MAUL
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FINAL FEASIBILITY STUDY

FORMER PRECISION ENGINEERING, INC. SITE

1231 SOUTH DIRECTOR STREET, SEATTLE, WASHINGTON

PREPARED FOR

STOEL RIVES LLP

MARCH 3, 2011

PROJECT NO. 8006.08.04

PIONEERING CHANGE WITH INNOVATIVE SOLUTIONS

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1231 SOUTH DIRECTOR STREET, SEATTLE, WASHINGTON

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Mark Adams

Prepared for
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The material and data in this report were prepared under the supervision and direction of the undersigned.

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FIGURES

ARAR	applicable or relevant and appropriate requirement
AWQC	ambient water quality criteria
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CUL	cleanup level
DCE	dichloroethene
DRO	diesel-range organic(s)
Ecology	Washington State Department of Ecology
e-mail	electronic mail
FS	feasibility study
FSDS	field sampling data sheet
GHG	greenhouse gas
gpm	gallons per minute
IHS	indicator hazardous substance
KCBOH	King County Board of Health Code
LUST	leaking underground storage tank
MFA	Maul Foster & Alongi, Inc.
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MTCA	Model Toxics Control Act
MTCO2e	metric tons carbon dioxide equivalents
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
NFA	No Further Action
ORO	oil-range organic(s)
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
POC	point of compliance
Precision	Precision Engineering, Inc.
RA	risk assessment
RI	remedial investigation
SE/E	Sweet-Edwards/EMCON, Inc.
SMP	soil management plan
TCE	trichloroethene
TEF	toxicity equivalency factor
TPH	total petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code
WBZ	water-bearing zone

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1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this final feasibility study (FS) for the former Precision Engineering, Inc. (Precision) site at 1231 South Director Street in Seattle, Washington (see Figures 1 and 2). The original FS was submitted by Precision on April 21, 2010. MFA has prepared this revised FS to address comments from the Washington State Department of Ecology (Ecology) provided in a July 22, 2010, electronic mail (e-mail) (Ecology, 2010b) and during a November 3, 2010, meeting with Ecology (Ecology, 2010c), including a request for an additional round of groundwater monitoring.

The FS is being conducted under Ecology's Voluntary Cleanup Program (identification number: NW 1511). Precision entered the program in October 2005, after completing a preliminary soil and groundwater assessment in June 2005. A supplemental remedial investigation (RI) (MFA, 2006a) was submitted to Ecology, summarizing investigations completed by MFA between June and December 2005. Based on that report, Ecology issued an opinion letter on March 27, 2006, that concluded that the work completed was not sufficient to meet specific substantive requirements contained in the Washington State Model Toxics Control Act (MTCA) and its implementing regulations, Chapter 70.105D Revised Code of Washington and Chapter 173-340 Washington Administrative Code (WAC) for characterizing the site (Ecology, 2006b). Precision submitted an RI and risk assessment (RA) report on July 17, 2006. Ecology has issued a number of comments on the RI/RA report by e-mail. A final RI/RA report was prepared on July 21, 2008, which superseded all previous submittals and incorporated many of Ecology's comments. On September 21, 2009, Ecology prepared an opinion letter (Ecology, 2009) including comments on the RI/RA report. Ecology's requests in the September 2009 letter for additional information, in addition to comments in a telephone conversation on January 28, 2010 (Ecology, 2010a), in a July 22, 2010 e-mail (Ecology, 2010b), and during a November 3, 2010, meeting (Ecology, 2010c), are addressed in this final FS report.

1.1 Property Location and Description

The approximately 3.5-acre site is in King County, Washington, section 32, township 24 north, range 4 east, Willamette Meridian. The site is approximately 1,800 feet west of the Duwamish River. The area surrounding the site is characterized by mixed industrial and residential use. The site is zoned I (Industrial). A single 62,000-square-foot building is located at the site. The east side of the building was constructed in 1968, and the west part was added in 1979. The building is surrounded by an asphalt parking lot (see Figure 2).

Precision operated continuously at the property between 1968 and 2005, ceasing operations on March 1, 2005. Precision specialized in the manufacture and repair of large hydraulic cylinders, large rolls used in the manufacture of paper and metal sheet products, and other equipment. Services included precision grinding and polishing, honing, hard-chrome plating, milling, welding, and a large number of flame- and arc-applied metal coatings. Much of Precision's work involved the use of chromic acid.

Approximately 10,000 square feet of the west side of the building was leased to Baszile Metals Service, an aluminum distributorship, between approximately 1985 and 2003. Former operational areas and tanks inside the building are shown on Figure 3.

The property was sold in March 2007 and is currently occupied by Pacific Industrial Supply, Inc., a wire rope and marine/industrial supply distributor.

West of the former Precision property is a business that repairs and sells refrigerators. East of the former Precision property is a towing and limousine service business (former KASPAC/Chiyoda property). According to former Precision personnel, the property to the east was used as a paint shop in the 1970s, and before that it was a fiberglass-boat-manufacturing operation.

1.2 Site Definition

Ecology's MTCA regulations (WAC 173-340-200) define a site or facility as:

> [A]ny building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, vessel, or aircraft; or any site or area where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located.

Ecology (2006a) has defined the site as the extent of contamination caused by:

- Diesel-range organics (DRO) and oil-range organics (ORO) in soil and groundwater
- Chromium and other metals in soil and groundwater
- Trichloroethene (TCE) and its breakdown products in soil, groundwater and air

Ecology requested that Precision's RI include the drainage ditch located south of the former Precision property. Therefore, the site includes the off-property drainage ditch.

1.3 Environmental Setting

The former Precision facility is located at the base of a hill along South Director Street. The site is generally flat except for the northern and western edges of the property, which consist of a steep excavated slope. The property is located in the lowland area of the Duwamish River Valley. The Duwamish River is approximately 1,800 feet east of the site and flows north to Elliott Bay.

1.3.1 Surface Water and Stormwater System

Stormwater from the western portion of the Precision property flows into a catch basin south of the building. The catch basin drains south to a manhole that in turn discharges to a drainage ditch south of the property boundary. Stormwater from the east side of the property flows east and southeast and mixes with stormwater from the property that lies east of the former Precision property. Stormwater from the east side flows into the drainage ditch south of the property. A 1989 survey by John R. Ewing and Associates shows a catch basin at the property directly east of the former Precision property. The catch basin is shown with an outfall to the ditch (see Figure 2).

The off-property drainage ditch empties into a 24-inch storm drain and then through a network of pipes that discharges to the Duwamish River (Sweet-Edwards/EMCON, Inc. [SE/E], 1990b). The pavement on the Highway 99/W Marginal Way S on-ramp south of the property slopes toward the drainage ditch such that stormwater from the on-ramp drains into the ditch via sheet flow. In addition to receiving runoff from the site and the Highway 99/W Marginal Way S on-ramp, the ditch receives surface-water runoff from properties to the west and east of the former Precision property, and water from a ditch that parallels 14th Avenue.

1.3.2 Geology

The site is underlain by localized fill up to 10 feet thick (observed only in the eastern portion of the site); alluvium composed of silt and sand (from the surface to a depth of approximately 20 feet, observed only on the eastern portion of the site); dense, gravelly, sandy silt glacial till (observed from surface to approximately 20 feet below ground surface [bgs] in the western part of the site and from 20 feet to 30 feet bgs in the eastern part of the site); and alluvium comprising sand and gravel (advanced outwash, observed from 30 feet bgs and below). The geology observed during the site investigations is generally consistent with a cross section prepared by SE/E (Precision, 1993). The 2008 RI/RA (MFA, 2008) report includes boring and well logs.

1.3.3 Hydrogeology

Two water-bearing zones (WBZs) are present beneath the site: (1) a confined alluvial WBZ beneath the eastern side of the site that flows easterly toward the Duwamish River (shallow WBZ), and (2) a confined sand and gravel WBZ beneath the low-permeability glacial till (deep WBZ, which is also referred to as the advanced outwash WBZ) (Precision, 1993). East of the facility, the glacial till appears to hydraulically separate the two WBZs (Precision, 1993).

The first groundwater in the alluvium is encountered between 5 and 8 feet bgs. Saturated conditions are first encountered deeper in the till (between approximately 7 and 14 feet bgs). Depth-to-water measurements were collected at monitoring wells MW1 through MW8. The depth to groundwater in wells installed in the shallow WBZ is between 3.49 and 6.39 feet bgs (see Table 1). The higher static groundwater elevations in the monitoring wells indicate confined conditions in the alluvium and the till. Because of the confining conditions in the shallow aquifer, while the potentiometric surface may be as shallow as 3.5 feet bgs, the till is not necessarily saturated at that depth. Figures 4 and 5 show the potentiometric surface for the shallow WBZ in December 2005 and April 2006, respectively. Estimated potentiometric contours show that the shallow WBZ generally flows from west to east. The hydraulic gradient of the shallow WBZ downgradient of the property was calculated to be 0.003, using site groundwater-elevation data collected from MW6 (located at the property boundary) on April 17, 2006, and an average daily staff gauge elevation for the Duwamish on the same day (USGS, 2007).

In the deep WBZ (confined sand and gravel WBZ), MW1 exhibited flowing artesian conditions and MW7 showed a water level below that of MW1 and the shallow WBZ (see Figures 4 and 5). A deep potentiometric surface map was not created because of insufficient data (only two data points). Based on the available data from MW1 and MW7, it is assumed that MW1 is upgradient of the site and MW7 is downgradient of the site.

The site-specific hydrogeology described above is generally consistent with that described for the central Duwamish Valley in the shallow groundwater use designation report prepared by the Duwamish Coalition (Duwamish Coalition, 1998).

2 SITE INVESTIGATION SUMMARY

2.1 Site Characterization Investigations

Extensive site characterization activities have been conducted at the Property since 1986. In April 1986, the Municipality of Metropolitan Seattle collected four off-site sediment samples in the drainage ditch southeast of Precision (Ecology, 1986). Also in 1986, SCS Engineers collected two composite soil samples in the southeastern corner of the facility, near a former solid-waste dumpster, where overland water runoff enters the drainage ditch (SCS, 1986). From 1988 through 1989, SE/E investigated soil around the original Plating Tanks 1 and 2 after observing yellow-stained soil in an opening in the concrete floor near Plating Tank 1 (SE/E, 1988, 1989, 1990a). In 1989, SE/E completed a study to assess sediments in the drainage ditch on the south side of the property (SE/E, 1990b). In 1989, one soil boring was drilled northeast of Plating Tank 7 to evaluate potential leakage of chrome-plating waste into soil and groundwater from cracks in the containment vault for Plating Tank 7 (Precision, 1993). In 1988, SE/E installed four groundwater-monitoring wells and two piezometers (MW-1, MW-2, MW-3, MW-4, P-1, and P-2). The results from three rounds of groundwater monitoring from June 1988 to March 1990 are described in Precision's 1993 Independent Remedial Action Report (Precision, 1993).

Investigations completed before 2005 are described in detail in the RI work plan (MFA, 2005b). Investigations completed from June 2005 through January 2007 are described in detail in the RI/RA report (MFA, 2008).

In June 2005, MFA conducted an initial investigation and advanced 11 Geoprobe™ borings (GP-1 through GP-11; see Figure 6) at the site to characterize releases of hazardous substances near former plating tanks and floor trenches and drains (MFA, 2005a). Additional investigations completed in December 2005 involved installing four monitoring wells (MW-5 through MW-8) and collecting soil, reconnaissance groundwater, and groundwater samples from 32 Geoprobe borings; surface soil samples from five locations in the ditch just south of the property; and groundwater samples from all eight monitoring wells (see Figure 6). On April 18 and 19, 2006, shallow-soil samples were collected from six additional locations in the ditch south of the property, groundwater samples were collected from the eight monitoring wells, and subslab soil vapor samples were collected from seven probes inside the building (see Figures 6 and 7). On June 13, 2006, indoor air samples were collected from eight locations inside the building, and one air sample was collected outside the building (see Figure 7). On January 7, 2007, additional samples were collected from 13 locations in the ditch to further investigate the nature and extent of lead and arsenic in and around the ditch. Between July 13 and 16, 2010, an additional round of groundwater sampling was conducted from the eight monitoring wells, at the request of Ecology. This additional sampling event was meant to provide current data.

2.2 Nature and Extent

Tables summarizing soil, groundwater, and air results for metals, volatile organic compounds (VOCs), petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls are included in the 2008 RI/RA report (MFA, 2008).

2.2.1 Soil on Property

Indicator hazardous substances (IHSs) in soil, including hexavalent chromium and TCE, were initially identified in the February 22, 2006, RI report (MFA, 2006a) by comparing soil analytical results to MTCA Method C soil cleanup levels (CULs) for direct contact (ingestion) and calculated CULs for the protection of groundwater, except for arsenic, lead, DRO, and ORO, which were compared to the MTCA Method A soil CULs. Subsequent to the 2006 screening, Ecology requested the addition of trivalent chromium, DRO, and ORO as IHSs. IHSs identified in on-site soil are:

- Hexavalent chromium and trivalent chromium
- Petroleum hydrocarbons (DRO and ORO)
- TCE

The nature and extent of IHSs in soil on the property have been adequately characterized, as described below. Based on the work described in the 2006 RI/RA report (MFA, 2006b), Ecology did not request any additional characterization for soil on the property (Ecology, 2006b).

2.2.1.1 Hexavalent Chromium and Trivalent Chromium

Hexavalent chromium detections ranged from 0.119 milligram per kilogram (mg/kg) (GP7 at 2.0 feet bgs) to 3,500 mg/kg (GP32 at 1.0 feet bgs). The highest concentrations of hexavalent chromium were found in the former chrome-shop area. Hexavalent chromium was not detected in on-site soil samples collected from outside the building.

Trivalent chromium was detected at concentrations ranging from 16.93 mg/kg (GP11 at 6.5 feet bgs) to 3,250 mg/kg (GP32 at 1.0 foot bgs). The highest concentrations of trivalent chromium on site are in the former chrome-shop area inside the building footprint.

2.2.1.2 Petroleum Hydrocarbons (DRO and ORO)

DRO were detected in soil at concentrations below 200 mg/kg, except for a sample from GP21 at 6.5 feet bgs, which contained DRO at 5,270 mg/kg. ORO were detected in soil at concentrations below 1,500 mg/kg, except for a sample from

GP21 at 6.5 feet bgs, which contained ORO at 19,900 mg/kg. Concentrations of DRO and ORO at GP21 increase with depth.

2.2.1.3 TCE

TCE was detected at concentrations ranging from 3.43 micrograms per kilogram (µg/kg) (GP18 at 1.0 feet bgs) to 1,160 µg/kg (GP6 at 14.5 feet bgs). All detections were in the former chrome shop and former grinding shop (see Figure 3).

2.2.2 Soil in Off-Property Ditch

IHSs in ditch soil, including arsenic, cadmium, copper, hexavalent chromium, lead, and chrysene, were initially identified based on a screening of soil analytical results compared to MTCA Method C CULs for direct contact (ingestion) and calculated CULs for the protection of groundwater, except for arsenic, lead, DROs, and OROs, which were compared to the MTCA Method A soil CULs (MFA, 2006a).

The nature and extent of contaminants in the off-property ditch is discussed in detail in Section 7 of the RI/RA (MFA, 2008). As described further in Section 2.4, contaminated ditch sediment identified in the RI/RA has been removed as part of an interim cleanup action. Soils were excavated, the ditch backfilled with clean soil, and the surface restored with grass. Based on this cleanup action, contaminants formerly found in ditch soil are not discussed in this report.

2.2.3 Groundwater

Reconnaissance groundwater samples were collected from GP2, GP4 through GP8, GP13, and GP15.

As part of the 2006 RI report (MFA, 2006a), IHSs in groundwater were identified by comparing analytical results for reconnaissance groundwater samples and groundwater samples collected from monitoring wells to MTCA Method C groundwater CULs, except for arsenic, DROs, and OROs, which were compared to the MTCA Method A groundwater CULs. Note that MTCA CULs for carcinogenic PAHs (cPAHs) have changed since the 2006 RI report to consider cPAHs as a single hazardous substance when screening. However, the MTCA rule amendment (October 12, 2007) does not change the outcome of the IHS selection and subsequent risk evaluation for groundwater. Analytical data from samples collected in April 2006 (after the 2006 RI report) and July 2010 were also compared to screening levels, and no additional IHSs resulted. IHSs identified in groundwater are:

- Metals (arsenic, copper, hexavalent chromium, trivalent chromium, and selenium)
- Petroleum hydrocarbons (DRO and ORO)
- VOCs (TCE and vinyl chloride)

2.2.3.1 Metals

Arsenic was detected in groundwater samples collected from monitoring wells at concentrations ranging from 4.59 micrograms per liter (μg/L) (MW5) to 33 μg/L (MW1). Copper was detected in groundwater samples from six of the eight monitoring wells at concentrations of up to 5.1 μg/L (MW6 in April 2006). Based on the presence of arsenic and copper at similar concentrations in groundwater throughout the site, including at upgradient monitoring wells, there is no indication that the former Precision property is a source of arsenic or copper.

Selenium was detected in groundwater samples collected from MW2, MW6, MW7, and MW8, with the highest concentration (19 milligrams per liter [mg/L]) in MW6. Because selenium was not detected in soil at the site, it does not appear that Precision is the source of the detected concentrations of selenium in the groundwater. In addition, concentrations of selenium have declined since 2006. Selenium was only detected in MW2 and MW6, with the highest detection from the July 2010 event at 2.9 mg/L in MW6.

Hexavalent chromium was detected in reconnaissance groundwater samples at concentrations of up to 61 mg/L (GP8), with higher concentrations in the former chrome shop. MW5 is a shallow well located in the former chrome shop and had the highest concentrations of hexavalent chromium (450 mg/L in December 2005). However, concentrations since 2005 have been declining and hexavalent chromium was detected in MW5 at 81.6 mg/L during the July 2010 sampling event. The maximum calculated concentration of trivalent chromium was in the groundwater sample from GP6 (300 mg/L). The calculated trivalent chromium concentrations from monitoring wells ranged from 0.0013 mg/L (MW7 in July 2010) to 126 mg/L (MW5 in July 2010).

Reconnaissance groundwater samples were not analyzed for arsenic, copper, or selenium.

2.2.3.2 Petroleum Hydrocarbons

The reconnaissance groundwater samples from GP2 and GP4 through GP8 were analyzed for petroleum hydrocarbons, using NWTPH-HCID, with detections quantified for gasoline-range organics, DRO, and ORO using NWTPH-Gx and NWTPH-Dx. The maximum concentration of DRO (0.814 mg/L) was from a sample collected at GP8, located near the former boiler underground storage tank (UST). ORO were not detected in the quantification analyses.

Samples from monitoring wells were analyzed for DRO and ORO. DRO were detected in shallow monitoring wells at concentrations of up to 2.64 mg/L. ORO were detected in shallow monitoring wells at concentrations of up to 1.32 mg/L. Generally, the highest concentrations of DRO and ORO occurred in shallow groundwater in the southeast quadrant of the site. Concentrations appear to have declined over time and were much lower during the July 2010 monitoring event.

2.2.3.3 VOCs

TCE was detected in three reconnaissance groundwater samples, with the highest concentrations in samples from below and downgradient of the former chrome shop. TCE was detected in only one monitoring well (MW5), at concentrations of up to 22.1 μg/L, and was not detected at all during the July 2010 monitoring event. The maximum concentration of TCE in groundwater was 1,130 μg/L in a reconnaissance groundwater sample from GP6 collected in June 2005. Vinyl chloride, a breakdown product of TCE, was detected in only one reconnaissance groundwater sample, from GP13 at 16.5 μg/L. This vinyl chloride detection occurred within the footprint of the building in the former cylinder shop and downgradient of TCE detections in soil at GP11. Vinyl chloride was detected in only one monitoring well (MW8), at concentrations of up to 0.80 μg/L. As with TCE vinyl chloride was not detected from any of the monitoring wells during the most recent July 2010 monitoring event.

Historically, the lack of TCE in groundwater at monitoring wells near the downgradient property line in all rounds of sampling, and the current non-detect of TCE, indicates that TCE concentrations significantly attenuate through biodegradation and other processes by the time groundwater reaches the downgradient property line.

2.2.4 Aquifer Low Yield Study

In order to evaluate whether the uppermost aquifer at the site should be considered as a future source of drinking water, MFA estimated aquifer yield using data from the field sampling data sheets (FSDSs) (see Appendix A) collected during groundwater monitoring events at the site. Yield was calculated by estimating pumping rate per foot of drawdown in the aquifer multiplied by a percentage of the full aquifer depth. The alluvial aquifer at the site tapers from 0 feet to approximately 12 feet thick. At the suggestion of Ecology (Ecology, 2010b), an average aquifer thickness was estimated at 6 feet, and of that, only about 4 feet would be available for drawdown.

Data from MW3, MW4, MW5, MW6, and MW8 were used to calculate yield, as the FSDSs from the April 2006 sampling event at the facility contained enough information to estimate the yield rate (i.e., the final depth to water was recorded). Additionally, MW6 was sampled in June 2006 and the depth to water was recorded after each purge volume—providing enough information to perform three separate calculations of aquifer yield. There were no final water-level measurements recorded for MW2; therefore, aquifer yield calculations for that location could not be made. Yield calculations were also performed for wells screened at the deeper aquifer (i.e., MW1 and MW7).

The calculated aquifer yield rate ranged from 0.025 gallon per minute (gpm) to 0.331 gpm, with a mean value of 0.11 gpm (see Table 2). The range of calculated yield rates is well below the 0.5 gpm threshold specified in WAC 173-340-720(2)(b)(i) for determining when an aquifer need not be considered a potential future source of potable water due to low yield. The yield rate for the deeper aquifer was similar (0.033 gpm at MW1 and 0.042 gpm at MW7).

Although not enough specific measurements (i.e., depth to water or exact drawdown) were available from 2005 well development activities to perform yield calculations, it should be noted that several of the wells went dry during development (see Appendix A), supporting the conclusion that the aquifer at the site cannot support production levels necessary for a potable well.

2.2.5 Investigation of Soil Vapor

Subslab soil-vapor samples were collected from probes A1 through A7 (see Figure 7). TCE was detected in subslab vapor samples A3 and A5 at concentrations of 6,100 and 37,000 micrograms per cubic meter ($\mu g/m^3$), respectively. Cis-1,2-dichloroethene (DCE) was detected in samples A3 and A5 at concentrations of 470 and 1,700 $\mu g/m^3$, respectively. Trans-1,2-DCE was not detected in any samples. Vinyl chloride was detected in a sample from A5 at a concentration of 420 $\mu g/m^3$. A3 is located beneath the former grinding shop and A5 is located beneath the former chrome-plating shop. Detections of TCE and its breakdown products in soil vapor match the distribution of TCE in soil and groundwater, indicating good correlation.

2.2.6 Investigation of Indoor Air

Indoor-air samples were collected from stations IA1 through IA8 (see Figure 7). TCE was detected in all eight samples, ranging in concentration from 0.046 $\mu g/m^3$ to 0.2 $\mu g/m^3$. No TCE breakdown products were detected in any of the samples. The concentrations of TCE in the samples collected inside the building were similar to each other.

2.3 Downgradient Property Review and Characterization

In late 2009, MFA reviewed a complete copy of Ecology files for the following sites located close to the Precision property: DBA & Airbus (Leaking Underground Storage Tank [LUST] database No. 92792171) and KASPAC & Chiyoda (Cleanup No. 2489) (see Figure 8). Information from these sites and conclusions based upon MFA's review is provided below. This review was undertaken to determine whether sampling at downgradient properties would likely provide useful information concerning off-property releases from the Precision facility.

2.3.1 DBA & Airbus—LUST

The DBA & Airbus property is located at 9004 14th Avenue South, Seattle, Washington (see Figure 8). In 1991, four USTs (gasoline and waste oil) were decommissioned and removed. The gasoline confirmation samples indicated that the excavation was "clean" and that the waste-oil tank excavation had been backfilled without sampling. A later investigation indicated that total petroleum hydrocarbon (TPH) contamination remained in soil around the waste-oil tank. The concentrations of DRO detected in soil were below current MTCA Method A criteria for diesel and oil. There was no indication that groundwater was encountered. Ecology had recommended that the remaining contaminated soil be removed, but there was no further information in the file indicating what action, if any, had been taken. The site status on the Ecology ISIS database is listed as "Closed" as of 2000.

Based on the above information, it appears that historical contamination at this site would not interfere with impacts from the Precision site.

2.3.2 KASPAC/Chiyoda Property—Independent Cleanup Program

The former KASPAC/Chiyoda property is located at 1237 South Director Street, Seattle, Washington, directly downgradient of the former Precision property (see Figure 8). An 8,000-gallon leaded-gasoline UST was removed from the site in 1989 and a Phase I assessment was completed (GeoEngineers, 1989). The Phase I identified potential paint and paint thinner disposal onto the ground surface adjacent to the former paint shed (centrally located); fuel contamination (diesel and very high levels of benzene, toluene, ethylbenzene, and xylenes [BTEX]) in the area of the former UST (centrally located); and a 55-gallon drum storage area near the loading dock on the south end of the site near the drainage ditch. KASPAC was cited in March 1989 for discharging oil, gasoline, diesel, and hydraulic fluid to the groundwater and/or surface water (e.g., the drainage ditch on the south end) (EMCON, 1995). The fuel release on the south end of the site was later determined to be from leaking drums that were stored in that area.

In February 1990, a Phase II assessment was completed (Applied Consultants, 1990), including installation of three monitoring wells (see Figures 8 and 9 of that report for monitoring well locations). Figures 9 and 10 show historical groundwater flow contours and concentrations of tetrachloroethene (PCE), TCE, cis1,2-DCE, and TPH in groundwater at the former KASPAC/ Chiyoda property. Note that BTEX constituents were not included on the figure, as they are not IHSs for the Precision property.

In the 1990 Phase II assessment, benzene, xylene, and TCE in groundwater were detected above MTCA CULs[1] in MW3, which was the closest well to the former UST. MW1 and MW2, which were located directly upgradient of MW3 and adjacent to Precision, were non-detect for VOCs. This evidence leads to the conclusion that the contamination on the Chiyoda site was not originating from Precision and was from a separate source.

Based on a summary in the SE/E independent remedial action report (EMCON, 1995), additional monitoring wells were installed in fall 1990 (MW4 through MW6). Groundwater from MW6 (in the loading dock area) had concentrations of BTEX and PCE above CULs. Wells MW7 through MW9 (in the loading dock area) were installed in April 1991 (Applied Consultants, 1991). MW9 had detections in groundwater of BTEX, PCE, cis-1,2-DCE, and TCE. MW6 was non-detect for chlorinated solvents; however, the detection limit was orders of magnitude above the CUL. The groundwater flow direction shown on Figure 9 on the very southwest end

[1] CULs used for screening in these historical reports were standard Method B CULs for surface water.

of the former KASPAC/Chiyoda site is actually moving toward Precision, which conflicts with groundwater flow directions based on Precision's historical data (see Figure 9). Precision's MW-8, which is located in that vicinity, has shown low-level concentrations of vinyl chloride. The source of the degraded chlorinated solvents in MW-8 may have actually originated from a PCE release at the Chiyoda property, based on this flow information.

Monitoring wells MW10 through MW12 were installed in December 1994 (EMCON, 1995). Only BTEX, TPH, and arsenic constituents were analyzed. Detections of BTEX and diesel were below MTCA CULs at that time; arsenic was above. However, MTCA CULs have become more stringent since then.

In 1996, soil borings were advanced (EMCON, 1996) as part of an addendum to an independent remedial action report. Gasoline, diesel, oil, BTEX, PCE, cis-1,2-DCE, and metals were detected in shallow soil (borings GB-1 through GB-9), indicating a local source on the KASPAC/Chiyoda property as opposed to migration in groundwater.

The data set for VOCs other than BTEX, specifically solvents such as PCE and TCE, is sparse. There are no historical PAH data even though there were historical releases of diesel and oil. BTEX compounds were the constituents focused on during previous investigations. Historically, there have been a few detections of TCE and PCE in soil and groundwater at the Chiyoda site that were above MTCA CULs. During these same sampling events, the wells between Precision and the wells with VOCs (including BTEX, PCE, and TCE) were non-detect, indicating that Precision was not the source. Various soil-removal events and some groundwater pump-and-filter remediation events were conducted at the site, specifically targeting the BTEX contamination (summarized in EMCON, 1995). However, it appears that there were no inquiries as to the source of the solvents at the site and the No Further Action (NFA) determination that was received in February 1997 specifically notes that the NFA was issued "...with regard to the release of TPH and toluene to the groundwater and/or upland soil."

Given this site's history of petroleum hydrocarbons, metals, and some chlorinated solvent contamination (the same IHSs as Precision) and its proximity to Precision, it would be very difficult to distinguish contamination from the KASPAC/Chiyoda site should there be detections in a new well installed between the Precision property and the Duwamish. This is especially true given the CULs that were used by Chiyoda in the 1990s. MTCA CULs have become more stringent since then and it is possible that residual concentrations at the KASPAC/Chiyoda site are above current levels. In light of this information, Precision believes that the groundwater model, previously undertaken as part of the RI (MFA, 2008) and which is considered reasonably conservative by Ecology, is complete in showing that concentrations from the Precision property will not reach the Duwamish. Downgradient groundwater data would not be representative of impacts from the Precision property and would likely provide false positives for IHSs because of the historical contamination in the area.

2.3.3 Downgradient Property Conclusions

Groundwater sampling off of the Precision property was not explored with neighboring property owners because the contaminant contributions from neighboring properties documented in MFA's review of Ecology file materials would result in the masking of any impacts from the former Precision site. This would preclude a determination of the source of any detected IHS concentrations.

In addition, groundwater concentrations appear to be declining at the site, and there were no detected concentrations in excess of Method B drinking water criteria at the property boundary during the most recent (July 2010) monitoring event. This indicates that groundwater leaving the site does not appear to be affecting downgradient properties and there is no need to install downgradient monitoring wells that may produce a false positive.

2.4 Interim Actions

Precision has performed multiple investigations and remedial actions over the years.

2.4.1 Source Removal

Precision completed chromium tank and soil removal associated with the former building operations in the 1990s. Precision removed the original Plating Tanks 1 and 2 after the investigation and removal of the contaminated soil around the tanks began in 1990 (Precision, 1993). In 1992, Precision removed original Plating Tanks 3, 4, 5, and 6 and a 35-foot-by-50-foot section of the concrete below the tanks. Visibly contaminated soils were removed, with the depth of excavation ranging from 6 to 28 inches below the bottom of the tank pit (Precision, 1993). An Independent Remedial Action Report Summary completed by Precision (Precision 1993) indicates that 1,200 cubic yards of soil and concrete have been removed and disposed of off-site.

The cost for completing the source removal was approximately $450,000 at the time of completion, approximately $670,000 in 2009 dollars[2].

2.4.2 Off-Property Ditch

Precision conducted soil removal and reclamation in the off-property ditch in 2007. Despite evidence of multiple sources of contamination, Precision proposed to excavate all ditch soil containing IHSs at concentrations that exceed CULs. A separate work plan for removal of soil from the ditch (MFA, 2007) was submitted to and subsequently approved by Ecology (Ecology, 2007a).

[2] This adjustment is based on the Consumer Price Index from the Bureau of Labor, though designed for consumer goods, it is an approximation of the increase in costs for construction. The annual average CPI for 1993 is 144.5 and 2009 is 214.537.

