Power House Complex area and using a combination of capping methods and institutional controls to limit exposure to COCs. Figure 14 shows the proposed extent of upland capping associated with Preferred Alternative 4. The proposed areas of upland soil to be capped will be covered with a permeable geotextile and an approximately 2-foot thick layer of clean soil will be placed upon the geotextile to create a physical barrier between the contaminated soil and Site users and terrestrial ecological receptors.

Prior to capping the Steel Production Building and Power House Complex areas, supplemental RI soil sampling will be conducted to further define the areas requiring capping. This soil sampling will build on the existing soil metals data set. Soil samples will be obtained in a systematic manner and will be analyzed for metals (arsenic, copper, iron, lead, nickel, and zinc). The ground surface in the area of proposed upland capping will require preparation prior to placement of the geotextile and soil cap components. Debris such as concrete pieces, large rocks, downed trees, etc. will require removal to achieve a relatively flat surface on which to place the geotextile. However, historic building and structure foundation and slabs, if found to be present, are expected to achieve adequate protection of receptors from underlying contaminated soil and will not be removed. Cap components will be tied into the foundation components.

The upland capping will generally require removal of plants across the cap area that would prevent placement of the geotextile. However, larger trees may be allowed to remain in place if determined to be healthy and not impacted by site contaminants. However, it is expected that placement of geotextile and a layer of soil on the ground surface within a tree's drip line (defined as the outermost leaves on a tree) may cause damage to near-surface roots and the eventual death of the tree. Therefore, within the tree's drip line placement of a thin (less than 6 inches) layer of mulch or beauty bark on top of the geotextile, rather than the 2-foot soil layer used across most of the cap area, may be necessary. During design and pre-construction stages, the cap area will be surveyed to better determine how the existing larger trees can be incorporated into the cap components or whether removing the trees and replanting following placement of the cap, as described below, is more appropriate.

Following completion of placement of the soil cap, the area will be replanted with plants suitable for the thin layer of soil placed over the geotextile. Native, drought-tolerant shrubs, grasses, and ground covers will be planted across the cap area to stabilize the soil and restore native vegetation for wildlife habitat. Larger trees that grow with shallow surface roots combined with a single tap root structure may be suitable for planting in the cap area, but will require puncturing the geotextile directly under the tree during planting to provide a path for the tree's tap root to follow during growth. Specific plant species that would be suitable for revegetation at the site include the following:

- Vine maple (*Acer circinatum*)
- Red flowering currant (*Ribes sanguineum*)
- Sword fern (*Polystichum munitum*)
- Oceanspray (*Holodiscus discolor*)
- Snowberry (*Symphoricarpos albus*)
- Evergreen huckleberry (*Vaccinium ovatum*)
- Tall Oregon grape (*Mahonia aquifolium*)
- Salal (*Gaultheria shallon*)
- Western hemlock (*Tsuga heterophylla*)
- Douglas fir (*Pseudotsuga menziesii*)
- Big leaf maple (*Acer macrophyllum*)

5.4 CONTAMINATION REMAINING ON-SITE FOLLOWING REMEDY

The selected cleanup action for the Site involves containment of contaminated surface and subsurface soil that exceeds Site cleanup levels. The areas of the Steel Production Building and the Power House Complex will rely on a cap, as described above, to eliminate the exposure pathway between Site receptors and contaminated soil. In addition to the areas where capping is the proposed remedy for addressing contaminated soil, the potential exists for the proposed soil and sediment excavation in the other areas of the Site to be incomplete as a result of contamination extending to inaccessible areas. For instance, the historic nature of the concrete AST structure may prevent partial demolition of the AST structure to achieve complete removal of TPH-impacted soil if determined to extend under the ASTAreas of residual contaminated soil will be documented following completion of the cleanup action and will be addressed through the use of confirmation monitoring and environmental covenants implemented at the Site. However, if significant contamination (such as free product) is found beneath the concrete floorslab of the historic AST, it may be necessary to stop work, meet with Ecology and DAHP to establish a method to remove contaminated soil or create a barrier to prevent downgradient recontamination of soil removed as part of this proposed remedy.

5.5 CONSTRUCTION PERFORMANCE MONITORING

Construction performance monitoring will involve collecting soil and/or sediment samples from the base and sidewalls of the proposed removal areas to confirm that Site cleanup levels have been achieved. The concentrations of Site contaminants remaining on Site below cleanup levels will be documented as well during performance monitoring activities. Specifically, performance monitoring activities will include the following:

- Collect discrete grab samples from the final limits of the upland and sediment remedial excavations, with the sampling density appropriately tailored to the location and size of the excavation (detailed post-construction verification sampling plans will be developed during remedial design).
- The confirmatory soil and sediment samples will be submitted for analysis of COPCs to verify that the removal actions are complete or to document remaining contaminant mass at the Site.

- Samples will be analyzed on a short turnaround basis to allow the results to be compared to cleanup levels during remedial excavation to evaluate whether the final limits of the remedial excavations have been achieved.

5.6 POST-CONSTRUCTION CONFIRMATION MONITORING

The limited groundwater impacts identified at the Site are directly associated with areas of soil contamination to be addressed by the selected cleanup action. The soil removal proposed in this alternative is expected to result in a reduction of contaminant concentrations in groundwater (TPH and metals [copper and nickel]), thereby obviating the need for active groundwater remediation. To verify that the soil removal is protective of groundwater, a network of new monitoring wells would be installed along the shoreline of the Site following completion of the soil removal activities. The monitoring wells would be sampled and analyzed for contaminant concentrations as well as indicators of natural attenuation during at least four quarterly events to demonstrate that groundwater impacts have been addressed. Long-term groundwater monitoring may be necessary if initial groundwater monitoring indicates the potential for contaminant transfer from remaining contaminated soil to groundwater over time.

Post-construction monitoring would also be required to ensure that the cap proposed to be installed in the Steel Production Building and Power House Complex areas remains intact. The primary purpose of the cap monitoring would be to ensure that soil above the geotextile remains at the desired thickness and is not eroding. In addition, monitoring will include observation of instances of burrowing wildlife and digging by Site users that may expose the geotextile. Final monitoring procedures and mitigation measures will be developed following completion of the cleanup action construction.

5.7 INSTITUTIONAL CONTROLS

The selective remedial action includes components that allow contaminants to remain on site, with receptors protected from the contaminants through the use of capping technologies. The contaminants remaining on site in the area of proposed capping exceeds MTCA cleanup values and would pose risks to human health and terrestrial ecological receptors in the absence of the cap. Institutional controls are proposed to be implemented that provide notification methods to prevent Site users from encountering contaminated soil and utilizes legal mechanisms such as restrictive covenants to guide future activities on the site in a way that protects workers and Park visitors.

Notification methods such as signage that notifies Site users of the presence of the soil cap and underlying contaminated soil will be utilized to prevent users from digging in the area and possibly damaging the cap. Restrictive covenants would be required to attach future development restrictions and requirements to property deeds for the lifetime of the remaining contamination. The restrictive covenants would outline remaining impacted areas and the cap monitoring and maintenance plan. Soil management plans would be required that instruct property owners on Ecology's requirements for performing invasive work in areas of remaining contaminated soil. The restrictive covenants would require maintenance in the form of periodic reviews and updating of soil management plans.

6.0 IMPLEMENTATION OF THE CLEANUP ACTION

The cleanup action described in this CAP has not been scheduled for construction to date. The cleanup action will require development of remedial design documents, permit applications, and contract documents prior to construction. This section describes the necessary steps to construct the proposed cleanup action following approval of this CAP.

6.1 PERMITS/OTHER REQUIREMENTS

The Cleanup Action is expected to be conducted directly by Ecology or under an Ecology Agreed Order, Enforcement Order, or Consent Decree. Accordingly, the cleanup action meets the permit exemption provisions of MTCA (WAC 173-340-710[9]), obviating the need to follow the procedural requirements of most State and local laws that would otherwise apply to the action. The cleanup action will, however, comply with the substantive requirements of applicable State and local laws. The exemption is not applicable if Ecology determines that the exemption would result in the loss of approval from a federal agency that may be necessary for the state to administer any federal law. Permits and substantive requirements applicable to the cleanup action are discussed below.

6.1.1 State Environmental Policy Act

The State Environmental Policy Act (SEPA) (Revised Code of Washington [RCW] 43.21C; WAC 197-11) and the SEPA procedures (WAC 173-802) are intended to ensure that State and local government officials consider environmental values when making decisions. A SEPA checklist will be prepared as part of the permitting process for the Cleanup Action.

6.1.2 Washington Shoreline Management Act

The Washington Shoreline Management Act (RCW 90.58) and its implementing regulations establish requirements for substantial developments occurring within water areas of the state or within 200 feet of the shoreline. According to Shoreline Management Act regulations, local shoreline management plans and requirements are adopted under the State regulations, creating an enforceable State law. The Site cleanup action will comply with substantive requirements set forth by local jurisdiction, but a shoreline permit will not be required.

6.1.3 Washington Hydraulic Code

The Washington Hydraulic Code (WAC 220-110) establishes regulations for the construction of any hydraulic project or the performance of any work that will use, divert, obstruct, or change the natural flow or bed of any of the salt or fresh water of the State. The code requires that a Hydraulic Project Approval (HPA) permit (administered by the Washington Department of Fish and Wildlife) be obtained for any activity that could adversely affect fisheries and water resources. Although an HPA permit will not be required for the planned cleanup action, substantive timing restrictions and technical requirements under the code are applicable to planned cleanup and shoreline restoration activities below MHHW.

6.1.4 Water Quality Permitting

The Clean Water Act (CWA) is the primary Federal law for protecting water quality from pollution. Section 404 of the CWA requires that permits be obtained from the U.S. Army Corp of Engineers for discharges of dredged or fill material into waters of the United States. The development of a Joint Aquatic Resources Permit Application (JARPA) for submittal to Corp will be required to meet the Section 404 permit requirements.

In addition to the Federal CWA, water quality is regulated by Ecology under the State Water Quality Act (RCW 90.48). Section 401 of the Federal CWA requires the State to certify that Federal permits are consistent with State water quality standards. State and Federal standards for marine waters specified in the Section 404 permit will apply to discharges to surface water during sediment dredging, and to return flows (if necessary) to surface water from dewatering operations.

Construction activities that disturb one acre or more of land need to comply with the provisions of State construction stormwater regulations. Accordingly, an Ecology Construction Stormwater General Permit is required for the cleanup action, to include a stormwater pollution prevention plan or equivalent MTCA construction quality assurance project plan.

6.2 ENGINEERING DESIGN REPORT

An Engineering Design Report will be prepared that provides sufficient information for the development and review of construction plans and specifications to document engineering concepts and design criteria used for the design of the cleanup action. The information required under WAC 173-340-400(4)(a) will be included in the Engineering Design Report. The Engineering Design Report will also include an Operations, Maintenance, and Monitoring Plan describing long-term operations, maintenance, and monitoring required following completion of initial cleanup action construction.

The Engineering Design Report will also include the proposed language of environmental covenants required to be implemented as a result of Deed Restriction.

6.3 CONSTRUCTION PLANS AND SPECIFICATIONS

The Construction Plans and Specifications will detail the construction of the cleanup action to be performed. As required by WAC 173-340-400(4)(b), the documents will include the following information, as applicable:

- A description of the work to be performed, and a summary of the engineering design criteria from the Engineering Design Report;
- A site location map and a map of existing conditions;
- A copy of applicable permit applications and approvals;
- Detailed plans, procedures, and specifications necessary for the cleanup action;
- Specific quality control tests to be performed to document the construction, including specifications for testing or reference to specific testing methods, frequency of testing, acceptable results, and other documentation methods; and
- Provisions to ensure that the health and safety requirements of WAC 173-340-810 are met.

All aspects of construction will be performed and documented in accordance with WAC 173-340-400(6). These aspects include approval of all of the plans listed above prior to commencement of work, oversight of construction by a Professional Engineer licensed in the State of Washington, and submittal of a Construction Completion Report that documents all aspects of the cleanup and includes an opinion of the engineer as to whether the cleanup was conducted in substantial compliance with the CAP, the Engineering Design Report, and the Construction Plans and Specifications.

6.4 ANTICIPATED SCHEDULE FOR DESIGN AND IMPLEMENTATION

The schedule for design and implementation is not known at this time.

7.0 FIVE-YEAR REVIEW

Because the cleanup action outlined in this CAP will result in hazardous substances remaining at the Site at concentrations exceeding cleanup levels and because environmental covenants are included as part of the remedy, Ecology will review the selected cleanup action described in this CAP every 5 years to ensure protection of human health and the environment. Consistent with the requirements of WAC 173-340-420, the 5-year review shall include the following:

- A review of the title of the real property subject to the environmental covenant to verify that the covenant is properly recorded;
- A review of available monitoring data to verify the effectiveness of completed cleanup actions, including engineered caps and institutional controls, in limiting exposure to hazardous substances remaining at the Site;
- A review of new scientific information for individual hazardous substances or mixtures present at the Site;
- A review of new applicable state and federal laws for hazardous substances present at the Site;
- A review of current and projected future land and resource uses at the Site;
- A review of the availability and practicability of more permanent remedies; and
- A review of the availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology will publish a notice of all periodic reviews in the Site Register and will provide an opportunity for review and comment by the potentially liable persons and the public. If Ecology determines that substantial changes in the cleanup action are necessary to protect human health and the environment at the Site, a revised CAP will be prepared and provided for public review and comment in accordance with WAC 173-340-380 and 173-340-600.

8.0 LIMITATIONS

We have prepared this report for the exclusive use by SAIC (GeoEngineers is subcontracted to SAIC for Ecology Contract #C0700034), it's authorized agents and the Washington State Department of Ecology. The information contained herein is not intended for use by others and it is not applicable to other sites. No other (third) party may rely on the product of our services unless we agree in advance and in writing to such reliance. This plan can be provided to contractors, maintenance and utility personnel or other third parties for informational purposes only. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted environmental science practices in this area at the time this report was prepared. The conclusions and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix A titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

9.0 REFERENCES

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TABLE 1
DRAFT SOIL CLEANUP LEVELS[1]
DRAFT CAP
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Receptor	Basis	TPH[3]		cPAHs		Arsenic (Arsenic V for Eco)		Copper		Iron		Lead		Nickel		Zinc	
		Value	Note	Value	Note	Value	Note	Value	Note	Value	Note	Value	Note	Value	Note	Value	Note
Human Health	**Default MTCA values**	2,000	Method A	0.137	Method B	20	Background	3,000	Method B	58,700	Background	250	Method A	1,600	Method B	1,600	Method B
TEE - Soil Biota	**Bioassays - 100% worm survival for metals; no TEE CULS required.**	136	Site-specific[2]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TEE - Plants	**Default TEE values. Plant bioassays were inconclusive.**	--	--	NA	NA	18	EPA SSL	70	EPA SSL	--	--	120	EPA SSL	48	Background	160	EPA SSL
TEE - Wildlife	**Co-located soil/worm samples. Values based on site-specific bioaccumulation factor (BAF)**	6,000	Table 749-3	NA	NA	386	Site-Specific	1,340	Site-Specific	--	--	285	Site-Specific	3,870	Site-Specific	360	Table 749-3
Selected Value		136 and 2,000		0.137		18		70		58,700		120		48		160	

Notes:

[1]All values are milligrams per kilogram

[2]136 mg/kg is site-specific combined TPH cleanup level developed for sediment. It is applicable to upland soil adjacent to former above ground storage tank due to the potential transport of upland soil to sediment via erosion. The MTCA Method A soil cleanup level at 2,000 mg/kg is applicable to soil above the bluff and in the northshore fill area.

[3]Total Petroleum Hydrocarbons equals sum of diesel-range and heavy-oil range concentrations.

Shading indicates lowest applicable soil screening level

-- = Not available

EPA SSL = US Environmental Protection Agency Soil Screening Level

NA = Not applicable (bioassay indicated no adverse effects to soil biota)

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TABLE 2
SITE SPECIFIC ARARS
DRAFT CAP
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Chemical-Specific ARARs			
National Toxics Rule; 33 USC 1251	Water Quality Standards; 40 CFR 131.36(b)(1)	Establishes surface water quality standards that protect aquatic life and human health. Washington adopted these standards in Chapter 173-201A WAC.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality.
WA Water Pollution Control Act; Chapter 90.48 RCW	Water Quality Standards for Surface Waters; Chapter 173-201A WAC	Establishes narrative and numeric surface water quality standards for waters of the state.	Potentially applicable to surface water and potentially relevant and appropriate sediment and groundwater that are likely to impact surface water quality.
Clean Water Act; 33 USC 1251-1387	Section 304a of the Clean Water Act; WAC 173-340-730(2)(b)(i)(B)	Establishes surface water quality standards that protect aquatic life and human health. Washington adopted these standards in Chapter 173-201A WAC.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality.
Hazardous Waste Management; Chapter 70.105D RCW	Washington Model Toxics Control Act Cleanup Regulation; Chapter 173-340 WAC	Establishes groundwater, surface water, and soil cleanup levels.	Potentially applicable to surface water and potentially relevant and appropriate to sediment and groundwater that are likely to impact surface water quality and to soils at the site.
Potential Location-Specific ARARs			
Shoreline Management Act of 1971; Chapter 90.58 RCW	Shoreline Management Act; Chapters 173-18, 173-22, and 173-27 WAC.	The substantive requirements of this statute and its implementing regulations apply to activities within 200 feet of shorelines in the state.	Proposed remedial actions must be consistent with the approved Washington State coastal zone management program.
Construction Projects in State Waters; Chapter 77.55 RCW	Hydraulic Code Rules; Chapter 220-110 WAC	Apply to work conducted in Puget Sound or within the designated shoreline that changes the natural flow or bed of the water body (and therefore has the potential to affect fish habitat).	May apply to remedial actions that take place on the shoreline.
Endangered Species Act; 16 USC 1531 et seq.	Endangered Species Act; 50 CFR Parts 17, 222, and 402	Act protects fish, wildlife, and plant species whose existence is threatened or endangered.	Applies to cleanup actions that may affect a listed threatened or endangered species or designated critical habitat.
Potential Action-Specific ARARs			
Hazardous Waste Management; Chapter 70.105D RCW	Selection of Cleanup Actions; WAC 173-340-350	Minimum requirements and procedures for conducting remedial investigation and feasibility studies.	Applicable to remedial action selection and implementation.
Hazardous Waste Management; Chapter 70.105D RCW	Institutional Controls; WAC 173-340-440	Institutional control requirements.	Potentially applicable to remedial action selection and implementation.
Hazardous Waste Management; Chapter 70.105D RCW	Compliance Monitoring Requirements; WAC 173-340-410, -720(9), -730(7), -740(7), and -745(8)	Compliance monitoring requirements for groundwater, surface water, and soil.	Potentially applicable to remedial action selection and implementation.

TABLE 2
SITE SPECIFIC ARARS
DRAFT CAP
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Action-Specific ARARs			
Ecology Area of Contamination Policy	8/20/1991 Interprogram Policy	Allows movement/placement of excavated contaminated material within the regulated site without triggering dangerous waste designation.	Could be applicable for containment remedial alternatives.
Ecology Construction Stormwater General Permit	State of Washington Water Pollution Control Law; RCW Chapter 90.48	Applies to construction activities that disturb 1 or more acres.	Substantive requirements could be addressed through project stormwater pollution prevention plan.
Water Well Construction; Chapter 18.104 RCW	Minimum Standards for Construction and Maintenance of Wells; Chapter 173-160 WAC	Applies to the construction and maintenance of monitoring wells	Potentially applicable to wells constructed for groundwater withdrawal and monitoring and decommissioning of existing or future wells.
Hazardous Waste Management; Chapter 70.105 RCW	Dangerous Waste Regulations; Chapter 173-303 WAC	Applies if dangerous wastes are generated during remedial program	These regulations must be fully complied with for any off site disposal of waste determined to be dangerous waste. This would only apply to upland remedial options as dredged sediment is exempt from waste classification.
WA Water Pollution Control; Chapter 90.48 RCW	NPDES Permit Program; Chapter 173-220 WAC	Applicable to the discharge of pollutants and other wastes and materials to the surface waters of the state	NPDES may be required for discharges related to ongoing remedial actions or discharge of stormwater/drainage.
State Environmental Policy Act (SEPA); Chapter 43.21C.110 RCW	SEPA Rules; Chapter 197-11 WAC	Applies if future construction/remedial action occurs at the site	Applies if future construction/ remedial action occurs at the site.
Solid Waste Management Chapter 43.21A RCW	Minimum Functional Standards for Solid Waste Handling WAC 173-304	Establishes minimum functional standards for the handling of solid waste.	Applies if non-dangerous wastes are generated during remedial program
Transportation of Hazardous Material; 49 USC 5101-5127	Hazardous Materials Regulations; 49 CFR Parts 171 through 180	Regulations that govern the transportation of hazardous materials.	Applies to any hazardous materials transported off-site as part of remediation.
Hazardous Waste-Land Disposal Restrictions; USEPA	40 CFR 268/22 CCR 66268	Establishes land disposal restrictions and treatment standards for hazardous wastes applicable to generators.	Any hazardous wastes generated as a result of on-site activities or by treatment systems must meet land disposal restriction requirements.
WA Water Pollution Control; Chapter 90.48 RCW	Federal Water Pollution Control Act Certification; Chapter 173-225 WAC	Applies to activities that may result in a discharge into navigable waters.	Substantive compliance with this requirement will be potentially applicable to alternatives where substantive compliance with NPDES or Section 404 permit is required.
WA Water Pollution Control; Chapter 90.48 RCW	Mixing Zones; WAC 173-201A-400	Applies to the allowable size and location of a mixing zone.	Potentially applicable to remedial alternatives that would require substantive compliance with NPDES permit requirements.

TABLE 2
SITE SPECIFIC ARARS
DRAFT CAP
IRONDALE AND STEEL PLANT, IRONDALE, WASHINGTON

Authorizing Statute	Implementing Regulation	Description	Rationale
Potential Action-Specific ARARs			
WA Water Pollution Control; Chapter 90.48 RCW	Short Term Modifications (to State Water Quality Criteria); Chapter 173-201A-410	Criteria may be modified for a specific water body on a short-term basis when necessary to accommodate essential activities, respond to emergencies, or to otherwise protect the public interest, even though such activities may result in a temporary reduction.	Substantive provisions potentially applicable to remedial alternatives involving excavation of sediments.
USACE permit	Section 404 Permit Program	Applies to dredging or filling in the waters of the U.S.	Permit may not be required but substantive compliance with typical permit conditions will be required.
Archeological and Historic Preservation	Federal Archeological and Historical Preservation Act; 16 USCA 496a-1	The Site is part of the Irondale National Historic District designated by the National Park Service and is also listed in the Washington State Heritage Register and the National Park Service Historic American Engineering Record.	Will be applicable for remedial alternatives that include grading and excavation activities.
Washington Clean Air Act; Chapter 70.94 RCW	General Requirements for Air Pollution Sources; Chapter 173-400 WAC. Controls for New Sources of Toxic Air Pollutants; Chapter 173-460 WAC	Establishes technically feasible and reasonably attainable standards and rules generally applicable to the control and/or prevention of the emission of air contaminants.	May apply to remedial alternatives that produce emissions to air.

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TABLE 3
PRELIMINARY REMEDIAL ALTERNATIVES
DRAFT CAP
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

Site Subunit	Matrix	Contaminants Exceeding Proposed Cleanup Levels	Objective	PRELIMINARY CLEANUP ACTION ALTERNATIVE COMPONENTS				
				ALTERNATIVE 1 (Institutional Controls)	**ALTERNATIVE 2 (Capping - All Sub-Units)**	**ALTERNATIVE 3 (Excavation + Institutional Controls)**	**ALTERNATIVE 4 (Excavation + Capping)**	**ALTERNATIVE 5 (Excavation - All Sub-Units)**
				Institutional Controls with Limited Action	Capping: Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex and Steel Production Building Natural Attenuation of Petroleum in Groundwater.	Excavation: Sediment Remediation Area, Former AST Area, and TP08 Vicinity Institutional Controls: Steel Production Building and Power House Complex	Excavation: Sediment Remediation Area, Former AST Area and TP08 Vicinity Capping: Steel Production Building and Powerhouse Complex	Excavation: Sediment Remediation Area, Former AST Area, TP08 Vicinity, Power House Complex and Steel Production Building
Upland Soil Areas (Steel Production Building and Power House Complex)	Soil Exceeding Human Health and Ecological Cleanup Levels	Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of remaining contamination in soil.	- Excavate the hot spots (soil exceeding human health cleanup levels) in the former buildings and work areas to achieve site cleanup levels. Backfill to restore original land topography, restore site features and surfaces. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations.
TP-08 Vicinity	Soil Exceeding Human Health and Ecological Cleanup Levels	Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. '-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.	- Excavate contaminated soil in TP-08 metal contamination hot spot to a depth of 6-feet. Dispose of soil at approved off-site landfill. Backfill and restore to original grade.
6,000 Barrel AST Area	Soil Exceeding Human Health and Ecological Cleanup Levels	TPH, Metals	Prevent human and terrestrial ecological contact with soil containing contaminants above proposed cleanup levels based on risk to respective receptors. Remove soil with high residual TPH with potential to cause contamination of adjacent marine sediments.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Install cap across areas with contaminants above human health and ecological risk-based cleanup levels. cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels. - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.	- Excavate soil in the AST area to a depth of 11 feet bgs exceeding human health and terrestrial ecological cleanup levels (depth based on known contamination at TP26/DP02). - Dispose of contaminated soil at approved off-site disposal landfill based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Restore shoreline where excavated.
Intertidal Sediment	Sediments Exceeding SMS Criteria and Risk-Based Cleanup levels	TPH, PAHs	Prevent human and ecological exposure to contaminated sediment.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Remove upper layer of sediment to the extent required to place cap material without altering marine topography - Install cap and armoring material across areas with contaminants above cleanup levels in sediments to prevent further erosion of contaminated sediment. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Prohibit digging in capped areas.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.	- Remove sediments exceeding cleanup levels ranging from 2 to 7 feet below mud line using a barge-mounted clamshell dredge, or from the shore at low tide using land-based earthwork equipment. - Backfill to restore original land topography, restore site features and surfaces. - Transport and dispose of contaminated sediment at an approved off-site disposal landfill.
Groundwater	Groundwater Exceeding Groundwater Cleanup Levels	TPH, PAHs, Metals	Remove free product with potential to cause contamination of adjacent Marine Area sediments.	-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. -Implement signage to notify site users of restricted activities	- Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas.. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Remove free product to the extent feasible, when encountered during excavation at the AST and intertidal areas.. - Monitor a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.

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TABLE 4
EVALUATION OF CLEANUP ACTION ALTERNATIVES
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IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

	ALTERNATIVE 1 **(Institutional Controls)**	**ALTERNATIVE 2** **(Capping - All Sub-Units)**	**ALTERNATIVE 3** **(Excavation + Institutional Controls)**	**ALTERNATIVE 4** **(Excavation + Capping)**
Alternative Description	- Institutional controls and limited action. '-Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site.	- Install cap across upland and sediment areas with contaminants above human health and ecological risk-based cleanup levels. Cap to be designed as permeable exposure barrier for human and ecological receptors. -Implement deed notifications to inform future owners of the presence of potentially hazardous substances at the site and /or Implement deed restrictions to restrict future use of site. Implement signage to notify site users of restricted activities in capped areas.	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the Former AST Area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP08 Vicinity area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 2 to 7 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. -Implement signage, deed notifications and institutional controls for the power house complex and steel production building areas. -Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the Former AST Area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP08 Vicinity area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 5 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. - Backfill to restore original land topography, restore site features and surfaces. - Install geotextile fabric and soil cap across the power house complex and steel production building areas. -Implement deed notifications and institutional controls for the power house complex and steel production building areas. - Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.
Alternative Ranking Under MTCA				
1. Compliance with MTCA Threshold Criteria				
Protection of Human Health and the Environment	**NO** - This alternative would not be protective of human health and the environment because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	**YES** - Alternative would protect human health and the environment through a combination of capping and institutional controls.	**YES** - Alternative would protect human health and the environment through a combination of removal and institutional controls.	**YES** - Alternative would protect human health and the environment through a combination of removal of the highest concentrations of contaminants in upland soil near the shoreline as well as within the marine environment.
Compliance With Cleanup Standards	**NO** - This alternative would not comply with cleanup standards because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	**YES** - This alternative would require acceptance of the use of alternative points of compliance for measurement of compliance with cleanup standards. Immobilizing site contaminants using capping would include long term monitoring to ensure compliance with cleanup standards at the conditional points of compliance.	**YES** - Alternative is expected to comply with cleanup standards in the most accessible portions of the site, while contamination in upland areas away from the shoreline (power house complex and steel production building areas) are addressed using institutional controls to prevent exposure to soil left in place.	**YES** - Alternative is expected to comply with cleanup standards in the most accessible portions of the site, while contamination in upland areas away from the shoreline (power house comlex and steel production building areas) are addressed by capping in place.
Compliance With Applicable State and Federal Regulations	**NO** - This alternative would not comply with applicable state and federal regulations because it would leave a significant amount of contaminated soil and sediments in place at shallow depths along the shoreline.	**YES** - Alternative complies with applicable state and federal regulations. Future development of property could potentially require additional environmental cleanup or special provisions	**YES** - Alternative complies with applicable state and federal regulations in all areas of the site except the power house complex and steel production building areas. Future development of property could potentially require additional environmental cleanup or special provisions.	**YES** - Alternative complies with applicable state and federal regulations in all areas of the site except the power house complex and steel production building areas. Future development of property could potentially require additional environmental cleanup or special provisions.
Provision for Compliance Monitoring	**YES** - This Alternative allows for compliance monitoring through the use of traditional groundwater monitoring as well as regular soil and sediment sampling.	**YES** - Alternative includes provisions for monitoring of groundwater to assess natural attenuation processes and sediment to ensure cap function.	**YES** - Alternative includes provisions for compliance groundwater monitoring.	**YES** - Alternative includes provisions for compliance groundwater monitoring.
2. Restoration Time Frame				
	Initial restoration time frame is relatively short. However, potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	**Initial restoration time frame is relatively short.** This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	**Initial restoration time frame is relatively short.** This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.	**Initial restoration time frame is relatively short.** This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)[1]				
Protectiveness	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 2** Achieves a medium-low level of overall protectiveness as a result of capping in place of the contaminated soil and sediments at the Site. Most upland soil would be effectively isolated from site users, but the reliability of notification methods as the primary prevention method at an uncontrolled site is questionable.	**SCORE = 3** Achieves a medium level of overall protectiveness as a result of removal of majority of contaminated soil in areas that are most accessible and nearest the shoreline. However, this alternative would leave in place the contaminated soil in the power house complex and the steel production building area, which will be addressed through implementation of institutional controls such as signage and deed restrictions.	**SCORE = 4** Achieves a medium-high level of overall protectiveness as a result of removal of majority of contaminated soil in areas that are most accessible and nearest the shoreline. However, this alternative would leave in place the contaminated soil in the power house complex and the steel production building area, which will be addressed by capping the contamianted soil in place to reduce the potential for exposure.
Permanence	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 2** Achieves permanent reduction of toxicity and mobility of hazardous substances at the Site without overall reduction of mass. The quantity of impacted soil and sediments allowed to remain on site is greater than with Alternatives 3 through 6.	**SCORE = 4** Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternative 5. The quantity of impacted soil allowed to remain on site is greater than with Alternative 5.	**SCORE = 3** Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, but to a lower degree than Alternatives 4 and 5. The quantity of impacted soil allowed to remain on site is greater than with Alternatives 4 and 5.
Long-Term Effectiveness	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 2** Prevents human and ecological contact to the contaminated soil and sediments but; does not remove hazardous substances from the Site. Effectiveness on a long term relies on monitoring and maintenance of capped areas.	**SCORE = 4** Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition, but leaves soil on site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. Future development may require modification of the remedy.	**SCORE = 3** Removes portion of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition, but leaves soil on site that exceeds cleanup levels. The use of institutional controls reduces the risk to human health and the environment from the residual contamination left in place. Future development may require modification of the remedy.
Management of Short-Term Risks	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 4** Involves capping of soils and sediments in the areas of park currently used by the public. However, the earthwork methods required under this alternative are well established and capable of reducing short-term risks.	**SCORE = 3** Involves extensive soil removal across the upland areas, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.	**SCORE = 3** Involves extensive soil removal across the upland areas, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Administrative Implementability	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 4** Capping of upland areas will require clearing of trees and other vegetation to allow placement of geotextile and fill but generally utilizes common earthwork methods. Temporary site closure to public would allow facilitation of project.	**SCORE = 3** Utilizes the same general construction methods as Alternatives 4 through 6. Temporary site closure to public would allow facilitation of project.	**SCORE = 3** Utilizes the same general construction methods as Alternatives 4 through 6. Temporary site closure to public would allow facilitation of project.
Consideration of Public Concerns	**NOT APPLICABLE** - Alternative does not meet MTCA threshold criteria.	**SCORE = 3** Addresses the exposure of human and ecological contact to the contaminated soil and sediments. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.	**SCORE = 4** Addresses the most accessible soil and sediments that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.	**SCORE = 4** Addresses the most accessible soil and sediments that poses the greatest risk to human health and the environment. The remaining contaminated soil left in place would require maintenance of institutional controls and impose limitations on future use and development of the public property.

TABLE 4
EVALUATION OF CLEANUP ACTION ALTERNATIVES
DRAFT CAP
IRONDALE IRON AND STEEL PLANT, IRONDALE, WASHINGTON

	ALTERNATIVE 5 (Excavation - All Sub-Units)
Alternative Description	- Excavate to the extent feasible, soil to a depth of 11 ft BGS in the AST area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the TP-08 vicinity area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 6 ft BGS in the power house complex area exceeding human health and terrestrial ecological cleanup levels. - Excavate to the extent feasible, soil to a depth of 3 ft BGS in the steel production building area exceeding human health and terrestrial ecological cleanup levels. - Dredge or Excavate sediments to the extent feasible, to a depth of 5 ft BGS exceeding human health and aquatic ecological cleanup levels. - Dispose of contaminated soil and sediments at approved off-site disposal facility based on contaminant concentrations. -Monitor groundwater a minimum of quarterly for one year following completion of soil remedial action; perform long-term monitoring as required by Ecology.
Alternative Ranking Under MTCA	
1. Compliance with MTCA Threshold Criteria	
Protection of Human Health and the Environment	**YES** - Alternative would protect human health and the environment through a combination of removal and incompliance monitoring.
Compliance With Cleanup Standards	**YES** - Alternative is expected to comply with cleanup standards as negotiated with Ecology.
Compliance With Applicable State and Federal Regulations	**YES** - Alternative complies with applicable state and federal regulations in all portions of the site.
Provision for Compliance Monitoring	**YES** - Alternative includes provisions for compliance groundwater monitoring.
2. Restoration Time Frame	
	Initial restoration time frame is relatively short. This alternative is expected to require two to three years for design and construction. The time frame for long-term monitoring is unknown. Potential future maintenance of institutional controls and coordination of proper handling and disposal of contaminated soil during future site development may extend the restoration time frame of this alternative.
3. Disproportionate Cost Analysis Relative Benefits Ranking (Scored from 1-lowest to 5-highest)[1]	
Protectiveness	**SCORE = 5** Achieves a high level of overall protectiveness as a result of excavation in all contaminated portions of the site and removal of contaminated soil and sediments to the extent feasible.
Permanence	**SCORE = 5** Achieves permanent reduction of mass, toxicity, and mobility of hazardous substances at the Site, in soil and sediments to a degree higher than all other alternatives.
Long-Term Effectiveness	**SCORE = 5** Removes the majority of hazardous substances from the Site and utilizes approved off-site disposal facilities for final disposition. Leaves the least mass of soil on site that exceeds cleanup levels.
Management of Short-Term Risks	**SCORE = 3** Involves extensive soil removal across the entire upland area, and sediment dredging using earth based equipment, including excavation in the park areas currently used by the public. However, the excavation methods required to achieve the level of removal under this alternative are well established and capable of minimizing short-term risks.
Technical and Administrative Implementability	**SCORE = 2** Utilizes the same general construction methods as Alternatives 3 and 4, with the addition of excavaiton being performed in the vicinity of the steel production building, lowering the relative implementability. Temporary site closure to public would allow facilitation of project.
Consideration of Public Concerns	**SCORE = 4** Addresses all areas of contamination in soil and sediments on the site. Aggressiveness of alternative results in significant interruptions of usability of the site by the public.