In October 2007, approximately 100 cubic yards of soil were removed and disposed of off site. Subsequent sampling and removal activities were also completed in November 2007 and March 2008, and are described in detail in the RI/RA (MFA, 2008). The area of excavation included approximately 2,685 square feet surrounding sample locations HA3, HA4, HA5, and HA22, where CUL exceedances had been documented (see Figure 11). The depth of excavation was approximately 1 foot.

MFA collected confirmation samples from the bottom of the excavation (B1 through B13) and from the side walls/surface soil along the perimeter of the excavation (P1 through P9). Because of elevated concentrations of arsenic and lead in two perimeter confirmation samples, additional surface soil samples (SS1 through SS6) were collected on November 19, 2007, and analyzed for arsenic and lead. Figure 11 and Tables 3 through 6 provide the locations and analytical results for the 31 confirmation samples.

Following confirmation sampling, the excavation was backfilled with clean topsoil in place of the excavated soil and graded to replicate the original contours. For erosion control, stabilization, and durability, the disturbed surface was hydroseeded with a fiber-bonded grass-seed mix. The fiber-bonding prevents erosion while the grass establishes a root system that stabilizes the soil.

Based on the initial confirmation sampling results, additional soil surrounding sample points P9, P1, and SS6 was excavated on March 27, 2008. An area of approximately 31 square feet was excavated around sample point P9 to a depth of 2 feet (see Figure 11). An area of approximately 39 square feet was excavated around sample points P1 and SS6 to a depth of 1.5 feet. The excavated areas were backfilled with clean soil and stabilized with grass seed.

MFA collected confirmation samples from the bottom of the excavation (C1 through C3). The concentrations of the IHSs were below CULs in all of the samples except sample C3. The results of this additional sampling indicated that there is no widespread contamination outside the area excavated. Based on the spatial pattern in concentrations, the exceedances near the boundary of the excavation encompass a very small area. No additional removal actions were deemed warranted as the concentrations are very close to soil CULs, residual soil impacts are both isolated and small in extent, and over a foot of clean fill material covers the sample location.

The cost for completing the soil investigation and removal was approximately $48,000 at the time of completion.

3 AREAS REQUIRING EVALUATION

Applicable cleanup standards include MTCA and other applicable or relevant and appropriate requirements (ARARs). A cleanup standard consists of the following three elements (WAC 173-340-700[3]):

- CUL, the concentration that must be met to protect human health and the environment
- Point of compliance (POC), the location where the CUL must be achieved
- Other regulatory requirements, commonly referred to as ARARs, that apply to the site because of the type of action required for cleanup or the location of the site

Appendix J of the 2008 RI/RA report further details the CUL calculations for soil, groundwater, and air. Site-specific CULs for these media are shown on the risk-screening Tables 7 through 18 for all IHSs (shown on the tables directly beneath the standard MTCA Method A, B, and C values, and the Ambient Water Quality Criteria [AWQC] values). Since the 2008 RI/RA report was submitted, several MTCA criteria values have changed, specifically values for TCE, which modifies the site-specific CULs as well.

The following sections summarize the CUL development process[3], in addition to discussing risk-screening results.

Potential risks that IHSs in soil, groundwater, soil gas, and indoor air may pose to human health are evaluated below by comparing detected concentrations in these media with site-specific CULs. Tables 3-1 and 3-2 and Figure 3-1, immediately following this section, show CUL exceedances.

3.1 Soil

3.1.1 Indicator Hazardous Substances

As discussed in Section 2, IHSs identified in on-site soil are: hexavalent chromium and trivalent chromium, petroleum hydrocarbons (DRO and ORO), and TCE.

[3] The CUL development process was also summarized in a letter from MFA to Ecology (MFA, 2009), in response to Ecology's RI/RA comments issued via an e-mail dated December 29, 2008.

3.1.2 Cleanup Level Development

The site meets the WAC 173-340-200 and WAC 173-340-745(1) definition of an industrial property based on these criteria: it is zoned industrial; there are no residential uses; public access to the property is limited; food is not grown or raised on the property; operations on the property were characterized by use and storage of chemicals; the surface of the property is covered by a building or asphalt; and there are no other facilities on the property. Because the site is an industrial property, site-specific modified Method C CULs were calculated that are protective of industrial workers, in accordance with WAC 173-340-745(5)(c).

Appropriate reasonable maximum exposure scenarios were defined for the site:

- Industrial workers—ingestion, inhalation, and dermal contact
- Industrial workers—volatilization from soil

Groundwater data were used to evaluate potential risks and determine protectiveness through an empirical demonstration. Determination of soil CULs for the protection of groundwater was therefore not necessary.[4]

Ingestion, inhalation, and direct contact: Equations 745-4 and 745-5 in WAC 173-340-745 were used to calculate CULs with one modification: the inhalation exposure route was included to comply with WAC 173-340-745(5)(c)(iv), which requires evaluation of inhalation whenever a site-specific CUL is greater than a leaching-to-groundwater CUL.

Volatilization from soil: The CUL was derived from a U.S. Environmental Protection Agency (USEPA) model because MTCA does not currently have methods to calculate volatilization or vapor intrusion. Transfer factors were used to estimate chemical migration from soil to air.

3.1.3 Point of Compliance

The POC for soil direct contact was established as the top 15 feet of soil throughout the site. For vapor intrusion, the POC is the entire soil column down to the water table, in accordance with WAC 173-340-740(6). Although potential future occupational workers are unlikely to contact soil below 3 feet bgs, the POC assumes that future excavations could allow direct-contact exposures to soil within 15 feet of the surface.

If post-remedial soil concentrations of IHSs exceed their CULs in the top 15 feet of soil, a restrictive covenant must be used to control direct contact. The restrictive covenant will require that the areas be covered by a cap as an exposure barrier; that

[4] Ecology approved the use of an empirical demonstration in e-mail correspondence dated February 28, 2007.

the cap be maintained; and that the contaminated soils be managed appropriately if the cap is disturbed.

3.1.4 Soil Risk Assessment

3.1.4.1 Soil on Former Precision Property

Only two IHSs were detected in soil on the former Precision property at a concentration greater than a site-specific soil CUL: hexavalent chromium and TCE. Because no CULs were developed for DRO and ORO, a risk evaluation of petroleum hydrocarbons is also discussed below. See Tables 8 through 11 for soil screening results. Table 11 includes all seven cPAHs (even though chrysene was the only original IHS), along with a total cPAH value calculated by applying toxicity equivalency factors (TEFs).

For on-site soil, the proposed CULs are 1,350 mg/kg for hexavalent chromium and 186 μg/kg for TCE. As discussed in the 2008 RI/RA, chemical-specific direct-contact CULs for on-site soil do not require adjustment to account for exposure to multiple hazardous substances via multiple pathways (WAC 173-340-745(6)). The areas where soil results exceed the proposed CULs are shown in Figure 3-1, immediately following this section. Cleanup alternatives will address these exceedances.

Hexavalent Chromium

Two soil samples collected beneath the building (GP18 and GP36) had concentrations of hexavalent chromium above the direct-contact CUL of 1,350 mg/kg for industrial workers. The concentration at GP18 was 2,300 mg/kg, and the concentration at GP32 was 3,500 mg/kg (Table 8). Both of the samples with hexavalent chromium concentrations above the CUL were collected at approximately 1 foot bgs (Table 8), and they were collected within approximately 5 feet of each other (Figure 6). Hexavalent chromium concentrations in several samples collected at multiple depths surrounding GP18 and GP32 were below the industrial-worker CUL. Therefore, it appears that soil with hexavalent chromium concentrations above a CUL is limited to a relatively small and well-defined area immediately beneath the building slab.

At present, the building prevents workers from having direct contact with hexavalent chromium in soil, and there is no current unacceptable risk to human health, based on hexavalent chromium in soil. Unacceptable risk would occur only if the building was removed in the future, contaminated soil was left on the ground surface for an extended period of time, and humans were present in the contaminated area. An environmental covenant precluding such exposure and requiring compliance with a Soils Management Plan could be used to address that scenario.

TCE

Soil samples collected at 14.5 feet bgs at GP6, and at 6.5 feet bgs at GP11, had concentrations of TCE above the vapor-intrusion CUL of 186 μg/kg (Table 10).

These soil samples were not observed to be saturated at the time of drilling; however, these samples were collected below static water levels at the site which are between 3.49 and 6.39 feet bgs. Due to the confining properties of the till, the static water level, or potentiometric surface, is higher than the elevation of saturated soils. Based on this information, and to be conservative, soil within the till was considered to be unsaturated and therefore was screened against vapor-intrusion CULs. The maximum detected concentration of TCE in soil was 1,160 μg/L at GP6. TCE was not detected in soil at concentrations exceeding a direct-contact CUL. Risk estimates based on comparisons of soil analytical results with soil CULs for vapor intrusion are less reliable than those based on interpretations of indoor-air sample results. Risks associated with potential exposure to TCE in indoor air are discussed in Section 3.3.

TPH

Concentrations of extractable petroleum hydrocarbons and other constituents for the soil sample with the highest petroleum-hydrocarbon concentrations (GP21 at 6.5 feet) were input into Ecology worksheets for evaluating petroleum hydrocarbons in soil. The result from the worksheet showed that this soil sample passed the calculated exposure pathways for industrial land use and Method B potable groundwater protection (see Appendix K of MFA, 2008), and that concentrations of petroleum hydrocarbons in soil do not pose a threat to human health or the environment.

3.2 Groundwater

3.2.1 Indicator Hazardous Substances

As discussed in Section 2.2, IHSs identified in groundwater are: metals (arsenic, copper, hexavalent chromium, trivalent chromium, and selenium), petroleum hydrocarbons (DRO and ORO), and VOCs (TCE and vinyl chloride).

3.2.2 Potability Determination

Site groundwater qualifies as nonpotable based on WAC 173-340-720(2) and the following demonstrations:

- The site is currently not a source of drinking water.
- The site is not a potential future source of drinking water based on insufficient yield (see Section 2.2.4)
- It is unlikely that hazardous substances will be transported from the site to groundwater that is a current or potential future source of drinking water based on the following:
  - Downgradient Geology. MFA has evaluated hydrogeologic conditions at the site, the downgradient Chiyoda property (see boring logs and geologic cross sections in Attachment D), and the nearby Port of Seattle Terminal 117 property (AECOM, Crete Consulting,

Inc., Dalton, Olmsted & Fuglevand, Inc., Integral Consulting, Inc., and WindWard Environmental LLC, 2010).

The site is underlain by alluvium comprised of silt and sand (from the surface to a depth of approximately 20 feet, observed only on the eastern portion of the site); dense, gravelly, sandy silt glacial till (observed from surface to approximately 20 feet bgs in the western part of the site and observed from 20 feet to 30 feet bgs in the eastern part of the site); and alluvium comprising sand and gravel (advanced outwash, observed from 30 feet bgs and below) (MFA, 2008).

Two WBZs are present beneath the site: (1) a confined alluvial WBZ beneath the eastern side of the site that flows easterly toward the Duwamish River (shallow WBZ), and (2) a confined sand and gravel WBZ beneath the low-permeability glacial till (deep WBZ, which is also referred to as the advanced outwash WBZ) (MFA, 2008). East of the facility, the glacial till appears to hydraulically separate the two WBZs.

Boring logs from the adjacent Chiyoda property and the nearby Port of Seattle Terminal 117 property confirm that the shallow alluvium (consisting mostly of silty sand), and shallow WBZ, continue east of the site and deepen as you get close to the river (approximately 300 feet from the river; see Attachment A for Terminal 117 cross-sections). Specific yield calculations for the site calculated from monitoring well data indicate insufficient yield to support a production well. This includes wells on the eastern portion of the site that are screened in the shallow and deeper alluvium. Since the geology is consistent downgradient of the site, it can be expected that low yield conditions likely exist downgradient. The Duwamish Industrial Area Hydrogeologic Pathways Project confirms that low yield is encountered throughout the basin in the shallow alluvium.

In addition to the low yield determination, according to WAC 173-340-720(2)(b), groundwater adjacent to the river, including under the Port of Seattle Terminal 117, is also considered nonpotable because it contains natural background concentrations of inorganic constituents that make it not a practical drinking source. The criteria for this determination are the maximum contaminant levels in WAC 246-290-31(3)(a). The salinity of groundwater is elevated in this area as shown with the groundwater conductivity measurements in groundwater on Map B-1 in Appendix B of the Revised Engineering Evaluation/Cost Analysis report for Terminal 117 (AECOM et al., 2010).

The low yield at the site and directly downgradient based on similar geology, coupled with the increasing salinity towards the river, make the entire area downgradient of the site nonpotable.

- Prior Analysis of Duwamish Hydrogeologic Pathways. In the late 1990s, the Duwamish Coalition completed a study on the Duwamish Industrial Area Hydrogeologic Pathways Project. The Duwamish Coalition team produced three Duwamish Industrial Area technical memoranda: Development of a Three-Dimensional, Numerical Groundwater Flow Model for the Duwamish River Basin; Duwamish Basin Groundwater Pathways Conceptual Model Report; and Shallow Groundwater Use Designation (see Attachment A and the entire set of Duwamish Coalition reports; Duwamish Coalition, 1997, 1998a,b).

  The Shallow Groundwater Use Designation report concluded that the highest beneficial use of the shallow aquifer in the Duwamish valley (up to 100 feet bgs in the central valley) is discharge to surface water.[5] The rationale for the designation was based on: (1) the distinct nature of the hydrogeologic conditions in the valley; (2) boundaries which confine the shallow aquifer; (3) marginal to poor groundwater quality due to mixing with saline water through current tidal action, and from the original estuarine depositional environment; (4) nonuse for drinking water purposes; and (5) institutional prohibitions against drinking water use. The hydrogeologic conditions described in the Current Use Designation Report for the Duwamish generally are confirmed with respect to the Precision site and the area downgradient of Precision by the investigations that have occurred at the Precision, Chiyoda and T-117 sites.

- Institutional Controls. Multiple institutional controls that either directly prohibit groundwater use or result in such use being a practical impossibility are in place with respect to the groundwater in the vicinity of the Precision site. It is currently illegal to install a water well in King County and the City of Seattle (see Attachment C). The King County Board of Health Code (KCBOH) prohibits any proposed well drilling based on the Code's (1) public-service-connection requirements; (2) source quality requirements on drinking water; and (3) physical location restrictions on the placement of wells (see Attachment C).

  The public-service connection requires that properties undertaking new development connect to a public water supply when the land is within an existing public-water-supply system, the system meets applicable water-quality standards, and the system is willing and able to provide service in a timely and reasonable manner. Since all of the properties downgradient of the site are already connected to public

[5] In a letter dated May 1st, 2000, Ecology commended the Duwamish Coalition and stated that Ecology found the Duwamish Coalition reports to be suitable for use by Ecology site managers and others in making site-specific cleanup decisions under MTCA (see Attachment B).

water and the quality of that water is not subject to dispute, any future development downgradient of the site would be required to connect to public water rather than install a water-supply well. In addition, the KCBOH places a limitation on the sources of drinking water, stating that it shall be obtained from the highest-quality source feasible. Seattle city water is certainly a higher-quality source than groundwater from a historically industrial area.

The KCBOH also imposes restrictions on the physical placement of drinking-water wells, including minimum setbacks of 100 feet from houses and garages, public roads, sewers, chemical-storage sites, surface waters, railroad tracks, power utility or gas lines, and USTs. Review of aerial photography of the area shows no property has a 200-foot-diameter area free of roads and buildings sufficient to provide the sanitary control area required to protect a well site. In fact, multiple street vacations would be necessary, in addition to the demolition of many structures, such that it would be practicably impossible to locate a water supply well in the area downgradient from Precision, even if it were not legally precluded by other local ordinances.

Written documentation from the directors of both the Seattle Water Department and the Seattle-King County Health Department that groundwater in the Duwamish valley is not a current or future source of drinking water, either public or private, was included as Attachment C of the Duwamish Pathways Project report (Duwamish Coalition, 1998a,b,c).

In addition to the area wide nonpotable determination and the current and future City and County institutional controls,

In addition to the natural hydrogeologic conditions and water chemistry in the area precluding use of groundwater downgradient from Precision as a source of drinking water, and the institutional controls that are in place that legally and practicably prohibit such use, the most recent groundwater monitoring event (July 2010) performed at the site indicates that concentrations are below drinking water standards at the property boundary. These conditions indicate that in addition to the site and surrounding area not being able to be used as a source of drinking water for multiple reasons, the groundwater flowing downgradient of the site is now below drinking water standards and is compliant with WAC 173-340-720(2)(c).

3.2.3 Cleanup Level Development

Site groundwater qualifies as nonpotable based on WAC 173-340-720(2) and the following demonstrations:

a. The site is currently not a source of drinking water.

b. The site is not a potential future source of drinking water based on insufficient yield, as demonstrated by site-specific yield calculations provided in the April 21st, 2010, FS (MFA, 2010).[6] Based on a comment by Ecology in a July 22nd, 2010 e-mail, the yield has been recalculated using the following formula (estimated gallons per foot of drawdown times a percentage of the full aquifer depth [estimated at 4 feet]), as suggested by Ecology. The updated version of the FS reflecting this re-calculation is being submitted to Ecology along with this letter.

c. It is unlikely that hazardous substances will be transported from the site to groundwater that is a current or potential future source of drinking water The low yield at the site and directly downgradient based on similar geology, coupled with the increasing salinity towards the river, make the entire area downgradient of the site nonpotable.

Because site groundwater is nonpotable,[7] site-specific Method B CULs were developed in accordance with WAC 173-340-720(6)(b)(ii) (site-specific RA for the protection of beneficial uses) and 173-340-720(6)(c)(i) (Method B site-specific groundwater cleanup determinations).

Appropriate reasonable maximum exposure scenarios were defined for the site:

- Industrial workers—volatilization from groundwater
- Excavation workers—direct contact
- Potential discharge to surface water

For all scenarios, the site meets the Method B site-specific groundwater CULs criteria specified in WAC 173-340-720(6)(c)(i)(A)-(D).

The volatilization from groundwater criterion was derived from a USEPA model because MTCA does not have methods to calculate volatilization or vapor intrusion. Transfer factors were used to estimate chemical migration from groundwater to air.

Methods to establish CULs for excavation workers are not currently included in MTCA. As approved by Ecology, Oregon Department of Environmental Quality risk-based concentrations for excavation workers were used.

For the potential discharge-to-surface water scenario, as required by WAC 173-340-720(6)(c)(i)(E), AWQC must be met at the POC unless "it can be demonstrated that the hazardous substances are not likely to reach surface water." The USEPA BIOCHLOR model was used, along with the most conservative assumptions available, to evaluate the fate and transport of IHSs in the groundwater. Modeling

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[6] The low yield conclusion had been earlier agreed to by Ecology in a February 28, 2007 e-mail.

[7] Ecology concurred that Site groundwater is nonpotable in a February 28, 2007 e-mail, and subsequently asked for additional supporting documentation concerning whether groundwater downgradient of the former Precision property could serve as a future drinking water source. The information related to downgradient properties contained in Section 3.2.2 was provided to Ecology in a March 9, 2011 letter.

results showed that IHSs would not reach surface water because of degradation and volatilization.

The site also complies with WAC 173-340-720(6)(c)(i)(F) in that the site is paved and there are no additional discharges (e.g., irrigation or foundation drains) that may reach groundwater and result in site-impacted groundwater entering stormwater.

Ecology also required that the model be run to calculate the highest concentrations at the site that would result in AWQC-compliant discharges to surface water. Concentrations at the site did not exceed the modeled concentrations (as would be expected, since modeling results show that site IHSs are not released to surface water).

3.2.4 Point of Compliance

A conditional POC may be established if it is not practicable to meet the CUL throughout the site within a reasonable restoration time frame (WAC 173-340-720(8)(c)). Meeting the groundwater CUL throughout the site would require further excavation of contaminated soils and removal of groundwater under the main site building. Precision had previously excavated the most significantly impacted materials under the building during an interim action in the early 1990s that removed approximately 1,200 cubic yards of dangerous waste soils. Since that time, Precision has sold the property to Pacific Industrial Supply, which now operates a marine supplies business out of the building, including retail sales.

Removing sufficient soils and groundwater to meet the groundwater CUL throughout the site would require closing the current property owner's business and demolishing approximately 7,000 square feet of the building slab, or roughly one-third of the current occupants' retail operations, to access contaminated subsurface soils and groundwater. The excavation would be a maximum depth of 15 feet, which would require shoring of the excavation and demolition of the building. The viability of the existing business at the facility would be at risk. A remedial action of that magnitude is not practicable under the circumstances, particularly since equivalent environmental protection can be realized through less intrusive means (see Section 5).

Short of complete removal of soil and groundwater which is infeasible due to practical limitations discussed above, the geology, specifically the till layer, prevents achieving a reasonable restoration time frame throughout the site. A conditional POC may not exceed the property boundary except for instances as described in WAC 173-340-720(8)(d). Because the previous interim action removed the source and significantly impacted material from under the building and the groundwater CUL can be met at the property boundary, the conditional POC for groundwater was determined to be in the shallow WBZ at the eastern (downgradient) property boundary.

As discussed below, none of the IHSs exceeded applicable criteria at the conditional POC and many IHSs were not detected above MRLs at the property boundary. A conditional POC at the property boundary will be protective of human health and the environment.

3.2.5 Risk Assessment

Applicable exposure pathways include groundwater discharge to surface water, vapor intrusion, and direct contact for excavation workers. Of the IHSs for groundwater, only hexavalent chromium and TCE exceeded applicable criteria at the site. For groundwater, the proposed CULs are 0.16 mg/L for hexavalent chromium and 48.7 μg/L for TCE.

The areas where groundwater results exceed the proposed CULs are shown in Figure 3-1.

Tables 12 through 16 provide groundwater screening results. Concentrations of dissolved metals (Table 13), PAHs (Table 15), and TPH (Table 16) were below site-specific groundwater CULs for the protection of surface water as well as available excavation-worker CULs. Note that Table 15 shows all seven cPAHs along with a total cPAH value calculated by applying TEFs under the new MTCA amendment (Ecology, 2007b), however, the risk results are unchanged. Risk associated with CUL exceedances for IHSs in groundwater is discussed below.

None of the IHSs in groundwater exceeded their respective CULs at the downgradient site boundary, or conditional POC; in fact, hexavalent chromium and TCE were not detected in wells located at the downgradient site boundary.

3.2.5.1 Hexavalent Chromium

Hexavalent chromium concentrations that exceeded CULs both for the protection of surface water and for excavation workers were detected in groundwater samples collected from MW5, located within the building footprint (see Table 12). Concentrations that exceeded the CUL for the protection of surface water only were collected from borings located inside the building footprint and from MW1, which is a deep well assumed to be upgradient of the building.

Concentrations of hexavalent chromium in wells located near the eastern property boundary, and the conditional POC, were below method reporting limits and did not exceed CULs.

3.2.5.2 TCE

The concentration of TCE in reconnaissance groundwater sample GP6, located within the building footprint, was above the groundwater CUL protective of indoor industrial workers who may have indirect exposure to chemicals that migrate from groundwater to indoor air (Table 14). As mentioned previously, risk estimates based on comparisons of groundwater analytical results with groundwater CULs are less reliable than those based on interpretations of indoor-air sample results. Based on empirical indoor-air sample results, TCE does not pose unacceptable risks to future workers (see Section 3.3). The reconnaissance groundwater sample collected at GP6 had a TCE concentration above the excavation-worker CUL (Table 14).

None of the detected concentrations of TCE exceeded the CUL for the protection of surface water.

3.3 Air

3.3.1 Soil Gas

A subslab soil gas sample collected at A5 had a concentration of TCE equivalent to the preliminary soil gas CUL (Table 17). The concentrations of TCE and vinyl chloride in all other subslab soil gas samples were below soil gas CULs protective of indoor industrial workers. Based on empirical indoor-air sample results discussed in Section 3.3.2, TCE does not pose unacceptable risks to future workers.

3.3.2 Indoor Air

As shown in Table 18, TCE was detected both in indoor-air samples and in an outdoor-air sample collected south of the building. Breakdown products of TCE were not detected in indoor- or outdoor-air samples. The presence of TCE in the outdoor-air sample suggests that there are significant sources of TCE near the site that are unrelated to the former Precision facility.

Absent any new TCE releases, current conditions represent the worst-case conditions for the foreseeable future. TCE concentrations in indoor air are currently below MTCA Method C CULs, indicating that these concentrations do not pose an unacceptable risk to future workers in the building.

Table 3-1
IHS Exceedances in Soil
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (ft. bgs)	Soil Chromium (Hexavalent) (mg/kg)	Trichloro-ethene (µg/kg)
MTCA Method A CULs for Unrestricted Land Use				19	30
MTCA Method B CULs for Ingestion only				240	11,000
MTCA Method C CULs for Ingestion Only				11,000	1,500,000
Site-Specific CUL for Industrial Workers—Direct Contact				1,350	30,500
CUL for Vapor Intrusion				NV	186
On-Site Geoprobe Sampling					
GP6	GP6-S-14.5	06/16/2005	14.5	--	**1,160**
GP11	GP11-S-6.5	06/17/2005	6.5	--	**281**
GP18	GP18-S-1.0	12/13/2005	1	**2,300 J**	--
GP32	GP32-S-1.0	12/14/2005	1	**3,500 J**	--

NOTES:
Bold indicates concentrations that exceed one or more relevant CULs.
-- = not detected at or above CULs.
CUL = cleanup level.
ft. bgs = feet below ground surface.
IHS = indicator hazardous substance.
J = estimated concentration.
mg/kg = milligrams per kilogram.
MTCA = Washington State Department of Ecology's Model Toxics Control Act.
µg/kg = micrograms per kilogram.
NV = no value.
[a]MTCA Method A—Industrial Use.

Table 3-2
IHS Exceedances in Groundwater
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Chromium (Hexavalent) (mg/L)	Trichloro-ethene (µg/L)
MTCA Method A Groundwater CULs			NV	5
MTCA Method B Groundwater CULs			0.048	0.109
MTCA Method C Groundwater CULs			88	1.1
MTCA Method C Surface Water CULs			1.22	37
AWQC—Human Health			NR	2.5
Surface-Water ARAR—Aquatic Life—Acute			0.015	NR
AWQC—Aquatic Life—Chronic			0.01	NR
CUL for Vapor Intrusion			NV	48.7
Site-Specific Groundwater CUL for Protection of Surface Water			0.16	1,630
Excavation Worker—Direct-Contact Groundwater CUL			190	130
Monitoring Well Groundwater Data				
MW1	MW1-W-35.0	06/16/2005	**0.269**	NA
MW5	MW5-122805	12/28/2005	**450**	--
	MW5-041906	04/19/2006	**350**	--
Reconnaissance Groundwater Data				
GP2	GP2-W-17-RECON	06/09/2005	**32.38**	--
GP4	GP4-W-8.0	6/16/2005	**31**	--
GP6	GP6-W-18.0	6/16/2005	**43**	**1,130**
GP8	GP8-W-10.0	6/16/2005	**61**	--

NOTES:
Bold indicates concentrations that exceed one or more relevant CULs.
-- = not detected at or above CULs.
ARAR = applicable or relevant and appropriate requirement.
AWQC = ambient water quality criteria.
CUL = cleanup level.
IHS = indicator hazardous substance.
mg/L = milligrams per liter.
MTCA = Washington State Department of Ecology's Model Toxics Control Act.
µg/L = micrograms per liter.
NA = not available.
NR = MTCA reported the CUL as not researched.
NV = no value.

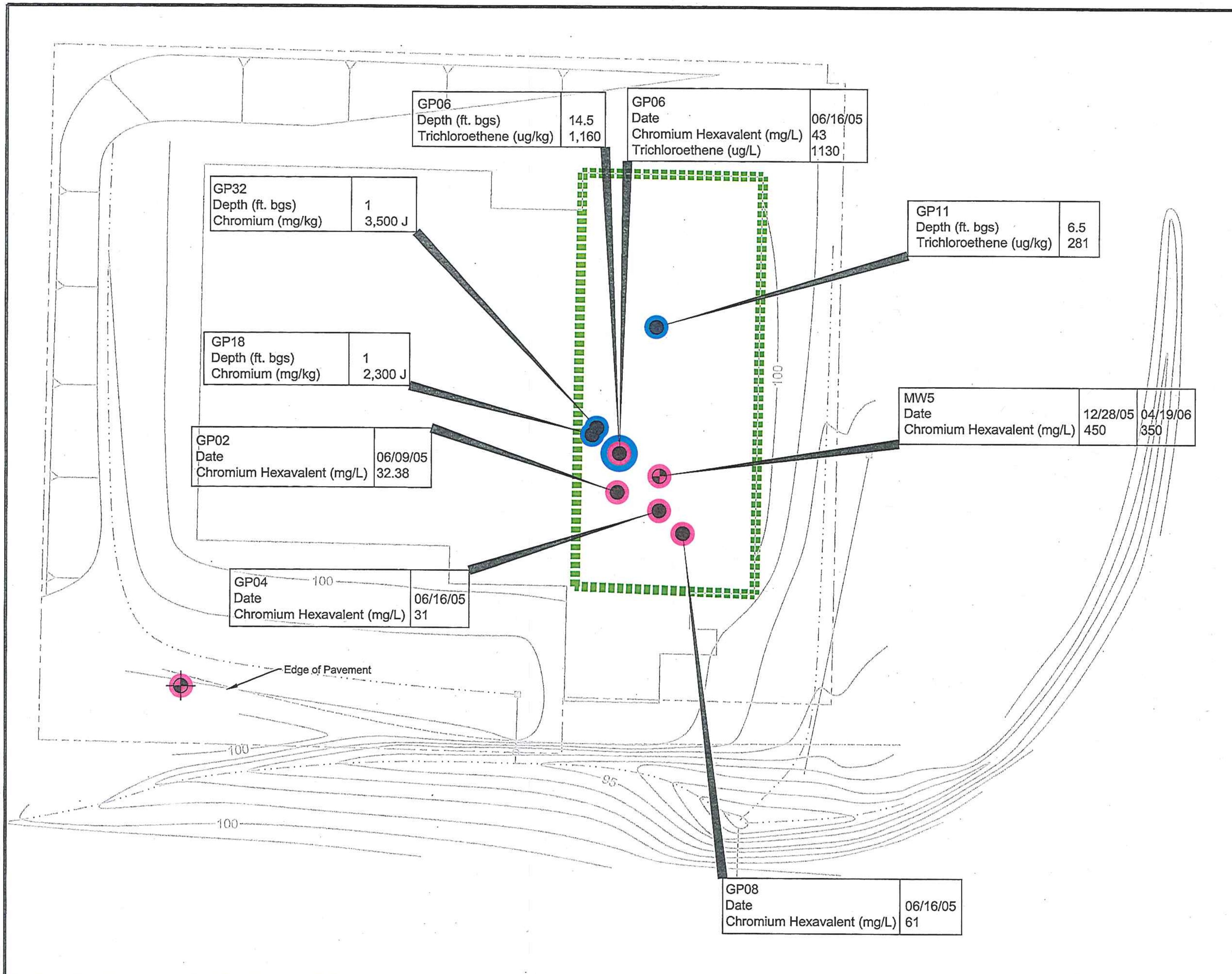

Figure 3-1

Groundwater and Soil Exceedances Above Cleanup Levels

Precision Engineering, Inc. Seattle, Washington

Legend:
- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval
- 2-inch Asphalt Curbing
- Geoprobe Boring
- Shallow Monitoring Well
- Deep Monitoring Well
- Soil Exceedance
- Groundwater Exceedance
- Alternative 2 Cap Extent

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) Locations of property boundary, building corners, monitoring wells, Geoprobe borings, and hand augers HA1 through HA5 based on 2006 survey by Duncanson Company, Inc. Hand Augers HA13 to HA27 were recorded using Trimble GeoXT GPS Unit (accuracy ±3 feet), all other locations are approximate.
3) Exceedances nomenclature:
ft. bgs = feet below ground surface
J = estimated concentration

MAUL FOSTER ALONGI

Layout: 1 Project: 8006.08.04 Drawn By: J. Fisher Approved By: J. King

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4 DEVELOPMENT OF CLEANUP ALTERNATIVES

Through the interim cleanup actions discussed in Sections 2.1 and 2.4, significant sources of hazardous substances were removed, reducing the need for long-term management. The residual contamination is in a localized area underneath a building with an active commercial facility. As reflected in the alternatives analysis presented in this section, the building, its continuous use, and the depth of the remaining contamination would make it difficult to treat or remove the contamination that remains following the completed interim actions. The following sections present the technology screening and the alternatives for addressing the residual contamination.