Notes:

[1]The numeric scoring scale of 1 (lowest) to 5 (highest) provides a relative ranking where the scores indicate how well the alternatives achieve each individual criterion. Scores were allocated based on best professional judgment.

Shading indicates the alternative complies with the MTCA threshold criterion

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TABLE 5
SUMMARY OF MTCA EVALUATION AND RANKING OF CLEANUP ACTION ALTERNATIVES
DRAFT CAP
IRONDALE IRON AND STEEL PLANT
IRONDALE, WASHINGTON

Alternative Number	ALTERNATIVE 1 (Institional Controls)	ALTERNATIVE 2 (Capping - All Sub-Units)	ALTERNATIVE 3 (Excavation + Institutional Controls)	ALTERNATIVE 4 (Excavation + Capping)	ALTERNATIVE 5 (Excavation - All Sub-Units)
Alternative Ranking Under MTCA					
1. Compliance with MTCA Threshold Criteria (1)	NO	YES	YES	YES	YES
2. Restoration Time Frame	Less than one year	Two to three years	Two to three years	Two to three years	Two to three years
3. DCA Relative Benefits Ranking	--	4th	3rd	2nd	1st
Protectiveness	--	2	3	4	5
Permanence	--	2	3	4	5
Long-Term Effectiveness	--	2	3	4	5
Management of Short-Term Risks	--	4	3	3	3
Technical and Administrative Implementability	--	4	3	3	2
Consideration of Public Concerns	--	3	4	4	4
Total of Scores	--	**17**	**19**	**22**	**24**
4. Disproportionate Cost Analysis (DCA)					
Probable Remedy Cost (+50%/-30%, rounded) (4)	--	$789,000	$2,230,000	$2,340,000	$4,120,000
Costs Disproportionate to Incremental Benefits	--	NA (2)	NO	NO	YES
Practicability of Remedy	--	Practicable	Practicable	Practicable	Practicable
Remedy Permanent to Maximum Extent Practicable	--	Yes (3)	Yes	Yes (3)	Yes
Overall Alternative Ranking	**Does not meet threshold requirements; not ranked**	**3rd**	**2nd**	**1st**	**Costs disproportionate; not ranked**

Notes:
1 Noncompliant alternatives were not considered in the DCA (items 3 and 4 in this table).
2 Not applicable since this is the lowest cost alternative.
3 May require modification due to future land use or development.
4 Costs associated with removal of slag outcrop material associated with shoreline restoration activities are not included in Probable Remedy Costs.

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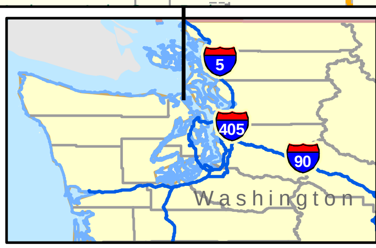

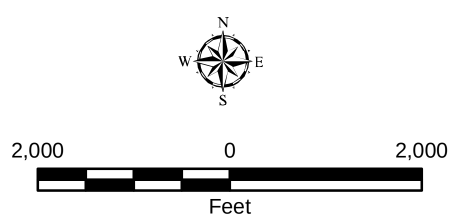

Map Revised: August 20, 2009

Path: P:\0\0504042\00\GIS\050404200 FIG-1-082009.mxd

Office: SEA

Data Sources: ESRI Data & Maps, Street Maps 2005.
Chimacum Creek Tidelands location and Irondale Beach Park Tidelands location obtained from "Health Consultation. Evaluation of Selected Metals in Irondale Beach Park and Chimacum Creek Tidelands Shell Fish." Irondale, Jefferson County, Washington. Agency for Toxic Substances and Disease Registry. July 28, 2008.

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map	
Irondale Iron and Steel Plant Irondale, Washington	
GeoEngineers	**Figure 1**

Map Revised: August 20, 2009

Path: P:\0\0504042\00\GIS\050404200_FIG-2-082009.mxd

Office:SEA

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures from Hart Crowser (1996).

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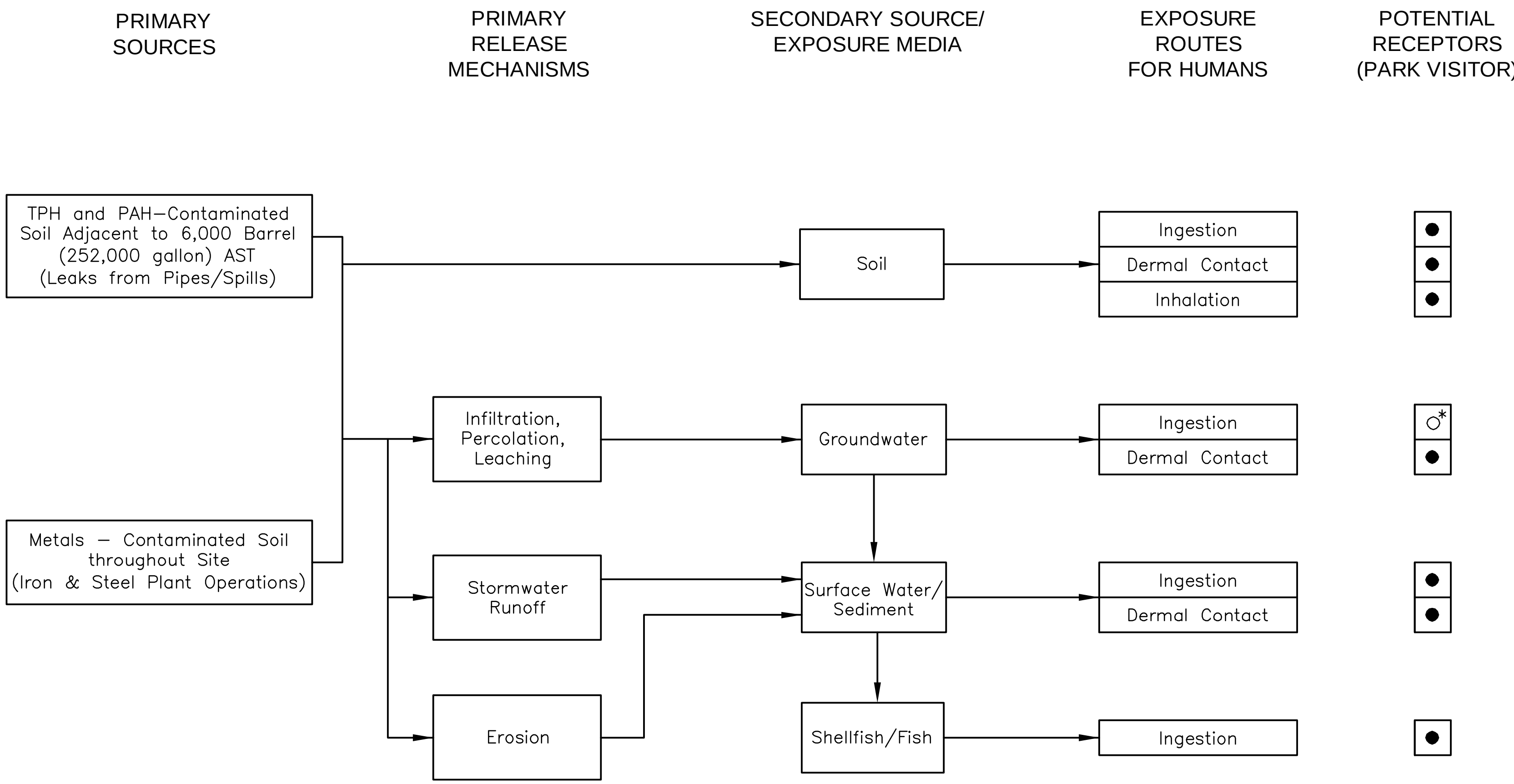
Site Plan

Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 2



EXPLANATION:

● COMPLETE EXPOSURE PATHWAY

○* COMPLETE BUT INSIGNIFICANT EXPOSURE PATHWAY

Notes:

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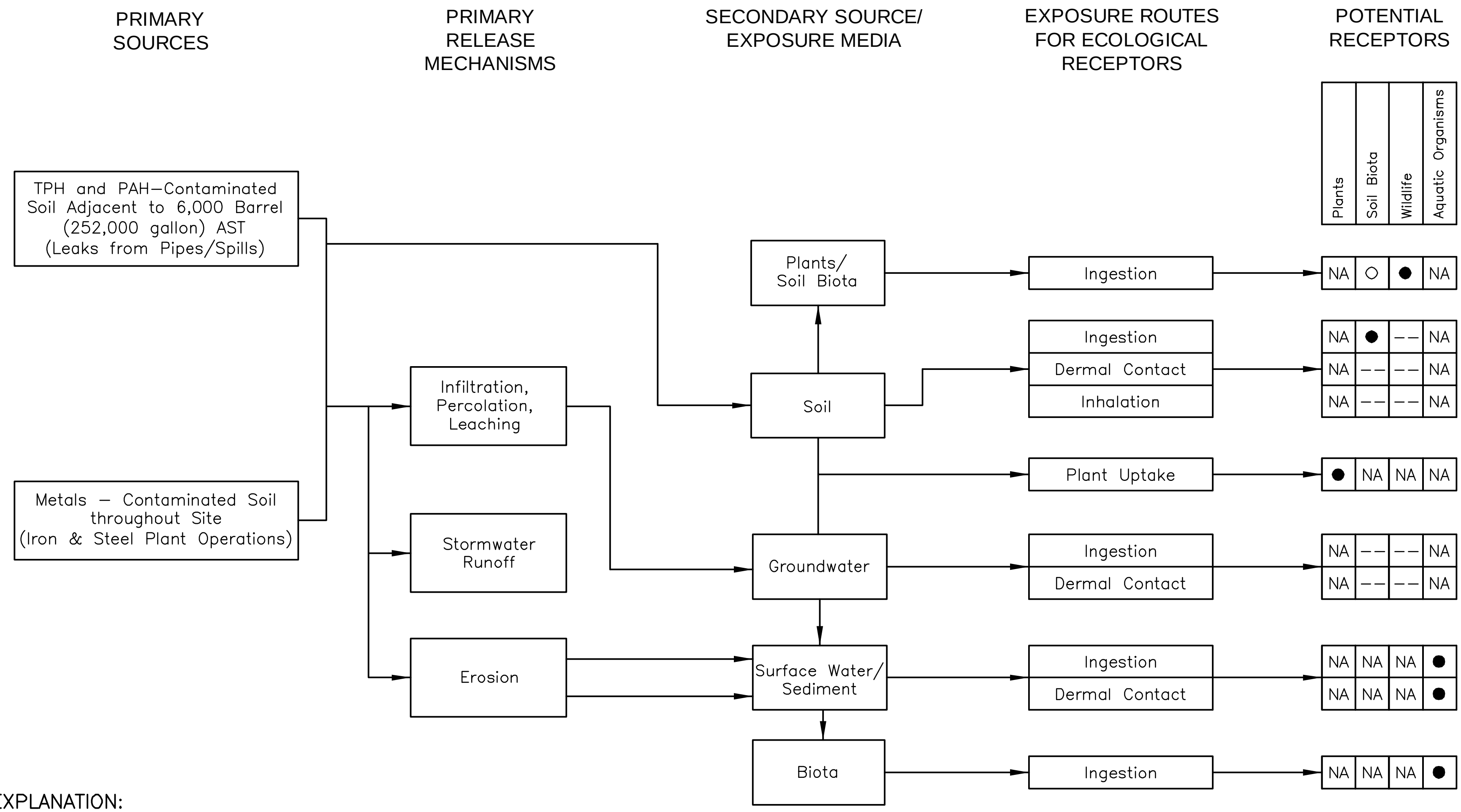
Human Health Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 3



EXPLANATION:

- ● COMPLETE EXPOSURE PATHWAY
- ○ INCOMPLETE EXPOSURE PATHWAY
- –– POTENTIALLY COMPLETE INSIGNIFICANT EXPOSURE PATHWAY
- NA NOT APPLICABLE

Notes:
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Ecological Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 4

JCL : TJM

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Pre-RI Sampling Locations (1996-2007)

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 5

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures and Hart Crowser sample locations from Hart Crowser (1996).
Jefferson County sample locations from Jefferson County (2001 and 2007).
Notes:
1. The locations of all features shown are approximate.
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Map Revised: August 20, 2009

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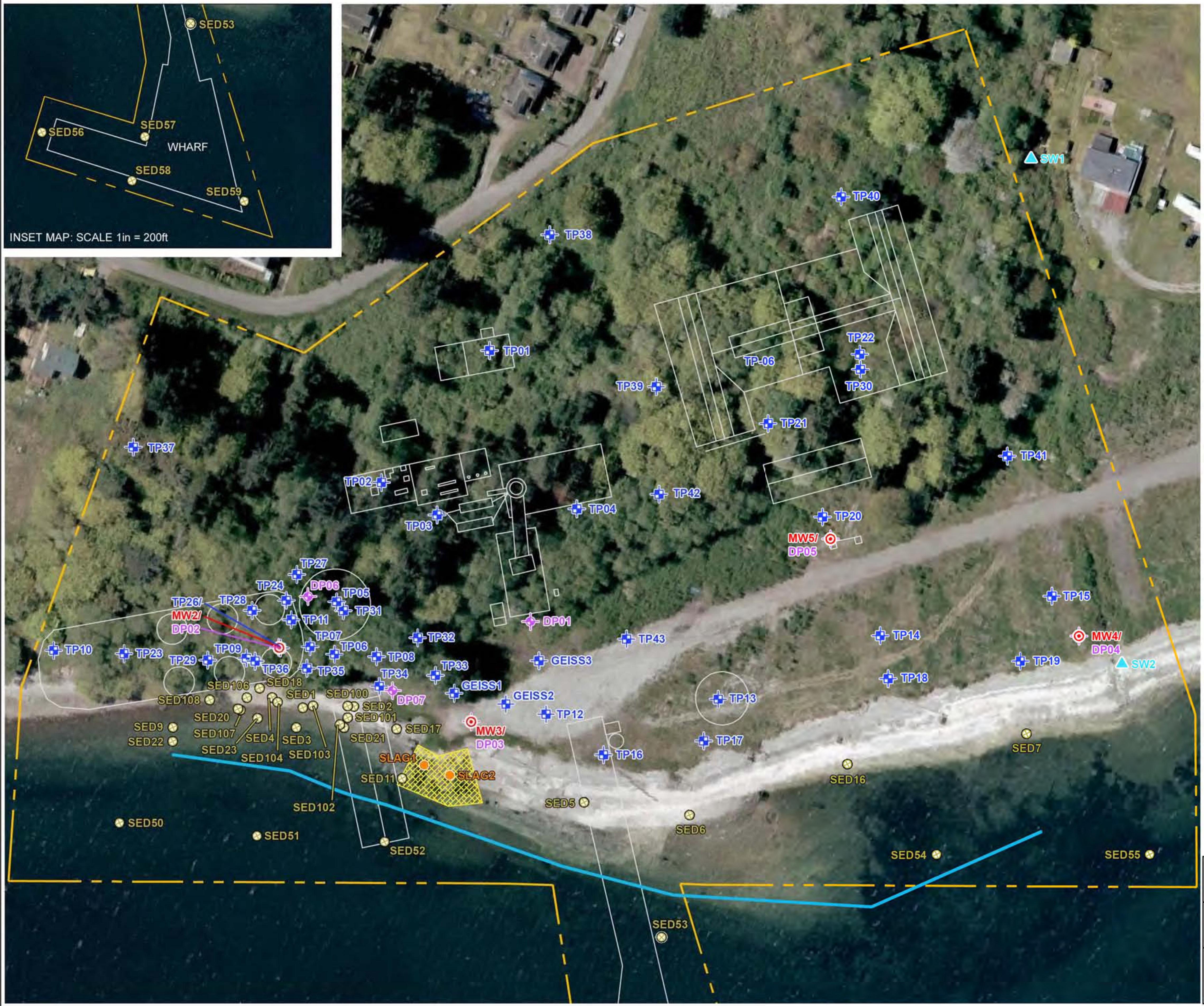
Office:SEA



Legend

- DP01 — Direct-Push Boring Location and ID
- TP40 — Soil Sample Location and ID
- SLAG1 — Slag Sample Location and ID
- SED104 — Sediment Sample Location and ID
- SW1 — Surface Water Sample Location and ID
- MW3 — Monitoring Well Location and ID
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop

100 0 100
FEET

Notes

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3. Monitoring well was not constructed at DD01 PC Draft RI/FS Work Plan (GeoEngineers, 2007A; i.e. MW01 does not exist).

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

RI Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS | **Figure 6**

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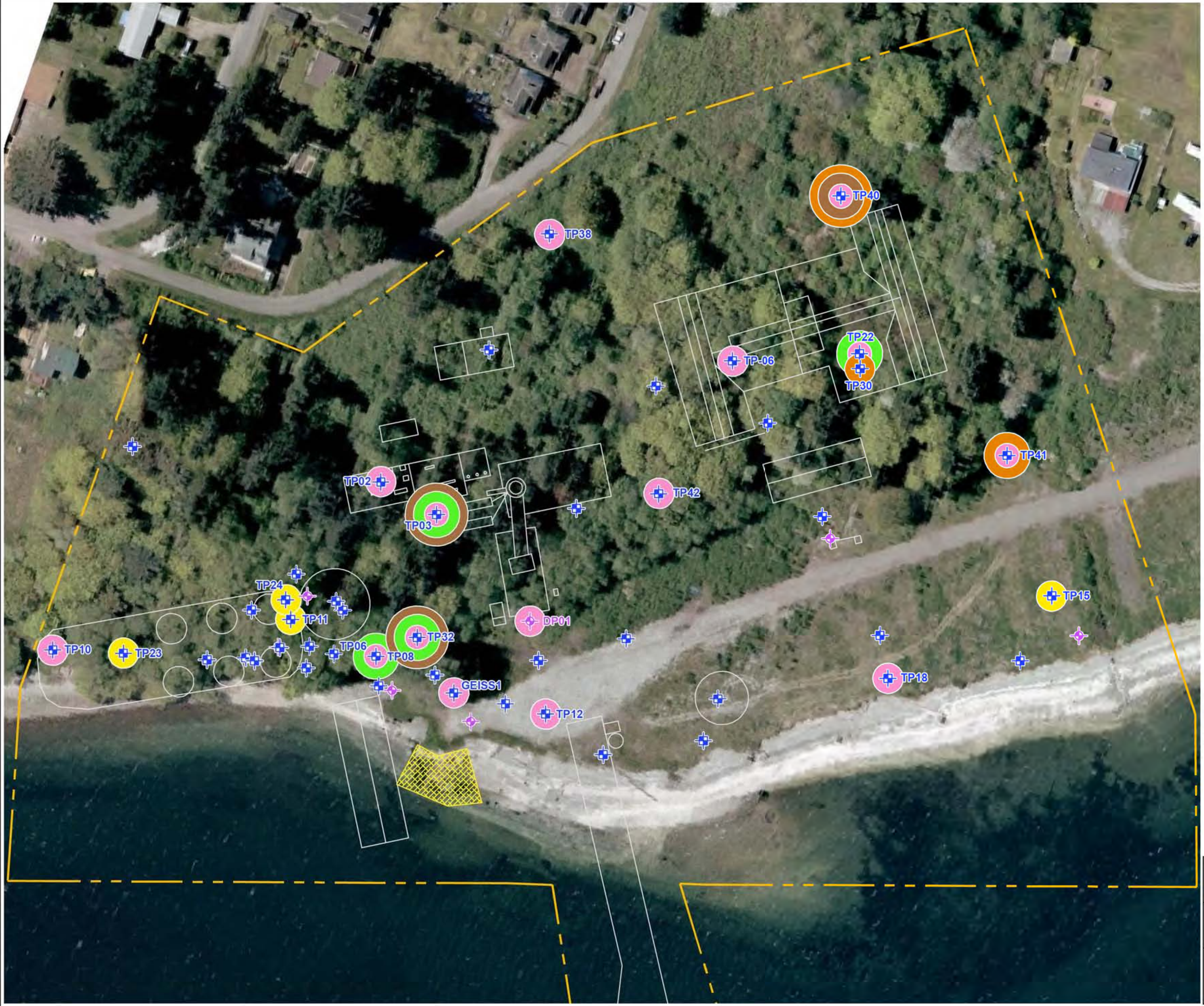

Legend

- Soil Biota Bioassay (TPH) Soil Sample Location
- Plant and Soil Biota Bioassay (Metals) Soil Sample Location
- Arsenic (III/V) Speciation Soil Sample Location
- Co-located Soil / Plant Sample Location
- Co-located Soil / Earthworm Sample Location
- DP01 Direct-Push Boring Location and ID
- TP40 Soil Sample Location and ID
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Terrestrial Ecological Evaluation Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

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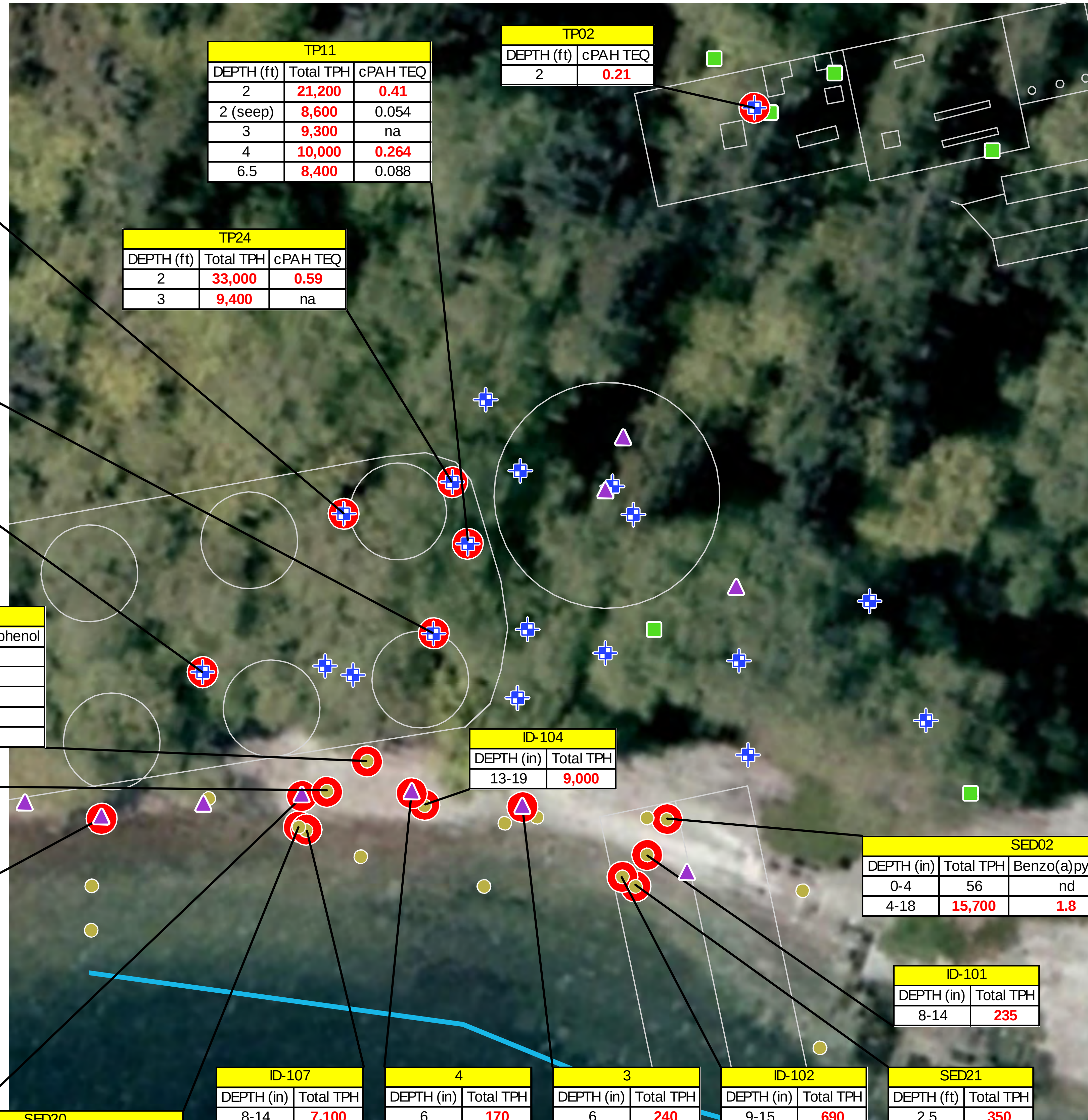
Figure 7

P:\0504042\00\CADD\T04\AUGUST 09 FIGURES\050404200 FIG 7.DWG\TAB:FIG 5 MODIFIED BY TMICHAUD ON AUG 20, 2009 - 14:11



TP02	
DEPTH (ft)	cPAH TEQ
2	**0.21**

TP11		
DEPTH (ft)	Total TPH	cPAH TEQ
2	**21,200**	**0.41**
2 (seep)	**8,600**	0.054
3	**9,300**	na
4	**10,000**	**0.264**
6.5	**8,400**	0.088

TP28	
DEPTH (ft)	Total TPH
3	nd
5	**350**
6.5	nd

TP24		
DEPTH (ft)	Total TPH	cPAH TEQ
2	**33,000**	**0.59**
3	**9,400**	na

TP26/DP02		
DEPTH (ft)	Total TPH	cPAH TEQ
2	na	na
4	na	na
6.5	**9,700**	**0.191**
7	**18,800**	0.13
11	**9,400**	na
13	23	na

TP29	
DEPTH (ft)	Total TPH
3	**183**
6	55
7	15

SED18		
DEPTH (ft)	Total TPH	2,4-Dimethylphenol
2.5	na	na
5	**6,100**	**0.14**
7.5	**1,290**	na
10	**950**	na
12.5	57	na

ID-104	
DEPTH (in)	Total TPH
13-19	**9,000**

ID-106	
DEPTH (in)	Total TPH
13-19	**6,200**

SED02			
DEPTH (in)	Total TPH	Benzo(a)pyrene	Chrysene
0-4	56	nd	nd
4-18	**15,700**	**1.8**	**3.3**

7	
DEPTH (in)	Total TPH
6	**180**
12	nd
18	**745**

ID-101	
DEPTH (in)	Total TPH
8-14	**235**

5	
DEPTH (in)	Total TPH
6	110
12	**230**
18	**450**

ID-107	
DEPTH (in)	Total TPH
8-14	**7,100**

4	
DEPTH (in)	Total TPH
6	**170**
12	**670**
18	104

3	
DEPTH (in)	Total TPH
6	**240**
12	**2,300**
18	**610**

ID-102	
DEPTH (in)	Total TPH
9-15	**690**

SED21	
DEPTH (ft)	Total TPH
2.5	**350**
5	27.7
7.5	na

SED20		
DEPTH (ft)	Total TPH	2,4-Dimethylphenol
1.5	**2,000**	**0.088**
3.5	**230**	na
5	**950**	na
6.5	7.9	na

Legend

- RI Soil Sample Location
- RI Sediment Sample Location
- Previous Soil Sample Location
- Previous Sediment Sample Location
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than human health or benthic screening levels

TPH and cPAH (Soil and Sediment Screening Levels)

Soil - cPAHs (0.137; Human Health)
Soil - TPH (2,000; Human Health)
Sediment - TPH (2,000; Human Health)
Soil / Sediment - TPH (136; Benthic)
Sediment - Benzo(a)Pyrene (1.6; 1988 Puget Sound AET)
Sediment - Chrysene (1.4; 1988 Puget Sound AET)
Sediment - Dimethylphenol (0.029; SMS)

Soil and Sediment Results in mg/Kg

Red/Bold Values exceed at least one screening level

SMS = Sediment Management Standards
AET = Apparent Effects Threshold
NA = Not Analyzed
ND = Not Detected

40 0 40
FEET

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

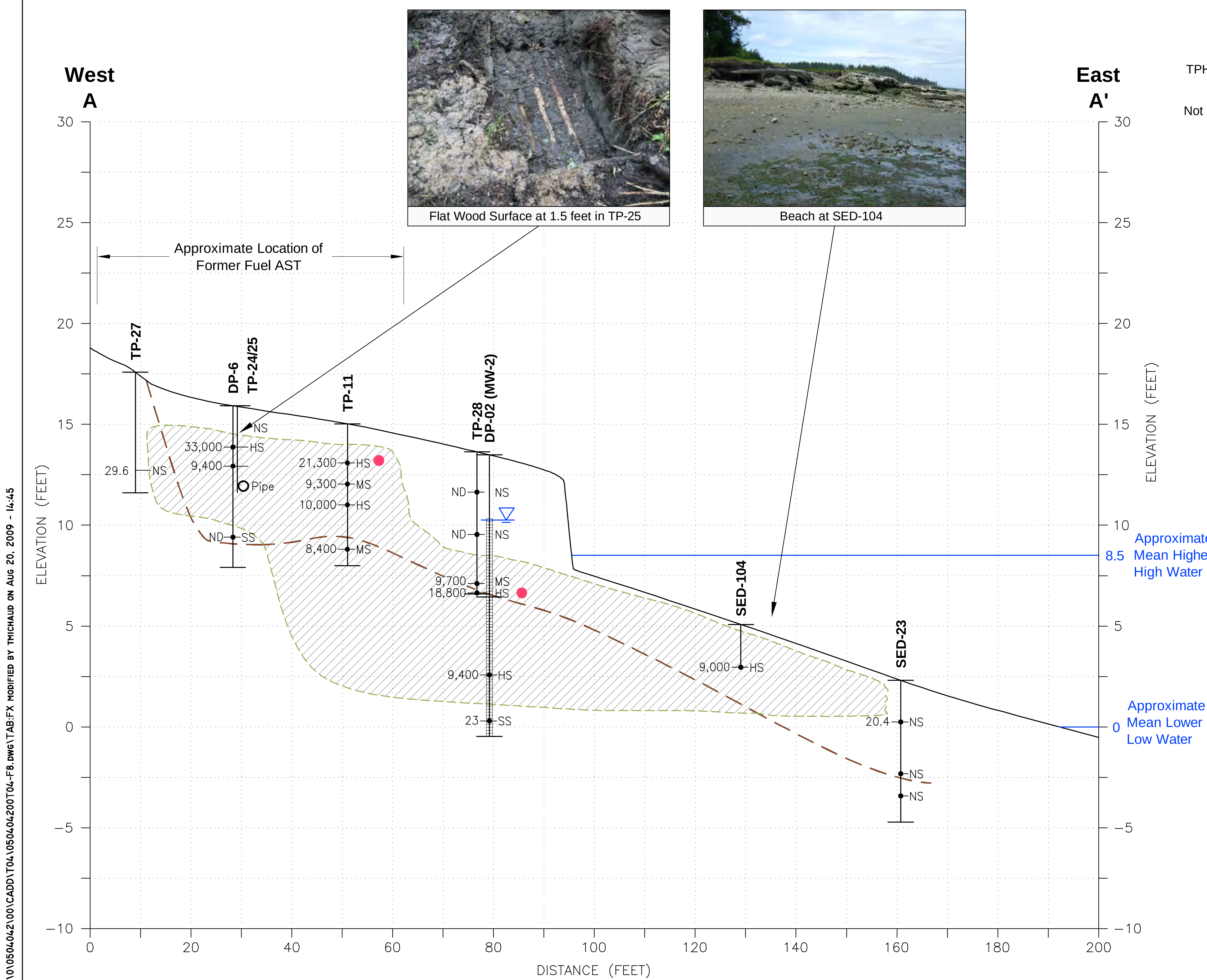
TPH and SVOCs: Soil and Sediment Locations with Exceedances of Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 8

P:\0\0504042\00\CADD\T05\050404200T04-Fig 8.dwg\TAB:Fig 11 Modified by tmichaud on Aug 28, 2009 - 16:21



Legend

TP-27 = Boring

Field Screen Result

TPH (mg/kg)* = 3,000 HS = Heavy Sheen

MS = Moderate Sheen

SS = Slight Sheen

Not Dectected = ND NS = No Sheen

= Water Level (1/8/09)

= Well Screen

= Oil seep from side of excavation

= Fill (sand, brick, slag) above this line
= Native sand below this line

= Interpreted extent of Total Petroleum Hydrocarbon concentrations greater than the cleanup level

* TPH is sum of diesel and oil-range hydrocarbon concentrations

HORIZONTAL SCALE: 1"= 20'
VERTICAL SCALE: 1"= 5'
VERTICAL EXAGGERATION: 4X

20 0 20
FEET

Notes

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

3. MLLW Tidal Datum, MLLW=0' Converted from NGVD 29.

Cross Section from AST through Beach

State of Washington Department of Ecology
Irondale, Washington

GEOENGINEERS

Figure 9

Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop
- Sample location with one or more sample result(s) greater than human health soil screening levels

Soil Results in mg/Kg

Metal (Human Health Soil Screening Level)

As = Arsenic (20)

Cu = Copper (3,000)

Fe = Iron (58,700)

Pb = Lead (250)

Red/Bold Values exceed Human Health Soil Screening Levels

100 0 100

FEET

Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

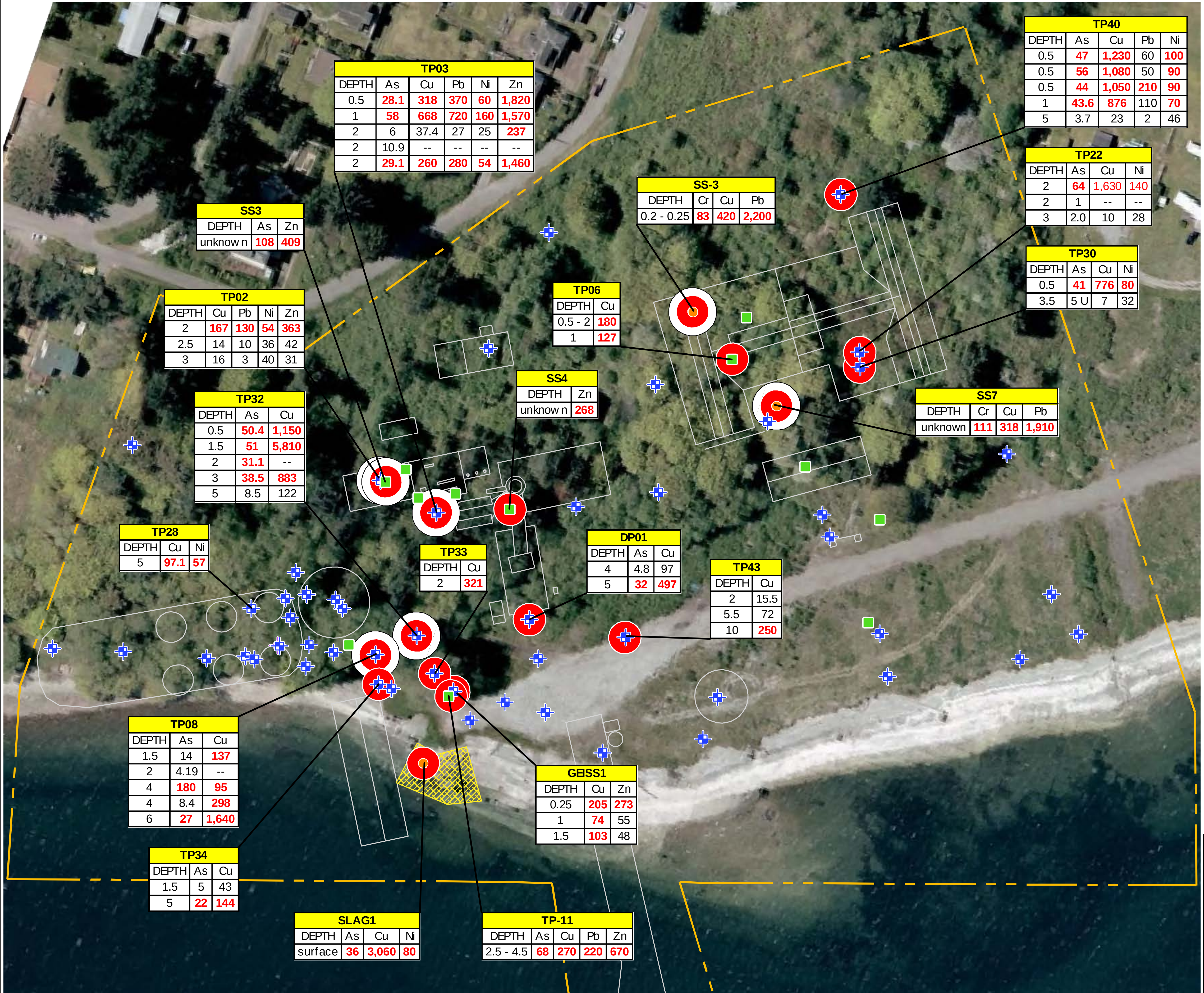
Metals: Upland Sample Locations with Exceedances of Human Health Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