4.1 Technology Screening

A preliminary screening of applicable technologies was completed. Table 19 summarizes the technologies screened. Retained technologies kept for further consideration in cleanup alternatives are shown in Table 20, and include the following:

- **Excavation and Off-Site Disposal:** Excavation would remove from the site all or some of the remaining soil that exceeds acceptable CULs. With excavation and off-site disposal, impacted material is removed and transported to permitted, off-site disposal facilities. The excavated soil from this site is not expected to require treatment before disposal. For the purposes of this FS, it is assumed that soil removed from the site will exhibit toxicity characteristics and will be disposed of as dangerous waste. Though retained as an option, excavation of soils underneath the building would be difficult to implement because of the depth of the excavation and the disruption to the business located at the site.
- **Separation:** To the extent that nonhazardous materials (e.g., concrete slab) may be separated from any excavation and used as backfill, separation is retained as a technology.
- **In Situ Stabilization:** This technology physically binds or encloses contaminants within a stabilized mass (solidification), or uses a chemical reaction between the stabilizing agent and the contaminant to reduce its mobility (stabilization). Typically, leachability testing is performed to measure the reduced mobilization of contaminants and corresponding reduction in dissolved-phase concentrations of the IHSs. Implementation of this technology is highly dependent on the physical properties of the soil and aquifer.

  Solidification can be effective for inorganics. Before implementation, a treatability study would likely be required. A stabilization material called EHC-M® (a compound composed of organic material with microscale zerovalent iron) has been developed to immobilize soluble metals via enhanced precipitation and adsorption. A solution is prepared and injected into the subsurface, using a drill rig. The EHC-M technology is considered implementable and reportedly has demonstrated effectiveness for stabilizing hexavalent chromium and TCE, assuming site chemistry is suitable (e.g. low redox conditions).

- **Engineered Cap:** Capping is a very common form of remediation because it effectively manages the potential human and ecological risks associated with impacted surface and subsurface soil by preventing exposure and is generally less expensive than other technologies. Cap design is site-specific and depends on site conditions, exposure pathways, and the intended function. Engineered caps can range from a one-layer system of vegetated soil to a complex, multilayer system of soil and geosynthetics or other impermeable barriers. For this site, an engineered cap would be used to prevent contact with impacted soil and thus minimize exposure to IHSs. The engineered cap could consist of a pervious or impervious material. A monitoring and maintenance program would be implemented to ensure that the integrity of the engineered cap was maintained over time.

- **Groundwater Removal:** The feasibility of a pump-and-treat facility is limited at the site because of the existing operations, the low aquifer yield, and the high capital cost compared to the limited extent of groundwater impacts. However, treatment may be provided by dewatering any excavations conducted for soil removal and disposing of the water off site at a licensed facility.

- **Natural Attenuation:** Natural attenuation is kept as a technology, to the extent it is occurring on-site. However, none of the remedy alternatives rely on natural attenuation for the completion of site remedial action.

- **Institutional Controls:** Deed notifications (e.g., an environmental covenant) are required to reduce or prevent future exposure of receptors to soil containing residual IHSs at concentrations above relevant CULs. Deed notifications inform potential purchasers of the site of the presence of IHSs in soil and may limit activities or land use at the site and define requirements for future site redevelopment activities.

  Deed restrictions require that future redevelopment activities at the site comply with a soil management plan (SMP). An SMP guides future on-site and off-site activities that could potentially encounter impacted soil. The SMP outlines specific requirements for managing soil on site as part of future redevelopment. Waste-disposal requirements and sampling and analysis requirements also are addressed in the plan.

4.2 Cleanup Alternatives

Remedial alternatives were developed by using the individual cleanup technologies discussed in Section 4.1 and the CULs presented in Section 3. The development of remedial alternatives included consideration of the POCs for each affected medium. In addition to a no-action alternative, three remedial alternatives were developed that meet cleanup standards. The remedial alternatives are described below.

4.2.1 Alternative 1: No Action

A no-action alternative was retained for comparison purposes.

4.2.2 Alternative 2: Cap Maintenance, Groundwater Monitoring, Institutional Controls

- Soil and groundwater that contain concentrations above CULs will remain covered with an impermeable cap, currently a concrete building slab, approximately 6 to 12 inches in thickness. For the purposes of the FS, the cap was assumed to be the existing building slab, as vapor sampling has demonstrated that it prevents vapor intrusion exceedances. For cost-estimating purposes, maintenance of the capping is continued for 20 years and will include sealing of cracks in the concrete slab within the impacted area. Figure 3-1 shows the extent of the cap, approximately 21,000 square feet.
- Monitoring will be completed to assess whether the concentrations of IHS are stable or declining at the conditional POC. For the purposes of the cost estimate, it is assumed that three existing wells (five monitoring wells will be abandoned as part of the remedial action) will be monitored quarterly for one year and the monitoring schedule reassessed at the end of that year.
- Institutional controls will be implemented as part of the remedial action. The institutional controls will be in the form of an environmental covenant that will prohibit groundwater use and will require adherence to an SMP for protection and maintenance of surface capping and management of residual contaminated soils during redevelopment or subsurface work. The environmental covenant will also require maintenance of the existing impermeable cap or an equivalent exposure barrier (e.g., liner, asphalt, concrete, building).

A cost estimate for Alternative 2 is presented in Table 21. As there is limited construction to implement this remedy, there is limited disruption to the active industrial facility on site. The remedial action is complete following implementation of the institutional controls. The implementation of the institutional controls will be completed by Precision, in concurrence with the current property owner.

4.2.3 Alternative 3: Soil Removal

- Soil with concentrations above the CULs (1,350 mg/kg of hexavalent chromium and 186 μg/kg of TCE) will be excavated, transported, and disposed of off-site at a licensed facility. Although the soil exceeding the TCE vapor intrusion CULs is not necessarily within the POC for vapor intrusion, the exceedances are included in the excavation due to the hydrogeology of the site. The depth to groundwater (between 3.49 and 6.39 feet bgs) may not be indicative of saturated conditions in shallow soil due to the presence of the confining glacial till. Based on these exceedances shown in Figure 3-1, the estimated total amount of excavated soil is approximately 1,000 cubic yards. The cost estimate assumes that material removed will be disposed of as a dangerous waste in a Subtitle C disposal facility. Samples will be collected at the sidewalls and floor of the excavation to ensure removal of soil above CULs. The excavations will be dewatered and groundwater will be sent off site for disposal.
- Monitoring will be completed to assess groundwater IHS concentrations at the conditional POC. For the purposes of the cost estimate, it is assumed that three existing wells will be monitored every quarter for one year and the monitoring schedule reassessed at the end of that year. In addition, five monitoring wells will be abandoned.
- Institutional controls will be implemented as part of the remedial action. During remediation, access to the property will be restricted and remediation workers will complete remedial actions according to applicable health and safety regulations. Following construction, the institutional controls will be implemented by restrictive covenants to prohibit groundwater use and, as necessary, to maintain the cap. The cost estimate assumes maintenance of the cap for five years, assuming that performance monitoring shows no concentrations of IHSs above CULs.

A cost estimate for Alternative 3 is presented in Table 22. Logistically, Alternative 3 poses some timing and construction concerns. During construction, the operations of the existing owner will be disrupted. In addition, the depth of the excavation will require either shoring or a cut slope. To limit soil disturbance to the impacted areas, shoring is the preferable option; however, installing shoring to an excavation depth of 15 feet within a building and with a subsurface geologic layer consisting of hard glacial till will pose construction concerns. Following construction completion, compliance monitoring will be required to ensure that the soil removal remediated the groundwater levels.

4.2.4 Alternative 4: Soil Removal and Injections

- Vadose soil (assumed to be 0 to 4.5 feet bgs) with concentrations above the CULs (1,350 mg/kg of hexavalent chromium and 186 μg/kg of TCE) will be excavated, transported, and disposed of off-site at a licensed facility. The estimated total amount of excavated soil is approximately 67 cubic yards. The cost estimate assumes that material removed will be disposed of as dangerous waste in a Subtitle C disposal facility.

- Areas with groundwater concentrations above the CULs (0.16 mg/L hexavalent chromium and 48.7 μg/L TCE) and soil below the water table with concentrations above the CULs (1,350 mg/kg of hexavalent chromium and 186 μg/kg of TCE) will be remediated via injection of a reductive material (EHC-M or equivalent). For the purposes of the cost estimate, a treatment area of 7,800 square feet was assumed, based on the exceedances shown in Figure 3-1, with a delivery concentration of 0.30 percent of soil mass and an injection interval of 4 to 15 feet bgs.
- Groundwater monitoring will be completed to assess remedial action performance. For the purposes of the cost estimate, it is assumed that three existing wells will be monitored every quarter for one year and the monitoring schedule reassessed at the end of that year. In addition, five monitoring wells will be abandoned.
- No additional institutional controls will be required. During remediation, access to the Property will be restricted and remediation workers will complete remedial actions according to applicable health and safety regulations.

A cost estimate for Alternative 4 is presented in Table 23. As the feasibility of injecting at shallow intervals is limited, Alternative 4 includes a component to remove shallow soils with concentrations above CULs. The feasibility of a metal-remediation compound for treating commingled TCE and hexavalent chromium contamination has been demonstrated at a facility in Washington. Based on information supplied by the manufacturer of the EHC-M, a high concentration of remediation material is required for the site conditions. Additional data collection will be necessary to assess whether the reductive conditions necessary for effective treatment are present at the site. Following data collection, a pilot study may be warranted to assess the chemistry of in situ conditions and the formation receptiveness of the injection material. Based on the geology under the site, the technical feasibility to inject the amount of material necessary may be limited because of low permeability and shallow injection intervals.

5 EVALUATION OF ALTERNATIVES

This section evaluates the proposed cleanup action alternatives in the context of the requirements of MTCA. The cleanup action must meet the threshold requirements, which include the following:

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

As shown in Table 24, Alternatives 2, 3, and 4 meet the threshold criteria and were included in the disproportionate cost analysis. To complete a quantitative ranking for the disproportionate cost analysis, the criteria with weighting factors are as follows:

- Protectiveness: Protectiveness of human health and the environment, including the degree to which existing risks are reduced; time required to reduce risk at the facility and attain cleanup standards; on-site and off-site risks resulting from implementing the cleanup action alternative; and improvement of the overall environmental quality. As this is a significant goal of the remedial action, this factor is weighted relatively highly at 30 percent.
- Permanence: Permanence is a factor by which the cleanup action alternative permanently reduces the toxicity, mobility, or volume of hazardous substances, including the adequacy 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 the waste treatment process, and the characteristics and quantity of treatment residuals generated. The factor of permanence is weighted at 20 percent to account for the extent of residual contamination and the minimal remaining risk.
- Effectiveness over the long term: Long-term effectiveness includes the degree of certainty that the alternative will be successful; the reliability of the alternative during the period of time hazardous substances are expected to remain on site at concentrations that exceed CULs; the magnitude of residual risk with the alternative in place; and the effectiveness of controls required to manage treatment residues or remaining wastes. The factor of long-term effectiveness is weighted at 25 percent because of the need to address the current and future property owners' needs.
- Management of the short-term risks: This factor addresses the risk to human health and the environment associated with the alternative during

construction and implementation, and the effectiveness of measures that will be taken to manage such risks. The factor of short-term risk management is weighted at 10 percent: although short-term risks may be minimized through careful implementation of the remedy, releases and safety concerns are significant determination factors, and this criterion is weighted accordingly.

- Technical and administrative implementability: This factor addresses whether the alternative can be implemented and is technically possible. The availability of necessary materials, regulatory requirements, scheduling, access for construction operations and monitoring, and integration with existing facility operations must be considered. As Precision is not the current owner of the property, accessibility to the property is limited. An alternative that is less invasive for the current owner is rated higher under this factor as more invasive alternatives would result in more significant impacts to the current business. These impacts are not quantifiable, but would be negotiated between the current owner and Precision. The factor of implementability is weighted at 10 percent, as the alternative must be implementable in order to be the preferred option.

- Consideration of public concerns: This factor includes considering concerns from individuals, community groups, local governments, tribes, federal and state agencies, or any other organization that may have an interest in or knowledge of the site and may have a preferred alternative. The factor of public concerns is weighted at 5 percent, as the public concern for each alternative is unknown at this time and assumed to be equivalent in terms of rating.

Evaluating the above factors with the estimated cost for each alternative, a relative cost to benefits ratio was determined to assess whether the costs are disproportionate to the benefits. On Figure 12, the rating and cost for each alternative is shown. The cost estimates do not account for activities discussed in Section 2.4 that Precision completed as interim cleanup actions. Based on future costs to complete the remediation, Alternative 2 has the lowest cost, with the highest rating, resulting in the lowest relative cost to benefit ratio.

WAC 173-340-360(4) contains guidance for determining a reasonable restoration period. As a reasonable restoration time frame for compliance with all CULs throughout the site is not feasible, the eastern property boundary, downgradient of the site was determined to be the conditional POC for groundwater. A preference is given for alternatives that can be implemented in a shorter time if other factors such as permanence and costs are equal. Permanence for Alternatives 2, 3 and 4 are considered equal, however costs for Alternatives 3 and 4 are disproportionate. Regardless, Alternatives 2 and 3 protect human health and the environment immediately or within very short periods (e.g., months). Alternative 4 has uncertainty in this area, due to the possible need for multiple injections over time.

A reasonable time frame is based on potential risk, practicality of achieving a shorter time frame, availability of alternate water supplies, likely effectiveness and reliability of institutional controls, ability to control and monitor contaminant migration, and potential for contaminant degradation over time. Currently, groundwater concentrations meet CULs at the conditional POC and no groundwater is used on site or poses a risk to receptors, resulting in immediate restoration for groundwater. Table 24 discusses the alternatives individually in terms of a reasonable restoration timeframe.

Under WAC 173-340-370, Ecology expects that any cleanup actions chosen will not result in a significantly greater overall threat to human health and the environment than other alternatives. Aligned with this expectation for alternatives, a brief qualitative evaluation of green remediation was conducted, defined by the USEPA as: "the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions."

Through remedial design, additional green remediation standards and best management practices can be incorporated into the remedial alternative selection, operation, and maintenance.

The USEPA's guidance for green remediation includes best management practices and criteria for consideration in the following categories:

- Energy requirements
- Air emissions, including greenhouse gas (GHG) emissions
- Water requirements and associated impacts on water resources
- Impacts on land and ecosystems
- Material consumption and waste generation
- Impacts on long-term stewardship of a site

Alternatives 2 and 3 have been determined to be equally protective, and thus for comparison, Alternatives 2 and 3 have been evaluated for consideration of the above categories. Alternative 3 will require a significant amount of resources beyond Alternative 2, resulting in impacts on land and ecosystems, material consumption and waste generation, and air emissions, as well as long-term stewardship of the site.

It is not expected that a significant amount of water consumption or energy use will be required for Alternatives 2 or 3. Alternative 2 results in no transport of material off-site and negligible impacts associated with long-term maintenance, similar to Alternative 3. The most significant quantitative difference between Alternative 2 and 3 is the amount of fuel consumption by on-site equipment use or off-site transport associated. Alternative 3 will include excavation and disposal of soil in significant quantities, creating GHG impacts. Air emissions from Alternative 3 in the form of GHG are estimated to be 51 metric tons carbon dioxide equivalents (MTCO2e) generated by transport of excavated soil and import of clean backfill. GHG from Alternative 2 are assumed to be negligible in comparison to Alternative 3.

6 RECOMMENDED ALTERNATIVE

The comparative analysis previously discussed shows that Alternative 2 best meets the MTCA criteria, and is permanent to the maximum extent practicable. It is the most favorable alternative because the incremental costs of the other alternatives are disproportionate to the incremental degree of benefits provided by the more costly alternatives; as compared to Alternative 2, the benefits of Alternatives 3 and 4 are lower, with the costs being higher. Alternative 2 also builds on the prior cleanup actions in which the bulk of the source was previously removed. Other factors include the nonpotability of groundwater at the site and the presence of an active industrial facility with a functioning cap. Alternative 2 is the recommended cleanup action alternative.

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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TABLES

Table Notes
Precision Engineering, Inc.
Seattle, Washington

Bold indicates concentrations that exceed one or more relevant CULs.
Gray indicates that criteria are included in tables; however, they are not applicable at Property and are therefore not screened against.
ARAR = applicable or relevant and appropriate requirement.
AWQC = ambient water quality criteria.
bgs = below ground surface.
cPAH = chlorinated polycyclic aromatic hydrocarbon.
CUL = cleanup level.
ft = feet.
>S = greater than saturation.
gal = gallon.
gpm = gallons per minute.
IDW = investigation-derived waste.
IHS = indicator hazardous substance.
J = estimated concentration.
mg/kg = milligrams per kilogram.
mg/L = milligrams per liter.
MPE = measuring point elevation.
MTCA = Washington Department of Ecology's Model Toxics Control Act.
µg/kg = micrograms per kilogram.
µg/L = micrograms per liter.
µg/m^3 = micrograms per cubic meter.
NA = not analyzed.
NC = not calculated.
NGVD = National Geodetic Vertical Datum 1929.
NR = MTCA reported the CUL as not researched.
NV = no value.
PAH = polycyclic aromatic hydrocarbon.
TCE = trichloroethene.
TEF = toxicity equivalency factors.
U = not detected at or above the method reporting limit.
UI = not detected due to matrix interference.
[a]MTCA Method A—Industrial Use.
[b]Trivalent chromium concentrations were calculated by subtracting the hexavalent chromium value from the total chromium value. If hexavalent chromium was not detected, then the entire total chromium value was assumed to consist of trivalent chromium.
[c]Source: Van Deuren et al., 2002.

Table 1
Water-Level Elevations
Precision Engineering, Inc.
Seattle, Washington

Location	Date	Measuring-Point Elevation (MPE) (ft NGVD)	Depth to Water (ft bgs)	Water-Level Elevation (ft NGVD)
MW-1	12/27/2005	23.16	2.03	21.13
	04/17/2006	23.16	0.61	22.55
	06/08/2006	23.16	1.57	21.59
MW-2	12/27/2005	18.86	4.82	14.04
	04/17/2006	18.86	4.65	14.21
	06/08/2006	18.86	4.64	14.22
MW-3	12/27/2005	19.51	5.48	14.03
	04/17/2006	19.51	5.79	13.72
	06/08/2006	19.51	5.93	14.61
MW-4	12/27/2005	20.54	5.77	14.77
	04/17/2006	20.54	5.55	14.99
	06/08/2006	20.54	5.61	14.93
MW-5	12/27/2005	19.86	5.52	14.34
	04/17/2006	19.86	5.32	14.54
	06/08/2006	19.86	5.29	14.57
MW-6	12/27/2005	17.99	4.70	13.29
	04/17/2006	17.99	4.27	13.72
	06/08/2006	17.99	4.10	13.89
MW-7	12/27/2005	17.84	5.77	12.07
	04/17/2006	17.84	4.64	13.20
	06/08/2006	17.84	5.17	12.67
MW-8	12/27/2005	17.35	3.32	14.03
	04/17/2006	17.35	3.12	14.23
	06/08/2006	17.35	3.33	14.02
Staff Gauge	12/27/2005	19.61 ft NGVD @ 8.00	Dry	Dry
	04/17/2006	19.61 ft NGVD @ 8.00	Dry	Dry
	06/08/2006	19.61 ft NGVD @ 8.00	0.02	19.63

Table 2
Aquifer Yield Calculations
Precision Engineering, Inc.
Seattle, Washington

Well	Date	Pumping Start Time	Pumping End Time	Difference	Time Elapsed	DTWi	DTWf	Drawdown	Total Pumped	Pump Rate	Aquifer Yield Rate
					min	ft	ft	feet	gal	gpm	gpm
Shallow Aquifer											
MW-3	04/17/2006	17:36	18:29	0:53	53	5.79	7.5	1.71	7.5	0.142	0.331
MW-4	04/18/2006	15:44	17:37	1:53	113	5.55	18	12.45	9.75	0.086	0.028
MW-5	04/19/2006	10:53	12:10	1:17	77	5.32	6.5	1.18	7.5	0.097	0.330
MW-6	06/08/2006	9:28	9:48	0:20	20	4.10	6.38	2.28	2.6	0.130	0.228
	06/08/2006	9:48	10:28	0:40	40	6.38	8.18	1.8	2.6	0.065	0.144
	06/08/2006	10:28	11:08	0:40	40	8.18	10.32	2.14	2.6	0.065	0.121
	04/19/2006	8:59	10:06	1:07	67	4.27	9.50	5.23	8.25	0.123	0.094
MW-8	04/18/2006	8:45	10:50	2:05	125	3.12	13.50	10.38	8.25	0.066	0.025
Deeper Aquifer											
MW-1	04/18/2006	15:33	18:05	2:32	152	0.61	17.30	16.69	21.00	0.138	0.033
MW-7	04/18/2006	12:05	14:21	2:16	136	4.64	14.00	9.36	13.50	0.099	0.042

Table 3
Total Metals in Soil from
Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (feet bgs)	Date Collected	Arsenic	Lead
MTCA Method A CULs for Unrestricted Land Use				20	NR
MTCA Method B CULs for Ingestion only				0.67	NR
MTCA Method C CULs for Ingestion Only				88	NR
Site-Specific CUL for Industrial Workers—Direct Contact				20[a]	1000[a]
B1	B1	1.5	10/24/2007	16.2	11.2
B2	B2	1.5	10/24/2007	13.9	36.7
B3	B3	1.5	10/24/2007	10.7	29.7
B4	B4	1.5	10/24/2007	3.79	3.6
B5	B5	1.5	10/24/2007	3.07	5.19
B6	B6	1.5	10/24/2007	2.76	3.5
B7	B7	1.5	10/24/2007	7.21	22.2
B8	B8	1.5	10/24/2007	10	40.4
B9	B9	1.5	10/24/2007	8	19.5
B10	B10	1.5	10/24/2007	16.1	37.2
B11	B11	1.5	10/24/2007	8.26	16
B12	B12	1.5	10/24/2007	11.3	108
B13	B13	1.5	10/24/2007	**26.3**	55.5
P1	P1	0.5	10/24/2007	**22**	653
P2	P2	0.5	10/24/2007	15.7	200
P3	P3	0.5	10/24/2007	13.3	202
P4	P4	0.5	10/24/2007	11.6	103
P5	P5	0.5	10/24/2007	9.54	64.6
P6	P6	0.5	10/24/2007	9.05	108
P7	P7	0.5	10/24/2007	19.9	196
P8	P8	0.5	10/24/2007	13.8	76.8
P9	P9	0.5	10/25/2007	**111**	**2410**
P10	P10	0.5	10/25/2007	15.6	365
SS-1	SS1-6	0.5	11/19/2007	2.64	120
SS-2	SS2-6	0.5	11/19/2007	4.82	75.2
SS-3	SS3-6	0.5	11/19/2007	37	668
SS-3	SS3-18	1.5	11/19/2007	6.79	230
SS-4	SS4-6	0.5	11/19/2007	3.58	18.5
SS-5	SS5-6	0.5	11/19/2007	4.43	44
SS-6	SS6-6	0.5	11/19/2007	16.8	838
SS-6	SS6-18	1.5	11/19/2007	**23.7**	526
C-1	C-1	2	03/27/2008	9.91	470
C-2	C-2	1.5	03/27/2008	**21.6**	**1020**
C-3	C-3	1.5	03/27/2008	13.2	213

Table 4
Polycyclic Aromatic Hydrocarbons in Soil from Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (ft bgs)	Date Collected	1-Methyl-naphthalene	2-Methyl-naphthalene	Acenaph-thene	Acenaph-thylene	Anthracene	Benzo(a) anthracene
B5	B5	1.5	10/24/2007	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U

Table 4
Polycyclic Aromatic Hydrocarbons in Soil from Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (ft bgs)	Date Collected	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(ghi) perylene	Benzo(k) fluoranthene	Chrysene	Dibenzo(a,h) anthracene
B5	B5	1.5	10/24/2007	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U

Table 4
Polycyclic Aromatic Hydrocarbons in Soil from Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (ft bgs)	Date Collected	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
B5	B5	1.5	10/24/2007	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U	0.0130 U

Table 5
Total Petroleum Hydrocarbons in Soil from Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (feet bgs)	Date Collected	Gasoline-Range Hydrocarbons	Diesel	Lube-Oil-Range Hydrocarbons
B5	B5	1.5	10/24/2007	5.30 U	13.0 U	32.5 U

Table 6
BTEX Compounds in Soil from
Ditch Removal Confirmation Samples (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample	Depth (feet bgs)	Date Collected	Benzene	Ethylbenzene	Toluene	Total Xylenes
B5	B5	1.5	10/24/2007	0.0318 U	0.0530 U	0.0530 U	0.106 U

Table 7
Exposure Scenarios
Precision Engineering, Inc.
Seattle, Washington

Medium	Exposure Pathway	Receptors	Selected Pathway	Reason for Selection or Exclusion
Soil (0 to 15 feet bgs)	Ingestion, Inhalation, and Dermal Absorption	Outdoor Industrial Workers	Yes	Future industrial workers may have contact with soil if the building and pavement are removed.
Vadose-Zone Soil (0 to15 feet bgs)	Volatilization to Indoor Air	Indoor Industrial Workers	Yes	Volatile chemicals in vadose-zone soil may penetrate an on-site building and enter indoor air.
Soil	Leaching to Groundwater	Industrial Workers	Yes	IHSs in soil may leach to groundwater.
Groundwater	Ingestion, Inhalation, and Dermal Absorption	Residents and Industrial Workers	No	Groundwater in the area is not used for drinking.
Groundwater	Volatilization to Indoor Air	Indoor Industrial Workers	Yes	Volatile chemicals in groundwater may penetrate an on-site building and enter indoor air.
Groundwater	Volatilization to Outdoor Air	Industrial Workers	No	Volatile chemicals in groundwater may migrate to outdoor air. However, CULs protective of indoor industrial workers are more stringent than those protective of outdoor workers.
Surface Water	Fish Ingestion	Recreational Fishers	No	Impacted groundwater does not extend to the Duwamish River.
Surface Water	Gill Uptake	Aquatic/Benthic Biota	No	Impacted groundwater does not extend to the Duwamish River.

Table 8
Risk Screening
Hexavalent Chromium in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Chromium (Hexavalent)	Chromium (Trivalent)[b]
MTCA Method A CULs for Unrestricted Land Use				19	2000
MTCA Method B CULs for Ingestion only				240	120,000
MTCA Method C CULs for Ingestion Only				11,000	5,300,000
CUL for Industrial Workers—Direct Contact				1,350	389,000
On-Site Geoprobe Sampling					
GP1	GP1-S-1.5	06/07/2005	1.5	152	53
	GP1-S-6.0	06/07/2005	6	31.8	115.2
	GP1-S-10.0	06/09/2005	10	14.4	59.1
GP2	GP2-S-1.0	06/07/2005	1	523	2157
	GP2-S-10.0	06/09/2005	10	0.109 U	24.9
GP3	GP3-S-2.0	06/09/2005	2	27.7	887.3
	GP3-S-6.0	06/09/2005	6	49.8	1050.2
	GP3-S-14	06/09/2005	14	34.4	906.6
GP4	GP4-S-1.5	06/16/2005	1.5	53.4	1176.6
GP5	GP5-S-1.5	06/16/2005	1.5	0.111 U	18.9
	GP5-S-14.0	06/16/2005	14	0.115 U	20.1
GP6	GP6-S-1.0	06/16/2005	1	627	NC
	GP6-S-14.5	06/16/2005	14.5	0.181	258.819
GP7	GP7-S-2.0	06/16/2005	2	0.119	23.481
	GP7-S-8.0	06/16/2005	8	0.113 U	21
GP8	GP8-S-1.5	06/16/2005	1.5	0.661	21.539
GP9	GP9-S-2.0	06/17/2005	2	2.97	40.33
GP10	GP10-S-1.5	06/17/2005	1.5	0.142	21.658
	GP10-S-13.5	06/17/2005	13.5	0.106 U	24.1
GP11	GP11-S-2.0	06/17/2005	2	0.573	21.127
	GP11-S-6.5	06/17/2005	6.5	0.37	16.93
GP12	GP12-S-3.0	12/13/2005	3	1.1 UJ	24.3
	GP12-S-5.0	12/13/2005	5	1.0 UJ	25.2
GP13	GP13-S-1.0	12/14/2005	1	1.4 UJ	26.6
	GP13-S-6.0	12/14/2005	6	1.3 UJ	46.6
GP14	GP14-S-3.0	12/13/2005	3	2.0 UJ	24.8
	GP14-S-6.0	12/13/2005	6	1.2 J	30.2
GP15	GP15-S-3.0	12/13/2005	3	1.2 UJ	24.7
	GP15-S-6.0	12/13/2005	6	1.2 UJ	20.2
GP16	GP16-S-1.0	12/13/2005	1	2.1 UJ	30.0
	GP16-S-5.0	12/13/2005	5	2.1 UJ	26.2
GP17	GP17-S-1.0	12/13/2005	1	1.7 UJ	254
	GP17-S-6.0	12/13/2005	6	60 J	1600

Table 8
Risk Screening
Hexavalent Chromium in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Chromium (Hexavalent)	Chromium (Trivalent)[b]
MTCA Method A CULs for Unrestricted Land Use				19	2000
MTCA Method B CULs for Ingestion only				240	120,000
MTCA Method C CULs for Ingestion Only				11,000	5,300,000
CUL for Industrial Workers—Direct Contact				1,350	389,000
On-Site Geoprobe Sampling cont.					
GP18	GP18-S-1.0	12/13/2005	1	**2300 J**	2130
GP19	GP19-S-1.0	12/13/2005	1	2.5 UJ	22.0
	GP19-S-1.0-Dup	12/13/2005	1	2.0 UJ	24.8
	GP19-S-7.0	12/13/2005	7	2.7 UJ	27.1
GP20	GP20-S-1.0	12/14/2005	1	1.1 UJ	17.6
	GP20-S-6.0	12/14/2005	6	1.5 UJ	24.5
GP21	GP21-S-1.0	12/14/2005	1	1.0 UJ	25.6
	GP21-S-6.5	12/14/2005	6.5	1.3 UJ	23.0
GP22	GP22-S-1.0	12/13/2005	1	2.9 J	43.9
	GP22-S-10.0	12/13/2005	10	1.3 UJ	32.1
GP23	GP23-S-7.0	12/14/2005	7	1.1 UJ	23.3
	GP23-S-10.5	12/14/2005	10.5	1.2 UJ	979
GP24	GP24-S-3.0	12/14/2005	3	1.0 UJ	30.2
	GP24-S-3.0-Dup	12/14/2005	3	1.1 UJ	26.2
	GP24-S-6.5	12/14/2005	6.5	2.4 UJ	29.3
GP25	GP25-S-1.0	12/12/2005	1	1.8 UJ	19.3
	GP25-S-7.0	12/12/2005	7	1.7 UJ	19.8
GP26	GP26-S-1.0	12/12/2005	1	2.2 UJ	23.7
	GP26-S-9.5	12/12/2005	9.5	2.1 UJ	24.0
GP27	GP27-S-1.0	12/12/2005	1	2.2 UJ	22.0
	GP27-S-13.0	12/12/2005	13	2.1 UJ	18.6
GP28	GP28-S-1.0	12/12/2005	1	2.2 UJ	20.5
	GP28-S-7.0	12/12/2005	7	1.8 UJ	22.4
GP29	GP29-S-1.0	12/12/2005	1	2.4 UJ	29.6
	GP29-S-6.0	12/12/2005	6	2.6 UJ	31.9
GP30	GP30-S-1.0	12/12/2005	1	2.1 UJ	27.2
	GP30-S-6.0	12/12/2005	6	2.4 UJ	32.7
GP31	GP31-S-1.0	12/12/2005	1	2.1 UJ	19.2
	GP31-S-6.0	12/12/2005	6	3.0 UJ	23.6
GP32	GP32-S-1.0	12/14/2005	1	**3500 J**	3250

Table 8
Risk Screening
Hexavalent Chromium in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Chromium (Hexavalent)	Chromium (Trivalent)[b]
MTCA Method A CULs for Unrestricted Land Use				19	2000
MTCA Method B CULs for Ingestion only				240	120,000
MTCA Method C CULs for Ingestion Only				11,000	5,300,000
CUL for Industrial Workers—Direct Contact				1,350	389,000
Off-Site Hand-Auger Sampling					
HA1	HA1-0.5	12/15/2005	0.5	2.9 UJ	34.3
	HA1-1.5	12/15/2005	1.5	6.5 J	103.5
	HA1-1.5-Dup	12/15/2005	1.5	2.8 UJ	84.5
HA2	HA2-0.5	12/15/2005	0.5	89 J	117
	HA2-1.5	12/15/2005	1.5	3.2 J	211.8
HA3	HA3-0.5	12/15/2005	0.5	2.6 UJ	1590
	HA3-1.5	12/15/2005	1.5	2.4 UJ	55.2
HA4	HA4-0.5	12/15/2005	0.5	7.2 UJ	8480
	HA4-1.5	12/15/2005	1.5	3.0 UJ	280
HA5	HA5-0.5	12/15/2005	0.5	5.8 UJ	155
	HA5-1.5	12/15/2005	1.5	2.9 UJ	32.7
HA6	HA6-0.5	04/18/2006	0.5	3.33 J	NC
HA7	HA7-0.5	04/18/2006	0.5	0.22 J	NC
HA8	HA8-0.5	04/18/2006	0.5	0.26 J	NC
HA9	HA9-0.5	04/19/2006	0.5	3.4 J	NC
HA10	HA10.05	04/19/2006	0.5	0.074 J	NC
HA11	HA11-0.5	04/19/2006	0.5	0.45 J	NC

Table 9
Risk Screening
Metal IHSs in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Arsenic	Cadmium	Copper	Lead
MTCA Method A CULs for Unrestricted Land Use				20	2	NV	250
MTCA Method B CULs for Ingestion only				0.67	80	3000	NV
MTCA Method C CULs for Ingestion only				88	3,500	130,000	NV
CUL for Industrial Workers—Direct Contact				20[a]	4,710	49,300	1,000[a]
Off-Site Hand-Auger Sampling							
HA1	HA1-0.5	12/15/2005	0.5	3.81	0.576 U	32.8	34.6
	HA1-1.5	12/15/2005	1.5	2.88 J	0.550 U	16.2 J	15.3 J
	HA1-1.5-Dup	12/15/2005	1.5	8.35 J	0.707 U	68.4 J	95.3 J
HA2	HA2-0.5	12/15/2005	0.5	3.94	0.984	70.9	81.4
	HA2-1.5	12/15/2005	1.5	2.71	0.613 U	28.2	36.5
HA3	HA3-0.5	12/15/2005	0.5	**53.9**	2.53	528	545
	HA3-1.5	12/15/2005	1.5	6.96	0.585 U	16.4	8.41
HA4	HA4-0.5	12/15/2005	0.5	**44.3**	28.7	978	**1710**
	HA4-1.5	12/15/2005	1.5	5.25	0.819 U	48.8	50.8
HA5	HA5-0.5	12/15/2005	0.5	**35.9**	3.13	129	**1440**
	HA5-1.5	12/15/2005	1.5	12.5	1.09	39.6	209
HA12	HA12-0.5	04/19/2006	0.5	9.0	0.48 J	39	220
HA17	HA17-S-0.5	01/09/2007	0.5	6.61	NA	NA	278
	HA17-S-1.5	01/09/2007	1.5	5.3	NA	NA	23.5
HA18	HA18-S-0.5	01/09/2007	0.5	5.03	NA	NA	61.5
	HA18-S-1.5	01/09/2007	1.5	2.12 U	NA	NA	2.12 U
HA19	HA19-S-0.5	01/09/2007	0.5	12.7	NA	NA	134
	HA19-S-1.5	01/09/2007	1.5	4.02	NA	NA	11.3
HA20	HA20-S-0.5	01/09/2007	0.5	2.02 U	NA	NA	27.9
	HA20-S-1.5	01/09/2007	1.5	1.81 U	NA	NA	8.91
HA21	HA21-S-0.5	01/10/2007	0.5	5.72	NA	NA	398
	HA21-S-1.5	01/10/2007	1.5	5.83	NA	NA	121
HA22	HA22-S-0.5	01/10/2007	0.5	**53.5**	NA	NA	986
	HA22-S-1.5	01/10/2007	1.5	10.3	NA	NA	32.4
HA23	HA23-S-0.5	01/10/2007	0.5	4.44	NA	NA	26.9
	HA23-S-1.5	01/10/2007	1.5	4.91	NA	NA	20.5
HA24	HA24-S-0.5	01/10/2007	0.5	4.9	NA	NA	63.9
	HA24-S-1.5	01/10/2007	1.5	5.23	NA	NA	24.3
HA25	HA25-S-0.5	01/10/2007	0.5	11.6	NA	NA	302
	HA25-S-1.5	01/10/2007	1.5	11.8	NA	NA	15.5

Table 10
Risk Screening
Volatile Organic Compound IHSs in Soil (µg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Trichloro-ethene	Vinyl chloride
MTCA Method A CULs for Unrestricted Land Use				30	NV
MTCA Method B CULs for Ingestion only				11,000	670
MTCA Method C CULs for Ingestion Only				1,100,000	88,000
CUL for Industrial Workers—Direct Contact				30,500	NV
CUL for Vapor Intrusion				186	NV
On-Site Geoprobe Sampling					
GP1	GP1-S-1.5	06/07/2005	1.5	0.839 U	0.839 U
	GP1-S-6.0	06/07/2005	6	1.12 U	1.12 U
	GP1-S-10.0	06/09/2005	10	7.65 U	7.65 U
GP2	GP2-S-1.0	06/07/2005	1	0.96 U	0.96 U
	GP2-S-10.0	06/09/2005	10	8.81 U	8.81 U
GP3	GP3-S-2.0	06/09/2005	2	15.9 U	15.9 U
	GP3-S-6.0	06/09/2005	6	8.96 U	8.96 U
	GP3-S-14	06/09/2005	14	7.71 U	7.71 U
GP4	GP4-S-1.5	06/16/2005	1.5	10.3 U	10.3 U
GP5	GP5-S-1.5	06/16/2005	1.5	7.12 U	7.12 U
	GP5-S-8.0	06/16/2005	8	7.03 U	7.03 U
	GP5-S-14.0	06/16/2005	14	8.1 U	8.1 U
GP6	GP6-S-1.0	06/16/2005	1	40.5	8.5 U
	GP6-S-14.5	06/16/2005	14.5	**1,160**	8.28 U
GP7	GP7-S-2.0	06/16/2005	2	7.81 U	7.81 U
	GP7-S-8.0	06/16/2005	8	8.84 U	8.84 U
GP8	GP8-S-1.5	06/16/2005	1.5	9.86 U	9.86 U
GP9	GP9-S-2.0	06/17/2005	2	7.42 U	7.42 U
GP10	GP10-S-1.5	06/17/2005	1.5	11.2 U	11.2 U
	GP10-S-13.5	06/17/2005	13.5	7.96 U	7.96 U
GP11	GP11-S-2.0	06/17/2005	2	87.2	8.37 U
	GP11-S-6.5	06/17/2005	6.5	**281**	8.61 U
GP12	GP12-S-3.0	12/13/2005	3	2.39 U	2.39 U
	GP12-S-5.0	12/13/2005	5	2.27 U	2.27 U
GP13	GP13-S-1.0	12/14/2005	1	9.89 U	9.89 U
	GP13-S-6.0	12/14/2005	6	2.89 U	2.89 U
GP14	GP14-S-3.0	12/13/2005	3	4.49	2.44 U
	GP14-S-6.0	12/13/2005	6	2.62 U	2.62 U
GP15	GP15-S-3.0	12/13/2005	3	2.72 U	2.72 U
	GP15-S-6.0	12/13/2005	6	10.5 U	10.5 U
GP16	GP16-S-1.0	12/13/2005	1	3.63	1.85 U
	GP16-S-5.0	12/13/2005	5	2.12 U	2.12 U

Table 10
Risk Screening
Volatile Organic Compound IHSs in Soil (µg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Trichloro-ethene	Vinyl chloride
MTCA Method A CULs for Unrestricted Land Use				30	NV
MTCA Method B CULs for Ingestion only				11,000	670
MTCA Method C CULs for Ingestion Only				1,100,000	88,000
CUL for Industrial Workers—Direct Contact				30,500	NV
CUL for Vapor Intrusion				186	NV
GP17	GP17-S-1.0	12/13/2005	1	2.09 U	2.09 U
	GP17-S-6.0	12/13/2005	6	2.27 U	2.27 U
GP18	GP18-S-1.0	12/13/2005	1	3.43	2.36 U
GP19	GP19-S-1.0	12/13/2005	1	2.67 U	2.67 U
	GP19-S-1.0-Dup	12/13/2005	1	2.40 U	2.40 U
	GP19-S-7.0	12/13/2005	7	2.72 U	2.72 U
GP20	GP20-S-1.0	12/14/2005	1	2.62 U	2.62 U
	GP20-S-6.0	12/14/2005	6	4.52 U	4.52 U
GP21	GP21-S-1.0	12/14/2005	1	2.18 U	2.18 U
	GP21-S-6.5	12/14/2005	6.5	2.79 U	2.79 U
GP22	GP22-S-1.0	12/13/2005	1	2.26 U	2.26 U
	GP22-S-10.0	12/13/2005	10	1.89 U	1.89 U
GP23	GP23-S-7.0	12/14/2005	7	1.80 U	1.80 U
	GP23-S-10.5	12/14/2005	10.5	2.27 U	2.27 U
GP24	GP24-S-3.0	12/14/2005	3	2.58 U	2.58 U
	GP24-S-3.0-Dup	12/14/2005	3	2.50 U	2.50 U
	GP24-S-6.5	12/14/2005	6.5	2.83 U	2.83 U
GP25	GP25-S-1.0	12/12/2005	1	2.13 U	2.13 U
	GP25-S-7.0	12/12/2005	7	2.47 U	2.47 U
GP26	GP26-S-1.0	12/12/2005	1	2.01 U	2.01 U
	GP26-S-9.5	12/12/2005	9.5	2.65 U	2.65 U
GP27	GP27-S-1.0	12/12/2005	1	2.19 U	2.19 U
	GP27-S-13.0	12/12/2005	13	2.05 U	2.05 U
GP28	GP28-S-1.0	12/12/2005	1	1.87 U	1.87 U
	GP28-S-7.0	12/12/2005	7	2.17 U	2.17 U
GP29	GP29-S-1.0	12/12/2005	1	2.47 U	2.47 U
	GP29-S-6.0	12/12/2005	6	2.43 U	2.43 U
GP30	GP30-S-1.0	12/12/2005	1	2.39 U	2.39 U
	GP30-S-6.0	12/12/2005	6	3.32 U	3.32 U
GP31	GP31-S-1.0	12/12/2005	1	2.02 U	2.02 U
	GP31-S-6.0	12/12/2005	6	3.41 U	3.41 U
GP32	GP32-S-1.0	12/14/2005	1	2.37 U	2.37 U

Table 11
Risk Screening
Polycyclic Aromatic Hydrocarbon IHSs in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Benzo(a) anthracene*	Benzo(a) pyrene*	Benzo(b) fluoranthene*	Benzo(k) fluoranthene*
MTCA Method A CULs for Unrestricted Land Use				NV	0.1	NV	NV
MTCA Method B CULs for Ingestion only				NV	0.14	NV	NV
MTCA Method C CULs for Ingestion only				NV	18	NV	NV
CUL for Industrial Workers—Direct Contact				NC	NC	NC	NC
Off-Site Hand-Auger Sampling							
HA1	HA1-0.5	12/15/2005	0.5	0.0151 U	0.0151 U	0.0151 U	0.0151 U
	HA1-1.5	12/15/2005	1.5	0.0129 U	0.0129 U	0.0129 U	0.0129 U
	HA1-1.5-Dup	12/15/2005	1.5	0.0288	0.0500	0.0769	0.0581
HA2	HA2-0.5	12/15/2005	0.5	0.0176 U	0.0176 U	0.0222	0.0205
	HA2-1.5	12/15/2005	1.5	0.0125 U	0.0125 U	0.0204	0.0151
HA3	HA3-0.5	12/15/2005	0.5	0.0340	0.0525	0.0982	0.0706
	HA3-1.5	12/15/2005	1.5	0.0118 U	0.0118 U	0.0118 U	0.0118 U
HA4	HA4-0.5	12/15/2005	0.5	0.554	0.694	0.771	0.749
	HA4-1.5	12/15/2005	1.5	0.0159 U	0.0159 U	0.0159 U	0.0159 U
HA5	HA5-0.5	12/15/2005	0.5	0.862	1.45	1.62	1.82
	HA5-1.5	12/15/2005	1.5	0.0153 U	0.0153 U	0.0153 U	0.0153 U

Table 11
Risk Screening
Polycyclic Aromatic Hydrocarbon IHSs in Soil (mg/kg)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Depth (feet bgs)	Chrysene*	Dibenzo(a,h) anthracene*	Indeno(1,2,3-cd) pyrene*	cPAHs including TEFs**
MTCA Method A CULs for Unrestricted Land Use				NV	NV	NV	0.1
MTCA Method B CULs for Ingestion only				NV	NV	NV	0.14
MTCA Method C CULs for Ingestion only				NV	NV	NV	18
CUL for Industrial Workers—Direct Contact				3.42	NC	NC	NC
Off-Site Hand-Auger Sampling							
HA1	HA1-0.5	12/15/2005	0.5	0.0151 U	0.0151 U	0.0151 U	0.011
	HA1-1.5	12/15/2005	1.5	0.0129 U	0.0129 U	0.0129 U	0.010
	HA1-1.5-Dup	12/15/2005	1.5	0.0612	0.0152 U	0.0201	0.070
HA2	HA2-0.5	12/15/2005	0.5	0.0276	0.0176 U	0.0176 U	0.016
	HA2-1.5	12/15/2005	1.5	0.0179	0.0125 U	0.0125 U	0.012
HA3	HA3-0.5	12/15/2005	0.5	0.0804	0.0133 U	0.0385	0.078
	HA3-1.5	12/15/2005	1.5	0.0118 U	0.0118 U	0.0118 U	0.009
HA4	HA4-0.5	12/15/2005	0.5	0.899	0.34 U	0.34 U	0.944
	HA4-1.5	12/15/2005	1.5	0.0159	0.0159 U	0.0159 U	0.012
HA5	HA5-0.5	12/15/2005	0.5	1.54	0.435	1.02	2.041
	HA5-1.5	12/15/2005	1.5	0.0153 U	0.0153 U	0.0153 U	0.012

Table 12
Risk Screening
Hexavalent Chromium in Groundwater (mg/L)
Precision Engineering, Inc.
Seattle, Washington

dissolved

Location	Sample ID	Date	Chromium (Hexavalent)	Dissolved Chromium (Trivalent)[b]
MTCA Method A Groundwater CULs			NV	NV
MTCA Method B Groundwater CULs			0.048	24
MTCA Method C Groundwater CULs			0.11	53
MTCA Method C Surface-Water CULs			1.20	610
AWQC—Human Health			NR	NR
Surface-Water ARAR—Aquatic Life—Acute			0.015	0.55
AWQC—Aquatic Life—Chronic			0.01	0.018
Site-Specific Method B Groundwater CUL for the Protection of Surface Water			**0.16**	**3,600,000,000**
Excavation Worker—Direct-Contact Groundwater CUL			**190**	**>S**
Monitoring Well Groundwater Data				
MW1	MW1-W-35.0	06/16/2005	**0.269**	NC
	MW1-122705	12/27/2005	0.00625 U	NC
	MW1-041806	04/18/2006	0.02 U	NC
	MW1-071510	7/15/2010	0.0013 U	NC
MW2	MW2-W-0605	06/17/2005	0.01 U	NC
	MW2-122805	12/28/2005	0.00625 U	0.00879
	MW2-041906	04/19/2006	0.02 U	0.021
	MW2-071510	7/15/2010	0.0065 U	0.0067
MW3	MW3-0605	06/07/2005	0.01 U	NC
	MW3-122905	12/29/2005	0.00625 U	0.00215
	MW3-041706	04/17/2006	0.02 U	0.0078
	MW3-071310	7/13/2010	0.10 UI	0.0021
MW4	MW4-0605	06/09/2005	0.01 U	NC
	MW4-0605-Dup	06/09/2005	0.01 U	NC
	MW4-122705	12/27/2005	0.00625 U	NC
	MW4-041806	04/18/2006	0.023	NC
	MW4-071510	7/15/2010	0.0013 U	NC
MW5	MW5-122805	12/28/2005	**450**	47
	MW5-041906	04/19/2006	**350**	NC
	MW5-071610	7/16/2010	**81.6**	126
MW6	MW6-122905	12/29/2005	0.00625 U	0.0187
	MW6-041906	04/19/2006	0.02 U	0.047
	MW6-071610	7/16/2010	0.013 U	0.0275
MW7	MW7-122805	12/28/2005	0.00738	0.0106
	MW7-041806	04/18/2006	0.02U	0.013
	MW7-041806-Dup	04/18/2006	0.02 U	NC
	MW7-071310	7/13/2010	0.0013 U	0.0013
	MW7-071310-Dup	7/13/2010	0.0013 U	0.0013

Table 12
Risk Screening
Hexavalent Chromium in Groundwater (mg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Chromium (Hexavalent)	Dissolved Chromium (Trivalent)[b]
MTCA Method A Groundwater CULs			NV	NV
MTCA Method B Groundwater CULs			0.048	24
MTCA Method C Groundwater CULs			0.11	53
MTCA Method C Surface-Water CULs			1.20	610
AWQC—Human Health			NR	NR
Surface-Water ARAR—Aquatic Life—Acute			0.015	0.55
AWQC—Aquatic Life—Chronic			0.01	0.018
Site-Specific Method B Groundwater CUL for the Protection of Surface Water			**0.16**	**3,600,000,000**
Excavation Worker—Direct-Contact Groundwater CUL			**190**	**>S**
MW8	MW8-122805	12/28/2005	0.00625 U	0.00755
	MWDUP-122805	12/28/2005	0.02 U	0.00849
	MW8-041806	04/18/2006	0.02 UJ	0.021
	MW-8-071510	7/15/2010	0.0065 U	0.0084
Reconnaissance Groundwater Data				
GP2	GP2-W-17-RECON	06/09/2005	**32.38**	4.72
GP4	GP4-W-8.0	06/16/2005	**31**	236
GP5	GP5-W-18.0	06/16/2005	NC	0.0897
GP6	GP6-W-18.0	06/16/2005	**43**	300
GP7	GP7-W-14.0	06/16/2005	NC	0.101
GP8	GP8-W-10.0	06/16/2005	**61**	294
GP-13	GP13-W-8.0	12/14/2005	NC	NA
GP-15	GP15-W-8.0	12/14/2005	NC	NA

Table 13
Risk Screening
Dissolved-Metal IHSs in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Arsenic	Copper	Selenium
MTCA Method A Groundwater CULs			5	NV	NV
MTCA Method B Groundwater CULs			0.058	590	80
MTCA Method C Groundwater CULs			0.58	1,300	180
MTCA Method C Surface-Water CULs			2.5	6,700	6,800
AWQC—Human Health			0.018	NR	170
Surface-Water ARAR—Aquatic Life—Acute			360	4.6	20
AWQC—Aquatic Life—Chronic			190	3.5	5
Site-Specific Method B Groundwater CUL for the Protection of Surface Water			**NV**	**22**	**NV**
Excavation Worker—Direct-Contact Groundwater CUL			**5,800**	**5,000,000**	**NV**
Monitoring Well Groundwater Data					
MW1	MW1-W-35.0	06/16/2005	NA	NA	NA
	MW1-122705	12/27/2005	32.3	1.01	1.00 U
	MW1-041806	04/18/2006	33	2.0 U	2.0 U
	MW1-071510	7/15/2010	28.1	0.2 U	0.1 U
MW2	MW2-W-0605	06/17/2005	NA	NA	NA
	MW2-122805	12/28/2005	5.63	1.17	6.28
	MW2-041906	04/19/2006	3.8	2.5	10
	MW2-071510	7/15/2010	2.3	0.2 U	0.71
MW3	MW3-0605	06/07/2005	NA	NA	NA
	MW3-122905	12/29/2005	15.3	1.00 U	1.00 U
	MW3-041706	04/17/2006	13	2.0 U	2.0 U
	MW3-071310	7/13/2010	14.5	0.2 U	0.1 U
MW4	MW4-0605	06/09/2005	NA	NA	NA
	MW4-0605-Dup	06/09/2005	NA	NA	NA
	MW4-122705	12/27/2005	15.1	1.00 U	1.00 U
	MW4-041806	04/18/2006	15	2.0 U	2.0 U
	MW4-071510	7/15/2010	11.2	0.2 U	0.1 U
MW5	MW5-122805	12/28/2005	4.59	3.67	1000 U
	MW5-041906	04/19/2006	4.9	2.0 U	2.0 U
	MW5-071610	7/16/2010	0.31 U	1 U	0.52 U
MW6	MW6-122905	12/29/2005	11.9	4.02	12.3
	MW6-041906	04/19/2006	24	5.1	19
	MW6-071610	7/16/2010	35.7	0.54	2.9
MW7	MW7-122805	12/28/2005	6.62	2.12	2.77
	MW7-041806	04/18/2006	7.1	2.4	5
	MW7-041806-Dup	04/18/2006	NA	NA	NA
	MW7-071310	7/13/2010	5.6	2.9	0.1 U
	MW7-071310-Dup	7/13/2010	5.4	2.9	0.1 U
MW8	MW8-122805	12/28/2005	6.41	1.00 U	4.11
	MWDUP-122805	12/28/2005	7.85	1.03	4.27
	MW8-041806	04/18/2006	4.8	2.0 U	3.6
	MW-8-071510	7/15/2010	6.3	0.2 U	0.1 U

Table 14
Risk Screening
Volatile Organic Compound IHSs in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Trichloro-ethene	Vinyl chloride
MTCA Method A Groundwater CULs			5	0.2
MTCA Method B Groundwater CULs			0.49	0.029
MTCA Method C Groundwater CULs			5	0.29
MTCA Method C Surface-Water CULs			170	92
AWQC—Human Health			2.7	2
Surface-Water ARAR—Aquatic Life—Acute			NR	NR
AWQC—Aquatic Life—Chronic			NR	NR
Site-Specific CUL for Vapor Intrusion			**48.7**	**36.9**
Site-Specific Method B Groundwater CUL for the Protection of Surface Water			**1,630**	**52**
Excavation Worker—Direct-Contact Groundwater CUL			**160**	**1,200**
Monitoring Well Groundwater Data				
MW1	MW1-W-35.0	06/16/2005	1 U	1 U
	MW1-122705	12/27/2005	0.200 U	0.200 U
	MW1-041806	04/18/2006	0.055 U	0.14 U
	MW1-071510	07/15/2010	0.50 U	0.20 U
MW2	MW2-W-0605	06/17/2005	1 U	1 U
	MW2-122805	12/28/2005	0.200 U	0.200 U
	MW2-041906	04/19/2006	0.055 U	0.14 U
	MW2-071510	07/16/2010	0.50 U	0.20 U
MW3	MW3-0605	06/07/2005	1 U	1 U
	MW3-122905	12/29/2005	0.200 U	0.200 U
	MW3-041706	04/17/2006	0.055 U	0.14 U
	MW3-071310	07/13/2010	0.50 U	0.20 U
MW4	MW4-0605	06/09/2005	1 U	1 U
	MW4-0605-Dup	06/09/2005	1 U	1 U
	MW4-122705	12/27/2005	0.200 U	0.200 U
	MW4-041806	04/18/2006	0.055 U	0.14 U
	MW4-071510	07/15/2010	0.50 U	0.20 U
MW5	MW5-122805	12/28/2005	22.1	0.200 U
	MW5-041906	04/19/2006	7.9	0.14 U
	MW5-071610	07/16/2010	1.0 U	0.20 U
MW6	MW6-122905	12/29/2005	1.00 U	1.00 U
	MW6-041906	04/19/2006	0.055 U	0.14 U
	MW6-071610	07/16/2010	1.0 U	0.20 U
MW7	MW7-122805	12/28/2005	0.200 U	0.200 U
	MW7-041806	04/18/2006	0.055 U	0.14 U
	MW7-041806-Dup	04/18/2006	0.055 U	0.14 U
	MW7-071310	07/13/2010	0.50 U	0.20 U
	MW7-071310-Dup	07/13/2010	0.50 U	0.20 U

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(b+k) fluoranthene
MTCA Method A Groundwater CULs			NV	0.1	NV	NV	NV
MTCA Method B Groundwater CULs			NV	0.012	NV	NV	NV
MTCA Method C Groundwater CULs			NV	0.12	NV	NV	NV
MTCA Method C Surface-Water CULs			NV	0.74	NV	NV	NV
AWQC—Human Health			NV	0.0028	NV	NV	NV
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**200,000,000**	**NC**	**165,000,000**	**55,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**9.1**	**0.53**	**>S**	**>S**	**NC**
Monitoring Well Groundwater Data							
MW1	MW1-W-35.0	06/16/2005	NA	NA	NA	NA	NA
	MW1-122705	12/27/2005	0.107	0.0114 U	0.104	0.108	NA
	MW1-041806	04/18/2006	0.029 J	0.057 U	NA	NA	0.03 U
	MW1-071510	07/15/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW2	MW2-W-0605	06/17/2005	0.192 U	0.192 U	NA	NA	0.962 U
	MW2-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	0.0099 U	NA
	MW2-041906	04/19/2006	0.031 J	0.066 U	NA	NA	0.034 U
	MW2-071510	07/15/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW3	MW3-0605	06/07/2005	NA	NA	NA	NA	NA
	MW3-122905	12/29/2005	0.01 U	0.01 U	0.01 U	0.01 U	NA
	MW3-041706	04/17/2006	0.11 U	0.063 U	NA	NA	0.033 U
	MW3-071310	07/13/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW4	MW4-0605	06/09/2005	NA	NA	NA	NA	NA
	MW4-0605-Dup	06/09/2005	NA	NA	NA	NA	NA
	MW4-122705	12/27/2005	0.01 U	0.01 U	0.01 U	0.01 U	NA
	MW4-041806	04/18/2006	0.1 U	0.061 U	NA	NA	0.032 U
	MW4-071510	07/15/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA

Table 14
Risk Screening
Volatile Organic Compound IHSs in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Trichloro-ethene	Vinyl chloride
MTCA Method A Groundwater CULs			5	0.2
MTCA Method B Groundwater CULs			0.49	0.029
MTCA Method C Groundwater CULs			5	0.29
MTCA Method C Surface-Water CULs			170	92
AWQC—Human Health			2.7	2
Surface-Water ARAR—Aquatic Life—Acute			NR	NR
AWQC—Aquatic Life—Chronic			NR	NR
Site-Specific CUL for Vapor Intrusion			**48.7**	**36.9**
Site-Specific Method B Groundwater CUL for the Protection of Surface Water			**1,630**	**52**
Excavation Worker—Direct-Contact Groundwater CUL			**160**	**1,200**
MW8	MW8-122805	12/28/2005	0.200 U	0.560
	MWDUP-122805	12/28/2005	0.200 U	0.400
	MW8-041806	04/18/2006	0.055 U	0.80 J
	MW-8-071510	07/15/2010	0.50 U	0.20 U
Reconnaissance Groundwater Data				
GP2	GP2-W-17-RECON	06/09/2005	5 U	5 U
GP4	GP4-W-8.0	06/16/2005	1 U	1 U
GP5	GP5-W-18.0	06/16/2005	1 U	1 U
GP6	GP6-W-18.0	06/16/2005	**1,130**	20 U
GP7	GP7-W-14.0	06/16/2005	1 U	1 U
GP8	GP8-W-10.0	06/16/2005	16.8	1 U
GP-13	GP13-W-8.0	12/14/2005	0.220	16.5
GP-15	GP15-W-8.0	12/14/2005	0.2 U	0.2 U

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(b+k) fluoranthene
MTCA Method A Groundwater CULs			NV	0.1	NV	NV	NV
MTCA Method B Groundwater CULs			NV	0.012	NV	NV	NV
MTCA Method C Groundwater CULs			NV	0.12	NV	NV	NV
MTCA Method C Surface-Water CULs			NV	0.74	NV	NV	NV
AWQC—Human Health			NV	0.0028	NV	NV	NV
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**200,000,000**	**NC**	**165,000,000**	**55,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**9.1**	**0.53**	**>S**	**>S**	**NC**
MW5	MW5-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	0.0099 U	NA
	MW5-041906	04/19/2006	0.095 U	0.057 U	NA	NA	0.03 U
	MW5-071610	07/16/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW6	MW6-122905	12/29/2005	0.0099 U	0.0099 U	0.0099 U	0.0099 U	NA
	MW6-041906	04/19/2006	0.1 U	0.062 U	NA	NA	0.032 U
	MW6-071610	07/16/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW7	MW7-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	0.0099 U	NA
	MW7-041806	04/18/2006	0.035 J	0.061 U	NA	NA	0.031 U
	MW7-041806-Dup	04/18/2006	0.1 U	0.061 U	NA	NA	0.031 U
	MW7-071310	07/13/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
	MW7-071310-Dup	07/13/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA
MW8	MW8-122805	12/28/2005	0.01 U	0.01 U	0.01 U	0.01 U	NA
	MWDUP-122805	12/28/2005	0.099 U	0.0099 U	0.0099 U	0.0099 U	NA
	MW8-041806	04/18/2006	0.13 U	0.075 U	NA	NA	0.039 U
	MW-8-071510	07/15/2010	0.015 U	0.015 U	0.015 U	0.015 U	NA