GeoEngineers

Figure 10

P:\0504042\00\CADD\T05\050404200 Fig 10.dwg\TAB:Fig 10 modified by tmichaud on Aug 21, 2009 - 10:24



TP03

DEPTH	As	Cu	Pb	Ni	Zn
0.5	**28.1**	**318**	**370**	**60**	**1,820**
1	**58**	**668**	**720**	**160**	**1,570**
2	6	37.4	27	25	**237**
2	10.9	--	--	--	--
2	**29.1**	**260**	**280**	**54**	**1,460**

SS3

DEPTH	As	Zn
unknown	**108**	**409**

TP02

DEPTH	Cu	Pb	Ni	Zn
2	**167**	**130**	**54**	**363**
2.5	14	10	36	42
3	16	3	40	31

TP32

DEPTH	As	Cu
0.5	**50.4**	**1,150**
1.5	**51**	**5,810**
2	**31.1**	--
3	**38.5**	**883**
5	8.5	122

TP28

DEPTH	Cu	Ni
5	**97.1**	**57**

TP08

DEPTH	As	Cu
1.5	14	**137**
2	4.19	--
4	**180**	**95**
4	8.4	**298**
6	**27**	**1,640**

TP34

DEPTH	As	Cu
1.5	5	43
5	**22**	**144**

SLAG1

DEPTH	As	Cu	Ni
surface	**36**	**3,060**	**80**

TP-11

DEPTH	As	Cu	Pb	Zn
2.5 - 4.5	**68**	**270**	**220**	**670**

GEISS1

DEPTH	Cu	Zn
0.25	**205**	**273**
1	**74**	55
1.5	**103**	48

TP33

DEPTH	Cu
2	**321**

SS4

DEPTH	Zn
unknown	**268**

TP06

DEPTH	Cu
0.5 - 2	**180**
1	**127**

DP01

DEPTH	As	Cu
4	4.8	97
5	**32**	**497**

TP43

DEPTH	Cu
2	15.5
5.5	72
10	**250**

SS-3

DEPTH	Cr	Cu	Pb
0.2 - 0.25	**83**	**420**	**2,200**

SS7

DEPTH	Cr	Cu	Pb
unknown	**111**	**318**	**1,910**

TP40

DEPTH	As	Cu	Pb	Ni
0.5	**47**	**1,230**	60	**100**
0.5	**56**	**1,080**	50	**90**
0.5	**44**	**1,050**	**210**	**90**
1	**43.6**	**876**	110	**70**
5	3.7	23	2	46

TP22

DEPTH	As	Cu	Ni
2	**64**	**1,630**	**140**
2	1	--	--
3	2.0	10	28

TP30

DEPTH	As	Cu	Ni
0.5	**41**	**776**	**80**
3.5	5 U	7	32

Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop
- Sample location with one or more sample result(s) greater than plant TEE soil screening levels
- Sample location with one or more sample result(s) greater than wildlife TEE soil screening levels

Soil Results in mg/Kg

Metal (Plant / Wildlife Soil Screening Level)

- As = Arsenic (18 / 386)
- Cu = Copper (70 / 1,340)
- Pb = Lead (120 / 285)
- Ni = Nickel (48 / 3,870)
- Zn = Zinc (160 / 360)

Red/Bold Values exceed TEE Soil Screening Levels

100 0 100

FEET

Notes

1. The locations of all features shown are approximate.
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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowley, 1996).

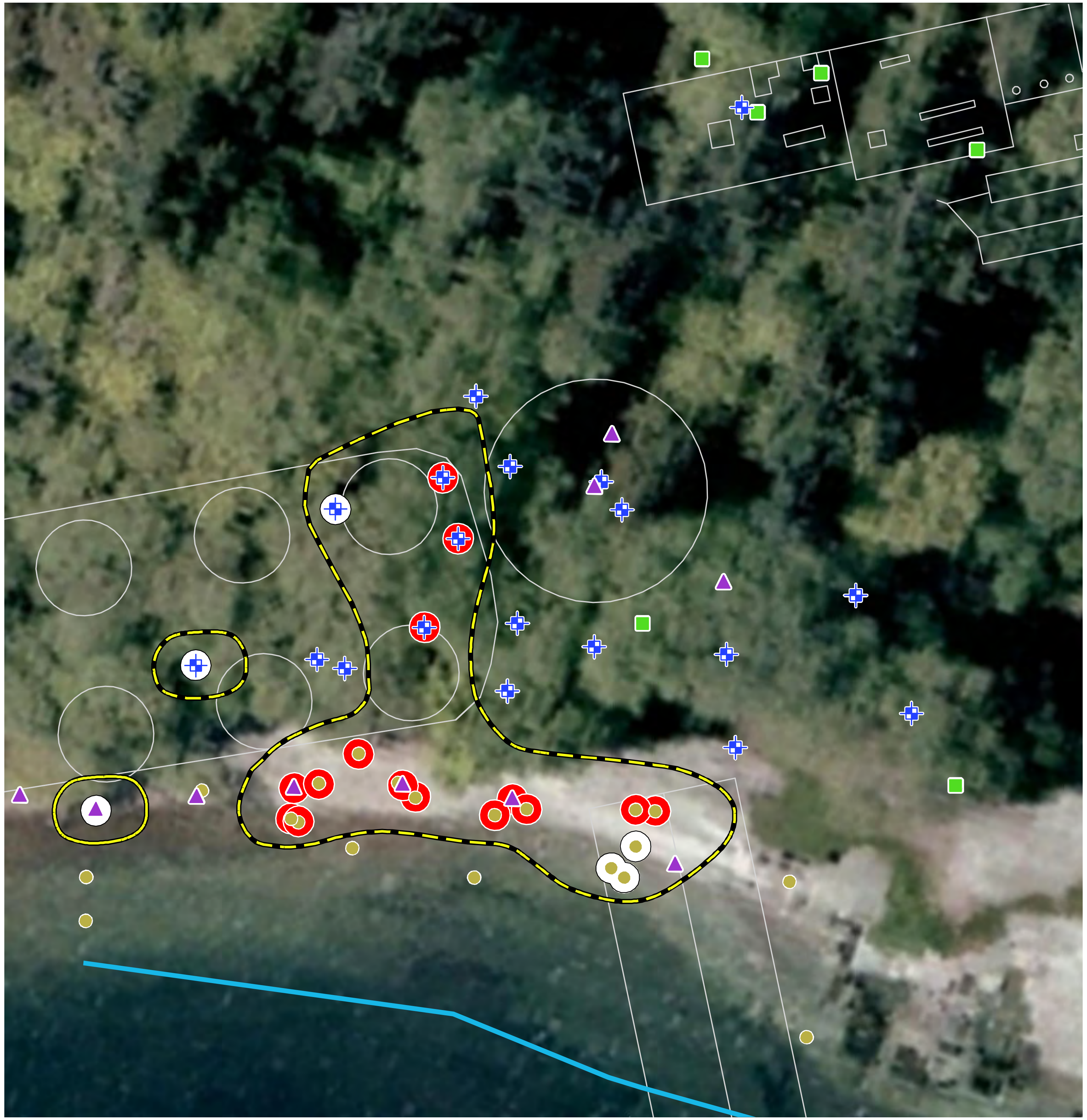
Metals: Upland Sample Locations with Exceedances of TEE Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 11

P:\0\0504042\00\CADD\T05\050404200 FIG 11.DWG\TAB:FIG 11 MODIFIED BY TMICHAUD ON AUG 21, 2009 - 10:32



Legend

- RI Soil Sample Location
- RI Sediment Sample Location
- Previous Soil Sample Location
- Previous Sediment Sample Location
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than soil/sediment screening level of 2,000 mg/Kg
- Sample location with one or more sample result(s) greater than sediment screening level of 136 mg/Kg, but less than 2,000 mg/Kg
- Sediment Areas Requiring Remedial Action (Total TPH >136 mg/Kg) - (dashes indicate extent is inferred)

40 0 40
FEET

Notes

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Former AST TPH Areas Requiring Remedial Action

Irondale Iron and Steel Plant
Irondale, Washington

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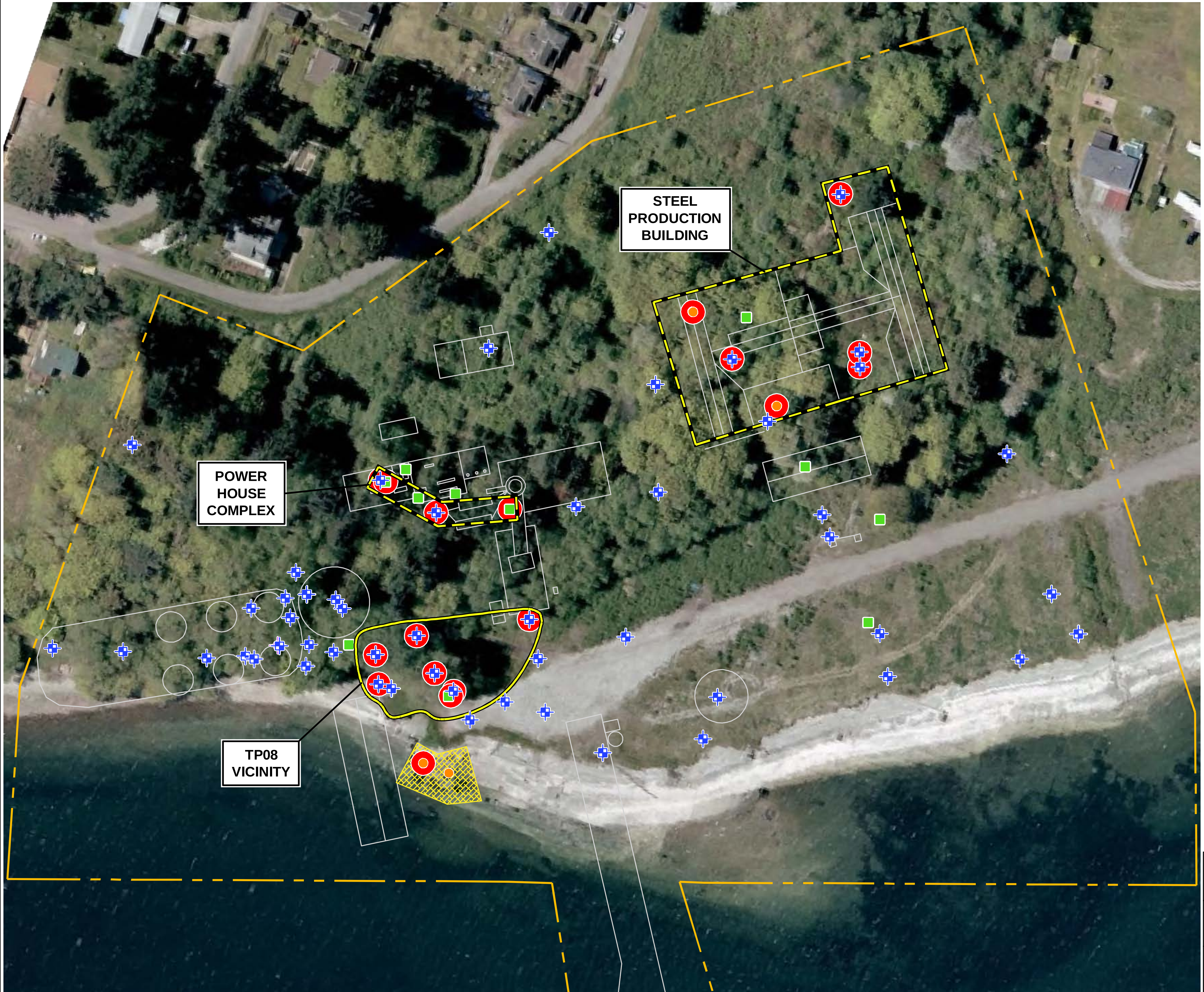
Figure 12

P:\0\0504042\00\CADD\T05\050404200 Fig 12.dwg\TAB:Fig 12 modified by tmichaud on Aug 20, 2009 - 15:49



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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Upland Areas Requiring Remedial Action

Irondale Iron and Steel Plant
Irondale, Washington

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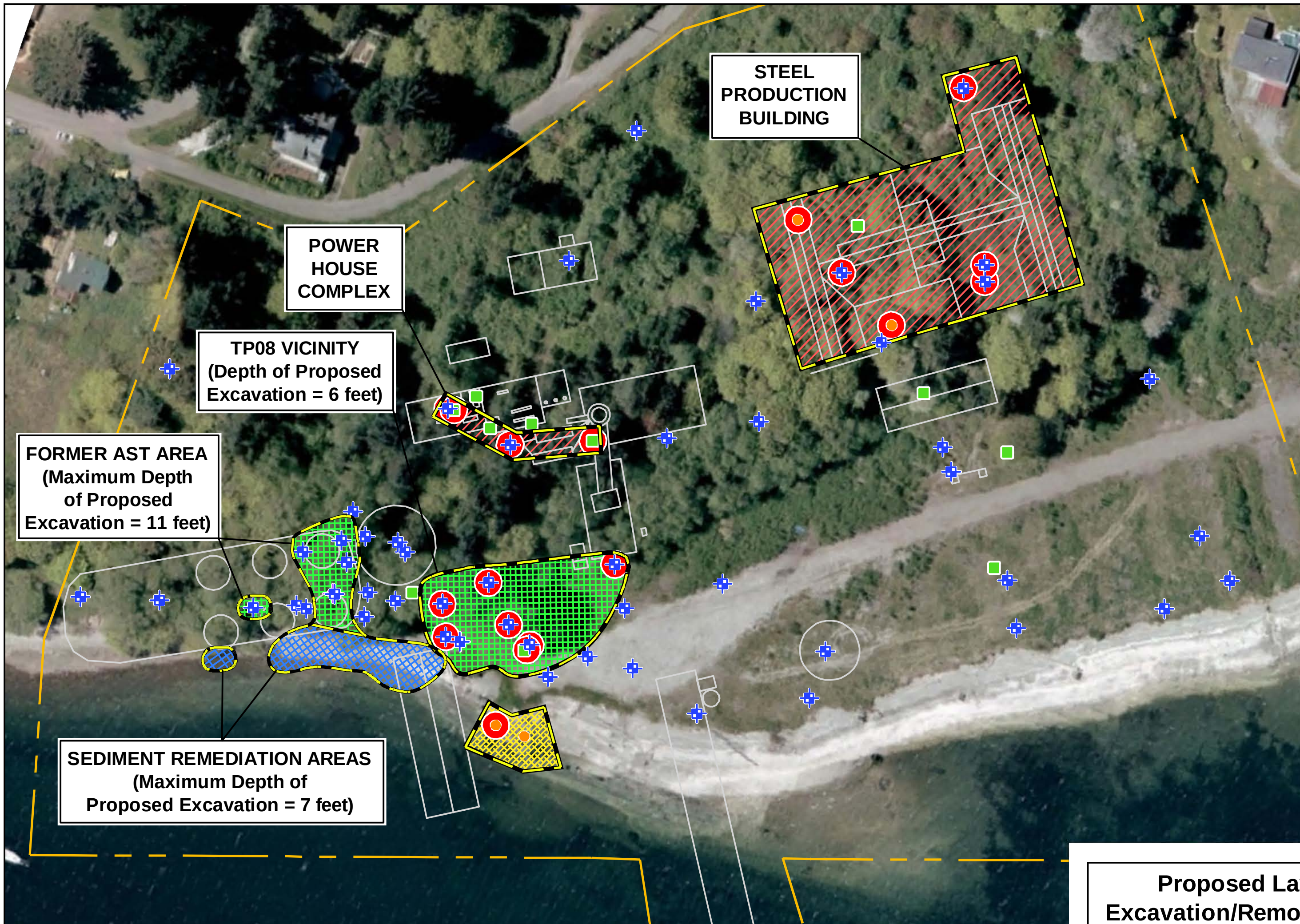
Figure 13

P:\0\0504042\00\CADD\T04\Site Plan Figures\SHEET\0504042OO Fig 13.dwg\TAB:Fig 13 modified by tmichaud on Aug 21, 2009 - 11:05



Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than human health or TEE soil screening levels
- Area Requiring Remedial Action
- Proposed Area of Geotextile and Soil Cap
- Proposed Area of Upland Remedial Excavation
- Proposed Area of Contaminated Sediment Removal
- Proposed Area of Slag Removal Associated with Shoreline Restoration

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

W N E S

150 0 150
FEET

Proposed Layout of Remedial Alternative 4
Excavation/Removal: Sediment Remediation Areas, Former AST Area, TP08 Vicinity
Capping: Power House Complex, Steel Production Building

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 14

GeoEngineers

Appendix A
Report Limitations and Guidelines for Use

APPENDIX A

REPORT LIMITATIONS AND GUIDELINES FOR USE[2]

This appendix provides information to help you manage your risks with respect to the use of this report.

ENVIRONMENTAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

GeoEngineers has prepared this Cleanup Action Plan for Irondale Iron and Steel Plant in general accordance with the scope and limitations of our proposal, dated April 24, 2007. This report has been prepared for the exclusive use of SAIC (GeoEngineers is subcontracted to SAIC for Ecology Contract #C0700034), it's authorized agents and the Washington State Department of Ecology. This report is not intended for use by others, and the information contained herein is not applicable to other properties.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an ESA study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and property. No one except SAIC, it's authorized agents and the Washington State Department of Ecology should rely on this environmental report without first conferring with GeoEngineers. Use of this report is not recommended for any purpose or project except the one originally contemplated.

THIS ENVIRONMENTAL REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for the Irondale Iron and Steel Plant. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made to the project or property after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

RELIANCE CONDITIONS FOR THIRD PARTIES

Our report was prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree to such reliance in advance and in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted environmental practices in this area at the time this report was prepared.

[2] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

ENVIRONMENTAL REGULATIONS ARE ALWAYS EVOLVING

Some substances may be present in the vicinity of the subject property in quantities or under conditions that may have led, or may lead, to contamination of the subject property, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substances, change or if more stringent environmental standards are developed in the future.

UNCERTAINTY MAY REMAIN EVEN AFTER RI/FS IS COMPLETED

Performance of an RI/FS is intended to reduce uncertainty regarding the potential for contamination in connection with a property, but no RI/FS can wholly eliminate that uncertainty. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely spaced sampling locations. It is always possible that contamination exists in areas that were not explored, sampled or analyzed. This CAP is based on the revised draft RI/FS dated August 13, 2009 prepared for the Irondale Iron and Steel Plant.

SUBSURFACE CONDITIONS CAN CHANGE

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the subject property, by new releases of hazardous substances, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Please contact GeoEngineers before applying this report for its intended purpose so that GeoEngineers may evaluate whether changed conditions affect the continued applicability of the report.

SOIL AND GROUNDWATER END USE

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other properties or for other on-site uses of the affected soil and/or groundwater. Note that hazardous substances may be present in some of the on-site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject property or reuse of the affected soil or groundwater on-site to evaluate the potential for associated environmental liabilities. We are unable to assume responsibility for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject property to another location or its reuse on-site in instances that we did not know or could not control.

MOST ENVIRONMENTAL FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations and chemical analytical data from widely spaced sampling locations at the subject property. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an informed opinion about subsurface conditions throughout the property. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

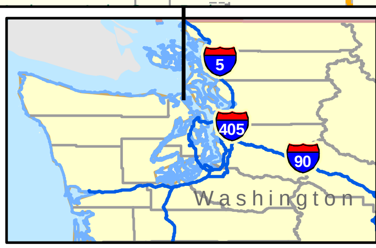
READ THESE PROVISIONS CLOSELY

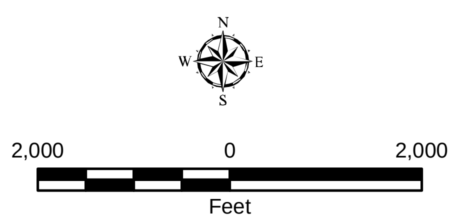
It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are less exact than other engineering and natural science disciplines. Without this understanding, there may be expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you need to know more about how these "Report Limitations and Guidelines for Use" apply to your project or property.

BIOLOGICAL POLLUTANTS

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.





Data Sources: ESRI Data & Maps, Street Maps 2005.
Chimacum Creek Tidelands location and Irondale Beach Park Tidelands location obtained from "Health Consultation. Evaluation of Selected Metals in Irondale Beach Park and Chimacum Creek Tidelands Shell Fish." Irondale, Jefferson County, Washington. Agency for Toxic Substances and Disease Registry. July 28, 2008.

Notes:
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3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 1

Office: SEA Path: P:\0\0504042\00\GIS\050404200 FIG-1-082009.mxd Map Revised: August 20, 2009

Site Plan

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 2

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures from Hart Crowser (1996).
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Map Revised: August 20, 2009
Path: P:\0\0504042\00\GIS\050404200_FIG-2-082009.mxd
Office:SEA

Map Revised: August 20, 2009

Path: P:\0\0504042\00\GIS\050404200_FIG-5-082009.mxd

Office:SEA

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007).
Former structures and Hart Crowser sample locations from Hart Crowser (1996).
Jefferson County sample locations from Jefferson County (2001 and 2007).

Notes:
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Pre-RI Sampling Locations (1996-2007)

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 5

TP03			
DEPTH	As	Fe	Pb
0.5'	**28.1**	**156,000**	**370**
1'	**58**	**419,000**	**720**
2'	6	24,300	27
2'	10.9	--	--
2'	**29.1**	**130,000**	**280**

TP40		
DEPTH	As	Fe
0.5'	**47**	**269,000**
0.5'	**56**	**243,000**
0.5'	**44**	**260,000**
1'	**43.6**	**202,000**
5'	3.7	19,800

TP22		
DEPTH	As	Fe
2'	**64**	**371,000**
2'	1	--
3'	2.0	15,300

SS-3		
DEPTH	Fe	Pb
0.2 - 0.25	**320,000**	**2,200**

TP30		
DEPTH	As	Fe
0.5'	**41**	**208,000**
3.5'	5 U	14,800

TP02	
DEPTH	Fe
2'	**99,000**
2.5'	16,100
3'	18,500

TP-06	
DEPTH	Fe
0.5' - 2'	**66,000**
1'	24,800

TP32			
DEPTH	As	Cu	Fe
0.5'	**50.4**	1,150	**95,700**
1.5'	**51**	**5,810**	**119,000**
2'	**31.1**	--	--
3'	**38.5**	883	**106,000**
5'	8.5	122	25,900

SS7	
DEPTH	Pb
unknown	**1,910**

TP28		
DEPTH	Cu	Ni
5	**97.1**	**57**

DP01		
DEPTH	As	Fe
4'	4.8	31,700
5'	**32**	**93,800**

TP08		
DEPTH	As	Fe
1.5'	14	39,800
2'	4.19	--
4'	**180**	**143,000**
4'	8.4	26,700
6'	**27**	**171,000**

TP34	
DEPTH	As
1.5'	5
5'	**22**

SLAG1			
DEPTH	As	Cu	Fe
surface	**36**	**3,060**	**363,000**

TP-11		
DEPTH	As	Fe
2.5' - 4.5'	**68**	**110,000**

Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop
- Sample location with one or more sample result(s) greater than human health soil screening levels

Soil Results in mg/Kg

Metal (Human Health Soil Screening Level)

As = Arsenic (20)

Cu = Copper (3,000)

Fe = Iron (58,700)

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Red/Bold Values exceed Human Health Soil Screening Levels

100 0 100

FEET

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Metals: Upland Sample Locations with Exceedances of Human Health Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 10

P:\0504042\00\CADD\T05\050404200 FIG 10.DWG\TAB:FIG 10 MODIFIED BY TMICHAUD ON AUG 21, 2009 - 10:24

Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop
- Sample location with one or more sample result(s) greater than plant TEE soil screening levels
- Sample location with one or more sample result(s) greater than wildlife TEE soil screening levels

Soil Results in mg/Kg

Metal (Plant / Wildlife Soil Screening Level)

As = Arsenic (18 / 386)
Cu = Copper (70 / 1,340)
Pb = Lead (120 / 285)
Ni = Nickel (48 / 3,870)
Zn = Zinc (160 / 360)

Red/Bold Values exceed TEE Soil Screening Levels

100 0 100
FEET

Notes

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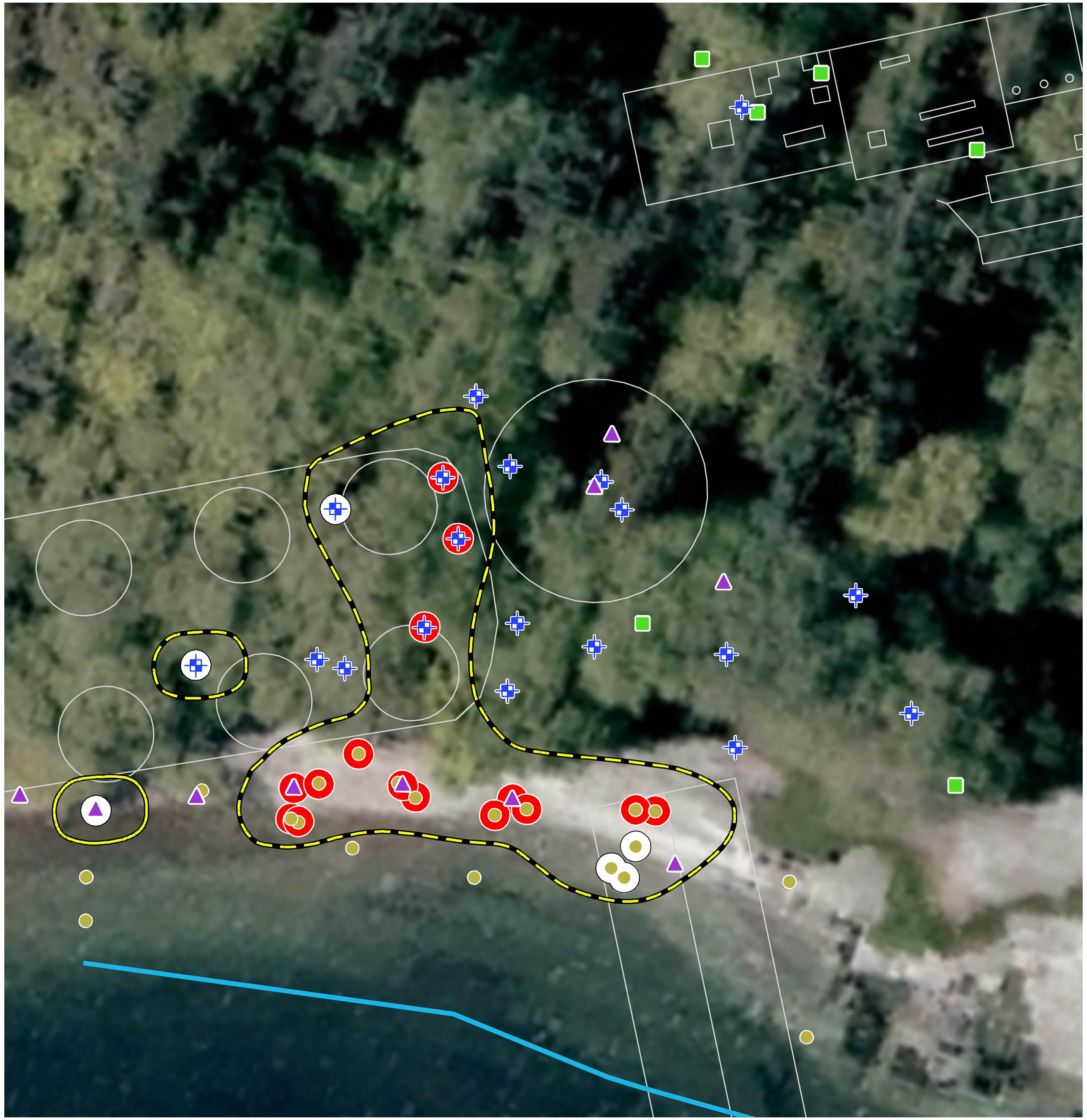
Metals: Upland Sample Locations with Exceedances of TEE Soil Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

GEOENGINEERS

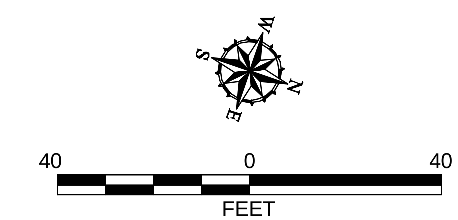
Figure 11

P:\0504042\00\CADD\T05\050404200 Fig 11.dwg\TAB:Fig 11 modified by tmichaud on Aug 21, 2009 - 10:32



Legend

- RI Soil Sample Location
- RI Sediment Sample Location
- Previous Soil Sample Location
- Previous Sediment Sample Location
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than soil/sediment screening level of 2,000 mg/Kg
- Sample location with one or more sample result(s) greater than sediment screening level of 136 mg/Kg, but less than 2,000 mg/Kg
- Sediment Areas Requiring Remedial Action (Total TPH >136 mg/Kg) - (dashes indicate extent is inferred)



Notes

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2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Former AST TPH Areas Requiring Remedial Action

Irondale Iron and Steel Plant
Irondale, Washington

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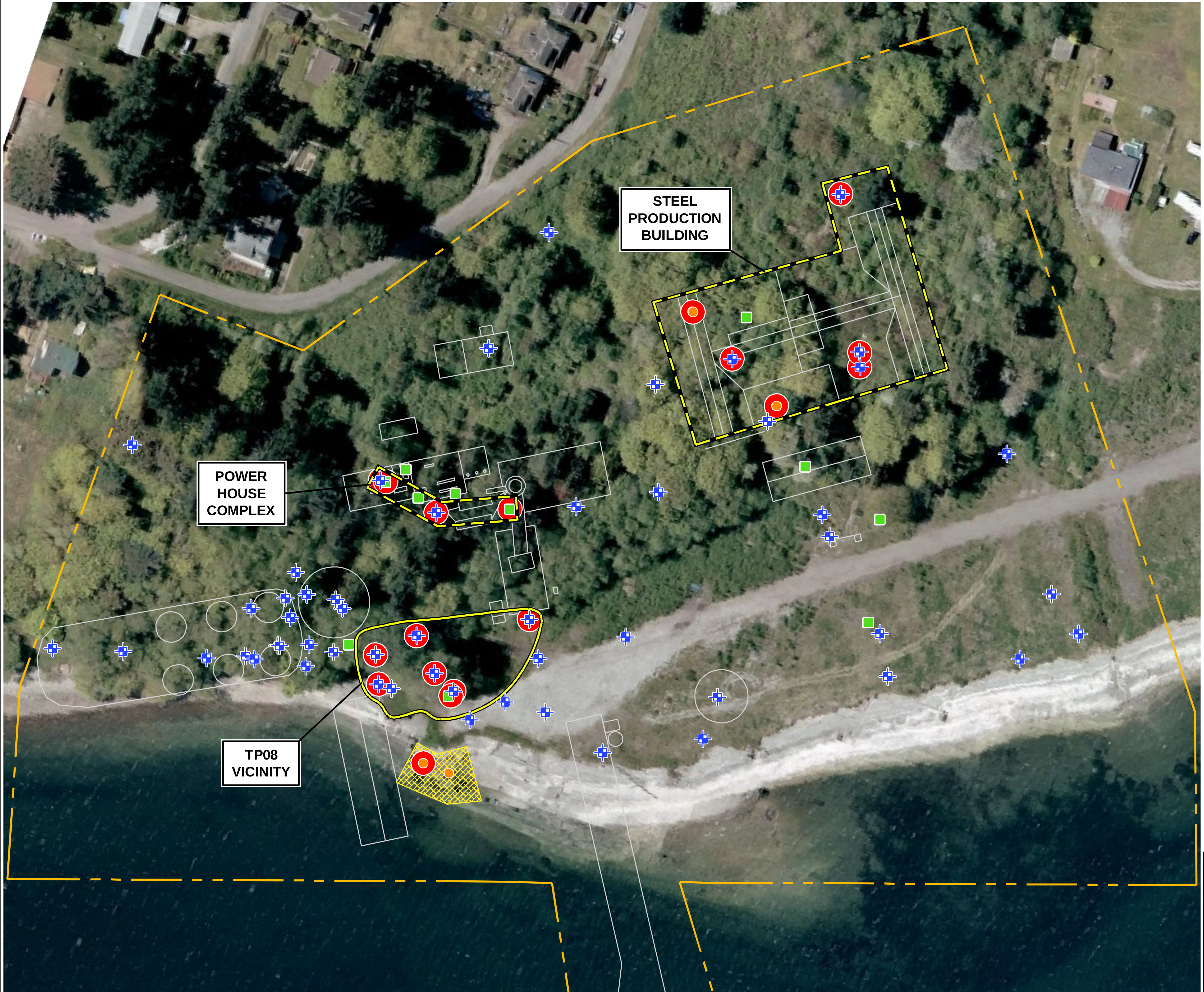
Figure 12

P:\0\0504042\00\CADD\T05\050404200 Fig 12.dwg\TAB:Fig 12 modified by tmichaud on Aug 20, 2009 - 15:49



Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than human health or TEE soil screening levels
- Upland Area Requiring Remedial Action (dashes indicate extent is inferred)
- Approximate Extent of Slag Outcrop

100 0 100
FEET

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Upland Areas Requiring Remedial Action