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Benzo(a) anthracene	Benzo(a) pyrene	Benzo(b) fluoranthene	Benzo(k) fluoranthene	Benzo(b+k) fluoranthene
MTCA Method A Groundwater CULs			NV	0.1	NV	NV	NV
MTCA Method B Groundwater CULs			NV	0.012	NV	NV	NV
MTCA Method C Groundwater CULs			NV	0.12	NV	NV	NV
MTCA Method C Surface-Water CULs			NV	0.74	NV	NV	NV
AWQC—Human Health			NV	0.0028	NV	NV	NV
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**200,000,000**	**NC**	**165,000,000**	**55,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**9.1**	**0.53**	**>S**	**>S**	**NC**
Reconnaissance Groundwater Data							
GP2	GP2-W-17-RECON	06/09/2005	NA	NA	NA	NA	NA
GP4	GP4-W-8.0	06/16/2005	0.191 U	0.191 U	NA	NA	0.954 U
GP5	GP5-W-18.0	06/16/2005	NA	NA	NA	NA	NA
GP6	GP6-W-18.0	06/16/2005	NA	NA	NA	NA	NA
GP7	GP7-W-14.0	06/16/2005	NA	NA	NA	NA	NA
GP8	GP8-W-10.0	06/16/2005	0.194 U	0.194 U	NA	NA	0.97 U
GP-13	GP13-W-8.0	12/14/2005	NA	NA	NA	NA	NA
GP-15	GP15-W-8.0	12/14/2005	NA	NA	NA	NA	NA

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd) pyrene	cPAHs TEC
MTCA Method A Groundwater CULs			NV	NV	NV	0.1
MTCA Method B Groundwater CULs			NV	NV	NV	0.012
MTCA Method C Groundwater CULs			NV	NV	NV	0.12
MTCA Method C Surface-Water CULs			NV	NV	NV	0.74
AWQC—Human Health			NV	NV	NV	0.0028
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**130,000,000**	**135,000,000**	**132,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**>S**	**0.21**	**>S**	**NC**
Monitoring Well Groundwater Data						
MW1	MW1-W-35.0	06/16/2005	NA	NA	NA	NA
	MW1-122705	12/27/2005	0.132	0.0114 U	0.0114 U	0.034
	MW1-041806	04/18/2006	0.014 J	0.095 U	0.034 J	0.011
	MW1-071510	07/15/2010	0.015 U	0.015 U	0.015 U	ND
MW2	MW2-W-0605	06/17/2005	0.192 U	0.192 U	0.192 U	ND
	MW2-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	ND
	MW2-041906	04/19/2006	0.11 U	0.11 U	0.11 U	0.015
	MW2-071510	07/15/2010	0.015 U	0.015 U	0.015 U	ND
MW3	MW3-0605	06/07/2005	NA	NA	NA	NA
	MW3-122905	12/29/2005	0.01 U	0.01 U	0.01 U	ND
	MW3-041706	04/17/2006	0.11 U	0.11 U	0.11 U	ND
	MW3-071310	07/13/2010	0.015 U	0.015 U	0.015 U	ND
MW4	MW4-0605	06/09/2005	NA	NA	NA	NA
	MW4-0605-Dup	06/09/2005	NA	NA	NA	NA
	MW4-122705	12/27/2005	0.01 U	0.01 U	0.01 U	ND
	MW4-041806	04/18/2006	0.1 U	0.1 U	0.1 U	ND
	MW4-071510	07/15/2010	0.015 U	0.015 U	0.015 U	ND

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd) pyrene	cPAHs TEC
MTCA Method A Groundwater CULs			NV	NV	NV	0.1
MTCA Method B Groundwater CULs			NV	NV	NV	0.012
MTCA Method C Groundwater CULs			NV	NV	NV	0.12
MTCA Method C Surface-Water CULs			NV	NV	NV	0.74
AWQC—Human Health			NV	NV	NV	0.0028
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**130,000,000**	**135,000,000**	**132,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**>S**	**0.21**	**>S**	**NC**
MW5	MW5-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	ND
	MW5-041906	04/19/2006	0.095 U	0.095 U	0.095 U	ND
	MW5-071610	07/16/2010	0.015 U	0.015 U	0.015 U	ND
MW6	MW6-122905	12/29/2005	0.0099 U	0.0099 U	0.0099 U	ND
	MW6-041906	04/19/2006	0.1 U	0.1 U	0.1 U	ND
	MW6-071610	07/16/2010	0.015 U	0.015 U	0.015 U	ND
MW7	MW7-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	ND
	MW7-041806	04/18/2006	0.013 J	0.038 J	0.039 J	0.011
	MW7-041806-Dup	04/18/2006	0.1 U	0.1 U	0.1 U	ND
	MW7-071310	07/13/2010	0.015 U	0.015 U	0.015 U	ND
	MW7-071310-Dup	07/13/2010	0.015 U	0.015 U	0.015 U	ND
MW8	MW8-122805	12/28/2005	0.01 U	0.01 U	0.01 U	ND
	MWDUP-122805	12/28/2005	0.0099 U	0.0099 U	0.0099 U	ND
	MW8-041806	04/18/2006	0.13 U	0.13 U	0.13 U	ND
	MW-8-071510	07/15/2010	0.015 U	0.015 U	0.015 U	ND

Table 15
Risk Screening
Polycyclic Aromatic Hydrocarbons in Groundwater (µg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Chrysene	Dibenzo(a,h) anthracene	Indeno(1,2,3-cd) pyrene	cPAHs TEC
MTCA Method A Groundwater CULs			NV	NV	NV	0.1
MTCA Method B Groundwater CULs			NV	NV	NV	0.012
MTCA Method C Groundwater CULs			NV	NV	NV	0.12
MTCA Method C Surface-Water CULs			NV	NV	NV	0.74
AWQC—Human Health			NV	NV	NV	0.0028
Surface-Water ARAR—Aquatic Life—Acute			NR	NR	NR	NR
AWQC—Aquatic Life—Chronic			NR	NR	NR	NR
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**130,000,000**	**135,000,000**	**132,000,000**	**NC**
Excavation Worker—Direct-Contact Groundwater			**>S**	**0.21**	**>S**	**NC**
Reconnaissance Groundwater Data						
GP2	GP2-W-17-RECON	06/09/2005	NA	NA	NA	NA
GP4	GP4-W-8.0	06/16/2005	0.191 U	0.191 U	0.191 U	ND
GP5	GP5-W-18.0	06/16/2005	NA	NA	NA	NA
GP6	GP6-W-18.0	06/16/2005	NA	NA	NA	NA
GP7	GP7-W-14.0	06/16/2005	NA	NA	NA	NA
GP8	GP8-W-10.0	06/16/2005	0.194 U	0.194 U	0.194 U	ND
GP-13	GP13-W-8.0	12/14/2005	NA	NA	NA	NA
GP-15	GP15-W-8.0	12/14/2005	NA	NA	NA	NA

silica gel cleanup

Table 16
Risk Screening
Petroleum Hydrocarbon IHSs in Groundwater (mg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Diesel-Range Organics	Oil-Range Organics
MTCA Method A Groundwater CULs			500 ug/L	500 ug/L
MTCA Method B Groundwater CULs			NV	NV
MTCA Method C Groundwater CULs			NV	NV
MTCA Method C Surface-Water CULs			NV	NV
AWQC—Human Health			NV	NV
Surface-Water ARAR—Aquatic Life—Acute			NV	NV
AWQC—Aquatic Life—Chronic			NV	NV
CUL for Vapor Intrusion			**NV**	**NV**
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**NV**	**NV**
Excavation Worker—Direct-Contact Groundwater CUL			**>S**	**>S**
Monitoring Well Groundwater Data				
MW1	MW1-W-35.0	06/16/2005	NA	NA
	MW1-122705	12/27/2005	0.248 U	0.495 U
	MW1-041806	04/18/2006	0.26 U	0.52 U
	MW1-071510	7/15/2010	0.076 U	0.38 U
MW2	MW2-W-0605	06/17/2005	0.438	0.512
	MW2-122805	12/28/2005	1.19	1.04
	MW2-041906	04/19/2006	0.41	0.58 U
	MW2-071510	7/15/2010	0.28	0.39 U
MW3	MW3-0605	06/07/2005	NA	NA
	MW3-122905	12/29/2005	0.312	0.505 U
	MW3-041706	04/17/2006	0.28 U	0.57 U
	MW3-071310	7/13/2010	0.082 U	0.41 U
MW4	MW4-0605	06/09/2005	NA	NA
	MW4-0605-Dup	06/09/2005	NA	NA
	MW4-122705	12/27/2005	0.248 U	0.495 U
	MW4-041806	04/18/2006	0.27 U	0.54 U
	MW4-071510	7/15/2010	0.078 U	0.39 U
MW5	MW5-122805	12/28/2005	0.831	0.495 U
	MW5-041906	04/19/2006	0.26 U	0.51 U
	MW5-071610	7/16/2010	0.13	0.39 U
MW6	MW6-122905	12/29/2005	2.64	1.32
	MW6-041906	04/19/2006	0.76	1.2
	MW6-071610	7/16/2010	0.73	0.93
MW7	MW7-122805	12/28/2005	0.248 U	0.495 U
	MW7-041806	04/18/2006	0.26 U	0.51 U
	MW7-041806-Dup	04/18/2006	0.26 U	0.51 U
	MW7-071310	7/13/2010	0.08 U	0.4 U
	MW7-071310-Dup	7/13/2010	0.077 U	0.38 U

Table 16
Risk Screening
Petroleum Hydrocarbon IHSs in Groundwater (mg/L)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Diesel-Range Organics	Oil-Range Organics
MTCA Method A Groundwater CULs			500	500
MTCA Method B Groundwater CULs			NV	NV
MTCA Method C Groundwater CULs			NV	NV
MTCA Method C Surface-Water CULs			NV	NV
AWQC—Human Health			NV	NV
Surface-Water ARAR—Aquatic Life—Acute			NV	NV
AWQC—Aquatic Life—Chronic			NV	NV
CUL for Vapor Intrusion			**NV**	**NV**
Site-Specific Method B Groundwater CUL for Protection of Surface Water			**NV**	**NV**
Excavation Worker—Direct-Contact Groundwater CUL			**>S**	**>S**
MW8	MW8-122805	12/28/2005	1.71	1.00
	MWDUP-122805	12/28/2005	1.79	1.21
	MW8-041806	04/18/2006	0.45	0.58 U
	MW-8-071510	7/15/2010	0.28	0.39 U
Reconnaissance Groundwater Data				
GP2	GP2-W-17-RECON	06/09/2005	NA	NA
GP4	GP4-W-8.0	06/16/2005	0.325	0.478 U
GP5	GP5-W-18.0	06/16/2005	NA	NA
GP6	GP6-W-18.0	06/16/2005	NA	NA
GP7	GP7-W-14.0	06/16/2005	NA	NA
GP8	GP8-W-10.0	06/16/2005	0.814	0.479 U
GP-13	GP13-W-8.0	12/14/2005	NA	NA
GP-15	GP15-W-8.0	12/14/2005	NA	NA

Table 17
Risk Screening
Volatile Organic Compounds in Subslab Vapor (µg/m^3)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Trichloro-ethene	Vinyl chloride
PCUL for Vapor Intrusion			37,000	103,000
A1	A1-042806	04/18/2006	4.0 U	1.9 U
A2	A2-042806	04/18/2006	4.9 U	2.3 U
A3	A3-042806	04/18/2006	6100	8.4 U
A4	A4-042806	04/18/2006	NA	NA
A5	A5-042806	04/18/2006	37,000	420
A6	A6-042806	04/18/2006	3.5 U	1.7 U
A7	A7-042806	04/18/2006	3.5 U	1.7 U

Table 18
Risk Screening
Volatile Organic Compounds in Air (µg/m^3)
Precision Engineering, Inc.
Seattle, Washington

Location	Sample ID	Date	Trichloroethene
MTCA Method C CUL for Air			1
IA1	IA1	06/13/2006	0.2
IA2	IA2	06/13/2006	0.083
IA3	IA3	06/13/2006	0.11
IA4	IA4	06/13/2006	0.14
IA5	IA5	06/13/2006	0.16
IA6	IA6	06/13/2006	0.15
IA6	IA6 Duplicate	06/13/2006	0.15
IA7	IA7	06/13/2006	0.046
IA8	IA8	06/13/2006	0.15

Table 19
Technology Screening Summary
Precision Engineering, Inc.
Seattle, Washington

Category	Technology[c]	Retained for Alternatives	Comments
		Soil	
In Situ Containment	Capping	Yes	Easily implementable, cost-effective.
In Situ Biological Treatment	Bioventing	No	Limited effectiveness for hex-chromium.
	Natural Attenuation	Yes	Retained as a potential enhancement technology.
	Enhanced Bioremediation	No	Not effective for hex-chromium.
	Phytoremediation	No	Not compatible with current/future industrial use.
In Situ Physical/Chemical Treatment	Chemical Oxidation	No	Oxidation may increase concentrations of hex-chromium.
	Electrokinetic Separation	No	Not effective for TCE; high capital cost.
	Fracturing (Enhancements)	No	Limited effectiveness for hex-chromium; no technologies retained for fracturing to enhance treatment.
	Soil Flushing	No	Technology mobilizes contaminants into groundwater and triggers the need for groundwater extraction, formulating a washing fluid difficult for complex contaminant mixtures.
	Soil Vapor Extraction	No	Limited effectiveness for hex-chromium.
	Solidification / Stabilization	Yes	Saturated soils may be remediated by reducing compound.
In Situ Thermal Treatment	Thermal Treatment	No	Not effective for hex-chromium; no free-phase product to justify expense.
Ex Situ Containment	Excavation and Off-Site Disposal	Yes	Effective technology to meet cleanup levels.
Ex Situ Biological Treatment	Biopiles, Composting, Land Farming, Slurry Phase	No	Limited effectiveness for IHSs.

Table 19
Technology Screening Summary
Precision Engineering, Inc.
Seattle, Washington

Category	Technology[c]	Retained for Alternatives	Comments
Ex Situ Physical/Chemical Treatment	Chemical Extraction	No	Not cost-effective and varying effectiveness for IHSs.
	Chemical Reduction/Oxidation	No	As an ex-situ treatment, not appropriate. Stabilization material will provide redox conditions.
	Soil Washing	No	Formulating a washing fluid difficult for complex contaminant mixtures.
	Dehalogenation	No	Limited effectiveness for hex-chromium.
	Separation (Soil Screening)	Yes	Separation retained in combination with ex situ treatment/disposal options; concrete will remain on site in excavation.
	Solidification / Stabilization	Yes	Retained to the extent that it would be required for off-site disposal.
Ex Situ Thermal Treatment	Hot Gas Decontamination, Incineration, Thermal Desorption, etc.	No	Limited effectiveness for IHSs.
Institutional Controls	Deed Notifications and/or Restrictions	Yes	Protects public health and minimizes potential for exposure to soil.
	Soil Management Plan	Yes	
	Access Restrictions/Fencing	Yes	
	On-Site Placement	Yes	

Table 19
Technology Screening Summary
Precision Engineering, Inc.
Seattle, Washington

Category	Technology[c]	Retained for Alternatives	Comments
		Groundwater	
In Situ Containment	Deep Well Injection	No	Not permitted under state law.
	Physical Barriers	No	High capital cost, limited mobility of contaminants.
In Situ Biological Treatment	Natural Attenuation	Yes	Retained as a potential enhancement technology.
	Enhanced Bioremediation	No	Not effective for hex-chromium.
	Phytoremediation	No	Not compatible with current/future industrial use.
In Situ Physical/Chemical Treatment	Air Sparging	No	Limited effectiveness for hex-chromium.
	Bioslurping	No	Technology treats free product and is not applicable.
	Chemical Oxidation	No	Limited effectiveness for hex-chromium.
	Directional Wells (enhancement)	No	No technologies retained where directional wells would enhance treatment.
	Dual-Phase Vacuum Extraction	No	Technology designed for free product; not effective for hex-chromium.
	Groundwater Circulation Wells, including In-Well Air Stripping	No	Limited effectiveness for IHSs.
	Hydrofracturing	No	No technologies retained where hydrofracturing would enhance
	Passive/Reactive Treatment Walls	No	High capital cost, limited mobility of contaminants.
	Stabilization	Yes	Stabilization compound retained that is effective for hex-chromium and TCE.
	Thermal Treatment	No	Technology designed for free product and not effective for hex-chromium.
Ex-Situ Treatment	Groundwater Removal	Yes	Retained as needed to dewater excavations.
Institutional Controls	Deed Notifications and/or Restrictions	Yes	Protects public health and minimizes potential for exposure to groundwater.
	Drainage Controls	Yes	

Table 20
Retained Technologies
Precision Engineering, Inc.
Seattle, Washington

Retained Technology	Media	
	Soil	Groundwater
Capping	X	
Natural Attenuation	X	X
Separation	X	
Solidification / Stabilization	X	X
Excavation and Off-Site Disposal	X	
Institutional Controls	X	X
Groundwater Removal		X

Table 21
Alternative 2: Cap Maintenance and Groundwater Monitoring
Precision Engineering, Inc.
Seattle, Washington

Remedy Components

1 Long-term maintenance of cap (building slab).
2 Long-term groundwater monitoring and reporting.
3 Institutional controls to restrict contact with subsurface soils and groundwater (restrictive covenant).

Assumptions

1 Cap inspection will be conducted annually.
2 Cap maintenance consists of sealing cracks in concrete every five years.
3 Groundwater monitoring performed at three wells; sampled every quarter for one year. Parameters include TCE, metals, and PAHs.
4 Discount rate of 4.4% based on 20-year nominal interest OMB Circular A-94.
5 20% contingency.

Item	Unit Cost	Units	Quantity	Total Cost
Monitoring Wells				
Abandonment of existing wells	5	EA	$2,000	$10,000
	Monitoring Well Subtotal			*$10,000*
Monitoring and Maintenance				
Groundwater monitoring, incl. reporting	$3,500	event	4	$14,000
Cap inspection	$1,000	event	1	$1,000
Cap maintenance	$1,000	event	1	$1,000
Present Value of Ongoing Costs Total				**$43,000**
Professional Services				
Negotiations				$ 10,000
Subtotal				**$53,000**
Contingency			20%	$10,600
	TOTAL ESTIMATED PRESENT VALUE			**$64,000**

Table 22
Alternative 3: Soil Removal and Groundwater Monitoring
Precision Engineering, Inc.
Seattle, Washington

Remedy Components

1. Excavate soil with IHSs above cleanup levels for off-site disposal.
2. Remove and dispose of groundwater from excavations.
3. Conduct performance and compliance groundwater monitoring.

Assumptions

1. Density of soil = 1.45 tons/cubic yard.
2. Density of concrete = 2 tons/cubic yard.
3. Excavation of soil exceeding CULs is completed with building in place.
4. Soil excavation volume is 1,007 cubic yards, located at GP-11 to a depth of 8 ft bgs and at GP-18, GP-6, GP32 to a depth of 15 ft bgs.
5. Soil and groundwater will be disposed of in Subtitle C hazardous waste landfill, but will not require treatment.
6. Shoring required for excavations, sheet pile bury depth one-third of excavation depth.
7. Groundwater monitoring performed at three wells; sampled every quarter for one year. Parameters include TCE, metals, and PAHs.
8. Discount rate of 4.4% based on 20-year nominal interest OMB Circular A-94.
9. Concrete slab is assumed to be 12 inches thick and reinforced.
10. Assume existing concrete slab is 12 inches thick, is suitable as fill, and will be replaced-in-kind.
11. Assume cap maintenance completed once in year 5.
12. 20% contingency.

Item	Quantity	Units	Unit Cost	Total Cost
Remedial Action				
Mobilization	1	LS	$15,000	$15,000
Remove concrete in excavation areas	74	CY	$149	$11,031
Temporary shoring	4,053	SF	$28	$113,232
Soil excavation and loading	1,007	CY	$114	$114,927
Structural backfill, purchase	1,007	CY	$12.00	$12,089
Placement and compaction	1,007	CY	$4.51	$4,548
Soil transport and disposal (hazardous)	1,461	ton	$210	$306,756
Waste disposal and profile fee	1	LS	$1,000	$1,000
Confirmation sampling	10	sample	$620	$6,200
Dewatering	10	Day	$884	$8,837
Disposal of groundwater	108,000	GAL	$1.32	$142,560
Replacement of concrete slab	74	CY	$752	$55,635
		Soil Removal Subtotal		*$791,800*
Monitoring Wells				
Well abandonment	5	EA	$2,000	$10,000
		Monitoring Well Subtotal		*$10,000*

Table 22
Alternative 3: Soil Removal and Groundwater Monitoring
Precision Engineering, Inc.
Seattle, Washington

Item	Quantity	Units	Unit Cost	Total Cost
Professional Services				
Negotiations				$25,000
Remedial design				$30,000
Geotechnical/structural design				$25,000
Construction oversight				$15,000
Reporting				$15,000
	Professional Services Subtotal			$110,000
Contingency		percent	20%	$182,400
	Remedial Action Subtotal			**$1,094,200**
Monitoring and Maintenance				
Groundwater monitoring, incl. reporting	$3,500	event	4	$14,000
Cap inspection	$1,000	event	1	$1,000
Cap maintenance	$6,000	event	1	$6,000
Present Value of Ongoing Costs Total				**$60,000**
	TOTAL ESTIMATED PRESENT VALUE			**$1,154,000**

Table 23
Alternative 4: Vadose Soil Removal and Injections
Precision Engineering, Inc.
Seattle, Washington

Remedy Components

1 Excavate vadose zone soil with IHSs above cleanup levels for off-site disposal.
2 Remove and dispose of groundwater from excavations.
3 Inject EHC-M material to remediate groundwater.
4 Conduct compliance groundwater monitoring.

Assumptions

1 Density of soil = 1.45 tons/cubic yard.
2 Density of concrete = 2 tons/cubic yard.
3 Excavation of soil exceeding CULs is completed with building in place.
4 Soil excavation volume is 67 CY, at GP-32 and GP-18 to a depth of 4.5 ft bgs.
5 Assume soil disposal in a Subtitle C hazardous waste landfill.
6 Temporary shoring required for excavations.
7 Assume existing concrete slab is 12 inches thick, is suitable as fill, and will be replaced-in-kind.
8 Groundwater monitoring performed at three wells; sampled every quarter for one year. Parameters include TCE, metals, and PAHs.
9 Discount rate of 4.4% based on 20-year nominal interest rate from OMB Circular A-94.
10 EHC-M will be injected into groundwater using Geoprobe equipment over 7800 SF at 0.3% EHC-M to soil mass, over injection interval of 4 to 15 ft bgs.

Item	Quantity	Units	Unit Cost	Total Cost
Remedial Action				
Mobilization	1	LS	$15,000	$15,000
Remove concrete in excavation areas	15	CY	$149	$2,236
Temporary shoring	480	SF	$28	$13,409
Soil excavation and loading	67	CY	$114	$7,605
Structural backfill	67	CY	$12.00	$800
Placement and compaction	67	CY	$4.51	$301
Soil transport and disposal (hazardous)	97	ton	$210	$20,300
Waste disposal and profile fee	1	LS	$1,000	$1,000
Confirmation sampling	5	sample	$620	$3,100
Dewatering	5	Day	$884	$4,418
Disposal of groundwater	1,122	GAL	$1.32	$1,481
Replacement of concrete slab	15	CY	$752	$11,277
			Soil Removal Subtotal	*$80,900*

Table 23
Alternative 4: Vadose Soil Removal and Injections
Precision Engineering, Inc.
Seattle, Washington

Item	Quantity	Units	Unit Cost	Total Cost
EHC-M Injection				
Mobilize equipment	1	LS	$2,000	$2,000
Concrete coring	69	inj. Point	$162	$11,178
Remediation material (EHC-M)	28,350	lb	$2.76	$78,246
Drilling services (labor and equipment)	23	Day	$3,675	$84,525
Start card per Washington regulations	69	inj. Point	$100	$6,900
IDW handling and disposal	1	LS	$5,000	$5,000
Concrete patching	69	inj. Point	$46	$3,207
EHC-M Injection Subtotal				*$191,100*
Monitoring Wells				
Well abandonment	5	EA	$2,000	$10,000
		Monitoring Well Subtotal		*$10,000*
Professional Services				
Negotiations				$25,000
Complete remedial design				$50,000
Structural design of shoring				$15,000
Construction oversight				$25,300
Reporting				$15,000
Professional Services Subtotal				$130,300
Contingency		percent	20%	$82,500
		Remedial Action Subtotal		**$494,800**
Monitoring and Maintenance				
Groundwater monitoring, incl. reporting	$3,500	event	4	$14,000
Present Value of Ongoing Costs Total				**$50,000**
		TOTAL ESTIMATED PRESENT VALUE		**$545,000**

Table 24
Evaluation of Alternatives
Precision Engineering, Inc.
Seattle, Washington

Alternative	1	2	3	4
Description	No Action	Cap Maintenance, Groundwater Monitoring, Institutional Controls	Soil Removal, Groundwater Monitoring, Institutional Controls	Vadose Soil Removal, Remediation Injections
Area of Containment (square feet)	--	21000	--	--
Volume of Soil Removed or Treated (cubic yards)	--	--	1007	3178
Overall Alternative Rating	--	7.6	7.4	6.7
Compliance with MTCA Threshold Criteria? (Yes/No)				
Protection of Human Health and the Environment	No.	Yes.	Yes.	Yes.
Compliance with Cleanup Standards	No.	Yes—requires conditional point of compliance for groundwater.	Yes—active remedial measures will be used to address the residual soil above CULs.	Yes—active remedial measures will be used to address the groundwater above CULs.
Compliance with Applicable State and Federal Laws	--	Yes.	Yes.	Yes.
Provision for Compliance Monitoring	No.	Yes—includes groundwater monitoring.	Yes—includes confirmation soil sampling and groundwater monitoring.	Yes—includes confirmation soil sampling and groundwater monitoring.
Reasonable Restoration Time Frame	No.	At conditional POC for groundwater, immediate. In soil, minimal time frame—through institutional controls, the site will be restored to a condition that allows use immediately and protects future receptors. Monitoring will confirm restoration.	At conditional POC for groundwater, immediate. In soil, moderate time frame—soil removal will be conducted following negotiations with current property owner. Monitoring will confirm restoration.	At conditional POC for groundwater, immediate. In soil, moderate/long time frame—soil removal and vadose injections will be conducted following negotiations with current property owner. Monitoring will confirm restoration.

Table 24
Evaluation of Alternatives
Precision Engineering, Inc.
Seattle, Washington

Alternative		**1**	**2**		**3**		**4**	
Evaluation Criteria	Weighting Factor			Rating		Rating		Rating
Protectiveness	30%	--	This alternative has a high degree of protection for human health and the environment because of the concrete cap and a restrictive covenant. Compliance monitoring will confirm protectiveness.	8	This alternative has a high degree of protection for human health and the environment. Compliance monitoring will confirm protectiveness.	8	This alternative is likely to reduce concentrations of IHSs to increase protectiveness to human health and the environment; however, the timeframe and the degree of success for the injections are uncertain. However, performance monitoring will assess the protectiveness.	7
Permanence	20%	--	Limited hazardous substances remain on site, as the sources have already been removed as part of an interim action.	7	Removal and off-site disposal of the residual soil reduces the volume of hazardous substances at the site somewhat, in addition to what has already been removed.	8	A small amount of soil is removed for off-site disposal, reducing the volume of hazardous substances at the site.	7

Table 24
Evaluation of Alternatives
Precision Engineering, Inc.
Seattle, Washington

Alternative		**1**	**2**		**3**		**4**	
Evaluation Criteria	Weighting Factor			Rating		Rating		Rating
Long-term Effectiveness	25%	--	The existing cap, which isolates the residual impacted soil; restrictive covenant; and compliance monitoring will be effective over the long term, as there is no exposure concern currently. Reliance on institutional controls diminishes the long-term effectiveness slightly.	7	This alternative is effective over the long term and is not expected to rely on institutional controls.	9	Stabilizing the contaminants via an injection slurry is expected to be effective; however, without bench and pilot test, this is not certain. Also, additional injections may be necessary, dependent on performance monitoring.	7

Table 24
Evaluation of Alternatives
Precision Engineering, Inc.
Seattle, Washington

Alternative		**1**	**2**		**3**		**4**	
Evaluation Criteria	Weighting Factor			Rating		Rating		Rating
Short-Term Risk Management	10%	--	There is currently no unacceptable risk on site; the alternative does not alter existing conditions in short term. The relative short-term risk is low.	9	Approximately 1,000 cubic yards of soil will be removed and disposed of at an off-site facility, posing risks to on-site and nearby workers, as well as transportation risks. In addition, the installation of shoring within an existing building may pose risks to the stability of the existing building. These risks will be mitigated by proper health and safety procedures and structural engineering oversight. Nonetheless, the relative short-term risk is high.	5	A small amount of soil will be removed and disposed of at an off-site facility, posing risks to on-site and nearby workers, as well as transportation risks. In addition, the installation of shoring for the small excavation within an existing building may pose risks to the stability of the existing building. These risks will be mitigated by proper health and safety procedures and structural engineering oversight. The relative short-term risk is moderate.	7

Table 24
Evaluation of Alternatives
Precision Engineering, Inc.
Seattle, Washington

Alternative		1	2		3		4	
Evaluation Criteria	Weighting Factor			Rating		Rating		Rating
Technical and Administrative Implementability	10%	--	The implementability of this alternative is high, as the cap is in existence and requires minimal negotiations and impact to the current property owner.	9	The implementation of an excavation to a depth of 15 feet within a building is technically difficult. The installation of shoring may impact the structural integrity of the building. This alternative requires significant negotiations and potential financial impact to the current property owner.	4	The excavation depth is approximately 4.5 feet bgs. This excavation is assumed to require shoring, increasing the difficulty of implementing a remedy. In addition, the injections will be completed to a depth of 15 feet bgs, but the compacted glacial till at some parts of the site is at 10 ft bgs, decreasing the ability to complete treatment in the injection interval. Also, the effectiveness of the in situ injections is uncertain until bench and pilot studies are completed. This alternative requires significant negotiations and potential financial impact to the current property owner.	5
Public Concerns	5%	--	No public concerns are known at this time.	5	No public concerns are known at this time.	5	No public concerns are known at this time.	5
	Cost	$0	$64,000		$1,154,000		$545,000	

FIGURES

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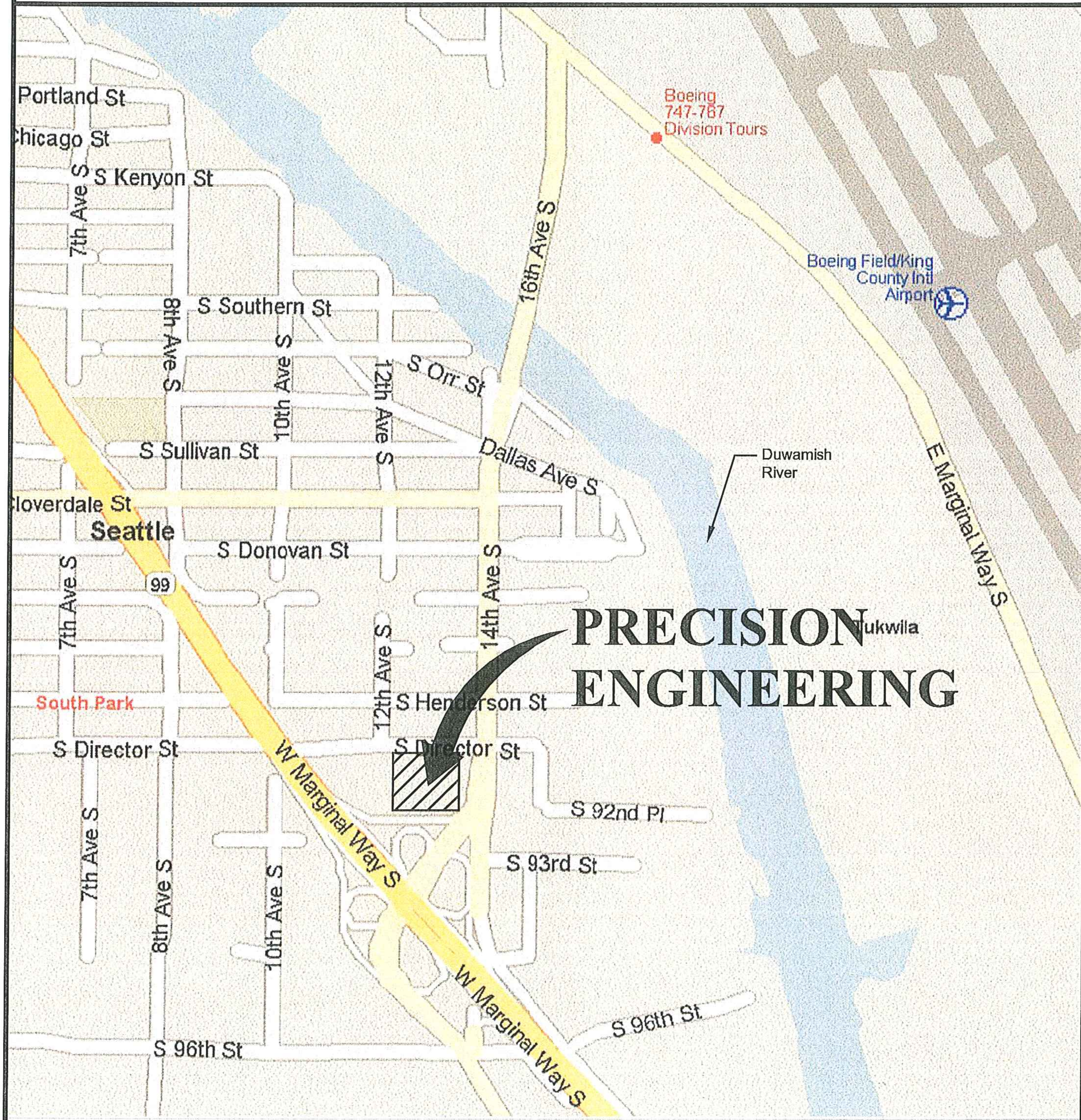
Figure 1
Site Location

N

0 800 1600
FEET

Precision Engineering, Inc.
Seattle, Washington

Source: Base map prepared from Microsoft Street & Trips 2000
Site Address: 1231 S. Director Street, Seattle, Washington
Section: 32 Township: 24N Range: 4E of Willamette Meridian



Layout: 1 Project: 8006.08.04 Drawn By: J. Fisher Approved By: J. King

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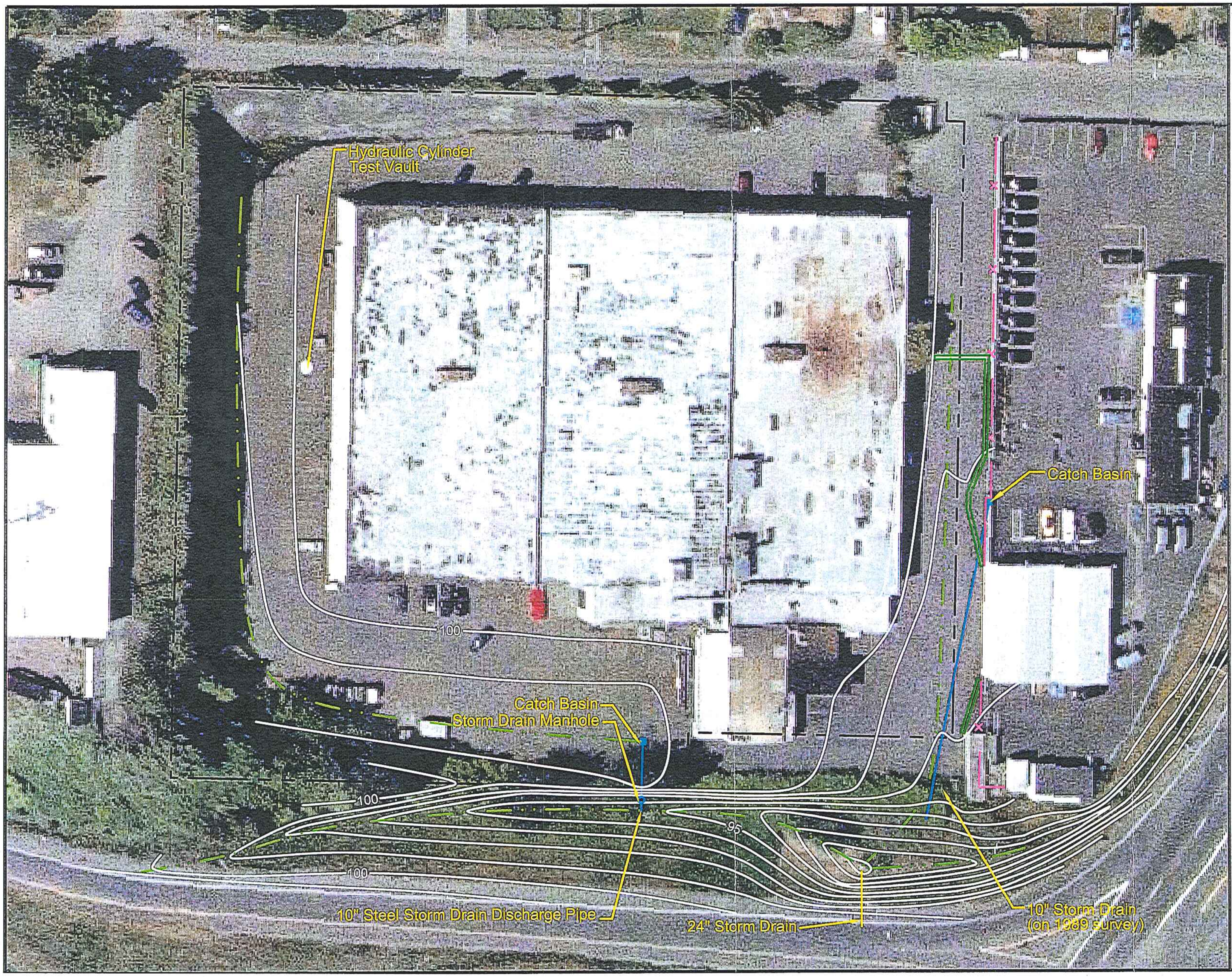

Figure 2
Outside Features

**Precision Engineering, Inc.
Seattle, Washington**

Legend:
- Property Boundary
- Asphalt Curbing
- Fence
- Drainage Ditch
- Topographic Contour Interval
- Storm Drain

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, and fence line created from a 1989 survey by John R. Ewing and Associates.
2) Locations of property boundary based on 2006 survey by Duncanson Company, Inc. All other locations are approximate.

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FEET

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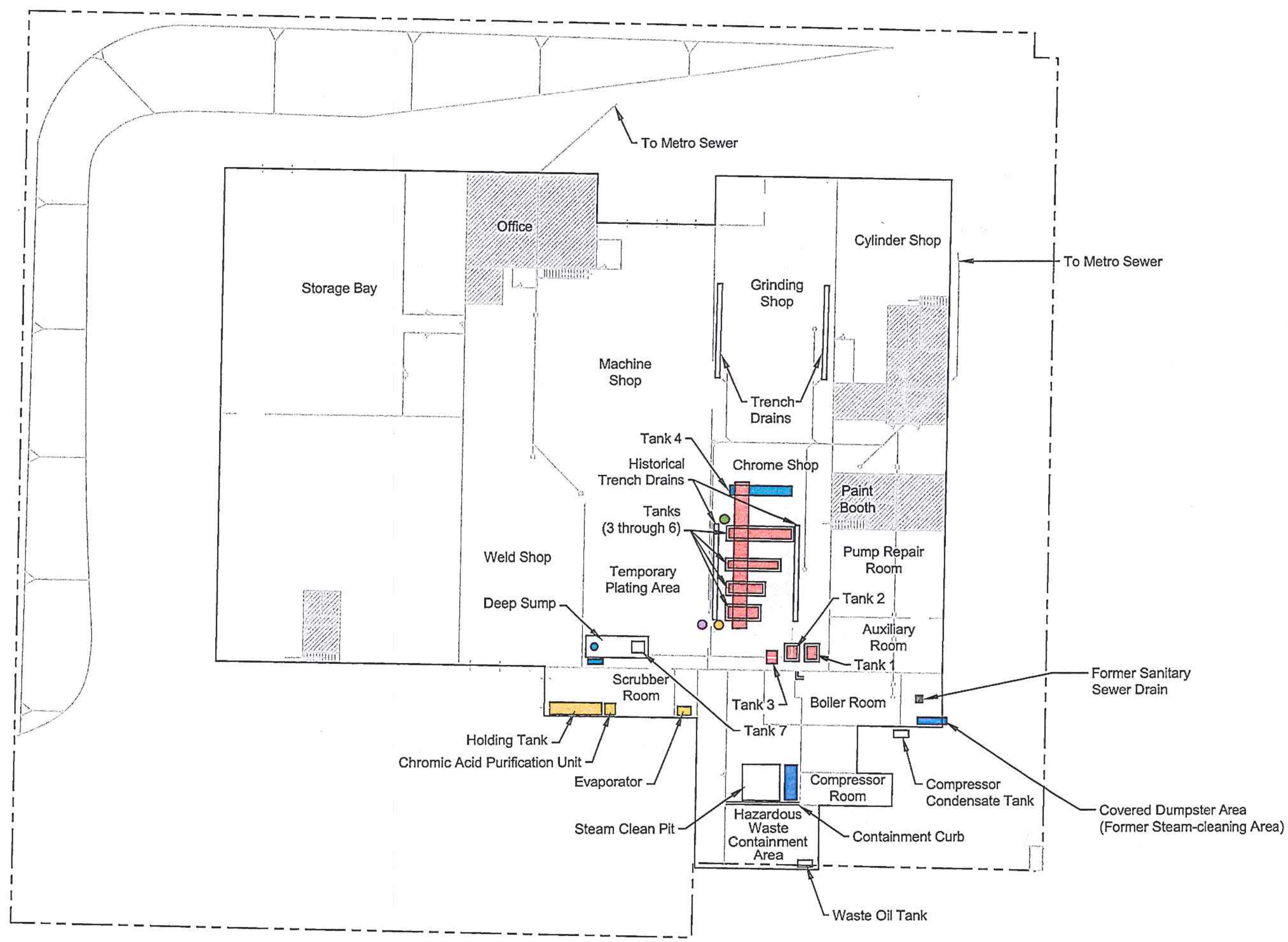
Figure 3
Former Building Features

Precision Engineering, Inc.
Seattle, Washington



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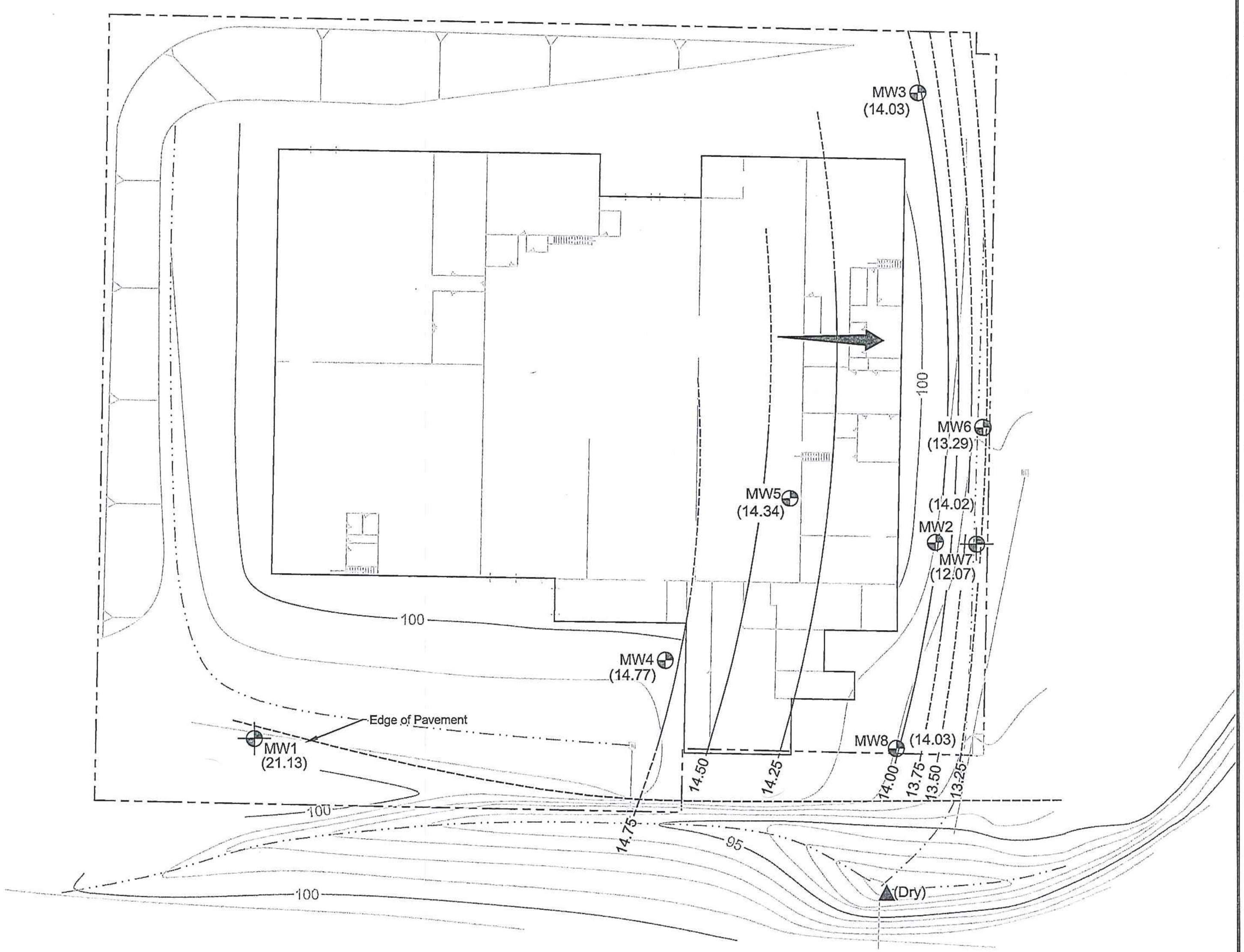

Figure 4

Potentiometric Surface for Shallow Water-Bearing Zone, December 2005

Precision Engineering, Inc. Seattle, Washington

Legend:

- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval (assumed datum)
- Shallow Monitoring Well
- Deep Monitoring Well
- Staff Gauge
- Groundwater Contour (0.25-Foot Interval)
- Inferred Groundwater Contour
- Flow Direction
- (13.29) Water Level Elevation (in Feet NGVD 1929)
- (Dry) No Measurable Water

Notes:

1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) MW1 & MW7 monitoring well water level elevations are shown but are not used to create the potentiometric surface. They are screened in the deeper advanced outwash aquifer (confined sand and gravel water-bearing zone).
3) Locations of property boundary, building corners and monitoring wells based on 2006 survey by Duncanson Company, Inc. All other locations are approximate.

0 50 100

Feet

N

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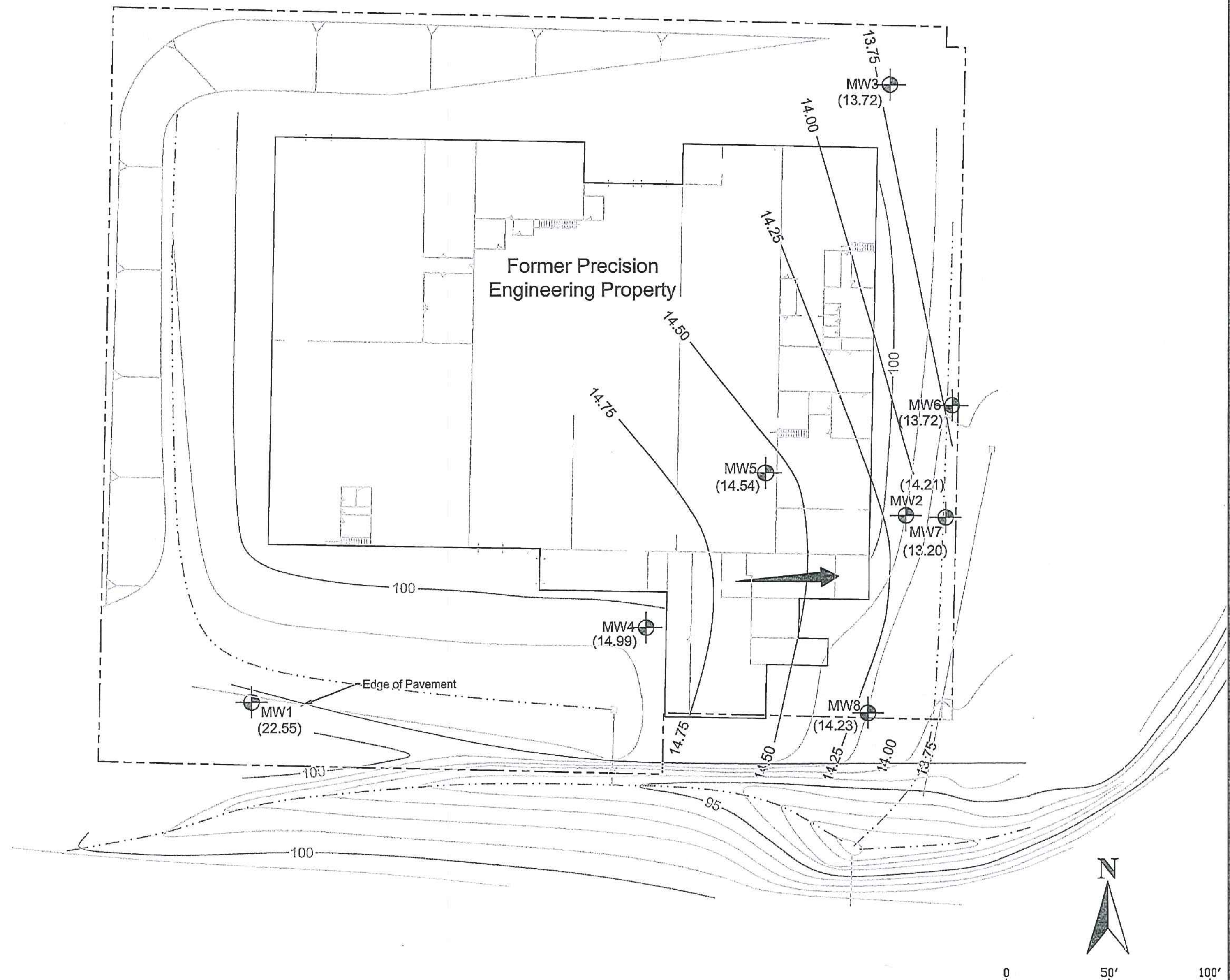

Figure 5

Potentiometric Surface for Shallow Water-Bearing Zone, April 2006

Precision Engineering, Inc. Seattle, Washington

Legend:

- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval (assumed datum)
- Monitoring Well
- Groundwater Contour
- Inferred Groundwater Contour
- Flow Direction
- (14.23) Water Level Elevation (in Feet NGVD 1929)

Notes:

1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) MW1 & MW7 monitoring well water level elevations are shown but are not used to create the potentiometric surface. They are screened in the deeper advanced outwash aquifer (confined sand and gravel water-bearing zone).
3) Precision Engineering water levels from April 2006.
4) Locations of Precision Engineering property boundary, building corners and monitoring wells based on 2006 survey by Duncanson Company, Inc.
5) KASPAC / Chiyoda site features, property boundary, and groundwater contours (depicted in red) derived from EMCON exhibit dated July 31, 1995.

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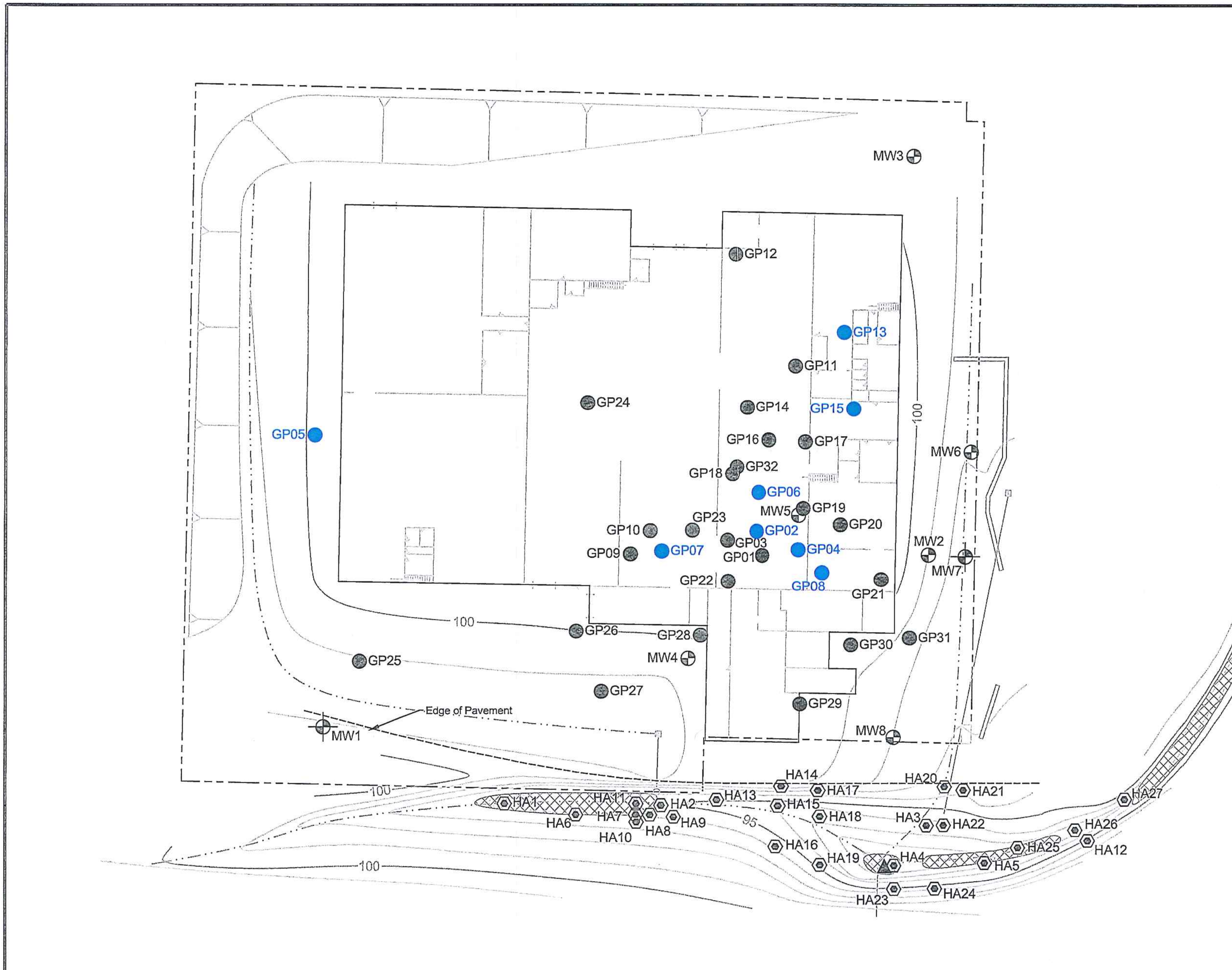

Figure 6
Soil and Groundwater Sample Locations

Precision Engineering, Inc.
Seattle, Washington

Legend:
- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval
- 2-inch Asphalt Curbing
- Shallow Monitoring Well
- Deep Monitoring Well
- Staff Gauge
- Geoprobe Boring
- Hand Auger Boring
- Reconnaissance Groundwater Sample
- Ponded Water (observed April 19, 2006)

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) Locations of property boundary, building corners, monitoring wells, Geoprobe borings, and hand augers HA1 through HA5 based on 2006 survey by Duncanson Company, Inc. Hand augers HA13 to HA27 were recorded using Trimble GeoXT GPS Unit (accuracy ±3 feet); all other locations are approximate.

0 50 100
Feet

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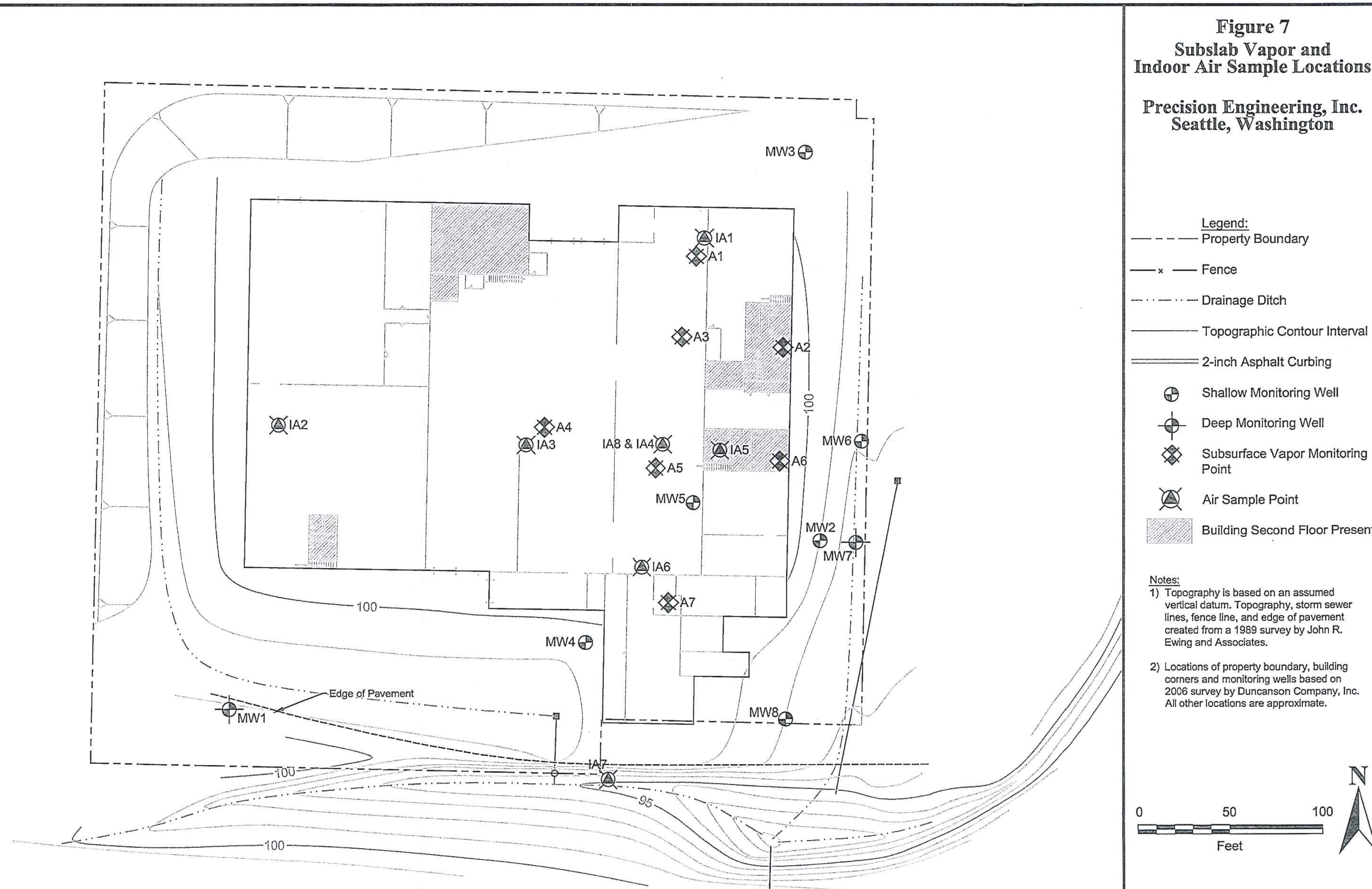

Figure 7
Subslab Vapor and Indoor Air Sample Locations

Precision Engineering, Inc.
Seattle, Washington

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.

2) Locations of property boundary, building corners and monitoring wells based on 2006 survey by Duncanson Company, Inc. All other locations are approximate.