Irondale Iron and Steel Plant
Irondale, Washington

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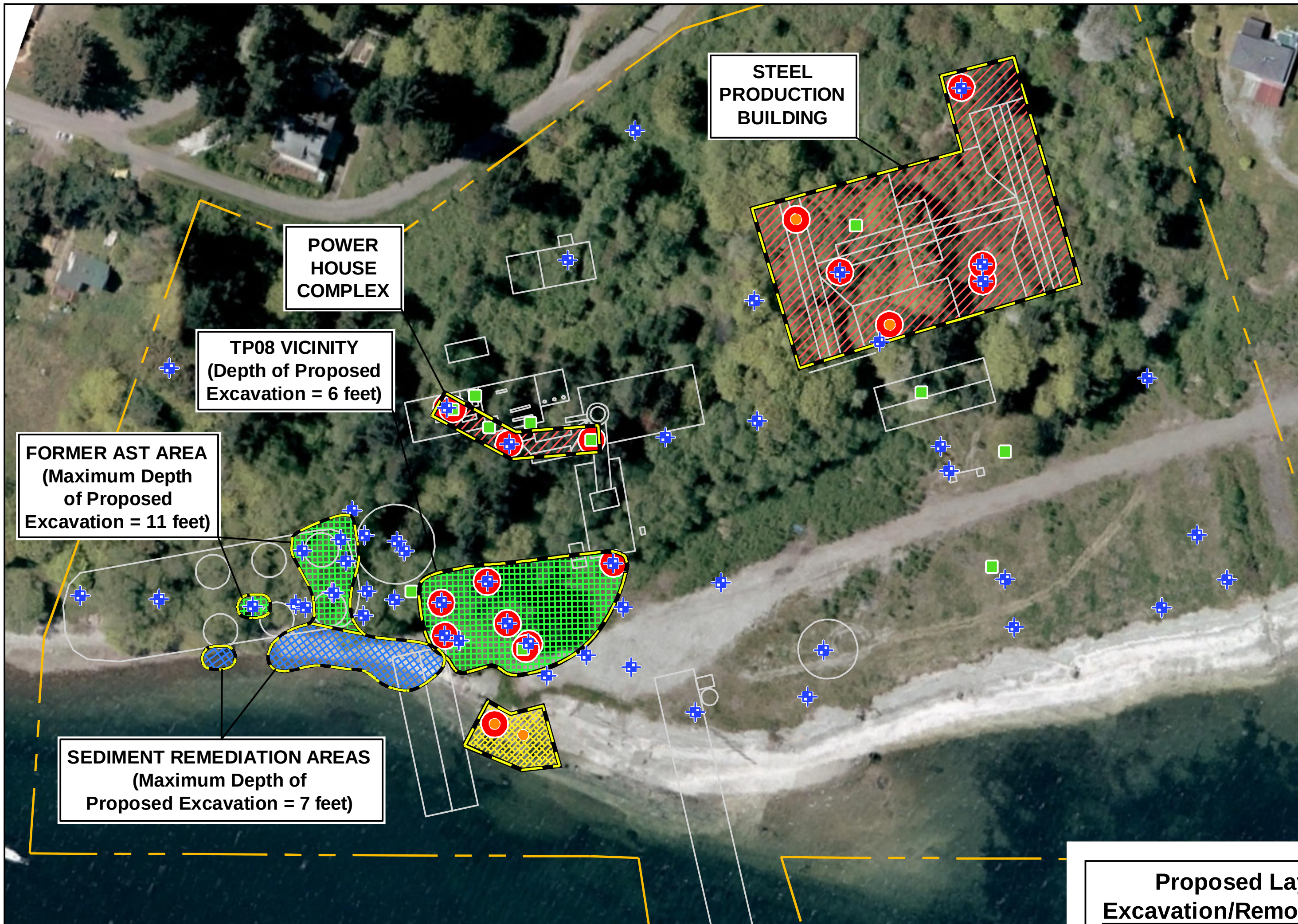
Figure 13

P:\0504042\00\CADD\T04\Site Plan Figures\SHEET\0504200 Fig 13.dwg\TAB:Fig 13 modified by tmichaud on Aug 21, 2009 - 11:05

P:\0\0504042\00\CADD\T04\August 09 Figures\050404200 Fig 14.dwg\TAB:f 15 modified by tmichaud on Aug 20, 2009 - 15:14



Legend

- RI Soil Sample Location
- Slag Sample Location
- Previous Soil Sample Location
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than human health or TEE soil screening levels
- Area Requiring Remedial Action
- Proposed Area of Geotextile and Soil Cap
- Proposed Area of Upland Remedial Excavation
- Proposed Area of Contaminated Sediment Removal
- Proposed Area of Slag Removal Associated with Shoreline Restoration

Proposed Layout of Remedial Alternative 4

Excavation/Removal: Sediment Remediation Areas, Former AST Area, TP08 Vicinity

Capping: Power House Complex, Steel Production Building

Irondale Iron and Steel Plant
Irondale, Washington

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Figure 14

Notes

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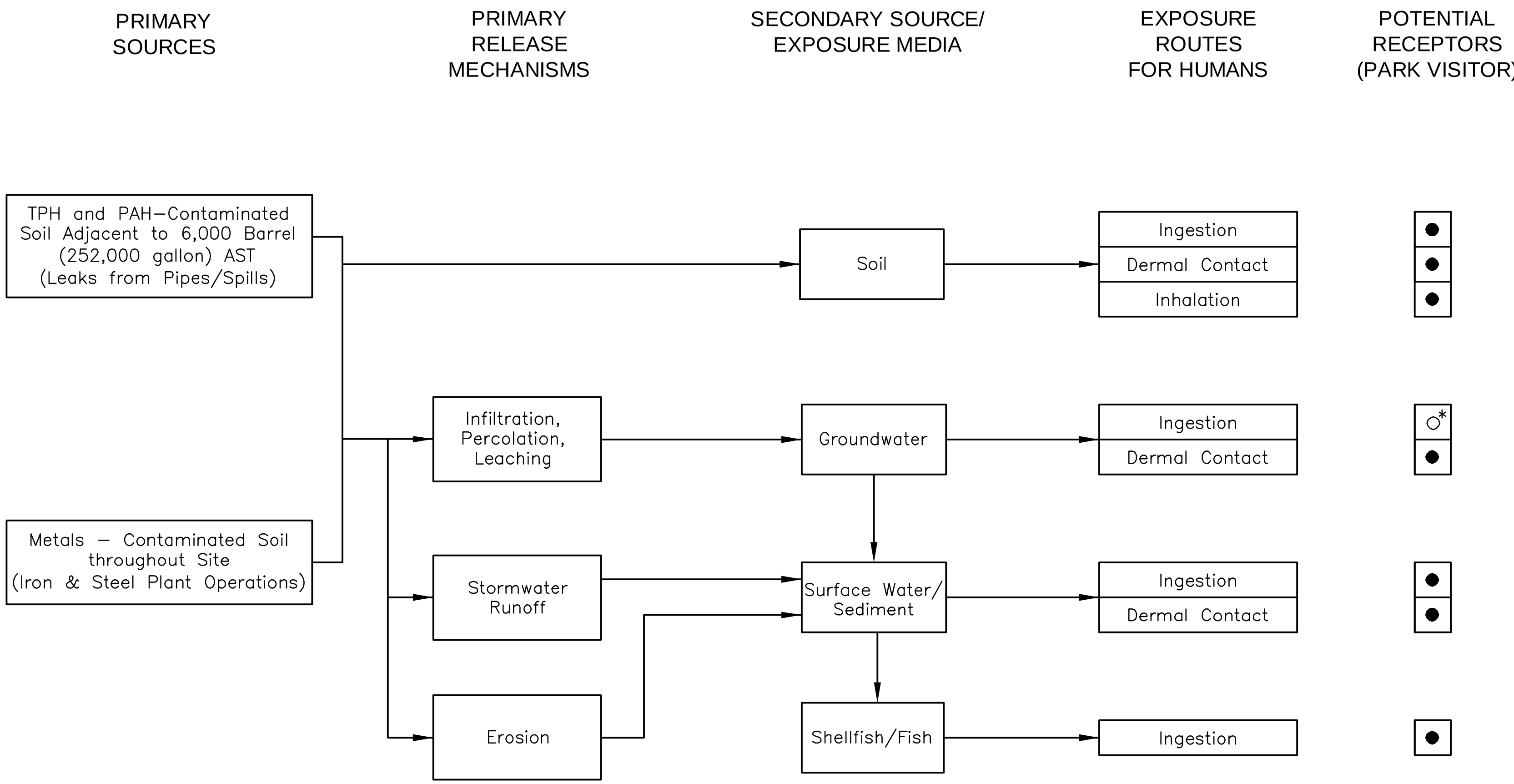
Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

150 0 150
FEET

P:\0\0504042\00\CADD\T05\050404200T04-Fig 3 and 4.dwg\TAB:Fig 6 modified on Aug 28, 2009 - 3:31pm

JCL : TJM



EXPLANATION:

● COMPLETE EXPOSURE PATHWAY

○* COMPLETE BUT INSIGNIFICANT EXPOSURE PATHWAY

Notes:

1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Human Health Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

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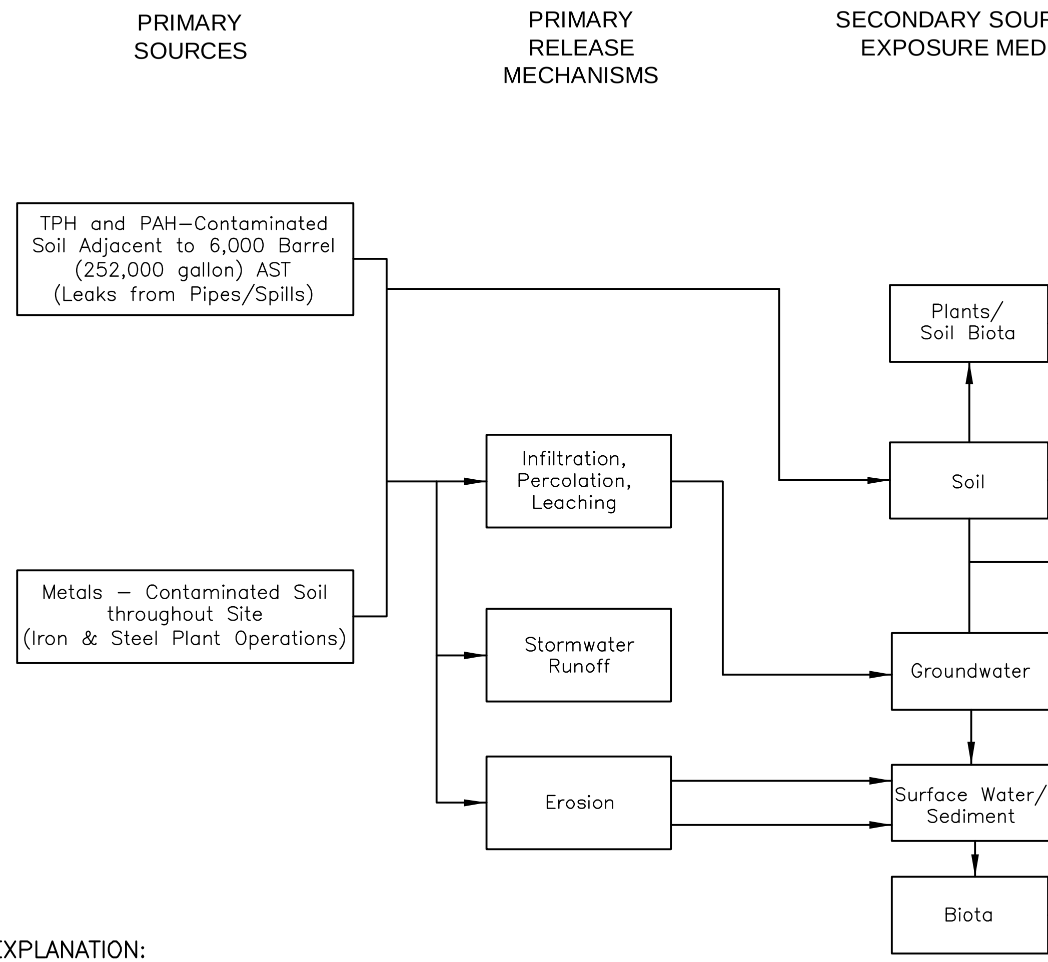
Figure 3



Media	Exposure Route	Plants	Soil Biota	Wildlife	Aquatic Organisms
Plants/Soil Biota	Ingestion	NA	○	●	NA
Soil	Ingestion	NA	●	––	NA
Soil	Dermal Contact	NA	––	––	NA
Soil	Inhalation	NA	––	––	NA
Soil/Groundwater	Plant Uptake	●	NA	NA	NA
Groundwater	Ingestion	NA	––	––	NA
Groundwater	Dermal Contact	NA	––	––	NA
Surface Water/Sediment	Ingestion	NA	NA	NA	●
Surface Water/Sediment	Dermal Contact	NA	NA	NA	●
Biota	Ingestion	NA	NA	NA	●

EXPLANATION:

● COMPLETE EXPOSURE PATHWAY

○ INCOMPLETE EXPOSURE PATHWAY

–– POTENTIALLY COMPLETE INSIGNIFICANT EXPOSURE PATHWAY

NA NOT APPLICABLE

Notes:

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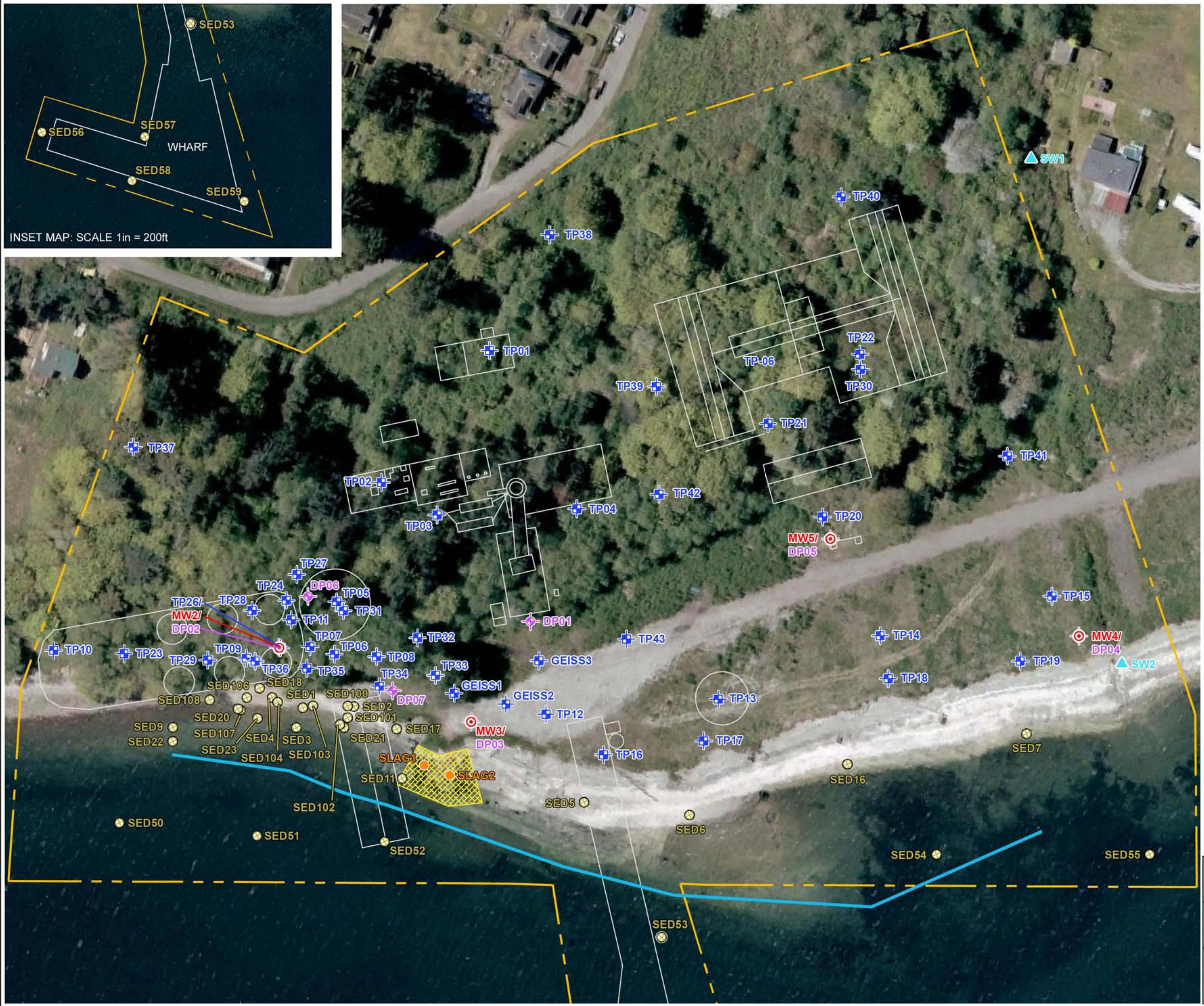
Ecological Conceptual Site Exposure Model

Irondale Iron & Steel Plant
Irondale, Washington

GEOENGINEERS

Figure 4



Legend

- DP01 — Direct-Push Boring Location and ID
- TP40 — Soil Sample Location and ID
- SLAG1 — Slag Sample Location and ID
- SED104 — Sediment Sample Location and ID
- SW1 — Surface Water Sample Location and ID
- MW3 — Monitoring Well Location and ID
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop

100 0 100

FEET

Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Monitoring well was not constructed at DD01 PC Draft RI/FS Work Plan (GeoEngineers, 2007A; i.e. MW01 does not exist).

Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

RI Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

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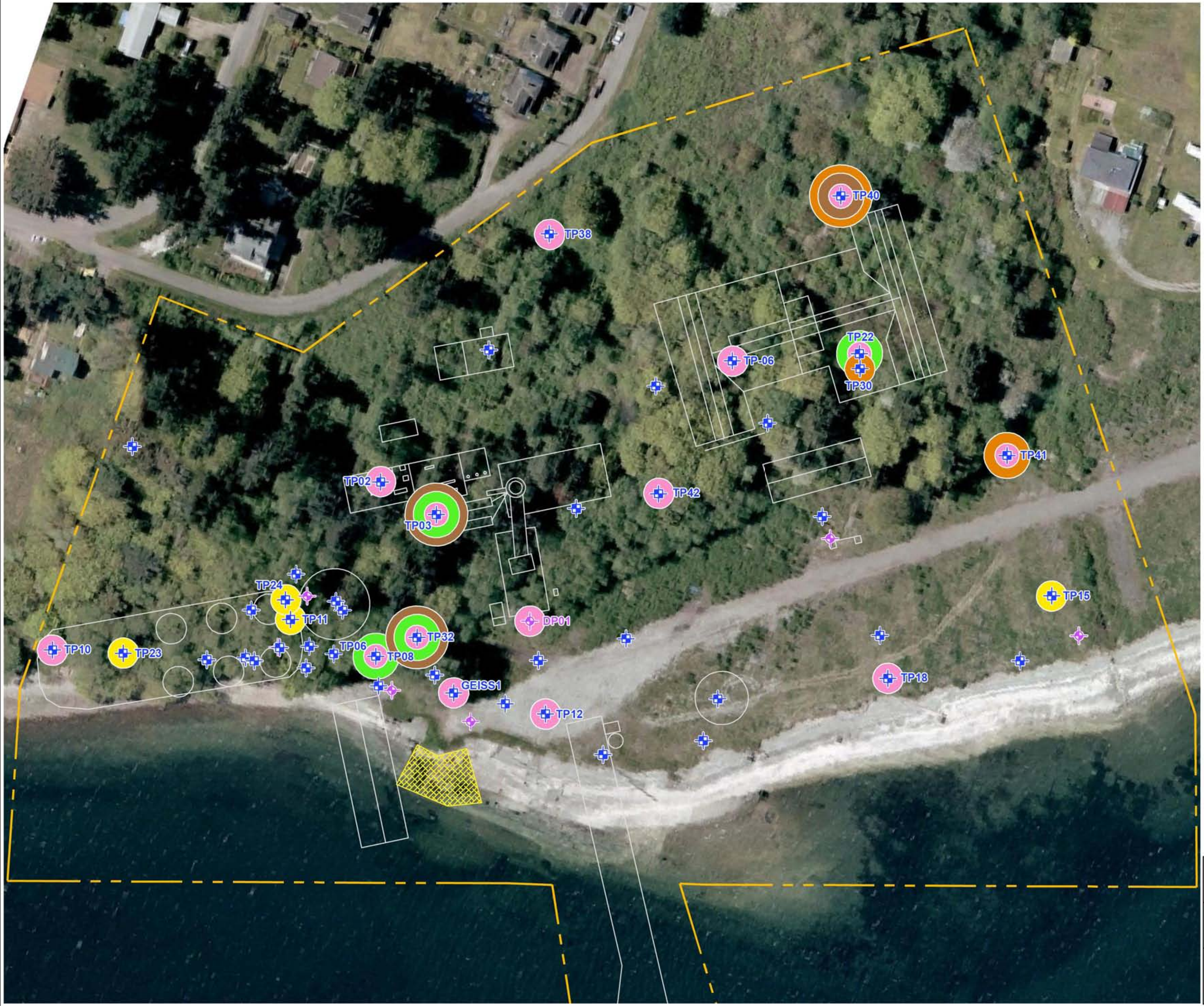
Figure 6

P:\0504042\00\CADD\T05\050404200T04-Fig 6.DWG\TAB:Fig 6 MODIFIED BY TMICHAUD ON AUG 20, 2009 - 15:52



Legend

- Soil Biota Bioassay (TPH) Soil Sample Location
- Plant and Soil Biota Bioassay (Metals) Soil Sample Location
- Arsenic (III/V) Speciation Soil Sample Location
- Co-located Soil / Plant Sample Location
- Co-located Soil / Earthworm Sample Location
- DP01 Direct-Push Boring Location and ID
- TP40 Soil Sample Location and ID
- Site Boundary
- Former Structures
- Approximate Extent of Slag Outcrop

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

Terrestrial Ecological Evaluation Sample Locations

Irondale Iron and Steel Plant
Irondale, Washington

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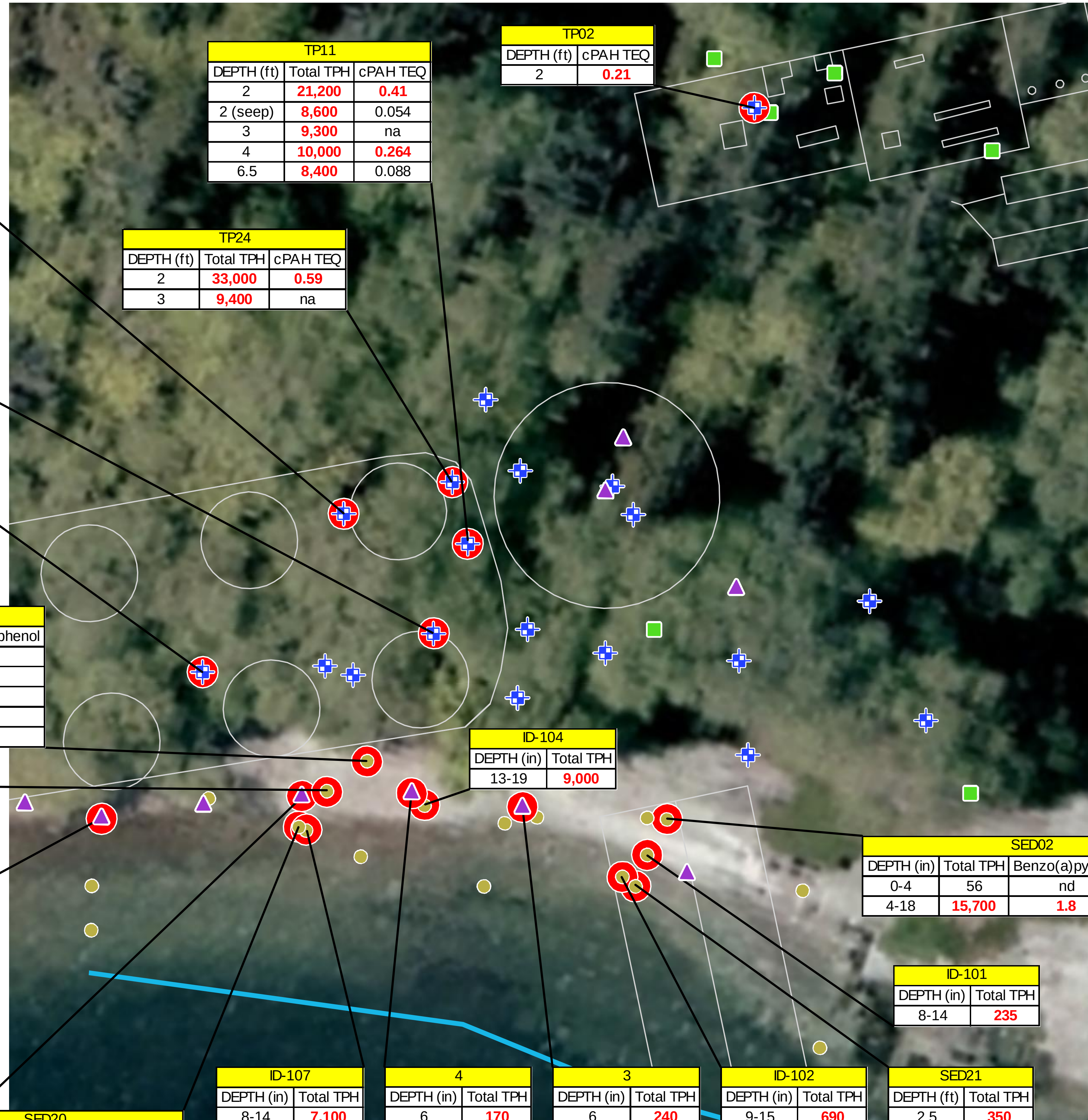
Figure 7

P:\0504042\00\CADD\T04\August 09 Figures\050404200 Fig 7.dwg\TAB:Fig 5 modified by tmichaud on Aug 20, 2009 - 14:11



TP02	
DEPTH (ft)	cPAH TEQ
2	**0.21**

TP11		
DEPTH (ft)	Total TPH	cPAH TEQ
2	**21,200**	**0.41**
2 (seep)	**8,600**	0.054
3	**9,300**	na
4	**10,000**	**0.264**
6.5	**8,400**	0.088

TP28	
DEPTH (ft)	Total TPH
3	nd
5	**350**
6.5	nd

TP24		
DEPTH (ft)	Total TPH	cPAH TEQ
2	**33,000**	**0.59**
3	**9,400**	na

TP26/DP02		
DEPTH (ft)	Total TPH	cPAH TEQ
2	na	na
4	na	na
6.5	**9,700**	**0.191**
7	**18,800**	0.13
11	**9,400**	na
13	23	na

TP29	
DEPTH (ft)	Total TPH
3	**183**
6	55
7	15

SED18		
DEPTH (ft)	Total TPH	2,4-Dimethylphenol
2.5	na	na
5	**6,100**	**0.14**
7.5	**1,290**	na
10	**950**	na
12.5	57	na

ID-104	
DEPTH (in)	Total TPH
13-19	**9,000**

ID-106	
DEPTH (in)	Total TPH
13-19	**6,200**

SED02			
DEPTH (in)	Total TPH	Benzo(a)pyrene	Chrysene
0-4	56	nd	nd
4-18	**15,700**	**1.8**	**3.3**

7	
DEPTH (in)	Total TPH
6	**180**
12	nd
18	**745**

5	
DEPTH (in)	Total TPH
6	110
12	**230**
18	**450**

ID-101	
DEPTH (in)	Total TPH
8-14	**235**

ID-107	
DEPTH (in)	Total TPH
8-14	**7,100**

4	
DEPTH (in)	Total TPH
6	**170**
12	**670**
18	104

3	
DEPTH (in)	Total TPH
6	**240**
12	**2,300**
18	**610**

ID-102	
DEPTH (in)	Total TPH
9-15	**690**

SED21	
DEPTH (ft)	Total TPH
2.5	**350**
5	27.7
7.5	na

SED20		
DEPTH (ft)	Total TPH	2,4-Dimethylphenol
1.5	**2,000**	**0.088**
3.5	**230**	na
5	**950**	na
6.5	7.9	na

Legend

- RI Soil Sample Location
- RI Sediment Sample Location
- Previous Soil Sample Location
- Previous Sediment Sample Location
- Approximate Mean Lower Low Water (MLLW)
- Site Boundary
- Former Structures
- Sample location with one or more sample result(s) greater than human health or benthic screening levels

TPH and cPAH (Soil and Sediment Screening Levels)

Soil - cPAHs (0.137; Human Health)
Soil - TPH (2,000; Human Health)
Sediment - TPH (2,000; Human Health)
Soil / Sediment - TPH (136; Benthic)
Sediment - Benzo(a)Pyrene (1.6; 1988 Puget Sound AET)
Sediment - Chrysene (1.4; 1988 Puget Sound AET)
Sediment - Dimethylphenol (0.029; SMS)

Soil and Sediment Results in mg/Kg

Red/Bold Values exceed at least one screening level

SMS = Sediment Management Standards
AET = Apparent Effects Threshold
NA = Not Analyzed
ND = Not Detected

40 0 40
FEET

Notes

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Reference: Aerial photo (April 2003) from Jefferson County (http:maps.co.jefferson.wa.us, accessed May 2007). Former structures from "Environmental Assessment, Log Chipping Facility, Irondale, Washington" (Hart Crowser, 1996).

TPH and SVOCs: Soil and Sediment Locations with Exceedances of Screening Levels

Irondale Iron and Steel Plant
Irondale, Washington

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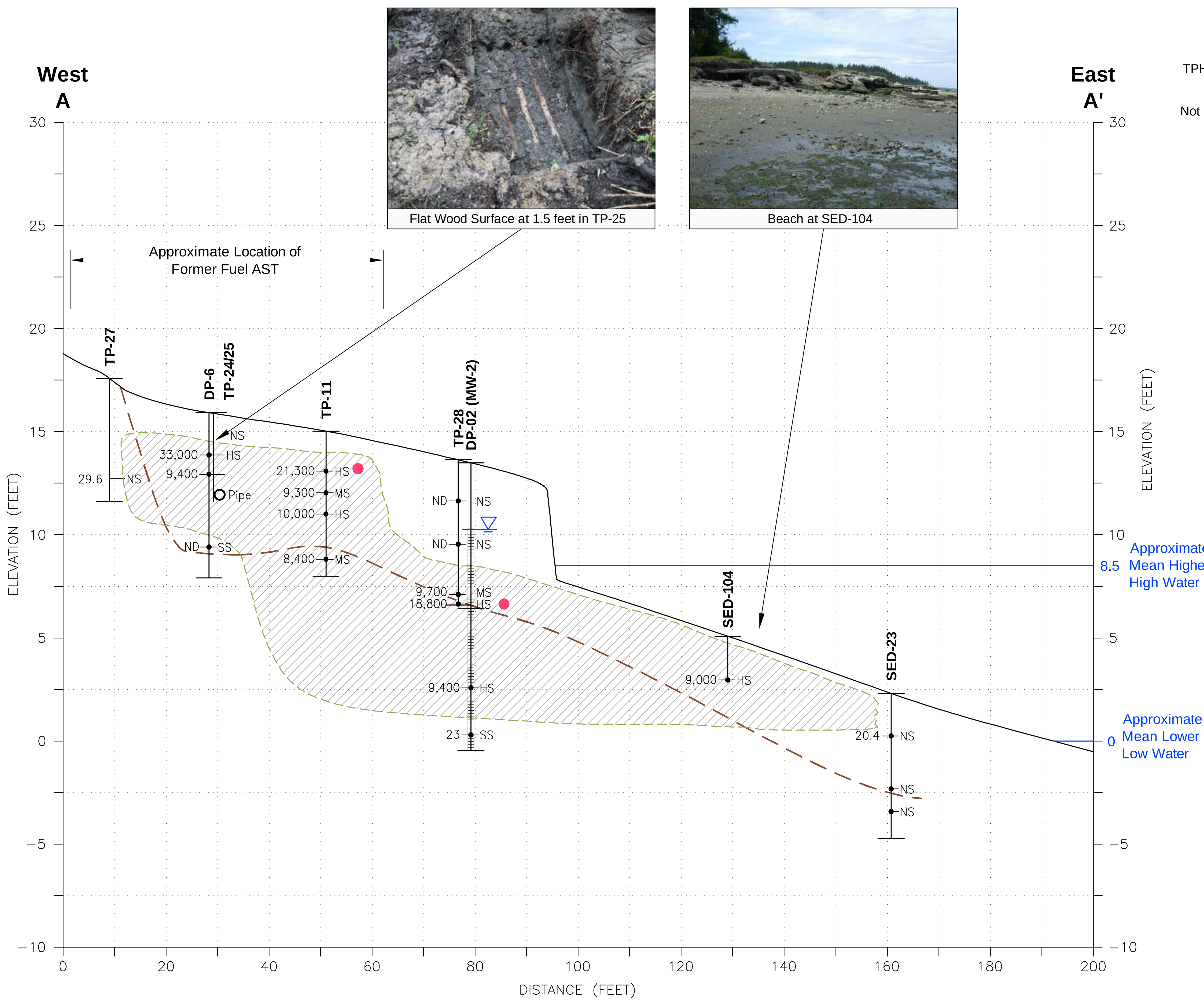
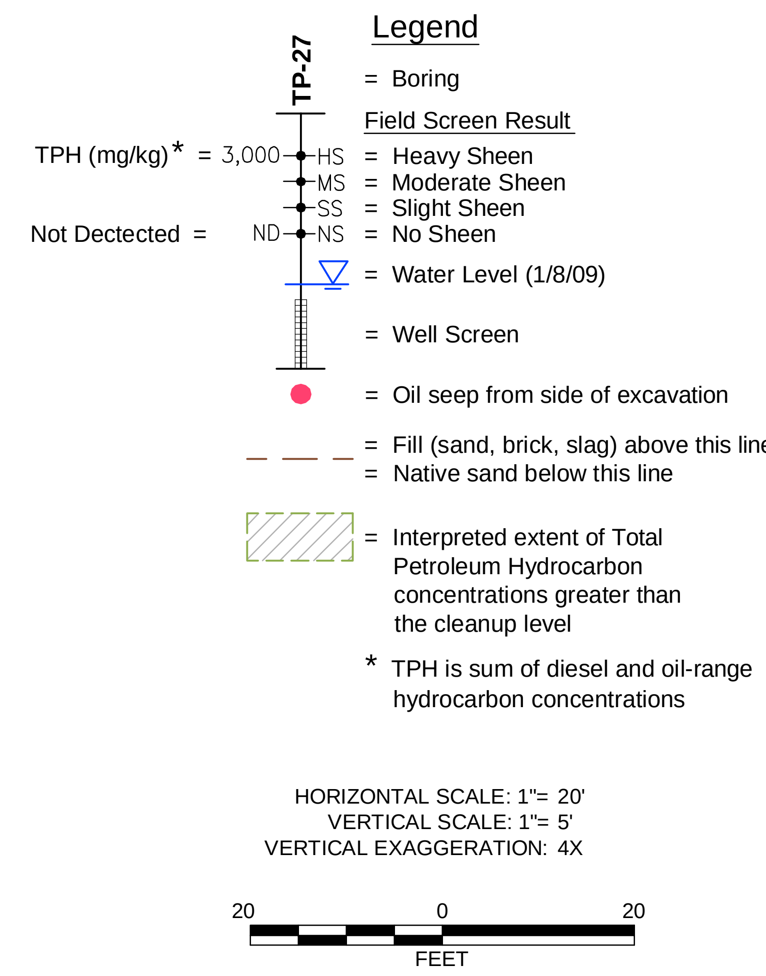
Figure 8

P:\0\0504042\00\CADD\T05\050404200T04-Fig 8.dwg\TAB:Fig 11 Modified by TMICHAUD on Aug 28, 2009 - 16:21





Notes

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Data were compiled from sources as listed in this figure. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.
3. MLLW Tidal Datum, MLLW=0' Converted from NGVD 29.

Cross Section from AST through Beach

State of Washington Department of Ecology
Irondale, Washington

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Figure 9

P:\0\0504042\00\CADD\T04\0504042200T04-F8.DWG\TAB:FX MODIFIED BY TMICHAUD ON AUG 20, 2009 - 14:45