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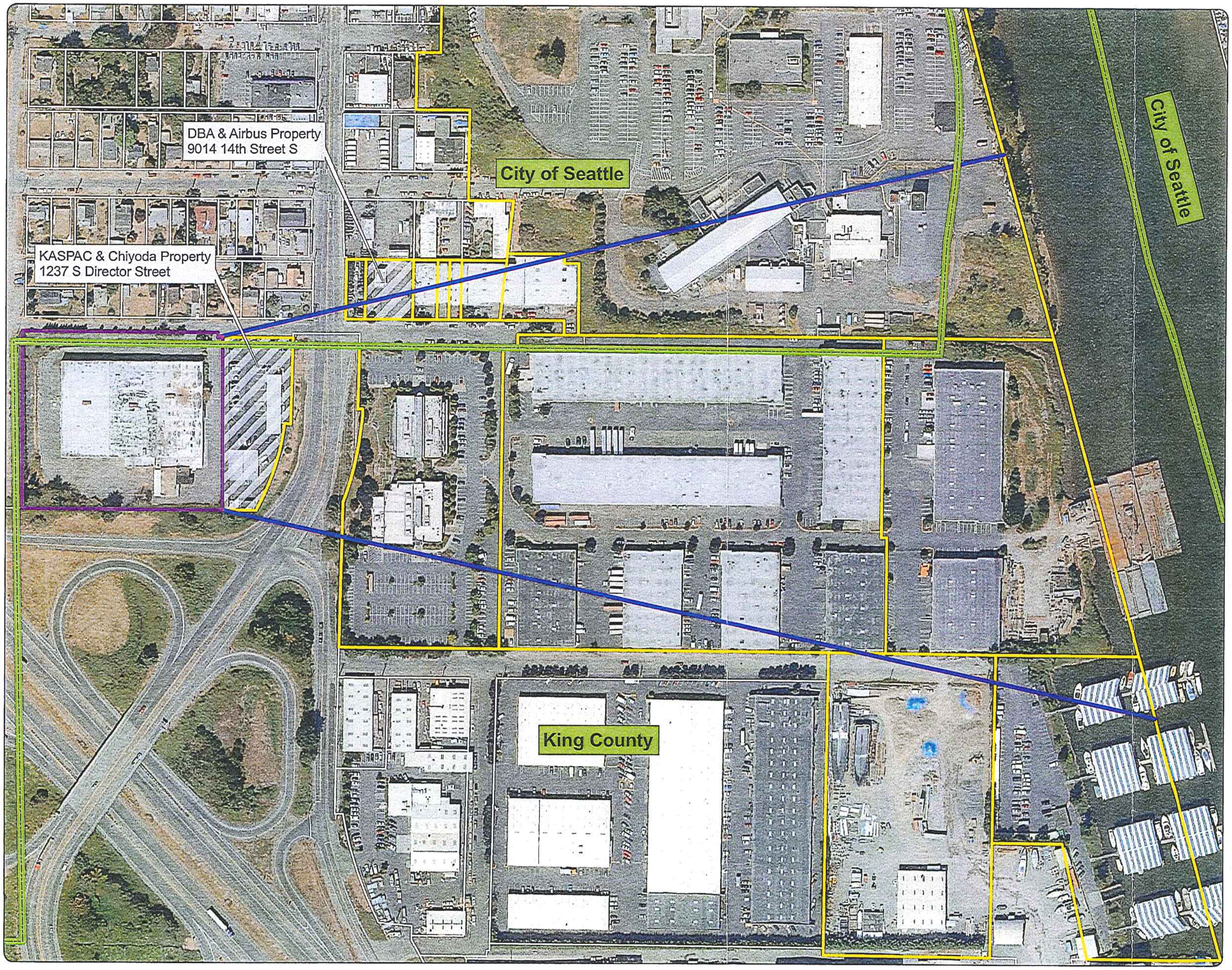
G:\8006.08 Stoel Rives-Precision Equipment\04_FS 2010 Seattle\Fig07_Air Sample.dwg, Layout1, 3/10/2010 3:55:09 PM

Figure 8
Downgradient Properties
Precision Engineering, Inc.
Seattle, Washington



Legend
- Study Area
- Tax Lots
- Tax Lots - Study Area
- Property of Interest
- Precision Equipment
- City of Seattle - King County Border

0 100 200
Feet

Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Microsoft Virtual Earth; tax lots obtained from King County; city boundary obtained from Washington Department of Transportation

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Project: 8006.08.04/12 Produced By: R. Maroni/Hines Approved By: M. Gibson Print Date: 03-05-10 File: X:\8006.08 Steel Rives Precision\Projects\08\Fig8_Downgradient Properties.mxd

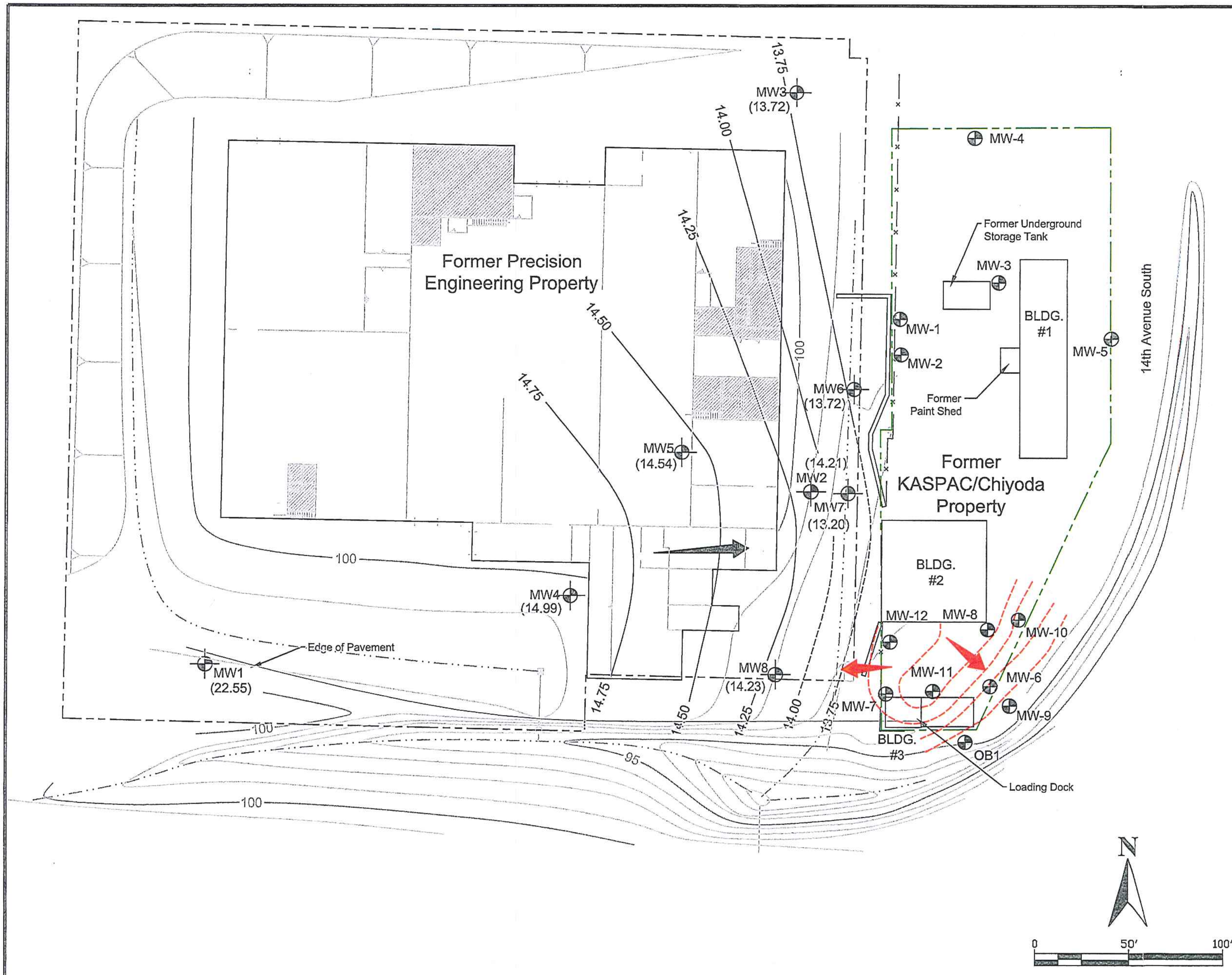

Figure 9
Potentiometric Surface for Precision site and former KASPAC/Chiyoda Property

Precision Engineering, Inc.
Seattle, Washington

Legend:
- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval (assumed datum)
- KAPSAC / Chiyoda Monitoring Well
- Precision Engineering Monitoring Well
- Groundwater Contour
- Inferred Groundwater Contour
- Flow Direction
- (14.23) Water Level Elevation (in Feet NGVD 1929)

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) MW1 & MW7 monitoring well water level elevations are shown but are not used to create the potentiometric surface. They are screened in the deeper advanced outwash aquifer (confined sand and gravel water-bearing zone).
3) Precision Engineering water levels from April 2006.
4) Locations of Precision Engineering property boundary, building corners and monitoring wells based on 2006 survey by Duncanson Company, Inc.
5) KASPAC / Chiyoda site features, property boundary, and groundwater contours (depicted in red) derived from EMCON exhibit dated July 31, 1995.

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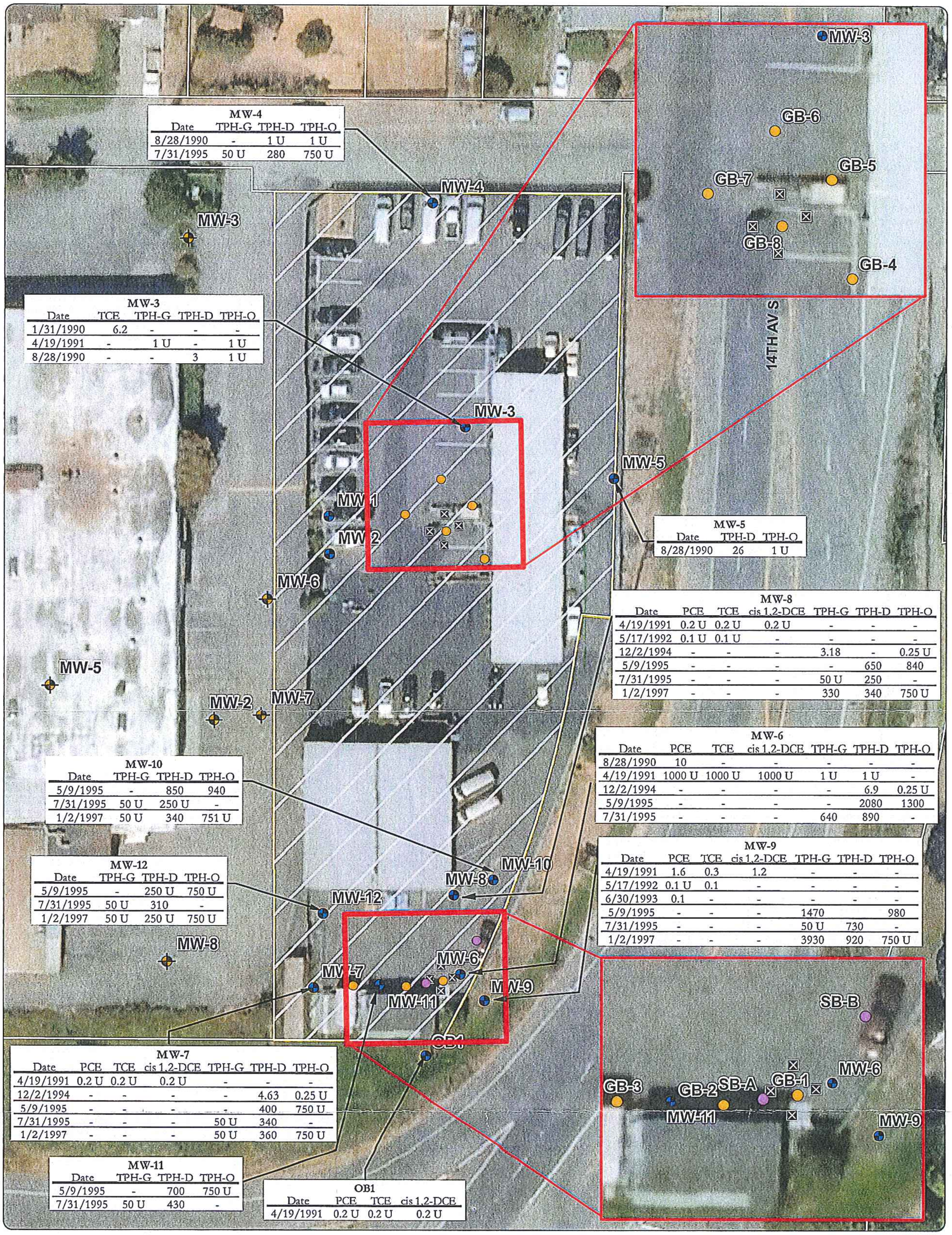

MW-4			
Date	TPH-G	TPH-D	TPH-O
8/28/1990	-	1 U	1 U
7/31/1995	50 U	280	750 U

MW-3				
Date	TCE	TPH-G	TPH-D	TPH-O
1/31/1990	6.2	-	-	-
4/19/1991	-	1 U	-	1 U
8/28/1990	-	-	3	1 U

MW-5		
Date	TPH-D	TPH-O
8/28/1990	26	1 U

MW-8						
Date	PCE	TCE	cis 1,2-DCE	TPH-G	TPH-D	TPH-O
4/19/1991	0.2 U	0.2 U	0.2 U	-	-	-
5/17/1992	0.1 U	0.1 U	-	-	-	-
12/2/1994	-	-	-	3.18	-	0.25 U
5/9/1995	-	-	-	-	650	840
7/31/1995	-	-	-	50 U	250	-
1/2/1997	-	-	-	330	340	750 U

MW-6						
Date	PCE	TCE	cis 1,2-DCE	TPH-G	TPH-D	TPH-O
8/28/1990	10	-	-	-	-	-
4/19/1991	1000 U	1000 U	1000 U	1 U	1 U	-
12/2/1994	-	-	-	-	6.9	0.25 U
5/9/1995	-	-	-	-	2080	1300
7/31/1995	-	-	-	640	890	-

MW-10			
Date	TPH-G	TPH-D	TPH-O
5/9/1995	-	850	940
7/31/1995	50 U	250 U	-
1/2/1997	50 U	340	751 U

MW-12			
Date	TPH-G	TPH-D	TPH-O
5/9/1995	-	250 U	750 U
7/31/1995	50 U	310	-
1/2/1997	50 U	250 U	750 U

MW-9						
Date	PCE	TCE	cis 1,2-DCE	TPH-G	TPH-D	TPH-O
4/19/1991	1.6	0.3	1.2	-	-	-
5/17/1992	0.1 U	0.1	-	-	-	-
6/30/1993	0.1	-	-	-	-	-
5/9/1995	-	-	-	1470		980
7/31/1995	-	-	-	50 U	730	-
1/2/1997	-	-	-	3930	920	750 U

MW-7						
Date	PCE	TCE	cis 1,2-DCE	TPH-G	TPH-D	TPH-O
4/19/1991	0.2 U	0.2 U	0.2 U	-	-	-
12/2/1994	-	-	-	-	4.63	0.25 U
5/9/1995	-	-	-	-	400	750 U
7/31/1995	-	-	-	50 U	340	-
1/2/1997	-	-	-	50 U	360	750 U

MW-11			
Date	TPH-G	TPH-D	TPH-O
5/9/1995	-	700	750 U
7/31/1995	50 U	430	-

OB1			
Date	PCE	TCE	cis 1,2-DCE
4/19/1991	0.2 U	0.2 U	0.2 U

Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Microsoft Virtual Earth

Legend

Monitoring Wells
- KASPAC/Chiyoda Site
- Precision Equipment Site

Property of Interest: KASPAC/Chiyoda

Tax Lots

Soil Boring Locations (1996)
- EMCON Soil Boring
- Other Soil Boring

Confirmation Soil Sample Location

0 25 50
Feet

Figure 10
Historical Concentrations in Groundwater at Former KASPAC/Chiyoda Property

Precision Engineering, Inc.
Seattle, Washington

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Project: 8006.08.04 Produced By: W. Coffey/Hines Approved By: M. Gibson Print Date: 03-05-10 File: X:\8006.08 Steel Rives Precision\Projects\04FS\Fig3 Chemical Concentrations.mxd

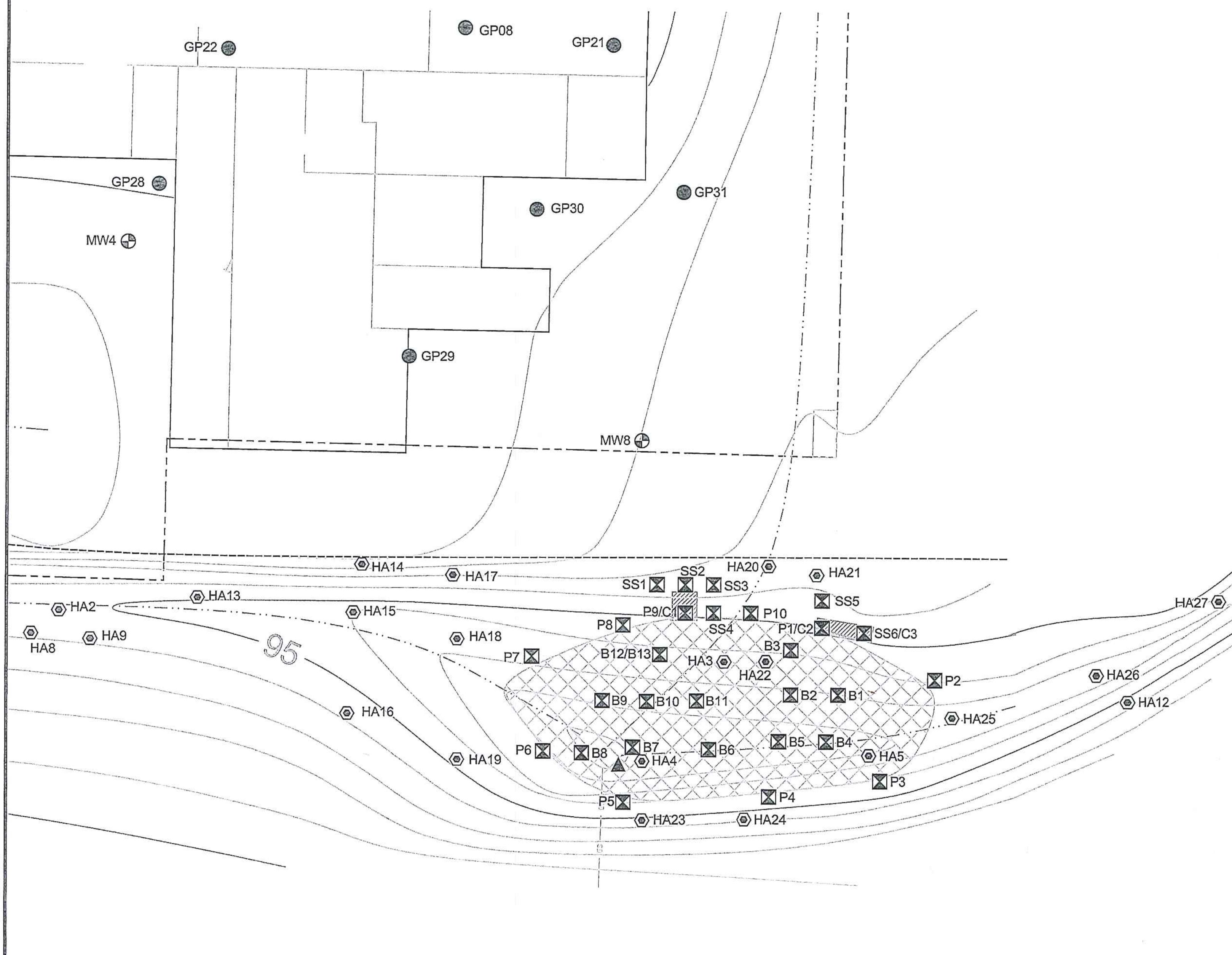

Figure 11
Ditch Soil Excavation Area and Sample Locations

Precision Engineering, Inc.
Seattle, Washington

Legend:
- Property Boundary
- Fence
- Drainage Ditch
- Topographic Contour Interval
- 2-inch Asphalt Curbing
- Shallow Monitoring Well
- Geoprobe Boring
- Staff Gauge
- Hand Auger Boring
- Confirmation Grab Sample
- Area Excavated in October 2007
- Area Excavated in March 2008

Notes:
1) Topography is based on an assumed vertical datum. Topography, storm sewer lines, fence line, and edge of pavement created from a 1989 survey by John R. Ewing and Associates.
2) Locations of property boundary, building corners, monitoring wells, geoprobe borings, and hand augers HA1 through HA5 based on 2006 survey by Duncanson Company, Inc. Hand auger HA13 to HA27 were recorded using Trimble GeoXT GPS Unit (accuracy ±3 feet); all other locations are approximate.

N

0 20 40
Feet

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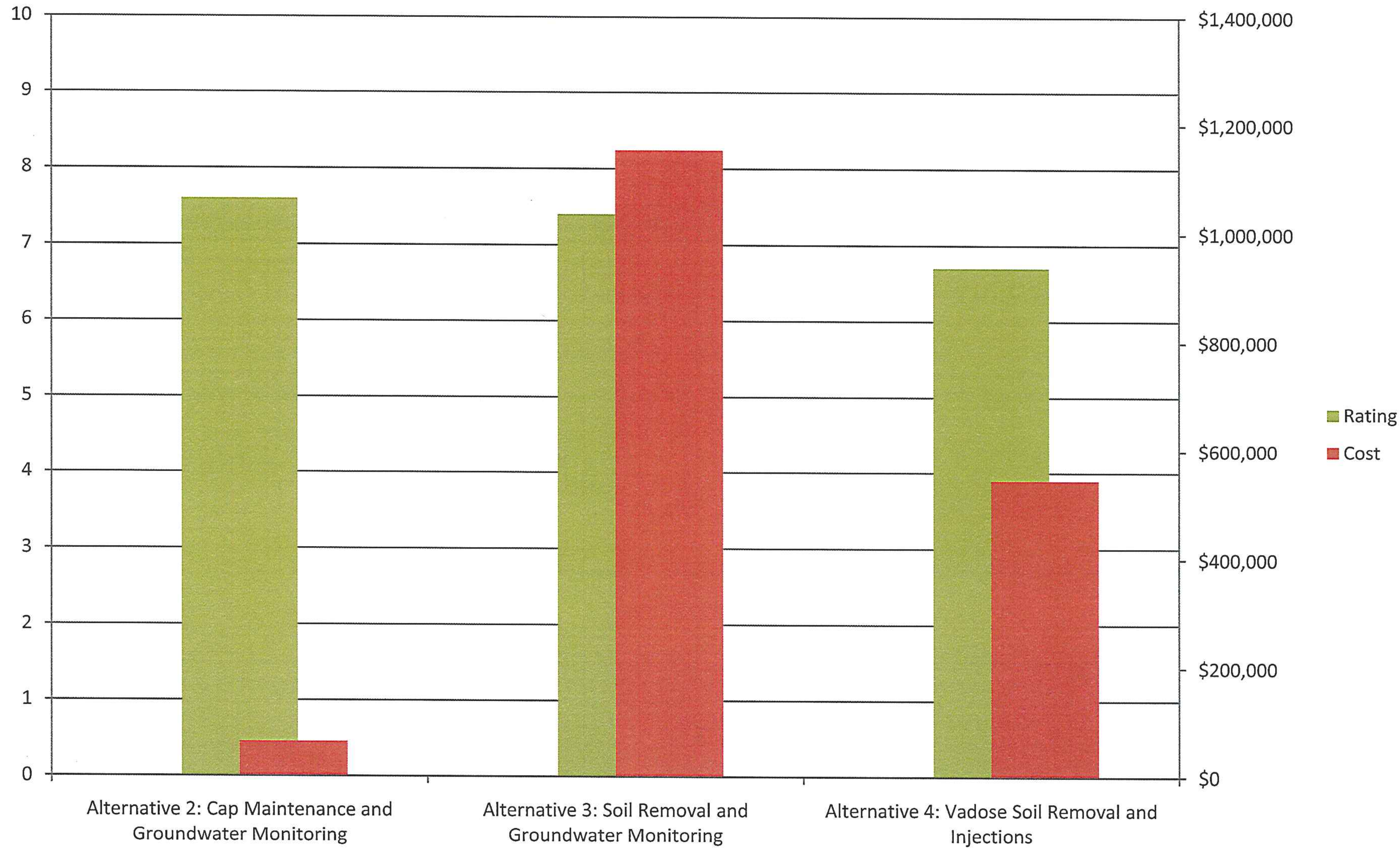
Layout: Site Project: 8006.08.04 Drawn By: J. Fisher Approved By: J. King

G:\8006.08 Stoel Rives-Precision Equipment\04_FS 2010 Seattle\Fig11_Ditch excavation samples.dwg, Site, 3/10/2010 3:56:44 PM

Figure 12: Disproportionate Cost Analysis
Precision Engineering, Inc.
Seattle, Washington



APPENDIX A

AQUIFER YIELD SUPPORTING DOCUMENTS

Maul Foster & Alongi, Inc.

7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-1
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	MW1-041806
Sub Area		**Sample Depth**	30
FSDS QA:	JLK 4/20/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
4/17/06	15:57	43.41	--	0.61	--	42.8	6.97

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	16:02	7.0	0.9	8.74	12.7	519	--	--	7.26
	16:24	11.0	0.9	8.34	12.9	224	--	--	2.54
Final Field Parameters	18:05	21.0	0.5	8.42	12.7	219	--	--	2.13

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	6:30:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments

Slow pumping rate to 0.5 L/min due to drawdown.
Water level = approximately 17.3 ft bgs after sampling.

Signature ______________________

Maul Foster & Alongi, Inc.

7223 NE Hazel Dell Avenue, Suite B, Vancouver, WA 98665 (360) 694-2691 Fax. (360) 906-1958

Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-2
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/19/2006
Sampling Event	April 2006	**Sample Name**	MW2-041906
Sub Area		**Sample Depth**	
FSDS QA:		**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
4/17/06	16:30	19.32	--	4.65	--	14.67	2.39

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump									
Final Field Parameters	12:48	2.4	0.3	6.71	15.9	1260	--	--	46.4

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Clear with slight yellowish orangish tint.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	8:15:00 AM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments

Turned down pump to 0.2 L/min after first pore volume; well went dry after approximately 2.75 gallons on 4/18/06. Sampled on 4/19/06.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-3
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/17/2006
Sampling Event	April 2006	**Sample Name**	MW3-041706
Sub Area		**Sample Depth**	15
FSDS QA:	JLK 4/20/06	**Easting**	

Northing		**TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
4/17/06	16:04	20.03	--	5.79	--	14.24	2.32

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	17:48	2.5	0.8	6.64	13.9	412	--	--	4.68
	18:10	5.0	0.8	6.65	13.9	381	--	--	3.48
Final Field Parameters	18:29	7.5	0.6	6.63	13.8	371	--	--	1.14

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear with suspended orange particulates and slight yellow tint; slight odor.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	6:40:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments: Water level = approximately 7.5 ft bgs after sampling.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-4
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	MW4-041806
Sub Area		**Sample Depth**	20
FSDS QA:	JLK 4/20/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
4/17/06	16:10	25.58	--	5.55	--	20.03	3.26

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	16:15	3.25	0.4	8.47	15.3	405	--	--	9.06
	16:55	6.50	0.4	8.19	15.2	386	--	--	3.00
Final Field Parameters	17:37	9.75	0.4	8.15	15.6	391	--	--	2.70

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	5:50:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments: Water level = approximately 18 ft bgs after sampling.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-5
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/19/2006
Sampling Event	April 2006	**Sample Name**	MW5-041906
Sub Area		**Sample Depth**	8
FSDS QA:	JLK 4/20/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
4/17/06	16:47	19.67	--	5.32	--	14.35	2.34

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	11:17	2.5	0.4	7.34	15.7	572	--	--	11.55
	11:44	5.0	0.4	6.58	15.5	640	--	--	2.46
Final Field Parameters	12:10	7.5	0.4	6.50	15.4	693	--	--	1.56

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Bright yellow color; odor.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	12:30:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments: Water level = approximately 6.5 ft bgs after sampling.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-6
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/19/2006
Sampling Event	April 2006	**Sample Name**	MW6-041906
Sub Area		**Sample Depth**	15
FSDS QA:		**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
4/17/06	16:35	19.86	--	4.27	--	15.59	2.54

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	9:19	2.75	0.5	6.58	13.9	3120	--	--	10.78
	9:41	5.50	0.5	6.66	14.3	1780	--	--	25.6
Final Field Parameters	10:06	8.25	0.5	6.63	14.4	1691	--	--	24.9

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Orangish-yellow and foamy with odor and sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	10:15:00 AM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments: Water level = approximately 9.5 ft bgs after sampling.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-7
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	MW7-041806
Sub Area		**Sample Depth**	20
FSDS QA:	JLK 4/20/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
4/17/06	16:25	31.30	--	4.64	--	26.66	4.35

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	12:39	4.5	0.5	7.24	15.6	1136	--	--	13.6
	13:30	9.0	0.5	7.28	16.3	971	--	--	46.9
Final Field Parameters	14:21	13.5	0.5	7.28	16.3	996	--	--	5.33

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	2:30:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments

Water level = approximately 14 ft bgs after sampling.
Duplicate sample collected from this location, MWDUP-041806.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-DUP
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	MWDUP-041806
Sub Area		**Sample Depth**	20
FSDS QA:	JLK 4/20/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
4/17/06	16:25	31.30	--	4.64	--	26.66	4.35

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	12:39	4.5	0.5	7.24	15.6	1136	--	--	13.6
	13:30	9.0	0.5	7.28	16.3	971	--	--	46.9
Final Field Parameters	14:21	13.5	0.5	7.28	16.3	996	--	--	5.33

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	2:30:00 PM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments

Water level = approximately 14 ft bgs after sampling.
This is a duplicate sample collected from MW7.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-8
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	MW8-041806
Sub Area		**Sample Depth**	15
FSDS QA:	JLK 4/20/06	**Easting**	

Northing		**TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
4/17/06	16:16	19.39	--	3.12	--	16.27	2.65

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	9:19	2.75	0.3	6.69	14.1	1082	--	--	164.5
	10:09	5.50	0.25	6.76	14.5	984	--	--	123.6
Final Field Parameters	10:50	8.25	0.3	6.84	14.2	920	--	--	135.2

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Slightly turbid with a yellowish-orangish tint; slight sheen.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	11:00:00 AM	VOA-Glass	3	No
			Amber Glass	2	No
			White Poly	1	No
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	7	

General Sampling Comments: Water level = approximately 13.5 ft bgs after sampling.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	Trip Blank
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/18/2006
Sampling Event	April 2006	**Sample Name**	Trip Blank
Sub Area		**Sample Depth**	
FSDS QA:	JLK 4/20/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Trip Blank		VOA-Glass	2	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	2	

General Sampling Comments

Laboratory supplied trip blank.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	Trip Blank
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	4/19/2006
Sampling Event	April 2006	**Sample Name**	Trip Blank
Sub Area		**Sample Depth**	
FSDS QA:	JLK 4/20/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Trip Blank		VOA-Glass	1	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	1	

General Sampling Comments

Laboratory supplied trip blank.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-1
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/27/2005
Sampling Event	December 2005	**Sample Name**	MW1-122705
Sub Area		**Sample Depth**	25
FSDS QA:	MN 1/5/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
12/27/05	7:48	43.41	--	2.03	--	41.38	6.74

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	11:46	6.75	0.8	8.07	11.8	294	--	--	17.5
	12:26	13.5	0.8	8.12	11.9	235	--	--	10.5
Final Field Parameters	13:04	20.25	0.8	8.09	12.0	232	--	--	10.2

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	1:10:00 PM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments: Drawdown in well to 25 ft below top of casing, pump stopped at 14.75 gallons, switched to a bailer.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-2
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	MW2-122805
Sub Area		**Sample Depth**	19
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
12/27/05	8:14	19.32	--	4.82	--	14.50	2.36

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump									
Final Field Parameters	10:37	2.5	0.6	6.30	14.5	1484	--	--	78.2

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear with yellow tint.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	9:30:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments: Well went dry after approximately 2.75 gallons on 12/27/05. Sampled well on 12/28/05.

Signature ______________________

Maul Foster & Alongi, Inc.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-3
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/29/2005
Sampling Event	December 2005	**Sample Name**	MW3-122905
Sub Area		**Sample Depth**	10
FSDS QA:	MN 1/5/06	**Easting**	

Northing		**TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume
12/27/05	8:21	20.03	--	5.48	--	14.55	2.37

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	10:18	2.5	0.6	6.45	14.0	655	--	--	31.6
	10:38	5.0	0.6	6.10	13.6	411	--	--	19.2
Final Field Parameters	10:56	7.5	0.6	6.13	14.4	397	--	--	11.9

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear with suspended orange particulates.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	11:00:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Signature

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-4
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/27/2005
Sampling Event	December 2005	**Sample Name**	MW4-122705
Sub Area		**Sample Depth**	20
FSDS QA:	MN 1/5/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	7:54	25.58	--	5.77	--	19.88	3.24

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	14:24	3.25	0.4	7.67	15.1	478	--	--	24.8
	14:57	6.50	0.4	7.54	16.1	399	--	--	7.23
Final Field Parameters	15:22	9.75	0.4	7.53	16.3	403	--	--	4.16

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear with small particles of orange particulates.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	3:30:00 PM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Signature ______________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-5
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	MW5-122805
Sub Area		**Sample Depth**	8
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	8:29	19.67	--	5.52	--	14.15	2.31

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	10:35	2.5	0.4	6.47	16.3	1252	--	--	3.44
	10:59	5.0	0.4	6.26	16.5	1058	--	--	2.72
	11:30	7.5	0.4	5.99	16.5	1020	--	--	2.26
Final Field Parameters	11:40	9.0	0.4	5.97	16.5	1020	--	--	1.46

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Bright orangish yellow. Odor.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	11:50:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Signature ______________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-6
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/29/2005
Sampling Event	December 2005	**Sample Name**	MW6-122905
Sub Area		**Sample Depth**	13
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	8:16	19.86	--	4.7	--	15.16	2.47

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	8:08	2.5	0.6	6.26	14.1	3130	--	--	4.63
	8:29	5.0	0.6	6.27	14.4	2850	--	--	16.65
	8:49	7.5	0.6	6.26	14.5	1924	--	--	10.38
Final Field Parameters	9:07	10.0	0.6	6.29	14.9	2620	--	--	16.88

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear with orangish yellow tint, foamy.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	9:15:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Signature ______________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-7
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	MW7-122805
Sub Area		**Sample Depth**	20
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	8:08	31.30	--	5.77	--	25.53	4.16

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	13:10	4.25	0.4	6.73	14.1	1222	--	--	3.71
	13:53	8.50	0.5	6.81	14.2	1125	--	--	2.24
Final Field Parameters	14:37	12.75	0.5	6.82	14.3	1115	--	--	3.00

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Clear and colorless.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	2:50:00 PM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Signature ______________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-8
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	MW8-122805
Sub Area		**Sample Depth**	19
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	8:02	19.39	--	3.32	--	16.07	2.62

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	9:38	2.7	0.3	6.33	14.0	--	--	--	152.8
Final Field Parameters	10:08	5.5	0.3	6.43	14.5	--	--	--	388

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Orangish yellow tint, slight odor, slightly foaming.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	7:45:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments

Well went dry after approximately 5.75 gallons on 12/27/05. Sampled well on 12/28/05. Duplicate sample, MWDUP-122805, collected from this location.

Signature ____________________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	MW-8
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	MWDUP-122805
Sub Area		**Sample Depth**	19
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)
12/27/05	8:02	19.39	--	3.32	--	16.07	2.62

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump	9:38	2.7	0.3	6.33	14.0	--	--	--	152.8
Final Field Parameters	10:08	5.5	0.3	6.43	14.5	--	--	--	388

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Orangish yellow tint, slight odor, slightly foaming.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(3) Disposible Bailer	Groundwater	7:45:00 AM	VOA-Glass	3	No
			Amber Glass	4	No
			White Poly	1	Yes
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	9	

General Sampling Comments: Well went dry after approximately 5.75 gallons on 12/27/05. Sampled well on 12/28/05. This is a duplicate sample collected from MW-8.

Signature ______________________

Maul Foster & Alongi, Inc.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	Trip Blank
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/28/2005
Sampling Event	December 2005	**Sample Name**	Trip Blank
Sub Area		**Sample Depth**	
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Trip Blank		VOA-Glass	6	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	6	

General Sampling Comments

Laboratory supplied trip blank.

Signature ______________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	Trip Blank
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/29/2005
Sampling Event	December 2005	**Sample Name**	Trip Blank
Sub Area		**Sample Depth**	
FSDS QA:	MN 1/5/06	**Easting** / **Northing** / **TOC**	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Trip Blank		VOA-Glass	2	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	2	

General Sampling Comments

Laboratory supplied trip blank.

Signature ______________________

Maul Foster & Alongi, Inc.

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	GP-13
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/14/2005
Sampling Event	December 2005	**Sample Name**	GP13-W-8.0
Sub Area		**Sample Depth**	8
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
(2) Peristaltic Pump									
Final Field Parameters	14:45	--	--	6.23	14.0	989	--	--	--

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Slightly turbid.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(2) Peristaltic Pump	Groundwater	2:45:00 PM	VOA-Glass	3	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	4	

General Sampling Comments

Signature ____________________

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Water Field Sampling Data Sheet

Client Name	Precision Engineering	**Sample Location**	GP-15
Project #	8006.08.04	**Sampler**	MG
Project Name	Remedial Investigation	**Sampling Date**	12/14/2005
Sampling Event	December 2005	**Sample Name**	GP15-W-8.0
Sub Area		**Sample Depth**	8
FSDS QA:	MN 1/5/06	**Easting**	
		Northing	
		TOC	

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	DTP-DTW (Product Thickness)	DTB-DTW (Water Column)	Pore Volume (Gallons/ft x Water Column)

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L) EH	Turbidity
(2) Peristaltic Pump								
Final Field Parameters								

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations: Slightly turbid.

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
(2) Peristaltic Pump	Groundwater	10:45:00 AM	VOA-Glass	3	No
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly	1	Yes
			Total Bottles	4	

General Sampling Comments

Signature ______________________________

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/21/2005
Site Location:	Seattle, WA	Well:	MW-5
Name:	Precision Engineering	Initial DTB: 19.60	Final DTB 19.66
Development Method:	P-pump/Bailer	Initial DTW: 6.00	Final DTW 7.51
Total Water Removed	24.75 gallons	Pore Volume:	2.22 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
7:43	2.25	660.00	7.14	1,471	18.7			Pump on at 7:28; stop pump and surge w/bailer.
7:54	4.50	396.00	6.73	1,487	19.2			Water is electric yellow/orange.
8:07	6.75	147.50	6.56	1,388	19.2			
8:17	9.00	77.30	6.12	1,346	19.1			
8:32	11.25	47.40	5.96	1,369	19.0			
8:46	13.50	13.89	5.89	1,337	19.2			
9:02	15.75	271.00	5.84	1,329	19.1			Stopped pump and surged w/bailer.
9:11	18.00	61.80	5.79	1,322	19.2			
9:22	20.25	21.50	5.76	1,316	19.1			
9:33	22.50	5.67	5.74	1,317	19.1			
9:46	24.75	3.32	5.71	1,314	19.0			

Well Development Form

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Project No.	8006.08.04	Date	12/16 & 21/2005
Site Location:	Seattle, WA	Well:	MW-6
Name:	Precision Engineering	Initial DTB: 19.85	Final DTB 19.86
Development Method:	P-pump/Bailer	Initial DTW: 5.09	Final DTW dry
Total Water Removed	41.5 gallons	Pore Volume:	2.40 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
12:37	5.0	116.9	7.07	3,290	17.6			12/16/05. Conductivity won't calibrate. Orangish yellow color.
12:46	10.0	81.7	6.24	2,960	17.9			Surged right after 10.0 gal w/bailer.
12:58	12.5	228.0	6.34	2,900	17.3			Well went dry after approximately 14 gal.
14:02	15.0	121.9	6.49	1,913	17.2			Pump back on at 13:58. Clear w/yellowish tint. Surged w/bailer.
14:21	17.5	117.2	6.55	1,775	16.7			
14:55	20.0	49.5	6.52	1,722	15.5			
15:15	22.5	28.1	6.53	1,701	15.0			
13:24	25.0	127.1	6.78	1,866	16.6			12/21/05. Surged with bailer.
13:33	27.5	332.0	6.50	1,820	17.4			
13:41	30.0	122.3	6.46	1,751	17.6			
13:51	32.5	103.1	6.35	1,749	17.6			Yellow/orange in color.
14:03	35.0	60.7	6.36	1,767	17.3			
14:20	37.5	91.2	6.51	1,741	17.1			Well went dry.
15:05	40.0	47.1	6.55	1,800	17.0			Well went dry.
15:30	41.5	117.0	6.52	1,750	17.1			Well went dry.

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Well Development Form

Project No.	8006.08.04	Date	12/19 & 21/2005		
Site Location:	Seattle, WA	Well:	MW-7		
Name:	Precision Engineering	Initial DTB:	30.00	Final DTB	31.3
Development Method:	P-pump/Bailer	Initial DTW:	6.10	Final DTW	dry
Total Water Removed	54.0 gallons	Pore Volume:	3.9 gallons		
Water Contained	Yes	Casing Diameter:	2"		
Estimated Specific Capacity		Meter No.			

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
11:19	8.0	358.0	7.75	2,080	15.5			12/19/05. Surged w/bailer before pumping.
11:49	12.0	644.0	7.47	1,970	16.9			
12:32	16.0	428.0	7.28	1,980	16.9			
13:06	20.0	342.0	7.16	2,060	16.4			Switch to a bailer.
13:32	24.0	411.0	7.15	1,980	16.3			
14:00	28.0	130.2	7.04	2,000	16.4			
14:25	32.0	87.3	7.02	2,000	16.4			
14:40	36.0	73.6	6.97	1,970	16.5			
15:00	40.0	50.1	6.96	1,970	16.4			
15:10	42.0	54.7	6.95	2,000	16.4			
10:33	43.0	474.0	6.78	1,555	16.5			12/21/05. DTB = 31.15 DTW = 5.49
10:45	44.0	173.2	6.82	1,199	16.0			Surge w/bailer.
10:52	45.0	171.2	6.76	1,194	16.7			
10:57	46.0	219.0	6.72	1,193	16.5			
11:08	48.0	98.6	6.74	1,190	16.2			
11:27	50.0	29.6	6.74	1,186	16.1			
11:43	52.0	15.05	6.75	1,176	16.1			
12:04	54.0	5.69	6.79	1,165	16.3			Clear w/slight yellow tint.

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Well Development Form

Project No.	8006.08.04	Date	12/19 & 20/2005
Site Location:	Seattle, WA	Well:	MW-8
Name:	Precision Engineering	Initial DTB: 18.10	Final DTB 19.55
Development Method:	P-pump/Bailer	Initial DTW: 3.90	Final DTW dry
Total Water Removed	29.0 gallons	Pore Volume:	2.3 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
14:38	4.5	>1,000	7.02	2,040	16.7			Well went dry after one pore volume.
15:12	7.0	>1,000	6.93	1,970	16.5			Let recharge.
15:58	9.3	171.0	6.49	2,130	15.4			
7:36	11.6	689.0	7.23	2,260	16.0			12/20/05. Surge w/bailer. Sheen in purge water. Purge w/bailer.
8:33	13.9	726.0	7.16	2,220	15.5			
10:17	16.2	303.0	7.25	2,240	13.6			Switched back to p-pump.
11:04	18.5	429.0	6.79	2,100	15.5			
12:17	20.8	308.0	7.11	2,060	13.6			
13:30	23.1	115.6	6.58	2,010	15.4			
14:34	25.4	83.7	6.57	1,970	15.3			
15:12	26.5	63.4	6.52	1,960	15.2			
15:39	27.7	60.7	6.55	1,930	14.9			Yellow tint with sheen.
15:51	28.4	44.3	6.52	1,950	14.9			
16:05	29.0	27.7	6.53	1,974	14.8			

Well Development Form

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ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/21/2005
Site Location:	Seattle, WA	Well:	MW-5
Name:	Precision Engineering	Initial DTB: 19.60	Final DTB 19.66
Development Method:	P-pump/Bailer	Initial DTW: 6.00	Final DTW 7.51
Total Water Removed	24.75 gallons	Pore Volume:	2.22 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
7:43	2.25	660.00	7.14	1,471	18.7			Pump on at 7:28; stop pump and surge w/bailer.
7:54	4.50	396.00	6.73	1,487	19.2			Water is electric yellow/orange.
8:07	6.75	147.50	6.56	1,388	19.2			
8:17	9.00	77.30	6.12	1,346	19.1			
8:32	11.25	47.40	5.96	1,369	19.0			
8:46	13.50	13.89	5.89	1,337	19.2			
9:02	15.75	271.00	5.84	1,329	19.1			Stopped pump and surged w/bailer.
9:11	18.00	61.80	5.79	1,322	19.2			
9:22	20.25	21.50	5.76	1,316	19.1			
9:33	22.50	5.67	5.74	1,317	19.1			
9:46	24.75	3.32	5.71	1,314	19.0			

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Well Development Form

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Project No. 8006.08.04		Date 12/16 & 21/2005	
Site Location: Seattle, WA		Well: MW-6	
Name: Precision Engineering		Initial DTB: 19.85	Final DTB 19.86
Development Method: P-pump/Bailer		Initial DTW: 5.09	Final DTW dry
Total Water Removed 41.5 gallons		Pore Volume: 2.40 gallons	
Water Contained Yes		Casing Diameter: 2"	
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
12:37	5.0	116.9	7.07	3,290	17.6			12/16/05. Conductivity won't calibrate. Orangish yellow color.
12:46	10.0	81.7	6.24	2,960	17.9			Surged right after 10.0 gal w/bailer.
12:58	12.5	228.0	6.34	2,900	17.3			Well went dry after approximately 14 gal.
14:02	15.0	121.9	6.49	1,913	17.2			Pump back on at 13:58. Clear w/yellowish tint. Surged w/bailer.
14:21	17.5	117.2	6.55	1,775	16.7			
14:55	20.0	49.5	6.52	1,722	15.5			
15:15	22.5	28.1	6.53	1,701	15.0			
13:24	25.0	127.1	6.78	1,866	16.6			12/21/05. Surged with bailer.
13:33	27.5	332.0	6.50	1,820	17.4			
13:41	30.0	122.3	6.46	1,751	17.6			
13:51	32.5	103.1	6.35	1,749	17.6			Yellow/orange in color.
14:03	35.0	60.7	6.36	1,767	17.3			
14:20	37.5	91.2	6.51	1,741	17.1			Well went dry.
15:05	40.0	47.1	6.55	1,800	17.0			Well went dry.
15:30	41.5	117.0	6.52	1,750	17.1			Well went dry.

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/19 & 21/2005		
Site Location:	Seattle, WA	Well:	MW-7		
Name:	Precision Engineering	Initial DTB:	30.00	Final DTB	31.3
Development Method:	P-pump/Bailer	Initial DTW:	6.10	Final DTW	dry
Total Water Removed	54.0 gallons	Pore Volume:	3.9 gallons		
Water Contained	Yes	Casing Diameter:	2"		
Estimated Specific Capacity		Meter No.			

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
11:19	8.0	358.0	7.75	2,080	15.5			12/19/05. Surged w/bailer before pumping.
11:49	12.0	644.0	7.47	1,970	16.9			
12:32	16.0	428.0	7.28	1,980	16.9			
13:06	20.0	342.0	7.16	2,060	16.4			Switch to a bailer.
13:32	24.0	411.0	7.15	1,980	16.3			
14:00	28.0	130.2	7.04	2,000	16.4			
14:25	32.0	87.3	7.02	2,000	16.4			
14:40	36.0	73.6	6.97	1,970	16.5			
15:00	40.0	50.1	6.96	1,970	16.4			
15:10	42.0	54.7	6.95	2,000	16.4			
10:33	43.0	474.0	6.78	1,555	16.5			12/21/05. DTB = 31.15 DTW = 5.49
10:45	44.0	173.2	6.82	1,199	16.0			Surge w/bailer.
10:52	45.0	171.2	6.76	1,194	16.7			
10:57	46.0	219.0	6.72	1,193	16.5			
11:08	48.0	98.6	6.74	1,190	16.2			
11:27	50.0	29.6	6.74	1,186	16.1			
11:43	52.0	15.05	6.75	1,176	16.1			
12:04	54.0	5.69	6.79	1,165	16.3			Clear w/slight yellow tint.

Well Development Form

MAUL FOSTER ALONGI
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Project No.	8006.08.04	Date	12/19 & 20/2005
Site Location:	Seattle, WA	Well:	MW-8
Name:	Precision Engineering	Initial DTB: 18.10	Final DTB 19.55
Development Method:	P-pump/Bailer	Initial DTW: 3.90	Final DTW dry
Total Water Removed	29.0 gallons	Pore Volume:	2.3 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
14:38	4.5	>1,000	7.02	2,040	16.7			Well went dry after one pore volume.
15:12	7.0	>1,000	6.93	1,970	16.5			Let recharge.
15:58	9.3	171.0	6.49	2,130	15.4			
7:36	11.6	689.0	7.23	2,260	16.0			12/20/05. Surge w/bailer. Sheen in purge water. Purge w/bailer.
8:33	13.9	726.0	7.16	2,220	15.5			
10:17	16.2	303.0	7.25	2,240	13.6			Switched back to p-pump.
11:04	18.5	429.0	6.79	2,100	15.5			
12:17	20.8	308.0	7.11	2,060	13.6			
13:30	23.1	115.6	6.58	2,010	15.4			
14:34	25.4	83.7	6.57	1,970	15.3			
15:12	26.5	63.4	6.52	1,960	15.2			
15:39	27.7	60.7	6.55	1,930	14.9			Yellow tint with sheen.
15:51	28.4	44.3	6.52	1,950	14.9			
16:05	29.0	27.7	6.53	1,974	14.8			

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Well Development Form

Project No.	8006.08.04	Date	12/21/2005		
Site Location:	Seattle, WA	Well:	MW-5		
Name:	Precision Engineering	Initial DTB:	19.60	Final DTB	19.66
Development Method:	P-pump/Bailer	Initial DTW:	6.00	Final DTW	7.51
Total Water Removed	24.75 gallons	Pore Volume:	2.22 gallons		
Water Contained	Yes	Casing Diameter:	2"		
Estimated Specific Capacity		Meter No.			

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
7:43	2.25	660.00	7.14	1,471	18.7			Pump on at 7:28; stop pump and surge w/bailer.
7:54	4.50	396.00	6.73	1,487	19.2			Water is electric yellow/orange.
8:07	6.75	147.50	6.56	1,388	19.2			
8:17	9.00	77.30	6.12	1,346	19.1			
8:32	11.25	47.40	5.96	1,369	19.0			
8:46	13.50	13.89	5.89	1,337	19.2			
9:02	15.75	271.00	5.84	1,329	19.1			Stopped pump and surged w/bailer.
9:11	18.00	61.80	5.79	1,322	19.2			
9:22	20.25	21.50	5.76	1,316	19.1			
9:33	22.50	5.67	5.74	1,317	19.1			
9:46	24.75	3.32	5.71	1,314	19.0			

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/16 & 21/2005
Site Location:	Seattle, WA	Well:	MW-6
Name:	Precision Engineering	Initial DTB: 19.85	Final DTB 19.86
Development Method:	P-pump/Bailer	Initial DTW: 5.09	Final DTW dry
Total Water Removed	41.5 gallons	Pore Volume:	2.40 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
12:37	5.0	116.9	7.07	3,290	17.6			12/16/05. Conductivity won't calibrate. Orangish yellow color.
12:46	10.0	81.7	6.24	2,960	17.9			Surged right after 10.0 gal w/bailer.
12:58	12.5	228.0	6.34	2,900	17.3			Well went dry after approximately 14 gal.
14:02	15.0	121.9	6.49	1,913	17.2			Pump back on at 13:58. Clear w/yellowish tint. Surged w/bailer.
14:21	17.5	117.2	6.55	1,775	16.7			
14:55	20.0	49.5	6.52	1,722	15.5			
15:15	22.5	28.1	6.53	1,701	15.0			
13:24	25.0	127.1	6.78	1,866	16.6			12/21/05. Surged with bailer.
13:33	27.5	332.0	6.50	1,820	17.4			
13:41	30.0	122.3	6.46	1,751	17.6			
13:51	32.5	103.1	6.35	1,749	17.6			Yellow/orange in color.
14:03	35.0	60.7	6.36	1,767	17.3			
14:20	37.5	91.2	6.51	1,741	17.1			Well went dry.
15:05	40.0	47.1	6.55	1,800	17.0			Well went dry.
15:30	41.5	117.0	6.52	1,750	17.1			Well went dry.

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/19 & 21/2005
Site Location:	Seattle, WA	Well:	MW-7
Name:	Precision Engineering	Initial DTB: 30.00	Final DTB 31.3
Development Method:	P-pump/Bailer	Initial DTW: 6.10	Final DTW dry
Total Water Removed	54.0 gallons	Pore Volume:	3.9 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
11:19	8.0	358.0	7.75	2,080	15.5			12/19/05. Surged w/bailer before pumping.
11:49	12.0	644.0	7.47	1,970	16.9			
12:32	16.0	428.0	7.28	1,980	16.9			
13:06	20.0	342.0	7.16	2,060	16.4			Switch to a bailer.
13:32	24.0	411.0	7.15	1,980	16.3			
14:00	28.0	130.2	7.04	2,000	16.4			
14:25	32.0	87.3	7.02	2,000	16.4			
14:40	36.0	73.6	6.97	1,970	16.5			
15:00	40.0	50.1	6.96	1,970	16.4			
15:10	42.0	54.7	6.95	2,000	16.4			
10:33	43.0	474.0	6.78	1,555	16.5			12/21/05. DTB = 31.15 DTW = 5.49
10:45	44.0	173.2	6.82	1,199	16.0			Surge w/bailer.
10:52	45.0	171.2	6.76	1,194	16.7			
10:57	46.0	219.0	6.72	1,193	16.5			
11:08	48.0	98.6	6.74	1,190	16.2			
11:27	50.0	29.6	6.74	1,186	16.1			
11:43	52.0	15.05	6.75	1,176	16.1			
12:04	54.0	5.69	6.79	1,165	16.3			Clear w/slight yellow tint.

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/19 & 20/2005	
Site Location:	Seattle, WA	Well:	MW-8	
Name:	Precision Engineering	Initial DTB: 18.10	Final DTB	19.55
Development Method:	P-pump/Bailer	Initial DTW: 3.90	Final DTW	dry
Total Water Removed	29.0 gallons	Pore Volume:	2.3 gallons	
Water Contained	Yes	Casing Diameter:	2"	
Estimated Specific Capacity		Meter No.		

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
14:38	4.5	>1,000	7.02	2,040	16.7			Well went dry after one pore volume.
15:12	7.0	>1,000	6.93	1,970	16.5			Let recharge.
15:58	9.3	171.0	6.49	2,130	15.4			
7:36	11.6	689.0	7.23	2,260	16.0			12/20/05. Surge w/bailer. Sheen in purge water. Purge w/bailer.
8:33	13.9	726.0	7.16	2,220	15.5			
10:17	16.2	303.0	7.25	2,240	13.6			Switched back to p-pump.
11:04	18.5	429.0	6.79	2,100	15.5			
12:17	20.8	308.0	7.11	2,060	13.6			
13:30	23.1	115.6	6.58	2,010	15.4			
14:34	25.4	83.7	6.57	1,970	15.3			
15:12	26.5	63.4	6.52	1,960	15.2			
15:39	27.7	60.7	6.55	1,930	14.9			Yellow tint with sheen.
15:51	28.4	44.3	6.52	1,950	14.9			
16:05	29.0	27.7	6.53	1,974	14.8			

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/21/2005
Site Location:	Seattle, WA	Well:	MW-5
Name:	Precision Engineering	Initial DTB: 19.60	Final DTB 19.66
Development Method:	P-pump/Bailer	Initial DTW: 6.00	Final DTW 7.51
Total Water Removed	24.75 gallons	Pore Volume:	2.22 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
7:43	2.25	660.00	7.14	1,471	18.7			Pump on at 7:28; stop pump and surge w/bailer.
7:54	4.50	396.00	6.73	1,487	19.2			Water is electric yellow/orange.
8:07	6.75	147.50	6.56	1,388	19.2			
8:17	9.00	77.30	6.12	1,346	19.1			
8:32	11.25	47.40	5.96	1,369	19.0			
8:46	13.50	13.89	5.89	1,337	19.2			
9:02	15.75	271.00	5.84	1,329	19.1			Stopped pump and surged w/bailer.
9:11	18.00	61.80	5.79	1,322	19.2			
9:22	20.25	21.50	5.76	1,316	19.1			
9:33	22.50	5.67	5.74	1,317	19.1			
9:46	24.75	3.32	5.71	1,314	19.0			

Well Development Form

MAUL FOSTER ALONGI
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Project No.	8006.08.04	Date	12/16 & 21/2005		
Site Location:	Seattle, WA	Well:	MW-6		
Name:	Precision Engineering	Initial DTB:	19.85	Final DTB	19.86
Development Method:	P-pump/Bailer	Initial DTW:	5.09	Final DTW	dry
Total Water Removed	41.5 gallons	Pore Volume:	2.40 gallons		
Water Contained	Yes	Casing Diameter:	2"		
Estimated Specific Capacity		Meter No.			

Time	Cum. Vol Removed	Sand/Silt	pH	EC (μhos)	Temp	DO	Eh	Comments
12:37	5.0	116.9	7.07	3,290	17.6			12/16/05. Conductivity won't calibrate. Orangish yellow color.
12:46	10.0	81.7	6.24	2,960	17.9			Surged right after 10.0 gal w/bailer.
12:58	12.5	228.0	6.34	2,900	17.3			Well went dry after approximately 14 gal.
14:02	15.0	121.9	6.49	1,913	17.2			Pump back on at 13:58. Clear w/yellowish tint. Surged w/bailer.
14:21	17.5	117.2	6.55	1,775	16.7			
14:55	20.0	49.5	6.52	1,722	15.5			
15:15	22.5	28.1	6.53	1,701	15.0			
13:24	25.0	127.1	6.78	1,866	16.6			12/21/05. Surged with bailer.
13:33	27.5	332.0	6.50	1,820	17.4			
13:41	30.0	122.3	6.46	1,751	17.6			
13:51	32.5	103.1	6.35	1,749	17.6			Yellow/orange in color.
14:03	35.0	60.7	6.36	1,767	17.3			
14:20	37.5	91.2	6.51	1,741	17.1			Well went dry.
15:05	40.0	47.1	6.55	1,800	17.0			Well went dry.
15:30	41.5	117.0	6.52	1,750	17.1			Well went dry.

Well Development Form

MAUL FOSTER ALONGI
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Project No.	8006.08.04	Date	12/19 & 21/2005
Site Location:	Seattle, WA	Well:	MW-7
Name:	Precision Engineering	Initial DTB: 30.00	Final DTB 31.3
Development Method:	P-pump/Bailer	Initial DTW: 6.10	Final DTW dry
Total Water Removed	54.0 gallons	Pore Volume:	3.9 gallons
Water Contained	Yes	Casing Diameter:	2"
Estimated Specific Capacity		Meter No.	

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
11:19	8.0	358.0	7.75	2,080	15.5			12/19/05. Surged w/bailer before pumping.
11:49	12.0	644.0	7.47	1,970	16.9			
12:32	16.0	428.0	7.28	1,980	16.9			
13:06	20.0	342.0	7.16	2,060	16.4			Switch to a bailer.
13:32	24.0	411.0	7.15	1,980	16.3			
14:00	28.0	130.2	7.04	2,000	16.4			
14:25	32.0	87.3	7.02	2,000	16.4			
14:40	36.0	73.6	6.97	1,970	16.5			
15:00	40.0	50.1	6.96	1,970	16.4			
15:10	42.0	54.7	6.95	2,000	16.4			
10:33	43.0	474.0	6.78	1,555	16.5			12/21/05. DTB = 31.15 DTW = 5.49
10:45	44.0	173.2	6.82	1,199	16.0			Surge w/bailer.
10:52	45.0	171.2	6.76	1,194	16.7			
10:57	46.0	219.0	6.72	1,193	16.5			
11:08	48.0	98.6	6.74	1,190	16.2			
11:27	50.0	29.6	6.74	1,186	16.1			
11:43	52.0	15.05	6.75	1,176	16.1			
12:04	54.0	5.69	6.79	1,165	16.3			Clear w/slight yellow tint.

Well Development Form

MAUL FOSTER ALONGI
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Project No.	8006.08.04	Date	12/19 & 20/2005			
Site Location:	Seattle, WA	Well:	MW-8			
Name:	Precision Engineering	Initial DTB:	18.10		Final DTB	19.55
Development Method:	P-pump/Bailer	Initial DTW:	3.90		Final DTW	dry
Total Water Removed	29.0 gallons	Pore Volume:	2.3 gallons			
Water Contained	Yes	Casing Diameter:	2"			
Estimated Specific Capacity		Meter No.				

Time	Cum. Vol Removed	Sand/Silt	pH	EC (µhos)	Temp	DO	Eh	Comments
14:38	4.5	>1,000	7.02	2,040	16.7			Well went dry after one pore volume.
15:12	7.0	>1,000	6.93	1,970	16.5			Let recharge.
15:58	9.3	171.0	6.49	2,130	15.4			
7:36	11.6	689.0	7.23	2,260	16.0			12/20/05. Surge w/bailer. Sheen in purge water. Purge w/bailer.
8:33	13.9	726.0	7.16	2,220	15.5			
10:17	16.2	303.0	7.25	2,240	13.6			Switched back to p-pump.
11:04	18.5	429.0	6.79	2,100	15.5			
12:17	20.8	308.0	7.11	2,060	13.6			
13:30	23.1	115.6	6.58	2,010	15.4			
14:34	25.4	83.7	6.57	1,970	15.3			
15:12	26.5	63.4	6.52	1,960	15.2			
15:39	27.7	60.7	6.55	1,930	14.9			Yellow tint with sheen.
15:51	28.4	44.3	6.52	1,950	14.9			
16:05	29.0	27.7	6.53	1,974	14.8			

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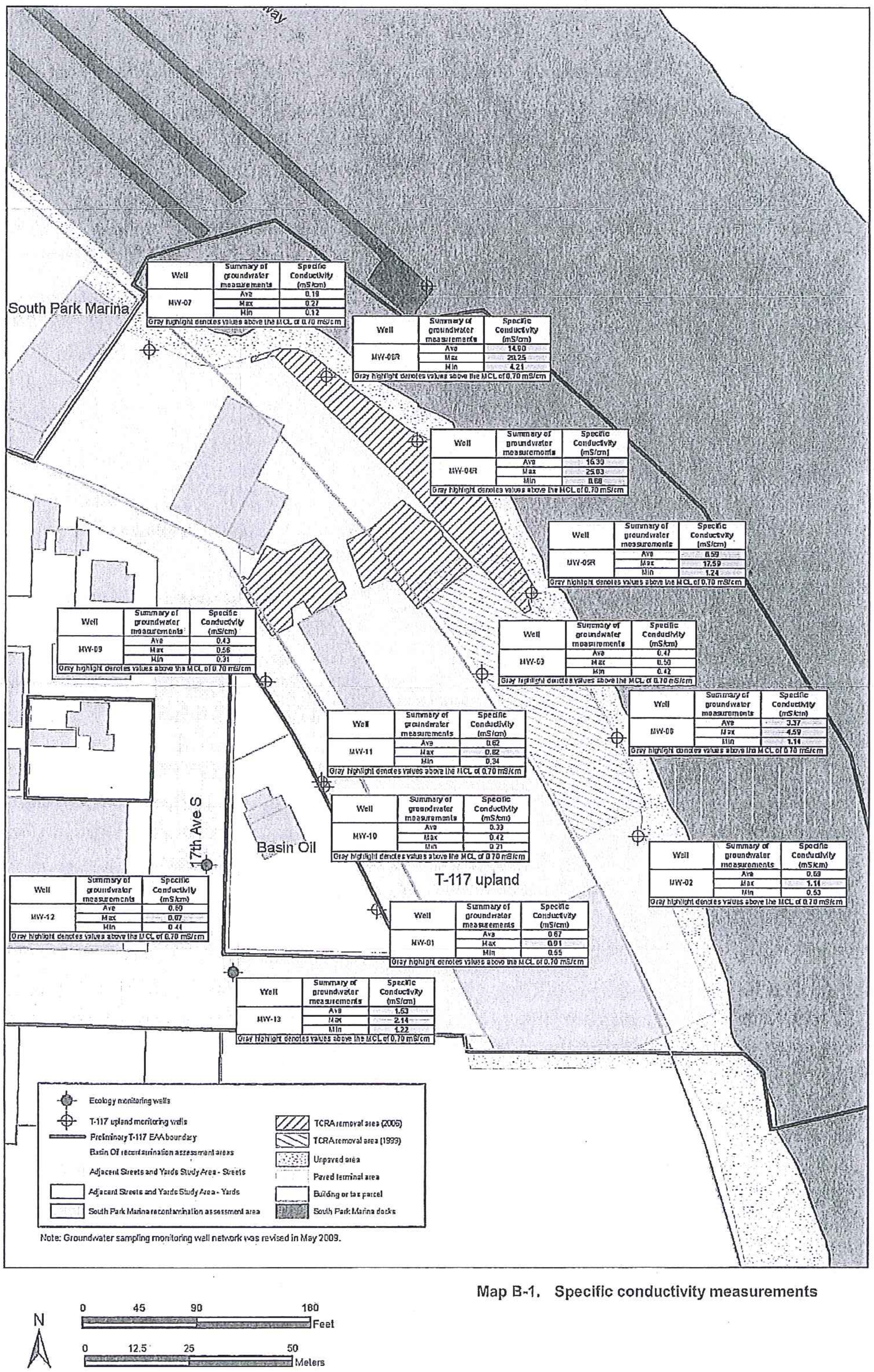

Map B-1. Specific conductivity measurements